Austrian Research and Technology Report 2016

Report under Section 8 (1) of the Research Organisation Act on federally subsidised research, technology and innovation in Austria

This report was commissioned by the Federal Ministry of Science, Research and Economy (BMWFW) and the Federal Ministry for Transport, Innovation, and Technology (BMVIT). It was written by a working group consisting of the Austrian Institute of Technology (AIT), JOANNEUM RESEARCH (JR) and the Austrian Institute of Economic Research (WIFO) with the support of the Centre for European Economic Research (ZEW). The Vienna University of Economics and Business (WU Wien) participated in the textual design.
Team of authors: Wolfgang Polt & Jürgen Streicher (Koordination, JR), Peter Biegelbauer (AIT), Eva Buchinger (AIT), Michael Dinges (AIT), Klaus Friesenbichler (WIFO), Georg Fürlinger (AIT), Florian Holzinger (JR), Werner Hölzl (WIFO), Kathrin Hranyai (WIFO), Jürgen Janger (WIFO), Angela Köppl (WIFO), Agnes Kügler (WIFO), Karl-Heinz Leitner (AIT), Reinhard Millner (WU Vienna), Michael Peneder (WIFO), Michael Ploder (JR), Christian Rammer (ZEW), Sybille Reidl (JR), Wolfram Rhomberg (AIT), Anna Strauss (WIFO), Fabian Unterlass (WIFO), Maximilian Unger (JR), Peter Vandor (WU Vienna).

Imprint

Owners, Authors and Publishers:
Federal Ministry of Science, Research and Economy (BMWFW), 1010 Vienna
Federal Ministry for Transport, Innovation and Technology (BMVIT), 1030 Vienna

Designed and produced by:
Peter Sachartschenko & Mag. Susanne Spreitzer OEG, Vienna
Translated by: Young Translations LLC, Vienna

Cover: © magann – Fotolia
Printed by:
Plöchl Druck, Freistadt

Vienna, 2016

Preface

The Austrian Research and Technology Report 2016, as a status report in accordance with sec 8 (1) of the Austrian Research Organisation Act (FOG), is dedicated to the current national and international developments in research, technology, and innovation. Key focus of this year's report is the Mid-term Report, which reviews, halfway through the RTI strategy of the Austrian federal government put forward in 2011, the progress that has been made implementing the set goals and measures since then. Within the framework of the RTI strategy, a number of specific goals and measures have been defined and implemented to varying degrees across different areas of the national research and innovation system. This report describes the achievements recorded and identifies the goals and measures that are currently implemented. It indicates that many measures have been worked on, and some of them have already been completed. At the same time, we can see that becoming an Innovation Leader will require a further increase in the intensity of implementation.

The RTI strategy has established itself as an important long-term and joint framework as far as policy-making and administration are concerned; with its broad, systematic perspective, it has also led to the improvement of the cross-departmental coordination of RTI-relevant topics. We regard the Mid-term Report as an opportunity to reflect on the tasks that remain, in addition to the ones already achieved, in order to achieve the ambitious goals of the RTI strategy in the remaining period, i.e. by 2020.

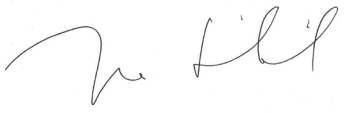
The second focus of this year's report looks at an area in which Austria continues to lag clearly behind the Innovation Leaders by international comparison. The federal government expects to see further stimulation of entrepreneurial and innovative systems on the back of the funding and promotion of "high-growth firms" in the knowledge-based service sector, the establishment of academic spin-offs, e.g. in the area of social entrepreneurship, encouraging the concept of the "entrepreneurial university", and strengthening the common public interest. The idea behind this approach is to cause the economic momentum to pick up speed, but also to help solve current and future challenges our society is facing.

Overall, Austria will boost its R&D expenditure according to the global estimate 2016 of Statistics Austria, to €10.74 billion, which represents an estimated increase of 2.9% (or €299.34 million) compared to the year before. Thus, the R&D expenditure falls slightly short of the estimated nominal increase of the gross domestic product of +3.65%. In 2016, Austria will achieve a research intensity of more than 3%, i.e. the European target value for 2020, for the third time in a row (2016: 3.07%). Relative to the rest of the EU, Austria currently (2014) ranks third behind Finland and Sweden in terms of research intensity, having just passed Germany and Denmark.

The business enterprise sector will account for the biggest share of R&D expenditure in terms of total expenditure at an estimated 47.8% (€5.14 billion), an increase of 4.58%. The share of foreign investment is very high by international

comparison at 16% (€1.72 billion). The total financing share of the private sector amounts to almost 64%, which constitutes a new high and as a result of which the system is taking another step towards reaching the target of a two-thirds/one-third split of private and public investments. With R&D expenditure of €3.83 billion, the public sector accounts for 35.7% of total expenditure. In spite of the high financing ratio of R&D by international comparison, it is clear that further steps will have to be taken by the public sector in order to ensure that the goal of becoming an Innovation Leader can actually be attained.

Dr Reinhold Mitterlehner
Vice Chancellor and Federal Minister of
Science, Research and Economy



BM Mag. Jörg Leichtfried
Federal Minister of Transport,
Innovation and Technology

Table of Contents

Executive Summary

The Research and Technology Report 2016 is a status report on Austria's federally funded research, technology, and innovation. It was commissioned by the Federal Ministry of Science, Research and Economy (BMWFW) and the Federal Ministry for Transport, Innovation and Technology (BMVIT). The report looks at current data and findings to describe significant trends in development and key themes in Austria's innovation system and examine them in the international context.

Global estimate of R&D expenditure in 2016

According to Statistics Austria's current global estimate of April 2016, the total expenditures for research and development carried out in Austria in 2016 will amount to €10.74 billion. This means an estimated growth of €299.34 million or 2.87% compared to the previous year. The forecasted R&D intensity (gross domestic expenditure for R&D in relation to gross domestic product) remained near the previous year's level at 3.07%, despite a slight decrease of 0.03 percentage points. Research intensity was adjusted to 3.10% (from 3.01%) for 2015 and to 3.07% (from 2.99%) for 2014. This means that the R&D intensity came out for the third year in a row above the European target of 3% for 2020. Overall, the constant upward trend continued for absolute R&D expenditure in recent years.

The largest portion of total gross domestic expenditure on R&D, expected to be €5.14 billion, or 47.8% of the overall sum, is financed by domestic firms (2014: 47%). Estimated growth compared to 2015 was €224.93 million (+4.58%), which, as in recent years, was above the forecasted nominal increase in gross domestic product (+3.65%).

The estimated financing from the public sector was approximately €3.83 billion, which was more than one-third (35.7%) of total R&D expenditures – a high share compared to other countries. The largest portion came from the federal government (about 30.1%), making it the most important public source of funding. R&D financing from the federal government, which saw an increase of 5.1% in 2015, will probably stagnate in 2016 according to the latest available information. In combination with the forecasted growth of nominal gross domestic product, which for 2016 lies above that of 2014 to 2015 this leads to a reduction in research intensity from 3.10% to 3.07% between 2015 and 2016. The share of financing from the regional governments will likely amount to 4.5% (about €478.47 million), those from other public institutions (municipalities, chambers of commerce, social insurance institutions) will amount to 1.1% (about €118.22 million).

About €1.72 billion (+3.65% or €60.61 million) came from abroad (primarily direct investments by foreign firms in their Austrian subsidiaries, a small part of which were returns from EU research programmes), whereby this sector contributed 16%, a financing share that was high in international comparison. Despite growth of 2.51%, the private non-profit sector contributed just 0.5% (about €49 million) to total expected R&D expenditures. Overall, there was significant growth since 2013 in all sources of funds for R&D expenditures, especially in the public sector (despite the stagnation in federal funds in 2016), which also was above that of gross domestic product in this period.

Austria was well above the EU-28 average of 2.03% in 2014 (the last year for which comparative international figures are available) with 3.07%, and is therefore just ahead of Denmark (3.05%) and Germany (2.87%), but behind Finland (3.17%), Sweden (3.16%).

Austria's position in international innovation rankings

One objective of the federal government's RTI strategy is to increase Austria's performance in research, technology and innovation in such a way that Austria breaks into the ranks of the leading nations for innovation (Innovation Leaders). Progress towards this goal is, among other things, measured by Austria's position in international innovation rankings. According to a preliminary assessment of the innovation rankings of the EU Commission, the European Innovation Scorecard (EIS; until 2015 called the Innovation Union Scoreboard), Austria was able to move up one ranking position in 2016 and would thereby be in tenth place among the EU member states. This would significantly reduce the gap between Austria and the Innovation Leaders in 2016, even though the gap would remain significant.

Austria was also able to improve in other innovation rankings, yet still displays a clear deficit compared with the top countries. In the Global Innovation Index, for example, Austria has improved its ranking by five places since 2013, reaching 15th place among the highly developed industrial countries. In the Innovation Indicator published by the German National Academy of Science and Engineering and the BDI Association of German Industry, Austria is currently ranked ninth and was able to move up five places. On the other hand, in the innovation-related indicator fields of the Global Competitiveness Index published by the World Economic Forum, Austria has fallen by one place in the 2015 edition.

The slow improvement of Austria's innovation performance, and to a certain degree its position in international innovation rankings, points to successes in efforts by the government, industry, and public research. However it also makes clear that structural changes will be required to tighten the gap to the leading countries and that, in an international environment in which all of the highly developed industrial countries are pushing to strengthen their innovative potential, rapid improvements within this group of countries will be extremely difficult. This is why it is important pursue the current path of ramping up efforts and focusing on the efficiency of the system.

Mid-term Report RTI Strategy

The federal government of Austria formulated its first Research, Technology and Innovation Strategy in March 2011. Since the strategy was adopted, various processes and institutions have been set up to implement it, many different activities and measures have been initiated, and some have already been completed. At about the halfway point of the RTI strategy, a mid-term report took stock of what has been achieved so far and what still has to be done, what likely cannot be achieved and what no longer seems worth pursuing in the light of changed strategic priorities and requirements. It was assembled using selected thematic priorities from the individual chapters of the RTI strategy. Neither the impact of the strategy nor of any of its related measures was analysed.

The RTI strategy formulates important measures for shaping the universities and strengthening their core functions in research and teaching. One central plan was the introduction of a new university financing model that splits funding for research and teaching, another is the expansion of competitive research financing. Although the main features of such a model have been developed, it has not yet been implemented in its entirety due to budgetary restrictions. However, incentives to improve the quality of teaching and supervisory relationships at Austrian universities were provided with the introduction of structural funding in the higher education sector, the

facilitation of admission restrictions in degree programmes that are in high demand, and within the framework of established performance agreements. In addition, the structural funding for the higher education sector increased the share of basic funding awarded in competitive processes. Moreover, measures were implemented for introducing a tenure-track model as well as increased support for doctoral candidates by expanding structured programme offerings. These two projects have not been completed yet and require further implementation and coordination processes from the stakeholders involved.

A series of specific measures were also implemented that support excellence in basic research. Although the excellence cluster programmes were not established in the form envisioned in the RTI strategy, there were nevertheless attempts to achieve similar results by expanding existing programmes (for example, Austrian Science Fund (FWF) special research areas, the START Programme) and existing institutions, such as the Austrian Academy of Sciences and the Institute of Science and Technology Austria (IST Austria).

Austria has already produced a long list of approaches and measures to accelerate gender balance in research, yet inequality persists. To encourage further progress, a systematic analysis of the policy mix for supporting equality is needed, as well as longer-term efforts and a resolute funding policy.

Ultimately, measures were also implemented to facilitate the expansion of research infrastructure, including incentives for promoting synergies and cooperation between various research stakeholders. An example of this is the joint procurement of research infrastructures financed by the higher education structural funds.

Quite a few steps were also taken in the field of innovation and corporate research to implement the RTI strategy (for example, cooperation between science and industry, demand-side stimulation of innovation, availability of venture capital for innovation-intensive enterprise creation, and Industry 4.0). For most of these measures, it seems too early to make an evaluation. In a few areas, such as cooperation between science and industry, there are numerous instruments, some of which are well established and designed for the long term. Here, the main policy task will be to adapt them by 2020 to reflect current and ongoing impact assessments. The field of venture capital requires that RTI policy remain patient: despite numerous initiatives and initial successes, for example in the field of crowdfunding, there have been no breakthrough improvements in attracting venture capital.

The RTI Task Force was created to define and coordinate implementation of the strategy at a high administrative level under the leadership of the Federal Chancellery in collaboration with the relevant federal ministries. Through intensive and regular information sharing and exchange, it has been possible in this way to strengthen further cooperation between RTI ministries in recent years, thereby making an essential contribution to shaping RTI governance structures in a more efficient way. The new federal budget law established long-term budget plans and defined output targets as important framework conditions for public research financing. Lastly, new RTI and Austrian Research Promotion Agency (FFG) guidelines were drafted in response to new European legal regulations for government aid. These new guidelines aim to make the awarding of funding more transparent and to avoid multiple funding.

The performance agreements with research institutions are a further important element in the efforts to improve governance. The improvement of the performance agreements with the universities has resulted in steps towards a more transparent and service-oriented process for awarding public funds being implemented in a continuous basis, which also at the same time guarantee medium-term planning security for the relevant institutions. This instrument was also applied to federal financing of non-university research institutions, the ÖAW, and IST Austria. The integration of various non-university institutions into the universities also constitutes an important

measure for setting research priorities at these institutions.

The European Commission has established the concept of "smart specialisation", thereby creating a major new policy framework. Smart specialisation represents an important reference framework for the definition of strategic priorities in research and technology development, both for policy and at the level of individual institutions. Coordinating and inter-ministerial working groups were set up in the fields of climate change and demographic change to cope with global and social challenges. Measures related to "Smart Cities" were implemented, and instruments were created such as the "Austrian Climate Research Programme" and the support programme "Energy Research: Technologies for the Future".

The European and International Programmes (EIP) at the Austrian Research Promotion Agency's (FFG) and the EU Performance Monitoring situated within the EIP are helping to successfully integrate Austria in European-level RTI policy and raise its visibility there. The "Beyond Europe" internationalisation strategy of the RTI Task Force also addresses strategic targets and measures for a stronger international orientation among Austria's RTI stakeholders. With regard to the relationship between research and society, progress was made in the course of public discussions towards establishing high standards for scientific integrity. This was particularly encouraged by activities of the Austrian Agency for Research Integrity (ÖAWI). Several target-group-oriented initiatives, such as the "Long Night of Research", highlight research as a social achievement that shapes the future.

In summary, the federal government's RTI strategy has created some essential incentives to change in several different areas and has a number of improvements to show. Despite the catching-up process in recent years, Austria has lost some of its dynamic momentum since the economic and financial crisis of 2008 with respect to its overarching goals, such as joining the group of Innovation Leaders or achieving an overall R&D intensity of 3.76%. The major challenge for reaching this intensity target is increasing the R&D intensity of the private sector. For this reason, many of the RTI strategy measures are designed as incentives and support for the private sector in order to facilitate an increase R&D in the business enterprise sector. If this does not happen or does so to an insufficient degree, then it will be very difficult to attain the intensity target. To overcome these substantial deviations from the plan equally substantial efforts will be required.

High-growth firms, academic spin-offs and social entrepreneurship in Austria

Employment growth and increasing social prosperity are also central objectives in research, technology and innovation policy. The topics of new ventures, spin-offs, and entrepreneurship have gained significance as important factors for innovation and structural change in recent years. The analysis of enterprise dynamics shows that Austria continues to lag clearly behind the Innovation Leaders. Although in technology-oriented production sectors the gap is comparatively small and the level similarly high, the dynamism of new ventures and high-growth firms in knowledge-intensive services remains lower than what we find among the Innovation Leaders. It is in this context that numerous RTI policy strategies, ministry initiatives, and specific measures meant to support technology and enterprise formation dedicate themselves to strengthening entrepreneurial culture, entrepreneurship, and innovation, with the goal of enlivening entrepreneurial ecosystems and innovative enterprise creation.

Support for academic spin-offs has long been gaining steam in Austria, just as entrepreneurial education for university students and the promotion of the concept of the *entrepreneurial university*. The numerous programmes aimed at promoting and funding cooperation between science and industry are in principle fertile soil for academic spin-offs, as scientists gain experience

here of economic problems, business management perspectives and future market needs.

The growing number of private initiatives, such as idea competitions, business plan competitions, prizes and awards, informational events, community meetings, and pitching events also contribute to the promotion and formation of an entrepreneurship ecosystem in general and of an increasingly beneficial environment for academic spin-offs in particular. The performance agreements with the universities for 2016–2018 highlight the topics of knowledge and technology transfer, as well as support for spin-off enterprises. Summing up, however, time and effort are still required in order for the desired broad impact to develop in such aspects as awareness raising, teaching offers, and specific advising services on entrepreneurship.

As the meaning of innovation has expanded, social entrepreneurship and common public interest have developed into fields of increasing relevance. Rising birth rates of social enterprises provide evidence that appreciably more individuals and organisations are making an entrepreneurial and innovative contribution to solving current and future challenges in society. Many of these organisations are active in the service sector, thus generating added value in the respective country. A corresponding ecosystem is also being formed at present that may be capable of advancing this trend over the long term. Additional measures will be needed in future to enable sustainable development, such as the creation of suitable legal frameworks for social businesses, both in terms of establishing a specific legal kind of business form as well as stimulating potential investors in this field, such as non-profit foundations.

In terms of funding, an initial comprehensive step has been taken to mobilise private investment capital for non-profit purposes (e.g. for new social enterprises, science and research, etc.) and to produce a complementary positive start-up dynamism in the non-profit foundation sector with the non-profit package and the amendment to the Federal Foundation and Fund Act. This is meant to help generate new venture dynamism, also in the non-profit foundation sector.

1 Current Trends

1.1 Trend of R&D expenditures based on new global estimate

According to Statistics Austria's current global estimate of April 2016, the total expenditures for research and development carried out in Austria in 2016 will amount to €10.74 billion. This means an estimated growth of €299.34 million or 2.87% compared to the previous year. The forecasted R&D intensity (gross domestic expenditure for R&D in relation to gross domestic product) remained at 3.07%, despite a slight decrease of 0.03 percentage points, approximately the same level as for 2015 (3.10%, revised from 3.01% in the global assessment 2015) and 2014 (3.07%, revised from 2.99% in the global assessment 2015). The R&D intensity has therefore been above the European target value for 2020 of 3% for three years in a row. Fig. 1-1 shows the trend of absolute amounts of R&D expenditures for individual sectors as well as the R&D intensity. Overall, the consistent upward trend for R&D expenditure continued in recent years. However, research intensity does not just depend on the amount of expenditure on R&D in Austria, but also to a high degree on the actual and forecasted development of gross domestic product.

Austria, with 3.07%, was well above the EU-28 average of 2.03% in 2014 (the last year for which comparative international figures are available) and is therefore ahead of Germany (2.87%), but behind Finland (3.17%), Sweden (3.16%), and just ahead of Denmark (3.05%).[1]

The anticipated growth of R&D financing by sources of funds is shown in Fig. 1-2 and Fig. 1-3. The financing from the public sector was approximately €3.83 billion, which was 35.7% of total R&D expenditures. The largest portion – €3.24 billion – came from the federal government (about 30.1%), which is the most important public source of funding. Nevertheless, a slight drop in federal funding is expected in comparison to the previous year (€7.15 million, or –0.22%), which partially explains the forecasted decline in R&D intensity. The regional governments contribute an estimated €478.47 million (+3.65%), with other public institutions (local government authorities, chambers, social security institutions) providing €118.22 million (+2.52%) of research financing, which corresponds to financing shares of 4.5% and 1.1% respectively.

An estimated 47.8% of total gross domestic expenditure on R&D, about €5.14 billion, is financed by domestic firms (2014: 47.0%). Estimated growth compared to 2015 is €224.93 million (+4.58%). The business enterprise sector continues to be the most quantitatively significant national economic sector for financing research in Austria. In 2016, as in recent years, growth in R&D financing from firms will exceed the forecasted nominal increase in Austria's economic output (GDP: +3.65%).

With just 0.5% (about €49 million) of total expected R&D expenditures, the private non-profit sector continues to have the lowest financing volume by far, even though it posted slight growth of €1.20 million (+2.51%).

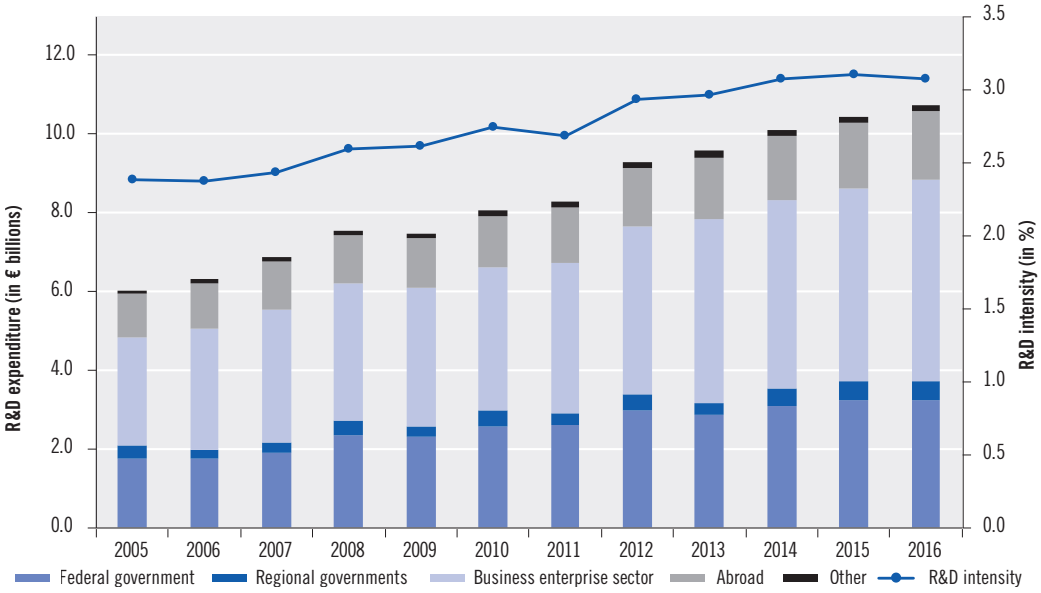
A high proportion of R&D financing (16.0%) continues to come from abroad (total of €1.72 bil-

1 See Eurostat (2016): Internal company R&D expenditure as a whole by sector of performance. [rd_e_gerdtot]

lion; +3.65% or €60.61 million), with foreign firms that invest directly in their Austrian subsidiaries constituting the most important source of financing. The returns from the EU Research Programmes are also included in the foreign funding.

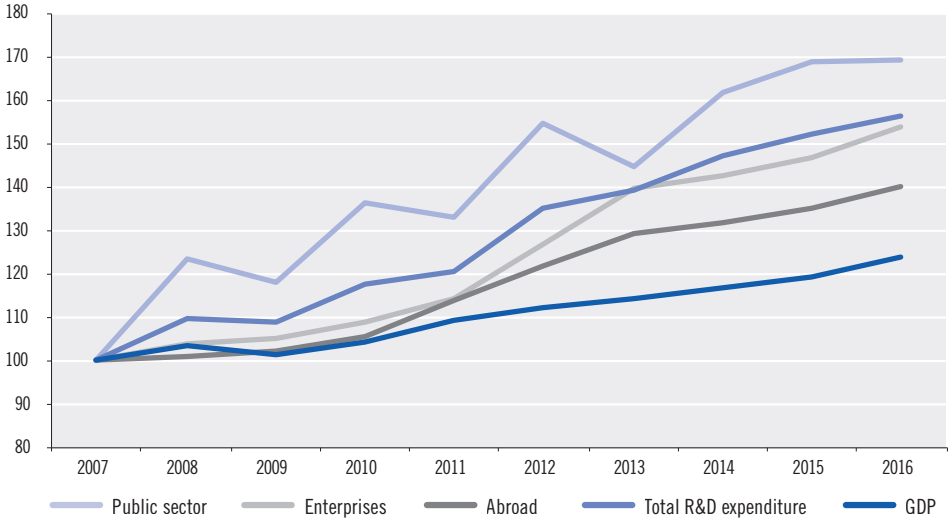
Overall, there was significant growth since 2013 in all sources of funds for R&D expendi-

Fig. 1-1: Expenditure on research and development in Austria by sources of funds



Source: Statistics Austria, Global Estimate as at 20 April 2016, nominal values.

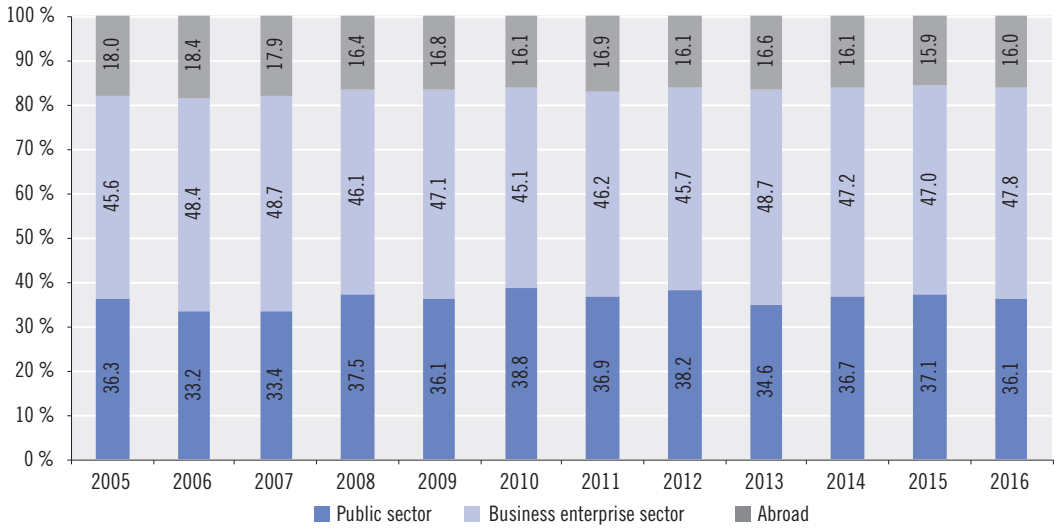
Fig. 1-2: Development of R&D in Austria by funding source (Index, 2007=100)



Note: The funding source "Other" (which includes the municipalities and the social insurance institutions) as well as the private non-profit sector was counted under the "Public sector" here.

Source: Statistics Austria, Global Estimate as at 20 April 2016.

Fig. 1-3: R&D funding shares in Austria by sources of funds (in %)



Note: The funding source "Other" (which includes the municipalities and the social insurance institutions) as well as the private non-profit sector was counted under the "Public sector" here.

Source: Statistics Austria, Global Estimate as at 20 April 2016.

tures, especially in the public sector (despite stagnation in federal funds in 2016), which also was above that of gross domestic product in this period (see Fig. 1-2). If we sum up the financing volumes for R&D from the business enterprise sector and from abroad, remaining mindful of the fact that most foreign funds come from firms, this yields a total financing share for the private sector of 63.8%, which is close to the target for the private financing share of two-thirds specified in the RTI strategy.

1.2 Financing and implementation of R&D in Austria

Statistics Austria collects data on research and development (R&D) every two years.[2] The current version of the R&D survey for 2013 appeared in 2015 and, like the R&D survey for 2011, was carried out as a full survey on the basis of the OECD's Frascati Manual's methodology, standards, and definitions, which facilitates the international comparison of data.[3] "*R&D is defined as an activity undertaken on a systematic basis to in order to increase the stock of knowledge ... and the use of this stock of knowledge to devise new applications.*" The elements of novelty and originality (new findings, new knowledge, new knowledge systems, and new applications) are therefore the most important criteria for distinguishing R&D from other scientific and technological activities. In addition, R&D includes natural science and technical research as well as research in the social sciences and the humanities.

There are four distinct sectors of performance: firms (institutes' sub-sector and company R&D sub-sectors), universities, the state, and the private non-profit sector. The institutes' sub-sector of the business enterprise sector includes research service institutions that regularly conduct R&D for firms. This sub-sector primarily consists of members of the Association of Austrian

2 The years 2006 and 2007 are an exception as the frequency of the surveys was moved to odd calendar years.
3 See OECD (2002).

Cooperative Research Institutions (ACR - Austrian Cooperative Research), JOANNEUM RESEARCH Forschungsgesellschaft mbH, the Austrian Institute of Technology GmbH (AIT), and since 2009, the competence centres from the COMET programme lines. By contrast, the company R&D sub-sector includes public and private firms that produce goods for the market due to the attainment of a profit or other economic advantage. The "university" sector includes public and private universities, universities of applied sciences, university colleges for teacher education, the University for Continuing Education Krems, the Austrian Academy of Sciences, the testing institutes at technical federal colleges, and other university institutions as well. The federal government, local governments, chambers of commerce, social insurance institutions, and other private non-profit institutions that are financed or controlled by the public sector, together comprise the "government" sector.[4] The private non-profit sector includes private non-profit institutions whose status is predominantly private or under civil law, denominational or otherwise non-public.

Distinctions are made with regard to financing between the business enterprise sector, the public sector, the private non-profit sector, and financing from abroad.[5]

R&D in Austria

According to the R&D survey, R&D expenditures increased from 2011 to 2013 by 16% to €9.571 billion (2011: €8.276 billion). The business enterprise sector accounted for the highest share (70.8%) of total R&D expenditures on R&D execution with €6.778 billion (Table 1-1). The higher education sector and the government sector constituted far lower shares with 24.3% (€2.328 billion) and 4.4% (€425 million). The private non-profit sector played a minor role with 0.4% (€40 million). By contrast, a more subtly differentiated image emerges on the financing side. Although the business enterprise sector also contributes the largest proportion (48.7%) to all R&D financing with €4.666 billion, the contribution to the public sector (34.2% or €3.270 billion) is significantly lower. Funding from abroad contributed 16.6%, of which the largest portion (€1.410 billion) comes from foreign firms and international organisations. The EU provided a share of 1.9%, or €181 million.

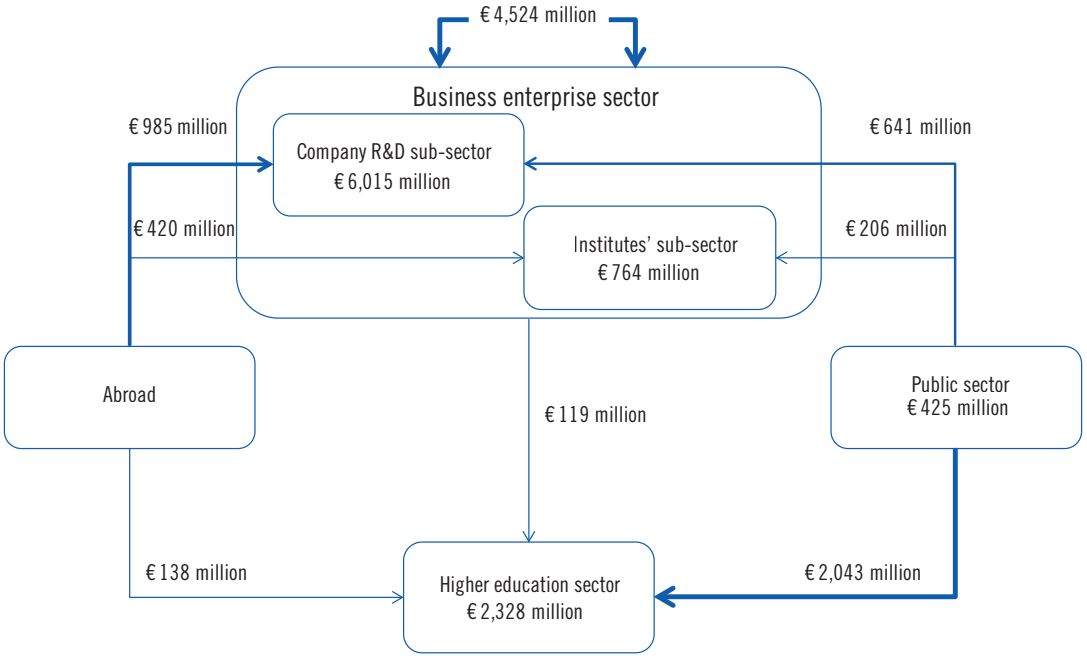
Fig. 1-4 shows financing flows between the different sectors: The boxes show the scope of R&D expenditures among the sectors of performance, while the arrows symbolise the funding streams. In the business enterprise sector, 97% of €4.666 billion is invested in R&D within the sector itself; 66.7% (2011: 64.8%) is financed from the sector's own funds. 88.4% of funding from abroad (primarily firms and the EU) went to the business enterprise sector. Although only 26% (€847 million) of public sector funds went to R&D in the business enterprise sector, the public sector was responsible for 12% of business financing, which is a very high proportion by international comparison. The public sector's €2.043 billion primarily went to the university sector (87.8% of R&D expenditures in the higher education sector are financed by the public sector). A total of €119 million (25% of its R&D funds) flowed from the business enterprise sector to the higher education sector.

Financing streams have scarcely changed since 2002 (Fig 1-5). Only the public sector, or more

4 Unless otherwise stated, the data includes Federal institutions (not including those combined in the higher education sector), regional government, local government and chamber institutions, R&D institutions of the social insurance carriers, public sector-financed and/or controlled private non-profit institutions as well as R&D institutions of the Ludwig Boltzmann-Gesellschaft, including regional hospitals. The regional hospitals were not surveyed by questionnaire, but instead Statistics Austria prepared an estimate of the R&D expenditures based on the reports of the offices of the provincial governments.

5 Unless otherwise stated, the term "abroad" includes foreign firms in the data including international organisations. The EU is stated separately as part of the foreign funding.

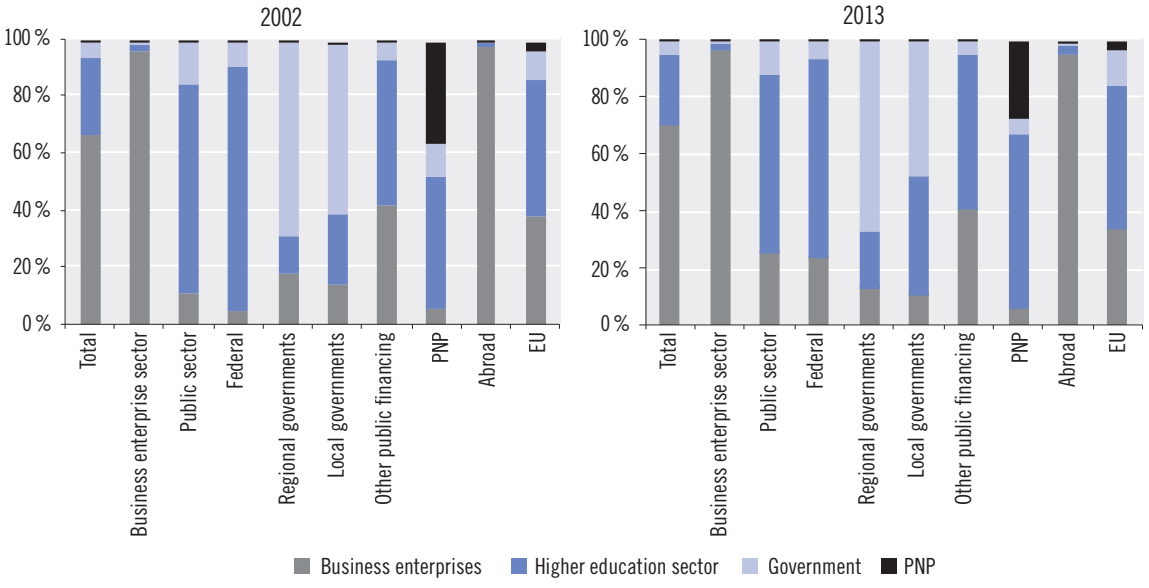
Fig. 1-4: Performance and funding of R&D, 2013



Note: The private non-profit sector was not shown in the interest of clarity. Foreign (incl. EU)

Source: Statistics Austria. Calculations: Austrian Institute of Economic Research (WIFO). Presentation based on JOANNEUM RESEARCH.

Fig. 1-5: Distribution of funding by sectors of performance (in %), 2002 and 2013



Note: The figure shows the distribution of the sources of funds (horizontal axis) among the different sectors of performance (vertical axis).
PNP = private non-profit sector

Source: Statistics Austria. Calculations: Austrian Institute of Economic Research (WIFO).

specifically the federal government, awarded more funds to the business enterprise sector in 2013 (and correspondingly less to the higher education and government sectors) than was the case in 2002 (2002: 11%; 2011: 25%; 2013: 26%). The increase by 15 percentage points shows the growing significance of public financing for the business enterprise sector. The reason for this increase may be the research premium, which is allocated to federal financing.[6] The research premium is an indirect research funding instrument that firms can apply for to cover expenditures for internal research and experimental development. This instrument was expanded from 8% to 10% on 1 January 2011 and has been 12% since 1 January 2016. Since 2013, in order for the premium to be granted, an expert opinion for R&D conducted since 2012 has to be obtained from the Austrian Research Promotion Agency (FFG).

Trend of R&D funding structure

Contrary to Fig 1-5, Fig. 1-6 shows the financing structure within the sectors of performance for the years 2002, 2011, and 2013. Financing from the business enterprise sector climbed from 44.6% of total R&D financing in 2002 to 48.7% in 2013. While little changed in the university and government sectors, the business enterprise sector has enjoyed an increase in the share of public financing (2002: 5.6%; 2013: 12.5%) and self-financing (2002: 64.5%; 2013: 66.7%) at the expense of foreign funding (2002: 29.9%; 2013: 20.7%).

One of the key objectives of European RTI policy and thus of the national RTI strategy is to increase the business enterprise sector's share in overall funding to 66%, and ideally even to 70%, by 2020.[7] The financing share of firms currently amounts to 47.4%[8], which is low in international comparison (OECD average: 60.1%). Austria, however, showed a very high proportion of funding from abroad (15.4%; OECD: 5.5%), most of which came from firms. If we view domestic and foreign corporate financing together (Fig. 1-7), Austria comes close, at about 62.8% (2011: 63.1%) in overall research financing to the OECD and EU-28 average (OECD: 65.7%; EU-28: 64.3%), although additional efforts are still required.

Statistics Austria's R&D survey differentiates R&D expenditures by the type of research (basic

Table 1-1: R&D expenditures broken down by sector of performance and source of funding, 2013

Sector of performance	in € millions	Share in %	Sources of funds	in € millions	Share in %
Business enterprise sector	6,778	70.8	Business enterprise sector	4,666	48.7
Institutes' sub-sector ("kooperativer Bereich")	764	8.0	Public sector	3,270	34.2
Company R&D sub-sector ("firmeneigener Bereich")	6,015	62.8	Private non-profit sector	45	0.5
Higher education sector	2,328	24.3	Abroad	1,590	16.6
Government sector	425	4.4	Abroad (excluding EU)	1,410	14.7
Private non-profit sector	40	0.4	EU	181	1.9
Total	**9,571**	**100**	**Total**	**9,571**	**100**

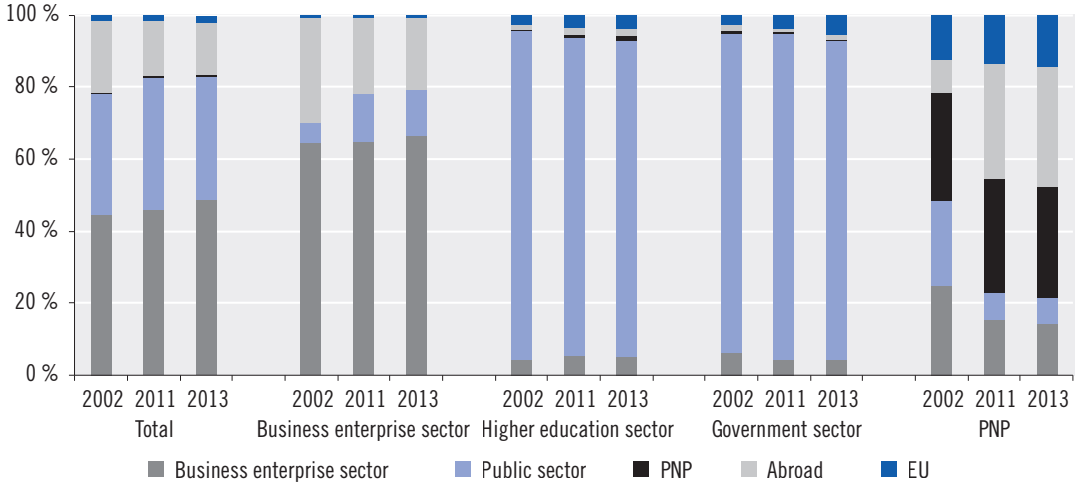
Source: Statistics Austria. Calculations: Austrian Institute of Economic Research (WIFO).

6 Corporate funding through the research premium is indirect funding according to the new Frascati Manual 2015. In international comparison itIt is consequently no longer allocated to public funding going forward, but rather to the business enterprise sector's own funding. For 2013 therefore the funding by the public sector would amount to 29.2% (instead of 34.2%), and by the business enterprise sector 53.6% (instead of 48.7%).

7 See BKA et al. (2011, 7).

8 The figures relate to OECD data and differ slightly from the national data from Statistics Austria. They were used in order to enable an international comparison.

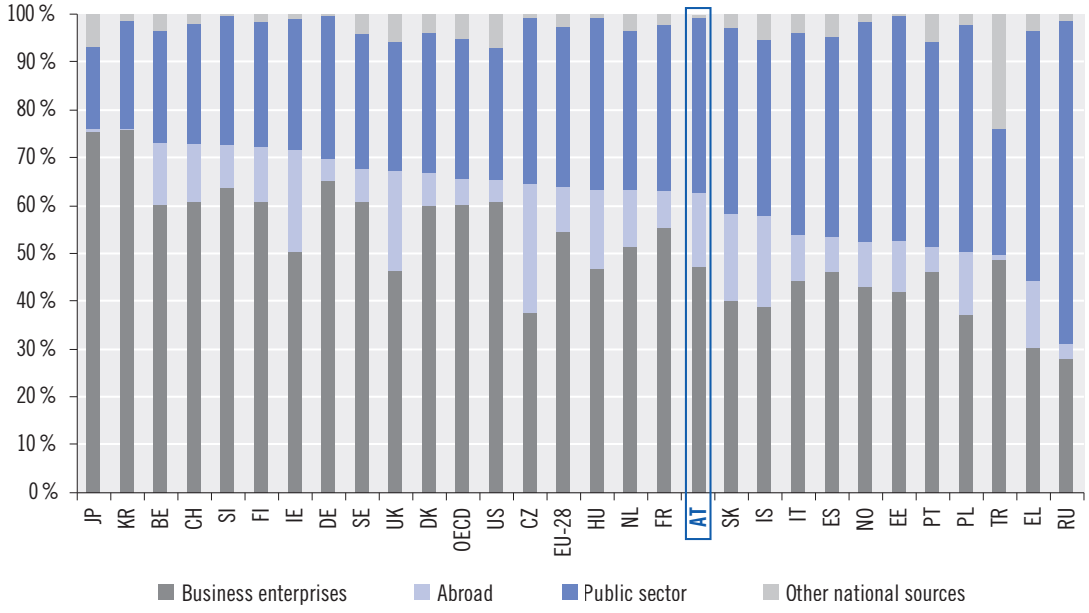
Fig. 1-6: R&D expenditure by sources of funds (in %)



Note: The figure shows the origin of the funds (vertical axis) within sectors of performance (horizontal axis). PNP = private non-profit sector

Source: Statistics Austria. Calculations: Austrian Institute of Economic Research (WIFO).

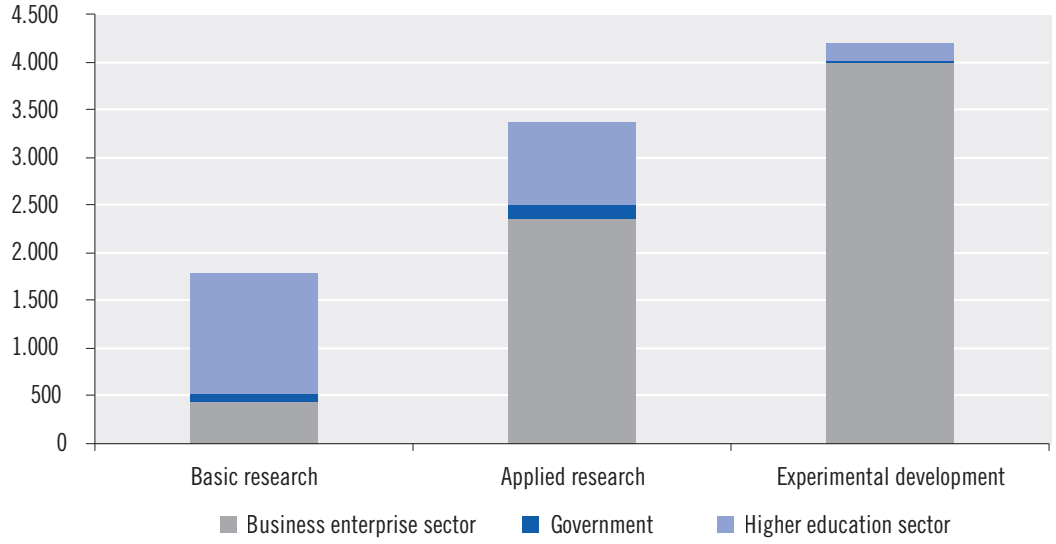
Fig. 1-7: Funding structure in an international comparison (in %), 2013



Note: some countries with estimates. See Table 7.1 in Annex I. for country abbreviations.

Source: OECD – MSTI, Statistics Austria. Calculations: Austrian Institute of Economic Research (WIFO).

Fig. 1-8: Expenditure for the different types of research by sectors of performance (in € millions), 2013



Note: The private non-profit sector was not included due to its minor share.

Source: Statistics Austria. Calculations: Austrian Institute of Economic Research (WIFO).

research, applied research, and experimental development) and the type of expenditure. In 2013, experimental development was pursued above all else (2013: 44.7%), which was done almost exclusively in the business enterprise sector (see Fig. 1-8). Most applied research was also conducted in this sector (69% of €3.403 billion). By contrast, the higher education sector is the most important sector of performance for basic research (70.4% in comparison to 24% for firms), for which the comparatively least amount – €1.806 billion – was spent. Expenditure for all three types of research has roughly doubled since 2002 (basic research: 2002: €819 million; 2013: €1.577 billion; applied research: 2002: €1.727 billion, 2013: €2.907 billion, experimental development: 2002: €2.051 billion, 2013: €3.642 billion), with basic research posting the greatest growth at 54.6%. While the share of experimental development in total expenditures has remained nearly constant (2002: 44.6%, 2013: 44.7%), spending on basic research has grown at the expense of applied research (2002: 17.8 % vs. 37.6%; 2013: 19.2% vs. 36.2%). By international comparison, Austria has caught up with the group of leading countries in spending for basic research: Austria's share of 0.56% of GDP (2013) puts it ahead of countries such as Denmark (2012: 0.52%), France (2012: 0.54%), and the US (2013: 0.48%), yet behind South Korea (2013: 0.75%) and Switzerland (2012: 0.9%).[9]

In R&D expenditures by type of expenditure (Table 1-2), both expenditures for equipment investments, construction, and real estate acquisition have changed relatively evenly over time. One striking change is the increase in current costs by almost €750 million from 2011 to 2013. These can be explained primarily by the increase in business financing for current costs (2011: €2.250 billion, 2013: €2,949 billion). Despite this increase in current costs, almost half of expenses (€4.686 billion) was spent on staff in 2013.

9 Any international comparison for basic research expenditure is only possible to a certain extent, because many countries such as Germany, Finland and Sweden do not distinguish between types of research in their R&D surveys.

Table 1-2: Type of expenditure over time

Type of expenditure	2002		2011		2013	
	[in € millions]	[in %]	[in € millions]	[in %]	[in € millions]	[in %]
Labour costs	2,322	50	4,186	51	4,686	49
Other current costs	1,965	42	3,423	41	4,166	44
Expenditure for instruments and equipment	316	7	502	6	553	6
Land and buildings	81	2	165	2	166	2
Total	**4,684**	**100**	**8,276**	**100**	**9,571**	**100**

Source: Statistics Austria. Calculations: Austrian Institute of Economic Research (WIFO).

R&D in the higher education sector

Depending on the scientific discipline, R&D expenditures in the higher education sector were between €78 million (agricultural science) and about €740 million (natural science). Financing from the public sector was over 80% in all fields of science (Table 1-3). Federal financing comprised the largest portion of public financing and oscillated between 59.8% for the technical sciences and 84.4% for the humanities. In the technical sciences, the business enterprise sector, beside the public financing, made an above-average contribution of 13% as well.

R&D in the business enterprise sector

In 2013, 62% (€4.206 billion) of total R&D expenditures went to firms in the manufacturing industry, meaning that this industry's share has fallen by almost ten percentage points since 2004 (2004: 71.1%) (Table 1-4). R&D expenditures on services have risen by about the same percentage (2004: 27.4%; 2013: 37%). There was also a shift

Table 1-3: Financing of R&D expenditures in the higher education sector by scientific discipline, 2013

Scientific discipline	Number of units conducting R&D	Total		Public sector							
			Business enterprise sector	Federal government	Regional governments	Local governments	Other	Total	PNP	Abroad (excluding EU)	EU
		[in € millions]	[in %]	[in %]	[in %]	[in %]	[in %]	[in %]	[in %]	[in %]	[in %]
1.0 to 6.0 Total	1,273	2,328	5.1	72.7	2.6	0.1	12.3	87.8	1.2	2.0	3.9
1.0 to 4.0 Subtotal	717	1,785	6.1	69.4	2.8	0.1	13.8	86.1	0.9	2.4	4.5
1.0 Natural sciences	262	738	2.4	71.7	2.3	0.1	15.2	89.3	0.4	2.1	5.8
2.0 Engineering	221	431	13.1	59.8	3.3	0.4	14.9	78.4	0.9	2.5	5.0
3.0 Human medicine, health sciences	182	538	6.3	72.1	3.3	0.1	11.6	87.0	1.6	2.8	2.4
4.0 Agricultural sciences, veterinary medicine	52	78	2.0	81.4	0.7	0.1	9.3	91.5	0.9	1.8	3.8
5.0 and 6.0 together	556	543	1.6	83.8	2.2	0.1	7.3	93.4	2.1	1.0	1.9
5.0 Social sciences	349	340	2.2	83.5	2.3	0.1	5.5	91.5	3.0	1.0	2.3
6.0 Humanities	207	203	0.7	84.4	1.8	0.1	10.3	96.6	0.7	0.9	1.2

Note: PNP = private non-profit sector

Source: Statistics Austria. Calculations: Austrian Institute of Economic Research (WIFO).

Table 1-4: R&D expenditure and employees in the business enterprise sector by economic sub-sectors and knowledge intensity, 2004 and 2013

Sector	2013					2004				
	Units conducting R&D	Employees in R&D, FTEs (full time equivalents)	R&D expenditure	GVA	R&D as component of GVA	Units conducting R&D	Employees in R&D, FTEs (full time equivalents)	R&D expenditure	GVA	R&D as component of GVA
	Share of all sectors [in %]				[in %]	Share of all sectors [in %]				[in %]
Agriculture and forestry, fisheries	4	0.0	0.1	1.4	0.1	5	0.1	0.1	1.7	0.1
Mining	11	0.0	0.0	0.5	0.2	11	0.1	0.1	0.4	0.3
Manufacturing	1,423	61.0	62.0	18.5	7.9	1,229	72.0	71.7	19.6	6.1
Innovation types										
high	596	35.4	36.6	5.8	14.9	514	43.3	44.2	5.2	13.9
medium-high	390	17.3	18.7	5.4	8.2	320	20.4	20.7	6.0	5.7
medium	327	7.1	5.7	5.0	2.7	283	6.5	5.1	5.0	1.7
medium-low	94	1.1	0.9	2.2	0.9	90	1.2	0.9	2.6	0.6
low	9	0.1	0.0	0.1	1.1	20	0.4	0.4	0.3	2.4
Technology types										
high technology	197	11.0	13.3	1.7	18.1	160	25.7	28.6	2.2	21.7
medium-high technology	539	34.8	34.3	6.4	12.7	466	30.1	28.9	5.8	8.3
medium-low/low technology	687	15.3	11.5	10.4	2.6	603	16.2	21.9	19.6	1.8
Electricity, gas and water supply	48	0.3	0.3	2.9	0.2	25	0.3	0.3	3.4	0.1
Construction	77	0.8	0.6	6.4	0.2	65	0.6	0.5	7.3	0.1
Services	1,763	37.8	37.0	70.2	1.2	788	26.9	27.4	67.7	0.7
Knowledge intensity										
high-tech knowledge intensive	788	24.0	21.6	3.0	17.1	344	15.4	15.5	3.2	8.0
Other services	975	13.7	15.4	70.2	0.5	444	11.5	11.9	64.4	0.3

Note: Economic sub-sectors according to ÖNACE 2008; innovation types: low (14, 15), medium-low (10–12, 18), medium (16, 17, 25, 31–33) medium-high (13, 19, 20, 22–24, 29, 30), high (21, 26– 28); technology types: high technology (21, 26), medium-high technology (20, 27–30) medium-low/low technology: miscellaneous; knowledge intensity: high-tech knowledge intensive (59–63, 72); 61–63 & 72 were used as the sectors 58–60 are stated as aggregates in the R&D survey; Other services: miscellaneous. GVA = gross value added.

Source: Statistics Austria. Calculations: Austrian Institute of Economic Research (WIFO).

in the share of employment in R&D in full-time equivalents (FTEs) from the manufacturing industry (2004: 72%; 2013: 61%) to services (2004: 26.9%; 2013: 37.8%).[10] In contrast, the R&D intensity (share of R&D expenditures as part of gross value added) increased in both industries (manufacturing: 2004: 6.1%; 2013: 7.9%; services: 2004: 0.7%; 2013: 1.2%). Taxonomies offer a nuanced view of economic structure by grouping sectors according to certain features, including Peneder's innovation taxonomy[11], which summarises the goods and services industry by their innovation performance, or classifications by the OECD that divide manufacturing and service sectors into groups based on their research and knowledge intensity. Both classifications – according to broader innovation performance that includes non-technological innovation, as well as more narrowly defined R&D intensity – reveal high concentrations of R&D expenditures

10 Attention must be paid to the classification problems, so e.g. the considerable research by carmakers in Austria is assigned to wholesale trade, as the overwhelming proportion of value creation is achieved in trade and not in production. Additionally, individual firms may also be reclassified over time.

11 See Peneder (2010). In this taxonomy, goods and service sectors are divided at the NACE 2 2-digit level according to their innovation performance. The innovation performance is measured based on micro data from the Community Innovation Survey (CIS) and includes e.g. the introduction of product innovations. It supplements taxonomies such as the high-tech taxonomy of the OECD, which is based narrowly on R&D intensity in manufacturing.

on classification segments that are most intensive in technology, innovation, or knowledge, although innovation activity is more broadly scattered than pure R&D activity.

Concentration tendencies also show up depending on firm size (Table 1-5) : Companies with 1,000 or more employees make up the largest share of internal R&D expenditures in the business enterprise sector. Although these firms only constitute 2.2% of all surveyed units conducting R&D, they are responsible for 40.5% of internal R&D expenditures. In the same class of large firms, there was a very high proportion of foreign funding (36.1%), which underscores Austria's international attractiveness as a place to carry out R&D. The importance of the research premium is on the rise for large firms with more than 250 employees (2011: 7.4%) in comparison to small companies (3.5–5.9%).

Internal and external R&D in the business enterprise sector

External R&D expenditure includes the acquisition of R&D allocated externally to third parties. Internal R&D expenditure on the other hand includes own R&D, R&D carried out on behalf of third parties and current costs that are incurred on account of the R&D project implemented. The distinction between internal and external R&D is not always a clear one. Only the internal R&D expenditure is stated in the R&D statistics in order to avoid duplicate payments.

While external R&D expenditure increased by 67.6% between 2002 and 2011, there was a 24.6% reduction between 2011 and 2013 (2002: €483.5 million; 2011: €810.4 million; 2013: €610.7 million) caused primarily by a decrease in the research contracts to foreign institutions (Fig. 1-9). The heavy fall in external funding for R&D has been accompanied by a significant increase in internal R&D expenditure for current costs in the business enterprise sector. These increased by 31% from €2.250 billion in 2011 to €2.949 billion in 2013. According to Statistics Austria[12], this could be as a result of a change in reporting behaviour by firms in response to the expert reports introduced by the Austrian Research Promotion Agency (FFG) for research premiums in 2013. According to these, firms must increasingly state internal funding in order to gain research premiums. This in turn reduces the external funding, presumably through shifts internally within the group. Unlike the

Table 1-5: Financing of R&D expenditure by employment size category, 2013

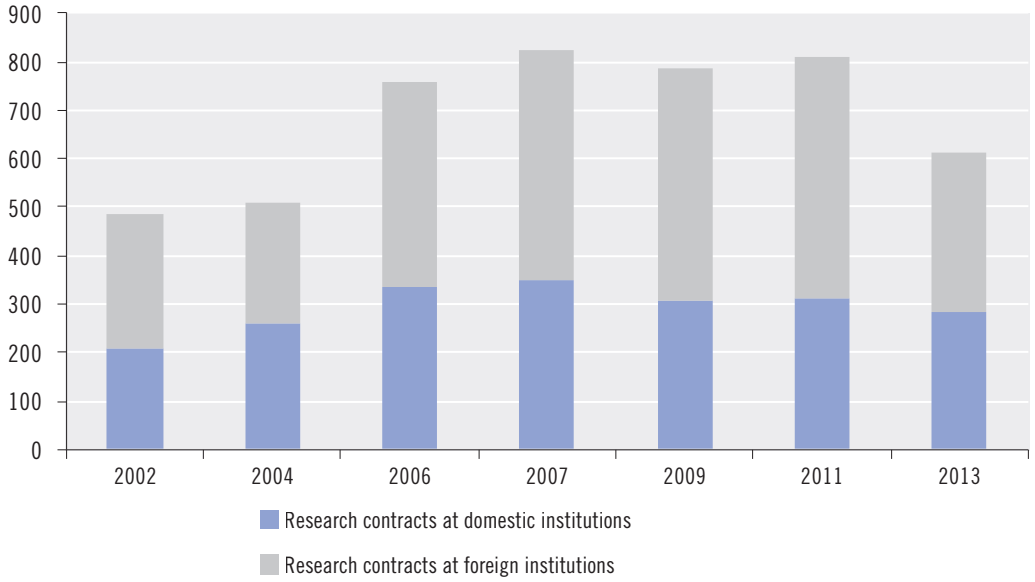
Size category	Units conducting R&D		R&D expenditure		Proportions by sources of funds [in %]									
					Business enterprise sector	Public sector						Abroad (excluding EU)		
	Number	Share [in %]	[in € millions]	Share [in %]		Federal government	Research premiums	Regional governments	FFG	other public financing	Total	PNP		EU
Less than 10 employees	1,135	34.1	160	2.4	70.1	2.6	3.5	1.8	12.2	1.6	21.7	1.1	4.3	2.8
10 – 49 employees	930	28.0	528	7.8	73.4	1.5	5.6	1.8	7.1	0.8	16.8	0.2	7.2	2.4
50 – 249 employees	805	24.2	1,213	17.9	70.3	2.1	5.9	1.6	5.8	0.4	15.8	0.0	12.5	1.4
250 – 999 employees	384	11.5	2,130	31.4	79.3	2.4	7.4	0.4	1.9	0.3	12.5	0.0	7.3	0.8
1,000 and more employees	72	2.2	2,747	40.5	53.9	1.0	7.4	0.1	1.1	0.1	9.7	0.0	36.1	0.3
Total	**3,326**	**100.0**	**6,778**	**100.0**	**66.7**	**1.7**	**6.9**	**0.6**	**2.9**	**0.3**	**12.5**	**0.0**	**19.8**	**0.9**

Note: PNP = private non-profit sector

Source: Statistics Austria. Calculations: Austrian Institute of Economic Research (WIFO).

12 See Schiefer (2015a, 2015b).

Fig. 1-9: Development of external R&D funding in the business enterprise sector (in € millions), 2002–2013



Source: Statistics Austria. Calculations: Austrian Institute of Economic Research (WIFO).

acquisition of contracted research, which has a cap of €1 million, there is no maximum calculation basis with internal R&D funding. Clinical studies commissioned externally are also no longer considered intramural R&D expenditure of the implementing research institution by the financial authorities, but rather as current costs incurred by a pharmaceutical company. Given that the fall in external R&D funding was only €200 million between 2011 and 2013, while the increase in current costs was around €700 million, any potential change in the interpretation of the allocation to internal or external R&D funding is only able to explain part of the increase in corporate funding.

Employees in R&D

There has been an increase in R&D staff since 2002 (Table 1-6), both in terms of headcount (2002: 65,725; 2013: 117,043) and of full time equivalents (FTEs) (2002: 38,893; 2013: 66,186). Most of the staff are employed in the business enterprise sector (2013: headcount: 55.8%; FTEs: 70.1%), at which this sector also recording the strongest growth (change 2002–2013: headcount: 92%; FTEs: 73.6%). The increase in R&D expenditure per employee in FTEs is attributable to the increase in R&D expenditure, which has increased much more significantly than the R&D staff. In the business enterprise sector, R&D expenditure has risen by 116.5% as compared with 2002, with FTE employees rising by 73.6%.

Employees in the R&D sector can be divided into three groups: researchers, technicians and equivalent staff and other supporting staff. The higher education sector has the highest proportion of researchers at 76.3%, while the business enterprise sector has the lowest at 55.5% (Fig. 1-10). The proportion of women among researchers has increased considerably since 2002 (2002: 15.8%; 2013: 23%), although the figure generally remains well below 50% in all sectors. The regional government sector has the highest proportion at 42.3% (2002:31.9%), while the business enterprise sector has the lowest at just 15.7% (2002: 9.7%). By contrast, the proportion of women among technicians and equivalent staff and the other supporting staff was above

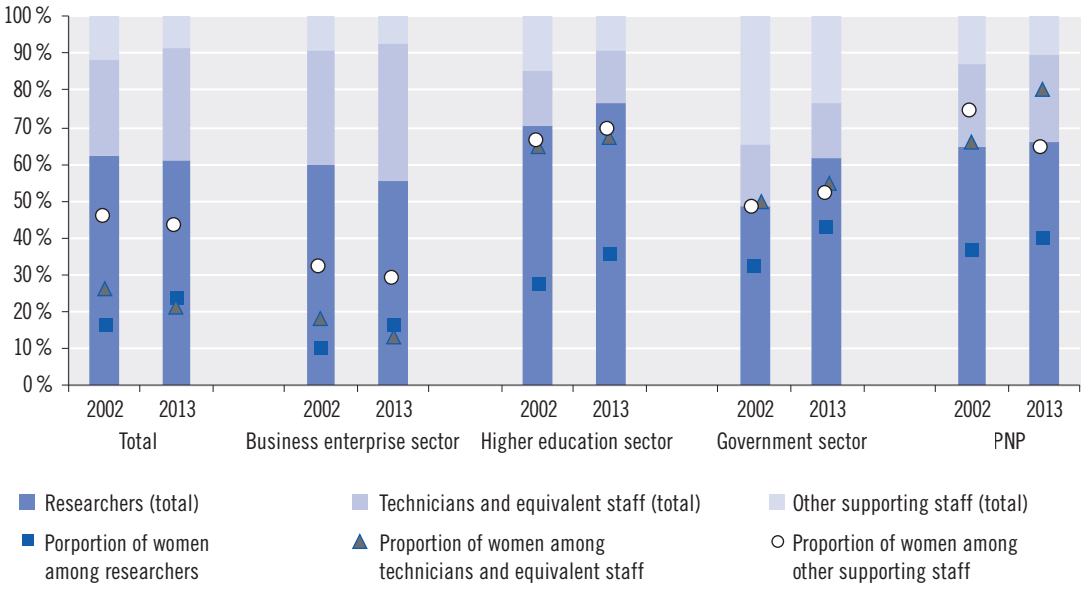
Table 1-6: Employees in R&D in all sectors of performance, 2002 and 2013

Sector of performance	Employees in R&D						R&D expenditures [in € millions]			R&D expenditure per FTEs		
	Headcount			FTEs (full time equivalents)								
	2002	2013	Change 2002–2013	2002	2013	Change 2002–2013	2002	2013	Change 2002–2013	2002	2013	Change 2002–2013
Business enterprise sector	34,020	65,320	+92%	26,728	46,412	+74%	3,131	6,778	+117%	117	146	+25%
Higher education sector	25,072	44,601	+78%	9,879	16,840	+70%	1,266	2,328	+84%	128	138	+8%
Government	6,010	6,232	+4%	2,060	2,538	+23%	266	425	+59%	129	167	+29%
PNP	623	890	+43%	227	396	+74%	21	40	+92%	92	101	+10%
Total	**65,725**	**117,043**	**+78%**	**38,893**	**66,186**	**+70%**	**4,684**	**9,571**	**+104%**	**120**	**145**	**+20%**

Note: PNP = private non-profit sector

Source: Statistics Austria. Calculations: Austrian Institute of Economic Research (WIFO).

Fig. 1-10: Employment structure of R&D staff (in FTEs), 2002 and 2013



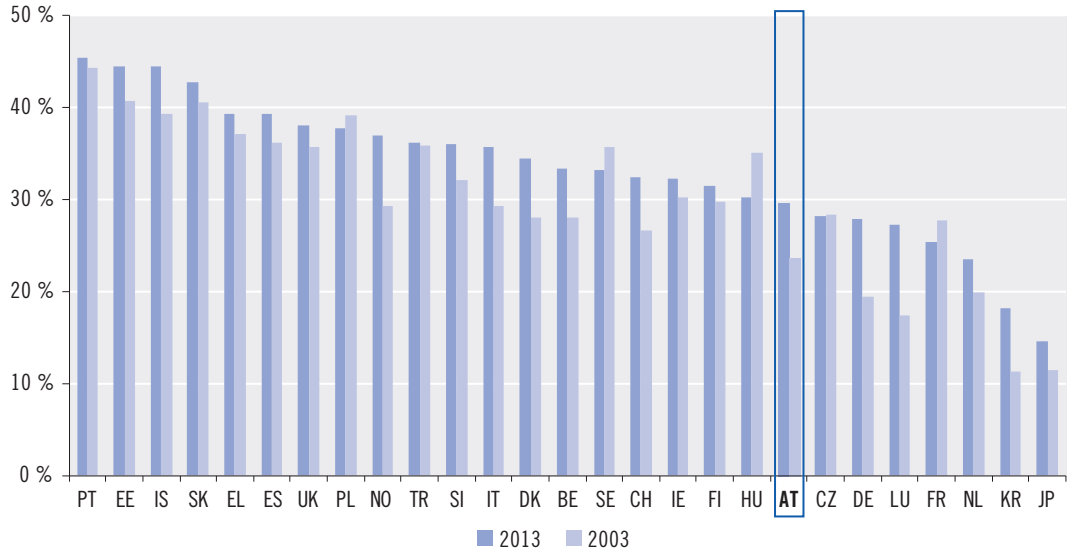
Note: PNP = private non-profit sector. FTEs = full time equivalents

Source: Statistics Austria. Calculations: Austrian Institute of Economic Research (WIFO).

50% in all sectors apart from the business enterprise sector in 2013.

International comparisons (Fig. 1-11) reveal that no country has achieved a share of 50% female researchers of total researchers. Although Austria has improved considerably by six percentage points compared with 2003, it remains in the lower part of the mid-range. The OECD countries, on the other hand, have increased their average share by 3.2 percentage points only. Compared with the leading innovation countries, only Germany has a lower proportion of women than Austria.

Fig. 1-11: Researchers (headcount in %), 2003 and 2013



Note: AT & CH: 2004; EE, SE, UK: 2005. See Table 7.1 in Annex I. for country abbreviations.

Source: OECD – MSTI. Calculations: Austrian Institute of Economic Research (WIFO).

1.3 Austria's position in an international context

Innovation rankings are tools used for comparing the innovation capability of national economies. They use indicators to record different aspects of innovation activity in industry and society, to condense these into a statistical value and thereby to compare countries' innovation performance. This chapter attempts to illustrate the position that Austria occupies in international innovation rankings and how this position has changed in recent times. The focus is on the European Commission innovation ranking that was known as the *Innovation Union Scoreboard* (IUS) until 2015 and has been called the *European Innovation Scoreboard* (EIS) since 2016. The EIS is of particular significance among the innovation rankings, as it is an important tool of the European Commission in evaluating progress in achieving the targets of the Innovation Union and of Europe 2020.

Three further international innovation rankings are also considered which all have the common feature that they publish a ranking updated annually on a transparent conceptual and methodical basis:[13]

- the *Global Innovation Index* (GII), which is published by Cornell University, INSEAD and the World Intellectual Property Organisation (WIPO),
- the *Global Competitiveness Index* (GCI) of the World Economic Forum, which includes several elements related to innovation,
- the *Innovation Indicator* (II), which was published until 2014 by the Deutsche Telekom Foundation, and has been published by the

13 There are also numerous other innovation rankings that have been published either once or sporadically but that are of limited use for the Austrian research and technology policy to draw conclusions from, due to their methodical approach. A few examples are the innovation ranking done by the Economist Intelligence Unit (2009), the Innovation Index of the Boston Consulting Group (Andrew et al., 2009), the Innovation Index of Bloomberg L.P. www.bloomberg.com/graphics/2015-innovative-countries and an Innovation Indicator Survey for the Transatlantic Economic Council (Atkinson, Andes, 2009).

National Academy of Science and Engineering (acatech) and the Federation of German Industries (BDI) since 2015.

Austria's position on the European Innovation Scoreboard 2016

The *European Innovation Scoreboard* (EIS) – until 2015 the *Innovation Union Scoreboard* – has been published each year since 2001 by the European Commission. It compares the innovation performance of EU Member States based currently on 25 individual indicators. While, in previous years, the EIS has been published at the start of the year, in 2016 the European Commission moved publication to the middle of the year. As a result, there was no current data available on the EIS based on an official publication from the European Commission at the time that the Austrian Research and Technology Report was drafted. Nevertheless the Austrian Institute of Economic Research has updated the individual EIS indicators and provided a "provisional EIS 2016" in order to portray Austria's latest developments in the EIS.[14] This is not identical to the EIS 2016 results, which will be published following publication of the Austrian Research and Technology Report, since further data updates will be provided for the final EIS. As such, the values for the three publication indicators in the EIS could not be updated for the purposes of these calculations.[15] The results presented here, however, should still be a sufficiently accurate reflection of the essential changes on the previous year and of Austria's current position in the country rankings.

Based on these calculations, Austria is likely to rise one place in the EIS 2016 compared with the previous year and would thereby be in tenth position (see Fig. 1-12). This would both stop and reverse the downward trend in the rankings. The deterioration in the ranking since 2011 was attributable to a stagnating overall index value (Summary Innovation Index). This index value could now improve considerably in 2016 for the first time since 2011. This would also reduce the gap with the country in fifth place. This gap had widened continuously between 2013 and 2015.

The gap with the group of Innovation Leaders as defined by the European Commission in the EIS would also fall based on the preliminary calculation for 2016 and now be just under 0.06 points (see Fig.1-12 right section).[16] The gap was almost 0.11 points in 2011 and was thereby almost double. As such, since 2011 Austria has been able to push forward its target of getting close to the group of Innovation Leaders, at least in small steps and despite losses in the EIS rankings. However, the gap in the EIS 2009 was considerably less at just 0.01 points. Over the course of the financial crisis, which has been reflected in the indicator values since the EIS 2011, Austrian innovation performance fell considerably as compared with the Innovation Leaders and recovery since then has been very slow.

Based on the preliminary calculation, Austria's projected improvement in the EIS would essentially be attributable to four indicators (see Table 1-7):

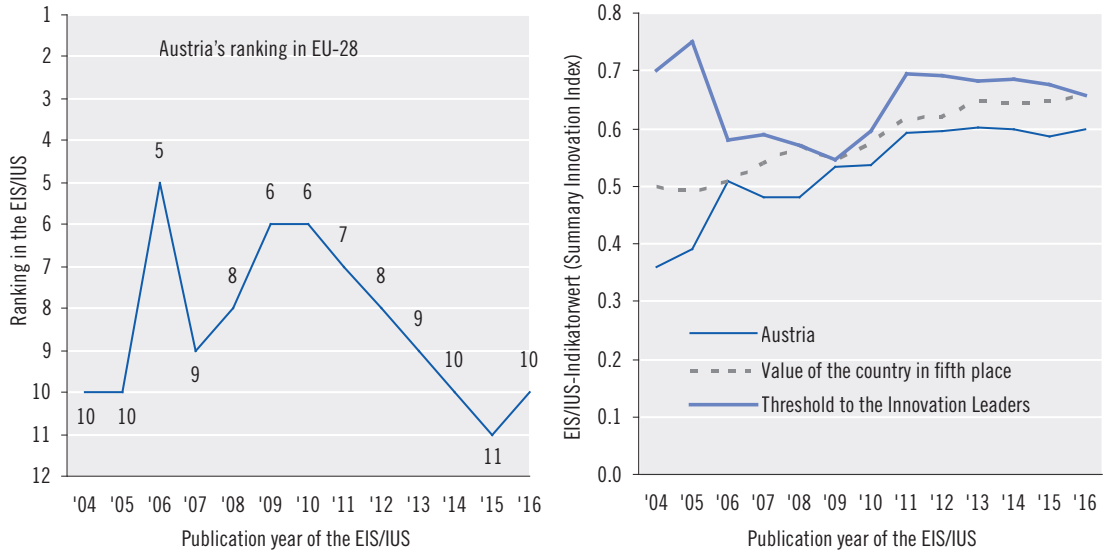
- The "Knowledge-intensive service exports as % of total service exports" indicator is calculated in 2016 based on a new broadly-defined definition of knowledge-intensive services. Austria's indicator value will increase considerably as a result.
- Austria's value in the "Percentage of 30 to 34 year-olds in the population with a tertiary degree" indicator will also increase following a change in definition, since the ISCED level 5

14 The authors would like to thank Hugo Hollanders from MERIT (Maastricht, Netherlands) for kindly providing the base data and for his support with the procedural questions.

15 International scientific co-publications per million of the population, proportion of publications among the top 10% of the most cited publications, public-private co-publications per million of the population.

16 The group of Innovation Leaders at the start of the EIS within the EU-28 only included Sweden and Finland. Between three and five countries were counted among this group in subsequent editions of the EIS. The value of the relevant country in fifth place is stated in Fig. 1-12 in order to compare Austria's gap with the group leaders over time.

Fig. 1-12: Austria's ranking and indicator value on the European Innovation Scoreboard[1)] within the EU-28 Member States, 2004–2016



1) The European Innovation Scoreboard was known as the Innovation Union Scoreboard (IUS) between 2011 and 2015.

Note: The changes in position are partly attributable to changes in the EIS methodology and in the indicators used. For example, the significant improvement in ranking position in 2006 was attributable to the incorporation of nine additional indicators and the fall in position in the following year to new revisions to the indicators. The information for the years 2004 to 2012 relates to the EIS/IUS published in the relevant year, even though this was already designated with the previous year's figure (i.e. the information on 2012 relates to the Innovation Union Scoreboard 2011, which was published in early 2012).

Source: European Commission (2015), Austrian Institute of Economic Research (WIFO)

(in Austria: higher professional education schools) will be counted among the tertiary degrees as of the EIS 2016.

- The third essential change will be implemented with the "Percentage of employment of high-growth firms in innovation sectors". This value rose from 17.2 to 19.4%.
- Finally, R&D expenditures in the business enterprise sector as a percentage of GDP also rose considerably from 1.93% to 2.11%.

However, the developments in the original values are not crucial in terms of any change in Austria's position in the EIS, rather it is developments in the standardised values that are crucial, as only these values are used in the *Summary Innovation Index*. Standardised values are ascertained via the "minimum/maximum method". Here the indicator value for a country is reduced by the value of the country with the smallest value and divided by the value of the country with the largest value. The radical of the original value is also used for indicators with a very high variance rather than the original value itself. Outliers are also truncated with the maximum values. If Austria's standardised values in the EIS 2015 are compared with those in the provisional EIS 2016, then in addition to the four indicators stated, the percentage of sales of product innovations also contributed to the projected increase in the summary innovation index for Austria, since the lowest and highest values changed following data updates.

Negative contributions to the Austrian summary innovation index accordingly originate primarily from the following five indicators:

- Venture capital investments as a percentage of GDP: this indicator is redefined in the EIS 2016. While the original value for this indicator has increased compared to the previous year following the redefinition, there will be a considerable deterioration in the standardised value compared with the definition used in

Table 1-7: Values of individual indicators for Austria in the EIS 2016 and change on 2015

	Original values		Change 2015–2016 in %	
	2015	2016	original	normal[1]
1 Enablers				
1.1.1 New doctoral graduates (ISCED 6) per 1,000 population 25 to 34-year-olds	2.20	2.02	-8	-17
1.1.2 Percentage population aged 30 to 34 having completed tertiary education[a)]	27.3	40.0	47	77
1.1.3 Percentage youth aged 20 to 24 having attained at least upper secondary education	87.4	89.6	3	6
1.2.1 International scientific co-publications per million population	1,313	-	-	-
1.2.2 Percentage of a country's scientific publications that are among the top-10% most cited publications	11.05	-	-	-
1.2.3 Non-EU doctoral students as a percentage of all doctoral students	9.00	9.32	4	-3
1.3.1 R&D expenditure in the public sector in % of GDP	0.860	0.850	-1	-1
1.3.2 Venture capital investments in % of GDP[b)]	0.346	0.360	4	-34
2 Business enterprise activities				
2.1.1 R&D expenditure in the business enterprise sector in % of GDP	1.93	2.11	9	7
2.1.2 Non-R&D innovation expenditures in % of turnover	0.458	0.412	-10	-28
2.2.1 Percentage of SMEs with innovations developed in-house	31.8	31.2	-2	-3
2.2.2 Innovative SMEs collaborating with others in % of all SMEs	15.3	15.3	0	1
2.2.3 Public-private co-publications per million population	71.0	-	-	-
2.3.1 PCT patent applications per billion GDP (in PPS €)	4.96	5.06	2	-2
2.3.2 PCT patent applications in societal challenges per billion GDP (in PPS €)	1.20	1.07	-2	-2
2.3.3 Community trademarks per billion GDP (in PPS €)	10.07	9.46	-6	-13
2.3.4 Community designs per billion GDP (in PPS €)[b)]	7.81	7.07	-9	-9
3 Output				
3.1.1 Percentage of SMEs with product or process innovations	35.7	35.7	0	0
3.1.2 Percentage of SMEs with marketing or organisational innovations	44.7	44.7	0	-3
3.1.3 Employment of fast-growing firms in innovative sectors (% of total employment)	17.2	19.4	13	27
3.2.1 Employment in knowledge-intensive industries (% of total employment)	14.6	14.7	1	-4
3.2.2 Exports of medium and high-tech products in % of total product exports	56.6	57.0	1	2
3.2.3 Knowledge-intensive service exports in % of total services exports [a)]	26.6	43.2	62	45
3.2.4 Turnover of product innovations in % total turnover	9.8	9.8	0	15
3.2.5 Licence and patent revenues from abroad in % of GDP	0.245	0.247	1	-12

Note: The original values for 2015 are taken from the EIS 2015.
a) Indicator redefined in 2016. Value for 2015 and change to the original value for 2015/16 based on the old definition.
b) Indicator redefined in 2016. Value for 2015 and change to the original value for 2015/16 based on the new definition.
1) Standardised values are ascertained via the "minimum/maximum method". For this the indicator value for a country is reduced by the value of the country with the smallest value and divided by the value of the country with the highest value. The radical of the original value is also used for indicators with a very high variance rather than the original value itself.

Source: European Commission (2015), Austrian Institute of Economic Research (WIFO)

the EIS 2015, since the gap with the maximum value has increased under the new definition while the gap with the lowest value has decreased.

- Non-R&D innovation expenditures in % of turnover: Austria's relative position will deteriorate considerably on account of data updates.
- Number of doctoral graduates (ISCED 6) per thousand 25 to 34-year-olds: This indicator will be worse both in terms of the original value and the standardised value.

- Number of registrations for community trademarks per billion GDP: There will also be a deterioration in terms of the original value and the standardised value.
- Licence and patent revenues from abroad as a percentage of GDP: Despite a marginal improvement in the original indicator value, the standardised value will fall as a result of changes in the gaps with the highest and lowest values.

Austria's position in other innovation rankings

In addition to the EIS and as in the Austrian Research and Technology Reports in previous years, Austria's position in three other international innovation rankings has also been examined, i.e. the *Global Innovation Index* (GII), the innovation-related sections of the *Global Competitiveness Index* (GCI) and the *Innovation Indicator* (II). As every ranking looks at a different number of countries, a uniform set of countries is used for the purposes of comparing Austria's ranking between the three rankings. This reference group includes countries with an industrial and technological level of development similar to Austria, as Austria is primarily engaged in innovation competition with these countries. The reference group includes all countries that feature at least half of Austria's per capita GDP and have a population of at least half of Austria's population. Oil-exporting countries are excluded due to their very specific conditions. This reference group includes 23 countries – among them Austria itself – of which 14 are in Europe.

In the latest editions of the three rankings within the reference group, Austria is between positions 9 (*Innovation Indicator*) and 15 (*Global Innovation Index*) (see Table 1-8). Austria's position within the EU-28 is between 6th and 9th place. Austria has been able to improve in two rankings within the reference group compared with the previous year's editions of the rankings. In the *Innovation Indicator* it rose five positions and in the *Global Innovation Index* two positions. On the other hand, Austria fell one position in the innovation-related sub-indicators in the *Global Competitiveness Index* . However, an improvement or deterioration in positions does not necessarily mean that there is a corresponding change in innovation performance. The clear improvement in the *Innovation Indicator* occurred for instance despite a slight fall in the index value. Austria was able to make up ground because the index value fell more heavily in other countries. The position lost in the *Global Competitiveness Index* is accompanied by a consistent index value. Austria was able to improve its index value slightly in the *Global Innovation Index*.

Switzerland is in first place by a clear margin in all three innovation rankings, as well as in the

Table 1-8: Austria's position in selected international innovation rankings, 2015

Ranking	Austria's rank			Change compared to 2014 ('+' = improvement in position)		
	all states	EU-28	Reference group[1)]	all states	EU-28	Reference group[1)]
Global Innovation Index	18	9	15	+2	0	+2
Innovation Indicator	9	6	9	+5	+3	+5
Global Competitiveness Index – HTBI[2)]	14	9	14	-1	-1	-1

1) Countries with at least 50% GDP per capita (at current exchange rates) and at least 50% of Austria's population, excluding OPEC member countries (AT, AU, BE, CA, CH, DE, DK, ES, FI, FR, IE, IL, IT, JP, KR, NL, NO, NZ, SE, SG, TW, UK, US). See Table 7.1 in Annex I. for country abbreviations.
2) Mean of the sub-indicators "Human capital and training", "Technological readiness", "Business sophistication" and "Innovation".

Source: acatech and BDI (2015); Cornell University et al. (2015); WEF (2015). Processing and calculations: ZEW.

Table 1-9: Positions and index values for the countries in the reference group in three innovation rankings, 2015

Ranking	Global Innovation Index		Innovation indicator		Global Competitiveness Index[1]	
1.	CH	68.3	CH	75.1	CH	5.97
2.	UK	62.4	SG	64.0	FI	5.78
3.	SE	62.4	FI	57.2	NL	5.76
4.	NL	61.6	BE	56.2	US	5.72
5.	US	60.1	DE	56.0	SE	5.70
6.	FI	60.0	IE	53.3	DE	5.70
7.	SG	59.4	NL	51.7	SG	5.69
8.	IE	59.1	US	51.3	JP	5.61
9.	DK	57.7	**AT**	**51.2**	UK	5.60
10.	DE	57.1	SE	51.1	DK	5.60
11.	HR	56.3	DK	50.8	NO	5.58
12.	NZ	55.9	UK	50.1	BE	5.54
13.	CA	55.7	HR	49.9	IE	5.41
14.	AU	55.2	NO	49.4	**AT**	**5.38**
15.	**AT**	**54.1**	AU	47.2	IL	5.34
16.	JP	54.0	IL	47.2	TW	5.30
17.	NO	53.8	CA	46.3	FR	5.28
18.	FR	53.6	FR	45.5	NZ	5.25
19.	IL	53.5	TW	44.8	CA	5.22
20.	ES	52.8	JP	43.2	AU	5.18
21.	BE	50.9	ES	24.3	HR	5.12
22.	IT	46.4	IT	20.1	ES	4.70
23.					IT	4.60
Gap between AT and position 5		**11%**		**9%**		**6%**

Note: See Table 7.1 in Annex I. for country abbreviations.

1) Means of the sub-indicators "Human capital and training", "Technological readiness", "Business sophistication" and "Innovation".

Source: acatech and BDI (2015); Cornell University et al. (2015); WEF (2015). Processing and calculations: ZEW.

EIS (see Table 1-9). Sweden, Finland, the Netherlands and the US are all among the Top 5 in two of the three rankings, in addition to Switzerland. The gap between Austria and the five countries in the top positions is not very large. In the *Global Competitiveness Index* (innovation-related sub-indicators only), Austria's index value is 6% below the figure for the country in fifth place, while the gap in the *Innovation Indicator* is 9% and in the *Global Innovation Index* 11%.

A closer look at the development in Austria's position in the three rankings shows that the shifts in position are partly based on indicators that have a low connection with innovation, while there were some changes in value that could not always be explained for other indicators which are certainly key for innovation performance:

- Austria's improvement in the *Global Innovation Index* is in part attributable to an improvement in the "Infrastructure" area, behind which there is in turn a higher "e-participation rate", i.e. a more favourable appraisal of the e-Government offerings by citizens, with comparisons between individual reporting years restricted as a result of different questions asked in the underlying survey. Austria was also able to improve in the GII in the "Level of development of the business enterprise sector" area, mainly as a result of higher foreign direct investment in Austria. The country has also improved in terms of cre-

ative output, including as a result of an increase in the number of country-code top-level domains per inhabitant. Austria's improvement in the GII could have been considerably better if there had not been a marked deterioration in the rankings in some key areas of innovation performance. This deterioration is not, however, the result of any real adverse changes. Austria's index value fell for instance in the GII due to the shift in the indicator "Number of researchers as a percentage of the population" from headcount to part-time jobs. There was another heavy decline related to the proportion of overall economic R&D expenditure that was funded by the business enterprise sector. This fell from 68.8% (reference year 2012) to 44.5% (2013) according to the GII. This is believed to be a result of changes in the accounting for R&D expenditure funded by firms abroad. These examples illustrate the limitations of the information that we can infer from changes in index values and in positions in the innovation rankings.

- Austria's decisive improvement in the ranking positions in the *Innovation Indicator* is due to the fact that five countries that were ahead of Austria in the *Innovation Indicator* 2014 fell down in the rankings – these were Sweden, Denmark, the UK, Norway and Taiwan. While a majority of countries in the *Innovation Indicator* 2015 reference group feature significant declines in their index values, Austria was able to buck this trend. The decline in index values in the group of reference countries as a whole means that the countries outside of the reference group, i.e. Southern and Eastern-European EU member states along with emerging nations were able to catch up somewhat with the leading nations in terms of innovation performance. There are significant improvements for Austria in, inter alia, the percentage of researchers among the population, their share in the 10% most cited scientific publications, international patent registrations, the proportion of university graduates in relation to highly qualified employees aged 55+ and in the media reports on research and technology. These are accompanied by deteriorations in, for example, the number of patent registrations by universities and research institutions per inhabitant, venture capital investments in relation to GDP[17] and the balance of trade with high-tech goods.
- Austria's fall in the rankings in the innovation-related sections of the *Global Competitiveness Index* is attributable to the fact that Ireland, which was directly behind Austria in the 2014 rankings, was able to increase its index value significantly while the Austrian index value remained unchanged. The fact that Austria's index value did not improve was due to sharp declines in three indicators: the "international internet broadband per user" fell dramatically from 128 kb/sec. to 80 kb/sec., probably because the number of users rose very significantly (which is essentially a positive development). The expert assessment on internet access in schools and on promoting innovation through public procurement both declined by 0.3 points. These deteriorations balanced out the positive developments in some other indicators, including the expert assessment on innovative capacity of firms (which rose sharply by 0.4 points), the number of users of mobile broadband and of fixed broadband and in the expert assessment on the quality of school management and further training in firms.

Austria's position over the past ten years

Austria's ranking has changed significantly in some of the areas in the four innovation rankings considered here, although there is no con-

17 Unlike the EIS, the Innovation Indicator only counts investments at the early stage (seed, start-up, expansion) as venture capital, while all private equity investments are considered venture capital in the EIS, with the exception of buyouts. This results in different developments in both rankings with this indicator.

sistent trend. In the EIS, Austria was able to improve as compared with the reference group and move up to 10th position between 2006 and 2009 – based on the last indicator selection used in the EIS which was calculated back for the earlier years (see Table 1-10). However, Austria fell four places again in 2010, and is currently in position 12, including in the latest provisional calculations for the reference year of 2015. In the *Global Innovation Index*, Austria rose significantly from 20th to 15th position, although its placing was better in 2009 at 14. Austria achieved its best ranking in the *Innovation Indicator* in 2011 when it was at number 8. After falling six places by 2014, it recorded a considerable improvement again in 2015. Austria was between 12th and 15th place in the last nine years in the innovation-related sub-indicators of the *Global Competitiveness Index*.

The different trends in the four innovation rankings reflect not only Austria's performance, but also that of the other countries considered. After all, it is possible to win (or lose) places when other countries slide backward (or improve more quickly). Another thing to keep in mind is that most of the indicators in the EIS reflect data from one to four years before the reference year (i.e. the results for the reference year 2016 are overwhelmingly based on data gathered for the years 2012 to 2015), while the indicators in the other rankings refer to the specified year.

All four rankings show an upward trend since 2010 looking at Austria's index values rather than the actual rankings (see Fig. 1-13). The gap with the five top-placed countries has tended to shrink over the last decade. A catching-up process is most evident in relation to the Innovation Leaders in the EIS. Austria has been able to increase its index value more rapidly here than the average value for the reference group, and was above this average value for the first time in 2015. In the *Innovation Indicator* Austria was almost without exception above the average value of the reference group in the last decade and was able to extend the gap considerably in 2015. In the innovation-related sub-indicators of the *Global Competitiveness Index*, Austria performed largely in line with the average values for the reference group, although the performance was less favourable in 2015. In the *Global Innovation Index* Austria is below the average value for the reference countries but has most recently been able to catch up.

Table 1-10: Austria's rank in international innovation rankings 2006–2015 within the reference group

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
European Innovation Scoreboard[1] (EIS)	14	13	11	10	14	14	13	13	14	12*
Global Innovation Index[2] (GII)	-	-	18	14	18	16	17	20	17	15
Innovation Indicator[3] (II)	14	11	12	14	13	8	11	11	14	9
Global Competitiveness Index (GCI) – HTBI[4]	-	13	14	15	15	14	12	12	13	14

1) The years are the reference year of the relevant publication (i.e. 2014 for the edition that appeared in 2015). The data used in determining the indicators' values is sometimes drawn from up to three years before the reference year.
* Information for 2015 provisional and upon the assumption that Austria's relative position has not changed in the EIS in relation to the non-European reference countries.
2) The years given are those of the year of publication. Global Competitiveness Index, mean value of the sub-indicators "Human capital and training", "Technological readiness", "Business sophistication" and "Innovation"; There are no comparative values from before 2008 because of changes to the methodology.
3) The years given are those of the year of publication. Change in method between 2013 and 2014.
4) The years given are those of the year of publication. Change in method between 2010 and 2011.

Source: acatech and BDI (2015); European Commission (2015); Cornell University et al. (2015); WEF (2015). Processing and calculations: ZEW.

Fig. 1-13: Development of the overall index for Austria and the reference countries in the international innovation rankings 2006–2015

1) Chain-linked indices, years refer to the reference year of the publication, information for 2015 is provisional and based on updates to the values for the five reference countries outside of Europe.
2) Index values revised on a scale from 0 to 1, all values based on the revised method applied in 2014.
3) HTBI: Sub-indicators "Human capital and training", "Technological readiness", "Business sophistication" and "Innovation" (Index values revised on a scale from 0 to 1).
4) Break in the methodology between 2010–2011 (index values revised on a scale from 0 to 1).

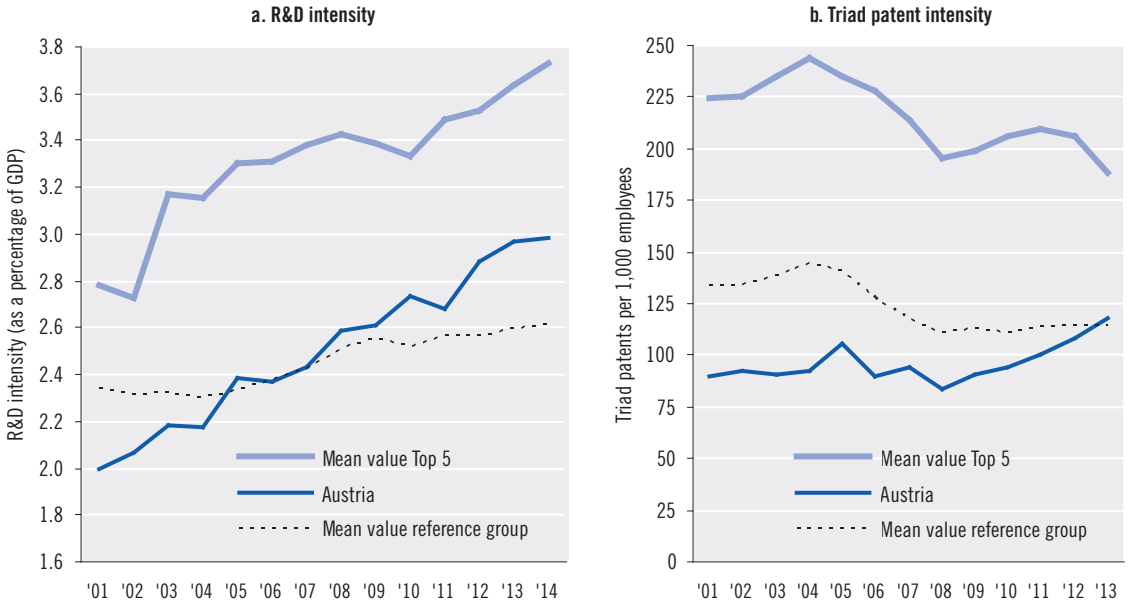
Source: acatech and BDI (2015); European Commission (2015); Cornell University et al. (2015); WEF (2015). Processing and calculations: ZEW.

Development of Austria's position in terms of R&D and patent intensity

The development of Austria's position in the individual innovation rankings is affected in part by indicators that are only loosely or indirectly linked to research and innovation. This applies in particular to the *Global Innovation Index* with its 79 individual indicators, which to some extent portray general economic and social conditions. The results of the *Global Competitiveness Index* in turn depend essentially on expert assessments, which do not necessarily reflect the actual situation within a country in a comprehensive way. In order to assess Austria's position in the innovation rankings, it is useful to look at the development of the "hard" indicators, i.e. indicators that permit quantitative measurement and can be reliably compared internationally, and also that directly reflect the important aspects of innovation performance. These certainly include the overall economic R&D intensity as a central input indicator and patent intensity as an indicator that records the direct results of R&D.

Austria has improved considerably in terms of both indicators as compared with the average value for the reference group. Austria has been above this average value since 2008 in terms of R&D intensity, and also exceeded the average value for patent intensity in 2013. The gap with the group of the five top-placed countries also fell, particularly for patent intensity. This trend is better than in the innovation rankings. This means that Austria has been able to catch up considerably in the core indicators for innovation performance and is moving towards becoming an Innovation Leader. The situation is rather different in a broad survey of innovation capacity

Fig. 1-14: Total R&D intensity and triad patent intensity of Austria and the reference countries 2001–2014



Source: OECD: MSTI, edition 2/2015. Calculations: ZEW.

as taken for the purposes of the innovation rankings. At the same time, there are different circumstances for innovation, such as the performance of the education system, the funding conditions or regulatory aspects, which weaken Austria's position in the rankings.

Summary

Innovation rankings are a tool for comparing countries' innovation performance and monitoring trends in a simple manner that is easy to communicate. Innovation rankings use a number of indicators in accordance with the complexity of innovation as a phenomenon. These indicators are constantly revised in order to map changes in the measurement of innovation activities as well as shifts in the relevance of individual aspects. As a result, changes in the methodology of the ranking also play a part in country positioning as well as the actual performance of individual indicators. This was the case for Austria in the *European Innovation Scoreboard* for 2016. The improvement by one position within the EU-28 projected based on a preliminary calculation is primarily attributable to procedural improvements in the measurements for two indicators for which Austria had previously had very low values (which also did not adequately reflect the actual performance in this area). These were: percentage of 30 to 34-year-olds in the population with a tertiary degree and share of knowledge-intensive services in all service exports.

Yet Austria has also been able to improve its position in two other innovation rankings. In the *Global Innovation Index* it also rose two places within the reference group of particularly innovation-oriented countries. In the *Innovation Indicator* there was even an improvement of five places. Austria has been able to improve in all three rankings over the last ten years, both in comparison to the average value of the reference countries that are strong in terms of innovation as compared to the relevant group leaders. The catching-up process was clearest in the *European Innovation Scoreboard*. Nevertheless the gap with the group of Innovation Leaders is still a

wide one in all three rankings. One additional favourable development could be see in the innovation-related indicators in the *Global Competitiveness Index*, which, unlike the other rankings are based primarily on expert opinions and not on statistical data.

Reference has already been made in earlier Austrian Research and Technology Reports to the need for a multidimensional viewpoint going beyond consideration of the rankings for the purposes of evaluating countries' innovation performances.[18] A current study on behalf of the ERA-Council Forum Austria examined this issue.[19] Against the background of Austria's consistent positioning in the group of innovation followers in the EIS, an analysis is required as to what Austria is able to learn from the leading innovation countries of Sweden and Denmark. The focus was on a comparative analysis of the innovation systems of both countries, with a view to crucial political and institutional reforms, programmes and challenges. The objective was to derive potential policy recommendations for Austria in this regard based on national experiences. In line with the structure of the EIS areas, the study focused on performance and determinants for research and innovation in the business enterprise sector, the characteristics of the funding systems as well as the role of universities in national innovation performance. Furthermore, the importance of programmes and initiatives was also examined for the national RTI landscape in the context of the European Research Area (ERA). An empirical analysis of data and literature going well beyond the EIS indicators revealed development in individual research areas and allowed hypotheses for the potential courses of action for Austrian RTI policy to be derived. These findings were discussed and validated in interviews with RTI experts from Sweden and Denmark and formed the basis for setting out concrete recommendations for Austria.

The outstanding funding conditions in these countries' higher education sectors were identified specifically as crucial factors for success in their innovation performances. Both countries use mechanisms here for capacity-oriented university funding which account for the number of credits achieved and degrees in addition to the number of students. A series of measures is dedicated to the provision of human capital for research and innovation, particularly in the area of doctoral student training. In Denmark, the processes for consolidating and reducing the number of universities and research institutions initiated in 2007 are seen as important steps towards priority setting externally and improved governance internally. The major significance of large enterprises in the high-tech areas was also illustrated in the area of corporate R&D and innovation, with locations in both states. Denmark in particular also has a vibrant enterprise-creation scene and a range of well-equipped and targeted instruments in this area.

The results of the study were presented and discussed as part of the Federal Ministry of Science, Research and Economy's Europe Conference 2015.[20] Essential recommendations that can be derived from a direct comparison of the strong points of the Danish and Swedish innovation system included rapid introduction of capacity-oriented university funding in Austria, further development of the governance instruments in the higher education sector (particularly the performance agreements), greater focus on the Austrian research landscape and better priority setting and role distribution between universities and universities of applied sciences, along with enhancement of doctoral programmes through improvements to recruitment and research conditions. In view of the clearly better-developed research funding system in the comparison countries, the continued promotion of non-profit forms of research funding was recommended as

18 See Austrian Research and Technology Report 2015, 18ff. BMWFW, BMVIT (2015); http://www.bmwfw.gv.at/ftb
19 See Polt et al. (2015).
20 See https://era.gv.at/object/event/1799

well as, in the business enterprise sector, an expansion of *later-stage* funding in the venture capital area along with other alternative types of funding for the purpose of promoting innovative new ventures. At the same time, reference was also made to Austria's existing strengths such as the wide range of successful national programmes for supporting knowledge and technology transfer and the national commitment in terms of implementing ERA initiatives and instruments.

The slow improvement in Austria's position in international innovation rankings points to successes in efforts by the government, industry, and public research institutions to raise the innovation performance of the Austrian national economy. However, it also illustrates the need for patience and shows that rapid improvements within this group of countries is very difficult to achieve in an international environment where all highly-developed countries are focused on boosting their innovative potential. This is why it is important to continue consistently down the current path of increasing innovation efforts at all levels of the innovation system.

1.4 Strategic measures, initiatives and further developments

This section provides an overview of the current strategic processes, initiatives and developments in Austrian RTI policy. These are based on the objectives in the federal government's RTI strategy and are either linked to existing measures (see Chapter 2) or supplement and expand on these.

Conclusion of performance agreements for 2016–2018 and amendment to the Universities Act 2002

The Federal Ministry of Science, Research and Economy (BMWFW) signed performance agreements with all 22 universities in December 2015 meaning that objectives and actions were agreed in research and teaching at the universities for the period between 2016–2018. The university budget was increased by €615 million for the 2016–2018 performance agreement period, equating to a 6.8% increase over the previous period.

Stronger priority setting was one crucial aspect in preparing, negotiating and concluding the 2016–2018 performance agreements with the universities. This is evident in particular through the consistent continuation of the university priorities in teaching and research, as well as in the university strategies on societal commitment, partnerships and the international focus, which were all enshrined in the performance agreements. Examples include efforts to accelerate joint research infrastructure use and better positioning in European programmes such as Horizon 2020.

Among other things, the universities' broad service spectrum for industry and society ("Third Mission") is more visible in the 2016–2018 performance agreements. Projects and targets for cooperation with industry and to exploit research results were also some of the things agreed within this framework.

Quality and quantity-related projects and targets related to teaching and staff were also agreed with the universities in the new performance agreements for the 2016–2018 period, including increasing the number of career points in order to improve career opportunities for upcoming scientific and artistic talents.

The amendment to the Universities Act (UG) in September 2015 results in changes to some important areas such as university career paths, access regulations and the early study stage. University lecturers and associate professors can, for instance, be appointed university professors in future (starting in October 2016) via a simplified procedure based on international quality standards. This enables consistent career paths to becoming a professor over the longer term (see Chapter 2.1.2). Moreover, younger scientists also gain the right to participate in the professors' curia. The admission regulations for five degree programmes that are in very high demand (Architecture, Biology, IT, Pharmacy, Economics), medical degrees (Human, Dental and Veterinary

Medicine) as well as Psychology and Communication Sciences have been extended until 2021. The students' introduction and orientation stage (StEOP) was amended and must in future feature between 8 to 20 ECTS points. A ceiling on remuneration was also imposed for the first time on members of the university council.

Strategy for the future for Life Sciences and Medicine in Austria

The area of Life Sciences is one of major scientific and economic significance for Austria, as illustrated by the "Life Science Report Austria 2015"[21] which was drafted on behalf of the Federal Ministry of Science, Research and Economy (BMWFW) using corporate, employment and publication statistics. Numerous measures have been implemented in the past few decades based on substantial initiatives and investments aimed at developing Austria into a location with an international reputation. In order to secure Austria as a location for research, innovation and industry in global competition, the Federal Ministry of Science and Research (today the Federal Ministry of Science, Research and Economy) launched a kick-off event in autumn 2015 to develope a new "Strategy for the future for Life Sciences and Medicine in Austria", ten years after the last strategy was published on this sector.[22] This strategy is intended to reinforce and improve Austria's position as a location for research, innovation and industry in Life Sciences along the entire value chain.

The current state of affairs is being analysed in a broad discussion on topics such as basic research, research infrastructures, personalised medicine, clinical research, partnerships between science and industry, translational research, medical devices, new ventures, production, market access and the dialogue between science and society, with ideas gathered for any necessary or potential improvements. The process includes round tables and meetings with experts along with an online consultation in order to incorporate as many stakeholders as possible into the discussion. The different points of view and comments are then consolidated, with suggestions assessed in terms of feasibility and actions then developed. These results plus a site analysis then lead to a final strategy document that will be published in September 2016.

Strategic development of humanities, cultural studies and social sciences

Further development for humanities, cultural and social sciences is enshrined as an objective in the federal government's RTI strategy. Objectives were set out for strategic positioning of humanities, cultural and social sciences as part of the Federal Ministry of Science, Research and Economy (BMWFW) action plan from 2015 for a competitive research area.[23] This is aimed at ensuring greater cross-linkage, both within the community as well as with other research areas, and contributing towards optimum use of the existing resources and infrastructures for the purposes of reinforcing research and research-led teaching in humanities, cultural and social sciences. Increasing the international visibility of Austrian research in these areas represents another aim. A further objective is to raise public awareness of the value of humanities, cultural and social sciences.

A strategic process launched in September 2015 also aims at developing the recommendations for concrete actions and measures for boosting humanities, cultural and social sciences in Austria by the autumn of 2016. The framework conditions for humanities, cultural and social sciences in Austria and the need for action were

21 See Life Science Report 2015, http://www.bmwfw.gv.at/Presse/Documents/LifeScienceReport-Austria_2015.pdf
22 See Council for Research and Technology Development (2005).
23 See BMWFW (2015a).

discussed as part of a forum for the future held on 2 December 2015, with the following five topic areas debated: free areas for humanities, cultural and social sciences, performance and quality measurement, added value of globalisation, open access and alternative areas for networking with researchers. The results form the working basis for further consolidation (focus groups, workshops, meetings with experts and reports) in the process towards concrete recommendations and actions.[24]

Open innovation strategy[25]

The Austrian federal government was tasked by the National Council on July 2015 with developing an open innovation strategy for Austria. This was delegated to the Federal Ministry for Transport, Innovation and Technology and Federal Ministry of Science, Research and Economy. This makes Austria one of the first countries in the world to develop its own national open innovation strategy. The aim of creating the strategy is to deploy open innovation as a guiding concept for further development of the national innovation system and thereby also to reinforce Austria's international competitiveness as a location for knowledge and business.

The technological shift that is accelerating requires new approaches to solutions that go well beyond traditional innovation models. The modern research, technology and innovation process accounts both for market-driven demand as well as demand driven by society. This results in greater incorporation of citizens and end-users of innovations as well as to open business networks.

Interdisciplinary networks and incorporation of a wide range of stakeholders in innovation processes also becomes more important for the purposes of remaining competitive in international competition.

The aim is to increase Austria's competitiveness significantly through targeted and strategic use of open innovation. There is a major potential for innovative forms of networking, exchanging knowledge and cooperating in a global digital world for highly-developed, small and open national economies such as Austria. Specific measures adjusted to the starting conditions and future challenges of the location should therefore be used for the purposes of exploiting the full innovation potential.

Following an open brainstorming stage in autumn 2015, the topic of open innovation was discussed in a major stakeholder workshop in January 2016 involving more than 400 interested parties in several thematic working groups. The first tangible text blocks for the national open innovation strategy were then provided based on this input in an open online consultation process for comment, discussion and any additions. After careful analysis and corresponding development of the contributions from the consultation process the strategy plan is due to be finalised and presented to the National Council in the summer of 2016.

24 See Federal Ministry of Science, Research and Economy (BMWFW) (2015).
25 For the ongoing discussions at the European level see e.g. "Amsterdam Call for Action on Open Science" 2016.

2 Mid-term Report RTI Strategy

The federal government of Austria formulated its first Research, Technology and Innovation Strategy in March 2011.[1] This strategy (which covers the period to 2020) is intended to "push Austria forward from the group of Innovation Followers to the group of Innovation Leaders, i.e. to be among the most innovative countries in the EU" (RTI Strategy, p. 2). Several processes and institutions have come into being since the decision was taken to implement the strategy, including the "RTI Task Force", an interministerial steering committee with constituent working groups. A variety of initiatives have been launched and some have already been implemented. One of the RTI strategy's particular strengths is that it offers a broad, integrative and systematic overview of the constituent parts (education, research and industry), especially regarding the educational system as an integral part of the innovation system.

At the same time, the circumstances have changed under which the RTI strategy is being implemented, particularly because of the ongoing economic weakness following the 2008 financial and economic crisis. The most significant difference is that the RTI strategy was formulated at a point in time when it was generally believed that a quick recovery from the financial and economic crisis would be followed by a renewed phase of dynamic growth and development. The strategy's implementation has instead been overshadowed by the crisis' unexpectedly long duration. This "structural disruption" meant that the ambitious goals of the RTI strategy were quickly confronted with the reality of shrinking budgets, which in turn led to a shift in priorities that continues to this day. Changes had to be made to the measures that had already been decided.

More importantly, Austria has since lost some of the dynamic momentum with respect to its overarching goals, such as joining the group of Innovation Leaders or achieving a general economic R&D intensity of 3.76% by 2020. Over the past several years, Austria has reduced the gap with leading countries when it comes to innovation performance, but it has also fallen behind other countries that have experienced greater dynamism in their own development.[2]

There has also been progress in reaching the goal of 3.76% growth in R&D intensity, with one third of this growth coming from the public sector and two thirds from the private sector. According to Statistics Austria's global estimate, the predicted R&D intensity for 2016 is 3.07%, which is similar to the prior years.[3] However, the dynamic growth that marked the period 1995–2007 has seen some flattening as a result of the 2008 economic and financial crisis. This is reflected in the numerous "financial restrictions" with respect to planned implementation measures of the RTI strategy. Nevertheless, public sector expenditures are currently slightly above the level that would be necessary, given a consistent level of growth, to reach the established goal by 2020. In contrast, private sector expenditures

1 See BKA, BMF, BMUKK, BMVIT, BMWFJ and BMWF (2011). "Becoming an Innovation Leader": Strategie der Bundesregierung für Forschung, Technologie und Innovation (Federal government's strategy for research, technology and innovation), Vienna.
2 See Austrian Research and Technology Report 2015, 18 et seq. BMWFW, BMVIT (2015); http://www.bmwfw.gv.at/ftb
3 See Hranyai and Janger (2015).

– at around €780 million in 2015 – are too low to achieve the goal that has been set.

In light of this situation, this report will look back on the first half of the strategy's planned time frame to take stock of what has been accomplished thus far, what still awaits implementation and what can no longer realistically be accomplished or no longer seems worthwhile given the strategy's altered goals and requirements. It should also be noted that the political area of RTI is experiencing rapid development, and policies will need to be reset over the course of the RTI strategy's time frame, which is – in international comparison – relatively long. Examples of these changes include the emergence of new concepts such as Industry 4.0, Responsible Research and Innovation, and Social Innovation, among others. Meanwhile, certain measures have appeared that, while not stemming directly from the RTI strategy, support developments in RTI. Other initiatives, as mentioned, were not implemented but have taken on new forms or are part of new combinations, for example the "Clusters of Excellence" that were aimed at in the strategy. The goals attached to this planned initiative can essentially also be targeted through other, functionally equivalent instruments, for instance doctoral programmes, specific programmes, the START and Wittgenstein Prizes, etc.

This report is based on analyses and documents related to the development of Austria's RTI environment and policies, and on extensive interviews with key actors in RTI policy-making, especially representatives of the "RTI Task Force", which is the central body responsible for both the formulation of the RTI strategy and coordinating its implementation (see Chapter 2.3). The following section will describe the key thematic areas of the strategy, i.e. scientific research and tertiary education, innovation and corporate research, RTI governance and priority setting. It will look at specific focuses within these thematic areas, the various starting points and/or changes, core objectives, and and select key measures and give an overview of implementation and possible future implementation steps and/or plans. Where appropriate, links will be drawn to other (sub-) strategies.

This report is part of a broader reflection on Austria's next steps, given what the country has already accomplished and implemented, if it is to meet the ambitious goals set out in the strategy within the remaining timeframe. Other recent attempts to assess the country's position have included a direct comparison of Austria to Denmark and Sweden, two of the Innovation Leaders in the EU[4] and an analysis of Austria's strengths and weaknesses.[5] This report is not intended to serve as an analysis of the impact of the strategy as a whole or of its components.

2.1 Scientific research and tertiary education

An array of goals and measures have been defined as part of the RTI strategy[6] that set significant parameters for improving the universities and their contributions to the economy and society.

With an eye to Austria's goal of joining the group of Innovation Leaders, it has been established that universities and universities of applied sciences must enjoy excellent working conditions and sufficient financial support to allow for optimal research and teaching. It is also necessary to improve the attractiveness of academic careers at Austrian universities so as to bring them more in line with international standards. Universities receive support from the political sphere "to conduct basic research at the highest level and produce exceptional graduates". Finally, well-developed research infrastructure at universities and universities of applied sciences not

4 See Polt et al. (2015).
5 See Leitner et al. (2015).
6 See BKA et al. (2011), specifically Chapter 2 (Education system) and Chapter 3 (Development of the research system).

only supports top research performance, but creates a sound basis for cooperation between academia, industry and society.

With this situation in mind, the Austrian federal government's RTI strategy defined a number of concrete measures that will be explicitly addressed in this year's Research and Technology Report, grouped according to the following general thematic areas:

- improving the quality of university instruction,
- improving conditions for researchers at universities,
- promoting gender equality in research,
- supporting excellence in basic research, and
- developing research infrastructures.

2.1.1 Improving the quality of university instruction

Austrian higher education policies have long included components targeted towards improving university instruction. With the RTI strategy, several key goals and measures took centre stage in 2011. The RTI strategy identified the following as key components in improving the quality of university instruction: 1) developing an "Austrian model" for the future separation of higher education funding between student-focused funds (teaching) and research, 2) improving the supervision relationships between students and their faculty, and 3) developing indicators for improving the quality of university instruction in higher education. Quality teaching at universities was thereby explicitly situated at the centre of domestic RTI policy. By placing more value on teaching, this effort puts into perspective the problematic and – until now – widely criticised hierarchical relationship between research and teaching.[7]

The development of a new model for university funding and the separation of funding between research and teaching was first defined in basic terms in 2013 in an amendment to UG 2002 (Federal Law Gazette No. I No. 52/2013). This identified the principal aims of a student-centred and capacity-oriented university funding scheme as: 1) increasing transparency in calculations and in monitoring, 2) improving quality in teaching and research/artistic research[8], 3) concrete planning of capacity, and 4) optimisation of the budget-cost structure. The planned implementation of this student-centred, capacity-oriented university funding scheme was postponed, however, because of the current budget situation.

Nevertheless, the funding package initiated in 2013 as part of the higher education funding structure initiative, which replaced the previous formal budget, increased funding for those universities that did well in meeting the "student-centred" assessment criterion of the number of (full-time) students. During the performance agreement period 2013–2015 €450 million were made available for the funding structure of higher education. The act outlining the funding structure of higher education provides for the distribution of funds in accordance with indicators and attached to specific projects. For teaching, it places particular emphasis on what it has identified as the key indicator: "The number of actively pursued study programmes, organised by subject area". 60% of higher education funding is distributed to Austrian universities according to this single indicator. Another 8% of funds are assigned according to the indicator "Graduates". This alone already constitutes a significant element of a student-centred funding of higher education. Higher education funding has been increased to €750 million in the current performance agreement period 2016–2018, of which funds in the amount of €450 million were assigned according to the number of full-time students and €60 million according to the number of graduates. 13% of the funding in 2016–2018 was competitively distributed as stimulus funding for university-based cooperative projects. In con-

7 See Hochschulforschung (University research) (2004).
8 "Development and Inclusion of the Arts" is seen as an artistic counterpart to scientific research.

junction with this, a tender was made in February 2016 to the amount of €35 million for university-based cooperative initiatives focused on teaching development. Significant funds were awarded for the implementation and expansion of new teacher training programmes.

Furthermore, incentives for improving teaching quality were included in the design of the performance agreement for both of the periods 2013–2015 and 2016–2018. For the performance agreement period 2013–2015, teaching performance and all newly established or shuttered courses and continuing education programmes (university level courses) were for the first time listed next to the outline of course programmes on offer in the performance agreements. Course conditions, important for assessing teaching capacity, became more transparent as a result of this, and potential starting points for further development were identified.

The past several years have seen more engagement with the question of the application and development of quality indicators in the context of improving university instruction. The student/teacher ratio in particular has been used as an indicator of the supervision available to students and, as a result, of teaching quality. In light of the rise in the number of students, adequate supervision plays a determining role in the quality of teaching and has assumed a more important role in decision-making. It was decided during discussions around the introduction of a new model for university funding to improve supervision ratios through two measures in particular. First, new temporary admissions regulations were allowed in 2013 (through the end of 2015) in five subject areas that were in particularly high demand (architecture and urban planning; biology and biochemistry; computer science; management, public administration/business and public administration/economics; and pharmacology). Given the positive effects seen in 2015, these admissions regulations were further developed and extended through 2021. Second, staffing numbers in these subject areas were increased by creating 95 professor positions (or equivalents) during the performance agreement period 2013–2015. A total of €36 million were used for this purpose from the funds associated with the "Teaching Quality Initiative". These funds earmarked towards improving student supervision were extended throughout the performance agreement period 2016–2018.

A working group within the Austrian Higher Education Conference led a broader discussion of quality indicators and quality in teaching that involved all higher education sectors for the first time. The Austrian Higher Education Conference developed a series of recommendations for improving university instruction that encompassed curriculum design, teaching activity, knowledge transfer, course management and evaluation.[9] The recommendations, presented in 2015, were directed predominantly at the universities, and they can implement them autonomously. One of the working group's additional outcomes was the creation of a website (www.gutelehre.at) that is meant to serve as a generic "online reference work". It seeks to provide examples of good practice with the larger aim of improving transparency in teaching quality and encouraging a much needed, cooperative exchange of information.

The performance agreement for the period 2016–2018, taking into account the Higher Education Conference's recommendations, among other things, includes additional measures intended to improve teaching quality, including plans to make good teaching more relevant to career planning, improving student supervision and strengthening the role of training in academic research.

From a broader perspective, the Act on Quality Assurance in Higher Education (HS-QSG, effective as of 1 March 2012) provided the first cross-sector legal basis for defining norms for pe-

9 See Austrian Higher Education Conference (2015).

riodic assessments of university quality development measures and their outcomes, especially those around the core concern, teaching. Working together with universities' own quality management systems, this form of external quality assurance contributes in a significant manner to ensuring the quality of university instruction and its continued development.

The importance of good teaching is furthermore demonstrated through the recognition of exceptional teachers. University instruction prizes and the government's "Ars Docendi" prize[10] confer material and intellectual distinction on the winners, and they play a role in creating practices by means of the criteria that are used in determining winners.

A look back at the performance agreement period 2013–2015 shows that universities drew particular attention on instruction as they developed their quality management systems. The determining effect of indicators involved in the distribution of higher education funding has directly resulted in an increase in the number of credits achieved. The coming 2016 Intellectual Capital Statements (Wissensbilanzen) will show the extent to which universities, amid rising student numbers, can enact plans and meet their goals related to the improvement of student supervision as set out in the performance agreement 2013–2015.

A gradual implementation of a new funding system is ultimately dependent on the budget available to universities in future and the legal conditions related to capacity management and could, if the necessary financial and legal prerequisites are put into place in time, begin at the start of the performance agreement period 2019–2021 at the earliest. Political agreement regarding implementation and earmarked funding is as necessary as it is for universities to set clear priorities and appropriately support their teaching staff. In addition, in the future the importance of the teaching aspect of an academic career should play a more important role in the hiring and professional development of staff. Improved cooperation in teaching will be as important in future as inter-university and cross-sector cooperation and coordination within the greater Austrian higher education sector.

To this end, the Federal Ministry of Science, Research and Economy (BMWFW) initiated the comprehensive "Tomorrow's University" process in February 2016, which aims to promote the development and strategic orientation of the entire Austrian higher education sector. Working together with the Austrian Science Board and with the involvement of the relevant universities and stakeholders in the research sector, they set the form and content of the provisions contained in the upcoming performance agreement periods and conceptualised plans for developing and funding universities of applied science. Whilst taking existing conditions fully into account, this effort tries to optimise the distinctive profiles of public universities and universities of applied science, the specialised structuring of their course offerings, the provision of assistance and simultaneous reinforcement of both sectors and more efficient use of the funding that has been made available.

2.1.2 Improving conditions for researchers at universities

The RTI strategy set itself the goal of improving conditions for university researchers in three particular areas. The first has to do with the transparent awarding of permanent positions at universities. The amendment to the University Act Federal Law Gazette No. 131/2015 (section 99 (5) of the University Act) clarified that the agreement on a tenure plan with a candidate in a tenure-track position must be preceded by an application process in line with international, com-

10 The "Ars docendi" was first awarded in 2013 and was extended to the universities of applied sciences and private universities in 2014 in partnership with the Association of Austrian Universities of Applied Sciences, the Private University Conference and the Students' Union. See Federal Ministry of Science, Research and Economy (2014b, 162).

petitive standards and, most importantly, that this must have been internationally advertised. The other two areas encompass the implementation of a tenure track model and improved support for doctoral students and post-docs through the expansion of structured programme offerings. These two areas will be dealt with in more detail below.

Reform of university career structures

The amount and quality of basic research and university research are of ever greater importance as knowledge economies strive to innovate. The two key factors in research quality are the conditions under which research occurs (funding levels and mechanisms[11]) and securing the brightest minds for university research.

The RTI strategy has identified the human resources-related issue of an "ongoing and significant brain drain to abroad" as a challenge facing the growth of Austria as a centre for innovation. This is partly influenced by structures at Austrian universities that have a negative effect on career building. Factors that are known to contribute to this negative effect and tend to promote the so-called brain drain include career opportunities that are segregated according to whether one belongs to the inner circle of staff who hold full professorships, and the lack of an intermediate stage between the post-doc/non-tenure track assistant professor level and full professors. Given the existing regulations for the hiring of professors (section 98 in the Universities Act of 2002), it is impossible for young researchers to plan for a career path leading to a full professorship at their current university. The career path outlined in the collective agreement ends with a permanent "associate professor" position (CA section 27), but the Universities Act does not consider these staff to be on equal footing with full professors.

In order to improve recruitment and retention of excellent researchers, the RTI strategy lays out explicit measures aimed at "improving collective agreements and the Universities Act concerning the tenure-track system (implement a career model with options for unlimited employment, dependent on performance evaluations)".

The November 2015 amendment to the 2002 Universities Act is a significant step towards implementing these measures, which will come into full effect in October 2016. Section 99, paragraphs 4 to 6 of the amended Universities Act essentially describe for the first time a new tenure track model that includes a streamlined process enabling researchers who can meet rigorous, international standards to become full professors at their own university. This offers in particular young researchers with excellent qualifications the chance to become a full professor at a much earlier stage in their careers. By offering the possibility of a full career path and eliminating a competitive disadvantage in comparison to higher education institutions here and abroad that have an Anglo-American tenure track model in place, Austrian universities are now better placed to compete for exceptional candidates. In addition, a streamlined process allows adjunct professors to apply for full professorships.

What makes these revisions of the Universities Act remarkable is the connection made, on the one hand, between labour regulations (related to the collective agreement at universities) and the legal governance of universities (in the form of the Universities Act) and the interests of distinct groups with distinct rights and responsibilities within the universities, i.e. the full professors and staff at the assistant professor level, on the other. The new regulations do not alter professors' traditional governing rights at Austrian universities, but these rights have been extended to associate professors, who may now participate on equal footing with full professors.

11 See Aghion et al. (2010).

These reforms were supported by studies and analyses on the subject and broader European trends in this direction as well as through the integration of measures outlined in the action plan for a competitive research area[12], which had been explicitly designed for implementation as part of the RTI strategy.

In addition to improving Austrian universities' ability to compete internationally for researchers, the reforms are also intended to increase the number of professors at Austrian universities more generally, a number that is currently low in international comparison.

The measure described here has not yet been fully implemented. While the amendment to the Universities Act has outlined a simplified process for hiring professors, the concrete form this will take is still to be determined. It remains to be seen whether this fundamentally important step of implementing new legal regulations will contribute in actual practice to the overarching aims of improving the attractiveness and quality of Austrian universities. The new regulations stipulate that the measures will be evaluated after five years. It must be emphasised that the goals stipulated in the RTI strategy with respect to implementing a tenure track model play an important role in achieving the overriding goals laid out in the RTI strategy. It may be assumed that the issue of career perspectives in winning the increasingly international competition for the brightest minds and the growing importance of basic research will be of even greater significance to firms' own innovation strategies.

Support for doctoral students through the expansion of structured programme offerings

Doctoral education and the training of future researchers plays a particularly important role in innovation and economic development in today's knowledge-based society. There is therefore a variety of initiatives across Europe to prepare doctoral students for their role as conveyers of knowledge. [13]

With respect to quality assurance and further development of doctoral training, the following are of particular relevance: the Salzburg Principles[14], the Salzburg II Recommendations[15], the Principles for Innovative Doctoral Training[16], the European Charter for Researchers, and the Code of Conduct for Recruitment of Researchers[17]. These all incorporate the concept of research excellence and the related premise that research ought to occupy a central place in doctoral training. Furthermore, relevant institution-level conditions are appreciated, including satisfactory working conditions and possibilities for career development. Stress is also laid on the importance of internal quality assurance in doctoral training. The transition from two- to three-year doctoral studies[18] in Austria was the driving force behind the qualitative development of doctoral training.[19] Within this broader context, a structured doctoral training programme took on greater significance, one which aimed to more tightly integrate doctoral students into university research and the scientific community, guarantee active monitoring and appropriate supervision, and ensure that doctoral students are conducting

12 See BMWFW (2015a).
13 See Federal Ministry of Science, Research and Economy (2014b).
14 See http://www.eua.be/eua/jsp/en/upload/Salzburg_Report_final.1129817011146.pdf
15 See http://www.eua.be/Libraries/publications-homepage-list/Salzburg_II_Recommendations
16 See http://ec.europa.eu/euraxess/pdf/research_policies/Principles_for_Innovative_Doctoral_Training.pdf
17 See http://ec.europa.eu/euraxess/pdf/brochure_rights/eur_21620_de-en.pdf
18 The universities have only been allowed to offered three-year long doctoral studies since the 2009/10 academic year (see BMWFW 2014b).
19 See Federal Ministry of Science and Research (2011, 93 et seq).

independent and high quality scientific research. As excellent training became a prerequisite for preparing future researchers, the RTI strategy provides for the support of doctoral students through the expansion of structured programmes.

The Austrian Science Fund's (FWF) Doctoral Programmes (DK), introduced in 2004, are based on the demand for doctoral training in accordance with the above-named criteria. These doctoral programmes are training centres for highly qualified young researchers from Austria and abroad, play a significant role in Austrian universities' priority-setting and determining their research focuses, and work to ensure the continuity and impact of these research directions. From the initiative's inception until now (as of 31 January 2016), 46 doctoral programmes have been established with 1,100 students and total funding amounting to just under €140 million. There are currently (first quarter 2016) 40 active doctoral programmes.

A recent evaluation of the Austrian Science Fund's (FWF) doctoral programme initiative highlights these programmes' reputation as centres of excellence, their role in ensuring critical mass in designated key research fields at universities and their contribution, alongside activities internal to their respective universities, to the further development of and quality assurance in doctoral training.[20] The doctoral programme initiative has been well received from the start, which is, for instance, evident in the continued rise in applications. The idea behind the doctoral programme – to create prototypical optimal conditions for doctoral training that could be applied to all disciplines – was fitting and important and it came at exactly the right time when it was implemented ten years ago. The original intent behind the programme, to change the culture of doctoral education especially in social science, arts and humanities in a fundamental manner, has not come to full fruition.

The Graduate School at IST Austria can also be mentioned here, which was founded in 2009 and designed explicitly to provide structured doctoral training. The PhD programme is based on the US model, in which students enter the doctoral programme without joining a specific research group right away.[21] Of the 300 researchers at IST Austria, around 120 are currently enrolled in the Graduate School, having been chosen in a competitive application process. All PhD students take part in an interdisciplinary training programme and are supervised by several experienced researchers.

In light of these developments, the Federal Ministry of Science, Research and Economy (BMWFW) initiated an intensive round of discussions in autumn 2013 with stakeholders within the context of the Austrian Higher Education Conference (HSK), which culminated in 2015 in the "Recommendations for the Enhancement of Quality in Doctoral Training in Austria".[22] The included proposals for the further development of quality markers and the expansion of administrative and organisational support for doctoral students were meant to strengthen the reputation of doctoral study to indicate one's ability to independently undertake original, high-quality scientific research. The recommendations are actionable and targeted towards the establishment of doctoral programmes. They are thus meant to provide a driving force in that initiative.

When preparing and negotiating the performance agreement 2016–2018 with the universities, particular attention was also paid to quality development in structured doctoral training.

The Federal Ministry of Science, Research and Economy (BMWFW) has defined what falls under the designation "structured doctoral training" with the intention of supporting the implementation of the organisational structures and processes recommended by the Austrian Higher

20 See Ecker et al. (2014).
21 See http://ist.ac.at/de/graduate-school/
22 See http://www.hochschulplan.at/wp-content/uploads/2015/07/2015-06-12_HSK-Empfehlung-Doktoratsausbildung.pdf

Education Conference (HSK). This definition[23] has been translated into a set of explicit criteria[24] and been transformed into a new indicator[25] for use in granting higher educational structural funding.

Funding of around €30 million has been provided by means of this indicator in the performance agreement period 2016–2018 for doctoral students in "structured doctoral training" whose employment contract with the university stipulates a minimum of 30 hours per week. An understanding of doctoral students as "early stage researchers" is reinforced by reference to an employment agreement, which tends to be tied to professional and institutional senses of belonging and social security mechanisms. An allocation of resources in accordance with this indicator will be provided first in 2017. The coming years will give evidence of the extent to which universities have been able to translate this additional financial support into the creation of sustainable structures.

Additional future discussion of the recommendations of the Austrian Higher Education Conference (HSK) will focus on the question of maintaining appropriate levels of funding for doctoral studies and financial support of innovative efforts within the stipulated parameters, e.g. in the form of cooperative models for doctoral training that also take into account the specific needs of universities of applied science.

Important stakeholders, such as Universities Austria (UNIKO), the Austrian Council for Research and Technology Development (RFTE) or the Austria Science Board (ÖWR), are also strong advocates for additional, accelerated expansion of structured doctoral training.

The Austrian Science Fund (FWF) will undertake a review and adjustment of its involvement in doctoral training regardless of the future successful implementation of doctoral programmes. The role of a research funding agency should be first and foremost to provide a driving force behind systematic developments throughout the sector. This is also why the revised plans for supporting structured doctoral programmes include a new form of cooperation between universities and the Austrian Science Fund (FWF).

2.1.3 Promoting gender equality in research

Despite numerous efforts in recent years to increase the number of women in research in Austria, they remain underrepresented. This includes research in the higher education sector, where women make up 34% of the research staff, in non-university research institutions (25%) and especially in the business enterprise sector (16%). Whilst the share of women among tertiary graduates has increased to 57%, research institutions continue to suffer from the "leaky pipeline" phenomenon: The more advanced the position, the fewer women are represented. Available talent is not being sufficiently utilised. Furthermore, a stark horizontal segregation is as evident as ever in the tertiary sector: female students are especially underrepresented in engineering-related fields, whilst men are underrepresented in the arts and humanities. Generally speaking, gendered socialisation and con-

23 The definition is as follows: creation of procedures and/or structures and liabilities which, on the one hand, secure the quality of the research, and on the other guarantee optimum and adequate scientific support to students; with the objective of securing independent premium-quality scientific research by students, including these in the institutional research operations with as much equality as possible and guiding these to completion through active support and supervision.

24 The framework criteria for the indicator are as follows: submission of a synopsis within the first year following admission to the relevant course of study, public presentation of the relevant doctoral thesis project, conclusion of a dissertation agreement with a schedule and work plan included, support from and/or supervision by a team, staff separation of support for and/or supervision of the dissertation and evaluation of this. The synopsis and the public presentation of the doctoral thesis project form a prerequisite for approval of the dissertation topic and conclusion of a dissertation agreement.

25 The "Doctoral student with employment contract with the university" Intellectual Capital Statement ("Wissensbilanz") indicator forms the basis for this, and in future this will be surveyed with a distinction made between doctoral students in structured and non-structured programmes.

ditions that advantage men create significant barriers for the equal participation of women in research, and this must be counteracted.

The RTI strategy therefore formulated a number of measures to promote equality in the research sector: 1) gender budgeting as a part of all research funding measures/programmes; 2) measures to support young women´s career development in basic and applied research and in their professional lives; and 3) measures to create a better work-family balance.

The Austrian Research Promotion Agency (FFG) and the Austrian Science Fund (FWF), similarly to Horizon 2020, integrated a focus on gender and gender equality in application procedures and in report guidelines. The Austrian Academy of Sciences (ÖAW) enshrined gender equality in its bylaws in 2011. In its performance agreement with the Federal Ministry of Science, Research and Economy (BMWFW) for 2015–2017, the Institute of Science and Technology (IST Austria) set itself the goal of creating equal opportunity and diversity through an expansion of gender mainstreaming and diversity management.

The enactment of the 2013 reform of the budget law additionally legally anchored gender budgeting as a means of promoting gender equality in all the measures in research funding. This means that objectives, measures and indicators are included at all budget levels that assess the promotion of equality between women and men, including in education, research and development, and science. The strategic goals surrounding equality that were set by the Federal Ministry of Science, Research and Economy (BMWFW) for the university sector, for example, have resulted in progress when it comes to the representation of women. The share of female professors has risen in the past few years and was at 22% in 2014 (19.5% in 2010). The January 2015 amendment to the Universities Act established a 50% quota for women in decision-making bodies at universities. In 2014, nearly all universities could demonstrate a 40%. In addition, all universities are required to present plans for supporting women. To this end, ÖAW and IST Austria have enacted specific measures and regulations to help support female researchers' careers at all levels.

In addition to these measures targeted towards research funding, an array of individual support measures for women in science have been implemented. These include the fellowship programmes of the Federal Ministry of Science, Research and Economy (BMWFW) e.g. the Herta Firnberg Programme (€1.9 million per year), the Elise Richter Programme (€2.2 million per year) and the L'ÓREAL grant (€40,000 per year for two awardees) for young female scientists engaged in basic research. Additionally networking and interdisciplinary exchange among female researchers at universities is supported through the Club Scientifica, and measures to promote women's involvement in university management functions and decision-making bodies were introduced.

A novel form of support for female researchers in applied research has been established as part of the w-fFORTE (economic ideas of women in research and innovation) with the Laura Bassi Centres of Expertise, which aim to support the creation of a new research culture. In these centres scientific excellence, interdisciplinarity, equality and aspects of management are all equally emphasised. The selection of centres was the result of a newly developed process that looked forward to researchers' future efforts rather than their past accomplishments.[26] Experiences with the design of gender equal research programmes in mind and of a better understanding of diverse research cultures on the individual and institutional levels will be passed on to the

26 See http://www.w-fforte.at/wissenschafft-erkenntnis/impulse-aus-dem-laura-bassi-programm/potenzialanalyse-als-neues-bewertungsmodell.html

entire RTI community. As part of w-fFORTE, training focused on the acquisition of career-based competencies for female researchers and women in RTI as well as management workshops for managers working on research projects that involve both science and business are offered. Events dedicated to the topic of diversity of career options shed light on pathways into research, business and industry.

The Federal Ministry for Transport, Innovation and Technology (BMVIT) also supports the impetus behind gender equality in research through its Austrian Research Promotion Agency (FFG) "Talents" funding programme. In light of impact-oriented budgeting, the ministry set itself the ambitious target of increasing the involvement of women in the business enterprise sector to 19% by 2014, a goal that is still active. In addition to introducing gender criteria in research funding, individual support mechanisms such as the FEMtech theses and FEMtech internships are intended to support female students at the beginning of their careers as researchers. Broader efforts directed at research culture include FEMtech Careers, which help R&D firms and non-university research institutions in the natural sciences and engineering to put equal opportunity initiatives into practice.

Finally, more attention should be paid to measures that promote a better balance between career and family. In addition to the support of women researchers, the 2015 amendment to the Universities Act established a requirement for universities to develop plans for equal opportunity, with particular focus on compatibility and antidiscrimination. The compatibility between family and career as a socially desirable goal is firmly anchored in the performance agreement with universities. The audit initiative "hochschuleundfamilie" ("highereducationandfamily") aims to assess the implementation of the above: 20 of the 69 universities and universities of applied sciences have received commendations so far.

More data is needed, however, to assess developments in the number of all-day schools and all-day care, which also contribute to creating a balance between career and family for researchers and scientists.

RTI strategy initiatives to stimulate interest among female school pupils for the natural sciences and engineering should also be recognised here. These too may contribute over the long term to gender equality in research. One noteworthy example is the Austrian Research Promotion Agency's "Talente" internship programme for female pupils. Others include the IMST Project (Innovation Makes Schools Top!), which supports teachers in bringing innovations into the classroom in teaching the MINT subjects (mathematics, informatics, natural sciences and technology). Also worthy of mention are the efforts supported by the Federal Ministry of Science, Research and Economy (BMWFW), Federal Ministry for Transport, Innovation and Technology (BMVIT) and Federal Ministry of Education and Women's Affairs (BMBF) to spur interest in mathematics through the "Club for Mathematics as a Cultural Achievement", known popularly as "math.space". These initiatives are not directed solely at female pupils and young women, but in practice they do explicitly target them.

The Federal Ministry of Education and Women's Affairs (BMBF) additionally has taken concrete steps to combat gender stereotypes in a number of educational areas. These include, among others, the teaching focus "Gender and Education" and the classroom principle "Educating Equality between Women and Men". The implementation of these initiatives in classrooms is supported through measures related to teacher training. Related measures have been implemented in schools from the earliest years to the final years of secondary education specifically to spur interest in the natural sciences and careers in technology.

On a structural level, the Federal Ministry of Education and Women's Affairs (BMBF) has worked gender and diversity management into its integrated approach to quality management in its vocational education and training system

(QIBB, the Austrian VET Quality Initiative).[27] In general education, appropriately designed initiatives have been created within the programme "School Quality in General Education" (SQA) with a core focus on "gender competence and gender equity".

In summary, Austria has recently been able to set up and implement some good methods to promote gender equality in research. Improvements are needed in areas where gender criteria are attached only to formal requirementswhen applying for research funding but are not checked whether the proposed measures to promote gender equality have actually been implemented. Of central importance is a systematic overview of the policy mix incorporating support for equality, long-term efforts and a consistent funding policy.[28]

2.1.4 Supporting excellence basic research

In Austria, as in other highly developed economies, basic research is of double importance for successful innovation. On the one hand, the development of new technologies is increasingly connected to discoveries made through basic research, whereas until the end of the 19th century, these were often the result of isolated, ad-hoc feats of engineering.[29] Knowledge is increasingly complex and it is therefore more difficult to develop new technologies on top of already existing ones.[30] On the other hand, the role of basic research in the success of innovation is not independent of the state of development of the economy in which it takes place. When competitiveness comes from innovation instead of imitation, the internal expansion of knowledge plays a central role. In addition to its role in education and training, basic research is key for young researchers both at universities and firms. The quality or excellence of basic research has a profound impact. Excellent research is utilised in innovation processes more frequently than average research, has a positive influence on transfers of knowledge (for example, through higher licensing income or more spin-offs) and attracts talented researchers and students. Efforts related to basic research are therefore a core component of an RTI strategy that aims to propel Austria into a position as an Innovation Leader.

The RTI strategy sees both input and output as challenges.[31] The goals of the RTI strategy are: 1) to increase investments in basic research by 2020 to the level of leading research nations. 2) to improve basic research by implementing further structural reforms in the university system; 3) to reform university financing, making it more competitive and project-based; 4) university research financing in the form of third-party funding from the Austrian Science Fund (FWF) via competitive applications, must be strengthened and given appropriate financing; and finally 5) the establishment of individual profiles of universities should be supported by creating clusters of excellence.

Specific measures announced to this end include the expansion of third-party funding of university research via competitively evaluated projects from the Austrian Science Fund (FWF), with a lump sum coverage of overheads amounting to 20%, as well as the implementation of an Austrian excellence initiative that will lead to the creation of up to ten clusters of excellence by 2020. Implementation of these measures took a variety of forms, but they were functionally usually equivalent to those measures mentioned explicitly in the strategy.

For example, the Austrian Science Fund (FWF) did not create its own excellence cluster pro-

27 See QIBB guiding principles: http://www.qibb.at/de/ueber_qibb/qibb_leitsaetze.html
28 See Austrian Research and Technology Report 2015, Chapter 5.2. BMWFW, BMVIT (2015); http://www.bmwfw.gv.at/ftb
29 See Dosi (1988).
30 See Jones (2009).
31 The RTI strategy states: "In international comparison, basic research in Austria – both in terms of monetary inputs and outputs (publications, quotations, etc.) – is located in middle field; however, it is lagging behind the global benchmarks, such as the USA and European reference countries."

gramme as was set forth in the RTI strategy but rather seeks to implement measures to support and expand already existing excellent research groups within its range of existing instruments. The regular awarding of funds by the Austrian Science Fund (FWF) as part of its support of single projects, which are subjected to a rigorous quality assessment, contributes to the support of existing high-performing research groups since these tend to be successful in their applications for FWF funds. These include the institutes belonging to the ÖAW (Quantum optics: IQOQI in Innsbruck, the Research Group for Quantum Optics, Quantum Nanophysics and Quantum Information in Vienna, the Life Science Institute in the Vienna Biocenter, the IMBA or GMI, and the CeMM). Specific excellence programmes run by the Austrian Science Fund (FWF), such as the Priority Programme (€31.3 million distributed in 2014), the Wittgenstein Prize and the START Programme (€10.8 million distributed in 2014) allow for substantial multi-year funding for excellent research groups (special research areas), excellent young researchers (START Programme) and established researchers (Wittgenstein Prize), and thereby contribute to the further development and strengthening of internationally preeminent research groups. The Austrian Science Fund's (FWF) budget was increased by 7% in 2015–2016 and will be fully covered for the first time by the regular federal budget as of 2016. This will improve dependability in planning as compared to prior years. Previously the funds distributed by the Austrian Science Fund (FWF) came from a variety of financial sources. From now on there will be a stable budget of €552 million for the years 2016–2018. The Austrian Science Fund (FWF) budget grew on the whole 12.5% from €490 million (for the period 2013–2015).

An additional structural revision to the financing of excellent research projects was the Higher Education Structural Funding Act (Federal Law Gazette II No. 292/2012, amendment Federal Law Gazette II No. 228/2015): A portion of the funds (15%) earmarked for research will be distributed on the basis of third-party funding that the universities have secured. More specifically, as of 2016, universities' overheads – research projects' indirect but necessary costs related to space, administration and the like – will be compensated in accordance with the "Knowledge Transfer" indicator. This will equate to approximately 20 additional cents for every euro of funding provided by the Austrian Science Fund (FWF) for R&D projects and artistic research projects.

An extension and safeguarding of the leading edge research can also be seen in the long-term funding prospects up to 2026 for the Institute of Science and Technology Austria (IST Austria) (federal funding is a maximum of €988 million here), with a third of this dependent on attracting third-party funding, particularly from the Austrian Science Fund (FWF) and the European Research Council (ERC), which also awards *principal investigator grants* in the same way as the Austrian Science Fund. The ERC is generally a valuable pillar for the funding of excellent research groups in Austria in addition to the groups stated above, including in particular IST Austria: 47% of the 36 research group leaders benefitted from an ERC Starting, Consolidator or Advanced Grant as at December 2015, a peak value in European comparisons. By mid-2015 the researchers at IST Austria had already attracted €50 million in third-party funding, with three-quarters of this from European sources of funding. The Doctorate Programme at the IST Austria is also supported by the EU as part of the Marie Skłodowska-Curie Programme with funding of €4.4 million, an amount that is very high in European comparisons. European funding is thus particularly important for Austria in the area of excellence: it could theoretically be extended further and supplement the funds from the Austrian Science Fund (FWF), although there is now very intense competition for funding via both the ERC and Marie Skłodowska-Curie Actions (MSCA).

The impact of the actions implemented can already be assessed in part, since the strict review process which precedes the ERC and Aus-

trian Science Fund (FWF) funding is most likely to select those projects that feature a particularly high level of quality. Success with Austrian Science Fund (FWF) and ERC project applications can therefore itself be interpreted as an impact, even if the research project has not yet even been completed. Bibliometric analyses from the publications that arise from Austrian Science Fund (FWF) projects show, for example, that the citation frequency is 40% above the global average from the years 2001–2010, on par with the United States, while the overall Austrian average is just 12% above the global average. As such, funding from the Austrian Science Fund (FWF) makes a crucial contribution to excellence in the Austrian research landscape.[32] Analyses of the scientific quality of publications based on citations always involve delays of several years, since citations only occur over time and reach their high point after approximately five years depending on the discipline. It will therefore take time to complete similar studies for the IST Austria also, although it can be assumed based on the aforementioned high quality of the projects reviewed by the ERC and Austrian Science Fund (FWF) that the IST Austria has in the meantime become a crucial component in the excellent basic research in Austria. There are already six "highly cited researchers" there (according to the ISI). However, this impact currently remains limited, as is to be expected given the extent of the funding. The competitive funding remains relatively low in terms of the share of total research funding for universities.

The excellence measures cannot yet be described as being completed. There is even a fear of a drop in the success rates at the Austrian Science Fund (FWF) in the foreseeable future, since there will be a huge increase in applications as a result of the growth in excellent research groups and an increase in the Austrian Science Fund's budget of between around 8–10% would be required. Budget consolidation therefore represents a particular challenge in terms of funding excellence and causes serious problems related to the successful implementation of measures.

Under the given circumstances the Austrian Science Fund (FWF) will therefore focus more on implementing measures aimed at stabilising the approval quotas and at modifying its programme portfolio in the upcoming years. This does not correspond with the objectives or the planned actions in the RTI strategy. It must be questioned whether an excellence cluster action in the form put forward in the RTI strategy is still required as a result of the functional equivalence of other actions aimed at achieving the strategic targets. In light of the budgetary restrictions, acceleration of the existing tracks for funding excellence, competitive funding by the Austrian Science Fund (FWF), European funding, IST Austria, Austrian Academy of Sciences etc., appear to be more effective with regard to the strategic targets by 2020.

The targets and actions related to excellent basic research itself remain just as important in any case for the purposes of achieving the higher-level targets in the RTI strategy. The quality of the basic research will become more important in future in obtaining Innovation Leadership status, since the development of new more competitive technologies is increasingly progressing in conjunction with basic research.

2.1.5 Developing the research infrastructure

The research infrastructure at universities, research institutions and firms is an important foundation for the international competitiveness of Austria's research and innovation system. Joint use of research infrastructures also enables the promotion of cooperation between science, industry, and society. Strategic development of the research infrastructure is accordingly an important objective of the Austrian federal government's RTI strategy and is dealt with by the RTI Task Force's working group 4, "Research infrastructure". Recommendations were developed

32 See van Wijk und Costas-Comesaña (2012).

for establishing and expanding research infrastructures under the auspices of the Federal Ministry of Science, Research and Economy (BMWFW) and the Federal Ministry for Transport, Innovation and Technology (BMVIT), working together with representatives from universities and other stakeholders. These deal, inter alia, with a survey of the available data and an analysis of the needs related to the research infrastructure, Austria's participation in the ESFRI Roadmap, the need to establish new funding instruments as well as promoting cooperation and the joint use of research infrastructures. The working group 4 already stated has also developed the Austrian Research Infrastructure Action Plan 2014–2020[33] and thereby directly seized on the action stated in the RTI strategy of creating a roadmap. In addition to the federal government's RTI strategy, the Austrian University Plan developed in 2011 has also provided the strategic basis for concerted and coordinated further development of the research infrastructures, particularly at universities.

The mapping of the research infrastructures represents an important action for the purposes of gaining a secure base of information for targeted and coordinated investments in research infrastructures. Efforts began in 2011 to establish a research infrastructure database in coordination with the universities that recorded infrastructures with a procurement cost of more than €100,000. The database also stated information about the number and type of research infrastructures in individual fields of science, their cooperative use, and the type of financing. An initial record of research infrastructures at universities was prepared in 2011, with updates provided in 2012 and 2014. The records of the research infrastructures were then also extended to the Austrian Academy of Sciences (ÖAW), the Institute of Science and Technology Austria (IST Austria), the universities of applied sciences, the Ludwig Boltzmann Society (LBG), the Central Institute of Meteorology and Geomagnetism (ZAMG), the Geological Survey of Austria (GBA) and to Campus Science Support Facilities GmbH (CSF). As such, information has been gathered concerning more than 1,500 research infrastructures at Austrian universities and research institutions. Reported research infrastructures are funded both by various public sector bodies as well as by firms and sponsors. Third-party funding however (e.g. the Austrian Research Promotion Agency (FFG), Austrian Science Fund (FWF) and EU programmes) made up no more than 15% across all disciplines on average. On the other hand, the share is higher for the technical sciences. Core funding for universities represents the most important source of funding overall. In addition, a large number of investments have been made in recent years using the former specific programmes of the Federal Ministry of Science and Research (BMWF) (today the Federal Ministry of Science, Research and Economy (BMFW)) – "specific programmes for improving research infrastructure". The analyses also show that research infrastructures are used in cooperation with other universities, research institutions and firms in around 20% of cases. The research infrastructure database thereby increasingly acts as an information portal between the relevant universities and research institutions involved, and is used as a tool for initiating cooperation and a forum for questions related to operating research infrastructures.

Individual targets and actions related to implementing the objective of greater joint use and strategic expansion of research infrastructures at universities were defined in a separate section of the performance agreements with the universities. The reference to the research priorities pursued by the universities was an important criterion for the negotiations on the performance agreements in 2012 (2013–2015 performance agreement period) and 2015 (2016–2018 performance agreement period). The interna-

33 See https://www.bka.gv.at/site/6485/default.aspx

tional involvement of universities in research infrastructures is also explicitly recorded in a separate section. Research infrastructures that are also used jointly were funded with implementation of the University Structural Funds Regulations introduced in 2012. For example, 39 projects that permit cooperative projects both within science as well as within industry received funding as part of the university structural funds awarded in 2013.[34] New research infrastructure projects are being funded starting in 2016 as part of the university structural funds for the years 2016–2018. The Federal Ministry of Science, Research and Economy (BMWFW) is attempting through both of these funding instruments to promote the priority-setting by universities as set out in the RTI strategy and to leverage potential synergies. Lastly, the new key figure "1.C.3 Investments in infrastructure in the R&D area/development and development of the arts in the euro area" is used to show investments made by the universities in research infrastructures as part of the efforts to implement an amendment to the Intellectual Capital Statements ("Wissensbilanzen"), with the basis for information for making investment decisions are also improved as a result.

The Federal Ministry of Science, Research and Economy (BMWFW) has been promoting and funding RTI infrastructure procured jointly at the ACR (Austria Cooperative Research) Institutes since 2012 and in association with this the development of new partners and (joint) usage (particularly with SMEs).

A few major research infrastructures have also received funding from the Federal Ministry of Science, Research and Economy (BMWFW) and the Federal Ministry for Transport, Innovation and Technology (BMVIT). These include the "Zentrum am Berg" (Centre on the Mountain) at the University of Leoben and the Hydraulic Engineering lab and pilot factory for Industry 4.0 at the Vienna University of Technology. The "Centre on the Mountain" project involves funding for a research infrastructure that is also due to be used by partners in industry to a large extent.

As a result of the increasing complexity and huge investment sums, it becoming more and more apparent that research infrastructures can frequently now only be financed and operated by multiple national governments. The "European Strategy Forum on Research Infrastructures" (ESFRI)[35] was set up against this background. ESFRI is a platform for the EU countries and the associate countries in the EU research framework programme to discuss and coordinate the development of pan-European research infrastructures. ESFRI has no funds of its own, but it does play a major role in the coordination process for constructing the next generation of major research facilities of a pan-European nature as part of the overall European decision-making processes. A roadmap is developed and/or updated at regular intervals, and Austrian RTI policy accordingly played a part in the consultations in 2011 and 2014, as is also explicitly stated in the RTI strategy. Austria is currently involved in eleven ESFRI projects, including, for example, the biomedical project BBMRI (Biobanking and Biomolecular Resources Research Infrastructure) which Austria is coordinating. Austrian participation in the two infrastructures related to the humanities CLARIN (Common Language Resources and Technology Infrastructure) and DARIAH (Digital Research Infrastructure for the Arts and Humanities) is being coordinated by the Austrian Academy of Sciences in cooperation with the University of Vienna and the University of Graz. The University of Linz is the national coordinator for the Austrian participation in SHARE (Survey on Health, Ageing and Retirement in Europe).

Aside from the participation in the ESFRI projects, EU funds from the European Regional Development Fund (ERDF) are also significant in

34 See Federal Ministry of Science, Research and Economy (2014b, 149f).
35 See http://ec.europa.eu/research/esfri

terms of the strategic establishment and also funding of research infrastructures.[36] As part of EU cohesion policy, the development of a "Research and innovation strategy for smart specialisation" was a prior condition for applying for ERDF funds.[37] This condition is met by Austria with the national RTI strategy with simultaneous complementary presentation of the relevant innovation strategies of the regional governments. The Austrian Research Infrastructure Action Plan 2014–2020 created by working group 4 was recognised by the European Commission as meeting the (further) prior conditions for research and infrastructure and therefore the potential use of ERDF funds for 2014–2020 for this area. The "Investments in Growth and Employment Austria 2014–2020" operational programme co-financed by the ERDF was implemented as a regional programme coordinated between the federal and regional governments and with thematic programme objectives and priorities, with a contribution made towards implementing the Austrian process for smart specialisation (see Chapter 2.3.4). In accordance with EU regulations, the ERDF programme of the "Investments in Growth and Employment Austria 2014–2020" focuses on four thematic programme objectives. "Strengthening research, technological development, and innovation" is the first of these: the construction and expansion of R&D infrastructures is stated in the first action set out here.[38]

In order to continue promoting and funding the acquisition of research infrastructures, efforts began in 2014 to formulate a specific funding programme open to various stakeholders, including in particular firms. The Austrian Research Promotion Agency (FFG) is implementing this new programme operationally. Initial funding of €13 million was approved by the National Foundation in 2015, and the first tender will take place in 2016. The Federal Ministry of Science, Research and Economy (BMWFW) is also preparing a research infrastructure database that will be accessible to the public and open to all research stakeholders, and will thereby provide information to firms on the research infrastructures that are available and the extent to which they can be used by industry. This means that new cooperation potential can be exploited in future, which is also an important target stated in the RTI strategy. The Open Science Infrastructure Programme from the Austrian Science Fund (FWF) will also receive funding in future, amounting to €3 million from National Foundation funds. The increasingly important topic of open access is addressed as a result, a topic that is not just limited to open access to publications, but also includes the publication of research data and access to research infrastructures.[39]

In summary, it can be stated that good progress has been made through a series of measures aimed at implementing the expansion of the research infrastructure as set out in the RTI strategy, with particular progress also made in promoting synergies and partnership between the different research stakeholders.

2.2 Innovation and corporate research

Chapter 4 of the RTI strategy is dedicated to firms' innovation activities. The RTI strategy's vision for the performance of Austrian firms by 2020 as a result of the strategic efforts is that they will develop increasingly into recognised world leaders in knowledge-intensive industries; there should be a rise in exports of top-flight technology and knowledge-intensive services supported by an increase in the proportion of innovative firms systematically carrying out

36 See Heller-Schuh et al. (2015).
37 See Chapter 2.3.4 on Smart Specialisation.
38 See ERDF programme investments in growth and employment in Austria, 2014–2020 – Operational programme for the use of ERDF funds, Version 1.2 of 10 December 2014; www.efre.gv.at/iwb-efre-programm
39 The Open Science infrastructure of the Austrian Science Fund (FWF), which in addition to the Austrian Research Promotion Agency's (FFG) infrastructure programme also received €3 million from the National Foundation, can also be mentioned in this context.

research in Austria. To achieve these objectives, numerous steps have been described and embedded in a broad approach to implement the RTI strategy. The incentives promoting technological developments should not only be implemented at the supply side; stimuli should also come from the demand side. They should emphasise promotion of non-technological innovations and highlight the importance of cooperation with science. In addition, not only existing firms are being addressed; entrepreneurial dynamics is a separate priority of its own within this area of the strategy.

This chapter focuses on four priorities in the RTI strategy related to corporate research and innovation:

- the demand-side promotion of innovation, particularly through public procurement with this in mind,
- cooperation between science and business,
- Industry 4.0 and
- actions to promote the availability of venture capital.

2.2.1 Demand-side stimulation for innovation

Innovation policy instruments for the demand side are becoming increasingly important, such as public procurement that promotes innovation, regulations and standards, and consumer policy. However, these are not meant to replace supply-side instruments, such as direct and indirect promotion of research, technology, and innovation (RTI), but rather to supplement them in a sensible policy mix.[40] Since public procurement is an important economic factor, public procurement promoting innovation is currently the most prominent demand-side instrument on the innovation policy agenda.

Public procurement promoting innovation arrived in Austria in 2007 as a topic driven by the EU that was visible through the widely communicated "procure_inno"[41] guidelines. Although the guidelines received very positive acceptance, they had no significant mobilisation impact due to the lack of any accompanying measures. The incorporation of the demand-side stimulation for innovation in the catalogue of objectives for the 2011 RTI strategy[42] was therefore a logical consequence and created the basis for concrete measures aimed at public procurement that promotes innovation. These measures cover the strategic, legal and operational dimension of policy action for the purposes of the RTI strategic principle of a comprehensive approach to innovation policy[43].

Strategic implementation of strategic public procurement that promotes innovation

The strategic centrepiece is the "guiding concept for public procurement that promotes innovation in Austria"[44]. The guiding concept has a robust political and institutional basis, as both its creation as well as its implementation were put forward by the Council of Ministers[45] and the contents are based on a comprehensive stakeholder process[46]. In addition, there is also a close cooperation with the regional governments on public procurement that promotes innovation with the interfaces for ecological procurement[47] and for discussion surrounding social procurement criteria[48] taken into account. The responsi-

40 See EC (2007/C/799, 2010/C/546); OECD (2011, 2014).
41 See Federal Ministry of Economics and Labour (2007).
42 The RTI strategy names demand-driven stimulation of innovation as a potential contributor with the following objectives: "boosting innovative potential of firms", "improving the quality of the public-procured infrastructure and services" and "increasing domestic value creation", see Federal Chancellery et. al (2011, 9–13, 26–27).
43 See BKA et al. (2011, 11).
44 See BMWFJ and BMVIT (2012a).
45 See BMWFJ and BMVIT (2011, 2012b).
46 More than 90 stakeholders from the public sector, industry, special interest groups and other specialist organisations took part in the process. For an overview of the process lasting more than one year see Buchinger (2012).
47 See Federal Ministry of Agriculture, Forestry, Environment and Water Management and Federal Ministry of Finance (2010).
48 See Fair public procurement (2014).

bility for creating and implementing the guiding concept for public procurement that promotes innovation rests in the partnership between the Federal Ministry of Science, Research and Economy (BMWFW) and the Federal Ministry for Transport, Innovation and Technology (BMVIT), with the support of the Federal Procurement Agency (with procurement expertise, access to public facilities) and the Austrian Institute of Technology AIT (innovation expertise, scientific support).

The global aim of the guiding concept for public procurement that promotes innovation is to increase the share of public procurement that is used for innovations. Unlike other European countries, a quantitative PPPI target was not set.[49] The impacts expected include: 1) stimulating innovation and increasing competition in manufacturing, 2) increasing the efficiency of public facilities, and 3) more quality public services and infrastructures.

Legal implementation of strategic public procurement that promotes innovation

Accounting for innovation in public procurement law was put forward as an action in the guiding concept for public procurement that promotes innovation. It was implemented in 2013 with the amendments to the Public Procurement Act, with "innovation" added as a new secondary target (in addition to the secondary objectives already contained there of "ecology" and "social affairs").[50]

Operational implementation of strategic public procurement that promotes innovation

A further measure in the guiding concept was also implemented in September 2013: setting up a central innovation-promoting public procurement service centre within the Federal Procurement Agency, initiated and funded by the Federal Ministry for Transport, Innovation and Technology (BMVIT) and the Federal Ministry of Science, Research and Economy (BMWFW). The service centre has the task of supporting public procurement agents in innovation-promoting public procurement. The following activities have been completed since 2013: more than 20 PPPI networking activities, events, seminars at the federal government's management academy, and PPPI competitions[51], support for public facilities[52] with their strategic innovation-promoting public procurement planning, construction of a PPPI online platform and, last but not least, raising of awareness for PPPI within the Federal Procurement Agency.[53]

Efforts then began in 2014 to gradually establish the PPPI competence and contact centres envisioned in the guiding concept. They should be viewed as subject-specific institutions that are complementary to the Service Centre and work closely with it. Competence centres currently include Austria Wirtschaftsservice (aws) (focus: commercial PPPI), the Austrian Research Promotion Agency (FFG) (focus: pre-commercial PPPI), the Austrian Energy Agency AEA (sectoral focus:

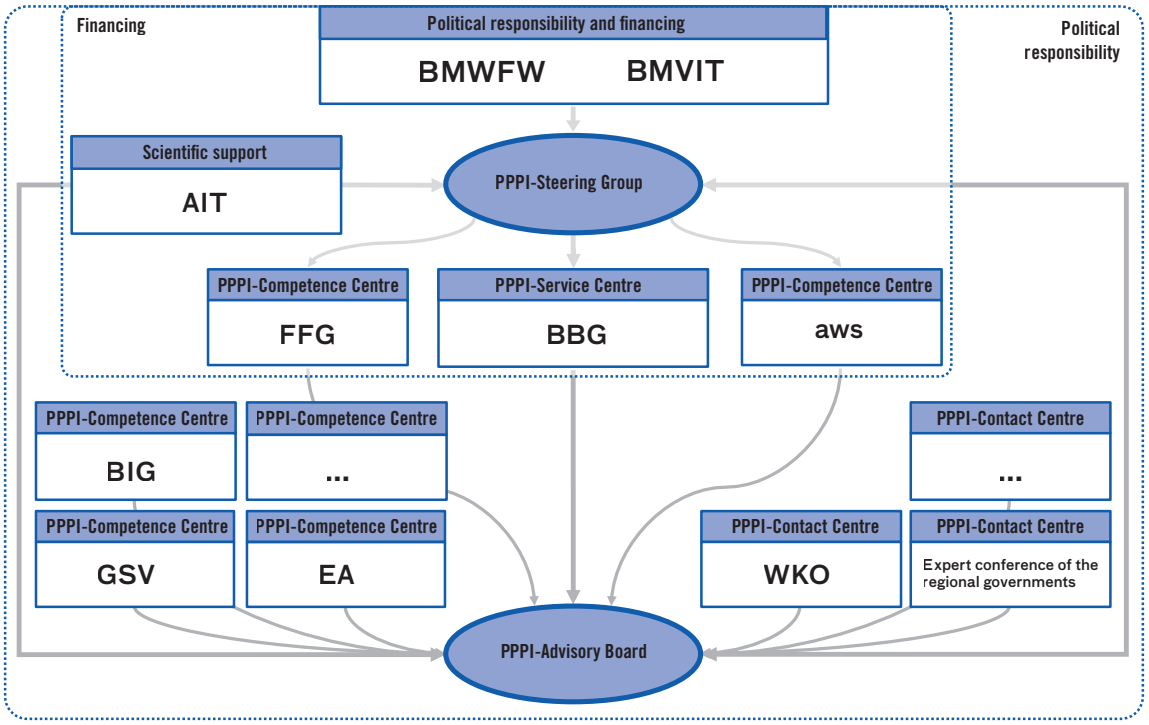
49 For the quantitative targets of other European countries and their reference basis see Buchinger (2015).
50 Public Procurement Act sections 19(7) and 187(7) (Federal Law Gazette 2006/17).
51 The winners of the project competitions up to 2015 are: Forschungs- und Technologietransfer GmbH from the University of Applied Sciences at Wiener Neustadt (infrastructure for 3D printing of metals), Wiener Mittelschule Leipziger Platz (participative learning area design concept), Federal Ministry of Finance (BMF) (mobile inspection system), BHAK/BHAS Baden (photovoltaic system plus battery storage system), Upper Austrian/Carinthian regional government (electric vehicles incl. charging infrastructure), Vorarlberg Environmental Association (large-scale installation of e-bike charging stations), Litschau municipality (energy system optimisation), Mozarteum University of Salzburg (locking systems and room booking), Leopold Franzens University of Innsbruck and Medical University of Innsbruck (energy monitoring), Joanneum University of Applied Sciences Graz (digital signage system), Vorarlberg municipality/environmental association (interactive bicycle road signs), Volkshilfe Vienna charitable organisation (computer-assisted facilities management CAFM).
52 See Innovation potential analysis with the Austria Wirtschaftsservice (aws); Austrian Research Promotion Agency strategy development.
53 For the details on the different activities see Federal Ministry for Transport, Innovation and Technology and Federal Ministry of Science, Research and Economy (2015) and www.ioeb.at.

energy), the Federal Real Estate Association BIG (sectoral focus: building construction) and the Austrian Association for Transport and Infrastructure (GSV) (sectoral focus: mobility) and, as contact points, the Federal Economic Chambers WKO and the "public procurement by the regional governments" expert conference.

Fig. 2-1 provides an overview of the governance and funding of the PPPI stakeholders stated. The "PPPI Annual Report 2013/2014" includes detailed descriptions of the PPPI stakeholders, their activities and a series of results in the form of PPPI good practices.[54]

There are also several funding schemes administered by the Austrian Research Promotion Agency (FFG) on behalf of the various departments. There are already several high-volume projects for pre-commercial procurement in the

Fig. 2-1: PPPI governance – stakeholders, bodies, political responsibility and financing



BMWFW	Federal Ministry of Science, Research and Economy	Austria Wirtschaftsservice (aws)	Austria Wirtschaftsservice
BMVIT	Federal Ministry for Transport, Innovation and Technology	BIG	Federal Real Estate Association
AIT	Austrian Institute of Technology	GSV	Austrian Association for Transport and Infrastructure
FFG	Austrian Research Promotion Agency	EA	Austrian Energy Agency
BBG	Federal Procurement Agency	WKO	Austrian Federal Economic Chambers
			Regional government expert conference "Public procurement by the regional governments"

Source: Updated version by Federal Ministry for Transport, Innovation and Technology and Federal Ministry of Science, Research and Economy (2015, 14).

54 See Federal Ministry for Transport, Innovation and Technology and Federal Ministry of Science, Research and Economy (2015). Further examples of successful implementation can e.g. be found in Brünner et al. (2012); PPPI Service Centre (2014).

topic areas of "Mobility" and "Building"[55] and a whole series of R&D projects with stakeholder involvement in the "Security" topic area.[56]

Impact of Public Procurement Promoting Innovation

PPPI events and the work of the PPPI service centre were all analysed as part of assessments – with positive results. An overall PPPI evaluation is planned for 2017/2018, since only an example examination and evaluation of the impact can be completed beforehand based on the short time involved in implementing the actions.

Efforts to develop a comprehensive PPPI monitoring system were launched in Austria in order to obtain extensive data for evidence-based action on policy. A pilot survey by Statistics Austria resulted in an estimated PPPI share of total procurement volumes in the government sector of between 2.3% and 3.3%[57]; there are no representative figures yet for the outsourced firms. This monitoring is coordinated with the EU developments on measuring PPPI.

In summary, it can be stated that innovation stimulation fuelled by demand is well-established institutionally using public procurement-promoting innovation. The "elite" good practices will need to be transferred to a broad "mass movement" in future. The existing commitment to RTI strategy should be upheld further and intensified from the policy side in order to enable this. One possibility would be, for example, to enshrine a PPPI target and/or earmark the PPPI budget in policy.

2.2.2 Expanding cooperation between science and industry

The Chapters 2.1.2 and 2.1.4 already covered the reasons why university knowledge is crucial for competitiveness of firms in highly developed economies. Empirical findings show that the proportion of scientific literature in all citations has increased significantly within patented corporate inventions since the 1980s. University research essentially provides ideas and human resources that are crucial for new technologies and radical innovations. Ideas and human resources from science may be relevant to innovative processes at firms in different ways.

A distinction can be made between cooperation (*i.e. engagement*) between universities and industry (for example through research cooperation, i.e. joint research projects or consulting) and the exploitation or commercialisation of research results by the universities themselves (e.g. through licensing patents, spin-offs, etc.).[58] Additional options are available in the inter-sectoral mobility of university and corporate researchers, where university graduates convey the university knowledge to the relevant firms, meaning that university instruction is generally considered to be one of the most important transfer channels.[59] Simple reading of academic publications by corporate researchers also ranks very highly among firms in terms of the significance of potential options for using university knowledge. However, research cooperation and exploitation are essential mechanisms for ensuring that corporate innovations are able to benefit from progress in sci-

55 With pre-commercial procurement, public bodies invite R&D tenders in a multi-stage competition (Pre-Commercial Procurement PCP). Austrian PCPs and their procurers include: "Traffic infrastructure research": ASFINAG and ÖBB INFRA; "Mobility of the future": ÖBB PRODUKTION; "Heating & cooling of historical buildings" Burghauptmannschaft Österreich.

56 The stakeholders are included as mandatory in the KIRAS safety research programme. There are 219 cases of stakeholder involvement in the 150 projects implemented (data correct as at 2014): these include e.g. BMI, BMLVS and the emergency services.

57 Uncertainties in making the distinction between PPPI became apparent in the pilot survey. Scenarios were therefore calculated with results for the PPPI share of between 2.3% and 3.3%. Reporting year 2013, source: Statistics Austria.

58 See Janger (2015); Perkmann et al. (2013).

59 See Leten et al. (2014); Veugelers and Del Rey (2014).

entific research and conversely that scientific research receives momentum at its side from practical problems or technological developments. In the following, we talk about the "exchange between science and industry" when referring to both mechanisms, and about "cooperation" or "exploitation" when referring to the individual mechanisms.

The significance of the exchange between science and industry is explicitly covered in the RTI strategy; although this is no longer a weakness in international comparison in the way it was in the 1990s, it does still need to be supported. There have been successful initiatives in the area of direct research cooperation in particular, first of all through the Kplus/ind/net programmes and then subsequently the COMET centres of excellence; the Austrian Research Promotion Agency (FFG) programmes Bridge and COIN as well as the Christian Doppler laboratories, however, also provide important support with cooperation. The Universities Act 2002 has also made a contribution towards promoting the exchange between universities and firms. The data situation for assessing how well universities are exploiting academic research results is not as good as for the area of cooperation, although initial findings indicate major potential for catching up here.[60]

The objectives of the RTI strategy related to the exchange between industry and science are as follows:

- Increasing the cooperation intensity of Austrian firms and strengthening the strategically oriented collaboration between science and industry – with a special focus on excellence and sustainability.
- Dismantling barriers and hindrances among firms, especially SMEs, for cooperating with science/research facilities, and making it easier for innovative companies to access external resources.
- This will allow more firms to expand their technology leadership and attain top positions in Innovation Leadership.

The strategy's actions include further development of the support measures for research cooperation, networks and strategic alliances with a focus on excellence and sustainability (such as COMET, Bridge, COIN) and models for thematically focussed basic research (such as Christian Doppler laboratories). Several of these elements have been implemented:

- Scientists from universities cooperate in Christian Doppler labs with firms on examining application-oriented principles (http://www.cdg.ac.at/).
- The Josef Ressel Centres for improving R&D cooperation between universities of applied sciences and firms were relaunched in 2012 within the Christian Doppler Society (http://www.cdg.ac.at/).
- The BRIDGE programme promotes projects at the interface between scientific basic research at institutes and experimental development in firms, i.e. for consortiums of firms and scientific institutes to take part in the proposals. (https://www.ffg.at/bridge).
- The Laura Bassi Centres of Expertise do research at the interface with manufacturing and are each led by an expert female researcher (https://www.ffg.at/programme/laura-bassi-centres-expertise).
- The Research Studios Austria supports the transfer of knowledge from research institutions to firms (www.researchstudiosaustria.at).
- The Academia plus Business (AplusB) programme supports spin-off activities and actual spin-offs from the academic environment (https://www.ffg.at/aplusb-academia-plus-business).
- The COIN (COoperation and INnovation) promotes application-oriented projects aimed at setting up innovation networks of multiple consortium partners (e.g. firms, especially SMEs, facilities for research and disseminat-

60 See Leitner et al. (2015); Arundel et al. (2013).

ing knowledge), in which innovative products, procedures and services[61] are developed from new using technology and knowledge transfers (COIN-Net). This programme line will also in future include proposals for networks that are explicitly international[62]. COIN Development also supports the RTI structures for research institutions and universities of applied sciences, including with due regard to the core functions towards firms (https://www.ffg.at/coin).

- The Innovation Voucher and Innovation Voucher Plus programmes promote small and medium-sized enterprises (SMEs) that are embarking on research and innovation on the one hand (https://www.ffg.at/innovationsscheck5000), and that wish to intensify their research and innovation output further on the other (https://www.ffg.at/innovationsscheck10000) and wish to benefit from the expertise of the research institutions.
- The Research expertise for industry programme also provides support with entrenching company-related research priorities in tertiary research institutions within the scope of improving the qualifications of existing research and innovation staff. (https://www.ffg.at/Forschungskompetenzen)

There are also initiatives in education that make a contribution towards promoting cooperation between schools and industry:

- The technical testing institutes of the higher technical colleges and agricultural schools take part in numerous R&D projects in collaboration with universities and business based on their technical expertise.
- For many years, the pupils in their final years at higher technical, commercial and arts and crafts schools have been completing their dissertations with partners from industry and science. Many SMEs also thereby have the opportunity of getting involved in R&D projects featuring a low threshold, including in collaboration with universities.
- "Jugend Innovativ" is the biggest school competition for innovative ideas that takes place throughout Austria each year in collaboration with the Federal Ministry of Science, Research and Economy (BMWFW), the Federal Ministry of Education and Women's Affairs (BMBF), and industry. Around 500 projects are submitted with this in the categories Design, Engineering, Science, Young Entrepreneurs and Sustainability. The Austria Wirtschaftsservice (aws) provides talks and seminars to pupils on registering patents and utility models in this context in collaboration with the Austrian Patent Office.
- Entrepreneurial attitudes and skills that are essential both for the purposes of founding a firm as well as for working dependently are fostered among students in the area of general and particularly vocational secondary education level II as part of the "Entrepreneurship Education" initiative. The specific core educational topic of "Entrepreneurship und Management" is offered at every third commercial high school in Austria on average, in addition to mandatory studies and working in training firms.[63] "Entrepreneurship education" is also enshrined within the educational objectives of the technical and social services schools[64].
- Pupils at technical and social services schools must pass holiday internships in the summer months in their relevant industry or in the services sector which provide insights into industry and entrepreneurial endeavours outside of the school.[65]

61 See Service initiative by the Federal Ministry of Science, Research and Economy: http://www.bmwfw.gv.at/Innovation/Initiativen/Seiten/Dienstleistungsinitiative.aspx
62 See IraSME – International Research Activities in SMEs; https://www.ffg.at/erasme
63 See https://www.bmbf.gv.at/schulen/bw/bbs/entrepreneurship.html
64 This includes: colleges for business careers, fashion, tourism, social affairs, art and product management and presentation, see http://www.hum.at
65 See http://www.abc.berufsbildendeschulen.at/de/page.asp?id=47

- The Federal Ministry of Education and Women's Affairs (BMBF) has also set up the EESI[66] Ideas Centre for the purposes of fostering an entrepreneurial spirit, and as well as promoting entrepreneurship as a discipline, it has also advanced positive attitudes towards entrepreneurial activities among pupils and teachers in all school-related areas.[67]

Two selected initiatives are described in more detail below, i.e. the COMET competence centres for direct research cooperation and the knowledge-transfer centres for exploitation of university knowledge.

The COMET Programme[68] promotes long-term partnerships between science and industry in competence centres. Here jointly-defined research programmes are developed in order to establish new skills and technological leadership at the international level. The focus here is on excellence, internationality and developing human resources, for example via numerous contact points for doctoral students. The programme runs along three tracks: K2 centres (a highly ambitious research programme with existing international peak performance), K1 centres (smaller than K2 centres and with less of an international focus), and K projects (space for new ideas in the area of cooperative research, with future development potential, established locally). Up to now, there have been two K2, three K1 and five K-project proposals with total federal funding of €465 million. There are currently five K2 centres, 15 K1 centres and 21 K-projects running. One example of a K2 centre is K2-Mobility, which works on new scientific methods and technologies for vehicles of the future; an example of a K1 centre is alpS, which researches technologies on adapting to climate change; the K-projects include "DEXHELPP", which develops methods for supporting the decision-making processes in the Austrian health services.

The current impact analysis of the COMET centres provides evidence of the successes in establishing expertise and increasing innovation output; for example products have been developed based on entirely new technological developments from the K centres and their partners which will consolidate the technological leadership of Austrian firms on the global market.[69] However, the focus is often on R&D that can be commercialised in the short term, meaning that the objectives related to establishing excellence in the longer term have not yet been achieved to their full extent. Projects are also often administered bilaterally between a firm and the K centre, meaning that the extent of the potential knowledge overlap is limited.

The new "Knowledge Transfer Centres and IPR Exploitation" programme is not established within the area of direct research cooperation with firms, but rather in the area of exploitation of research results by universities. The idea is that local knowledge transfer centres benefit from the existing potential at Austrian universities and leverage synergies in order to promote and accelerate the exploitation of inventions both within industry and society. The 20 universities taking part in the programme have demonstrated noticeable initial success based on 16 cooperation projects: joint further education and training events are, for example, increasingly being offered in the area of entrepreneurship and intellectual property, exploitation management at universities is becoming more professional thanks to the acquisition of modern exploitation software, and the technology offerings of the local knowledge transfer centres are not only being published nationally on the centres' homepages,

66 Entrepreneurship education innovations in schools.
67 See http://www.eesi-impulszentrum.a/
68 See https://www.ffg.at/comet-competence-centers-excellent-technologies
69 See Dinges et al. (2015).

but are expanding their potential clientele by taking part in online platforms in Germany also (web platform and invention store of the German Technologie Allianz). Contacts with industry are also constantly being improved using targeted measures such as partnering days, interdisciplinary entrepreneurship camps and round tables. Knowledge transfer is also promoted from the areas of the humanities, cultural and social sciences and art. This knowledge transfer is primarily concerned with more effective communication of results from science and research in business and society.

The Life Sciences thematic knowledge transfer centre is meant to serve as a contact point for research institutions and start-ups for the purposes of creating good circumstances for transferring academic research into the development of drugs and diagnostics.

The regional East, South and West university knowledge transfer centres, as well as the thematic Life Sciences knowledge transfer centre, were launched with an investment of €11.3 million until 2018.

A total of €5 million is being provided until the end of 2018 as part of additional patent funding aimed at giving universities incentives to strategically develop patents with a high potential for exploitation.

Prototype funding is also being provided at a total value of €3 million (2014–2016) aimed at developing prototypes from inventions based on university research. Ten university prototypes are being funded at an amount of €1 million as part of the 3rd round of proposals for prototype funding, with additional momentum provided for successful implementation of scientific findings in industrial practice.

It is too early to assess the impact at the present time as the knowledge transfer centres have only just started. The measure in any case addresses the weak spot of the Austrian innovation system within the exchange between science and industry, i.e. rapid implementation of academic research results in applications that can be used in industry and society, which is why the property right and exploitation strategies of the universities, the Austrian Academy of Sciences and IST Austria are being further developed in a targeted manner in accordance with the performance agreements. The National Contact Point for Intellectual Property (NCP-IP) also addresses the exploitation of academic research results. This was set up together with the Federal Ministry for Transport, Innovation and Technology (BMVIT) and the Federal Ministry of Science, Research and Economy (BMWFW) following a decision by the federal government before the RTI strategy was adopted based on a Recommendation by the European Commission ("IP Recommendation"). The inter-ministerial office supports universities and public research institutions with their professional handling of intellectual property rights and knowledge transfer (e.g. IP training, workshops, events with representatives from science and industry, representing Austria on European bodies, etc.).

The IPAG project ("Intellectual Property Agreement Guide"[70]) is also supported as part of the NCP-IP, with standardised online sample agreements on technology transfer developed for the first time in this project with the cooperation of universities, non-university research institutions, industrial firms and SMEs.

Finally it can be stated in relation to the exchange between science and industry that numerous initiatives have been implemented both related to direct cooperation as well as to exploitation. The strategic actions can thereby be described as being largely implemented, with plans in place to complete the activities further at a high level. The opportunities for success in terms of exploitation depend not only on the support from specific funding initiatives, but also inter alia on the quality of the research and teach-

70 See http://www.ipag.at

ing at the universities, which is also covered in the RTI strategy (see Chapter 2.1.1).

2.2.3 Promoting Industry 4.0 in Austria

Digitisation and integration of industrial value creation processes are designated as Industry 4.0 based on the concept of different stages of industrial development. Following the mechanisation of production using water and steam power (Industry 1.0), electrification with the expansion of Taylorist assembly line production (Industry 2.0), automated mass production using electrical power and digital control (Industry 3.0), the fourth development stage now follows with intelligent, networked and autonomous production.

Increasing productivity, resource efficiency, quality and flexibility are the essential benefits expected through the use of Industry 4.0 technologies and processes. Industry 4.0 is developing in what are known as "smart factories", intelligent manufacturing facilities comprised of closely knit and highly sophisticated production networks. "Smart products" are also being developed and produced, which have knowledge of the manufacturing process and actively support future implementation and the manufacturing process. This should also allow individual customer requests to be met at the same time.

The concept of Industry 4.0 was defined in Germany as part of the formulation of high-tech strategy in 2012 as a project for the future. The terms Advanced Manufacturing Technologies (AMT) and Industrial Internet are also frequently used internationally as synonyms in order to illustrate the major potential of new technologies for new forms of industrialisation. In addition to Germany, other industrialised nations and the European Commission consider the development and use of new production and process technologies to be a strategic challenge for industrial manufacturing.

The strategy of promoting Industry 4.0 is also in line with the plan to push industrial policy more: as part of its Europe 2020 strategy, the European Union has elevated industrial policy to one of its leading initiatives. The assumption here is that a stronger production sector also spurs R&D in other sectors, contributes at an above-average level to international trade, and produces above-average demand for services from other economic sub-sectors.[71]

Manufacturing is highly significant in Austria with a proportion of value creation amounting to 19% and it is also responsible for two-thirds of Austrian exports. Around 30 Austrian manufacturing firms are considered to be international global market leaders. Industry 4.0 is driven on the one hand by plant builders and equipment manufacturers, as well as by production plants that deploy innovative production technologies. With its innovative mechanical and plant engineers, competitive industrial plants, and strong ties to Germany, Austria has good conditions for realising potential of Industry 4.0.

Against this background, Austrian RTI and industrial policy started to dedicate itself increasingly to this important topic, with a series of initiatives and actions implemented as a result.[72] Although Industry 4.0 was not explicitly stated in the RTI strategy, implementation of the strategic targets related to innovation and corporate research can be seen as "Austrian firms (…) acquiring technological competitive advantages through innovations so that they are able to rise in the global leadership positions in global competition and thereby create economic growth and jobs."[73] The actions implementing these objectives must be adjusted accordingly when new developments arise. Elements from Industry 4.0 also occupy an important position

71 See Mayerhofer (2013).
72 See Aichholzer et al. (2015).
73 See BKA et al. (2011, 24).

in the Digital Roadmap currently being developed by the federal government in the context of the digitisation of industry.

In order to benefit from the Industry 4.0 potential as well as improved resource efficiency and greater flexibility in the best possible and socially responsible way, many different areas of action must be addressed by all stakeholders, i.e. by entrepreneurs, research partners, employees, interest groups, customers, citizens and politicians. Industry 4.0 is thereby much more than a technical challenge. The realisation of this vision calls for integration of technological and social innovations. Industry 4.0 in particular has manifold effects on the type of collaboration within added value networks as well as on work requirements and organisation.

In terms of R&D, Industry 4.0 addresses new issues for technological development and research. The greatest need for research internationally is seen in the area of horizontal and vertical integration of production processes, as well as the universality of the engineering.[74]

A series of measures has been implemented in the last few years related to promoting research and technological development for Industry 4.0:

- The "Production of the future" programme launched by the Federal Ministry for Transport, Innovation and Technology (BMVIT) in 2011 (being handled via the Austrian Research Promotion Agency (FFG)) promotes and funds R&D in the area of production research (with up to approx. €107 million so far).
- Development of the new "pilot factory" funding format by the Federal Ministry for Transport, Innovation and Technology (BMVIT) and the Austrian Research Promotion Agency (FFG). Award to the Vienna University of Technology in 2015 (total volume: €4 million with €2 million of funding) and construction of the first pilot factory at the Vienna University of Technology where domestic firms are able to experiment and gather experience in order to adjust to the future of industrial production.
- Since 2014, funding for thematically-relevant endowed professorships by the Federal Ministry for Transport, Innovation and Technology (BMVIT). Funding for an additional endowed professorship using funds from the Marshall Plan Foundation.
- A national "Platform Industry 4.0" was launched in April 2014 at the initiative of the Federal Ministry for Transport, Innovation and Technology. The Association Industry 4.0 Austria – the Platform for Smart Production was set up at the start of June 2015.
- Funding by the Federal Ministry of Science, Research and Economy (BMWFW) for Industry 4.0 projects is provided in the Austrian Research Promotion Agency (FFG) programmes "Research expertise for industry" as well as "Research Studios Austria".
- The development of new and innovative business models and services specifically for SMEs has been promoted since 2014 as part of the "service initiative" from the Federal Ministry of Science, Research and Economy (BMWFW) and the Austrian Research Promotion Agency (FFG).
- The Austria Wirtschaftsservice (aws) funding programme "ProTRANS-4.0" and the Federal Ministry of Science, Research and Economy (BMWFW) programme to promote product identification strategies for SMEs in the context of product, process (such as Industrie 4.0) or service innovations also promote projects which contribute towards improved incorporation in added value chains of leading companies from 2015 following a successful pilot phase in 2014 (Industry 4.0). In addition, a total of €50 million has been reserved from the multi-year programme of the erp fund for loans with the priority on "Future Industry 4.0".
- The Austria Wirtschaftsservice (aws) Industry 4.0, initiative which has been in place since

74 See Industry-Science Research Alliance and the German National Academy of Science and Engineering (Acatech) (2013, 39 et seq).

2015 and is financed by the National Foundation, is aimed at providing investment incentives for implementation of Industry 4.0 methods for Austrian manufacturing.
- The National Cluster Platform of the Federal Ministry of Science, Research and Economy (BMWFW) has also defined Industry/Production 4.0 as a separate priority and set up a separate "Industry 4.0 and innovative services" working group as of summer 2014.

At the regional government level, Upper Austria as well as Styria are considered the pioneers in Industry 4.0 initiatives. Upper Austria should be expanded to become the Industry 4.0 model region, with the "Industry 4.0 platform" founded in July 2014. The Federation of Austrian Industry sees favourable conditions in Upper Austria for a migration to Industry 4.0, as the focal points of the traditional engineering disciplines, logistics and IT are already present and need to be cross-linked.[75] The same applies to "Innoregio Süd", the innovation network in Styria and Carinthia. Styria and Upper Austria want to set up a model region together and also cooperate more intensively in local funding policy in order to bring together skills and expertise of leading companies and research institutions.[76] Observers see major potential for SMEs in the service sector with this.

In addition to Upper Austria and Styria, there are also targeted activities taking place in all other regional governments related to Industry 4.0. These include, for example, the Tyrol R&D platform, the Vorarlberg Industry 4.0 network, the Industry 4.0 qualification network in Salzburg and the Enterprise 4.0 project in Lower Austria. The national "Industry 4.0 platform" is also aimed at linking the various activities in the regional governments.

The Industry 4.0 concept also represents a major challenge for education policy. Graduates from higher technical colleges for example are already introduced to the possibilities of Industry 4.0 today in lessons[77] and degree projects in an original and innovative manner – including in collaboration with industry clusters and universities where applicable (e.g. the "Eisenstraße" project[78]). Educational priorities for Industry 4.0 can be found principally in the vocational education areas of IT and mechatronics[79].

Lastly, reference can be made in this context to the promotion and funding of the expansion of the broadband infrastructure, since the prerequisite for implementing intelligent production systems is the widespread availability of fail-safe, state-of-the-art broadband networks, also known as next generation access. The plan is for the Federal Ministry for Transport, Innovation and Technology (BMVIT) to invest up to €1 billion in expanding the high-speed internet network by 2020.

Rapidly picking up on the far-reaching developing trend Industry 4.0 shows that the RTI strategy has been successful in flexibly seizing new topics and implementing wide-ranging measures expeditiously.

2.2.4 Improvements to the availability of venture capital

Venture capital investments have a particular significance for the national economy on account of their specific mode of operation: the financiers take on the role of a financial intermediary that is limited to small and medium-sized enterprises with major potential for growth or increasing earnings and low levels of assets that serve as collateral. As such, venture capital also plays an

75 See IV Upper Austria (2013).
76 See Bast (2014).
77 See http://www.tgm.ac.at/index.php/tagesschule/hit
78 See https://www.htlwy.ac.at and http://www.meinbezirk.at/waidhofenybbstal/lokales/regionale-leitbetriebe-machen-sich-fit-fuer-industrie-40-d1577200.html
79 See http://www.x-technik.at/downloads/flipbook/mc/MT_2016_screen.pdf

important role in the innovation system through funding the economic exploitation of new technologies subject to high levels of risk.[80]

The general corporate financing system is the starting point for the discussion regarding the availability of venture capital. This can be subdivided into bank and market-based systems. Third-party financing has considerably more influence in bank-based systems as a result of the availability of loans. Venture capital is a special form of equity capital which generally involves lower venture capital investments in bank-based systems. Funds are made available by banks in Austria for the majority of firms.[81] However, this strength with general bank-based funding also means a challenge for firms focused on growth which do not obtain the required borrowed capital on account of the high risk normally associated with major information asymmetries between investors and firms looking to raise capital[82]. This involves a critical phase in corporate financing which is commonly known as the "valley of death". This financial dry spell is caused by the time gap between the investment required to start a business associated with production and market launch, while the self-financing from its own cash flow is still low and the risk is accordingly high, which in turn affects the firm's creditworthiness.[83]

The federal government's RTI strategy also notes this: "Due to its historic strongly bank-biased corporate financing structure, Austria is underdeveloped in terms of venture capital, in both early phases and expansion phases. This complicates high-risk, growth-oriented early-phase financing for young, innovative, knowledge-based firms".[84] The Austrian RTI strategy embeds venture capital in the higher-level objective of funding young, growth and technology-oriented firms and pursues three actions in particular: 1) to create a regulatory framework to strengthen equity capital in young firms that are oriented towards technology and growth, 2) to expand venture capital initiatives to stimulate early-phase investment, taking previous developments developments into account, 3) to optimise and complete existing support measures for forming technology-based and innovative enterprises, focussing above all on measures for the start-up phase.[85]

These topic areas have been pushed forward in economic policy since the strategy was published. Rounding out of the instrument mix has been promoted in particular, with a particular focus on the early stages of corporate financing (pre-seed and seed financing). Venture capital initiatives have also been promoted using funds from the National Foundation, i.e. funds from the federal government, the Austrian National Bank and the erp fund. European regulations related to the venture capital area have also been implemented into national law, such as the EU Directive on Alternative Investment Fund Managers in the Austrian Alternative Fund Manager Act.

The funding programmes available today enable support for early-stage and growth processes using many different funding instruments. This is particularly true in the early stages of the business cycle when the financing gap is at its largest. The Austria Wirtschaftsservice (aws) provides multiple instruments in this regard, such as the Venture Capital Fund (Austria Wirtschaftsservice SME fund, aws Start-up Fund), and provides additional funding for private funds (Austria

80 See Friesenbichler and Url (2013); Jud et al. (2013).
81 The significance of third-party capital and equity in the funding system can be analysed using the "Survey on the Access to Finance of Enterprises" (SAFE). This data is based on surveys carried out by the European Commission and the European Central Bank, see Doove et al. (2014).
82 See Peneder (2012).
83 See Peneder (2013).
84 See BKA et al. (2011).
85 The additional points in the objective of funding young growth and technology-oriented firms relate to boosting financial expertise and entrepreneurship at universities, including through setting up knowledge transfer centres, as well as developing new financing models with venture capital investment for realising university intellectual property rights (IPR), and establishing university-related venture investment companies.

Wirtschaftsservice Business Angel Fund, EAF Austria) as well as fund-of-funds solutions (Venture Capital, Cleantech Initiative). Coordination also takes place with the existing programmes of the Austrian Research Promotion Agency, particularly in order to close the gap between market launch and research funding. One particular priority is the area of university-related new enterprises.

The Austria Wirtschaftsservice (aws) Start-up Fund is mentioned as an example here which provides funds to start-ups with high growth potential based on an endowment of €68.5 million. The fund promotes firms to which the market will not provide the required funds in order to implement their business model. This equates to the common problem that bank loans are not suitable for risky projects and private equity is barely available. Since early 2013 the Start-up Fund has offered open and silent partnerships in line with standard practice in the industry and at standard market conditions, with co-investments also normal. The distribution of risk by involving private investors is an important component in the design of the instrument. It means that private funds are leveraged by public funds. The Austria Wirtschaftsservice (aws) Start-up Fund leveraged twice as much in private funds in November 2015 as part of twelve investments for the fund capital deployed. The investment value is between €100,000 and €3 million. Funds such as the Austria Wirtschaftsservice (aws) Start-up Fund offer funding for standard industry and market funds and the firms which receive investment are selected based on a standard industry due-diligence process.

Both a continuation of the existing measures and a thematic expansion of the funding mix are planned by 2020. On the one hand, measures of this type are to be continued in order to enable a gradual boost to the private sector. Additional priorities will also be implemented on the other, such as an international start-up programme (Global Incubator Network) which supports firms from birth through to international expansion. The Austria Wirtschaftsservice (aws) Jump-Start Initiative is also aimed at supporting offerings from incubators themselves. It funds selected incubators that contribute towards more rapid and higher quality maturing of start-ups that are not covered by existing funding programmes at the federal level.

It also features a considerable structural change in the funding area to the benefit of small investors. The Austrian federal government has created a basis for crowdfunding here at the initiative of the Federal Ministry of Science, Research and Economy (BMWFW) with the recently adopted "Alternative Funding Act" that may also have a favourable impact on the general environment for venture capital investments.[86] There have also been changes to the laws on foundations with the "Non-profit package" which allows additional funds to be mobilised (see Chapter 4.3). However, these instruments cannot under any circumstances replace a functioning market for institutional venture capital.

In summary, it can be stated that the Austrian funding landscape offers a broad array of tools aimed at boosting the weak venture capital industry. Efforts to push forward investments funded with venture capital are taking place in a difficult environment. This relates both to the tense economic situation as well as the funding system that is heavily based on borrowed capital and the banks. The public sector commitment must be maintained in order to use the frequently delayed effects of instruments employed to greater advantage. Adjustments to the mix of instruments are also conceivable based on the changes to the corporate funding landscape (e.g. new international ventures, crowdfunding).

2.3 RTI governance and setting priorities

Creation of the best possible circumstances for research and innovation in Austria, effective designs for governance structures in RTI policy as

86 See http://www.ris.bka.gv.at/Dokumente/BgblAuth/BGBLA_2015_I_114/BGBLA_2015_I_114.pdf

well as the provision of an adequate mix of instruments for RTI funding are stated as core objectives related to political governance of the national innovation system. Some essential cornerstones for implementation are presented and discussed in this chapter against the background of these objectives.

The RTI Task Force was created to hone and coordinate implementation of the strategy at a high administrative level under the leadership of the Federal Chancellory in collaboration with the relevant federal ministries (Federal Ministry of Finance (BMF), Federal Ministry for Transport, Innovation and Technology (BMVIT), Federal Ministry of Science, Research and Economy (BMWFW) and Federal Ministry of Education and Women's Affairs (BMBF)). Through intensive and regular information sharing and exchange, it has been possible this way to further strengthen cooperation between RTI ministries in recent years. With the aim of dealing with and addressing various topics more deeply, several relevant experts were included in the RTI Task Force meetings. The RTI Task Force was also advised frequently by the Austrian Council for Research and Technology Development (RFTE).

The performance agreements with research institutions are a further important element in the efforts to improve governance. The improvement of the performance agreements with the universities has resulted in steps towards a more transparent and service-oriented process for awarding public funds being implemented in a continuous basis, which also at the same time guarantee medium-term planning security for the relevant institutions. Implementation of performance agreements in the process for funding the Austrian Academy of Sciences (ÖAW) and the Institute of Science and Technology Austria (IST Austria) is considered in more detail below (see Chapter 2.3.1). The integration of non-university institutions into universities which has also been initiated in the performance agreements (see Chapter 2.3.2) is also an important measure for setting the priorities for the research by the institutions and is also discussed subsequently. The Austrian Research Promotion Agency's European and International Programmes (EIP) and the EU-Performance Monitoring which is also located there is also considered (see Chapter 2.3.3).

Governance is also exercised by setting priorities. As a new European reference framework for RTI strategies, the concept of smart specialisation represents an important change to the framework conditions in defining the priorities for research and technology development, and this is discussed in Chapter 2.3.4. The area of priority setting and global societal challenges in RTI strategy is also addressed based on the examples of climate and demographic change as well as smart cities (Chapter 2.3.5).

The development of a research funding act as a governance element spanning structures and funding and which has a long-term budget path enshrined, and also includes the definition of principles and objectives for research agendas and the definition of output objectives was proposed in Chapter 6 of the RTI strategy. However, these functions are now largely guaranteed with the changes to budgetary law, particularly with the implementation of the second stage of budgetary reform. Options are therefore being discussed as part of the RTI task force which could demonstrate the additional benefits that a research financing act could provide in comparison. International examples, particularly from Germany and Switzerland, also serve as a basis for reflection which could illustrate the options and limits with these types of approach. Chapter 2.3.6 is dedicated to the adjustments to the funding law principles based on the creation and implementation of the RTI and Austrian Research Promotion Agency (FFG) guidelines. The amendment that came into force on 1 October 2015 to the Research and Technology Funding Act (FTF-G) and which is based in particular on the creation of new organisational structures in the Austrian Science Fund (FWF) can be stated in this context.

Governance also has an increasingly international dimension. The challenges stated in the

RTI strategy in the context of increasing globalisation in R&D are addressed by the "Beyond Europe" globalisation strategy developed as part of the RTI working group 7a of the RTI task force (see Chapter 2.3.7).

Lastly Chapter 2.3.8 is dedicated to the increased interaction between research and society as called for in the RTI strategy. Measures of this kind that are discussed in detail include the establishment of the Austrian Agency for Research Integrity (ÖAWI) and the "Long night of research".

2.3.1 Performance agreements with the Austrian Academy of Sciences (ÖAW) and IST Austria

The conclusion of performance agreements between the federal government and the Austrian Academy of Sciences (ÖAW) and the Institute of Science and Technology Austria (IST Austria) is in accordance with the principles for implementing impact-oriented budgeting within the context of an increase focus on performance and effectiveness. The aim is to increase transparency and accountability for the use of public funds in association with guaranteeing medium-term planning security (three years). The structure of the performance agreements is based on those of the universities. The introduction of performance agreements in funding for the Austrian Academy of Sciences is part of the measures for boosting basic research set out in the RTI strategy. The introduction of a performance agreement with the IST Austria is one of the objectives for impact-oriented budgeting of the Federal Ministry of Science, Research and Economy (BMWFW) as the department responsible. Both the Austrian Academy of Sciences (ÖAW) and the IST Austria are legal entities under public law. As with development plans, the creation of performance agreements is governed in a framework agreement with the Federal Ministry of Science, Research and Economy (BMWFW), and unlike the situation with the universities, they are in the form of agreements under private law. Adaptation and further development of this tool for governance is a continual process.

Austrian Academy of Sciences – ÖAW

The first performance agreement between the Austrian Academy of Sciences (ÖAW) and the Federal Ministry of Science, Research and Economy (BMWFW) was entered into for the 2012–2014 period, thereby replacing the existing practice of preparing annual budgets. With a global budget of €223.8 million, this guaranteed planning security for the first time for a three-year period. The priority for the first period was structural and organisational change aimed at guaranteeing optimum circumstances for excellent basic research. As a result, the number of research institutions was reduced from 63 previously to 29 currently (also including a transfer of ÖAW institutions to universities for the purposes of setting priorities for site reassessments) and processes were introduced to set up and convert administrative and monitoring structures.

This path of institutional renewal is also continued in the current performance agreement period of 2015–2017, for which the federal government is providing total funds amounting to €315 million.[87] As with the last SA period, the particular focus for the planned activities is on stepping up the dialogue between science and society, e.g. through events or expert opinions on the issues relevant to society. Another new element is the endowment of a "Research, science and society" innovation fund[88] aimed at competitive funding and promotion for innovative ideas within the ÖAW, along with the introduction of performance-based internal funding based on the insti-

87 Academy of Sciences and Federal Ministry of Science, Research and Economy (2014): http://wissenschaft.bmwfw.gv.at/fileadmin/user_upload/forschung/OEAW_BMWFW-Leistungsvereinbarung_2015–2017_Webversion__Febr.15_.pdf

88 Endowed with 1% of the global budget, project funding amount up to max. €300,000, http://www.oeaw.ac.at/stipendien-foerderungen/foerderprogramme/innovationsfonds-forschung-wissenschaft-und-gesellschaft

tution's own objectives as part of a comprehensive innovation and quality strategy. In addition to the evaluation of research projects, this also specifically involves measures aimed at supporting the acquisition of third-party funding and scientific partnerships, renewal of the research infrastructure and the development of an exploitation strategy. Additional priorities include the further development of the international focus on guaranteeing the competitiveness of national research, in particular by developing a participation strategy for Horizon 2020, the continuation of international programmes and participation in major research infrastructures, the implementation of gender and diversity measures as well as a review of the funding portfolio (grants and awards). The measures set out in the performance agreement are monitored in supporting meetings that take place twice per year. Key performance figures (members, employees, budget, third-party funding, publications and presentations) are outlined and described in the Annual Report.

Institute of Science and Technology Austria – IST Austria

The first performance agreement concluded between the federal government and IST Austria includes objectives and actions for the IST Austria for the 2015–2017 period. The performance agreements that are now to be renewed every three years thereby replace the existing payment agreement between the IST Austria and the former Federal Ministry of Science and Research (BMWF) (now known as the Federal Ministry of Science, Research and Economy (BMWFW)) for the 2007–2016 period, which governed the processing of federal payments and the funding for the IST Austria.[89] The budgetary framework for joint funding by the federal government and the regional government of Lower Austria remains in place for a ten-year funding period from 2017 until the planned complete expansion to around 100 professors, 400 PhD students and up to 200 post-doctorates in 2026, with this enshrined in the current performance agreement for 2015–2017. Funding for the IST Austria by the federal government includes an annual total amount plus a performance-related funding portion. The global amount was set at a maximum of €195 million and the performance-related funding portion at a maximum of €95 million for the first funding period of 2007–2016 for the IST Austria according to the 15a B-VG Agreement. The latter performance-related funding figure is calculated based on the actual third-party funding raised and called off by the IST Austria. The development and implementation of a new calculation method for the performance-based funding portion for the second funding period between 2017–2026 forms part of the current performance agreement. The intention for the future is for this to include 50% of "research-related quality criteria"[90], with 50% still calculated based on the third-party funding called off. A maximum amount of €329.3 million is planned for the performance-based funding portion for the 2017–2026 period. The global amount comes to a maximum of €658.7 million. Overall the federal government is providing a maximum amount of €1.278 billion for the IST Austria for the entire period between 2007–2026, with just €988 million of this in the period from 2017. The funding obligation of the regional government of Lower Austria in accordance with the 15a B-VG Agreement amounts to €479.5 million for the overall period between 2007–2026. This includes funds to establish and maintain buildings and is administered via the Lower Austria's economic agency Ecoplus. Furthermore the regional government also funds the use and operation of the Kloster-

89 In accordance with Art. 15a B-VG. Federal Law Gazette I No. 100/2012 the federal government is under an obligation to set up the IST Austria and to maintain it in conjunction with the regional government of Lower Austria.

90 Indicators on training for upcoming junior researchers, doctorates, research partnerships, perception of role in society, gender & diversity actions in career development with a weighting of 10% of the performance-related funding portion.

neuburg site as well as facility management, with the total funds provided by 2026 amounting to a maximum of €540 million.[91]

The IST Austria's mission statement and orientation is stipulated in the performance agreement as an institution exclusively involving the production of scientific excellence, with the main priority on international competitiveness in selected fields of research (life sciences, physical sciences, formal sciences). Within the European context this is measured in particular based on success in attracting ERC grants or funding through the Marie Skłodowska-Curie Programme. The planned measures specifically include surveys on the need for R&D infrastructure, positioning related to open access and scientific ethics, cooperation with firms as well as activities in the area of scientific communication and knowledge and technology transfer. The latter include the development of a property right and exploitation strategy.

Implementation of the measures set out in the performance agreements is monitored in supporting meetings that take place each year. Furthermore, an annual performance report is created along with an annual report that covers the research programme and results. The statement of accounts to be provided each year provides information on the financial management. The budgetary arrangement between the Federal Ministry of Science, Research and Economy (BMWFW) and the IST Austria can be agreed if necessary based on the information in the statement of accounts. However, this does not affect the amount for the global budget stipulated for the overall period. Improving the coordination between the federal government and regional government is a continual process for the IST Austria which was most recently expressed in a "Joint Declaration" which covers the essential principles for cooperation by the Federal Ministry of Science, Research and Economy (BMWFW), the regional government of Lower Austria and the IST Austria.

The target set out in the RTI strategy or in the Federal Ministry of Science, Research and Economy's (BMWFW) objectives for introduction of the performance agreement tool in the funding for the Austrian Academy of Sciences and the IST Austria can be considered to have been implemented. This measure was implemented in the context of restrictive budgetary and economic framework conditions. At the Academy of Sciences (ÖAW) in particular, the difficult environment may have had a positive effect in terms of accepting this process. The multi-year performance agreements play a crucial role in planning security, while the funding for the IST Austria had already established beforehand. As with the universities, the steady further development of this tool based on the experiences of all participants is an ongoing process.

2.3.2 Integration and merger of non-university institutions

With numerous different organisations and partnership structures, non-university research institutions occupy an important position on Austria's research scene. Their most important tasks include cooperation with the higher education sector, business partnerships and the use of their own research results and technology transfers. This includes institutions that have been set up temporarily and involve different prerequisites[92] (e.g. mandatory participations, partnerships between science and business), as well as research institutions that have been set up on a permanent basis.[93] With the exception of the Academy of Sciences (ÖAW), these latter institutions focus overwhelmingly on applied research, experimen-

91 Economic evaluation of the IST Austria – Synthesis Report: http://wissenschaft.bmwfw.gv.at/uploads/tx_contentbox/Wirtschaftliche_Evaluierung_des_IST_Austria__Synthesis_Report.pdf

92 E.g.: COMET competence centres, Christian Doppler laboratories, Josef Ressel Centres, Ludwig Boltzmann Institutes, Laura Bassi Centres.

93 E.g.: Austrian Academy of Sciences, the Austrian Institute of Technology (AIT), JOANNEUM RESEARCH, Salzburg Research and Upper Austrian Research.

tal and industrial development and taking on diffusion tasks, and have different levels of basic funding.

As illustrated in the federal government's RTI strategy, a series of restructuring processes and adaptation measures have been completed in recent years in the field of non-university research. The general targets stated include the development of clear role models in line with defined performance targets, adaptation of the internal structures for the facilities as well as improved coordination of the overall structure for the non-university research sector. The trend towards increased priority-setting in the research area, the dismantling of (parallel) structures and creation of larger more flexible entities in order to be able to process topics on a holistic basis can be observed in the European context. This development was reflected in Austria in the creation of development plans and performance agreements (e.g. Academy of Sciences), simplification of the ownership structure and internal reorganisation measures (e.g. AIT) as well as in the development of accounting guidelines and establishment of areas of cooperation on individual topics (e.g. ACR).[94] Funding programmes such as the COMET competence centre programme, which has a major impact on the research landscape with around 1,800 researchers, are evaluated or subject to impact analyses at regular intervals. In addition, the requirements related to cooperation with firms, raising third-party funding and evaluation of the scientific results in the non-university research area have been increased significantly.

The action stipulated in the RTI strategy related to (re-)integration of non-university institutions or lower-level offices of the Federal Ministry of Science, Research and Economy (BMWFW) into universities or other larger research structures was, for example, implemented by linking the research excellence of existing archives and institutions[95] as the platform of historical political archives of the Academy of Sciences. Further examples include the integration on 1 January 2016 of the Austrian Archaeological Institute (ÖAI) into the Academy of Sciences and the Austrian Institute of Historical Research into the University of Vienna. Together with the archaeology institutions located at the Academy of Sciences (ÖAW), the Austrian Archaeological Institute (ÖAI) now forms an archaeological cluster in which research can be carried out on relevant topics across the institution. The Austrian Institute of Historical Research (IÖG) on the other hand was already closely associated with the University of Vienna (e.g. coordination of the master's degrees in historical research, ancillary science of history and archival science) and can now make the most of further synergies through incorporation into the university. It should also be noted that COMET centres of competence will remain in place with their focus on their scientific institutions after the expiry of the funding period.

2.3.3 Data monitoring and EIP area of the Austrian Research Promotion Agency (FFG)

Linking Austrian firms and scientific research institutions to EU and international programmes is seen as crucial in the RTI strategy in order to enable greater use of European and international research funds. The globalisation of research projects is also expected to have a positive effect on the quality of the projects, as cooperative international projects are generally highly demanding and the project participants are expected to demonstrate increased specialisation in their core skills. In order to achieve the target of more intensive European links, the RTI working group 7b launched an "EU Action Plan" involving the relevant stakeholders, and including around 70 actions and various programmes and projects.

94 See Austrian Research and Technology Report 2012. Federal Ministry of Science and Research, Federal Ministry for Transport, Innovation and Technology, Federal Ministry of Economy, Family and Youth (2012); http://www.bmwfw.gv.at/ftb

95 This includes: Dr. Wilfried Haslauer Library, Karl von Vogelsang Institute, Bruno Kreisky Foundation Archivs, Association for the History of the Labour Movement.

The appointment of the Austrian Research Promotion Agency (FFG) as a consultative and supportive body in the annual work programme (European and International Programmes [EIP]) is one of these actions. Following the evaluation of the existing consultation activities[96] there was a new appointment for the period between 2014–2020 which gives the Austrian Research Promotion Agency (FFG) a greater strategic role and also results in a clearer definition of the distribution of responsibilities between the Agency/EIP and other Austrian consultative bodies (e.g. the university research departments, regional agencies). An interim evaluation in 2017 is provided in the consultation agreement.

Under the title "EU-Performance Monitoring" (EU-PM) the Austrian Research Promotion Agency (FFG) processes the data on the EU framework programmes (Horizon 2020, previously monitoring of the 7th framework programme by PROVISO) and evaluates this with special consideration of the Austrian participations. The appointment for this was made by the ministries responsible of the Federal Ministry of Science, Research and Economy (BMWFW), Federal Ministry for Transport, Innovation and Technology (BMVIT) and Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW) for the period between 1 July 2014 and 30 June 2021. Monitoring involves three tasks: data provision, periodic and ad-hoc assessments and operation of an internet portal. Data provision includes the collection and processing of data regarding Austria's participation in RTI-related funding lines from the EU as well as the integration of these sources into the database. Regular reports are based on qualitative and quantitative analyses and are aimed at demonstrating Austria's success at acquiring projects as compared with other EU countries and in relation to the budget set. The data collected is assessed based on thematic and regional aspects (regional government level). The internet portal also allows an analysis of the strengths and weaknesses related to topics, organisation types (e.g. firms, universities) and industries. EU-Performance Monitoring is a tool for more effective tracking of the implementation of the strategy related to linking firms and research institutions to European programmes.

Table 2-1 shows that Austrian participation in the framework programmes has increased slightly (in % of all participators). In budgetary terms, Austria's performance in the framework programme can be assessed as positive, since an above-average level of funding was achieved in

Table 2-1: Development of the proportion of Austrian participation in EU framework programmes

	7th Framework Programme (as at 11/2015)	Horizon 2020 (as at 02/2016)
Austrian participation in all projects	9.7%	8.5%
Austrian participation as proportion of all participation	2.6%	2.9%
"Capacity exploited"[1]	131	139
Austria's share of EU-28 for the returns from the EU budget paid out in the research area	2.33%[2]	2.31%[3]

1) The indicator shows whether Austria is participating in the EU framework programme above (>100) or below its theoretically available capacity (potential). Calculations: Proportion of approved Austrian framework programme applications/proportion of Austrian RSEs of EU-28 RSEs. RSEs = researchers, scientists, engineers (full time equivalents).

2) Cumulative average over the entire term of the 7th Framework Programme 2007–2013.

3) As of 2014.

Source: Austrian Research Promotion Agency (FFG). Calculations: Austrian Institute of Economic Research (WIFO).

96 See Evaluation of Austrian Support Structures for FP7 and EUREKA and Impact Analysis of EU Research Initiatives on the Austrian Research and Innovation System. Final Report: https://era.gv.at/object/document/557/attach/1273-EvalFP7_Final.pdf

relation to the budget in place, and the same is true in relation to the number of researchers.

Apart from the consultation and support activities and the monitoring by the Austrian Research Promotion Agency, funding options were also created for firms as part of the efforts to implement this strategic point, including for example support for participation by Austrian firms in public-private partnerships as part of Horizon 2020. Further implementation of the RTI strategy action to support links between Austrian firms and scientific and research institutions and EU and international programmes arises through the EUREKA initiative for application-related research and development in Europe, i.e. a funding opportunity for developing market-oriented R&D projects (almost all European countries are involved in EUREKA, along with Canada, South Korea, South Africa, Israel, Turkey and Russia). This programme initiative is aimed primarily at promoting and funding cross-border application-oriented research (applicants are required from at least two countries in order to achieve funding status) and developing products, procedures and services for the global market. Funding for the national portion in Austria generally runs via the Austrian Research Promotion Agency general programmes. Aside from a generally open funding pool, projects can also be submitted in different clusters (fields of technology), and there is a programme specially tailored to research-intensive small and medium-sized enterprises (Eurostars), organised in accordance with Article 185 of the Lisbon Treaty (75% national project funding, 25% EU top-up). The EUREKA Danube Region Call-Initiative launched by Austria in 2015 is addressed primarily at firms in the Danube region and will take place again in 2016 following some great feedback.

In summary, it can be stated that instruments have been created with the EIP appointment (including the EUREKA agendas integrated into EIP) and EU-Performance Monitoring that are suitable for promoting and funding (EIP) and analysing (EU-PM) progress with the strategies in relation to the continuous increase in participation by firms and research institutions in European projects. This part of the action can thereby be seen to be successful. However, the success of the actions related to greater use of international funding programmes and projects can probably only be assessed in 2020, since the observation period appears to be too brief at the present time. Feedback from the scientific community, however, is already indicating that the new direction of the EIP and EU-PM is being received very positively.

2.3.4 Thematic specialisation in the context of Europe-wide smart specialisation

The European Commission has established the concept of "smart specialisation", thereby creating a major new policy framework for the priorities in research and technology development sought in the RTI strategy. As a local component in the EU's 2020 strategy for sustainable growth and development, smart specialisation acts as a science-based development concept for regions and also corresponds with the new logic in EU funding policy for the purposes of focusing on thematic priorities. As a part of the EU's 2014–2020 cohesion policy, the development of a research and innovation strategy (RIS3) or of a strategic framework for smart specialisation is also a precondition for receiving funds from the European Regional Development Fund (ERDF).

The basis for the process of defining priorities is a SWOT analysis of a region's innovation system that includes relevant stakeholders at all levels: the EU, the nation, the region, and institutions from industry, science, and society. Priorities developed on the basis of regional potentials are in turn an important foundation for the efficient and transparent allocation of public funds (e.g., in university research infrastructures). The concept of smart specialisation thereby results in a new generation of local strategies which defines thematic investment priorities along societal and industrial challenges where site-specific strengths promise to advance industry and soci-

ety through innovation and success in international markets.[97]

Although the concept of smart specialisation was not yet public when the Austrian federal government was working out its RTI strategy, the government had already anticipated some of the crucial features of a smart specialisation strategy when developing the RTI strategy, such as the development and implementation process and the process for monitoring implementation (RTI Task Force, Council for Research and Technology Development). The federal government's RTI strategy is thereby also a central reference framework for implementation at the regional level. The federal government's RTI strategy was therefore announced in 2014 to the European Commission as the core document for Austria's "Strategic framework for smart specialisation" for the purposes of fulfilling the condition precedent.[98] In recent years a series of regional governments have also interrelated the concept of smart specialisation in newly developed RTI strategies.[99] The thematic priorities formulated in the federal government's RTI strategy thereby form an important framework for defining areas of strength by 2020 that are aligned towards societal and industrial challenges. Without prejudice to the promotion and funding of excellence at research institutions, the investment in infrastructures or innovation-promoting initiatives, the process involves the following thematic priorities until 2020 related to smart specialisation: 1) Information and Communication Technology, 2) Life Sciences, 3) Material sciences and smart production, 4) Bio-economy and sustainability, 5) Humanities, social sciences and cultural studies (including social innovation), with business sector strategies currently being developed and implemented based on RTI strategies, as well as those grand challenges which Austria is facing in implementing the RTI strategy (Chapter 5), 6) Climate change, 7) Energy use and handling scarce resources and 8) Securing quality of life in view of demographic change (including urbanisation, mobility and migration).

Although Austria has welcomed the concept of smart specialisation, exploitation of its potential requires further coordination between the federal government and the regional government[100]. The search for new areas of growth and ways out of the crisis require greater strategic coordination beyond politics and governance levels and knowledge-led regional policy is gaining increased attention throughout Europe.

2.3.5 Setting priorities and societal challenges

The urgent need for finding a new approach to establishing priorities becomes particularly clear when we consider the grand challenges, the great social challenges of the future. They must be addressed in a way that covers the entire system.[101] This requires new forms of cooperation between ministries, agencies and stakeholders at the national and international levels. Climate change, dealing with scarce resources and ensuring quality of life in the midst of demographic change are unquestionably among the global developments that often have unforeseeable consequences and will require a major collective effort to solve. As part of the process to implement the RTI strategy, two inter-ministerial working groups have been set up on the priorities of "Climate change and scarce resources" (RTI working group 2) be-

97 See Austrian Research and Technology Report 2015, Chapter 3.2. BMWFW, BMVIT (2015); http://www.bmwfw.gv.at/ftb

98 see ERDF programme investments in growth and employment in Austria, 2014–2020 – Operational programme for the use of ERDF funds, Version 1.2 of 10 December 2014; www.efre.gv.at/iwb-efre-programm

99 The federal government has supported this inter alia with the RIS 3 Key from the Federal Ministry of Science, Research and Economy in the form of a guideline that contains clearly formulated process steps and questions (see www.bmwfw.gv.at/ris3-key). Burgenland, Lower Austria, Salzburg, Upper Austria, Vorarlberg, Tyrol and Vienna have implemented thematic priorities to different extents in their RTI strategies.

100 Initiatives on this are in the dialogue with the regional governments by the Federal Ministry of Science, Research and Economy (BMWFW) and the Strat.AT Smart Specialisation partnership from ÖROK.

101 See Lund Declaration (2009).

tween the Federal Ministry for Transport, Innovation and Technology (BMVIT), Federal Ministry of Science, Research and Economy (BMWFW), the Life Ministry and Federal Chancellery (BKA) as well as on "Quality of life and demographic change" (RTI working group 3) between the Federal Chancellery (BKA), Federal Ministry of Labour, Social Affairs and Consumer Protection (BMASK), Ministry of Health (BMG), Federal Ministry for Transport, Innovation and Technology (BMVIT) and Federal Ministry of Science, Research and Economy (BMWFW), with the objective of greater alignment, linkage and development of the different activities of the departments in both areas.

The RTI working group 3 deals with the coordination of RTI policy related to the challenge of quality of life and demographic change. The objective of the RTI working group 3 is for the departments involved to work together with the stakeholders on solving concrete challenges in the relevant areas. Funding priorities such as test regions for smart homes, mobility and individualised medicine are defined in this context, while taking into consideration the aspects of urbanisation, migration, integration, and labour and employment systems as crucial priorities.[102]

The area of mobility and quality of life was adopted as the first pilot topic based on this. Coordinated and joint actions were developed between the ministries involved along an RTI and implementation roadmap.[103] Upstream of this the RTI working group 3 developed a process for operationalising the concept of quality of life based on a study that it had commissioned, and identified action areas in a broad-based consultation process with stakeholders from science, industry, non-profit organisations and other stakeholders.[104] The action areas identified with this were used as a reference system for priority cross-ministerial topic areas based on this.

The "mobility, quality of life and demographic change" roadmap published in September 2015 for the purposes of implementing the federal government's RTI strategy defines the following concrete cross-departmental topics in RTI that will be implemented in the 2015–2020 period:

1. Public areas: RTI actions aimed at designing public areas in urban and rural areas for different age and population groups are covered by national and transnational initiatives, such as the joint programme initiative More Years, Better Lives, the ambient assisted living test regions and the Mobility for the Future programme. Comprehensive knowledge platforms and test regions in urban areas are also being set up regarding the exchange of relevant research projects on behaviour and movement patterns.

2. Diversity: The objective is to record the different needs of the population in relation to their mobility behaviour in order to be able to design traffic systems in line with mobility requirements for all population groups.

3. Paradigm shift: Transformative RTI is aimed at helping to improve the quality of life and health of the population through the selection of non-motorised modes of transport and increasing health skills and expertise within the population.

4. Governance and change processes: Working out the scientific bases and assessing practical experiences for new approaches to governance should facilitate change processes. All departments involved in the RTI working group 3 endeavour to ensure increased involvement of the relevant parties or civil society or representative organisations together with the further relevant stakeholder environment in research projects, as well as to establish the contact points required for this and exchange experiences in this regard.

5. ICT, e-Government and logistics: Actions in the e-Government and logistics areas are aimed at playing a part in promoting and funding optimum mobility from a social, health and eco-

102 See RTI Task Force (2013).
103 See RTI working group 3 (2015).
104 See Dinges et al. (2015).

logical aspect and reducing motorised mobility in urban and rural areas.

The general theme of the RTI working group 2 is supporting "Prospects 2050: supporting the switch to a CO_2-neutral future". This is taken as a starting point for priority setting in RTI policy with the areas of renewable development, sustainable securing of raw materials and social transformation. Based on the priorities set in the area of climate and energy, a mapping of existing actions and potential cooperative actions was developed in the inter-ministerial working group. Different lines of cooperation became clear with this which represent an initial starting point for further details and specifications related to future partnerships

There are also expectations from the bio-economy – industry based on renewable natural resources – that it will make a crucial contribution in moving towards a CO_2-neutral future. This is why the RTI working group 2 produced a report in collaboration with BIOS Science Austria and the Austrian Society for Environment and Technology (ÖGUT) which provided an overview of the status quo of bio-economy-related RTI activities and of relevant areas of research.[105] The report was discussed in June 2015 as part of an online consultation with the Austrian community and then in a breakout session in the Alpbach technology meetings in an international context. The results of the consultation as well as the discussion in Alpbach are incorporated into the report on the "Status quo of the bio-economy and RTI activities in Austria – towards the bio-economy RTI strategy". The next step is to prepare an action and implementation plan. The plan is to develop this by the autumn of 2016 as part of the dialogue forums with the relevant stakeholders. The entire process should be supported by a group of experts from a technical and organisational point of view, with the quality assurance provided by a scientific support group.

The topic of smart cities is one of the essential actions that was implemented as part of setting priorities in the RTI strategy. The central features here include 1) the role of new smart technological solutions in urban infrastructures, particularly involving ICT, 2) maintenance and expansion of the quality of life and the environment in towns and cities and 3) the use of renewable resources and efficiency increases, particularly in the areas related to building, energy and mobility. The first summary report by the RTI working group 2 (March 2013) confirms that "all sub-areas, such as building infrastructure, traffic and mobility solutions, energy production, storage and distribution as well as supply and disposal must be taken into account for this".

It is also emphasised that interdisciplinary and transdisciplinary research and process innovations are required in order to guarantee "smart area planning, efficient and comprehensive town planning processes and the involvement of the affected parties". This shows not only that technological research is at the heart of RTI policy in this regard, but that social and systematic research is also highlighted as in the RTI strategy[106].

The two central national pillars of RTI-policy instruments for smart cities are the "Smart Cities Demo" programme by the KLIEN Climate and Energy Fund and the "City of the Future" by the Federal Ministry for Transport, Innovation and Technology. The objective is to make an essential contribution to the development of smart cities through coordinated and synchronised control of both proposals:[107]

- "City of the Future" is a programme aimed at developing new technologies, technological (sub-)systems, and urban and other services.
- The Climate and Energy Fund was the first sponsor to launch its Smart Cities Initiative in 2010.

105 See RTI working group 2 (2015).
106 See BKA et al. (2011, 35).
107 However, it should be noted that KLIEN is not included in the inter-ministerial RTI working group 2.

- The Joint Programming Initiative (JPI) Urban Europe[108] can be mentioned as a further concrete action aimed at ensuring coordination across departments. This is an international collaboration between EU states (public-public partnership) and the European Commission. The JPI-Urban Europe is being coordinated by Austria (Federal Ministry for Transport, Innovation and Technology, BMVIT). It is being coordinated at the national level by the Federal Ministry for Transport, Innovation and Technology (BMVIT) and Federal Ministry of Science, Research and Economy (BMWFW).

Further actions in this regard include the "Austrian Climate Research Programme" and the "Energy research: technologies for the future" funding programme. Both are geared towards research organisation and firms The climate research programme aims to develop the scientific principles for implementing adaptation measures, while the energy research programme aims to promote technological developments.

In summary, it can be stated that initial actions have been implemented aimed at better coordination for the purposes of the RTI strategy, both in terms of the societal challenge of "demographic change" and of "climate change". However, these have initially related in essence to the aspects of mapping and developing the strategy in certain sub-areas.

2.3.6 Adjustment to the funding law principles

It was necessary to create new guidelines for RTI and the Austrian Research Promotion Agency in 2014 following the introduction of new principles under European law[109] related to state aid law. The new guidelines are aimed at ensuring transparent processes for awarding funding as well as at avoiding undesirable multiple funding. The new European laws create more flexibility and allow more rapid implementation of new programmes, although they do also have more requirements in terms of disclosure.

A new structure was required for the guidelines in order to account for the new legal framework conditions. This new structure is geared towards both the formal aspects as well as other aspects that are linked contextually. Funding is awarded to firms subject to state aid law and also to natural persons and institutions for non-economic activities based on the new guidelines.

The principle of impact-oriented budgeting also required greater focus in the guidelines on contextual targets and indicators. Against this background, the guidelines for the Promotion of Economic-Technical Research, Technology Development and Innovation (RTI guidelines 2015) were drafted in the form of three guidelines:

1) The RTI Thematic guidelines serve as a basis for programmes that pursue specific thematic priorities, particularly with respect to societal challenges.
2) The RTI Structural guidelines act as a basis for open-topic programmes that aim to improve on a lasting basis research structures, particularly with respect to partnerships between science and industry.
3) The RTI Human Resources guidelines define the basis for open theme programmes that deal with the new research location with respect to human resource issues.

The structure and formal specifications are the same in all three guidelines, although there are differences in terms of the motives, targets and indicators of the projects eligible for funding. The RTI guidelines govern the required document hierarchy, projects eligible for funding, funding type, fundable costs, funding amount and intensity, process for granting the funding, controls, payments and evaluation, as well as disclosure, data protection, gender sensitive language, period of validity and any transitional provisions,

108 See http://jpi-urbaneurope.eu/

109 General Block Exemption Regulation – GBER: Commission Regulation (EU) No 651/2014; Framework for government aid for research and development and innovation: Communication from the Commission (2014/C 198/01).

and thereby serve to reinforce the innovative potential of Austrian firms.

A written evaluation concept must be prepared for all funding programmes and measures based on the RTI guidelines. An appropriate monitoring system must be created to collect the necessary information that provides standardised basic information for the duration of the project.

The guidelines for the Austrian Research Promotion Agency for the purposes of funding and promoting applied research, development and innovation (Austrian Research Promotion Agency guidelines 2015) govern the process for implementing funding programmes and measures on behalf and for the account of the Agency. They focus on strategic funding aimed at ensuring a relevant and impact-oriented research and innovation policy. As such, their objective is to play a part in reinforcing the innovative potential of Austrian firms and to position these favourably in international competition using funding measures and programmes.

As with the RTI guidelines, the new framework conditions required the Austrian Research Promotion Agency (FFG) guidelines to structure its fundamental objectives accordingly in three guidelines:

1) The "Initiative" guidelines of the Austrian Research Promotion Agency serve as a basis for programmes that focus on strategic funding aimed at ensuring relevant and impact-oriented research and innovation policy.
2) The "SME" Austrian Research Promotion Agency (FFG) guidelines define the open theme programmes relevant to the target group of researching firms categorised as small and medium-sized enterprises (SMEs).
3) The "Industry" guidelines of the Austrian Research Promotion Agency define the open theme programmes relevant to the target group of research firms not categorised as small or medium-sized enterprises (SMEs).

These Austrian Research Promotion Agency (FFG) guidelines for 2015 define the fundable projects, applicants and type of funding as well as the fundable costs, funding amount and intensity and also the process for and controls on funding awards. As such, they represent the basis for the production of lower-level documents that allow concrete funding agreements to be entered into.

Indicators and target values are defined at the level of the individual funding measures and programmes in accordance with the new framework conditions and requirements and the need to account for impact-oriented budgeting. Aside from mandatory definition of targets and indicators, mandatory evaluation is also required of the achievement of objectives at the individual programme level in programme documents or in action documents in the case of individual measures.

A written evaluation concept must be prepared for all funding programmes and measures based on the RTI and Austrian Research Promotion Agency (FFG) guidelines. An appropriate monitoring system must be created to collect the necessary information that provides standardised basic information for the duration of the project.

The new RTI and Austrian Research Promotion Agency (FFG) guidelines have helped to simplify governance of the research funding system and implementation of impact-oriented budgeting as set out in the federal government's RTI strategy.

2.3.7 Globalisation activities: "Beyond Europe"

According to the Community Innovation Survey (CIS), Austrian firms are among the most eager in the EU to engage in partnerships. The geographical focus of these partnerships is, however, predominantly on Austria and Europe and only marginally outside of Europe. Various measures have been launched in recent years aimed at initiating R&D partnerships with partners outside of Europe for this reason and for the purposes of boosting globalisation among Austrian university and research institutions. An important step here in stimulating international cooperation was the establishment of the working group 7a (Globalisation and RTI foreign policy) in the RTI task force, which submitted the "Beyond Europe" strategic

document in mid-2013. Various measures aimed at intensification of the scientific and technological cooperation with non-European states were put forward as part of the strategy whereby potential partner countries have been ranked in accordance with priorities. The US, China, India and Russia have highest priority according to this.

An additional working group, working group 7b from the RTI task force, worked on intensifying inner-European cooperation, resulting in the *Austrian EU Action Plan*[110] with a total of 70 measures. The RTI working group 7b also monitors and supports implementation of the measures proposed. A globalisation round table for exchanging experiences was also set up by the Austrian Research Promotion Agency (FFG) in which the RTI stakeholders present their partnerships in certain destination countries and regions in order to achieve synergy effects. The Austrian Institute for International Affairs (OIIP) took on the task of setting up a permanent research body for foreign science and foreign technology policy.

These activities are focused predominantly on nations and regions outside of Europe featuring a high level of dynamism in research, technology and innovation, such as North America, Asia and the BRIC countries, as well as on the neighbours that are important for Austria in Central, Eastern and South-East Europe. Establishment of the Office of Science and Technology Austria – OSTA at the Austrian Embassy in Beijing in 2012, which complements the existing OSTA in Washington, D.C. is a crucial step towards increasing the presence in these regions.

The latest initiative within these activities is the "Beyond Europe" programme run by the Austrian Research Promotion Agency (FFG) on behalf of the Federal Ministry of Science, Research and Economy (BMWFW). The target of this initiative is to support Austrian organisations in setting up and expanding R&D partnerships with partners outside of Europe. The programme is open to all technical fields.

There is €4.6 million in funding available for two types of project in an initial call for proposals until 30 March 2016: "Exploratory projects" assist with preparing R&D projects with international partners and can receive funds of up to €200,000 over a maximum of one year. "Cooperative R&D projects" are joint research projects between Austrian organisations and foreign partners. These can receive funds of up to €500,000 maximum over three years. The initiative is open to firms, universities, research institutions and other research organisations, such as non-profit associations. However, the application must be submitted by an Austrian firm.

A series of measures aimed at promoting internationalisation has been implemented as part of the RTI strategy. The Austrian Research Promotion Agency's new programme "Beyond Europe" aims to intensify cooperation between Austrian firms and research institutions with partners outside of Europe. It is too early, however, to assess the effectiveness of these and the other measures stated here.

2.3.8 Research and society

The higher-level objective in terms of the relationship between research and society in the Austrian federal government's RTI strategy is to promote "a culture of appreciation for research, technology, innovation, and to promote an understanding of how this field makes an essential contribution to increasing the quality of life and societal prosperity."[111] Among other items there were also two measures set out under the subgoal of establishing high standards of scientific integrity: i.e. developing strict guidelines related to handling conflicts of interest in the acquisition of R&D and "the disclosure of value systems in research".

Unlike the Anglo-Saxon world, there has only been intense public debate in Continental Europe on ethical conduct in science since the

110 See https://era.gv.at/directory/159
111 See BKA et al. (2011, 34).

2000s. One crucial line of this discussion was concerned with questions of ethics and law in medicine.[112] As in many other countries, this discussion in Austria led to the establishment of ethics committees in, among other institutions, universities and in the regional governments; the establishment of the Bioethics Committee within the Federal Chancellery in 2001 was particularly prominent.[113] A subsequent but equally intense debate that attracted public attention concerned accusations of plagiarism of university dissertations.

Austrian Agency for Research Integrity – ÖAWI

The Austrian Agency for Research Integrity (ÖAWI) was formed in 2008 against the background of these discussions. Members of this Agency include all public Austrian universities, non-university research institutions such as the Austrian Institute of Technology (AIT) and the Austrian Academy of Sciences (ÖAW), as well as the Vienna Science and Technology Fund (WWTF), the Austrian Research Promotion Agency (FFG) and the Austrian Science Fund (FWF). The Agency reviews accusations of scientific misconduct. The Committee for Research Integrity, which is made up of foreign scientists, has a central role here.

In the first six years of its existence, i.e. between 2009 and 2014, the Committee for Research Integrity processed a total of 82 queries. 29 of these were examined in greater detail. Increasingly conflicts regarding authorship and problems related to support and supervision for doctoral students are also being worked on rather than just cases of plagiarism.

The Agency also has the objective of actively preventing scientific misconduct and working to raise awareness in this area. This occurs inter alia via talks and workshops on good scientific practices in the member institutions. This part of the Agency's work, i.e. prevention and raising awareness, has become more and more important in recent years.

The ÖAWI also issued guidelines on good scientific practice in April 2015 based on international examples, such as the "European Code of Conduct of Research Integrity" from the European Science Foundation (ESF) and the umbrella organisation for European academies (All European Academies, ALLEA). One of the Agency's crucial tasks in future will be to implement these guidelines in the member institutions, where they are to be introduced as part of organisation bylaws, funding agreements from funding organisations and service agreements. The Agency is also part of the European Network of Research Integrity Offices (ENRIO), which currently has 23 members from European countries, and has also held the presidency there since 2012. ENRIO was recommended to the national agencies by the EU Research Council in December 2015, particularly in respect of the "train-the-trainer" programmes to be implemented within the scope of this European network.

The Agency has made the most of public debate in recent years and actively contributed towards raising awareness with regards to scientific integrity at universities. This supports the implementation of the objectives of the RTI strategy in this regard, as can be seen, for example, from the increasing number of cases brought to the attention of the Committee for Research Integrity and the acquisition of new members for the Agency. The ÖAWI also plans to expand the training that it offers, with the aim of embracing more students at the universities in its campaigns. Mandatory training for all pupils and students at universities and universities of applied sciences related to plagiarism, intellectual property and – graded by academic year and stage of study – good scientific practice appears to be desirable in this context. This type of training has been standard in the US since the 1980s but is less common in continental Europe.

112 See Biegelbauer and Hansen (2011); Biegelbauer et al. (2013).
113 See Griessler (2010).

Research that makes a social contribution that shapes the future

Within the framework of the targets already mentioned for the relationship between research and society in the Austrian government's RTI strategy, a sub-goal was formulated related to a "culture of appreciation for research, technology and innovation" of establishing a stable infrastructure environment for multiple forms of dialogue between science and society, along the lines of a "scientific citizenship". One crucial action here involves implementation of a regular national performance survey to show how research makes a social contribution that shapes the future.[114]

In a Eurobarometer survey[115] carried out in the spring of 2013, Austria did less well in science and technology in comparison to other European countries. Earlier Eurobarometer studies showed similar results. The report showed that only 30% of those surveyed in Austria consider themselves to be well informed on developments in science and technology, and only 45% stated that they were interested in these types of developments in the first place. With these values, Austria is well below the equivalent European average values of 40% and 53% respectively, and is thereby the only EU country with high expenditure on research and technology that has such low values.

Efforts have been made for decades to give the public a more detailed understanding of the achievements in research and technology. The international tenor in the last 15 years – which Austria has followed with a slight delay – has increasingly challenged the idea of a passive public suffering from a lack of information and has instead argued for active engagement of the public in dialogue. The growing discussion concerning public or "citizen" science reflects the changes in relations between the scientific establishment and the public.

An example of this in Austria is the Federal Ministry of Science, Research and Economy's "Sparking Science" programme, which includes elements of the citizen science discussion and has promoted and funded cooperation for scientists with pupils since 2007. Citizen science elements have increasingly been supported in this programme since 2015, such as through the new "Young Citizen Science Award" for young people. Austrian Science Fund (FWF) and Sparking Science projects have also been invited since 2015 to submit proposals in the "Top Citizen Science" initiative supported by the Federal Ministry of Science, Research and Economy (BMWFW), the Austrian Science Fund (FWF) and the OeAD for project extensions with respect to Citizen Science objectives.

The "Children's and Junior Universities" initiative also supports the dialogue between the scientific establishment and the public. The basic idea of children's and junior universities is to arouse children's curiosity for new things, encourage critical thinking and convey a sense of enjoyment for learning and discovery. It offers age-appropriate access to science and research through readings, camps, workshops, etc. Educationally deprived children plus children of migrants are an important target audience here.

Studies of the examinations of the "ethical, legal and social aspects" (ELSA) of research and technology have also been increasingly concerned with the social impact of scientific work since the 1990s. These issues were promoted in Austria in the 2000s by the GEN-AU ELSA programmed funded by the Federal Ministry of Science and Research (now known as the Federal Ministry of Science, Research and Economy (BMWFW)).

As part of the discussions around the current EU research framework programme Horizon 2020, the issues debated before within the scope of ELSA were translated into the concept pushed forward by the European Commission of "Re-

114 See BKA et al. (2011, 34).
115 See EC (2013).

sponsible Research and Innovation" (RRI). The responsibility is highlighted here for the consequences of research and technology shared by science, firms, research promotion, administration, politicians and civil society that should be developed, monitored and regulated as part of common processes.[116] The Federal Ministry of Science, Research and Economy (BMWFW) also published a brochure in this context in 2015 and founded the Alliance for Responsible Science in conjunction with scientific institutions and institutions promoting research, and also implemented further specific measures aimed also at driving forward the discussions in Austria around RRI and intensifying the interaction between science and society.[117] Reference can be made to the federal government's Open Innovation strategy which is currently under development and which is also aimed at integrating members of the public into science and innovation processes.[118]

One crucial action related to the dialogue between research and technology with the public is the "Long Night of Research". This was held for the first time in 2005. It is an event that takes place all over Austria and presents the research output of universities, non-university institutions, universities of applied sciences, manufacturing, infrastructure operators as well as schools. The aim of the "Long Night of Research" is to present research and technology free from barriers in a sophisticated and, at the same time, comprehensible manner, and thereby achieve an understanding of the content and significance of scientific research. Special emphasis is placed on interactive presentations, tours and activity stations where individuals come into direct contact with researchers, discuss the relevant results and are able to experiment themselves.

The "Long Night of Research" is funded by the Federal Ministry of Science, Research and Economy (BMWFW) and the Federal Ministry for Transport, Innovation and Technology (BMVIT) and is also supported by the Federal Ministry of Education and Women's Affairs (BMBF) and administered by the Austrian Research Promotion Agency (FFG). The Council for Research and Technology Development, together with the coordination point for the "Long Night of Research", is responsible for coordinating between the federal ministries and regional governments in organising the content of the event. The individual regional governments are themselves responsible for actual implementation, with the actual communication related to research and technology provided by the scientists.

The event takes place every two years (with the exception of 2007). The "Long Night of Research" is constantly growing both in terms of the number of exhibitors and the number of participants. Information on the event is disseminated via social media, the event homepage, press releases and conferences, brochures and a programme booklet, reports in newspapers and via media partnerships. It is free to attend throughout Austria. There were more than 2,183 stations at 253 locations throughout Austria in 2016, and a record number of more than 180,000 visitors. The "Long Night of Research" took place on 22 April in 2016.[119]

The objective of funding a culture of appreciation for RTI was set out in the RTI strategy in terms of the relationship between research and society. Progress was made with the sub-goal of establishing high standards for scientific integrity in the course of public discussions that above all were promoted by activities by the Austrian Agency for Research Integrity (ÖAWI). Despite the efforts already made, further action is required in relation to the sub-goal of reinforcing the dialogue between science and society for the purposes of scientific citizenship, as can be seen, for example, from the results of the Eurobarome-

116 See EC (2011).
117 See Federal Ministry of Science, Research and Economy (2015c).
118 See www.openinnovation.gv.at
119 See www.langenachtderforschung.at

ter Study 2013. These findings have resulted in further activities being implemented in 2015 by the Federal Ministry of Science, Research and Economy and the Federal Ministry for Transport, Innovation and Technology. Further long-term activities will be required since the scepticism surrounding RTI among Austrians (and in other countries of the former Austro-Hungarian Empire) relates to attitudes that have grown historically and become culturally ingrained.

2.4 Overall summary

A range of targets and measures were defined as part of the RTI strategy 2011 in various areas of the national research and innovation system, and these have so far been implemented to differing extents. At the political level, the RTI strategy is perceived as an important long-term vision of the future that has also resulted in improvements in cross-departmental coordination and diffusion of RTI-related topics thanks to its systematic approach. This report gives an indication of developments with selected measures from the areas of scientific research and tertiary education, innovation and corporate research, as well as RTI governance and the corresponding priorities.

Difficulties have arisen with respect to achieving the overarching goals, such as joining the group of Innovation Leaders or achieving an overall economic R&D intensity of 3.76% by 2020: Over recent years, Austria has reduced the gap with leading countries when it comes to innovation performance. It has also, however, fallen behind other countries because they have experienced more dynamic growth.[120] From that point of view and also since substantial changes in ranking generally require a long time, making it into the top group is becoming increasingly difficult within the planned timeframe.

Progress has also been made in terms of the target of increasing R&D intensity to 3.76%. The 3% mark was exceeded for the first time in 2015 for example according to projections. However, achieving this objective has become increasingly unlikely since the start of the economic and financial crisis in 2008 following the flattening of the dynamic growth between 1995 and 2007. This is reflected in the numerous "financial restrictions" with respect to planned components of the RTI strategy. Nevertheless, public sector expenditures are currently slightly above the level that would be necessary, given a consistent level of growth, to reach the established goal by 2020. Accordingly, the major challenge for reaching this intensity target lies primarily in increasing the R&D intensity of the private sector. The federal government has therefore designed several RTI strategy measures as incentives and support for the private sector in order increase in R&D in the business enterprise sector. If this does not happen or does so to an insufficient degree, then it will be very difficult to attain the intensity target.

In terms of universities, the RTI strategy set out the important target of reinforcing the core functions in teaching and research. One of the projects pursued was the introduction of a new university financing model that anticipates a division in funding for research and teaching, as well as an expansion of competitive research financing. Although the main features of this kind of model were developed, it has not yet been implemented in its entirety due to budgetary restrictions. The proportion of competitive research funding was one of the things that increased through the higher education sector structural funds. As a result of this and the facilitation of admission restrictions for popular degree programmes, and given established performance agreements, incentives were provided to improve the quality of teaching, boost basic research and improve supervisory relationships at Austrian universities. Gradual implementation

120 See Austrian Research and Technology Report (2015, 18 et seq). Federal Ministry of Science, Research and Economy (BMWFW), Federal Ministry for Transport, Innovation and Technology (BMVIT) (2015); http://www.bmwfw.gv.at/ftb

of a new funding system, however, requires both political agreement regarding implementation and earmarked funding, as well as clear priorities by the universities and the corresponding support from teaching staff.

Moreover, measures were implemented for introducing a tenure-track model as well as increased support for doctoral candidates by expanding structured programme offerings. These two projects have not been completed yet and require further implementation and coordination processes from the stakeholders involved.

A series of specific measures was also implemented that support excellence in basic research, although often not in the format described in the RTI strategy (clusters of excellence). The goals of leading edge research, for example, have been essentially realised through the use of other, functionally equivalent instruments (doctoral programmes, specific programmes, the START Programme and Wittgenstein Prizes, etc.). In view of the scarcity of funds, promoting the existing tracks for funding excellence appears to be more effective with a view to the strategic targets by 2020. There already exist in Austria a series of approaches and measures for the acceleration of gender balance in research, yet inequality persists. To encourage further development, however, we need a systematic analysis of the policy mix for supporting equality, as well as longer-term efforts and a consistent funding policy.

Overall the RTI strategy has certainly been successful in revealing the interdependencies and interaction of the different stakeholders, creating synergies and partnership – e.g. by expanding the research infrastructure – and particularly in working out the significance of education and qualification for the innovation system and successfully initiating appropriate measures. This is also reflected in the fact that an improvement in the quality of the teaching within the universities as a whole is a greater priority now than it was in the 2000s.

Several support measures were also established in the field of innovation and corporate research to implement the targets under the RTI strategy, including for example, cooperation between science and industry, demand-side stimulation of innovation, availability of venture capital for innovation-intensive enterprise formation. Responses have also been provided in part to developments that were either not foreseeable or could not be predicted to the same extent when the RTI strategy was set out, for example in relation to Industry 4.0. Based on the long timeframe required for the RTI measures to take effect, it is much too early to carry out an impact assessment at present, particularly in the latter areas. There are numerous initiatives in terms of cooperation between science and industry, some of which are well-established and designed for the long term. Here, the main policy task will be to adapt them by 2020 to reflect current and ongoing impact assessments. The field of venture capital requires that RTI policy remain patient: despite numerous initiatives and initial successes, for example in the area of crowdfunding, there have been no indications of any major improvements as yet. This should provide the grounds for stepping up the efforts in this area by 2020.

Optimum drafting of the framework conditions and governance structures in RTI policy is another core feature of the RTI strategy. Actions have been implemented here in view of the changes to the general circumstances and the scarcity of funds: these include further development of performance agreements for the universities and the Austrian Academy of Sciences, as well as the merger of non-university institutions. The EU Performance Monitoring of Austrian participation in EU projects has been professionalised, with adjustments also made to the RTI and Austrian Research Promotion Agency (FFG) guidelines for increased transparency and greater control. Efforts have been stepped up to set out the priorities, as illustrated, for example, in the RTI strategy with reference to the grand challenges. The activities of the departments have e.g. been coordinated and linked more effectively based on inter-ministerial working groups, including in areas such as climate and demographic change. Attempts are also being made to coordi-

nate these priorities properly with activities at the EU level.

Research as a social achievement that shapes the future is addressed within the scope of several initiatives aimed at target groups, with the "Long Night of Research" already having successfully inspired a wider population in relation to science, research and innovation for years as a major high-profile event. The crucial steps in terms of science policy of predominantly mono-directional communication of science to bi-directional cooperation between the scientific establishment and civil society have been taken with the Federal Ministry of Science, Research and Economy's initiative "Sparkling Science", the research partnerships between colleges and scientific institutions, and "Responsible Science" and "Citizen Science", which are priorities under the Federal Ministry of Science, Research and Economy Action Plan for a competitive research area. As well as improving understanding of the overall societal importance of R&D, these initiatives have also opened up new paths for knowledge and resources for scientific development. The experiences already gained as part of the initiatives and programmes stated above clearly illustrate the positive synergies that arise when members of the public are involved in excellent science, and this is also expressed both at the theoretical level as well as in practical research and in the practical relevance of the results.

Overall the federal government's RTI strategy has created some essential momentum for change in some fields and resulted in some progress. Other parts of the strategy are either no longer relevant or have been supplemented by other specific strategies. An estimate of the extent to which the measures implemented, which are aimed at achieving the higher-level targets since the RTI strategy was enacted, including those related to improving Austria's ranking among leading countries in the *European Innovation Scoreboard (EIS)*, have contributed in each individual case remains to be relevant fully examined. Substantial deviations in achieving the higher-level targets can be noted in any case at the aggregated level, with substantial efforts also required accordingly in order to overcome these challenges.

3 Major Federal Funding Agencies in Austria

3.1 The Austrian Science Fund (FWF)

The objectives of the Austrian Science Fund (FWF), the main institution for funding basic research in Austria, include high-level qualitative and quantitative ongoing development of Austrian science and research in accordance with the principle of "education through research", as well as strengthening communication between scientific, cultural and economic interests and stakeholders. As such, the Austrian Science Fund (FWF) contributes to Austria's international competitiveness. By applying the principle of peer reviews involving international peers when selecting projects worthy of funding, along with targeted funding for leading edge research, the Fund aims to promote basic research at the highest level and thereby strengthens the knowledge-based society as a whole as a pillar of Austrian prosperity.

Compared with the previous year, a slight increase was observed in the volumes of applications decided, up around 3% to €818.2 million (2014: €795.5 million). The number of applications decided also grew by around 8% to 2,617 applications (2014: 2,432). At the same time, the total values approved fell as compared with the previous year (2014: €211.4 million) by around 3% to €204.7 million in 2015 (see Table 3-1). The number of new projects approved (655) fell by approx. 5% (2014: 691) (see Table 3-2). Overall the Austrian Science Fund's budget of €490 million for 2013–2015 rose by 12.5% to €552 million for 2016–2018.

With regard to the total funding amount, the majority of the funding (approx. 46%) was award-

Table 3-1: Overview of research funding: Total grants in 2015

Funding programme	Applications decided		New approvals		Approval rate		
	in € millions	% women	in € millions	% women	Rate [in %]	% women	% men
Stand-alone projects (incl. clinical research)	375.4	26.7	93.4	25.7	24.9	24.0	25.2
International programmes	148.4	23.3	21.4	17.8	14.4	11.1	15.4
Priority research programmes (SRA, NRN) – new applications[1]	16.3	24.1	3.0	36.7	3.1	18.8	0.0
Priority research programmes (SRA, NRN) – extensions	25.7	21.8	21.7	21.2	84.3	82.1	84.9
START Programme and Wittgenstein Award	127.1	31.7	10.5	45.7	8.3	12.0	6.6
Doctoral Programmes – new applications[1]	9.8	28.2	8.5	27.1	21.8	23.1	21.3
Doctoral Programme – extensions	16.6	0.0	13.9	0.0	83.3	0.0	83.3
Schrödinger Programme	16.6	39.5	6.3	47.6	38.1	45.2	33.4
Meitner Programme	27.4	33.2	7.2	26.4	26.2	20.7	28.9
Career Development for Female Researchers	39.9	100.0	10.5	100.0	26.3	26.3	-
Programme for the Development and Inclusion of the Arts (PEEK)	13.7	36.0	2.6	26.9	19.3	13.6	22.4
Communication of Sciences Programme	1.2	44.5	0.3	33.3	23.2	19.6	26.0
Total	**818.2**	**30.4**	**199.3**	**28.5**	**21.4**	**21.9**	**21.2**
Total funding amount including supplemental grants			204.7	28.7			

1) The approval rate is calculated from the complete applications approved on plans submitted (not presented here).

Source: Austrian Science Fund (FWF).

Table 3-2: Overview of research funding: Number of grants in 2015

Funding programme	Applications decided		New approvals		Approval rate		
	Number	% women	Number	% women	Rate [in %]	% women	% men
Stand-alone projects (incl. clinical research)	1,246	26.4	317	26.5	25.4	25.5	25.4
International programmes	599	23.4	93	20.4	15.5	13.6	16.1
Focus Programmes (SRA, NRN) – new applications [1/2]	44	22.7	9	33.3	4.3	25.0	0.0
Focus Programmes (SRA, NRN) – extensions[2]	61	24.6	53	22.6	86.9	80.0	89.1
START Programme and Wittgenstein Award	103	31.1	9	44.4	8.7	12.5	7.0
Doctoral Programmes – new applications[1]	4	25.0	4	25.0	23.5	20.0	25.0
Doctoral Programme – extensions	6	0.0	6	0.0	100.0	0.0	100.0
Schrödinger Programme	147	38.8	59	45.8	40.1	47.4	35.6
Meitner Programme	185	33.0	49	26.5	26.5	21.3	29.0
Career Development for Female Researchers	155	100.0	41	100.0	26.5	26.5	-
Programme for the Development and Inclusion of the Arts (PEEK)	40	37.5	8	25.0	20.0	13.3	24.0
Communication of Sciences Programme	27	44.4	7	42.9	25.9	25.0	26.7
Total	**2,617**	**31.6**	**655**	**31.9**	**24.8**	**25.1**	**24.7**

1) The approval rate is calculated from the complete applications approved on plans submitted (not presented here).
2) Sub-projects.

Source: Austrian Science Fund (FWF).

ed to stand-alone projects (2014: 43%) as well as special research areas (SRAs) and national research networks (NRNs) (approx. 12%; 2014: 15%). By working to actively shape ERA-Net initiatives and Science Europe, the Austrian Science Fund (FWF) focuses on coordinating the national research and funding activities of the European Research Area (ERA) and the internationalisation of Austrian science. However, the volumes of new approvals in the international programmes recorded a decline of approx. 20% to €21.4 million (2014: €27 million). Nevertheless the funding contribution for the international area in 2015 was still above the approval volume two years earlier (2013: €15.2 million).

The targeted funding and establishment of outstanding young research scientists within the Austrian science system is a major concern for the Austrian Science Fund (FWF). The particular objectives pursued include efforts to increase the share of female research staff at universities and to ensure that links are established with and between female researchers. In 2015, a total of 41 excellent female scientists (see Table 3-2) received funding in the amount of €10.5 million (see Table 3-1) as part of the Hertha Firnberg Programme (22 female researchers), the Elise Richter Programme (16 female researchers) and the Elise Richter PEEK Programme (three female researchers). An approval rate of approx. 26% is indicative at the same time of major competition in awards within the scope of career development programmes.

The proportion of women in all new projects approved remained consistent compared to the previous year at approx. 32% (see Table 3-2). In addition to the career programmes for young scientists, the proportion of women is relatively high in new projects approved as part of the Schrödinger Programme for funding experience abroad in the post doc-phase (approx. 46%). Yet a proportion of women of more than 40% in new projects can also be recorded in the START Programme and the Wittgenstein Prize, as well as in the Communication of Sciences Programme. In the Doctoral Programmes (0% of extensions, 25% of new applications) and the international programmes (approx. 20%) the proportion of women does, however, represent considerably less than a quarter of the applications funded. Overall, the approval rate for women, i.e. the ratio of approved projects to applications submit-

Table 3-3: Research personnel funded by the Austrian Science Fund (FWF), 2012–2015

	2012		2013		2014		2015	
	All	% women	All	% women	All	% women	All	% women
Post-docs	1,288	40.1	1,351	38.4	1,392	40.5	1,432	43.6
Pre-docs	1,935	42.3	1,967	42.7	1,955	42.7	1,998	44.2
Technical staff	173	68.2	170	72.4	158	76.6	167	71.3
Other staff	456	47.1	476	48.7	468	49.1	513	53.2
Total	**3,852**	**43.3**	**3,964**	**43.2**	**3,973**	**44.0**	**4,110**	**46.2**

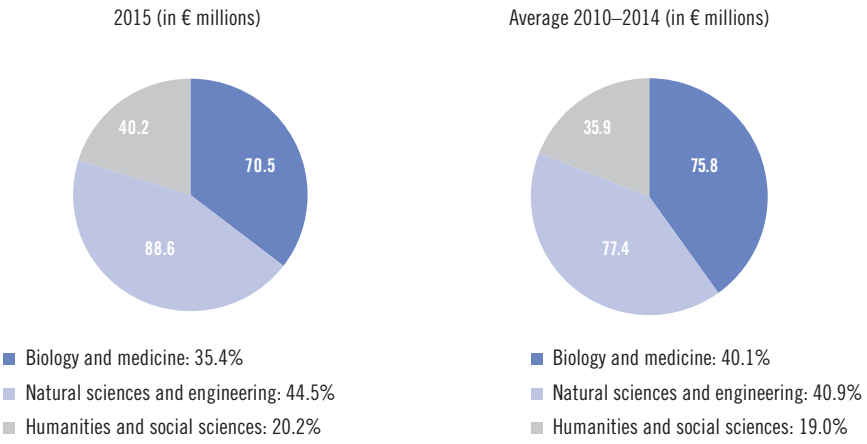
Source: Austrian Science Fund (FWF).

ted, was 25.1% (22.1% of the approved funding amount in € millions) compared to an approval rate for men of 24.9% (24.4% of the approved funding in € millions). In particular the low proportion of project applications from female scientists of less than one third combined with the higher numbers of female university graduates suggests some potential for targeted funding of women, which has not been exploited yet and may further improve the already high professional level of funding applications.

Table 3-3 shows the research staff funded by the Austrian Science Fund (FWF) in relation to their areas of responsibility and gender distribution. The funding of scientific personnel and hence the development of scientific human potential is currently a main focus of the Austrian Science Fund's objectives. In 2015, some 4,110 persons working in science, approx. 46.2% women, received funding. Just under half of this amount are pre-doctoral students. The proportion of women who form part of the technical staff is also particularly high at approx. 71%, and women also make up more than half of the other personnel. In contrast only around 44% of the positions funded in post-doctoral and pre-doctoral areas are occupied by women, with a slight increase in the proportion of women of approx. 3 and 1.5 percentage points observed respectively in each case.

Fig. 3-1 shows the distribution of the funding totals in relation to different scientific disciplines. The majority of funding totals go to the areas of natural science and engineering

Fig. 3-1: Approvals by scientific discipline (complete overview of all Austrian Science Fund (FWF) programmes)



Note: Biology and Medicine: human medicine, veterinary medicine and biology; natural science and engineering: natural sciences without biology, agriculture and forestry, without veterinary medicine or engineering. Humanities and social sciences, including fine arts and cultural sciences.

Source: Austrian Science Fund (FWF).

(€88.6 million) and biology and medicine (€70.5 million), while the humanities and social sciences received the smallest share of funding (€40.2 million). There are only minor changes recorded in 2015 in relation to the distribution of funds for the benefit of biology and medicine as compared with the average value between 2010 and 2014.

The new "Top Citizen Science" programme (TCS) was introduced in mid-December 2015 with the aim of actively involving citizens (with specialist subject knowledge) in ongoing research work and thereby increasing communication between the scientific, cultural and scientific areas and stakeholders. Expansion projects (up to a maximum of €50,000) to ongoing Austrian Science Fund (FWF) projects may be submitted within the scope of the TCS proposal. Total funds of €500,000 are available for this funding project, which was launched together with the Austrian Academic Exchange Service (OeAD) and the Federal Ministry of Science, Research and Economy (BMWFW). Of this amount, 50% is allotted to Austrian Science Fund (FWF) projects and 50% to OeAD Sparkling Science projects.

The Partnership in Research programme (PiR) introduced in autumn 2015 is also aimed at boosting partnerships between science and industry. With a funding volume of €1 million, the programme has been established to promote cooperation between scientists with specific ideas from basic research and firms. The aim is to provide momentum that will lead to the construction of CD laboratories, JR centres and other stable forms of cooperation in order to improve the links between science and industry along with the distribution of knowledge.

The electronic application submission system "elane", which the Austrian Science Fund (FWF) has provided since early January 2015, is aimed at improving the efficiency of submitting new applications. Applicants are now able to submit a project proposal to the Austrian Science Fund (FWF) electronically for the first time, in addition to submitting hard copies for funding applications. Mandatory use of the Open Researcher and Contributor ID (ORCID) is also intended to facilitate the process of allocating projects and publications and distinguishing between scientists. Funding can be tracked more efficiently over the course of time and can be allocated more easily to the scientists since the researchers can be uniquely identified via the ID assigned to them.[1] Documentation on the funding and on the resulting outputs, such as publications, is made easier and processes can be designed with increased transparency and efficiency.

Demands for a reduction in (monetary) barriers to access to scientific publications have resulted in attention from the media ever since the protests by universities across Europe against the pricing strategies of major publishers.[2] As a consequence, the European Commission has also declared that Open Science is one of its priorities with the aim of reorganising the publication system.[3] The Austrian Science Fund (FWF) has already been pursuing Open Access as a strategic objective for some years and has been able to enter into the first global agreement with major publishers (e.g. Springer Verlag) in cooperation with universities, libraries and the Federal Ministry of Science, Research and Economy. Austrian researchers are able to publish via Open Access free of charge as a result. The medium-term objective of the Austrian Science Fund's Open Science strategy is for all research data collected over the course of one of its projects to be made available online free of charge, subject to legal and ethical standards. Initial experiences with the efforts to implement this plan will be collated by the "Open Research Data" pilot programme, which was launched in early 2016. A

1 Until recently, the Austrian Science Fund (FWF) was able to guarantee a clear assignment of researchers to projects. For legal reasons, this is no longer possible.
2 See ORF Science (2015).
3 See Moedas (2015).

prerequisite for this is that the research data verifiably stems from approved Austrian Science Fund (FWF) projects from the past five years. Smaller projects may be submitted in the "Independent Publications" programme independently of any prior funding from the Austrian Science Fund (FWF). As of 2016, the programme will fund innovative and open digital publication formats (e.g. apps, Wiki models etc.) with a flat-rate sum of up to €50,000. As such, the Austrian Science Fund (FWF) is following the recommendations of the 14 experts from the Open Access Network Austria (OANA) working group, which has developed the strategy plans for migrating the overall scientific publication activities in Austria to Open Access by 2025[4]. The Austrian Science Fund was just recently confirmed as having one of the world's most effective open access strategies for a funding organisation according to a qualitative[5] and quantitative[6] evaluation of the EU's PASTEUR4OA network.

3.2. The Austrian Research Promotion Agency (FFG)

The Austrian Research Promotion Agency (FFG) is the national agency for funding application-focused, business-relevant research and development in Austria. It offers a portfolio of sophisticated and targeted monetary and non-monetary instruments for funding research, technology and development at firms and research institutions along the entire innovation chain. The offering includes thematically open and thematic funding, measures for strengthening human resources and optimising the structure of innovation systems, and a wide range of services, such as the job bank for research and technology, evaluations for realising tax concessions for research activities (research premium), as well as partner search and advisory, training and networking measures, particularly for the (research) programmes of the EU (Horizon 2020, EUREKA, Eurostars), the European Space Agency (ESA) and COST (European Cooperation in Science and Technology).

In 2015, the Austrian Research Promotion Agency (FFG) provided a total of €467.1 million in funds (including liability and loans, excluding commissions), which corresponds to a cash value of €343 million. The reason that the cash value of the funding fell in comparison to the previous year is due primarily to funds from the COMET programme being only sporadically put out to tender (2014: €106.1 million cash value; 2015: €17 million cash value). A corresponding overview of newly approved funding in 2015 by programme area is provided in Table 3-4.

With a cash value of funding of €159 million the highest funding volume went to the thematically open, bottom-up funding of firms in the *general programmes* area. The projects in this area are primarily stand-alone projects by firms or, as in the case of an Innovation Voucher intended to help SMEs launch R&D activities, a partnership between a firm and a research institution. With 1,198 projects funded (-5.5%) and 1,277 (-2.6%) stakeholders involved, the number of projects and stakeholders funded also remained widely steady compared to the previous year.

The *Thematic Programmes* area is the second-largest area of funding in the portfolio of the Austrian Research Promotion Agency (FFG). The area implements campaigns to promote research and development activities by Austrian firms as well as sustainable cooperation between science and industry with the aim of also achieving internationally visible critical masses in research. A total of 420 cooperative R&D projects were funded with a cash value of funding of €157.1 million (+11.3%).

With a cash value of €26.3 million in funding, the structure programmes area represented the

4 See Open Access Network Austria (2015).
5 See Tonta et al. (2015).
6 See Swan (2016).

Table 3-4: Austrian Research Promotion Agency (FFG) funding statistics (in €1,000), 2015

Programmes	Projects	Participations	Stakeholders	Total costs	Funding incl. liability and loans	Cash value
General Programmes Area	***1,198***	***1,669***	***1,277***	***540,150***	***283,535***	***158,970***
BASIS	732	732	613	408,655	232,962	108,397
General programme	705	705	588	393,889	226,809	103,176
BILAT-Israel	1	1	1	305	183	183
Service innovations	21	21	21	11,028	4,557	3,945
Headquarters	1	1	1	2,351	662	662
Rare diseases	4	4	4	1,082	751	431
Bridge	68	193	168	24,166	17,328	17,328
Competence Headquarters	15	15	15	50,330	14,382	14,382
EUROSTARS	26	26	24	9,328	4,753	4,753
Frontrunners	11	11	11	44,914	11,694	11,694
Innovation Voucher	346	692	552	2,758	2,415	2,415
European and International Programmes	***3***	***3***	***3***	***256***	***192***	***192***
TOP.EU	3	3	3	256	192	192
Structural programmes	***1,186***	***1,384***	***799***	***75,188***	***26,322***	***26,322***
COMET	4	101	100	58,142	16,987	16,987
Research expertise for industry	1	11	11	57	45	45
Research partnerships	27	27	20	5,638	2,580	2,580
Talents	1,154	1,245	692	11,351	6,710	6,710
Topic-based programmes	***420***	***1,400***	***808***	***296,188***	***157,102***	***157,102***
Benefit	28	51	42	8,706	5,461	5,461
Federal-regional partnerships	18	57	44	7,603	4,857	4,857
ENERGIE DER ZUKUNFT (Energy for the Future)	37	142	113	12,319	8,499	8,499
Energy Research (e!MISSION)	71	271	184	55,305	37,913	37,913
ERA-NET ROAD	8	39	31	3,206	3,206	3,206
IEA	14	25	21	2,031	2,031	2,031
IKT der Zukunft (ICT of the Future)	46	98	76	55,082	16,347	16,347
IV2Splus	1	4	4	392	313	313
KIRAS	20	101	63	9,227	5,920	5,920
Beacons for eMobility	4	24	22	8,467	3,811	3,811
Mobilität der Zukunft (Mobility of the Future)	96	299	193	37,361	21,596	21,596
NANO-EHS	2	2	2	476	476	476
Produktion der Zukunft (Production for the future)	40	148	113	36,461	23,573	23,573
Smart Cities	14	82	74	15,462	8,146	8,146
TAKE OFF	20	56	47	14,098	8,951	8,951
Centre on the Mountain	1	1	1	29,990	6,000	6,000
FFG TOTAL	**2,807**	**4,456**	**2,497**	**911,781**	**467,149**	**342,585**
Commissions[1]	239	240	180	5,373	5,373	5,373
Total operational funds:					**472,522**	**347,958**

1) Commissions are ancillary activities financed by operative funds from the programmes (e.g. studies).

Source: Austrian Research Promotion Agency (FFG).

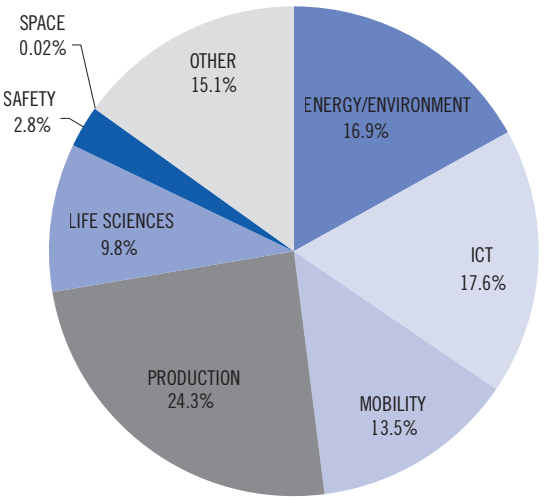
third-largest programme area of the Austrian Research Promotion Agency (FFG) funding portfolio in 2015. The programme area optimises structures and infrastructures of research for innovation projects, and enables firms with research and transfer facilities to generate new forms of collaboration, as well as knowledge, and develop new fields of strength.

The *Aeronautics and Space Agency* implements domestic aeronautics and space policy and represents Austria on international bodies in this sector. Representing Austria in the European Space Agency (ESA) is strategically important here. The Austrian Research Promotion Agency (FFG) supports the involvement of Austrian researchers in international and bilateral partnerships on aeronautics and space activities and promotes the establishment and expansion of international networks. The Austrian space programme ASAP supports Austrian involvement and priorities within the ESA and EU programmes and prepares Austrian areas of specialisation.

The task of the *European and International Programmes* area at the Austrian Research Promotion Agency (FFG) is to increase Austria's involvement in programmes, initiatives and campaigns that form part of European and international research and technology partnerships – particularly the EU research programme. The European and International Programmes area at the Austrian Research Promotion Agency (FFG) provides regular information to more than 30,000 interested parties in Austria regarding European programmes and initiatives, attributable to industry at 40%, universities at 29%, non-university research at 11% and other organisations at 20%, which include multipliers and administrative offices.

The distribution of total funding across thematic fields can be mapped across all programmes using the Austrian Research Promotion Agency's (FFG) established thematic-based monitoring. The following weighting can be seen: Around 24% of funding is allocated to the area of production (production technology, tool and mechanical engineering, industrial processes, etc.), 17.6% to information and communication technologies, 16.9% to the area of energy/environment, 13.5% to mobility and approx. 10% to Life Sciences (Fig. 3-2). The "Others" group includes all those areas that cannot be assigned to specific thematic fields because of their heterogeneity, the breadth of their individual fields, or because these projects are situated at the interfaces between different research areas, something that can be observed more and more frequently.

Fig. 3-2: Austrian Research Promotion Agency (FFG) funding by thematic fields, 2015



Source: Austrian Research Promotion Agency (FFG).

The Austrian Research Promotion Agency (FFG) funding by organisation type (Table 3-5) shows that in 2015 approx. 59% (2014: 48%) of funds (cash value) was allocated to firms. The proportion of research institutes is 20.7%. In 2014 this value was 34.1%, due primarily to funds from the COMET programme being only sporadically put out to tender. The proportion of the higher education sector is 18.4%.

The following two assignments must also be considered in order to obtain an overall picture of all funds and/or programmes aimed at funding research, development and innovation that are being handled or indirectly supported by the

Table 3-5: Austrian Research Promotion Agency (FFG) funding by type of organisation, 2015

Organisation type	Participations	Total funding [in €1,000]	Cash value [in €1,000]	Percentage of cash value [in %]
Firms	2,384	326.3	201.7	58.9
Research institutions	813	70.9	70.9	20.7
Universities	920	63.1	63.1	18.4
Intermediaries	31	2.2	2.2	0.6
Other	308	4.6	4.6	1.3
Total	**4,456**	**467.1**	**342.6**	**100.0**

Source: Austrian Research Promotion Agency (FFG).

Austrian Research Promotion Agency (FFG) in the form of agency services (consultancy, service, networking, expert opinions):

- All Austrian National Contact Points for the Horizon 2020 sub-programmes are represented in the Austrian Research Promotion Agency (FFG). The Austrian Research Promotion Agency (FFG) is responsible for boosting and expanding participation in Horizon 2020 by Austrian organisations using services such as consultancy, training, networking and partner searches. Since the start of Horizon 2020 in 2014, Austrian organisations have been involved 981 times in 693 projects with €391.2 million of funding pledged.[7]
- Any firms that wish to claim a research premium (tax credit for expenditure in research and experimental development) must furnish an expert opinion from the Austrian Research Promotion Agency (FFG) for the financial years as of 2012. This expert opinion is created by the Austrian Research Promotion Agency (FFG) for the relevant firm free of charge and using an electronic workflow (accessed via FinanzOnline), although the amount of the research premium paid can only be discovered via the Federal Ministry of Finance and not via the Austrian Research Promotion Agency (FFG). The volume of research premiums paid out in 2015 amounted to €501.9 million.[8] An overview of the research premiums awarded in recent years can be found in the statistical appendix to this Report.

New funding programmes and initiatives of the Austrian Research Promotion Agency (FFG)

The availability of networks with transmission speeds of up to 100 megabytes per second (broadband) is a crucial economic site factor. In 2015, the Austrian Research Promotion Agency (FFG) was appointed by the Federal Ministry for Transport, Innovation and Technology (BMVIT) to handle the awarding of funds from the "Broadband Billion" programme. Proposals in all four programme lines of "Broadband Austria 2020" were launched by the end of the year with a total budget of approx. €240 million.

Infrastructure costs could only be funded proportionally in line with usage up until now within the scope of R&D projects funded by the Austrian Research Promotion Agency (FFG). A new programme was launched in 2015 with funds from the National Foundation that enables direct funding for research infrastructures used jointly. An amount of €13 million has been made available for this.

Funds from the *European Regional Development Fund (ERDF)* are made available by the Austrian Research Promotion Agency (FFG) for research projects by firms within the scope of the new "EFREtop" programme. Up to €41.5 million can be used from the current EU funding period (up until 2020) for research, development and innovation projects, and the Austrian Research Promotion Agency (FFG) is topping up this amount by a further €10 million out of its own

7 Source: EU-Performance Monitoring of the Austrian Research Promotion Agency (FFG) based on European Commission data; as at: 26 Feb. 2016.
8 Source: Statistics Austria, Global Estimate 2016.

budget. There is therefore over €50 million available in total.

The first proposal for an Industry 4.0 pilot factory was implemented in 2015 as part of the RTI initiative "Production of the Future" with the pilot factory opened in late August in Seestadt Aspern.

A bilateral proposal from two regional governments was processed by the Austrian Research Promotion Agency (FFG) in 2015 for the first time. The regional governments of Upper Austria and Styria made a total of €4 million available for joint research projects on the topics of mobility and logic under the title "Smart Mobility".

Internationalisation

The topic of "internationalisation" was also a high priority for the Austrian Research Promotion Agency (FFG) in 2015. As a result, it is pursuing the priorities of the government programme, as well as the "Beyond Europe" concept and the strategy of the "Internationalisation" taskforce to implement the federal government's RTI strategy. The Austrian Research Promotion Agency (FFG) launched the "Beyond Europe" programme in 2015, with the Federal Ministry of Science, Research and Economy providing €4.6 million for the first proposal for this. The funding is being made available for open-topic exploration projects as well as partnership projects for experimental development by firms, research institutions, universities and other organisations from all sectors, with the exception of gambling and military research. Partners from Austria and non-European countries can participate and receive funding in the "Beyond Europe" projects.

The "Global Incubator Network" programme (GIN) is based on the "Start-Up Country Austria" and "Start-up Campaign 2014" initiatives and plays a part in establishing the Start-up Hotspot Austria using targeted actions together with the pioneers initiatives and in cooperation with partners Austria Business Agency, Austrian Federal Economic Chambers, ADVANTAGE AUSTRIA as well as the Vienna Business Agency. GIN is processed by the Austrian Research Promotion Agency (FFG) and the Austria Wirtschaftsservice (aws) with funds from the Austrian National Foundation.

GIN serves three target groups: start-ups, investors and incubators, for which the programme develops actions and services. A distinction is made here between actions aimed at attracting foreign start-ups, investors and incubators to Austria and thereby promoting the start-up Hotspot Austria abroad (incoming), and conversely actions and services aimed at supporting Austrian start-ups, investors and incubators in their internationalisation plans (outgoing). GIN has three destination countries that represent international start-up hotspots: Israel, Japan (Tokyo), Hong Kong and Singapore.

The incoming actions for start-ups include a three-week accelerator programme that provides customised programmes to up to ten foreign start-ups selected by a jury with the aim of supporting these with internationalisation in Austria. Foreign start-ups are also given access to established Austrian firms and joint R&D projects are promoted. Co-investment pitch events are offered to investors in order to link these with national investors and VC funds and thereby increase their readiness to (co-)invest in Austrian start-ups. Austrian incubators (e.g. AplusB Centres, JumpStart incubators) are given the opportunity to discuss internationalisation topics with international incubators, as well as offering exchange options to their start-ups, thereby supporting these in their internationalisation efforts.

The outgoing actions include accelerator programmes for Austrian start-ups selected by a jury, which are able to take part in an accelerator programme in one of the GIN destination regions in a process similar to the one for international start-ups in Austria. Austrian start-ups are connected with relevant local partners and introduced to investors using support actions. GIN gives Austrian investors the option of getting to know the relevant GIN regions and meeting potential partners as part of start-up ecosystem trips.

3.3 Austria Wirtschaftsservice (aws)

Austria Wirtschaftsservice Gesellschaft mbH (aws) is the Austrian federal promotional bank that supports firms as a financing partner with a highly differentiated and target-oriented portfolio of instruments in all stages – from pre-seed to enterprise creation and international growth projects. The tools used for funding and financing include loans, grants, guarantees and participating interests (equity holdings). The Austria Wirtschaftsservice (aws) also offers diverse consultancy and other services.

In 2015 there was an increase in both the funding commitments (+4.4% to 5,126) as well as the financing (+12% to €825.6 million) as compared with 2014 with total project costs of €1.875 billion.

The support tools used by Austria Wirtschaftsservice (aws) depend on the specific corporate stage that the firm is in and on its focus. Table 3-6 provides an overview of developments with the different funding and financing instruments.

The demand for guarantees continued to increase on the whole in 2015. Both the number of guarantees pledged (+11%) and the financing (+33%) rising significantly. This sustained increase in demand is attributable to a fundamental reform of funding regulations, for instance the postponement of the procedural interest rate applied until mid-2014 in the SME Funding Act, through which banks that had awarded aws-guaranteed loans in the past were limited to a maximum interest rate. This had a restrictive effect on awards of bank loans guaranteed by the federal government in the past.

Based on agreements with the EU programmes COSME (Competitiveness of Enterprises and SMEs) and InnovFin (EU Finance for Innovators) in February 2015, Austria Wirtschaftsservice (aws) is now able to make additional funds available to firms subject to particularly favourable guarantee charges, which means an average charge benefit of 30%.

The financing volume for loans increased by 7% in 2015 with virtually the same number of loans awarded as compared with the previous year. In line with economic developments, the growth in demand for loans was positive over the course of 2015, having started at a low level. It can be noted here that major investment projects were submitted by manufacturing following a longer period of restrained investment activity. Awards of grants remained consistent with those in 2014, while the number of projects involving equity interests and the financing for equity participation saw positive development.

The Austria Wirtschaftsservice (aws) focuses on the "enterprise creation" and "growth and industry" actions areas of business policy in the strategic direction for its ongoing multi-year 2014–2016 programme. Actions and activities in this regard are described in more detail below.

New enterprises

Overall, the Austria Wirtschaftsservice (aws) implemented new programmes relevant to new enterprises in 2015 and provided start-ups with a total of €220 million in funds (+14% on 2014), including via the seed financing programme established by the aws. While the aws Start-up

Table 3-6: aws: Funding, 2014–2015

	Funding commitments [number]		Total project costs [in € millions]		Financing [in € millions]	
	2015	2014	2015	2014	2015	2014
Participation	28	22	35.0	23.9	14.4	13.6
Guarantee	975	881	388.2	237.9	210.4	157.2
Loan	1,148	1,140	744.5	740.1	527.1	491.1
Subsidy	2,975	2,868	707.3	702.5	73.6	74.8
Total	**5,126**	**4,911**	**1,874.9**	**1,704.3**	**825.6**	**736.8**

Source: Austria Wirtschaftsservice (aws).

Premium programme expired in the 2015 funding year and the aws Start-up Cheque was extended for another year, the aws JumpStart Programme now funds the professionalization and further development of business incubators and accelerators and of the start-ups growing in these.

With the aws Start-up Fund and the aws Business Angel Fund, Austria Wirtschaftsservice launched two initiatives in 2013 aimed at offering long-term growth capital to start-ups (Table 3-7):

- The Austria Wirtschaftsservice (aws) Start-up Fund offers long-term growth capital through open and silent partnership. Three new equity holdings were executed in 2015 (2014: 8) along with four follow-up investments in existing portfolio firms. The total value of the investments executed amounts to approx. €4 million.
- The Austria Wirtschaftsservice (aws) Business Angel Fund doubles the capital that angel investors provide to young entrepreneurs. Two additional co-financing agreements were awarded with Business Angels in 2015 amounting to €4 million, with approx. 50% of the total fund volume awarded. Following the approval for four projects for the first time in 2014 as part of the aws Angel Business Fund, twelve equity investments in Austrian start-ups were co-financed from the fund in 2015.

The aws Venture Capital initiative also ensures fresh private equity for start-ups over next few years amounting to approx. €14 million. There were seven investments made in Austrian firms in 2015 as a result of existing agreements with nine funds. Two new investments were concluded via the aws SEM fund with a total investment value of €7 million.

The technology programmes aws PreSeed and aws Seedfinancing also address the pre-seed and foundation stages (see Table 28 in the statistical annex). They support companies with the commercial implementation of ideas and are intended to provide an incentive for technology-based and growth-oriented start-up firms. With an unabated high level of interest in the programme, 13 pre-seed projects received funding in 2015 (2014: 6) along with 6 seed financing projects (2014: 11) with the thematic focus on ICT and physical sciences. The life sciences area was also supported in 2015 by Life Science Austria (LISA) with 6 pre-seed (2014: 4) and 7 seed financing projects (2014: 6).

The Global Incubator Network (GIN), developed together with the Austrian Research Promotion Agency (FFG), aims to act as a supplement to the existing funding programmes and to support new enterprises from the early stage of formation through to internal expansion. The objective is to make Austria more attractive as a location for start-ups, investors and firms based on international partnerships (see also Chapter 3.2).

Growth and industry

One additional area of focus in the business activities of the Austria Wirtschaftsservice (aws) is in the area of growth and industry, with the aws Frontrunners Programme and the new services related to Industry 4.0 particularly prominent

Table 3-7: aws: Overview of performance of equity, 2014–2015

	Financing commitments [number]		Total project values [in € millions]		Financing [in € millions]	
	2015	2014	2015	2014	2015	2014
aws SME Fund	2	2	8.0	5.0	7.0	5.0
aws Venture Capital Initiative	7	8	15.3	8.6	2.8	0.7
aws Start-up Fund	7	8	1.0	26.2	4.0	7.4
aws Business Angels Fund	12	4	1.6	0.6	0.5	0.2
Total	**28**	**22**	**34.9**	**40.4**	**14.3**	**13.3**

Source: Austria Wirtschaftsservice (aws).

here. Awarded in conjunction with ERP loans, the aws Frontrunners Programme funds projects with high potential for growth and innovation. This initiative is intended to help successful, primarily medium-sized firms maintain and expand their top position in global competition. As in 2014, there were 12 projects that once again received funding via the aws Frontrunners Programme in 2015 (total grant: approximately €4.1 million).

The aws ProTRANS-4.0 programme supports firms in developing and improving corporate strategies related to the areas of innovation management, product and procedural innovations and the development of innovative services or new organisational structures and modified processes. Since the test phase in 2014, projects may also include measures that contribute to improved incorporation within value chains for control operations (initial linkage or improved positioning in the value chain). A total of 34 projects were funded in 2015 via aws ProTRANS-4.0, which has been subject to high demand since the introduction of the Industry 4.0 component, with the value of these projects amounting to approximately €3.7 million. The aws Industry 4.0 initiative introduced in 2015 and financed by the National Foundation is aimed at providing investment incentives for implementation of Industry 4.0 methods for Austrian manufacturing. With grants of up to half a million euros, the Austria Wirtschaftsservice (aws) funds the implementation of new production and logistics methods in particular.

Service and consultancy

A high level of interest in aws consultancy and other services can also be clearly identified in addition to the demand for loans, guarantees and grants. With around 180 network events in particular that were held in 2015 (+23% on 2014), the Austria Wirtschaftsservice (aws) was able to reach significantly more firms with 10,299 participants than in the previous year (2014: 7,065). The "Intellectual property" events created a high level of interest and saw a growth in demand of more than 70%. There was also a high level in events vents on the topics "New ventures and young firms" (70 events, 5,232 participants) as well as "Growth and Industry" (72 events, 3,892 participants).

4 High-growth firms, academic spin-offs and social entrepreneurship in Austria

Job growth and increasing social prosperity are key objectives of research, technology and innovation policy. Economic growth through competition – in and between sectors –, innovation and structural change is essential in order to achieve these objectives. Against this background, RTI policy in Austria has focused increasingly on issues related to enterprise creation, spin-offs and entrepreneurship. Supporting and funding these projects is an important objective of the federal government's RTI strategy. Recent RTI-policy strategies at the departmental level have also been dedicated increasingly to the issues of entrepreneurial culture, entrepreneurship, and innovation.

This chapter outlines the developments connected with enterprise creation and high-growth firms in Austria (Chapter 4.1). The topics presented focus on a European (international) comparison, paying particular attention to the links between high-growth firms and research and innovation policy aspects, making reference to the relevant literature. Chapter 4.2 looks at academic spin-offs and provides an overview of the most important measures implemented by academic institutions, along with the programmes in place at the regional and national level. Finally, Chapter 4.3 is dedicated to the topic of social entrepreneurship and the non-profit sector. Following a few introductory clarifications of the concepts, the details of social enterprises in Austria will then be described, followed by an analysis of the potential for social business and social entrepreneurship at the national level.

4.1 Enterprise creation and high-growth firms

The role of enterprise creation and high-growth firms in growth is of ever-increasing importance in a modern, knowledge-based, national economy such as Austria's. New ventures and general enterprise (WIFO) dynamics play a role in maintaining competition and in ensuring that all firms have a high incentive to introduce product and process innovations and to ensure efficient business processes. Particular attention has been paid to high-growth firms in recent years. This is largely attributable to the fact that they make an essential contribution to job growth. As shown by studies for different countries, between 3% and 6% of high-growth firms create between 35% to 70% of the new jobs in existing firms depending on the country.[1] The concept of high-growth firms has also gained acceptance as a new indicator in the area of research, technology and innovation policy. The European Commission's new Innovation Output Indicator, for example, explicitly takes account of the contribution to job growth made by high-growth firms as one of its four constitutive elements.[2]

Although ambitious start-ups and high-growth firms create competition and contribute to job growth, their contribution to structural change is particularly relevant for RTI policy and for innovations. New technologies and new markets are often established by new firms that subsequently exhibit a high degree of growth potential.[3] Chapter 4.1.1. reveals where Austria is located in terms of enterprise creation (WIFO) and high-

1 See the summary article by Henrekson and Johansson (2010); Coad et al. (2014). The 3% to 6% high-growth firms relate to the old statistical definition of high-growth firms which provided for average annual growth of at least 20%, while the new definition provides for a lower growth benchmark of 10%. This change to the statistical definition results in an increase in the percentage of high-growth firms to an average of around 10% of firms with more than 10 employees.

growth firms based on a European comparison. Relevant research and innovation policy aspects are also examined.

4.1.1 Entrepreneurial dynamics and high-growth firms in Austria

The significance of new enterprises relative to existing firms is reflected in the enterprise birth rate. This is the proportion of births in a year relative to firms already in existence in the same year. Table 4-1 shows the number of active firms, births and the birth rate for Austria as a whole and by economic sector. There were 48,063 new enterprises formed in 2013. This corresponds to a birth rate of 8.3%. Most new enterprises are in the services sectors. While health and social services, along with other economic services, display a relatively high level of enterprise-creation activity, the areas of water and waste disposal as well as financial and insurance services are characterised by low enterprise birth rates.

The percentage of high-growth firms can also be found in Table 4-1. This relates to those employer firms that feature average annual growth of at least 10% in terms of the number of their employees over a three-year period. Only those companies that have more than ten direct employees at the start of the observation period are taken into account in order to avoid any distortion between the number of high-growth firms and the total number of firms employing people.

In terms of the employment intensity, it may be noted that for 2013 the contribution made by new enterprises in their year of birth equated to approximately 76,000 employees, which in turns corresponds to around 2.1% of employment in Austria overall. High-growth firms employed around 45,484 workers in 2014, which corresponds to a share of approximately 1.2% of overall employment. However, this number of employees does not correspond to the number of employees in a year, but instead consists of the number of employees at the start of the three-year observation period and the accruals over three years. This shows that the gross contribution of new enterprises and high-growth firms to employment is a crucial one; however, the contribution to the employment gains cannot be ascertained based on the existing data. Studies that use other data sources show that new enterprises are responsible for more than 35% of the jobs created in any year, while the contribution of high-growth firms in Austria is below the level of other European countries.[4]

An overview of the trends in the enterprise birth rates and the proportions of high-growth firms is provided in Fig. 4-1. This figure also shows the enterprise birth rates as published by the Federal Economic Chambers.[5] The increase of enterprise birth rates, and the proportions of high-growth firms over the last few years, clearly show the influence of the financial and economic crisis of 2008. When interpreting these figures it must be noted that the growth of the high-growth firms is calculated over a three-year period. The data for 2011, therefore, no longer takes account of the recession year 2008. The proportion of high-growth firms falls in the period of the crisis from 2008–2010 but then rises again after this. By contrast, the enterprise birth rates over the entire period feature a downward trend from 9.8% (2008) to 8.3% (2013).

The data from the Federal Economic Chambers shows another slight fall in entrepreneurial dynamics for 2014 (to 7.95%) and a rise to an av-

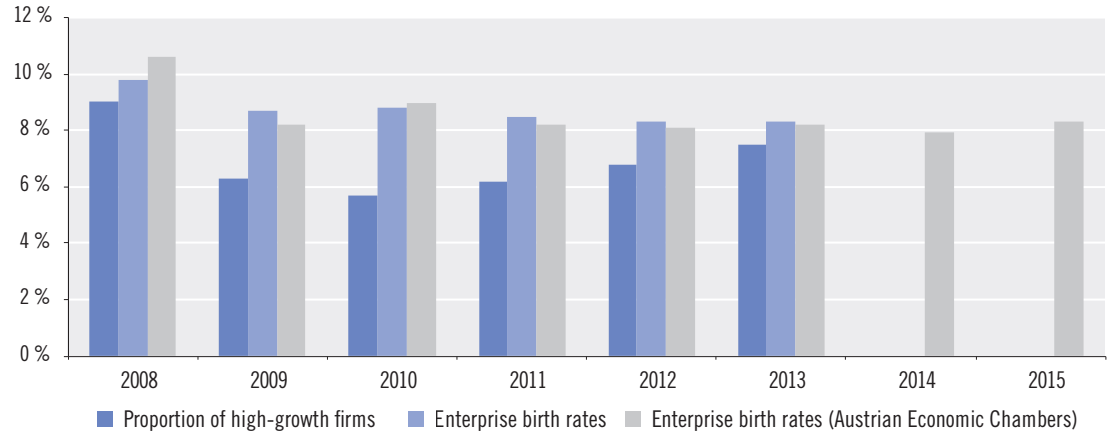
2 See European Commission (2013).
3 See Audretsch und Keilbach (2006).
4 See Hölzl (2011).
5 See Austrian Federal Economic Chambers (2016). The enterprise-creation data from the Austrian Federal Economic Chambers (WKO) is based on systematic assessments of the new members of the Chamber. This data differs in methodology from that of Statistics Austria in relation to the corporate definition, methodology and international comparability. However, the WKO data is more contemporary and has a high degree of correlation with the data trends from Statistics Austria in the period 2008–2013 (correlation coefficient of 0.96).

Table 4-1: Enterprise creation and high-growth firms in Austria, last point in time

	Enterprise creation (reporting year 2013)			High-growth firms (reporting year 2014)			
						Proportion (in %) of high-growth firms	
	Active firms	New enterprises formed	Enterprise birth rates (in %)	Employer firms with at least ten employees	High-growth firms with at least ten employees	Employer firms with at least one direct employee	Employer firms with at least ten direct employees
Total	**581,946**	**48,063**	**8.3**	**45,484**	**3,400**	**1.3**	**7.5**
Mining	453	26	5.7	121	7	2.5	5.8
Manufacture of goods	31,777	1,653	5.2	6,713	425	2.1	6.3
Energy supply	3,765	408	10.8	126	7	0.7	5.6
Water supply and rubbish disposal	3,169	135	4.3	304	17	1.4	5.6
Construction	41,720	3,023	7.2	5,896	399	1.5	6.8
Trade	101,985	7,485	7.3	9,223	627	1.1	6.8
Transport	18,107	1,573	8.7	2,583	199	1.8	7.7
Hotels and restaurants	56,679	3,582	6.3	6,139	402	1	6.5
Information and communications	27,277	2,163	7.9	1,349	169	1.9	12.5
Finance and insurance services	13,484	689	5.1	912	47	0.9	5.2
Properties and housing	13,181	1,203	9.1	358	22	0.5	6.1
Freelance/technical services	96,560	6,796	7	3,785	338	1	8.9
Other business services	24,588	3,206	13	2,546	303	2.7	11.9
Education	12,550	911	7.3	1,048	99	2	9.4
Health and social work	84,645	11,613	13.7	2,111	180	0.8	8.5
Art, entertainment and recreation	22,276	1,337	6	806	75	1.4	9.3
Other services	29,730	2,260	7.6	1,464	84	0.5	5.7

Source: Statistics Austria, Company demographics.

Fig. 4-1: Enterprise birth rates and proportion of high-growth firms in Austria (in %), 2008–2015



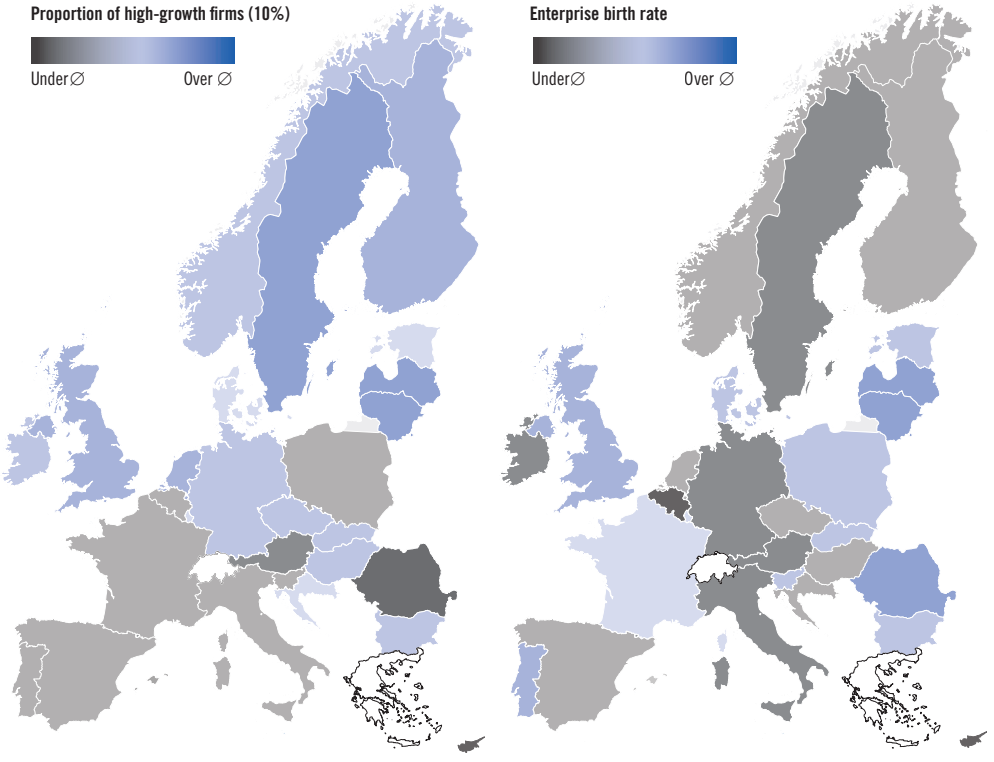
Source: Statistics Austria, Company demographics (available for the years 2008–2013); Austrian Economic Chambers, New enterprises (available for the years 2008–2015).

erage level once again for 2015 (8.3%). The unfavourable development in enterprise birth rates is partly attributable to the lack of any dynamic economic growth in Austria since the crisis. Enterprise birth rates also react to economic circumstances in the same way as corporate growth processes. However, a downward trend in entrepreneurial dynamics can also be ascertained for other European countries and the United States.[6]

4.1.2 Austria in international comparison

A precise stipulation of the determinants of high-growth firms and new enterprises, which are successful in the long term at the corporate level, is a difficult task. The few international comparisons on enterprise dynamics available show that there are significant differences in the number of new enterprises, high-growth firms and the enterprise dynamics between countries that are also relevant for innovation policy.[7] Against this background, the enterprise birth rates and percentages of high-growth firms (10%) are shown below in an international context (see Fig. 4-2). The data is aggregated over the period 2010–2013 but cannot be compared with the Austrian data stated previously because of the differences in accounting for different sectors. Economic sectors such as education and teaching, health and social services, art, entertain-

Fig. 4-2: Enterprise birth rates and proportions of high-growth firms (10%) in Europe



Note: Enterprise birth rates are average enterprise birth rates for the years 2011–2012. Proportions of high-growth firms are average values for the years 2012 and 2013.
Source: Eurostat, Statistics on enterprise demographics.

6 See Decker et al. (2014).
7 See Bravo-Biosca (2010); Bravo-Biosca et al. (2013); OECD (2014b).

ment and recreation as well as other services are not accounted for in the international comparison. According to this data, the average birth rate in the period between 2011 and 2013 is approx. 0.8 percentage points, and the proportion of high-growth firms approx. 0.2 percentage points below the national values stated in Table 4-1 and Fig. 4-1.

As Fig. 4-2 shows, in terms of enterprise birth rates, Austria, like most countries in Central and Northern Europe, is below the European average of 10.1%. The enterprise birth rates are higher than this in Portugal and in the UK in particular. The picture is a different one when we look at the share of high-growth firms. Austria also has a below-average percentage of high-growth firms here compared with the rest of Europe (European average: 9.6%). However, the leading innovative countries in Northern Europe, including Germany, feature above-average percentages of high-growth firms, while the Southern-European countries, France and Austria feature below-average values in a European comparison.

For research, technology and innovation policy not only aggregated enterprise birth rates and shares of high growth firms are not the only important indicators, the structure of new enterprise formation is also relelvant. The innovation activity of new enterprises and of high-growth firms differs significantly by technology area. High enterprise birth rates contribute less to long-term economic and job growth than does the structure of the new enterprises.[8] This is because only a very small proportion of founders manage to establish their firm successfully in the market. One of the consequences of these empirical observations is that greater attention is paid to high-growth firms as an indicator of overall economic relevance for entrepreneurship and start-ups.[9]

Table 4-2 shows the enterprise birth rates and employment shares of the sectoral aggregates. The economic sectors are presented according to statistical sectoral aggregations for technology-intensive production sectors and knowledge-intensive services used by Eurostat[10], while the country groups from the *European Innovation Scoreboard (EIS)* have been used for a consolidated presentation of the country dimension. This selection of aggregations enables sectoral and country differences to be presented concisely, with the focus on the policy-related dimensions of research and technology.

In terms of enterprise birth rates, it can be seen throughout the country groups that the Eastern and Southern-European countries consolidated in the Moderate Innovators and Modest Innovators country groups feature considerably higher enterprise birth rates than Austria or the Innovation Leader and Innovation Follower country groups. While Austria (see Fig. 4-2) features enterprise birth rates that are far below average in terms of the overall economy, this result improves when we look at the technology-based production sectors. In the high-tech sectors, Austria has considerably higher average enterprise birth rates than the Innovation Leaders and the Innovation Followers. This is in contrast to the sectors with medium technology intensity and to the low-tech sectors. In relation to services, however, it is clear that Austria remains well behind the Innovation Leaders and Innovation Followers. The low overall economic birth rate as compared with other European countries is primarily attributable to the below-average start-up intensity in the service sectors.

The proportion of employment, which is also presented in Table 4-2, confirms the finding that structural change in Austria has also been heavily characterised by a structural change within the sectors, and less by a structural change between the sectors. The proportion of employment in research, technology and knowledge-in-

8 See Shane (2008).
9 See Coad et al. (2014); OECD (2014b).
10 See http://ec.europa.eu/eurostat/cache/metadata/DE/htec_esms.htm

Table 4-2: Enterprise birth rates and employment in technology and knowledge-intensive production and services segments, average values for the years 2011–2013

	Austria	Innovation Leaders (DE, DK, FI, SE)	Innovation Followers (AT, BE, CY, EE, FR, IE, LU, NL, SI, UK)	Moderate Innovators (CZ, ES, HR, HU, IT, LT, PL, PT, SK)	Modest Innovators (BG, LV, RO)
			Enterprise birth rates in %		
Production sectors					
High-tech sectors	6.1	5.0	4.8	5.8	10.4
Sectors with medium technology intensity	4.7	5.3	6.0	7.9	11.6
Low-tech sectors	4.9	5.9	5.9	8.6	12.3
Services					
Knowledge-intensive services - High-tech	8.1	12.3	12.1	12.3	20.8
Knowledge-intensive services - Finance	5.1	8.0	8.7	14.2	18.4
Knowledge-intensive market services	7.5	10.5	10.2	10.9	15.2
Services with low knowledge intensity	7.9	8.2	8.6	10.8	14.4
			Proportion of jobs in %		
Production sectors					
High-tech sectors	7.0	12.2	5.2	6.1	6.3
Sectors with medium technology intensity	6.5	7.3	4.5	6.7	5.9
Low-tech sectors	4.6	3.8	3.1	5.7	10.0
Services					
Knowledge-intensive services - High-tech	3.6	4.4	4.8	2.9	3.7
Knowledge-intensive services - Finance	4.4	4.1	5.1	3.7	2.2
Knowledge-intensive market services	12.2	12.5	14.2	9.1	9.1
Services with low knowledge intensity	44.9	39.8	46.3	40.5	41.3

Note: High-tech includes the high-tech and medium high-tech manufacturing segments. See Table 7.1 in Annex I. for country abbreviations.
Source: Eurostat, Structural enterprise statistics, average values for the years 2011–2013.

tensive sectors is considerably below that of the Innovation Leaders.

Table 4-3 shows the shares of high-growth firms by sectoral and country groups. The shares of high-growth firms are presented on the one hand as percentages of employer firms with at least ten direct employees, and on the other as percentages of all firms. The more detailed presentation also provides nuances to the finding in Fig. 4-2. In the high-tech sectors, Austria's share of high-growth firms in all employer firms with at least 10 employees (9.9%) is just slightly below the Innovation Leader (10.6%) and Innovation Follower (10.2%) country groups, while in the industries with medium and low technology intensity the differences between Austria and the other country groups are considerably greater, particularly in the services segments.

When we look at high-growth firms as a percentage of all firms we see a very similar picture: with the exception of the high-tech sectors and knowledge-intensive market services, the percentage of high-growth firms in Austria is significantly below the levels in the comparison countries.

These results essentially confirm that Austria has a below-average level of enterprise dynamics in relation to new enterprises and high-growth firms.[11] However, we can also see that enterprise

11 See e.g. Hölzl (2010); Schibany et al. (2013).

Table 4-3: Shares of high-growth firms in technology and knowledge-intensive production and services segments, average values for the years 2011–2013

	Austria	Innovation Leaders (DE, DK, FI, SE)	Innovation Followers (AT, BE, CY, EE, FR, IE, LU, NL, SI, UK)	Moderate Innovators (CZ, ES, HR, HU, IT, LT, PL, PT, SK)	Modest Innovators (BG, LV, RO)
			Shares of high-growth firms: Proportion of employer firms with at least ten employees		
Production sectors					
High-tech sectors	9.9	10.6	10.1	13.3	11.9
Sectors with medium technology intensity	7.0	10.6	8.6	10.8	11.4
Low-tech sectors	4.7	7.2	6.4	8.9	9.7
Services					
Knowledge-intensive services - High-tech	11.6	18.7	13.9	14.0	11.5
Knowledge-intensive services - Finance	5.1	10.5	10.4	11.6	11.1
Knowledge-intensive market services	9.1	15.4	10.1	10.8	7.0
Services with low knowledge intensity	6.0	10.8	8.1	8.9	7.5
			High-growth firms: Proportion of all firms		
Production sectors					
High-tech sectors	3.2	3.1	3.0	4-2	4.1
Sectors with medium technology intensity	1.9	2.2	1.9	1.8	2.2
Low-tech sectors	0.8	0.9	1.0	1.0	2.2
Services					
Knowledge-intensive services - High-tech	0.7	1.5	1.0	1.0	1.0
Knowledge-intensive services - Finance	0.8	1.4	2.0	2.8	1.8
Knowledge-intensive market services	2.2	2.2	1.5	1.7	1.2
Services with low knowledge intensity	0.7	0.9	0.8	0.5	0.6

Note: High-tech includes the high-tech and medium high-tech manufacturing segments. See Table 7.1 in Annex I. for country abbreviations.

Source: Eurostat, Structural enterprise statistics, average values for the years 2012 and 2013.

dynamics in the high-tech sectors is certainly comparable with that of the Innovation Leader and Innovation Follower comparison country groups. The low overall economic enterprise dynamics in Austria is primarily attributable to the below-average enterprise dynamics in the services segments, while the differences in the production sectors are less pronounced.

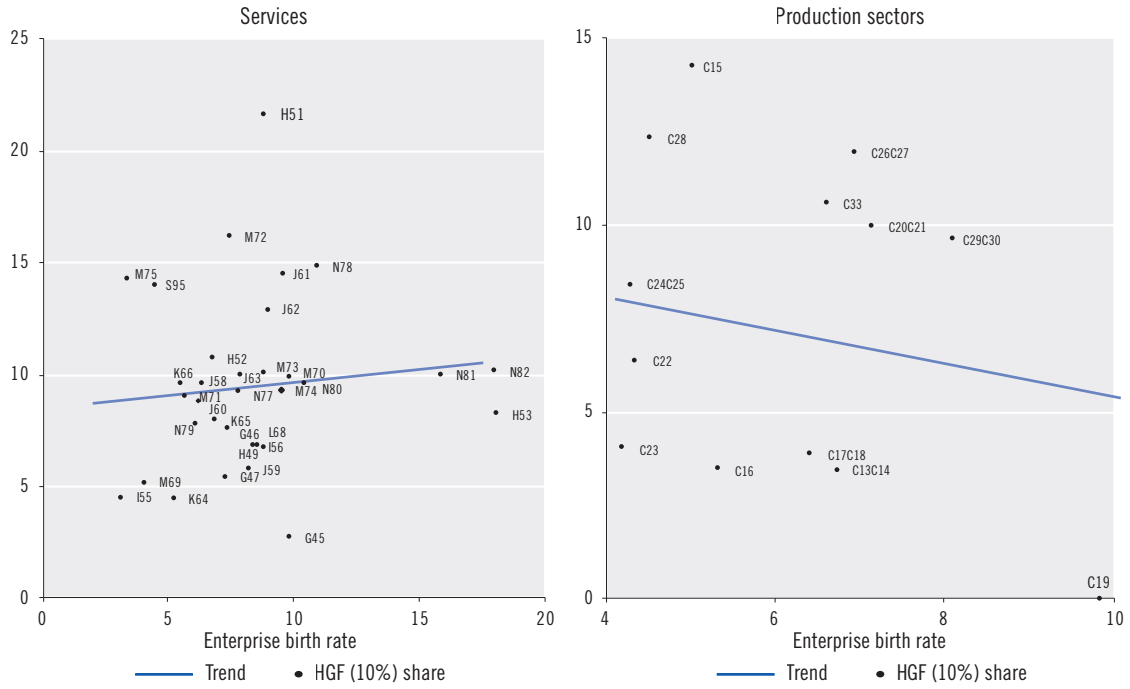
When interpreting these results, however, we must remember that the correlation between enterprise birth rates and high-growth firms is certainly not always clear. An increase in the enterprise birth rates does not result in an increase in the share of high-growth firms across all sectors. In many sectors, particularly in the production sectors, access to the market requires high levels of both tangible and intangible capital (e.g. routines, knowledge and expertise), which manifest themselves as structural barriers to entry. On the other hand, these same factors can lead to higher growth potential at the corporate level. Fig. 4-3 confirms that the systematic correlation between the birth rate and the percentage of high-growth firms is somewhat low and shows different links in different economic sectors.

As with the European countries as a whole, patterns vary between the services and production sectors in Austria as well. In the services segments, the correlation in Austria is marginally positive, but not significant statistically, unlike in the overall European sample (ϱ=0.1 for Austria, ϱ=0.5 for the European countries

sample) (see Fig. 4-3): Higher enterprise birth rates tend to be accompanied by higher shares of high-growth firms. In the production sectors, however, the correlation tends to be reversed. Higher enterprise birth rates are linked to lower shares of high-growth firms, although these correlations are not statistically significant (ϱ=-0.2 for Austria, ϱ=-0.3 for the European countries sample). This indicates that entry barriers are not at all the same as growth barriers. It can even be assumed that firms that are successful in these sectors will also be able to grow rapidly over a longer period based on more prolonged competitive advantages, for example as a result of innovation activities.[12]

As also set out in the enterprise-creation strategy by the Federal Ministry of Science, Research and Economy (BMWFW)[13], this empirical evidence shows that enterprise-creation policies aimed at boosting long-term and sustained competitiveness need to account specifically for the structure of new enterprises and the relevant sectors to which they belong, because merely increasing enterprise birth rates does not in any way necessarily result in more jobs and economic growth. The primary issue is to create entrepreneurial ecosystems where ambitious and specialist entrepreneurship has an opportunity to implement successful entrepreneurial concepts.

Fig. 4-3: Correlation between enterprise birth rates and shares of high-growth firms by sector



Note: HGF = High -growth firms. Sectoral values are unweighted averages for the period 2011 and 2013. See Table 7.2 in Annex I for a directory of sectors.

Source: Eurostat, Structural enterprise statistics. Calculations: Austrian Institute of Economic Research (WIFO).

12 Studies show that the extremely low level of persistence in economic growth – there are hardly any firms that are able to repeat their rapid growth in the next three-year period – is more pronounced in the production sectors than the services segments (see Ciraci et al. 2013).

13 See Federal Ministry of Science, Research and Economy (2015b).

4.1.3 Innovation activity of new ventures and high-growth firms

The effects of new enterprises and high-growth firms on structural change and employment can be partly attributed to innovation, research and development. This is why research, technology and innovation policy focuses so heavily on innovative new enterprises, in particular high-tech new enterprises. It has been shown for Austria that, in relation to knowledge and technology-intensive new enterprises, firms that feature higher research and innovation intensity also feature job growth.[14] We also see that research and innovation are important growth factors for high-growth firms in developed countries, in particular those close to the technological frontier.[15] In general, it may be stated that R&D expenditure (measured as a proportion of turnover) has a greater impact on the growth of those firms featuring the highest growth.[16] Fig. 4-4 shows the correlation between R&D intensity, at the country level, with both of the indicators for enterprise dynamics. There is a negative relationship for the enterprise birth rates. Countries with high levels of R&D expenditure tend to have lower enterprise birth rates in the overall economy than countries with a lower

Fig. 4-4: Correlation between R&D intensity and enterprise birth rates as well as shares of high-growth firms

Note: HGF = High Growth Firms. Values are unweighted averages over the period 2011–2013. See Table 7.1 in Annex I. for country abbreviations.

Source: Eurostat, Structural enterprise statistics. Calculations: Austrian Institute of Economic Research (WIFO).

14 See Falk and Spitzlinger (2013).
15 See Hölzl and Friesenbichler (2010); Hölzl and Janger (2014).
16 See Falk (2012); Coad and Rao (2011); Coad et al. (2014).

R&D intensity. On the other hand, the relationship between high-growth firm shares and R&D intensity is vaguely positive.

However, consideration of the sectoral and country level conceals some important aspects that occur at the corporate level. The literature available on high-growth firms shows that the determinants for high-growth are highly firm specific. The heterogeneity at the enterprise level, however, is barely accounted for if at all. There are, for example, firms with no innovation activities in the high-tech sectors just as there are firms that show innovation in the low-tech sectors. One important question that cannot be answered using sectoral or country data is whether the innovation activity of high-growth firms differs significantly from that of other firms. There is evidence[17] here to suggest that the innovation activity (not R&D intensity) of high-growth firms barely differs from that of similar, non-high-growth firms active in the same sector.

There are barely any differences in the ranking of the sources of information for innovation activity and the assessment of the most important partners. The most important sources of information, for both high-growth firms as well as for non-high-growth firms, are internal company sources of information, followed by suppliers and customers. While it is true that high-growth firms consider universities, research institutions and scientific publications to be more significant as sources of information in the high-tech sectors than do their non-high-growth competitors, it can also be seen that the differences between the sectoral groups are significantly greater than the differences between the assessments of the high-growth firms and those of the non-high-growth firms within the sectoral groups. High-growth firms are incorporated into their specific sectoral and local innovation systems.[18]

4.1.4 Summary

The overview of enterprise formation and high-growth firms shows that Austria features considerable differences in relation to the Innovation Leaders in terms of the statistical indicators on enterprise dynamics. However, we can also see that the gap between the technology-oriented production sectors, which are important for structural and innovation policy, and the Innovation Leaders is very minor if it exists at all. Nevertheless, the entrepreneurial dynamism is much weaker in Austria in terms of new enterprises and high-growth firms in knowledge-intensive services than it is in the comparison countries. Yet this dynamism is important for the purpose of increasing the economic influence of the research, technology and knowledge-intensive sectors in order also to ensure long-term growth. With regard to the subsequent Chapters 4.2 and 4.3, it should certainly be emphasised at this point that initiatives that take a broad approach to improving enterprise dynamics in terms of the revival of entrepreneurial ecosystems and high-growth firms have been implemented by the federal government in recent years, for example in the venture capital area (see also Chapter 2.2.4). Increased attention is also being paid to the needs of innovative enterprise creation and high-growth firms within the scope of existing support measures in the area of technology and corporate funding, such as those depicted in the "Country of Entrepreneurs" initiative.

4.2 Academic spin-offs in Austria

Research, technology and innovation-based new venture formation (RTI) plays an important role for economic growth, job creation and structural change. Academic new enterprises represent a specific group of young firms that have major po-

17 See Hölzl and Janger (2013); Hölzl (2016).
18 See Hölzl (2016).

tential for growth and dynamism, and these have received increasing funding in Austria for approx. the last 15 years. Funding RTI-based new enterprises is an important objective of the federal government's RTI strategy. Recent RTI-policy strategies, such as the Federal Ministry of Science, Research and Economy's action plan for a competitive research area, formulate targets and measures aimed at funding academic spin-offs and entrepreneurship at universities with the aim of ensuring that universities and non-university research institutions place greater focus on the framework conditions for successful spin-offs. There have also been strategies and targets in place for some time aimed at funding firms at the early stages (e.g. seed financing) and at providing a boost to the venture capital market in Austria, which have a particular significance in terms of developing spin-offs.

This chapter goes into further detail about the development of academic spin-offs against the background of these strategies and targets, and the increased significance of entrepreneurship.[19] A distinction is made first of all between spin-offs as compared with other types of enterprise creation. The issue as to how academic spin-offs can receive comprehensive support will also be addressed below, along with the concepts of the entrepreneurship ecosystem and the entrepreneurial university that explain the factors that essentially determine the emergence of academic spin-offs. The important RTI-policy measures from the last few years will then be described, with an assessment of their impact.

4.2.1 Definition of academic spin-offs

Academic spin-offs are new firms that have the idea and foundation of their business based on research results that were developed at a university or research institution.[20] As such, they commercialise knowledge and technological developments generated at universities and public research institutions. Academic spin-offs are research, technology or innovation-based and represent a sub-group of RTI-based new ventures.[21]

There are no systematic empirical findings or statistics on the development of academic spin-offs in Austria at present.[22] More recent international comparative studies on academic spin-offs based on surveys at universities and research institutions do, however, find that the potential for spin-offs is not yet exhausted at Austrian universities and research institutions as compared with other European universities.[23] The key figure stated in the Intellectual Capital Statements (Wissensbilanzen) on exploitation spin-offs is 15 spin-offs in 2014. The universities list those spin-offs in their Intellectual Capital Statements in which the university is directly or indirectly involved or where the firm would not have been founded without using new research results or a property right resulting from these.

An assessment of the Austrian Research Promotion Agency's AplusB programme shows that more than 500 spin-offs have been funded since it was launched in 2001. The number of academic spin-offs is greater, however, since only a partic-

19 The chapter is essentially based on work by Fürlinger (2014); Fürlinger and Leitner (2016a, 2016b); Ecker and Gassler (2016); Hammerer (2016) and Ploder et al. (2015).

20 A distinction is frequently made in the literature between "exploitation spin-offs" and "competence spin-offs". Exploitation spin-offs are spin-offs for which actual research results or new procedures were used for the new enterprise. Competence spin-offs on the other hand use special abilities and knowledge which the entrepreneurs have acquired in science (see Egeln et al. 2003).

21 Since spin-off new enterprises generally involve high business risk and major growth potential, they can often simply be categorised as start-up firms. Start-ups can be defined as such that pursue an innovative business idea and feature a particularly high risk, whereby they have particular funding requirements in the form of the provision of venture capital, which also requires growth at the same time.

22 Reference can be made to an initiative to establish a start-up monitor for Austria which is aimed at identifying start-ups and spin-offs and analysing their performance over the course of time, see http://www.austrianstartupmonitor.at

23 See Arundel et al. (2013) as well as Ecker and Gassler (2016).

ular section of all academic spin-offs go through the AplusB programme. Over the last few years, in particular, a series of measures have been implemented by a wide range of stakeholders who offer support services and look after many new enterprises and their founders.

4.2.2 Significance and factors for the success of academic spin-offs

The literature provides a series of findings on the significance of academic spin-offs in terms of economic development and structural change. There are good reasons why university spin-offs have gained attention as tools for commercialising academic research in recent years: firstly, these spin-offs feature a particularly high potential for developing innovative products, as compared with the creation of enterprises with no academic background.[24] The commercialisation of academic research, using spin-offs, brings technologies to the market that may not otherwise be realised or realised to their full potential.[25] Secondly, this results in job creation and in demand for highly qualified staff.[26] The new firms offer job opportunities to local talent and thus also play a role in stemming the brain drain.[27] Thirdly, these jobs can also be considered to be safer than other jobs at new enterprises based on a comparison of their survival rates. A study of spin-offs at the ETH Zurich revealed that 90% of the 153 spin-offs formed between 1998 and 2008 were still operating five years later.[28] In addition, academic spin-offs challenge established firms and this contribute to competition in the markets.

Enterprise-creation researcher Scott Shane carried out one of the most comprehensive studies of university spin-offs at the MIT – Massachusetts Institute of Technology.[29] According to his study, there are certain factors that are central to the spin-off process. Firstly, he emphasises that the qualifications of the new enterprise founders should complement each other as much as possible so that both the technical as well as the economic side of the spin-off are able to develop based on the relevant division of labour. Secondly, he points to the significance of the private equity acquired that allows the team to develop the technology further and to hire additional employees. In addition to this, capital which stems from a source with a good reputation (e.g. from a well-known venture capital firm) also acts as a seal of quality and lets the firm appear more attractive to external stakeholders. Thirdly, the spin-off must get a grip on the technology push problem and be capable of adapting products to customer requirements and identifying market applications. Finally, a flexible relationship with the university can help in keeping costs low. Intermediaries (e.g. liaison offices and incubation centres) can also help to increase the success of spin-offs.

4.2.3 The entrepreneurship ecosystem for academic spin-offs

In recent years, academic literature has been dedicated increasingly to the issue of the process for funding enterprise creation in general, and to RTI-based new ventures in particular. The concept that gains significance here is that of the entrepreneurship ecosystem, which is a concept that goes back to Daniel Isenberg. He defines it as: *"a set of networked institutions […] with the objective of aiding the entrepreneur to go through all the stages of the process of new venture development. It can be understood as a service network, where the entrepreneur is the focus of action and the measure of success."*[30]

24 See Blair and Hitchens (1998).
25 See Etzkowitz (2003).
26 See Tool et al. (2015); Czarnitzki et al. (2014).
27 See McDevitt et al. (2014).
28 See Veugelers (2014).
29 See Shane (2004).
30 See Isenberg (2011).

According to Isenberg, an entrepreneurship ecosystem consists of politics, markets, finance capital, human capital, culture and support. The argument here is that a prospering entrepreneurship ecosystem can only be established based on a holistic approach that supports the interactions between the various elements and takes account of the local conditions. The entrepreneurship ecosystem has a significant influence in terms of the funding of academic spin-offs in particular. The section below examines the individual factors and their relevance for establishing spin-offs.

Policy makers and the public sector play a central role in the entrepreneurship ecosystem, for example by funding R&D and generating demand for new technologies. Policy has a direct impact on new enterprises, as well as an indirect impact on other factors in the ecosystem. In addition to direct research funding, policy makers also have additional options available for the purposes of supporting the entrepreneurship ecosystem and academic spin-offs: these include the legal framework (company law, commercial law, tax law) and other regulatory measures (market intervention). Legal issues related to intellectual property and the regulation of exploitation rights, such as whether these rest with the university or research institution or with the inventor, are additional important factors for academic spin-offs.

Regional and national market conditions, and the access to international markets, provide opportunities and determine the framework conditions for enterprise creation. It is therefore important for new enterprises – particularly in smaller countries such as Austria – to think globally right from the start and ensure that they take an international approach to their business activities and to the market. Austria's position in Central Europe, with its many contacts in Eastern Europe, also provides a head start.

The funding opportunities provided by Business Angels and venture capital are additional factors in the entrepreneurship ecosystem. Aside from private venture capital, the public sector also acts as a risk financier in Austria and many other countries, and, for example, funds government venture capital companies. There is now a wide range of funding instruments for academic spin-offs from the early stages through to the growth phase. These include the Austrian Research Promotion Agency's (FFG) Start-up Initiative and the PreSeed and SeedFinancing instruments of the Austria Wirtschaftsservice (aws). The i2-Business Angel Platform of the Austria Wirtschaftsservice is also significant as a communication channel between entrepreneurs and potential investors. In addition, the public sector has also started to invest in entrepreneurs via investment firms (generally as co-investors), and has, thereby, provided momentum to the venture capital market in Austria. Examples of this are the Austria Wirtschaftsservice's (aws) Start-up Fund established in 2013 and aws Business Angel Fund. As a subsidiary of the Austria Wirtschaftsservice (aws), the Start-up Fund has private equity available of approx. €68.5 million and is involved as a co-investor in high-growth new enterprises. More details on venture capital funding can be found within the scope of the Mid-term Report RTI Strategy (Chapter 2.2.4).

Public sector funding plays a central role in the research and early technology development phase in particular.[31] This influence should, however, decrease gradually the more the product is developed or the service progresses so as not to distort the (investment) market. Funding by private or institutional investors is a good indicator of the market potential of the services offered by a new enterprise. Both business angels and venture capitalists provide more than pure financial support to new enterprises. Because of their entrepreneurial experience, they are able to provide important feedback on development of the product or the service and thereby reduce the likelihood of failure. There has, however, been a need

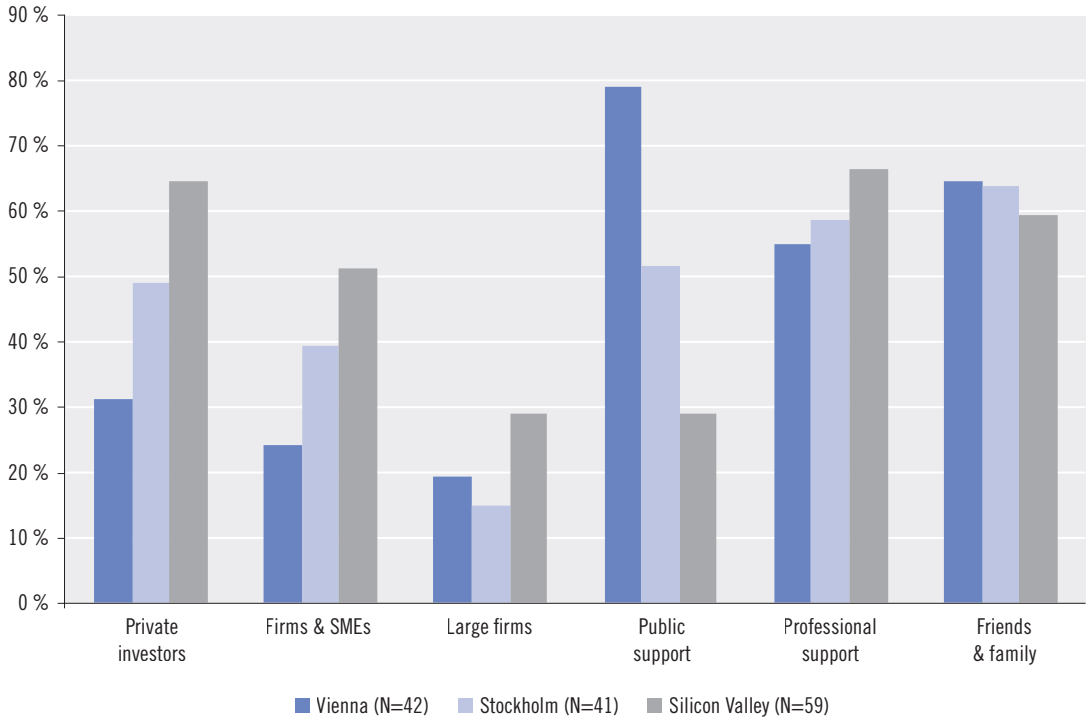
31 Reference can also be made here to the work of Mazzucato (2011) which emphasises the role of the government and show's how firms benefit above all from funding at the early stage and from government-funded technologies.

for Austria to catch up in terms of these types of private investor commitments Fig. 4-5).[32]

The effectiveness of an entrepreneurship ecosystem depends heavily on talented individuals. The human capital provided by universities is one of the most important components for a well-functioning entrepreneurship ecosystem. Enhancing the training of students and researchers in the area of entrepreneurship at universities is important in order to increase the number of spin-offs.

Both local and national culture shape the motivation for founding new firms. The entrepreneurial spirit depends initially on the individual's predisposition and aptitude. Largely, however, this is also determined by the environment, the framework conditions and the general mood within a country. Individual countries also differ in terms of their entrepreneurial commitment. Countries in Europe, as well as in Asia, generally feature a low level of tolerance about failure in business. Business failure and insolvency carry a heavy social stigma in Europe: persons who go bankrupt are generally considered to be failures and find it difficult to arrange funding for any new undertaking.[33] In the United States, on the other hand, entrepreneurial failure is generally seen as being acceptable. Insolvency law there allows failed entrepreneurs to start again relatively quickly and the bankruptcy is viewed as part of the learning process.

Fig. 4-5: Comparative analysis of the significance of different stakeholders for the development of academic spin-offs in Austria, Sweden and the United States (in %)



Note: Question: "Which type of actors have you used to develop your firm?"
Source: Fürlinger and Leitner (2016).

32 In this context see the recommendations of the ERA Council Austria. https://era.gv.at/object/event/1799
33 See European Commission (1998).

One important cultural phenomenon in a sustainable entrepreneurship ecosystem is reciprocal stimulation and support between entrepreneurs. Many successful entrepreneurs are investors, consultants or members of executive boards of new enterprises who provide capital, experience and contacts from their personal network to entrepreneurs. These mentors also act as an important link between the market and the university. Platforms should be created that allow these different groups of people to meet each other on an equal footing in order to bring potential mentors together with academic business founders.

Geographical vicinity is indispensable for innovation and entrepreneurship. A lower geographical distance between individuals results in a higher number of (spontaneous) face-to-face meetings and an increased amount of communication. Accordingly, an entrepreneurship ecosystem requires physical infrastructures that serve as places for the stakeholders to meet. Examples of these types of meeting points include incubators, accelerators and co-working spaces.

The successful commercialisation of research results primarily involves overcoming the "structural gaps" that exist between the scientific community and the different stakeholders in the market (professional managers, investors, partners from industry, etc.).[34] Systematic ways must be found accordingly in order to bridge these gaps between the networks. The significance of social networks in different ecosystems (Vienna, Stockholm, Berlin, New York, Boston and Silicon Valley) was recently examined in a comparative study on academic spin-offs. Fig. 4-5 shows an example of the stakeholders with whom spin-offs cooperated in three selected ecosystems (Vienna, Stockholm and Silicon Valley) for the purposes of developing their firms.[35]

The study shows that there is a disproportionate level of public support in Vienna compared with Stockholm and Silicon Valley. This relates both to active commitment by government institutions in the area of enterprise creation as well as the generously equipped public funding landscape. At the same time, we can also observe that cooperation with private investors, entrepreneurs and SMEs in setting up the spin-offs is comparatively low. The newly formed spin-offs lose some important benefits as a result because these stakeholders have significant experience in enterprise creation and are generally well connected within the market.

4.2.4 The concept of the entrepreneurial university

Aside from the concept of the entrepreneurship ecosystem the idea of the entrepreneurial university is also increasingly finding its way into the discussion surrounding academic spin-offs.

The term "entrepreneurial university" was coined by Henry Etzkowitz[36] and describes the development of a higher education system that also emphasises economic development in addition to the traditional tasks of teaching and research. Entrepreneurship at the university level requires a corresponding mentality that penetrates through the overall university organisation and the internal working environment, and is thereby capable of overcoming different hierarchical and internal conflicts.[37] Academic and entrepreneurial processes and activities are enshrined within an entrepreneurial university and are ideally internalised by each individual academic.[38]

The entrepreneurial university is accordingly more than a producer of new firms: it also signifies that the university acts in an entrepreneurial manner as a whole.[39] In a similar process to the concept of the entrepreneurship ecosystem, it is

34 See Mosey and Wright (2007).
35 See Fürlinger and Leitner (2016b).
36 See Etzkowitz (1983).
37 See Yusof and Jain (2010).
38 See Brennan et al. (2005).
39 See Etzkowitz (1983); Gibb (2007).

argued here that a series of institutional, cultural and financial factors determine whether universities are capable of acting in a more entrepreneurial manner and accelerating the pace for generating academic spin-offs. The commercialisation of research results by spin-offs, such as in the form of licence fees, is at the same time an important source of income for universities. However, spin-offs also depend on the commitment and responsiveness of universities, because exaggerated expectations related to income and licences are incompatible with entrepreneurial risk as well as with the financial solvency of new enterprises.

The spin-off process is a crucial component in the transfer of knowledge, and in the contribution of universities to solving economic and societal issues, is also considered in the context of the discussion surrounding the Third Mission of universities. Producing new firms is increasingly seen by universities themselves as evidence of the quality of their research and training and is prominently marketed accordingly. However, spin-offs also act as future research partners, create jobs and career options, and the stories of success in turn contribute to a university's reputation. An active entrepreneurial culture at universities also generally strengthens their position in relation to international competition for talent and brains. The support infrastructure is particularly important here as already stated. For this reason, we will now take a closer look at infrastructures that promote spin-offs.

4.2.5 Infrastructures that promote spin-offs

Compared with other types of new enterprises, academic spin-offs have a particular need for support and supervision, which cannot be provided adequately by traditional advice offerings and infrastructures.[40] As such, incubator programmes have been put in place in many countries over the last few years which are often funded by the public sector. This special form of incubation centre promotes the development of new enterprises using different resources and strategies, such as legal assistance (e.g. intellectual property rights), networking with other entrepreneurs, marketing, help with finance management, and improving presentation techniques. Incubators support new firms primarily during the earlier stages in searching for partners, with the aim of finding a reproducible and scalable business model. At the end of the incubation phase, the prototype (product or service) should have been successfully launched on the market and, ideally, the new enterprise should have already been acknowledged by its first customers in the market.

The AplusB programme

The AplusB programme was set up in Austria in 2001 to promote academic spin-offs at universities and research institutions based on a specific infrastructure and a support model aligned with local requirements. Academic spin-offs are defined as enterprise creation by individuals with an academic background. The AplusB programme is funded using federal and regional government funds and private sources, with the federal government's contribution (of approx. €32 million in the period from 2002 to 2012) making up around one-third of overall funding. Seven AplusB Centres were being funded as at the end of 2015 by the Austrian Research Promotion Agency (FFG) in the 2012–2017 funding period. These are accent NÖ (at three sites), Build! Kärnten, CAST Tirol, INiTS Wien, Science Park Graz, Tech2b OÖ and ZAT Leoben. Aside from universities and universities of applied sciences, government funding agencies and companies are also frequently co-owners of the institutions organised as a "GesmbH" (Austrian private limited company).

The AplusB Centres maintain close connections with universities in particular, and have

40 The technology parks and innovation centres set up in the 1990s which are not generally focused on academic spin-offs can for example be mentioned here. These generally represent a beneficial and attractive environment for entrepreneurs.

good links with other local stakeholders. The Centres offer a wide range of support services, which include individual advice and coaching, provision of office premises, raising public awareness and support with funding and internationalisation. The incubators also have a different thematic orientation against the background of the relevant priorities and directions of the universities and technical colleges.

The AplusB Centres focus on academic spin-offs by scientists, students and graduates, although the target group was expanded in the second funding period from 2007 to include academics with professional experience from a business environment.[41] According to a recent evaluation[42] of the AplusB programme, 486 firms were founded between 2002 and early 2014 with support from the Centres, with 386 of these firms still operating by early 2014. A firm was formally founded for approximately 86% of the accepted projects. The majority of the spin-offs rely on the Centre as a formal new venture following the incubation period.

In terms of the thematic orientation of the individual new enterprises in the different AplusB Centres, it can be seen that approximately 84% of the AplusB new enterprises recorded belong to the services sector. New enterprises in the area of information technology-based services represent the most significant sector, followed by other knowledge-intensive services.

Compared with other enterprise creations, the AplusB enterprises feature higher R&D propensities and intensities according to an assessment of the programme. Their survival rate is also higher, which is also linked to the selection process that firms undergo before they are accepted into an AplusB Centre. There are no significant differences identified between the Centres or sites in terms of the ability of the supported firms to survive. A survey of entrepreneurs also reveals that approximately 30% of them state that their firm would not have been founded without the AplusB programme.

The AplusB new enterprise monitoring by the Austrian Research Promotion Agency (FFG) also records the obstacles and challenges faced by AplusB entrepreneurs. A lack of appropriate sources of funding, plus a lack of qualified staff and lack of knowledge of the market and customers, represent the most significant barriers, and indicate the specific support requirements that entrepreneurs have.

The data from the AplusB monitoring and evaluation also reveals the role of women in the enterprise-creation process. In terms of the number of female entrepreneurs, the data shows that only around 9% of all initial entrepreneurs are women. The percentage, therefore, is even significantly below the average percentage of women at technical universities and non-university research institutions in Austria. Recently, greater attention has been paid, therefore, to funding women as potential entrepreneurs. The Gender working group at the AplusB Association supports the Centres throughout Austria in their efforts to integrate gender mainstreaming into everyday life and to develop specific offerings.

Additional initiatives receiving public funding

Aside from the AplusB programme established in 2001, reference may be made primarily to the "Knowledge Transfer Centres and IPR Exploitation" funding programme launched in 2014 by the Federal Ministry of Science, Research and Economy (BMWFW) that aims to provide comprehensive and long-term support services which are required for enterprise creation. The aim is to fund the commercialisation of research results at universities with a wide range of different partners that go beyond the partnerships already established between science and industry (e.g. COMET, CD laboratories). Providing incentives

41 As part of the expansion in the service range through the "AplusB 2.0" Directive in 2011, centres are increasingly offering activities for non-academics and thereby not only supporting academic new enterprises or traditional spin-offs.
42 See Ploder et al. (2015); see also Chapter 5.1.

within universities for developing inventions and patents with a high potential of exploitation through the knowledge transfer centres connected with the universities is another objective. The regional (East, South, West) and thematic knowledge transfer centres (Life Sciences) provide an important infrastructure for funding spin-offs. Joint educational and training events related to entrepreneurship and intellectual property rights aimed at students and researchers are offered in the knowledge transfer centres.

The Research Studios Programme offered by the Austrian Research Promotion Agency (FFG) is also aimed at funding the commercialisation of research results by entrepreneurs, although this addresses a later phase than the AplusB programme or the knowledge transfer centres.

Reference can also be made to the JumpStart Programme set up by the Austria Wirtschaftsservice (aws) in 2015 for the purpose of supporting existing and new incubators and accelerators. The first tender took place in 2015, with the Speed Start Studio (Dornbirn), Impact Hub Vienna, i²nkubator at the Vienna University of Technology, Sektor5/5starts (Vienna) and Up To Eleven (Graz) funded from 2016 on. The new programme aims to provide customised consultation services to innovative entrepreneurs in addition to office, laboratory and production space. Explicit reference is made to the fact that the Austria Wirtschaftsservice's JumpStart Programme is not limited to supporting academic spin-offs.

Private incubators and initiatives

In addition to the infrastructures receiving public funding, there are also increasing numbers of private initiatives in Austria providing support to young entrepreneurs with an academic background. These include for example co-working spaces, where entrepreneurs are able to work alone or in a team. While some co-working spaces simply provide office space, an internet connection and a printer to their tenants, others also organise events, professional talks and workshops on certain topics.

Some of the private co-working spaces, incubators and accelerators on offer include for example i5invest Inkubator, Treibhaus, the BizSpark Microsoft Programme, Kubator, the co-working space in the Cisco Office at the Millennium Tower, Matchmaker Ventures, the A1 Start-up Campus and the Frequentis Start-up Centre. While these are not explicitly aimed at academic new enterprises, they certainly attract innovative new enterprises and offer an attractive infrastructure to service and IT-based academic spin-offs. The increasing supply is also a response to the demand from entrepreneurs and an expression of the development in enterprise culture in Austria.

4.2.6 Funding spin-offs at Austrian universities

Austrian research and higher education policy implemented important framework conditions for funding academic spin-offs with the 2002 University Act, which also provided universities with the opportunity of registering patents themselves. However, the technical universities in particular had already established initial technology transfer facilities in the 1990s.

Austrian universities started to institutionalise their knowledge and transfer activities with implementation of the 2002 University Act in particular, and to promote and fund the creation of spin-offs in addition to their strategic processes for patents.[43] An international comparative study among managers at universities does, however, show that self-perception of entrepreneurship skills is still below the European average.[44]

43 There is also increasing criticism in the literature of the role of technology transfer offices, particularly related to the narrow focus on technology licensing (see Lowe 2006). Licensing only has a limited effective role in creating and developing spin-offs and the argument is made that focusing on licensing of technologies as a means of linking universities and manufacturing restricts the understanding of the university's role as regards technological progress in society (see Grimaldi et al. 2011).

44 See Davey et al. (2013).

Guidelines for reporting on the implementation of property right and exploitation strategies were also provided to the universities. These take into account the individual spin-off strategies with their targets and actions.

Numerous targets and actions related to knowledge and technology transfer were set out between the Federal Ministry of Science, Research and Economy (BMWFW) and the individual universities in the current performance agreements for the 2016–2018 period, including further development of property right and exploitation strategies (knowledge transfer strategies). The specific funding targets and actions of the "Knowledge Transfer Centres and IPR Exploitation" Programme were also incorporated into the performance agreements, because the programme is aimed in particular at promoting enterprise creation at the interface between science and industry more forcefully than has previously been the case. Entrepreneurship by students and by researchers at the universities is being boosted further by using targeted educational and training measures within the scope of numerous partnership projects in the knowledge transfer projects.

Frequently, the expansion of Third Mission activities, and the development of universities that are more entrepreneurial, are defined as higher-level targets in the performance agreements.

Some example actions and targets are presented below. The University of Vienna, for example, founded the U:start Programme in 2014, a specific training programme for young entrepreneurs that is due for further expansion in the future. The Technology Transfer Office at the University of Vienna also supports the University's spin-offs as well as the management of intellectual property rights.

Like some other universities, the University of Graz has set itself the target of increasing awareness of entrepreneurial action among students at all faculties. Aside from its commitment to the Science Park Graz, and to the Knowledge Transfer Centre South, the University of Graz also plans to establish a Centre for Knowledge and Innovation Transfer (ZWI) – a meeting place between university and industry with room for spin-offs. Reference can also be made to the TIMEGATE (Transfer Initiative for Management and Entrepreneurship Goals, Awareness, Training and Employability) Programme funded using university structural funds and aimed at all students at the Graz universities. Numerous activities take place at the Centre of Entrepreneurship and Applied Business Studies.

Graz University of Technology works together with the University of Graz at the *Entrepreneurial University* site partnership, thereby combining a series of complementary activities aimed at promoting entrepreneurship. The importance of spin-offs is also depicted in Graz University of Technology's Start-Up and Spin-Off Road Map.[45] The Science Park Graz is also due to be expanded to include an incubator centre for the European Space Agency.

Vienna University of Technology has set up the Informatics Innovation Centre (i2c) in recent years, which offers numerous measures (training programmes, mentoring, investor days, Start-Academy, etc.) for IT students, but which will increasingly operate across all faculties in future. The Centre will position itself as an entrepreneurship and innovation centre in future and also receive funding under the JumpStart Programme.

The academic start-up network akostart oö at the University of Linz is a cross-university network for academic start-ups and spin-offs that offers numerous services for entrepreneurs and also provides a co-working space.

The University of Innsbruck is also increasingly active in funding entrepreneurship and spin-offs. The University of Innsbruck has its own enterprise participation model that makes a distinction between three different types of participation: i) in research enterprises (e.g. participation in competence centres); ii) in transfer facilities (e.g. participation in incubators); and iii) in spin-offs. The University participates in 14 commercial spin-offs via its holding company. The Entrepreneurial Campus at the University of Innsbruck is a project defined in the performance

agreement aimed at enshrining an entrepreneurship mentality across all faculties.

The Vienna University of Technology, Graz University of Technology, University of Graz, University of Innsbruck, Medical University of Vienna, University of Veterinary Medicine Vienna, University of Leoben and the University of Natural Resources and Life Sciences Vienna have all explicitly set out the guiding principle of the *Entrepreneurial University* in their 2016–2018 performance agreements. This involves more than merely supporting funding for spin-offs: the literature here covers entrepreneurial actions in the broadest sense as described above, including also the areas of university management and teaching. Nevertheless, it may be stated that the concept of the entrepreneurial university has been discussed frequently in the context of funding entrepreneurship training among students and funding spin-offs up to now.

The medical universities also see themselves as hotbeds for young, research-based enterprises. The Medical University of Vienna for example has a stake in the spin-off Xiber. The Medical University of Graz is involved in the Life Science Incubator that is part of the Centre for Knowledge and Technology Transfer founded in 2013. Like other universities, the Medical University of Graz has developed guidelines for funding spin-offs, which inter alia define the property rights, and that also provide that the University premises can be used by new enterprises for a certain period. As well as appealing to students, the University of Veterinary Medicine Vienna also wants to expand entrepreneurship skills in a targeted manner among scientists and managers as part of its LeadingVet leadership programme.

The University of Natural Resources and Life Sciences Vienna is striving to establish an incubation centre at each of its three sites. In 2015, an incubation centre was set up at the Vienna University of Economics and Business aimed at increasing the quality of new enterprises by students, alumni and scientists on a sustained basis. The Entrepreneurship Centre Network (ECN) is a platform for linking students from different subject areas. The platform was founded by six Viennese universities and serves as a point of contact for students interested in entrepreneurship. Among other things, students and young entrepreneurs are also given the opportunity of spending a few months with experienced entrepreneurs abroad via the Erasmus for Young Entrepreneurs exchange programme funded by the European Union.

In 2014, the number of "exploitation spin-offs" emanating from universities was 15 according to the Intellectual Capital Statements (Wissensbilanz). This number is low when compared internationally, partly because of the definition and eligibility criteria, but also because the universities are not yet able to record these in their entirety. According to information provided by the universities, however, there are a number of spin-offs at the preliminary foundation stage, and this number can therefore be expected to rise accordingly.

An international comparison also shows that the latest measures implemented by Austrian universities already cover many of the elements implemented by renowned universities internationally (e.g. the University of Zürich, University of Munich, Delft University in the Netherlands, Technical University of Denmark).[46] Nevertheless, it may be noted that comparable universities had already started to fund entrepreneurship at universities many years ago.

The Austrian universities of applied sciences are also beginning increasingly to address the concept of the entrepreneurial university. The Management Centre at Innsbruck that positions itself as a prominent entrepreneurial university may be mentioned here for example. The University of Applied Sciences at Wiener Neustadt cooperates with the AplusB Centre "accent" in the areas of raising awareness, generating ideas

45 See http://www.fth.tugraz.at/startupmap
46 See details in Gassler and Ecker (2016).

and qualifications. The University of Applied Sciences in Upper Austria has set up a separate office for funding academic spin-offs. Like the Carinthia University of Applied Sciences and Management Centre at Innsbruck, it is also involved as a shareholder in the relevant local AplusB incubators.

Lastly, IST Austria has also started recently to fund spin-offs systematically. Researchers who are interested in developing and exploiting their research results commercially receive support via the TWIST Programme. The programme supports discussion and exchange with manufacturing, works with entrepreneurs and assists students with career development. The internal TWIST Fellowship Programme enables graduates and post-doctoral students to develop their start-up ideas for one year. There is also the opportunity here for researchers to spend 20% of their working time examining commercial exploitation options for the research results using external resources in parallel with the scientific research at the IST Austria. There are also plans in partnership with the Lower Austrian Ecoplus business agency to set up a technology park adjacent to the IST Austria Campus that will also be home to the IST Austria's spin-offs in the future.

4.2.7 Summary

Academic spin-offs are an important form of knowledge and technology transfer between science and industry and enable the further development of new technologies and the implementation of scientific results in marketable products. Funding academic spin-offs has gained importance in Austria over the last 15 years and is now an extremely high priority on the political agenda.[47] Entrepreneurial training for students, and the development into entrepreneurial universities, have been promoted and funded as part of the federal government's 2011 RTI strategy and as part of the Federal Ministry of Science, Research and Economy (BMWFW) action plan published in 2015 for a competitive research area.

Funding academic spin-offs requires a series of measures in different areas, ranging from the provision of specific infrastructures such as incubators to stimulating the private venture capital market and funding entrepreneurship at universities and research institutions.

Their networking and mediation activities, and their ability to exchange ideas with other entrepreneurs, are considered to be crucial roles of incubators. The AplusB programme from the Austrian Research Promotion Agency (FFG) has frequently contributed to the efforts to raise awareness of new enterprises with an academic background. Although the mission and objective of AplusB are aimed at funding high-tech new enterprises with an academic background, in practice the established incubators have been focused on the target group of universities and universities of applied sciences or they have been set up by the latter. At the same time, this indicates that non-university research institutions have major potential.

Knowledge and technology transfer in general, and the funding of spin-offs, are seen by universities in Austria as important factors in the Third Mission and are systematically funded. Funding for academic spin-offs is an important priority in both the development plans as well as in the performance agreements. The knowledge transfer centres are also important new instigators for boosting knowledge and technology transfer as an essential part of the Third Mission. Some universities are increasingly implementing entrepreneurial university type activities. This may also be seen from the 2016–2018 performance agreements, which show how the entrepreneurial university might be understood in Austria in the future.[48] The universities increasingly see themselves as an important

47 See BKA et al. (2011); BMWFW (2015a); BMWFW (2015b).

48 In the context of developments into an entrepreneurial university there are also plans (see Federal Ministry of Science, Research and Economy (BMWFW) 2015a) for universities to use the HEInnovate (https://heinnovate.eu) more intensively in future, i.e. a self-assessment tool for improving universities' entrepreneurial orientation.

central point in the local entrepreneurship ecosystem. This is important to the extent that an active entrepreneurial culture, at and around a university, in turn increases the appeal of the university itself, attracts new talent, opens up new opportunities for partnership and stimulates joint use of research infrastructures. Universities can be starting points with this, as well as important partners to knowledge-intensive new enterprises from various origins.

Raising awareness, teaching and specific consultancy services on entrepreneurship are now implemented as standard by Austrian universities. However, time and effort are still required in order for the desired broad impact to develop. In particular, measures should be implemented that facilitate the transition from a scientific to an entrepreneurial career or which play a part in minimising the risk.

The numerous programmes aimed at promoting and funding cooperation between science and industry, such as COMET, the CD laboratories and the COIN Programme, are in principle fertile soil for academic spin-offs, as scientists gain experience here of economic problems, business management perspectives and future market needs. However, there have barely been any incentives or measures implemented in these types of research institutions or programmes aimed at promoting enterprise creation further. Note should also be taken of those funding programmes whose goal is directly to create new enterprises, or indirectly as a potential result, such as Research Studios Austria or the Laura-Bassi Programme.

The non-university research institutions have so far tentatively started to accelerate the pace of funding for spin-offs. The formation of targets and strategies, and the implementation of training and consultation services and/or linkage with existing offerings, are required here in order to provide researchers with the opportunity of setting up their own business. Other forms of implementation of research results are feasible here that go beyond the traditional transfer based on cooperative projects with firms and, for example, open up applications in entirely new areas.

The broad-based public and increasingly private initiatives in recent years provide evidence of the formation of an entrepreneurship ecosystem in general and of an increasingly beneficial environment for academic spin-offs in particular. Numerous competitions for ideas and business plans, awards, information events, community meetings, pitching contests and similar events provide evidence of this development. Many private firms and companies now offer specific consultation and coaching services.

Austria has recently produced a few internationally successful spin-offs that in turn act as role models and an incentive for students, graduates and scientists to set up their own business.[49] The economic developments, and specifically the increasing uncertainty in industry, are contributing to students increasingly being open to new career options and patterns. Self-employment can be perceived as an attractive course for life in addition to a scientific career or employment in an established firm.

As shown in the comparison stated earlier (in Fig. 4-5), the challenge is in mobilising more private stakeholders in Austria. New initiatives to promote and fund Austrian spin-offs should be aimed at linking academic spin-off founders more with private investors and entrepreneurs and, thereby, further developing the entrepreneurship ecosystem. In order to provide systematic support for the development of spin-offs, on the one hand there should be guarantees that the entrepreneurs will support, network and ex-

49 Firms such as TTTech (Vienna University of Technology), Lithoz (Vienna University of Technology), METEO-data Limited (University of Vienna), Stirtec (Graz University of Technology), Runtastic (University of Applies Sciences UA), XIBER Science (Medical University of Vienna), Laserdata (University of Innsbruck), TAmiRNA (University of Natural Resources and Life Sciences, Vienna) and MKW electronics (ACCM/University of Linz) can be mentioned here.

change with each other. On the other hand, the entrepreneurs also need to be put into contact with mentors who are prepared to share their knowledge, experience and contacts. This involves both the social infrastructure, therefore, as well as the physical one.

Increasingly, Austria is gaining a reputation internationally as a start-up location. For example, the INiTS that ranks seventh in the global incubator rankings and third in Europe may for be mentioned here.[50] The Pioneers Festival, which is well known outside of Austria and may be viewed as a part of the ecosystem, can also be stated in this regard. Although the entrepreneurial dynamics and attitude towards entrepreneurship in Austria have improved in recent years[51], further efforts are still required overall to promote and fund enterprise creation and to realise the major potential that has not yet been exploited.

4.3 Social entrepreneurship and the non-profit sector

This chapter addresses two important areas that are supposed to be understood within the sense of an expanded concept of innovation. On the one hand this includes social entrepreneurship and social business, which have gained increased attention over the last 15 years as specific types of entrepreneurial and social innovations[52]. The central characteristics in the definition of these corporate and innovative forms are that they have a social mission as their purpose or are devoted in particular to (creatively) solving society's problems and thereby use business management tools of traditional and profit-based firms, non-profit organisations and social movements and innovatively combine these.[53] The chapter begins with an explanation of social entrepreneurship and social business and the relevance of these concepts for Austria (Chapter 4.3.1). It then includes a description of the prevalence of social entrepreneurship and social business at the national level (Chapter 4.3.2) and outlines the significance of the ecosystem in supporting social entrepreneurship and its stakeholders (Chapter 4.3.3).

The second part of the chapter looks at the non-profit sector in its entirety and then explicitly at (non-profit) foundations (Chapter 4.3.4). In addition to an overview of the number and areas of activity, the current significance of foundations is also revealed in the area of research and science, along with the measures implemented by the Austrian federal government to promote and fund non-profit foundations in Austria.

4.3.1 Social entrepreneurship and social business

The academic debate surrounding these concepts has intensified accordingly against the background of the increased interest in social entrepreneurship and social business. Although there is still no complete agreement on the definitions and the underlying concepts, we can already identify corresponding categorisations and typical features.

Social entrepreneurship focuses on people and organisations that produce and offer new products and services in an entrepreneurial manner which make an effective contribution to solving challenges in society. It focuses on the entrepreneurial process of looking for, finding, developing and implementing appropriate solutions to societal problems.

Two lines of thought are discussed in the literature and in practice.[54] On the one hand the

50 See http://ubi-global.com/
51 See Global Entrepreneurship Monitor (2015); Davey et al. (2013).
52 The concepts of social enterprises and social business are gaining global attention, particularly in the context of the Nobel Peace Prize 2006 to Muhammad Yunus for his microfinance concept.
53 See Dees (2001); Mair and Marti (2006); Jansen (2012); Schneider and Maier (2013); Millner et al. (2013); Hafellner and Schiffbänker (2015); Vandor et al. (2015a).
54 See Dacin et al. (2010).

"Social Innovation School of Thought", which places the emphasis on individual entrepreneurs and their achievements in recognising and implementing social innovations, and on the other hand the "Earned Income / Social Enterprise School of Thought". The latter places the main focus on financial independence by generating market income by organisations that wish to contribute towards solving societal challenges. However, there is a lack of unity regarding the extent and the concrete form of this independence.[55] The social business model is predominantly discussed in conjunction with the latter understanding. However, unlike social entrepreneurship, innovation is not a mandatory criterion in the definition of social business. Nevertheless, it is worth considering, as the social business model also includes organisations that work in new ways with established value creation models, e.g. by integrating the target group of a social measure as employees or customers in the social value creation process.

The concepts of social business, social enterprise and social entrepreneurship are often used synonymously.[56] They are generally organisational forms that shift between the boundaries of profit-maximising and non-profit organisations (NPOs). While the concept of the "social enterprise" has been used in particular in association with work integration social enterprises (WISEs) since the 1980s in the Austrian context, the concept of social business is rather new.

Four criteria have been developed that identify social business based on an extensive international literature review as part of a study on the potential of social business in Austria for the purpose of operationalising social business for Austria[57] . A must-meet criterion and a should-meet criterion have been developed as relevant in the "social impact" and "economic sustainability" dimensions alongside the hybrid character of social business. While the mandatory criteria must be provided in order for an organisation to be considered a social business, there are no clear theoretical or empirical grounds for the additional criteria. They are frequently, although not always, used in the definition and their use is flexible in different contexts.

1. *Positive social impact as an organisational target (must-meet criterion)*
   The social or ecological target[58] must be the organisation's principle objective to which purely economic considerations must be subordinate. It is also important that this objective is consciously pursued. Many commercial firms also achieve a positive social impact, however, this is not their primary objective and they cannot therefore be considered to be social businesses.
2. *Generating market income (must-meet criterion)*
   Social businesses generate the majority (more than 50%) of their income via the sale of goods and services on the market. This distinguishes them in many cases from "traditional" organisations within civil society and/or the non-profit sector, which are funded e.g. via private donations or public funding.
3. *Positive impact on all reference groups (should-meet criterion)*
   Social businesses serve a defined primary target group which predominantly benefits from the activity. However, it is important that other reference groups also have a share in the positive impact of the organisation: Muhammad Yunus for example, the pioneer of microcredit, emphasises that good working conditions are also important for social business.

55 See Millner, Vandor et al. (2013, 433) and Vandor et al. (2015a, 5f).
56 The concepts can also be distinguished more precisely based on the literature and differing national contexts; see Schneider and Maier (2013); Millner et al. (2013); Vandor et al. (2015a). However, this is not done here for the purposes of clarity in this article and the operationalisation of Vandor et al. (2015a) is utilised for the Austrian context.
57 Vandor et al. (2015a, 6f).
58 The English meaning of social entrepreneurship, social business and similar concepts is generally more comprehensive and therefore also often includes social services, as well as e.g. ecological objectives.

4. *Limited distribution of profits (should-meet criterion)*
   Social businesses should invest the profits they make predominantly in order to achieve their societal objectives. However, profits must also be capable of being distributed in order to appeal to investors, although this component should be limited.

The following statements are based on recent studies and examinations into the topic of social entrepreneurship in Austria, which for example use different definitions of social entrepreneurship and social business for survey and analysis purposes. Reference is made to these differences in the information displayed and in the descriptions.

4.3.2 Prevalence of social entrepreneurship and social business in Austria

There are two studies available on the empirical relevance of social entrepreneurship and social business for Austria. Schneider and Maier (2013) identified 273 organisations and individuals as part of a snowball sampling that are active on a social enterprise basis and, in their own opinion, also take part in the social entrepreneurship discourse.[59] A total of about 75% of these initiatives (as of 2012) had been in place for less than four years and had an annual budget available of €30,000. Compared with the established non-profit organisations, these initiatives are characterised by efforts to achieve financial independence and economic sustainability through generating market incomes and also more frequently through the selection of legal forms from the profit-based sector (limited liability companies, sole proprietorships). These organisations originate more from an upcoming social entrepreneurship start-up culture than from the civil society tradition of established non-profit organisations. In contrast, Vandor et al. (2015a) used three secondary data records[60] based on a definition of social business supported in the literature, analysed these and validated them using an expert survey, in order to learn about the current and future potential of social business in Austria.

Thus analysis permits an initial cautious estimate that at least 1,200 to 2,000 organisations in Austria correspond with the working definition of social business used. These are made up of start-ups and established non-profit organisations which have been qualified as social businesses in accordance with the aforementioned criteria. The organisations differ significantly in terms of their ages, numbers of employees, income and areas of activity and target groups. There are 200 organisations for which there is tangible data available that generate an annual turnover of just under €700 million and employ more than 16,000 people.

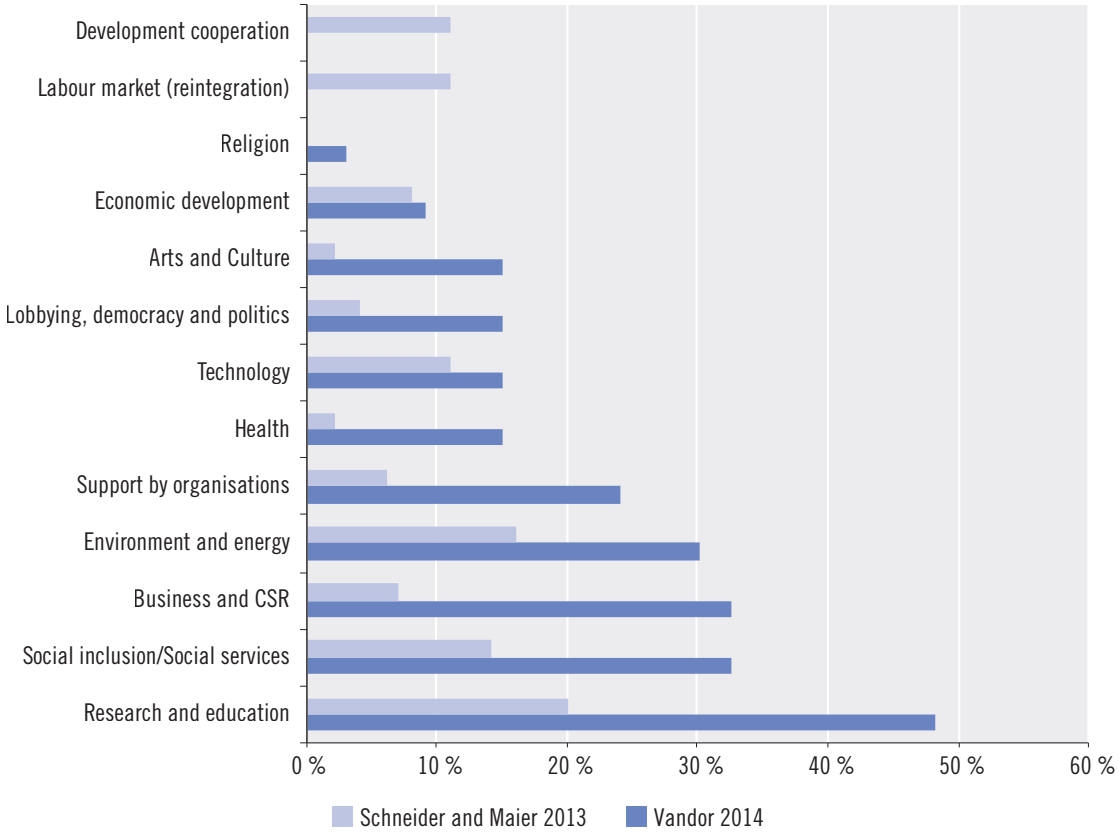
It is worth studying their areas of activity and frequency of innovation in order to gain an impression of the areas in which young social enterprises in Austria in particular achieve social impact based on innovative approaches. The study by Vandor et al. (2015a) provides an insight into the areas of activity of social enterprises in Austria and contrasts corresponding results from Schneider and Maier (2013) with a second data record from Vandor (2014). The latter relates to a study of members of the Impact Hub Vienna, the largest network organisation for social entrepreneurship in Austria. Nascent organisations tend to dominate here also (the average age of the organisation being two years).

The results show that the topics of research and education, environment as well as social inclusion and/or social services are a particularly high priority in both studies. Children and young

59 Method: telephone survey (105 organisations); sampling: multi-stage snowball sampling based on the criteria: a) self-image as a social entrepreneur, b) exchange relationship with support organisations, other social enterprises or documented self-attribution in the media.

60 These data records stem from Schneider and Maier (2013); Vandor (2014) and Pennerstorfer et al. (2015).

Fig. 4-6: Areas of activity with a focus on younger organisations/social start-ups[61]



Source: Vandor et al. (2015a, 36).

people, sustainable consumer behaviour, broadly defined community work as well as people with disabilities represent the target group most often stated with the younger social start-ups (see Fig. 4-6).[62] A specific combination of activities and target groups can generally be identified. Children and young people are for example primarily the target groups for education, while Corporate Social Responsibility (CSR) and business activities are generally aimed at sustainable consumer behaviour.

The results of the study by Vandor et al. (2015b)[63] in turn show the form in which products and services from social enterprises are delivered in the Impact Hub Vienna: 21% are sold at market prices, 46% are free of charge and 33% are provided at a discount. 12.5% of statements indicate that the target group is integrated in the employment process. A further 8% relate to target groups that act as suppliers, while 13% also resort to other forms of market revenues.

Creating innovation is an organisational role that is frequently discussed in the context of social entrepreneurship and is important for society.[64] The survey among the members of the Impact Hub Vienna[65] also provides empirical results

61 See Vandor (2014): n=33; % of statements, duplicates were possible; (Schneider and Maier 2013): n=44, duplicates were possible.
62 See Schneider and Maier (2012).
63 See Vandor et al. (2015b), multiple statements were possible with this question.
64 See Millner et al. (2013).

on this. The predominantly young organisations in the Impact Hub environment are for the most part active in innovation, at least according to their own perception, and state that for the Austrian context they offer a new product or new service (58%), use a new form of service provision (33%, e.g. in production or sales) or serve a new target group (18%).[66] As such, 79% of the organisations surveyed feature one or more innovative aspects in terms of their service provision.

4.3.3 The social entrepreneurship ecosystem

Entrepreneurs often need particular support services, resources and funding during the foundation phase, which may be provided by different private, public and non-profit stakeholders.[67] This is also true, if not even more so, for social entrepreneurial new enterprises and new social enterprises. The various forms of support for social enterprises can thereby be seen as a connected "ecosystem" that are linked to each other in partially competitive and partially collaborative relationships.[68]

Although the discussion surrounding social entrepreneurship in Austria is just a few years old, there are some institutions that have already adopted the typical role of an ecosystem (see Fig. 4-7 for an overview of the most important stakeholders). These are congruent to some extent with the stakeholders in the commercial and academic start-up ecosystem in Austria (see Chapter 4.2.3) that have developed their own initial offerings for the topic area. In most cases, however, it is organisations specialising in social entrepreneurship that emerge as funders or business partners (e.g. Impact Hub Vienna).

Financiers play an important role in the ecosystem. The development of an "investor scene" for social entrepreneurship and social business is still in progress in Austria. However, there are already some initial relevant offerings available. Several pilot projects have been launched in the last year by the public sector: the Vienna Business Agency launched a call for tenders in June 2015 explicitly for social entrepreneurship, thereby funding projects at the interface between creative work and social entrepreneurship. Priorities related to social entrepreneurship were also enshrined in the "Services", "Material goods" and "Focus on local supply" funding programmes. This is the first public funding for social entrepreneurship in Austria.

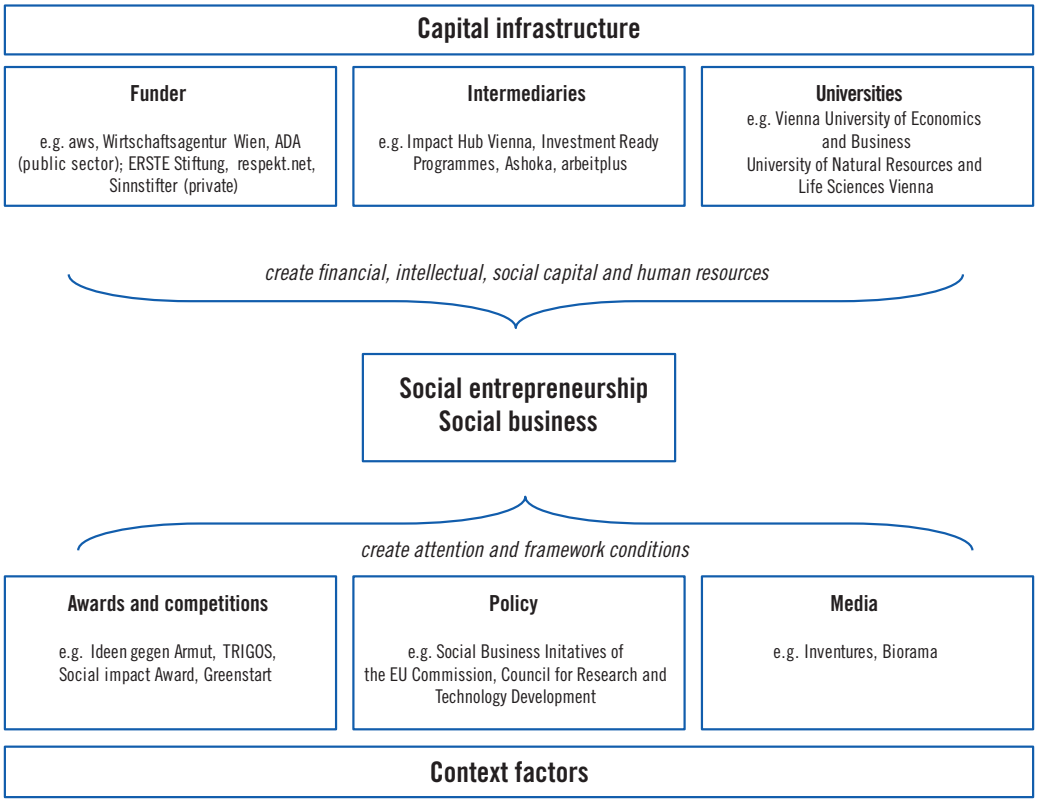
The Austrian Development Agency ADA launched the Social Entrepreneurship Challenge in December 2015. The ADA is thereby providing €1 million to fund ideas and potentials for development cooperation for social entrepreneurs.

The Austria Wirtschaftsservice (aws) is developing and supporting measures for a more attractive environment for this young sector in Austria within the scope of a national capacity-building approach through expanding knowledge and expertise, knowledge transfer and nationwide network development. Further steps and a corresponding funding call are also planned in future in addition to a roadshow through Austria, the expansion of the evidence base using studies and establishment of the Austria Wirtschaftsservice's (aws) social business initiative.

With the "benefit" technology programme, the Austrian Research Promotion Agency (FFG) is also providing support for research and development for innovative technology products (particularly in the ICT area) and technology-assisted services in the relevant area here. The programme is aimed at providing support to older people at home for as long as possible and thereby producing technological and social innovations in the areas of intelligent living, safety and mobility, and maintaining social inclusion.

65 For a detailed description of the data record see Vandor et al. (2015b).
66 Multiple statements possible.
67 See Vandor et al. (2015b).
68 See Chapter 4.2.3; Isenberg (2010); CASE (2008) and Nicholls (2010) specifically for social entrepreneurship ecosystems.

Fig. 4-7: The ecosystem for social entrepreneurship and social business



Source: Vandor and Millner (2014, 291); Vandor et al. (2015a, 20).

On the private side there are primarily a few non-profit foundations active at present whose non-profit actions are based on long tradition. Some of these view their commitment as stimulus for social innovations which will subsequently be scaled and are then developed further by other stakeholders and/or the government. The "SinnStifter", an association currently of nine Austrian private foundations, pursue this approach. Some foundations such as the ERSTE Foundation and Katharina Turnauer Private Foundation also pursue a targeted strategy for funding social entrepreneurs. The scope of these activities, however, is low in view of the very negligible non-profit foundation landscape in Austria (see Chapter 4.3.4).[69] However, private investments at the individual level are also increasingly being made via crowdfunding and donation platforms (e.g. respekt.net, greenrocket.at).

Networks and support organisations are a crucial component of the ecosystem ("*intermediaries*"). They link social entrepreneurs and social business with investors and champion measures from the political side. Important stakeholders in Austria here include the Vienna Impact Hub, Ashoka and arbeit plus for work integration social enterprises. The Impact Hub is a co-working space and support network for social enterprises and social start-ups in Vienna. Various incubation and funding programmes are implemented

69 See Millner and Meyer (2016, 5f).

with the support of the Impact Hub, such as the Investment Ready Programme and Social Impact Start Programme. The Impact Hub Vienna has more than 400 members (as of February 2016) supporting Austria's biggest network of social entrepreneurs and is itself part of a network of more than 11,000 members in 70 countries. Ashoka has been active in Austria and CEE (Czech Republic, Slovakia, Hungary, Poland) since 2011, and is also part of a network that operates globally. Ashoka accepts fellows, i.e. individual social enterprises, into its funding programme every year. They are supported with a three-year grant and funded by pro-bono partners.[70] Arbeit plus (previously "Bundesdachverband sozialer Unternehmen" – Federal umbrella organisation of social enterprises) is a network of work integration social enterprises that must frequently be qualified as social business in accordance with the definition stated at the start. Many businesses work based on a business model with which the relevant parties in the organisations themselves also work and therefore benefit financially and personally through gainful employment (e.g. Wienwork).

The media also play an important role in the ecosystem of social enterprises by raising public awareness of the issue. There has been animated discussion in the media and academia for some time surrounding the concepts of social business, social innovation and social entrepreneurship. Mentions for "social enterprises" and "social entrepreneurship" almost quadrupled overall in the period between 2006 and 2012.[71] Media such as Inventures, Lebensart and Biorama, which regularly report on social entrepreneurs, play a part in shaping the environment, although there has not been any separate specialist medium as the English Pioneers Post Quarterly as yet. Awards and prizes also play a role in making the topic accessible to a wider public. They provide an important signal and are able to stir people into launching social projects, and also frequently provide important initial funding for young start-ups. Many of them also additionally offer coaching, workplaces and networks. The number of awards specialising in social entrepreneurship is estimated at between 15–20 throughout Austria.

Universities also play a significant role in the development of the sector. Through research and educational and further training offerings they make a contribution to supplying the stakeholders with empirical evidence via actions and support, and also raising awareness of social entrepreneurship as an option for founding a firm among university graduates. The Vienna University of Economics and Business has for example already been providing corresponding offerings and contributes to the research efforts in this area both nationally and internationally. There has also been a research group since 2014 in the form of the Social Entrepreneurship Center (SEC) which is dedicated to research, training and further education as well as transfers in practice. In addition to the Vienna University of Economics and Business, the topic area is now also promoted by the University of Natural Resources and Life Sciences, Vienna, the IMC University of Applied Sciences Krems and the University for Continuing Education Krems as part of teaching events or separate competitions (e.g. the Sustainability Challenge).

Measures implemented by politicians and/or political institutions also contribute to creating a favourable environment. The EU is already active at various levels. On the one hand it supports a socio-political understanding of social investment, while there are also EU-wide initiatives aimed at funding socially-relevant investments on the other. The European Commission's Social Business Initiative has since 2011 explicitly drawn attention to the fact that social enterprises have the potential to make a significant contribution to economic growth, and that more

70 That is, experts who provide their knowledge free of charge (e.g. in the form of advice services).
71 See Schneider and Maier (2013).

visibility, regulatory framework conditions (e.g. an appropriate legal form for social enterprises) and alternative funding instruments are required here for social enterprises. Estimates by the EU currently assume that every fourth new enterprise within the EU involves a social enterprise.[72] Recent recommendations from the Council for Research and Technology Development[73] include inter alia the creation of a separate legal form for social enterprises, adjustments to the law regarding non-profit organisations so that foundations are able to invest directly in social business enterprises and also the mobilisation of sustainable private capital from private investors in order to solve the challenges in society, along with the introduction of tax incentives for private investments in areas relevant for society, e.g. social business. The current status quo in Austria in terms of the non-profit sector is addressed in the next Chapter 4.3.4 against this background.

4.3.4 The non-profit sector

The non-profit sector relates to the entirety of non-profit organisations (NPOs) in a country and is contrasted with the "market" and "government" sectors in a three-sector model. The "market" sector includes profit organisations, i.e. firms that are characterised by profit-maximising and market-financed activities. The government sector includes public organisations, i.e. entities such as the federal government, regional government, municipalities and communes that are characterised by the fulfilment of sovereign tasks and funding using public funds.[74]

The Austrian non-profit sector is of societal and economic relevance, as can be seen from the following key figures: the sector includes approx. 120,000 organisations, with the largest share of all involving associations, followed by foundations, "gGmbH" non-profit limited companies and other legal forms. Although NGOs do not represent a separate category from a legal point of view, the issue of the legal form helps in marking out the sector, since these organisations do not generally represent activities aimed at generating a profit.[75] Austrian NPOs generated €5.9 billion in gross value added in 2010, a figure which does not include the value of the work performed in a voluntary capacity. There were approx. 212,000 contractual relations in the non-profit sector same year according to projections. This represents 5.2% of the entire working population in Austria. A strong growth dynamic can be identified from 2000 onwards. Both the employment figures as well as the added value have grown more strongly since then than they have in the overall economy.[76] This picture is supplemented by the significant amount of voluntary work in the sector. Just under €8 million of voluntary working hours per week equate to the work output of 200,000 full-time equivalents and an equivalent value of €4.72 billion based on conservative estimates.[77] In terms of income and funding, output-based payments via service contracts predominantly emanate from the public sector, followed by sales revenues and grants. The sector benefits from around €600 million in private donations.[78]

Considering their purposes, non-profit foundations must also often be viewed as civil society organisations that can make a contribution to more innovation activity based on their asset position and independence that goes with this. On the one hand they act as potential financiers of civil society initiatives and therefore for the activities of third parties, generally non-profit organisations, social enterprises and research insti-

72 See European Commission (2014).
73 See http://www.rat-fte.at/tl_files/uploads/Empfehlungen/150730_Social%20Business_Empfehlung_Final_NP.pdf
74 See Meyer and Simsa (2013, 9f.).
75 See Nowotny (2013, 183).
76 See Pennerstorfer et al. (2013).
77 See Pennerstorfer et al. (2013) and Pennerstorfer et al. (2015) for a detailed presentation along with the data on the Austrian non-profit sector.
78 See Fundraising Association Austria (2015).

tutions (*grant making foundation*). On the other they also implement activities, projects, initiatives and measures themselves in various areas of society (*operative foundation*).

As such they are normally relevant stakeholders in the science area in both of these forms. Numerous think tanks and research institutions are organised as foundations internationally, or the foundations fund activities by universities, research institutions or other organisations in the research and science area (e.g. the Bertelsmann Foundation or the Volkswagen Foundation in Germany). As financiers at universities for example they provide direct funding for research projects or endowments for entire academic chairs. There were 660 endowed chairs in Germany in 2009, with 27% of these funded by foundations.[79] There is currently nothing on this scale or no similar examples in Austria. As of 1 March 2014 there were 66 endowed professorships at Austrian universities, with 13 of these funded by foundations, and five of these in turn (co-)financed by Austrian foundations. In contrast there were 2,356 professors at Austrian universities in 2014.[80]

Status quo of the non-profit foundation sector in Austria

There are essentially two statutory bases at present for foundations in Austria: one relates to foundations pursuant to federal and regional governments foundations and fund acts that are non-profit by virtue of the law, and thereby represent the real non-profit legal institution for non-profit foundations. The other relates to the legal institution of the private foundation that was introduced in 1994.

In a survey from 2014 by the Vienna University of Economics and Business, 2,609 of the 3,025 private foundations were classified as overwhelmingly devoted to private means based on the foundation purposes.[81] This number must be viewed as an approximate value since the foundation purposes are often specified in the foundation's articles that are not available to the public. On the other hand there are 226 private foundations that can be classified as purely non-profit since their purposes indicate the fulfilment of and support for non-profit activities. A total of 17 private foundations have a clear focus on supporting employees. The extent to which this must be assessed as non-profit remains open, as they are dedicated to a limited circle of addressees, e.g. current and former employees of certain firms. The total number of 3,025 private foundations also includes 35 savings bank foundations (Sparkassenstiftungen), which may exclusively pursue non-profit, charitable or church-related aims pursuant to section 27a of the Savings Bank Act. Although the main intention frequently involves participation in the relevant local savings banks, many also develop corresponding non-profit commitments in addition to this. Private foundations with private and non-profit purposes respectively where the importance of the non-profit intentions is unclear represent the difference.

Of the 216 foundations pursuant to the Federal Foundation and Fund Act (Federal Law Gazette No. 11/1975) and the 224 foundations pursuant to the State Foundation and Fund Act, around 700 Austrian foundations were capable of being classified as non-profit in 2014. These figures have essentially remained stable over the last few years. A slight decline can be noted in purely private foundations.

Foundation disbursements

The number of foundations dedicated to non-profit or private benefit purposes is merely a rough indication. The annual disbursements from foundations is a more informative figure in terms of

79 See Frank et al. (2009).
80 See BMWFW (2014c).
81 The chapter "Non-profit sector" is based in part on the work by Millner and Meyer (2016).

the relevance of foundations to society and the economy. However, there is barely any truly reliable data for any country, and estimates are required almost everywhere here.

One such estimate was made for Austria in 2009 for private foundations based on a Delphi study.[82] If these figures are aggregated together with the data surveyed on the federal and regional government foundations and the savings bank foundations, then the estimate of the charitable expenditure by foundations is between €29–61 million.[83] Around €10–40 million is attributable to non-profitally oriented private foundations, approximately €12 million to federal and regional government foundations and approximately €8–9 million to savings bank foundations.

As such the non-profit foundation sector in Austria must be viewed as being underdeveloped as compared internationally (see Table 4-4). The estimated disbursements for Germany amount to €17 billion, and for Switzerland the figure is €1.2–1.7 billion. In relation to the number of inhabitants this means €210 per person in Germany, between €150 and €212 per person in Switzerland, and between just €3.5 and €7.3 per person in Austria.

In terms of the main areas of their activity there are predominantly three areas in Austria in which foundations are involved (see Fig. 4-8): social services, art and culture and education and research. This is largely in accordance with foundation activities in other countries when compared internationally.

Upon closer inspection the thing that is striking for Austria is the fact that education and research provide the focus for federal foundations, while social concerns provide the particular focus for regional government foundations.[84] These different priorities in the foundation purposes for federal and regional government foundations may to date have reflected the distribution of competencies among the respective authorities.

In terms of the actual purposes and activities in the area of education, science and research, closer analysis of the focus areas within the main areas of activity reveals that the funding of research projects that are not defined in more detail as well as education and training for academics (particularly in the form of grants) can be made out as actual priorities for activities and funding.

In a more up-to-date survey forming part of the EUFORI Study[85] on behalf of the European Commission, in 2014 approximately 300 non-profit

Table 4-4: Number of foundations and foundation disbursements in an international comparison

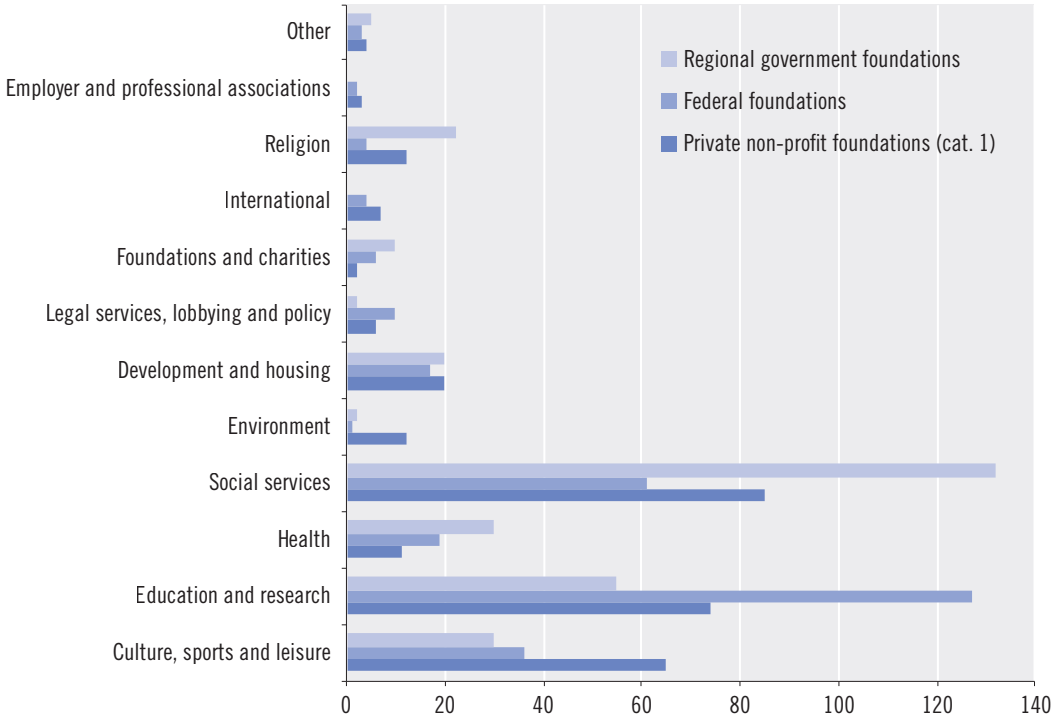
Country	Number of non-profit foundations	Foundations per 1 million inhabitants	Estimated foundation disbursements per annum [in € millions]	Foundation disbursements per inhabitant [in €]
Austria[1]	701	85	29–61	3.5–7.3
Germany[2]	19,500	240	17,000	210
Switzerland[3]	12,909	1,620	1,200–1,700	150–212
EU-24[4]	90,000–110,000	370	83,000–150,000	166–360

1) See Schneider et al. (2010) or later figures in Schneider et al. (2015).
2) See Association of German Foundations (2014).
3) See Eckhardt et al. (2012).
4) See Hopt et al. (2008).

Source: Own chart.

82 See Millner et al. (2009) and Schneider et al. (2010).
83 See Schneider et al. (2015).
84 See Millner et al. (2008).
85 As part of the EUFORI Study (European Foundations for Research and Innovation) the foundation sectors were surveyed in 29 European countries (EU-27, Switzerland and Norway) in relation to their contributions to science, research and innovation. The Vienna University of Economics and Business was the national research partner for Austria here.

Fig. 4-8: Categorisation of foundations by non-profit purposes (acc. to ICNPO)



Note: The values are absolute values. Multiple statements possible, i.e. foundations may come under different categories at the same time; classification in accordance with ICNPO, International Classification for Non-Profit Organisations[86], survey time: September 2014.

Source: Millner and Meyer (2016).

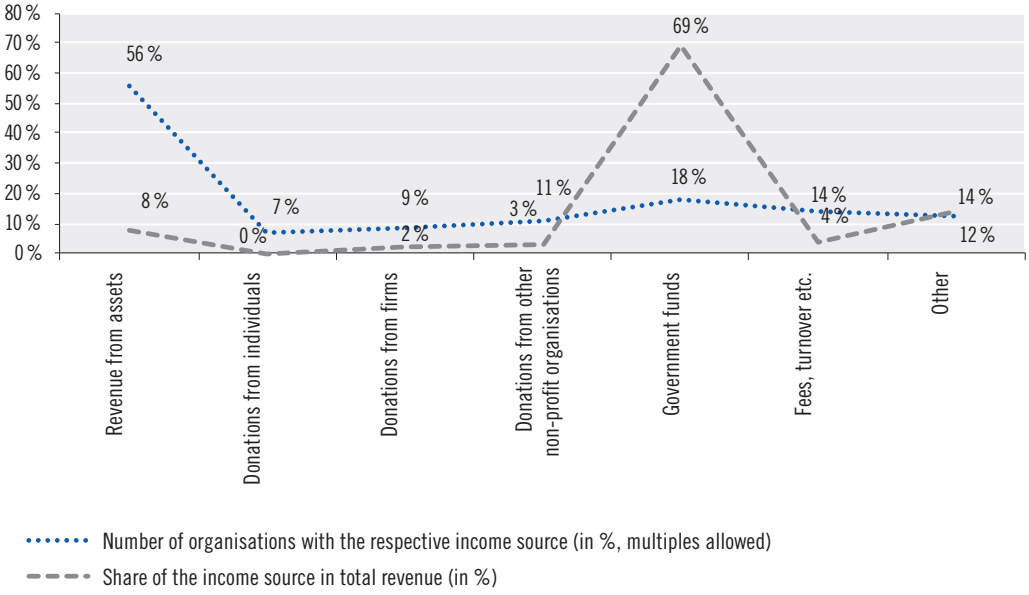
foundations and temporary endowment funds[87] could be identified associated with research and/or innovation in Austria based on an analysis of the foundation purposes.[88] However, only around 60% were actually active in the research area at this time, while the remaining 40% either had stated the funding of science and/or research and development as a subsidiary purpose in their foundation documents or did not actively exercise any corresponding activities.

The picture in relation to founders is highly diverse. The majority of foundations were founded or co-founded by private individuals/families (46%), followed by the public sector (28%), firms (23%), other non-profit organisations (18%), universities as well as other organisations (10% each) and private research institutions (3%).

Government institutions play a major role at the founding stage for foundations and temporary endowment funds that promote and fund research. This is even clearer when you consider the funding for these foundations and temporary endowment funds for 2012: 69% of total annual income originates from public sources, 18% of the foundations in the sample (n=10) received public funding with this. On the other hand for example 56% of organisations (n=32) generated income from assets, although this only constituted a total of 8% of the total income of all organisations that responded (see also Fig. 4-9).

86 See Salamon and Anheier (1996).
87 Temporary endowment funds were also included in Austria that play a major role in research funding in order to permit comparison with other European countries. These are funds pursuant to Austrian federal and regional government foundation and fund laws.
88 See Schneider et al. (2015).

Fig. 4-9: Composition of the aggregated income of the foundations/funds in the research area



Note: Basis: in % of known income, multiple responses possible; N=57.
Source: Millner and Meyer (2016).

The question regarding how high the annual expenditure is for science and research in total by foundations and temporary endowment funds can only be answered based on different scenarios. The assumptions was made for these estimates that not all foundations and temporary endowment funds identified in the sample are currently active in the research and innovation area. Based on the results of the survey within the scope of the EUFORI Study it was assumed that only 60% of foundations and temporary endowment funds associated with research and/or innovation (i.e. 181) are actually active.

A projection based on this sample over all foundations and temporary endowment funds results in an estimated bandwidth of between €45–67 million per annum spent on research and innovation. The high significance of temporary endowment funds can be seen in the estimated value (€29–61 million) achieved in relation to the total amount of non-profit foundation disbursements. If this amount is reduced by the foundations and temporary endowment funds funded publically, then an estimated funding value remains of €29–36 million. International comparisons show that Austria lags significantly behind in terms of private research funding by foundations. For instance a comparative study between Austria, Sweden and Denmark reveals several individual examples of foundations that fund research in the comparison countries which in each case provide this amount of research funding alone.[89]

The Austrian federal government's non-profit package

The Austrian federal government's non-profit package was introduced in 2015 in large part based on this circumstance. At the centre of this initiative was the political desire to develop the non-profit foundation sector further in order to

89 See Polt et al. (2015, 73ff.).

produce more jobs, sustainable growth and a stronger civil society as well as to achieve an internationally comparable level as regards to non-profit foundation activities. This is meant to be achieved through improvements to the bureaucratic and tax law conditions, including in the form of a corresponding new legal framework for non-profit foundations (Federal Foundation and Fund Act 2015 – BStFG 2015, see Federal Law Gazette No. 160/2015), corresponding simplifications related to the starting of foundations and tax law changes to the Federal Tax Regulation.

Different entities (public limited companies, family businesses, private foundations, non-profit foundations, associations and private individuals) have been able to make tax-deductible donations to non-profit foundations since 2016. Tax deductions are limited to €500,000 within five years. Donations are deductible in each business year provided that they do not exceed 10% of the profit before accounting for the tax-free profit allowance.

Another new item is the fact that entities that receive tax concessions are able to allocate their funds to a different entity provided that this promotes the same purpose. This includes inter alia the awarding of grants and prizes if a university, the Austrian Academy of Sciences or a university of applied sciences makes the decision on this award. Simple indirect funding may suffice for the purposes of obtaining the tax concessions from 2016, which should ultimately facilitate the establishment and operation of foundations that purely provide funding or allocations to the assets of a private law foundation. In order to make the most of philanthropy and patronage, also in the form of foundations for the benefit of science and research, supporting measures are also required in addition to the (tax) law prerequisites and incentives. In addition to the initiatives already in place such as matching funds initiatives by the Federal Ministry of Science, Research and Economy, more societal understanding for non-profit activities should be created via awareness and recognition measures with increased professionalisation of fundraising in science and research.[90]

This reform to non-profit foundations could provide further momentum for growth in the funding for commitments to civil society in general and to funding for private research in particular, with the ambitious target of approaching the Swiss level of non-profit foundation investments amounting to €1.2 billion per annum over the next 15 years.

4.3.5 Summary

The developments presented here for Austria related to social entrepreneurship and the non-profit sector show that these areas are relevant for research, technology and innovation. Rising enterprise birth rates related to social enterprises provide evidence that appreciably more individuals and organisations are making an entrepreneurial and innovative contribution to solving current and future challenges in society. The frequently market-oriented approaches to goods and services provided contribute to employment and economic growth, not least because many of these organisations are active in the service sector, with added value generated in our own country. A corresponding ecosystem is also being formed at present which may be capable of advancing this trend on a sustained basis, provided that further measures are implemented.

As stated by the Austrian Council for Research and Technology Development in its recommendations, the legal situation for social businesses must be adapted, both in regards to the establishment of a separate legal form as well as for potential investments in this area by non-profit foundations.[91] Further public funding should also be

90 See BMWFW (2015, 35ff.).
91 See Council for Research and Technology Development (2015).

provided for social businesses in order to promote the foundation of these further, e.g. through incubation programmes. Finally, measurement of the effectiveness of social business should also be improved in order to enable comprehensible reporting on their successes and social impact.

In terms of funding, an initial comprehensive step has been taken to create corresponding administrative and tax incentives to mobilise private investment capital for non-profit purposes (e.g. for social enterprise new enterprises, science and research, etc.) and to produce a corresponding positive entrepreneurial dynamics in the non-profit foundation sector with the non-profit package and the amendment to the Federal Foundation and Fund Act included within this.

5 Evaluations

Evaluations are an indispensable part of the process of introducing and implementing research and technology policy support measures today, both from a legal perspective and in daily practice. The relevant statutory foundations are provided by a series of laws in Austria, including the Research and Technology Promotion Act (FTF-G), the 2004 Act for Creation of the Austrian Research Promotion Agency (FFG-G), the Research Organisation Act (FOG; reporting standards: sections 6-9), and guidelines for research funding[1] based on these laws and for the promotion of economic-technical research and technology development, the so-called "RTD guidelines".[2] The FTF-G (section 15, para. 2) in particular creates a legal standard for the principals of evaluation, stipulating a set of minimum requirements for the guidelines. The guidelines stipulate that "a written evaluation plan must be created for all subsidy programmes and measures based upon the [thematic, structural and human resource] RTI guidelines. This plan must include the purpose, objectives, and procedures, as well as deadlines for evaluating the achievement of the funding objectives, and must define appropriate indicators".[3]

This statutory basis has played no small part in the fact that nearly all research and technology programmes use evaluations in their programme planning (ex-ante evaluations), programme implementation (monitoring and interim evaluations) and programme conclusion (ex-post evaluation), and they are considered essential to providing direction to the further strategic development of Austria's research funding portfolio.

This chapter will provide an overview of recent evaluations of Austrian research funding programmes. They have been selected according to the following criteria:

- The evaluations are primarily relevant to federal policy.
- An approved evaluation report is available.
- The evaluation report must be accessible to the public; this essentially means that the report has been published on the Austrian Platform for Research & Technology Evaluation's homepage.[4]

The results of the following evaluations will be briefly discussed: the evaluation of the AplusB programme (on behalf of the Federal Ministry for Transport, Innovation and Technology – BMVIT), the ex-post evaluation of the TAKE OFF strategy programme (2002–2013) (on behalf of the Federal Ministry for Transport, Innovation and Technology – BMVIT), the interim evaluation of the Innovation Voucher Plus programme (on behalf of the Federal Ministry of Science, Research and Economy – BMWFW), the exploratory and evaluation study of Young Science – Centre for Cooperation between Science and Schools (on behalf of the Federal Ministry of Science, Research and Economy – BMWFW), the 2015 impact analysis of the Austrian competence centres programme

1 See the federal government's guidelines on offering and implementing funding mechanisms as in paragraphs 10–12 of the Research Organisation Act (FOG), Federal Law Gazette. No. 341/1981.
2 See the guidelines for supporting commercial-technical research and technology development (RTI guidelines 2015), which are: RTI thematic guidelines, RTI structural guidelines, RTI human resources guidelines in accordance with the Research and Technology Funding Act (FTFG) from the Federal Minister for Transport, Innovation and Technology (GZ BMVIT-609.986/0011-III/I2/2014), and the Federal Minister of Economics and Labour (GZ BMWFW-97.005/0003-C1/9/2014).
3 See RTI theme guidelines, RTI structure guidelines, RTI human resources guidelines, Chapter 3.3.
4 See www.fteval.at

COMET (on behalf of the Austrian Research Promotion Agency – FFG), the evaluation of research funding for universities of applied sciences (on behalf of the Federal Ministry of Science, Research and Economy – BMWFW), the evaluation of the START programme and the Wittgenstein Prize (on behalf of Austrian Science Fund – FWF), and the evaluation of Austria's participation in the AAL programme (2008–2013) (on behalf of the Federal Ministry for Transport, Innovation and Technology – BMVIT).

5.1 Evaluation of the AplusB programme

Objective of the evaluation

The evaluation of the Academia plus Business (AplusB) programme[5] examines the design, implementation, and effects of AplusB after a runtime of more than ten years. The assessment anticipates various reasons for economic policy to support knowledge-intensive start-ups with an academic background. One essential aspect of the study was the heterogeneity of the regional context in which AplusB centres are located.

Programme objectives and key information

The aim of the AplusB programme, which was implemented in 2001, is to support innovative new ventures that emerge from academia. The programme focuses on the early phase of the start-up process and on the specific needs of the target group, which evinces a high need for support for typically technology-intensive and highly complex projects. This sets the programme apart from the services of private incubators and from the project funding provided by the Austrian Research Promotion Agency (FFG) (including the Research Studio Austria funding programme).

The programme, which was initiated by the Federal Ministry for Transport, Innovation and Technology (BMVIT) and administered by the Austrian Research Promotion Agency (FFG), envisions the establishment of regionally anchored centres (incubators) that support selected start-up projects on-site. Close coordination between the federal government and the regional governments creates a foundation for this. At the time of the evaluation, there were seven AplusB centres in Lower Austria, Carinthia, Tyrol, Upper Austria, Vienna, and (two) in Styria. The programme is now in its third funding period, which is set to run until 2017. The financing for all three previous periods since 2002, including the planned figures until 2017, is being provided in roughly equal amounts by the federal government, the regional governments, and regional umbrella organisations to the total amount of €134 million. From 2002 to early 2014, the last point in time at which data were available for evaluation, 486 firms were founded with support from the centres, of which 386 were still commercially active in early 2014.

The support services of the AplusB centres include the mobilisation and stimulation of new ventures by means of awareness campaigns (for example, events and information activities), as well as direct support of start-up projects by means of personal supervision and consulting, supplemented by financial support and qualification offers, for a period of 1.5 years (incubation phase). The services offered by the centres vary depending on regional needs. The type of support depends upon the developmental status of the project. For example, the project could receive support for networking with other firms or private financiers, submitting applications to start-up-related funding programmes, or plans for internationalisation. Low threshold support measures, such as the targeted supervision of alumni start-up projects, have gained ground recently.

Results of the evaluation

Overall, the findings regarding targeted effects were positive. With regard to the economic effects of the programme, the results indicated that

5 See Ploder et al. (2015).

projects or firms supported by AplusB had a significantly higher survival rate, and more dynamic development of employment, than did their cohorts in a representative control group. Furthermore, new AplusB enterprises beat the control group in terms of more dynamic revenue development, higher export rates, and greater R&D intensity. There were no major deviations among the results at the regional level. AplusB firms employed a total of 1,752 people in 2013.

Aside from economic figures, there were also positive effects discovered in a direct survey of entrepreneurs and stakeholders in the programme. The centres therefore offer target-group-specific advising, supervision, and information, which is presently a unique selling proposition. According to a survey among new ventures, about 30% of projects could not have been completed without AplusB, and 52% only in a reduced form. The evaluation indicates that the awareness-raising measures at the centres have made a positive contribution both to creating awareness about the possibility of creating a new enterprise, and overall to increasing the significance of entrepreneurship and knowledge-intensive start-ups at the national and regional level. The low portion of women among entrepreneurs (9%) was singled out for criticism.

Overall, the evaluation recommended to continue the programme. Required improvements were identified, especially with regard to improving coordination between the individual centres and private initiatives, as well as between the centres, stakeholders, and the Federal Ministry for Transport, Innovation and Technology (BMVIT). Furthermore, the evaluation recommended the adaptation of a specific set of indicators for reporting as well as an ongoing monitoring according to the programme's objectives. Start-up monitoring should also be further developed because the identification and follow-up monitoring of firms for interim assessments is only possible to a limited degree at the present time.

5.2 Ex-post evaluation of the TAKE OFF strategy programme (2002–2013)

Objective of the evaluation

The ex-post evaluation of the TAKE OFF strategy programme[6] was dedicated to the analysis and survey of mid- to long-term effects of the programme in terms of its strategic objectives. Furthermore, the evaluation assessed the incorporation of the programme into Austria's research landscape. This evaluation builds on the interim evaluation conducted in 2008.[7]

Programme objectives and key information

The objective of TAKE OFF, a programme initiated in 2002 by the Federal Ministry for Transport, Innovation and Technology (BMVIT), is to strengthen the research and development potential of the Austrian aeronautics (supply) industry and research in order to stimulate the funding of innovation and the minimisation of financing risks and barriers to market entry. The programme originated from the need for support for a particularly granular, less interconnected national aeronautics supply industry in the early 2000s. The programme then formed an essential cornerstone of the Federal Ministry for Transport, Innovation and Technology's RTI aeronautics strategy, developed in 2008, and is embedded in strategic processes at the European level that are meant to contribute to the European aeronautics industry's leadership in terms of strategy and market position. Specific sub-goals of TAKE OFF include ensuring the competitiveness of the Austrian aeronautics industry, support of an efficient, safe, environmentally friendly and comfort-oriented aviation system, the training of

6 See Kaufmann et al. (2015a).
7 See Prognos (2009).

qualified researchers and engineers, the intensification of cooperative and ambitious research projects, and the improvement of Europe-wide and international visibility of the national R&D community in this field.

The Austrian Research Promotion Agency (FFG) is responsible for the implementation and execution of the programme; the Austrian Space Agency (ASA) was merged into the Austrian Research Promotion Agency in 2004. Programme instruments encompass funding of cooperative R&D projects as part of the Austrian Research Promotion Agency's thematic programmes, as well as measures for networking among national stakeholders, and the funding of participation in bi- and multinational cooperation processes, for example JTI Clean Sky, SESAR, or in the context of calls for proposals in the EU Framework Programme. TAKE OFF is also the national programme line through which participation in the ERA-Net AirTN was funded.

From 2002 to 2013, a total of 151 research projects and 45 accompanying measures were funded to a total of €65.1 million. The average funding sum was € 667,000. The majority of payouts in this period were distributed after the preparation of the RTI aeronautics strategy in 2008. About one-third of the 411 participating projects belonged to research institutions and institutions of higher education. Another third were small and medium-sized enterprises (SMEs).

Results of the evaluation

The findings of the evaluation justify the implementation of TAKE OFF due to the resulting potential of a critical mass of firms as well as the specific funding need of this industry due to the prevalence of long innovation cycles and national specifics. According to the evaluation, TAKE OFF has made a sustainable contribution to further develop this industry in Austria. This is clear both on the basis of financial figures as well as the results of the survey conducted with firms and research institutions over the course of the evaluation. An input-output analysis estimated that programme funding led to a rise in gross value added to €61.9 million. The evaluation also reported a positive contribution to networking national stakeholders in the industry, both in the corporate sector as well as with research institutions, which also led to positive spill-overs to other industries and sectors. While aeronautics projects may also be funded through the Austrian Research Promotion Agency's general programme, TAKE OFF maintains a clear focus on cooperative R&D. Furthermore, TAKE OFF facilitates projects with a low TRL[8], which indicates close proximity to basic research, whereas the general programme supports later development phases up to shortly before market maturity.

Recommendations include the need for revising the programme's targets. The programme's support structure for an efficient, safe, environmentally friendly, and comfort-oriented aeronautics system includes sub-goals with very different implicit priority, and this calls for further clarification. In particular, the international objectives related to climate protection contributions from the aeronautics industry represent a challenge that a programme such as TAKE OFF could prioritise even further. Networking with international forums and programmes takes up a major part of programme management in this kind of long-term-oriented, strategic market, and this should remain so. It is also recommended that financing for continuing education increasingly be left to firms and research institutions, but that more should be invested in the training of the next generation of scientists so that they can complete their training while working on an application-oriented project and then immediately be available to industry or the research sector. The TAKE OFF programme will be continued as recommended by the evaluation.

8 Technological readiness level.

5.3 Interim evaluation of the Innovation Voucher Plus programme

Objective of the evaluation

The interim evaluation of the Innovation Voucher Plus programme[9], conducted three years after the programme's introduction, focused on an analysis of the programme's design and implementation status with regard to its objectives. Furthermore, the evaluation assessed the programme's first identifiable effects and formulated recommendations for its further development.

Programme objectives and key information

The Innovation Voucher Plus (ISplus) is part of a package of measures by the Federal Ministry for Transport, Innovation and Technology (BMVIT) and the Federal Ministry of Science, Research and Economy (BMWFW) in cooperation with the Austrian Research Promotion Agency (FFG) to support research and innovation among small and medium-size enterprises (SMEs). The Federal Ministry of Science, Research and Economy (BMWFW) is responsible for the ISplus programme, which was implemented in 2011. The purchase of R&D services from non-university research institutions, universities and universities of applied sciences by SMEs is funded with up to €10,000 (80% of eligible costs up to a maximum of €12,500). This is meant to provide firms with their first access to scientific research and to dismantle barriers to cooperation. The ISplus is therefore a supplement to the Innovation Voucher (IS), which was introduced in 2007 by the Federal Ministry for Transport, Innovation and Technology (BMVIT) and the Federal Ministry of Science, Research and Economy (BMWFW) and provides a maximum funding amount of €5,000, without an in-house contribution, for initiating R&D and innovation cooperative projects. The ISplus is especially meant to make projects with a higher complexity possible. Both programmes accept applications for projects that do not have a thematic focus. Innovation Vouchers are prerequisites for a series of other support services for SMEs that are offered by the Austrian Research Promotion Agency (FFG). These programmes range from funding for feasibility studies (FEASIBILITY) and the development of R&D projects (PROJEKT.START), to the execution of R&D projects in the general programmes, to support for market entry of the resulting products (MARKT.START).[10] The objective is to increase the overall number of SMEs with regular R&D and innovation activities.

A total of 344 projects, with 688 project partners in all, received support between June 2011 and June 2014. The projects were allotted to 329 individual firms. Of the participating research institutions, 42% were universities, 41% non-university research institutions, and 17% universities of applied sciences. About 85% of approvals went to small firms with less than 50 employees. Half of the participating firms were located in the federal states of Vienna and Styria (each about one-quarter), and almost 20% came from Upper Austria. In accordance with the programme's focus, about one-quarter of projects were allotted to industrial production, and another 15% were in the ICT sector. Interest in the Innovation Voucher Plus programme has increased consistently within the observation period. The annual framework budget was therefore increased from €1.5 to €2 million in 2012.

Results of the evaluation

The results of the evaluation indicate that the Innovation Voucher Plus programme has made a positive contribution to broadening Austria's foundation of research and innovation. This instrument has significantly contributed to reaching the SME target group through the Austrian Research Promotion Agency (FFG) programmes.

9 See Kaufmann et al. (2015b).
10 See Austrian Research Promotion Agency (FFG) (2016).

Funding recipients have also reported a great deal of satisfaction with the programme. As the evaluation shows, about one-half of firms funded during the observation period were first-time recipients of the Austrian Research Promotion Agency (FFG) funding. At the same time, just about one-fourth of the funded firms were involved for the first time in R&D or innovation activities. Overall, the programme had the highest additionality in the group of first-time funding recipients with low R&D experience. The "follow-up activity rate" for this group in terms of taking advantage of additional Austrian Research Promotion Agency (FFG) services was 24%, which is high in comparison to the smaller IS programme (€5,000). The empirical evidence shows that Innovation Voucher Plus projects often have the same degree of complexity as a small Innovation Voucher project, but due to the higher funding volume ISplus projects are carried further, providing the foundation for decision making within these firms.

It has been recommended to continue the programme. Recommendations for further development focused first on the interdependence between ISplus and IS; the evaluation found that ISplus had a high substitutability for IS. For example, the eligibility for ISplus could be restricted to new customers of the Austrian Research Promotion Agency (FFG) and firms with a high R&D potential who would facilitate a continuous expansion of the R&D base. Firms experienced with the Austrian Research Promotion Agency (FFG) should therefore only be serviced from the rest of the FFG portfolio.

There were also suggestions to implement measures to make access to ISplus more flexible. For example, instead of the five-year limit[11], the required in-kind contribution could be increased if an application is submitted with an existing cooperation partner. Furthermore, specific measures should be established to reach firms in the production sector to increase their participation in the programme. Both of the Innovation Voucher programmes should be evaluated jointly so that mutual effects can be better recorded.

5.4 Exploratory and evaluation study Young Science – Centre for Cooperation between Science and Schools

Objective of the evaluation

The study[12] encompasses an evaluation of the previous activities of "Young Science" and an exploration of future potential for its further development. The analyses focused on selected activities of the "Young Science" project, including networking activities, sustainability projects completed in 2012[13], the topic platform for pre-scientific papers, and the Young Science seal of approval.

Programme objectives and key information

Young Science is a project initiated in 2011 by the former Federal Ministry of Science and Research (BMWF) for the purpose of supporting cooperation between schools, universities, and research institutions. The programme targets pupils, teachers, researchers, and people who work at the intersection of teaching and research. The Young Science Centre is located at the Austrian Exchange Service (OeAD) and serves as a networking and service platform. Its diverse activities include networking activities which are promoted via the website and public relations work, as well as events, targeted consultations and the implementation of thematic projects. The evalu-

11 See Austrian Research Promotion Agency (FFG) (2015): IS and ISplus guidelines for calls for proposals: "The SME cannot have had in the past five years any contractual relationship for an R&D project with any research institution at which it has paid for expertise using the Innovation Voucher."
12 See Manahl et al. (2015).
13 See the "Rio+20 – Scientists and Young People Take Stock" initiative: http://www.youngscience.at/ueber-uns-ys/archiv_initiativen_zu_nachhaltigkeit/

ation at hand also assessed the "Rio+20 – Scientists and Young People Take Stock" project, which supports for example research internships for pupils at Austrian universities and research institutions, as well as school research projects in the field of sustainability. Current thematic priorities include *Citizen Science*, which involves projects and an award for school classes, and the event and presentation series "Mini Med Junior" on the topic of health awareness.

The platform went online in 2014 and provides access to current research projects and literature that is appropriate for pupils. It aims to support the definition of research topics for pre-scientific papers and diploma theses. Participating universities and research institutions provide topic recommendations and scientists are available to answer questions.

The Young Science seal of approval has been awarded to research-oriented schools since 2012. These schools have supported sustainable, and scientifically ambitious research projects, as well as national and international cooperative relationships. Thirty-three schools have received this seal of approval to date.

The Federal Ministry of Science, Research and Economy's "Sparkling Science" programme is also integrated in the Young Science initiative and provides funding for scientific projects that include pupils. However, this programme is administered under its own agenda track and was evaluated separately in 2014.[14]

Results of the evaluation

Overall, the evaluation found positive developments in the selected activities of Young Science. Since 2011, for example, there has been steady growth in event participation, up to 1,200 in 2014. For the first time since 2014, pupils were also by far the largest group among the participants. Innovative formats such as "science slams" were considered a positive way to reach pupils and keep them involved. Nevertheless, the evaluation noted the importance of the commitment of teaching staff, who, after all, are essential catalysts for the participation of pupils in Young Science activities. Thus there should be additional support services for teachers so that Young Science can be even more deeply integrated into the teaching practices in schools. This recommendation is based on experience in organising Rio+20 projects as well as Sparkling Science projects.

The aim of the topic platform is to respond to the expected need for information according to newly introduced instrument of pre-scientific papers (vwa), in the context of the Austrian Matura. This evaluation also comes to the conclusion that there is major potential here. The lack of coordination among individual stakeholders, however, led in the first phase to high efforts, especially among participating researchers. Researchers reported that they were confronted with repeated requests and unrealistic expectations regarding their contribution to pre-scientific papers.

Schools in eastern Austria, especially in urban areas, have showed a strong dedication to the Young Science seal of approval up to the present. The current focus on *citizen science* could also be leveraged to increase awareness of Young Science activities in rural areas.

5.5 2015 impact analysis of the Austrian competence centres programme COMET

Objective of the evaluation

The focus of the impact analysis of the Austrian competence centres programme COMET [15] was to build on the characterisation of the programme lines and R&D activities, and to generate findings about the impact of COMET on participat-

14 See Austrian Research and Technology Report 2015, Chapter 6.7. BMWFW, BMVIT (2015); http://www.bmwfw.gv.at/ftb
15 See Dinges et al. (2015).

ing firms and scientific partners on the effects resulting from activities at the international level and on the development and expansion of skilled staff.

Programme objectives and key information

COMET's strategic objectives include the cultivation of new areas of competence through the initiation and support of strategically coordinated, long-term research collaboration between science and industry, as well as the development and consolidation of technology leadership among firms. The further development and bundling of existing strengths and the integration of international research know-how will increase Austria's attractiveness for research and innovation over the long term. The COMET programme consists of the following three programme lines to implement these objectives. These lines differ primarily in the demands placed on the funded institutions in terms of their international character, project volume, duration, and (physical) infrastructure:

- *K projects:* The aim of the K projects is to initiate high-quality research involving collaboration between science and industry, over the medium-term and on clearly restricted topics with development potential. K projects have a "multiple actor" character (at least three corporate partners) and are strategic in that they strive for sustainable priority-setting from a medium-term perspective. So far, five calls for proposals have resulted in support for 46 projects.[16]
- *K1 centres:* The objective of the K1 centres is to initiate high-quality research involving collaboration between science and industry over the medium- to long-term. K1 centres perform research at a high level and focus on scientific and technological developments with an emphasis on markets that are important to the future. So far, four calls for proposals have resulted in support for 18 K1 centres.[17]
- *K2 centres:* The K2 centres strive to bring together existing national areas of competence over the long term and to promote collaboration between researchers, academic partners, and firms in shared strategic research projects at the highest level. The long-term aim is to strengthen and significantly improve Austria's international attractiveness as a place to do research. So far, two calls for proposals have resulted in support for five K2 centres.[18]

Results of the evaluation

The impact analysis suggests that the K2 and K1 programme lines, apart from funding volumes, only differ in terms of their size and international orientation. K2 centres have significantly larger partner networks and more international academic and corporate partners than K1 centres. The impact analysis found only relatively minor differences between the programme lines in terms of regional integration, the type of projects, and the type of scientific and technological output.

COMET is characterised as a programme that focuses on the implementation of specific, application-oriented R&D plans at firms that can often be put to use very quickly after the completion of R&D work in the firms. Under these conditions, the evaluation team found that the programme's orientation towards excellence, which calls for longer-term, strategically new cooperative RTI activities, would be very difficult to realise. The evaluation made positive note of the effect of cooperative research in terms of contributions to increasing the development of competence and innovation output at firms involved in the K centres.

Among the academic partners, the impact analysis first and foremost found a deepening ef-

16 Information on K projects: https://www.ffg.at/content/comet-compentence-centres-excellent-technologies-k-projects
17 Information on K1 centres: https://www.ffg.at/content/compentence-centres-excellent-technologies-k1-centres
18 Information on K2 centres: https://www.ffg.at/content/compentence-centres-excellent-technologies-k2-centres

fect for existing research topics, a corresponding development of areas of competence, and a highly significant impact on publication and innovation activities. The large majority of academic partners, however, did not perceive any stronger integration in regional, national, European and international cooperation networks for their institution. Interestingly, it seems that the academic partners of K projects had a much more positive view of programme participation than did the partners of the K centres. In comparison with the K projects, cooperative research in the K centres only led to a relatively low number of 1) follow-up projects with corporate partners or 2) other academic partners, 3) instances of obtaining other third-party funding. According to the report, this can be explained by the upstream function of centres, which are responsible for the coordination and performance of R&D projects.

The impact analysis arrived at the overall conclusion that the strong orientation towards directly utilisable research projects in individual firms may enjoy high attractiveness among firms and lead to presentable market innovations, yet on the other hand it conceals a number of risks in terms of research and technology policy. The impact analysis therefore recommends a re-design of the programme, focusing on increasing openness for new, user-inspired research problems, as well as promoting sustainable problem-solving that is of systemic importance to the economy and society. The evaluation of R&D activities should therefore be more closely aligned towards multi-year R&D programmes and their projects.

5.6 Evaluation of research funding for universities of applied sciences in Austria

Objective of the evaluation

The objective of the evaluation of research funding for universities of applied sciences (Fachhochschulen, FHs)[19] was to assess the current status of research at Austrian FHs and especially the contribution of the funding programmes financed by the Federal Ministry of Science, Research and Economy (BMWFW) – COIN Development, Research Studios Austria (RSA) and the Josef Ressel Centres (JR Centres) – for developing research at Austrian FHs and its utilisation for the economy.

The evaluation was based on empirical surveys and tested whether or in what form existing funding programmes can be redesigned in an effective and efficient way in order to preserve existing research potential at the FHs in the future.

Programme objectives and key information

The COIN Development programme line, the RSA programme, and the JR Centres are among the funding instruments that count FHs to their designated target groups. The COIN Development programme seeks to develop and strengthen areas of competence and functions at providers of application-oriented research, development and innovation competence (RDI) in the Austrian innovation system, especially for small and medium-sized enterprises (SMEs). The programme funds strategically oriented projects with medium- to long-term impact that clearly and measurably increase RDI competence and RDI capacity. The maximum project size is €2 million. Projects last from 2 to 5 years. The COIN Development programme is aimed at non-university research institutions with a maximum of 150 employees (full-time equivalents) as well as FHs and their transfer centres.

JR Centres consist of a compact research group with a centrally positioned director. Funding is provided for application-oriented (or applied) research at a high level and with strict scientific quality controls that are embedded in the FH's academic environment. The research programme is based on a firm's research problem, which is then addressed on a shared basis by industry and sci-

19 See Geyer und Warta (2016).

ence. The minimum annual budget of the JR Centres is €80,000, and the maximum permissible annual budget is €400,000. The maximum lifetime of a JR Centre is five years (a two-year inception phase and a three-year extension phase upon successful evaluation). The programme is directed at FHs and highly qualified researchers at FHs.

The RSA programme supports the establishment and operation of distinct R&D units (studios) that perform applied research on an embedded basis in Austrian studio administrators. They can be set up alone or in cooperation with a partner with the aim of transforming research results as quickly as possible into marketable products and services. The duration lasts four years. The maximum federal funding per studio amounts to €1.3 million. The RSA programme's target group includes firms, universities, universities of applied science, and their transfer centres, as well as cooperative and non-university research institutions.

Results of the evaluation

According to the evaluation, the COIN Development programme line and its predecessor, FH-plus, were primarily responsible for stimulating, or even enabling in the first place, the development of R&D competence at FHs. The evaluation found that the financial scope, orientation and funding criteria are well-aligned with the needs and circumstances of research activities at universities of applied science. JR Centres offer especially strong research groups the opportunity to do research together with industry partners at a high scientific level. Universities of applied science have scarcely made inroads into the RSA programme. The evaluation found that the opportunities envisioned by the RSA programme – namely, to bring in academic basic research as a knowledge foundation in the RSA – have been limited up to now.

The evaluation also determined that the existing programmes are well-aligned with industry needs in the context of cooperative research relationships with universities of applied science. At the same time, the evaluation pointed out that the direct leverage exercised by the programmes on the expansion of corporate research, or on the extent of corporate financing of research at FHs, should not be overestimated, because firms profit above all indirectly from R&D competence established at FHs during the course of research funding.

The evaluation came to the conclusion that more specific funding instruments, oriented towards universities of applied science, are needed. Such programmes would enable open-topic, long-term, application-oriented research, much like the COIN Development programme and the JR Centres. The evaluation team believes this is necessary to shore up the current status of research at Austrian universities of applied science. The opportunities for FHs to move to other funding schemes or funding sources are currently limited.

5.7 Evaluation of the START Programme and the Wittgenstein Prize

Objective of the evaluation

The aim of the evaluation of the START Programme and the Wittgenstein Prize[20] was to assess the performance of these instruments in terms of their usefulness and outcomes, thereby preparing the ground for taking a decision as to whether and in what way these initiatives can be continued in future.

Programme objectives and key information

The START Programme and the Wittgenstein Prize aim to fund and support excellent research and provide up to six years of financing for this purpose. This is meant to give funding recipients the opportunity to conduct their research with as much freedom and flexibility as possible. The START Programme is directed at young excel-

20 See Seus et al. (2016).

lent researchers (post-docs) and is meant to allow START project leaders to develop, expand and lead a working group to enhance their credentials for leadership positions in the science system. The Wittgenstein Prize, on the other hand, recognises outstanding past research achievements and is the most prestigious award offered for basic research in Austria. The prize-winner should be granted the highest degree of freedom and flexibility in carrying out their research, thereby facilitating extraordinary improvement in their scientific achievements.

The START Programme typically supports six to eight junior scientist group leaders each year. The Wittgenstein Prize is awarded to up to two researchers in the same period of time. Since 1996, 122 START junior scientist group leaders (including 21 women) have received support, and 32 Wittgenstein Prizes have been awarded (including five women).

Results of the evaluation

The evaluation found that both the START Programme and the Wittgenstein Prize are unique within the Austrian funding and research landscape. The START Programme is the only programme in Austria that provides a kind of starter package for the scientific career of promising junior researchers. The Wittgenstein Prize is the Austrian Science Fund's only funding vehicle that follows the "finance people, not projects" principle and has strong "blue sky" elements.

With regard to the START Programme, the evaluation came to the conclusion that funding significantly increased the already high scientific performance of funding recipients. The achievements of START participants turned out to be significantly better, in terms of bibliometric indicators, than those of a comparable control group. Furthermore, the evaluation provides indications that START funding enabled the exploration of new and unconventional scientific problems. In accordance with the programme's intentions, START also makes significant contributions to the career development of funding recipients. All of the START participants up to this point have been able to establish themselves in the science system, of whom the majority are at Austrian institutions.

The evaluation shows that the Wittgenstein Prize, on the other hand, contributes to unconventional, high-risk research activities. The prize therefore elevated the scientific achievements of the prize-winners as well as the visibility of Austrian researchers. Furthermore, the evaluation concludes that the Wittgenstein Prize also increased the visibility of research in Austria. Prize-winners used the freedom that prize bestows to develop new methods and research questions and to pursue interdisciplinary research with renewed vigour. The elaboration of new research priorities was expressed in numerous successful bids for third-party funding, which enabled the Wittgenstein groups to expand upon their leading role in top research and to create a stimulating environment for young researchers financed with prize money.

The evaluation recommended the continuation of both programmes without reservation due to their multiple positive effects on the Austrian science system. Suggestions for improvement focused on reducing the circle of nominations for the Wittgenstein Prize and incremental modifications to the selection process.

5.8 Evaluation of Austrian participation in the AAL programme (2008–2013)

Objective of the evaluation

The evaluation[21] analyses Austria's participation in the Ambient Assisted Living Joint Programme (AAL JP) from 2008 to 2013, as well as the programme's four national rounds of calls for proposals from 2010 to 2013. The evaluation assesses the effect and goal attainment at the programme and project level and analyses the asso-

21 See Geyer und Good (2016).

ciated community or stakeholder situation. The evaluation formulates recommendations for the future based on its findings.

Programme objectives and key information

From 2008 to 2013, the Federal Ministry for Transport, Innovation and Technology (BMVIT) participated in the Ambient Assisted Living Joint Programme (AAL JP) with 22 other nations and the European Commission. AAL JP is based on Section 169 of the Maastricht Treaty and provides joint funding from national and EU funds. The Austrian Research Promotion Agency (FFG) has disbursed €22.3 million to Austrian participants in six calls for proposals in the AAL JP, whereby €12.7 million came from the Federal Ministry for Transport, Innovation and Technology (BMVIT) and €9.6 million from the European Commission.

The European AAL programme focuses on the development of products and services based on information and communication technologies, which increase the quality of life for older people, their independence, safety, and wellbeing. This is meant to facilitate first and foremost a long, independent life in one's own private sphere. End users are included in the project consortia in order to guarantee high applicability and acceptance of those product and service developments that receive funding.

According to the evaluation report, Austrian project partners were involved actively in the AAL JP calls for proposals and projects. Austrian partners were involved in more than one-third of funded projects. Measured by the number of partners or by the project budget, Austria's share of 8.5% put it in fourth place among the participating states, behind Spain, Germany, and Switzerland. There have been 54 projects with Austrian partners thus far, with 61 participations by research institutions, 31 participations by firms, and 14 participations by public services such as aid organisations and other institutions in the fields of health care, social work, and long-term care.

The programme 'benefit' provides the national basis for funding AAL projects. The Federal Ministry for Transport, Innovation and Technology (BMVIT) would like to use benefit to spur the development of future markets in the leisure, living, care and health sectors, which will also be borne by the significant purchasing power of senior citizens. In addition to the European AAL JP initiative, the Federal Ministry for Transport, Innovation and Technology (BMVIT) conducted four rounds of calls for proposals from 2010 to 2013 to fund projects on ICT-supported, active aging in the following clusters of topics: 1) Social inclusion (communication; social network formation and perpetuation; information/advising); 2) Activities inside and outside of one's own living environment (active in the sense of games, movement training, physical activity; tourism, mobility in (an expanded) living environment); 3) Comfort (Smart Homes, Smart Textiles), and 4) Safety and health (measurement/monitors/alarms; management of risk factors and chronic illnesses).

The four calls for proposals generated the submission of a total of 103 project applications with 348 participating partners, and funded 47 projects with 172 partners. Of the 172 partners, 20 were public services (aid organisations, etc.), 78 research institutions, and 74 firms. The four benefit calls for proposals resulted in the approval of €11.0 million in funding for total projects costs of €18.9 million.

Results of the evaluation

The evaluation took for granted the attainment of network-related programme objectives. The projects were assumed to have been successful, by means of the participation of public services, in involving elderly people and other users in a significantly greater scope than was previously the case for other R&D programmes, and the programme participants identified this aspect as the most important aspect of the AAL JP's success.

The evaluation team believes that the economy-related programme objectives placed on the

AAL JP and benefit programmes were too ambitious previously. According to the evaluation report, only some of the completed AAL projects with Austrian participation were able to transform project results into products and services within the programme's commercialisation horizon of two to five years. Less than one-third of project partners in completed projects reported products and services that were already on the market. In four of five cases, developments were however carried forward, frequently funded in subsequent (European) projects.

Although the evaluation claimed that projects resulted comparatively often in the founding of firms and spin-off firms, less attention was paid to new business models, marketing concepts, and value-creation chains – in what the evaluation tended to characterise as heavily research- and technology-oriented projects – in order to further develop project results into market-ready products and services.

On the basis of its analysis, the evaluation recommends an even stronger inclusion of key public actors in the health care, social work, and long-term care sectors as a target group in the successor programme, and to also create an appropriate organisational framework, as the previous positioning of the AAL JP in the Federal Ministry for Transport, Innovation and Technology's (BMVIT) ICT of the Future programme was insufficiently focused on the AAL JP's claim to social innovations.

6 Literature

acatech and BDI (eds.) (2015): Innovationsindikator 2015. Berlin: Deutsche Akademie der Technikwissenschaften and Bundesverband der Deutschen Industrie.

Aghion, P., Dewatripont, M., Hoxby, C., Mas-Colell, A. and Sapir, A. (2010): The governance and performance of universities: evidence from Europe and the US, Economic Policy, 25(61), 7–59.

Aichholzer, G., Gudowsky, N., Saurwein, F., Rhomberg, W., Weber, M. and Wepner, B. (2015): Industrie 4.0 Foresight & Technikfolgenabschätzung zur gesellschaftlichen Dimension der nächsten industriellen Revolution. Final summary report. Project report no. ITA-AIT–2, Vienna.

Andrew, J. P., DeRocco, E. S. and Taylor A. (2009): The Innovation Imperative in Manufacturing. How the United States Can Restore Its Edge, Boston: Boston Consulting Group.

Arundel, A., Es-Sadki, N., Barjak, F., Perrett, P., Samuel, O. and Lilischkis, S. (2013): Knowledge Transfer-Study 2010–2012, Final Report, European Commission, Brussels.

Atkinson, R. D. and Andes S. M. (2009): The Atlantic Century. Benchmarking EU & U.S. Innovation and Competitiveness, Washington: The Information Technology and Innovation Foundation.

Audretsch, D. B. and Keilbach, M. (2006): Entrepreneurship, growth and restructuring, in Casson, M., Yeung, B., Basu, A. and Wadeson, N., The Oxford Handbook of Entrepreneurship, Oxford.

Austrian Higher Education Conference (2015): Empfehlung der Hochschulkonferenz zur qualitativen Weiterentwicklung der Doktoratsausbildung in Österreich, 11.06.2015, Vienna.

Austrian Research Promotion Agency (FFG) (2015): Interessensbekundung 2. Ausschreibung Stiftungsprofessur. https://www.ffg.at/stiftungsprofessur/2015, downloaded on 19.03.2015

Austrian Science Board (2014). Empfehlung zum Promotionsrecht in einem differenzierten Hochschulsystem, Vienna.

Austrian Science Board (2015). Das österreichische Hochschul- und Wissenschaftssystem – Ein Weißbuch und eine konkrete Utopie, Vienna.

Bast, H. (2014): Industrie 4.0: Oberösterreich und Steiermark planen Modellregion. http://wirtschaftsblatt.at/home/nachrichten/oesterreich/steiermark/4623523/Industrie-40_Oberosterreich-und-Steiermark-planen-Modellregion

Ben-David, J. and Zloczower, A. (1962): Universities and academic systems in modern societies, European Journal of Sociology, 3, 45–84.

Biegelbauer, P. and Hansen, J. (2011): Democratic Theory and Citizen Participation: democracy models in the evaluation of public participation in science and technology, Science and Public Policy, 38(8), 589–598.

Biegelbauer, P., Grießler, E. and Loeber, A. (2013): Politik, öffentliche Verwaltung und Wissen: Wer prägt die Politikgestaltung ethisch und technisch komplexer Themen? der moderne staat – dms 6 (Sonderheft 1), 223–240.

BKA, BMF, BMUKK, BMVIT, BMWFJ and BMWF (2011): Der Weg zum Innovation Leader: Strategie der Bundesregierung für Forschung, Technologie und Innovation, Vienna.

Blair, D. and Hitchens, D. (1998): Campus Companies – UK and Ireland. Aldershot, UK.

BMLFUW and BMF (2010): Österreichischer Aktionsplan zur nachhaltigen öffentlichen Beschaffung, Vienna.

BMVIT (2014): Stöger: Drei heimische Universitäten erhalten Stiftungsprofessur für Produktion und Industrie 4.0. http://www.bmvit.gv.at/presse/aktuell/nvm/2014/0917OTS0068.html

BMVIT and BMWFW (2015): IÖB-Jahresbericht 2013/2014, Vienna.

BMWA (2007): procure_inno: Praxisorientierter Leitfaden für ein innovationsförderndes öffentliches Beschaffungs- und Vergabewesen, Vienna.

BMWF (2011): Universitätsbericht 2011, Vienna.

BMWF, BMVIT, and BMWFJ (2013): Austrian Research and Technology Report 2013. Status report in accordance with Section 8 (1) of the Research Organisation Act on federally subsidised research, technology and innovation in Austria. http://www.bmwfw.gv.at/rtr

BMWFJ and BMVIT (2011): Ministerratsvortrag: Entwicklung eines österreichischen Leitkonzeptes für eine innovationsfördernde öffentliche Beschaffung (IÖB), Vienna.

BMWFJ and BMVIT (2012a): Leitkonzept für eine innovationsfördernde öffentliche Beschaffung (IÖB) in Österreich, Vienna.

BMWFJ and BMVIT (2012b): Ministerratsvortrag: Umsetzung des österreichischen Leitkonzeptes für eine innovationsfördernde öffentliche Beschaffung (IÖB), Vienna.

BMWFW (2014a): Empfehlungen der Österreichischen Hochschulkonferenz zur Verbesserung der Qualität der hochschulischen Lehre, Vienna.

BMWFW (2014b): Universitätsbericht 2014, Vienna.

BMWFW (2014c): Statistisches Taschenbuch 2014.

BMWFW (2015): Zukunftsforum zur strategischen Weiterentwicklung der Geisteswissenschaften, Kulturwissenschaften und Sozialwissenschaften – Protokoll; 02. December, Palais Niederösterreich: http://wissenschaft.bmwfw.gv.at/fileadmin/user_upload/Studien_und_Berichte/2015_12_22_BMWFW_Zukunftsforum_Protokoll_final.pdf

BMWFW (2015a): Aktionsplan für einen wettbewerbsfähigen Forschungsraum. Maßnahmen des Bundesministeriums für Wissenschaft, Forschung und Wirtschaft zur verstärkten Umsetzung der FTI-Strategie der Bundesregierung in ausgewählten Themenfeldern.

BMWFW (2015b): Land der Gründer. Auf dem Weg zum gründerfreundlichsten Land Europas. Vienna.

BMWFW (2015c): Wissenschaft und Gesellschaft im Dialog: "Responsible Science", Vienna.

Bologna Process (2003): Den Europäischen Hochschulraum verwirklichen. In: Kommuniqué der Konferenz der Europäischen Hochschulministerinnen und -minister on 19.09.2003 in Berlin.

Bravo-Biosca, A. (2010): Growth Dynamics: Exploring Business Growth and Contraction in Europe and the US. Research Report, London.

Bravo-Biosca, A., Criscuolo, C. and Menon, C. (2013): What Drives the Dynamics of Business Growth? OECD Science, Technology and Industry Policy Papers, No. 1, OECD Publishing.

Brennan, M. C., Wall, A. P. and McGowan, P. (2005): Academic entrepreneurship. Assessing preferences in nascent entrepreneurs. Journal of Small Business and Enterprise Development, 12(3), 307–322.

Bruin, A. D. and Flint-Hartle, S. (2005): Entrepreneurial women and private capital: The New Zealand perspective, International Journal of Entrepreneurial Behaviour and Research, 11(2), 108–128.

Brünner, H. C., Buchinger, E., Jäger, D., Schieg, A., Steiger, M. and Unger, J. (2012): 4 x Good practice: Public procurers as drivers of innovation, AIT Austrian Institute of Technology, Vienna.

Buchinger, E. (2012): PPPI Notes: The Austrian innovation procurement strategy process 2011/12, AIT Austrian Institute of Technology, Vienna.

Buchinger, E. (2015): Österreichs IÖB-Performance im internationalen Vergleich, in: BMVIT and BMWFW (eds.): IÖB-Jahresbericht 2013/2014, Vienna, 51–53.

Buchinger, E. and Kienegger, M. (2014): Assessment: IÖB-Veranstaltungen 2012/2013, AIT Austrian Institute of Technology, Vienna.

Bundesverband Deutscher Stiftungen (2014): Zahlen, Daten, Fakten zum Deutschen Stiftungswesen.

CASE (2008): Developing the Field of Social Entrepreneurship. Center for the Advancement of Social Entrepreneurship, Duke University, Durham.

Ciriaci, D., Moncada-Paternò-Castello, P. and Voigt, P. (2013): Innovation and Job Creation: A sustainable relation?, IPTS Working Papers on Corporate R&D and Innovation 01/2013.

Coad, A. and Rao, R. (2011): Innovation and firm growth in high-tech sectors: A quantile regression approach, Research Policy, 37, 255–283.

Coad, A., Daunfeldt, S., Hölzl, W., Johansson, D. and Nightingale, P. (2014): High-growth firms: introduction to the special section, Industrial and corporate Change, 23(1), 91–112.

Cornell University, INSEAD, WIPO (2015): The Global Innovation Index 2015: Effective Innovation Policies for Development, Fontainebleau, Ithaca, and Genf.

Czarnitzki, D., Rammer, C. and Toole, A. (2014): University Spin-offs and the "Performance Premium", Small Business Economics, 43(2), 309–332.

Dacin, P., Dacin, T. and Matear, M. (2010): Social entrepreneurship. Why we don't need a new theory and how we move forward from here, The Academy of Management Perspectives, 24(3), 37–57.

Davey, T., Altmann, A., Ebersberger, B., Meerman, A. and Galán-Muros, V. (2013): The State of University-Business Cooperation in Austria. UBC Country Report. Part of the DG Education and Culture Study on the Cooperation Between Higher Education Institutions and Public and Private Organisations in Europe.

Decker, R., Haltiwanger, J., Jarmin, R. and Miranda, J. (2014): The secular decline in business dynamism in the U.S. Unpublished Manuscript: University of Maryland.

Dees, J. G. (2001): The Meaning of Social Entrepreneurship, Kansas City.

Dinges, M., Zahradnik, G., Wepner, B., Ploder, M., Streicher, J. and Linshalm, E. (2015): Wirkungsanalyse 2015 des österreichischen Kompetenzzentren-programms COMET, AIT-IS-Report, No. 111.

Doove, D., Gibcus, P., Kwaak, T., Smit, L. and Span, T. (2014): Survey on the access to finance of enterprises (SAFE). Analytical Report, Brussels.

Dosi, G. (1988): Sources, Procedures, and Microeconomic Effects of Innovation, Journal of Economic Literature, (3), 1120–1171.

EC (2010): Science and Technology: Special Eurobarometer 340, Brussels.

EC (2011): Towards Responsible Research and Innovation in the Information and Communication Technologies and Security Technologies Fields, Brussels.

EC (2013): Responsible Research and Innovation (RRI), Science and Technology: Special Eurobarometer 401, Brussels.

Eckhardt, B., Jakob, D. and von Schnurbein, G. (2012): Der Schweizer Stiftungsreport 2012. CEPS Forschung und Praxis – vol. 6.

Ecker, B. and Gassler, H. (2016): Akademische Spinoffs. Das universitäre Gründungsökosystem in Österreich der Nutzen von Spinoffs für die Herkunftsuniversität, Study commissioned by the Federal Ministry of Science, Research and Economy (BMWFW), Vienna:

Ecker, B., Kottmann, A. and Meyer, S. (2014): Evaluation of the FWF Doctoral Programme (DK Programme). Vienna: Institut für Höhere Studien (IHS).

Economist Intelligence Unit (2009): A New Ranking of the World's Most Innovative Countries, London: Economist Intelligence Unit.

ERDF programme investments in growth and employment in Austria, 2014–2020 – Operational programme for the use of ERDF funds, Version 1.2 dated 10 December 2014.

Egeln, J., Gottschalk, S., Rammer, C. and Spielkamp, A. (2013): Spin-off-Gründungen aus der öffentlichen Forschung in Deutschland, Schriftenreihe des ZEW, vol. 68, Baden-Baden.

ESF and ALLEA (2011): The European Code of Conduct for Research Integrity, Strasbourg.

Etzkowitz, H. (1983): Entrepreneurial Scientists and Entrepreneurial Universities in American Academic Science, Minerva, 21(2-3), 1573–1871.

Etzkowitz, H. (2003): Research Groups As 'Quasi-Firms': The Invention of the Entrepreneurial University, Research Policy, 32(1), 109–121.

European Commission (2013): Measuring innovation Output in Europe, towards a new indicator, COM(2013)624 and SWD(2013)325.

European Commission (2014): The Social Business Initiative of the European Commission. lnternal Market and Services.

European Commission (2015): Innovation Union Scoreboard 2015, Brussels.

European Commission (1998): Fostering Entrepreneurship in Europe: Priorities for the future, Brussels, April 1998 COM (98) 222 final.

European Commission (2007): Pre-commercial procurement: Driving innovation to ensure sustainable high quality public services in Europe, 2007/C/799, Brussels.

European Commission (2010): Europe 2020 flagship initiative innovation union, 2010/C/546, Brussels.

European Commission, EACEA and EURYDICE (2015): The European Higher Education Area in 2015: Bologna Process Implementation Report, Luxembourg.

Faire Vergaben (2014): Österreich Katalog: Faire Vergaben sichern Arbeitsplätze. Initiative Faire Vergaben Parlamentarische Enquete 11.11.2014, Vienna.

Falk, M. (2012): Quantile estimates of the impact of R&D intensity on firm performance. Small Business Economics, (39), 19–37.

Falk, M. and Spitzlinger, R. (2013): Erfolgsfaktoren für neue Arbeitsplätze von F&E-durchführenden Unternehmen, Study commissioned by the Austrian Research Promotion Agency, Vienna.

Felt, U. (ed.) (2003): O.P.U.S. – Optimising Public Understanding of Science and Technology: Final Report. Vienna, Department of Philosophy of Science and Social Studies of Science, University of Vienna.

Forschungsunion Wirtschaft und Wissenschaft and acatech (2013): Deutschlands Zukunft als Produktionsstandort sichern. Umsetzungsempfehlungen für das Zukunftsprojekt Industrie 4.0. Abschlussbericht des Arbeitskreises Industrie 4.0, Frankfurt/Main.

Frank, A., Kralemann, M. and Schneider, M. (2009): Stiftungsprofessuren in Deutschland. Zahlen, Erfahrungen, Perspektiven. Stifterverband für die Deutsche Wissenschaft, Essen.

Friesenbichler, K. S. and Url, T. (2013): Standortfaktoren und Investitionspotential von Risikokapital in Österreich, WIFO-Monatsberichte 86, 673–683.

FTI-AG2 (2015): Klimawandel und Ressourcenknappheit (ed.) Bericht: Bioökonomie und FTI-Aktivitäten in Österreich, ein Beitrag zur Bioökonomie-Entwicklung der Bundesregierung. Vienna.

Fundraising Verband Austria (2015): Spendenbericht 2015. Vienna.

Fürlinger, G. (2014): Die Bausteine eines Gründerökosystems, in: Funke, T., and Zehrfeld, W. A. (eds.) Abseits von Silicon Valley: Beispiele erfolgreicher Gründungsstandorte, Frankfurter Allgemeine Buch, Frankfurt.

Fürlinger, G. and Leitner, K.-H. (2016a): Kulturelle Aspekte der Förderung universitärer Spin-offs, in: Lemmens, M., Horváth, P. and Seiter, M. (eds.) Wissenschaftsmanagement – Handbuch & Kommentar, Lemmens Medien Bildung, Forschung, Technologie, Bonn, Berlin, New York.

Fürlinger, G. and Leitner, K.-H. (2016b): The role of social capital for university start-up incubation: A multi-level comparison of USA and Europe, Endbericht zum Jubiläumsfondsprojekt Nr. 15500 der Österreichischen Nationalbank, AIT-IS-Report, March, Vienna.

Gerhard, D. (2014): TUWin 4.0 – One Stop Shop für Industrie 4.0, Lecture on 04.11.2014.

Geyer, A. and Warta, K. (2016): Evaluierung der Forschungsförderung für Fachhochschulen in Österreich. Final report to the Federal Ministry of Science, Research and Economy. Technopolis Group, May 2015.

Geyer, A. and Good, B. (2016): Evaluierung der österreichischen Beteiligung am Ambient Assisted Living Joint Programme (AAL JP 2008–2013). Final report. Technopolis Group.

Gibb, A. A. (2007): Creating the entrepreneurial university: do we need a different model of entrepreneurship, in: Fayolle, A. (ed.) Handbook of research in Entrepreneurship Education, Vol. 1, Cheltenham, 67–104.

Griessler, E. (2010): "Weil das so ein heißes Thema ist, rühren wir das besser nicht an." Zur Regulierung kontroverser biomedizinischer Forschung in Österreich, in: Biegelbauer, P. (ed.): Steuerung von Wissenschaft? Die Governance des österreichischen Innovationssystems, Innsbruck/Bozen/Vienna, 143–186.

Grimaldi, R., Kenney, M., Siegel, D.S. and Wright, M. (2011): 30 years after Bayh-Dole: reassessing academic entrepreneurship, Research Policy, (40), 1045–1057.

Hafellner, S. and Schiffbänker, H. (2015): Social Entrepreneurship als Berufsfeld mit Zukunft. Social Entrepreneurship als eine Antwort auf gesellschaftliche Herausforderungen und die Suche der Generation Y nach sinnvoller Arbeit, POLICIES Working Paper 82/2015, Vienna.

Hammerer, L. (2016): Start-up Ökosystem Österreich, Projektarbeit, Vienna University of Technology and the Austrian Institute of Technology, March, Vienna.

Heller-Schuh, B., Kasztler, A. and Leitner, K.-H. (2015): Forschungsinfrastrukturfinanzierung: FTI-politische Steuerung und Förderung im nationalen und internationalen Kontext, comissioned project for the Federal Ministry of Science, Research and Economy (BMWFW), Federal Ministry for Transport, Innovation and Technology (BMVIT) and the Austrian Council for Research and Technology Development, Vienna.

Henrekson, M. and Johansson, D. (2010): Gazelles as job creators: a survey and interpretation of the evidence, Small Bus Econ, 35(2) 227–244.

Hicks, D. (2012): Performance-based university research funding systems, Research Policy, 41(2), 251–261.

Hochschulforschung (2004): Die Trends der Hochschulbildung und ihre Konsequenzen. Wissenschaftlicher Bericht für das BMBWK, Vienna.

Hölzl, W. (2010): Die Bedeutung von schnell wachsenden Unternehmen in Österreich, WIFO-Monatsberichte, 83(11), 887–898.

Hölzl, W. (2016): High growth firms in Europe, chapter in: European Commission: Science, Research and Innovation performance of the EU: A contribution to the Open Innovation Open Science Open to the World agenda 2016, Brussels.

Hölzl, W. and Friesenbichler, K. (2010): High growth firms, innovation and the distance to the frontier, Economics Bulletin 30, 1016–1024.

Hölzl, W. (2011): Unternehmenswachstum im internationalen Vergleich, WIFO Monatsberichte 8/2011, 557–567.

Hölzl, W. and Janger, J. (2013): Does the analysis of innovation barriers perceived by high growth firms provide information on innovation policy priorities? Technological Forecasting and Social Change, 80 (8), 1450–1468.

Hölzl, W. and Janger, J. (2014): Distance to the frontier and the perception of innovation barriers across European countries, Research Policy, 43(4), 707–725.

Hölzl, W. and Reinstaller, A. (2015): Unternehmertum, Wettbewerbsfähigkeit und Wachstum, Wirtschaftspolitische Blätter, 3/2015, 430–456.

Hopt, K. J., Anheier, H. K., Ebke, W., von Hippel T., Reimer, E., Then, T. and Vahlpahl, T. (2008): Feasibility Study on a European Foundation Statute. Planck Institute for Comparative and International Private Law & University of Heidelberg, Centre for Social Investment.

Hranyai, K. and Janger, J. (2015): Forschungsquotenziele 2020. Aktualisierung 2015, commissioned by the Austrian Council for Research and Technology Development, Vienna.

IÖB-Servicestelle (2014): Zehn Beispiele für innovationsfördernde öffentliche Beschaffung, Vienna.

Isenberg, D. (2010): How to start an Entrepreneurial Revolution, Harvard Business Review, June 2010.

Isenberg, D. (2011): The entrepreneurship ecosystem strategy as a new paradigm for economic policy: Principles for cultivating entrepreneurship, Presentation at the Institute of International and European Affairs, May 12, 2011, Dublin, Ireland.

IV Oberösterreich – Industriellenvereinigung Oberösterreich (2013): Produktion der Zukunft. http://www.iv-oberoesterreich.at/b723m59

Jakubitz, P. (2015): Assessment: Einrichtung und Betrieb einer Servicestelle für eine innovationsfördernde öffentliche Beschaffung. Jakubitz Projektentwicklung und Training, Vienna (unpublished).

Janger, J. (2015): Business science links for a new growth path, WWWforEurope Working Paper Series 107.

Janger, J. and Nowotny, K. (2014): Bestimmungsfaktoren für die Arbeitsplatzwahl von Wissenschaftern und Wissenschafterinnen, WIFO-Monatsberichte, 87(1), 81–89.

Janger, J. and Pechar, H. (2010): Organisatorische Rahmenbedingungen für die Entstehung und Nachhaltigkeit wissenschaftlicher Qualität an Österreichs Universitäten, Austrian Institute of Economic Research (WIFO), Vienna.

Janger, J., Hölzl, W., Hranyai, K. and Reinstaller, A. (2012): Hochschulen 2025: eine Entwicklungsvision, Austrian Institute of Economic Research (WIFO), Vienna. http://www.wifo.ac.at/wwa/pubid/44698

Janger, J., Strauss, A. and Campbell, D. (2013): Academic careers: a cross-country perspective, WWWforEurope Working Paper Series, 2013 (37).

Jansen, S. A. (2012): Wer macht was? Gesellschaftsspiele des Guten. Vermessungsversuche der Spiele und Spieler einer Zivilgesellschaft des 21. Jahrhunderts. In: Jansen, S. A. (ed.): Bürger, Macht, Staat? Wiesbaden.

Jones, B. F. (2009): The burden of knowledge and the "death of the Renaissance man": is innovation getting harder?, Review of Economic Studies, 76(1), 283–317.

Jud, T. (2013): Funktionsmodell und Rahmenbedingungen der Risikokapitalfinanzierung, WIFO-Monatsberichte 86, 663–672.

Jud, T., Marchart, J., Friesenbichler, K. S., Peneder, M. and Haslinger, S. (2013): Risikokapital in Österreich. Angebots- und nachfrageseitige Erklärungen der geringen Ausprägung und Empfehlungen zu ihrer Überwindung. Improveo Beratungs-GmbH – Austrian Private Equity and Venture Capital Organisation – Austrian Institute of Economic Research (WIFO) – KPMG Alpen-Treuhand AG Wirtschaftsprüfungs- und Steuerberatungsgesellschaft, Vienna.

Kaufmann, P., Kerlen, Ch., Bräuninger, M. and Wolf, L. (2015): Ex-post Evaluation des Strategieprogramms Take Off (2002-13), KMU Forschung Austria, Economic Trends Research, Dr. Christian Kerlen – Evaluation und Beratung, Study commissioned by the Federal Ministry of Transport, Innovation and Technology (BMVIT).

Kaufmann, P., Wolf, L. and Sheikh, S. (2015b): Zwischenevaluierung des Programms Innovationsscheck Plus – Endbericht; KMU Forschung Austria; Study commissioned by the Federal Ministry of Science, Research and Economy.

Kommission für wissenschaftliche Integrität (2014): Jahresbericht 2014, Vienna.

Leitner, K.-H., Dachs, B., Degelsegger, A., Ecker, B., Gassler, H., Heller-Schuh, B., Hochgerner, J., Janger, J., Lampert, D., Peneder, M., Ploder, M., Polt, W., Scherngell, T., Schuch, K., Streicher, G., Unger, M., Unterlass, F., Zahradnik, G. (2015): Stärkefelder im Innovationssystem: Wissenschaftliche Profilbildung und wirtschaftliche Synergien, commissioned by the Federal Ministry of Science, Research and Economy.

Leten, B., Landoni, P. and Van Looy, B. (2014): Science or graduates: How do firms benefit from the proximity of universities?, Research Policy, 43(8), 1398–1412.

Lowe, R. A. (2006): Who develops a university invention? The impact of tacit knowledge and licensing policies, Journal of Technology Transfer, 31(4), 415–429.

Mair, J. and Martí, I. (2006): Social entrepreneurship research: A source of explanation, prediction, and delight, Journal of World Business, 41(1), 36–44.

Manahl, C., Dobner, S., Holocher-Ertl, T. and Kieslinger, B. (2015): Sondierungs- und Evaluationsstudie „Young Science – Zentrum für die Zusammenarbeit von Wissenschaft und Schule", commissioned by the Federal Ministry for Science, Research and Economy.

Marchart, J. (2013): Der österreichische Risikokapitalmarkt im europäischen Vergleich, WIFO-Monatsberichte 86, 685–697.

Mayerhofer, P. (2013): Wiens Industrie in der wissensbasierten Stadtwirtschaft: Wandlungsprozesse, Wettbewerbsfähigkeit, industriepolitische Ansatzpunkte, Austrian Institute of Economic Research (WIFO), Vienna.

Mazzucato, M. (2011): The Entrepreneurial State. London.

McDevitt, V. L., Mendez-Hinds, J., Winwood, D., Nijhawan, V., Sherer, T., Ritter, J. and Sanberg, P. (2014): More than Money: The exponential impact of Academic Technology, Technology and Innovation, 16, 75–84.

Meyer, M. and Simsa, R. (2013): NPOs: Abgrenzungen, Definitionen, Forschungszugänge. In: Simsa, R., Meyer, M. and Badelt, C. (eds.) Handbuch der Nonprofit-Organisation: Strukturen und Management, Stuttgart, 3–14.

Millner, R. and Meyer, M. (2016): Status Quo und Zukunftsperspektiven des gemeinnützigen Stiftungssektors in Österreich. In: Philanthropie 2.0 – Finance & Ethics Vol. 3, eds. Krall, J., Lernbass, R., Mahrer, H., Neumayer, C. and Stauber, O., Frankfurt am Main etc.

Millner, R. and Vandor, P. (2014): Neues Unternehmertum: Social Entrepreneurship und die Rolle des Umfelds, in: Simsa, R. and Zimmer, A. (eds.) Forschung zu Zivilgesellschaft, NPOs und Engagement. Quo vadis?, Wiesbaden, 283–300.

Millner, R., Meyer, M. and Neumayr, M. (2008): The Legal Structure of Foundations and its Impact on their Areas of Activities. Many Privileges and no Obligations? The Case of Austria. 37th Annual ARNOVA Conference, Philadelphia.

Millner, R., Schneider, H. and Meyer, M. (2009): Painting a Blackbox Grey: The Application of Delphi Techniques to Assess Scope and Functions of the Private Foundation Sector in Austria. 38th Annual ARNOVA Conference, Cleveland.

Millner, R., Vandor, P. and Schneider, H. (2013): Innovation und Social Entrepreneurship im Nonprofit-Sektor, in: Simsa, R., Meyer, M. and Badelt, C. (eds.) Handbuch der Nonprofit-Organisation: Strukturen und Management, Stuttgart, 431–449.

Moedas, C. (2015): European Commission press release: Open Innovation, Open Science, Open to the World. SPEECH/15/5243. http://europa.eu/rapid/press-release_SPEECH-15-5243_en.htm

Mosey, S. and Wright, M. (2007): From human capital to social capital: a longitudinal study of technology-based academic entrepreneurs, Entrepreneurship Theory and Practice, 31(6), 909–935.

Nicholls, A. (2010): The Legitimacy of Social Entrepreneurship: Reflexive Isomorphism in a Pre-Paradigmatic Field, Entrepreneurship Theory and Practice, (34), 611–633.

Nowotny, C. (2013): Rechtliche Gestaltungsformen für NPOs. Simsa, R., Meyer, M. and Badelt, C. (eds.) Handbuch der Nonprofit-Organisation: Strukturen und Management, Stuttgart, 183–204.

OECD (1999): Managing National Innovation Systems, Paris.

OECD (2002): Frascati Manual Proposed Standard Practice for Surveys on Research and Experimental Development, Paris.

OECD (2011): Demand-side innovation policies, Paris.

OECD (2014): Intelligent demand: Policy rationale, design and potential benefits, Paris.

OECD (2014b). Entrepreneurship at a glance, Paris.

Open Access Network Austria (2015): Empfehlungen für die Umsetzung von Open Access in Österreich. https://zenodo.org/record/33178/files/OANA_OA-Empfehlungen_12-11-2015.pdf

ORF Science (2015): Niederlande drohen Elsevier mit Boykott. http://science.orf.at/stories/1760557/

Peneder, M. (2010): Technological regimes and the variety of innovation behaviour: Creating integrated taxonomies of firms and sectors, Research Policy, 39(3), 323–334.

Peneder, M. (2012): Firm growth, Schumpeterian entrepreneurship and venture capital, Cambridge, MA.

Peneder, M. (2013): Von den „trockenen Tälern" der Risiko- und Wachstumsfinanzierung, WIFO-Monatsberichte 86, 637–648.

Pennerstorfer, A., Schneider, U. and Badelt, C. (2013): Der Nonprofit-Sektor in Österreich, in: Simsa, R., Meyer, M. and Badelt, C. (eds.) Handbuch der Nonprofit-Organisation, Stuttgart, 55–76.

Pennerstorfer, A., Schneider, U. and Reitzinger, S. (2015): Nonprofit-Organisationen in Österreich 2014, Forschungsberichte Institut für Sozialpolitik, Vienna University of Economics and Business.

Perkmann, M., Tartari, V., McKelvey, M., Autio, E., Broström, A., D'Este, P., Fini, R., Geuna, A., Grimaldi, R., Hughes, A., Krabel, S. et al. (2013): Academic engagement and commercialisation: A review of the literature on university–industry relations, Research Policy, 42(2), 423–442.

Piacentini, M. (2013): Women Entrepreneurs in the OECD: Key Evidence and Policy Challenges, OECD Social, Employment and Migration Working Papers, Vol. 147, Paris.

Ploder, M., Streicher, J., Linshalm, E., Grasenick, K., Handerl, R. and Egeln, J. (2015): Evaluierung des AplusB-Programms, final report, Vienna.

Polt, W., Unger, M., Ploder, M., Wagner-Schuster, D., Bundgard Vad, T., Palmquist, S., Barsl and Fosse, H. (2015): The Leverage Potential of the European Research Area for Austria's Ambition to become one of the Innovation Leaders in Europe – A comparative study of Austria, Sweden and Denmark, by the ERA Council Forum Austria.

Prognos (2009): Zwischenevaluierung des österreichischen Forschungs- und Technologieprogramms für die Luftfahrt TAKE OFF – Endbericht; Study commissioned by the Federal Ministry of Transport, Innovation and Technology (BMVIT).

RFTE (2005): Rat für Forschung und Technologieentwicklung (Council for Research and Technological Development, RFT). Strategie 2010. Perspektiven für Forschung, Technologie und Innovation in Österreich, Vienna.

RFTE (2015): Empfehlung des Rates für Forschung und Technologieentwicklung zu Social Business in Österreich, Vienna.

Salamon, L. M. and Anheier, H. K. (1996): The International Classification of Nonprofit Organizations: ICNPO Revision 1. Working papers of the Johns Hopkins Comparatative Nonprofit Sector Project. Baltimore.

Seus, S., Heckl, E., Bührer, S. (2016): Evaluierung des START Programms und Wittgenstein Preis. Fraunhofer ISI, KMU Forschung Austria, Karlsruhe and Vienna.

Schibany, A., Gassler, H. and Sellner, R. (2013): Gründungen und Unternehmensdynamik, IHS Projektbericht, IHS Vienna.

Schiefer, A. (2015a): Forschung und experimentelle Entwicklung (F&E) im Unternehmenssektor 2013 – Teil 1, Statistische Nachrichten, 9, 664–692.

Schiefer, A. (2015b): Forschung und experimentelle Entwicklung (F&E) im Unternehmenssektor 2013 – Teil 2, Statistische Nachrichten, 10, 773–794.

Schiffbänker, H., Woitech, B., Gassler, H., Heckl, E., Dörflinger, A. and Dörflinger, C. (2007): Gründerinnen in Österreich: Vergleich internationaler Förderungsmodelle für forschungs- und technologieintensive Unternehmensgründungen, Vienna.

Schneider, H. and Maier, F. (2013): Social Entrepreneurship in Österreich. Working Paper 2013/1. Institut für Nonprofit Management. Vienna University of Economics and Business

Schneider, H., Millner, R. and Meyer, M. (2010): Die Rolle der Gemeinnützigkeit in Österreichischen Stiftungen, Working Paper 2010/1. Institut für Nonprofit Management. Vienna University of Economics and Business.

Schneider, H., Millner, R. and Meyer, M. (2015): Austria Country Report. EUFORI Study – European Foundations for Research and Innovation, European Commission, Directorate General for Research and Innovation.

Shane, S. (2008): Illusions of Entrepreneurship: The Costly Myths that Entrepreneurs, Investors, and Policy Makers Live, New Haven, CT.

Shane, S. (2004): Academic Entrepreneurship – University Spin-offs and Wealth Creation, Cheltenham/UK.

Stokes, D. E. (1997): Pasteur's Quadrant: Basic Science and Technological Innovation, Washington, DC.

Swan, A. (2016): Open Access policies: policy effectiveness. PASTEUR4OA Regional Workshop (funders), Brussels, 10 February 2016. http://www.pasteur4oa.eu/sites/pasteur4oa/files/events/Open%20Access%20policy%20effectiveness%20AS%20%28funders%29.pdf

Tonta, Y., Güleda, D., Umut, A., Orçun, M. (2016): Open Access Policies of Research Funders: The Case Study of the Austrian Science Fund (FWF). http://dx.doi.org/10.5281/zenodo.35616

Toole, A., Czarnitzki, D. and Rammer, C. (2015): University Research Alliances, Absorptive Capacity, and the Contribution of Startups to Employment Growth, Economics of Innovation and New Technology, 24(5), 532–549.

Vienna University of Technology (2015): Österreichs erste Pilotfabrik eröffnet in der Seestadt Aspern. www.tuwien.ac.at/aktuelles/news_detail/article/9629/

Van Bouwel, L. and Veugelers, R. (2013): The determinants of student mobility in Europe: the quality dimension, European Journal for Higher Education, 3(2), 172–190.

Van Wijk, E. and Costas-Comesaña, R. (2012): Bibliometric Study of FWF Austrian Science Fund 2001–2010/11, 2012.

Vandor, P. (2015): Annual Member Survey des Impact Hub Global 2014. Unpublished survey, Vienna University of Economics and Business.

Vandor, P., Hansen, H., Millner, R. and Asyamova, A. (2015): What External Support do Nascent Social Entrepreneurs Need? Evidence from a Global Survey. ARNOVA's 44th Annual Conference, Chicago, USA, 18.11.–21.11.

Vandor, P., Millner, R., Moder, C., Schneider, H. and Meyer, M. (2015): Das Potential von Social Business in Österreich, Vienna University of Economics and Business.

Veugelers, R. (2014): The contribution of academic research to innovation and growth, No. 71, WWWforEurope.

Veugelers, R. and Del Rey, E. (2014): The contribution of universities to innovation, (regional) growth and employment, EENEE Analytical Report 18.

Waldinger, F. (2012): Peer Effects in Science: Evidence from the Dismissal of Scientists in Nazi Germany, Review of Economic Studies, 79(2), 838–861.

WEF (2015): The Global Competitiveness Report 2015–2016, Genf: World Economic Forum

Wirtschaftskammer Österreich (Austrian Federal Economic Chambers) (2016): Unternehmensgründungen 1993–2015, Federal Economic Chambers Austria, Vienna.

7 Annex I

7.1 Country codes

Country/region	Codes
Albania	AL
Argentina	AR
Austria	AT
Australia	AU
Belgium	BE
Bulgaria	BG
Brazil	BR
Canada	CA
Switzerland	CH
China	CN
Cyprus	CY
Czech Republic	CZ
Germany	DE
Denmark	DK
Estonia	EE
Greece	EL
Spain	ES
Finland	FI
France	FR
Hong Kong	HK
Croatia	HR
Hungary	HU
Ireland	IE
India	IN
Iceland	IS
Italy	IT
Japan	JP
South Korea	HR
Liechtenstein	LI
Lithuania	LT
Luxembourg	LU
Latvia	LV
Montenegro	ME
Malta	MT
Mexico	MX
Nigeria	NG
Netherlands	NL
Norway	NO
New Zealand	NZ
Poland	PL
Portugal	PT
Romania	RO
Serbia	RS
Russia	RU
Sweden	SE
Singapore	SG
Slovenia	SI
Slovakia	SK
Turkey	TR
Taiwan	TW
United Kingdom	UK
United States of America	US

7.2 Overview of industries

Industry classification (NACE Rev. 2)	Name	Assigned industry group
B	Mining and quarrying	
C	Manufacturing	
C10_C12	Manufacture of food and feed products; beverages and tobacco products	Low-technology industries
C13_C14	Manufacture of textiles and wearing apparel	Low-technology industries
C15	Manufacture of leather, leather products and shoes	Low-technology industries
C16	Manufacture of wood and of products of wood and cork, except furniture	Low-technology industries
C17_C18	Manufacture of paper and paper products; manufacture of printing products; reproduction of recorded media	Low-technology industries
C19	Coke and refined petroleum products	Low-technology industries
C20_C21	Manufacture of chemical products and of pharmaceutical products	High-technology industries
C22	Manufacture of rubber and plastic products	Industries with medium-technology intensity
C23	Manufacture of other non-metallic mineral products	Industries with medium-technology intensity
C24_C25	Manufacture of basic metals, manufacture of fabricated metal products, except machinery and equipment	Industries with medium-technology intensity
C26_C27	Manufacture of computer, electronic and optical products; manufacture of electrical equipment	High-technology industries
C28	Manufacture of machinery and equipment n.e.c.	High-technology industries
C29_C30	Manufacture of motor vehicles, trailers and semi-trailers; manufacture of other transport equipment	High-technology industries
C31_C32	Manufacture of furniture and other manufacturing	Low-technology industries
C33	Repair and installation of machines and equipment	Industries with medium-technology intensity
D	Electricity, gas, steam and air conditioning supply	
E	Water supply; sewerage, waste management and remediation activities	
F	Construction	

7 Annex I

Industry classification (NACE Rev. 2)	Name	Assigned industry group
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	
G45	Wholesale and retail trade and repair of motor vehicles and motorcycles	Low knowledge-intensive services
G46	Wholesale trade, except of motor vehicles and motorcycles	Low knowledge-intensive services
G47	Retail trade except of motor vehicles and motorcycles	Low knowledge-intensive services
H	Transportation and storage	
H49	Land transport and transport via pipelines	Low knowledge-intensive services
H51	Air transport	Knowledge-intensive market services
H52	Warehousing and support activities for transportation	Low knowledge-intensive services
H53	Postal- and- courier activities	
I	Accommodation and support service activities	Low knowledge-intensive services
I55	Accommodation	Low knowledge-intensive services
I56	Food and beverage service activities	Low knowledge-intensive services
J	Information and communication	
J58	Publishing activities	
J59	Motion picture, video and television programme production, sound recording and music publishing activities	High-tech knowledge-intensive services
J60	Programming and broadcasting activities	High-tech knowledge-intensive services
J61	Telecommunications	High-tech knowledge-intensive services
J62	Computer programming, consultancy and related activities	High-tech knowledge-intensive services
J63	Information service activities	High-tech knowledge-intensive services
K	Financial and insurance activities without the activities of holding companies	
K64_X_K642	Financial service activities, except insurance, pension funding, and holding companies	Knowledge-intensive financial services
K65	Insurance, reinsurance and pension funding, except compulsory social security	Knowledge-intensive financial services
K66	Activities auxiliary to financial services and insurance activities	Knowledge-intensive financial services
L	Real estate activities	
L68	Real estate activities	
M	Professional, scientific and technical activities	
M69	Legal and accounting activities	Knowledge-intensive market services
M70	Activities of head offices; management consultancy activities	Knowledge-intensive market services
M71	Architectural and engineering activities; technical testing and analysis	Knowledge-intensive market services
M72	Scientific research and development	High-tech knowledge-intensive services
M73	Advertising and market research	Knowledge-intensive market services
M74	Other professional, scientific and technical activities	Knowledge-intensive market services
M75	Veterinary activities	
N	Administrative and support service activities	
N77	Rental and leasing activities	Low knowledge-intensive services
N78	Employment activities	Knowledge-intensive market services
N79	Travel agency, tour operator, other reservation services and related activities	Low knowledge-intensive services
N80	Security and investigation activities	Low knowledge-intensive services
N81	Services to buildings and landscape activities	Low knowledge-intensive services
N82	Office administrative, office support and other business support activities	Low knowledge-intensive services
S	Other service activities	
S95	Repair of computers and consumer durable goods	Low knowledge-intensive services

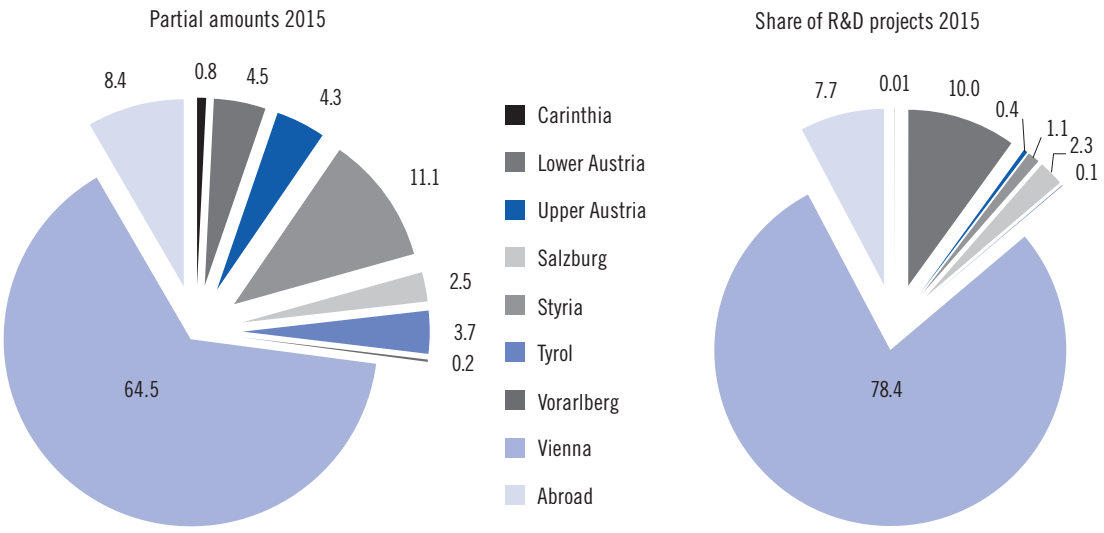
8 Annex II

Research funding and research contracts of the federal government according to the federal research database

Figures 8-1 to 8-4 provide an overview of R&D funding and contracts recorded in the federal research data base B_f.dat by the ministries in 2015. The database for recording research funding and contracts (B_f.dat) for the federal government has been in place since 1975, and was set up as a "documentation of facts by the federal government" in the then Federal Ministry of Science and Research. The mandatory reporting of the ministries to the relevant Science Minister is recorded in the Research Organisation Act (FOG), Federal Law Gazette No. 341/1981, last amended by the Federal Law Gazette No. 74/2002. The last adaptation took place in 2008 with the migration to a database to which all ministries have access and in which they all enter their research-related funding and contracts independently. Starting on 1 July 2016 the federal research database is accessible to the public. The B_f.dat database is not used for recording payments made. Instead, it is a documentation database which also records contextual information on the R&D projects. With regard to the relevant reporting year, the database makes a distinction between ongoing and completed R&D projects, their overall funding volume and actual funds paid in the reporting year, thereby providing a current picture of the number of projects and of project financing.

For 2015, a total of 706 ongoing R&D projects and R&D projects completed in the reporting year can be found in the B_f.dat, with an overall funding volume of around €607 million. Of this overall financing volume, €437 million (72%) were already paid out in 2015. Over 80% of the

Fig. 8-1: Share of R&D projects and partial amounts in 2015 by contractor's main location (in %)



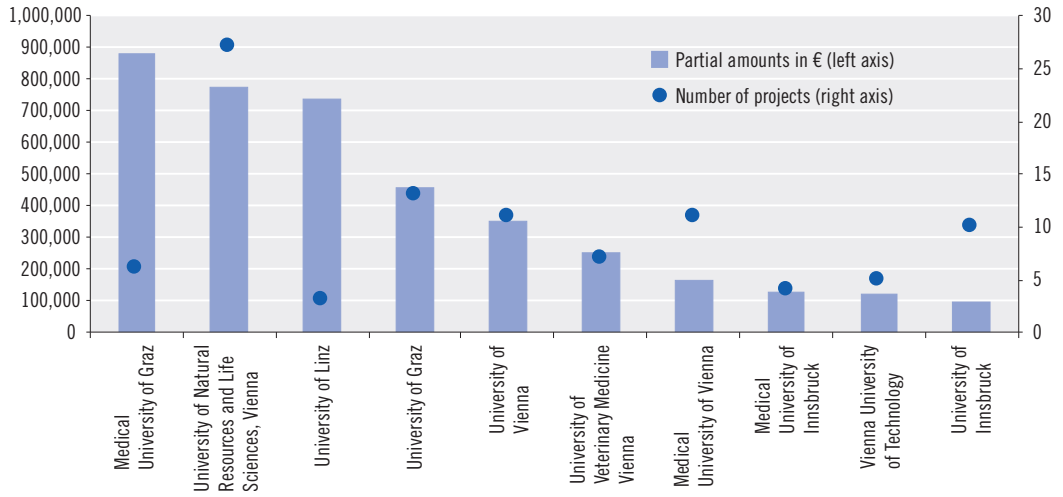
Note: including "major" global financing for research institutions and the Austrian Science Fund (FWF). Vorarlberg had one completed project (share: 0.0003%) in 2015.
Source: Federal Ministry of Science, Research and Economy (BMWFW), Federal research database B_f.dat. Reference date 17 March 2016.

funds paid were global financing to institutions that fund research and research institutions themselves. When these global amounts are subtracted[1], a funding total of €70.85 million remains for 2015.

A differentiation by the headquarters of the applicant shows that about 78% of the R&D funds paid out and 64.5% of the ongoing and completed projects can be ascribed to Vienna. About 8% of the amounts go abroad, primarily in the form of membership contributions in international organisations. No project was allocated to the regional government of Burgenland in 2015, as in the previous reporting year.

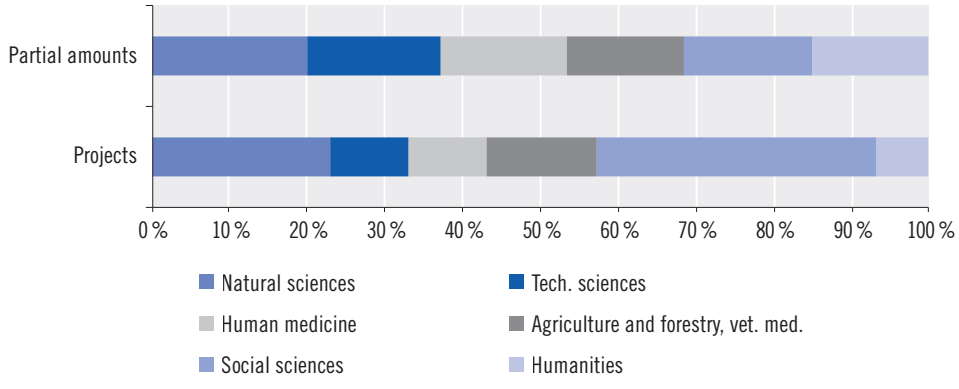
In the current reporting year €4.33 million were paid out for 115 ongoing and completed projects with university contractors. This corresponds to 22.4% of the total ongoing and completed projects and 1% of the paid funds. While the Medical University of Graz shows for univer-

Fig. 8-2: Partial amounts and projects by selected universities, 2015



Source: Federal Ministry of Science, Research and Economy (BMWFW), Federal research database B_f.dat. Reference date 17 March 2016.

Fig. 8-3: Partial amounts and projects by fields of science (in %), 2015



Note: including "major" global financing for research institutions and the Austrian Science Fund (FWF).

Source: Federal Ministry of Science, Research and Economy (BMWFW), Federal research database B_f.dat. Reference date 17 March 2016

1 Funding to FWF, ÖAW, IST Austria etc. was over €500,000 in each case.

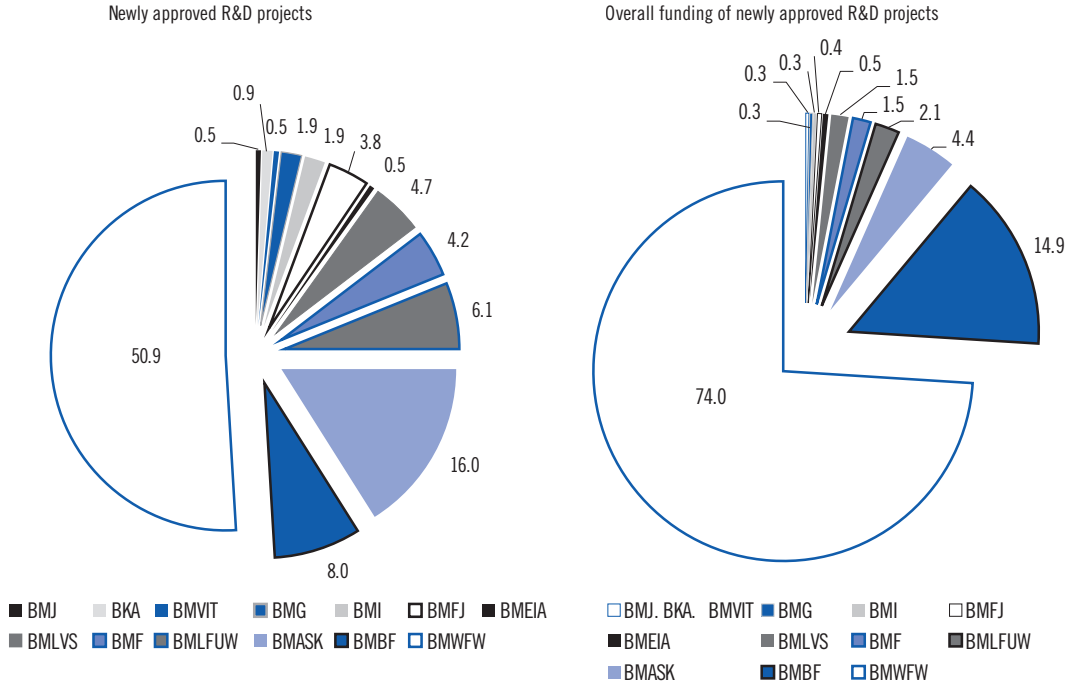
sity contractors the highest sum of partial amounts in 2015, the University of Natural Resources and Life Sciences Vienna had the greatest number of projects.

Broken down by fields of science, the natural sciences achieved the greatest portion of ongoing and completed R&D projects (20.2%), whereas the social sciences had the greatest number of projects (36.1%).

In the 2015 reporting year a total of 216 R&D-related projects were newly approved, with a funding volume of €413.5 million. Just of half (50.9%) of these newly approved projects (without global financing) were approved by the Federal Ministry of Science, Research and Economy (BMWFW), followed by 16% by the Federal Ministry of Labour, Social Affairs and Consumer Protection (BMASK) and 8% by the Federal Ministry of Education and Women's Affairs (BMBF). The greatest portion of the total financing volume of these projects was contracted by the Federal Ministry of Science, Research and Economy (BMWFW) (74%). The reason the Federal Ministry for Transport, Innovation and Technology (BMVIT) had a small percentage was that most of the R&D funds were handled by the Austrian Research Promotion Agency (FFG) and the Austria Wirtschaftsservice (aws).

The annual documentation on the research funding and research contracts by the federal government shows the projects in the reporting year which have been newly awarded or are ongoing or completed, with the titles, contractors, funding contributions, scientific classifications, contract and completion dates classified according to the awarding party, and this can be found on the Federal Ministry of Science, Research and Economy's website.[2]

Fig. 8-4: New approvals in 2015 by number and total financing amounts by ministry (in %), 2015



Note: excl. "major" global financing with funding amounts higher than €500,000.

Source: Federal Ministry of Science, Research and Economy (BMWFW), Federal research database B_f.dat. Reference date 17 March 2016.

2 Link to the publications: http://bmwfw.gv.at/jb-bfdat

9 Statistics

9.1 Financing of gross domestic expenditure on R&D (Tables 1 and 2)[1]

According to an estimate by Statistics Austria, more than 3.07% of the gross domestic expenditure are expected to be spent in Austria in 2016 on research and experimental development (R&D). This means that, for the third year in a row, the research intensity is above the European target for 2020 of 3%, although it is a slight decrease as compared with 2015. Last year's research intensity was estimated to be 3.10%. R&D expenditure in Austria will most likely be 2.9% higher in 2016 than in 2015, although this is less than the rise in the domestic economic output. From 2014 to 2015, as in the years before that, the increase in research expenditure was still above the nominal trend of the GDP. In 2016 a total of €10.74 billion will be spent on research and development.

47.8% of the total gross domestic expenditure on R&D (about €5.14 billion) will be financed by domestic firms. The business enterprise sector continues to be the most significant national economic sector for financing research in Austria in terms of quantity. It is estimated that in 2016, as in the previous years, the trend of R&D financing from firms will exceed the forecasted nominal increase in Austria's economic output.

The public sector will finance 35.7% of the total forecast for research expenditure in 2016 (around €3.83 billion). Of this the federal government, with €3.24 billion (30.1% of total R&D expenditure), is the most important source of R&D funding. The regional governments contribute an estimated €478 million, with other public institutions (local government authorities, chambers, social security institutions) providing €118 million of research financing. Based on the information currently available, government funding of R&D in 2016 is expected to stagnate, which results in a reduction in research intensity (R&D expenditures as a percentage of GDP) from 3.10% to 3.07% between 2015 and 2016.

16% of R&D funding (around €1.72 billion) comes from abroad, with foreign firms representing the most significant sources of funding. The returns from the EU Research Programmes are also included in the foreign funding.

The private non-profit sector features the lowest funding volume with around € 49 million (0.5% of total R&D expenditure).

Austria's research intensity, an indicator that represents gross domestic expenditure for R&D as a percentage of gross domestic product (GDP), has grown substantially in recent years – from 2.68% in 2011 to 2.96% in 2013. Since 2014 it has been over 3%.

Austria was well above the EU-28 average of 2.03% in 2014 (the last year for which comparative international figures are available) with a re-

1 On the basis of the results of the R&D statistical surveys and other currently available documents and information, in particular the R&D-related budget appropriations and outlays of the federal and regional governments, Statistics Austria annually creates the "Total estimate of the gross domestic expenditures for R&D." Under this annual compilation of the total estimate, any retroactive revisions or updates appear as based on the latest data. In accord with the definitions of the Frascati Manual, which is globally valid (OECD, EU) and thus guarantees international comparability, the financing of the expenditures for research and experimental development is presented as carried out in Austria. According to these definitions and guidelines, foreign financing of R&D done in Austria is included, although Austrian payments for R&D performed abroad are excluded (domestic concept).

search intensity of 3.07%, and is therefore behind Finland (3.17%) and Sweden (3.16%), and just ahead of Denmark (3.05%) and Germany (2.87%).

The estimates and year-end closing data of the federal and the regional governments, current economic data and the results of the last R&D survey for the reporting year 2013 were taken into account in estimating the Austrian gross domestic expenditure on R&D in 2016. Research intensity depends not just on the amount of expenditure on R&D in Austria, but also to a high degree on the actual and forecasted trend of gross domestic product.

9.2 Federal R&D expenditure in 2016

9.2.1 The federal expenditure shown in Table 1 for R&D carried out in Austria in 2016 is composed as described below. According to the methodology used for the R&D global estimate, the core is the total amount of Part b of the "Detailed overview of research-related appropriation of federal government funds" in the R&D Annex to the Federal Finances Act (BFG) 2016. The estimate also includes, according to the information currently available, the funds that should be paid out by the National Foundation for Research, Technology, and Development, as well as the estimates of the 2016 payout for research premiums (Source: Federal Ministry of Finance in each case).

9.2.2 In addition to its expenditures for R&D in Austria, in 2016 the federal government will pay contributions to international organisations aimed at research and the promotion of research amounting to €97 million. They are shown in the "Detailed overview of research-related appropriation of federal funds" in the Federal Finances Act (BFG) 2016 (Part a), but according to the domestic concept they are not included in the Austrian gross domestic expenditure on R&D.

9.2.3 The research-related spending by the federal government that is summarised in the "Detailed overview of research-related appropriation of federal funds" in the R&D Annex to the Federal Finances Act (BFG) 2016 (Part a and Part b), which includes the research-related shares of contribution to international organisations (see Pt. 2.2 above), are included under the title "Federal expenditure on research and research promotion." These correspond to what is called the "GBARD" concept[2] that is used by the OECD and the EU on the basis of the Frascati Manual, referring primarily to the budgets of the central government and/or federal state. It includes (in contrast to the domestic concept) research-related contributions to international organisations and provides the basis for classification of R&D budget data by socioeconomic objectives as required for reporting to the EU and OECD.

In 2016 the following socio-economic goals will receive the largest portions of federal expenditure on research and research promotion:

- Funding of general advancement of knowledge: 31.7%
- Funding of trade, commerce, and industry: 25.4%
- Funding of the health care system: 21.0%
- Funding of social and socio-economic development: 4.6%
- Funding of research on the earth, oceans, atmosphere and space: 4.4%
- Funding of schools and education: 3.0%

9.3. R&D expenditure of the regional governments

The research financing by the Austrian government as collated in Table 1 is listed from the

2 GBARD: Government Budget Allocations for Research and Development.

state budget-based estimates of R&D expenditure reported by the offices of the regional governments. The R&D expenditure of the regional hospitals is estimated annually by Statistics Austria by a methodology agreed on with the regional governments.

4. Comprehensive R&D survey 2013

In addition to the observations in Chap. 1.2, Tables 12 to 17 provide an overview of the amount of funding and personnel devoted to research and experimental development (R&D) that was recorded by Statistics Austria among all institutions in all economic sectors that conduct R&D, in the course of the comprehensive 2013 survey.

5. An international comparison of 2013 R&D expenditure

Overview Table 18 shows Austria's position compared to the other European Union member states and the OECD in terms of the most important R&D-related indices (Source: OECD, MSTI 2015-2).

6 Austria's participation in the European Framework Programmes

Tables 19 through 22 provide an overview of Austria's participation in the European Framework Programmes for research and development.

7. Research funding by the Austrian Science Fund (FWF)

Tables 23 through 25 provide detailed information about funding volumes and the number of projects approved by the Austrian Science Fund (FWF).

8. Funding by the Austrian Research Promotion Agency (FFG)

Tables 26 and 27 provide detailed information on funding approvals by the Austrian Research Promotion Agency (FFG).

9. The Austria Wirtschaftsservice (aws) technology programmes

Table 28 shows an overview of disbursed funding under the auspices of the Austria Wirtschaftsservice (aws) technology programmes.

10. Christian Doppler Gesellschaft

Tables 29 to 31 depict the status and historical development of the CD laboratories and the "Josef Ressel Centres (JR-Centres)" support programme for universities of applied sciences that was set up in 2013.

List of Tables in the Statistical Annex

Table 1: Global estimate for 2016: Gross domestic expenditure on R&D financing of research and experimental development carried out in Austria in 1998–2016

Financing	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
1. Gross domestic expenditure on R&D (in € millions)	**3,399.84**	**4,028.67**	**4,393.09**	**4,684.31**	**5,041.98**	**5,249.55**	**6,029.81**	**6,318.59**	**6,867.82**	**7,548.06**	**7,479.75**	**8,066.44**	**8,276.34**	**9,287.84**	**9,571.28**	**10,099.78**	**10,444.16**	**10,743.50**
of which financed by:																		
Federal government[1]	1,097.51	1,225.42	1,350.70	1,362.37	1,394.86	1,462.02	1,764.86	1,772.06	1,916.96	2,356.78	2,297.46	2,586.43	2,614.29	2,984.27	2,852.68	3,086.03	3,244.95	3,237.80
Regional governments[2]	142.41	248.50	280.14	171.26	291.62	207.88	330.17	219.98	263.18	354.35	273.37	405.17	298.71	416.31	307.45	461.59	461.63	478.47
Business enterprise sector[3]	1,418.43	1,684.42	1,834.87	2,090.62	2,274.95	2,475.55	2,750.95	3,057.00	3,344.40	3,480.57	3,520.02	3,639.35	3,820.90	4,243.33	4,665.75	4,771.20	4,913.86	5,138.79
Abroad [4]	684.63	800.10	863.30	1,001.97	1,009.26	1,016.61	1,087.51	1,163.35	1,230.24	1,240.53	1,255.93	1,297.63	1,401.67	1,495.94	1,590.21	1,621.86	1,660.62	1,721.23
Other [5]	56.86	70.23	64.08	58.09	71.29	87.49	96.32	106.20	113.04	115.83	132.97	137.86	140.77	147.99	155.19	159.10	163.10	167.21
2. Nominal GDP [6] (in € billions)	195.83	213.20	220.10	226.30	231.00	241.51	253.01	266.48	282.35	291.93	286.19	294.63	308.63	317.06	322.88	329.30	337.16	349.48
3. Gross domestic expenditure on R&D (in % of GDP)	***1.74***	***1.89***	***2.00***	***2.07***	***2.18***	***2.17***	***2.38***	***2.37***	***2.43***	***2.59***	***2.61***	***2.74***	***2.68***	***2.93***	***2.96***	***3.07***	***3.10***	***3.07***

As at: 20 April 2016

Source: Statistics Austria (Bundesanstalt Statistik Österreich)

1) 1998, 2002, 2004, 2006, 2007, 2009, 2011, 2013: Survey results (federal government including the Austrian Science Fund, the two research promotion funds (FFF/FFG) and in 1998 and 2002 also including ITF).
2000, 2001, 2003, 2005, 2008, 2010, 2012: Annex T of the Federal Finances Acts (in each case Part b, Outlays); 2014: Federal Finances Act 2016, Detailed overview of research-related appropriation of federal funds (Part b, Outlays).
2015, 2016: Federal Finances Act
2016, Detailed overview of research-related appropriation of federal funds (in each case Part b, Financing proposal).
2005: Including €84.4 million National Foundation for Research, Technology and Development and €121.3 million research premiums paid out.
2008: Including €91.0 million National Foundation for Research, Technology and Development and €340.6 million research premiums paid out.
2010: Including €74.6 million National Foundation for Research, Technology and Development and €328.8 million research premiums paid out.
2012: Including €51.3 million National Foundation for Research, Technology and Development and €574.1 million research premiums paid out.
2014: Including €38.7 million National Foundation for Research, Technology and Development and €493.2 million research premiums paid out.
2015: Including €85.0 million National Foundation for Research, Technology and Development and €501.9 million research premiums paid out.
2016: Including €51.7 million through the National Foundation for Research, Technology and Development and €501.9 million research premiums (based on currently available information; Source: Federal Ministry of Finance (BMF), April 2016).

2) 1998, 2002, 2004, 2006, 2007, 2009, 2011, 2013: Survey results.
1994–1997, 1999–2001, 2003, 2005, 2008, 2010, 2012, 2014–2016: Based on the R&D expenditure reported by the regional government offices.

3) 1998, 2002, 2004, 2006, 2007, 2009, 2011, 2013: survey results. 1994–1997, 1999–2001, 2003, 2005, 2008, 2010, 2012, 2014–2016: Estimates made by Statistics Austria.

4) 1998, 2002, 2004, 2006, 2007, 2009, 2011: survey results. 1994–1997, 1999–2001, 2003, 2005, 2008, 2010, 2012–2015: Estimates made by Statistics Austria.

5) Financing by local governments (excluding Vienna), chambers, social insurance institutions and other public financing and from the private non-profit sector.
1998, 2002, 2004, 2006, 2007, 2009, 2011, 2013: survey results. 1994–1997, 1999–2001, 2003, 2005, 2008, 2010, 2012, 2014–2016: Estimates made by Statistics Austria.

6) 1998–2015: Statistics Austria, as of March 2016. 2016: Austrian Institute of Economic Research (WIFO), economic forecast March 2016.

Table 2: Global estimate for 2016: Gross domestic expenditure on R&D financing of research and experimental development carried out in Austria in 1998–2016 (as a percentage of GDP)

Financing	1998	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Gross domestic expenditure on R&D in % of GDP	***1.74***	***1.89***	***2.00***	***2.07***	***2.18***	***2.17***	***2.38***	***2.37***	***2.43***	***2.59***	***2.61***	***2.74***	***2.68***	***2.93***	***2.96***	***3.07***	***3.10***	***3.07***
of which financed by:																		
Federal government[1]	0.56	0.57	0.61	0.60	0.60	0.61	0.70	0.66	0.68	0.81	0.80	0.88	0.85	0.94	0.88	0.94	0.96	0.93
Regional governments[2]	0.07	0.12	0.13	0.08	0.13	0.09	0.13	0.08	0.09	0.12	0.10	0.14	0.10	0.13	0.10	0.14	0.14	0.14
Business enterprise sector[3]	0.72	0.79	0.83	0.92	0.98	1.03	1.09	1.15	1.18	1.19	1.23	1.24	1.24	1.34	1.45	1.45	1.46	1.47
Abroad [4]	0.35	0.38	0.39	0.44	0.44	0.42	0.43	0.44	0.44	0.42	0.44	0.44	0.45	0.47	0.49	0.49	0.49	0.49
Other [5]	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
2. Nominal GDP [6] (in € billions)	195.83	213.20	220.10	226.30	231.00	241.51	253.01	266.48	282.35	291.93	286.19	294.63	308.63	317.06	322.88	329.30	337.16	349.48

As at: 20 April 2016

Source: Statistics Austria (Bundesanstalt Statistik Österreich)

Footnotes cf. Table 1.

Table 3: Federal expenditure on research and research promotion, 2013–2016

Ministries[1]	Outlays				Financing appropriation			
	2013[2]		2014[3]		2015[3]		2016[3]	
	€ millions	%	€ millions	%	€ millions	%	€ millions	%
Federal Chancellery (BKA)[4]	2.812	*0.1*	34.805	*1.3*	39.360	*1.4*	39.095	*1.4*
Federal Ministry of the Interior (BMI)	0.812	*0.0*	1.040	*0.0*	1.067	*0.0*	1.219	*0.0*
Federal Ministry for Education, Arts and Culture (BMUKK)	77.426	*3.0*	-	-	-	-	-	-
Federal Ministry for Education and Women's Affairs (BMBF)	-	-	46.194	*1.7*	40.277	*1.5*	40.059	*1.4*
Federal Ministry for Science and Research (BMWF)	1,870.872	*72.4*	-	-	-	-	-	-
Federal Ministry of Science, Research and Economy (BMWFW)	.	.	2,044.037	*77.3*	2,103.894	*76.3*	2,163.212	*77.9*
Federal Ministry for Labour, Social Affairs and Consumer Protection (BMASK)	5.854	*0.2*	7.034	*0.3*	5.462	*0.2*	5.707	*0.2*
Federal Ministry for Health (BMG)	7.390	*0.3*	7.342	*0.3*	7.307	*0.3*	7.043	*0.3*
Federal Ministry for European and International Affairs (BMEIA)	1.949	*0.1*	-	-	-	-	-	-
Federal Ministry for Europe, Integration and Foreign Affairs	-	-	2.161	*0.1*	2.305	*0.1*	2.151	*0.1*
Federal Ministry of Justice (BMJ)	-	-	-	-	0.130	*0.0*	-	-
Federal Ministry of Defence and Sports (BMLVS)	1.224	*0.0*	2.325	*0.1*	1.267	*0.0*	3.311	*0.1*
Federal Ministry of Finance (BMF)	30.475	*1.2*	29.629	*1.1*	34.350	*1.2*	31.931	*1.1*
Federal Ministry for Agriculture, Forestry, Environment and Water Management (BMLFUW)	91.581	*3.5*	46.105	*1.7*	70.679	*2.6*	45.611	*1.6*
Federal Ministry of Economy, Family and Youth (BMWFJ)	101.965	*3.9*	-	-	-	-	-	-
Federal Ministry for Family and Youth (BMFJ)	-	-	1.118	*0.0*	1.654	*0.1*	1.427	*0.1*
Federal Ministry for Transport, Innovation and Technology (BMVIT)	395.226	*15.3*	425.699	*16.1*	450.314	*16.3*	440.030	*15.8*
Total	**2,587.586**	***100.0***	**2,647.489**	***100.0***	**2,758.066**	***100.0***	**2,780.796**	***100.0***

As at: April 2016

Source: Statistics Austria (Bundesanstalt Statistik Österreich)

1) In accordance with the applicable version of the Act Governing Federal Ministries of 1986 (2013: Federal Law Gazette I No. 3/2009; 2014, 2015, 2016: Federal Law Gazette I no. 11/2014). –2) Annex T (Parts a and b) of the Auxiliary Document for the Federal Finances Act of 2015 (financing proposal). Revised data. – 3) Federal Finances Act 2016, Detailed overview of research-related appropriation of federal funds. – 4) Including the highest executive bodies.

Table 4: Detailed overview of research-related appropriation of federal funds, 2014–2016

Federal spending on research from 2014 to 2016 by ministry

The following tables for the years 2014 to 2016 are broken down according to

1. Contributions from federal funds to international organisations whose goals include research and the promotion of research (**Part a**)

2. Other federal spending on research and research promotion (**Part b, federal research budget**)

This list has been drawn up primarily in consideration of research effectiveness, as based on the research concept defined by the Frascati manual of the OECD. This concept is also used by Statistik Austria as a benchmark in carrying out surveys of research and experimental development (R&D).

Please Note:
The notes for the following tables can be found on page 178.

BUNDESVORANSCHLAG 2016

Detailübersicht Forschungswirksame Mittelverwendungen des Bundes
(Beträge in Millionen €)

a) Beitragszahlungen an internationale Organisationen - Finanzierungsvoranschlag														
VA-Stelle	Konto	UgI	Bezeichnung	Anm	Finanzierungsvoranschlag 2016			Finanzierungsvoranschlag 2015			Erfolg 2014		
					Insgesamt	hievon		Insgesamt	hievon		Insgesamt	hievon	
						%	Forschung		%	Forschung		%	Forschung
			Bundeskanzleramt										
			UG10										
10010100	7800	100	Mitgliedsbeiträge an Institutionen im Ausland		0,192	100	0,192	0,184	100	0,184	0,186	100	0,186
10010100	7800	101	Mitgliedsbeitrag für OECD		3,368	20	0,674	3,062	20	0,612	3,289	20	0,658
10010100	7800	102	OECD-Energieagentur (Mitgliedsbeitrag)		0,230	20	0,046	0,240	20	0,048	0,222	20	0,044
10010100	7800	103	OECD-Beiträge zu Sonderprojekten		0,010	20	0,002	0,010	20	0,002			
10010100	7800	110	Mitgliedsbeitrag AV-Infostelle		0,030	5	0,002	0,029	5	0,001	0,031	5	0,002
10010200	7800	100	Mitgliedsbeiträge an Institutionen im Ausland		0,006	30	0,002	0,006	30	0,002	0,006	30	0,002
			Summe UG10		**3,836**		**0,918**	**3,531**		**0,849**	**3,734**		**0,892**
			Summe Bundeskanzleramt		**3,836**		**0,918**	**3,531**		**0,849**	**3,734**		**0,892**
			BM für Europa, Integration und Äußeres										
			UG12										
12020200	7840	000	Internationale Atomenergie-Organisation (IAEO)		3,190	35	1,117	3,200	35	1,120	3,187	35	1,115
12020200	7840	002	Organisation der VN für industr.Entwicklung(UNIDO)		0,695	46	0,320	0,850	46	0,391	0,695	46	0,320
12020200	7840	003	Org. VN Erziehung,Wissensch.u.Kultur(UNESCO)		2,112	30	0,634	2,350	30	0,705	2,110	30	0,633
12020200	7840	030	Inst. der VN für Ausbildung und Forschung (UNITAR)					0,020	40	0,008	0,015	40	0,006
12020200	7840	054	Beitrag zum Budget des EUREKA-Sekretariates					0,001	52	0,001			
12020200	7840	056	Drogenkontrollprogramm der VN (UNDCP)		0,400	20	0,080	0,400	20	0,080	0,435	20	0,087
			Summe UG12		**6,397**		**2,151**	**6,821**		**2,305**	**6,442**		**2,161**
			Summe BM für Europa, Integration und Äußeres		**6,397**		**2,151**	**6,821**		**2,305**	**6,442**		**2,161**
			BM für Arbeit, Soziales und Konsumentenschutz										
			UG21										
21010100	7800	030	Europarat - Teilabkommen										
			Summe UG21										
			Summe BM für Arbeit, Soziales und Konsumentenschutz										
			BM für Gesundheit										
			UG24										
24010100	7800	000	Laufende Transferzahlungen an das Ausland					0,365	50	0,183			
24010100	7800	040	Europ. Maul- u. Klauenseuchenkommission					0,012	50	0,006			
24010100	7800	043	Europarat Teilabkommen					0,010	20	0,002			
24010100	7840	082	Internat. Tierseuchenamt					0,130	50	0,065			
24010100	7840	083	Weltgesundheitsorganisation					3,370	30	1,011			
			Summe UG24					**3,887**		**1,267**			
			Summe BM für Gesundheit					**3,887**		**1,267**			

			BM für Bildung und Frauen										
			UG30										
30010300	7800	104	OECD-Schulbauprogramm		0,031	100	0,031	0,031	100	0,031	0,023	100	0,023
30010400	7800	000	Laufende Transferzahlungen an das Ausland		0,004	100	0,004				0,088	100	0,088
			Summe UG30		**0,035**		**0,035**	**0,031**		**0,031**	**0,111**		**0,111**
			Summe BM für Bildung und Frauen		**0,035**		**0,035**	**0,031**		**0,031**	**0,111**		**0,111**
			BM für Wissenschaft, Forschung und Wirtschaft										
			UG31										
31030100	7800	000	Laufende Transferzahlungen an das Ausland		0,500	100	0,500	0,500	100	0,500	0,572	100	0,572
31030100	7800	066	Forschungsvorhaben in internationaler Kooperation		1,402	100	1,402	1,701	100	1,701	0,689	100	0,689
31030100	7800	200	Beiträge an internationale Organisationen		1,480	50	0,740	1,290	50	0,645	1,068	50	0,534
31030204	7260	000	Mitgliedsbeiträge an Institutionen im Inland										
31030204	7270	032	Verpflichtungen aus internationalen Abkommen										
31030204	7800	062	ESO		6,300	100	6,300	6,184	100	6,184	5,991	100	5,991
31030204	7800	063	Europ. Zentrum für mittelfristige Wettervorhersage		1,110	100	1,110	1,150	100	1,150	1,106	100	1,106
31030204	7800	064	Molekularbiologie - Europäische Zusammenarbeit		2,900	100	2,900	2,899	100	2,899	2,713	100	2,713
31030204	7800	065	World Meteorological Organisation		0,640	50	0,320	0,630	50	0,315	0,422	50	0,211
31030204	7800	200	Beiträge an internationale Organisationen		0,810	50	0,405	0,770	50	0,385	0,781	50	0,391
31030204	7800	242	Beitrag für die CERN		19,600	100	19,600	20,340	100	20,340	19,033	100	19,033
			Summe UG31		**34,742**		**33,277**	**35,464**		**34,119**	**32,375**		**31,240**
			UG40										
40020100	7800	100	Mitgliedsbeiträge an Institutionen im Ausland		1,000	11	0,110	1,000	16	0,160	1,268	11	0,139
			Summe UG40		**1,000**		**0,110**	**1,000**		**0,160**	**1,268**		**0,139**
			Summe BM für Wissenschaft, Forschung und Wirtschaft		**35,742**		**33,387**	**36,464**		**34,279**	**33,643**		**31,379**
			BM für Verkehr, Innovation und Technologie										
			UG34										
34010100	7800	200	Beiträge an internationale Organisationen		0,060	100	0,060	0,022	100	0,022	0,078	100	0,078
34010100	7800	600	ESA-Pflichtprogramme		17,900	100	17,900	17,400	100	17,400	17,564	100	17,564
34010100	7800	601	EUMETSAT		9,600	100	9,600	5,350	100	5,350	4,136	100	4,136
34010100	7800	602	OECD-Energieagentur		0,070	100	0,070	0,069	100	0,069	0,074	100	0,074
34010100	7800	603	ESA-Wahlprogramme		30,364	100	30,364	36,223	100	36,223	34,805	100	34,805
34010100	7830	000	Laufende Transfers an Drittländer		0,130	100	0,130	0,080	100	0,080	0,130	100	0,130
			Summe UG34		**58,124**		**58,124**	**59,144**		**59,144**	**56,787**		**56,787**
			UG41										
41010100	7800	200	Beiträge an internationale Organisationen		0,180	6	0,011	0,180	6	0,011	0,106	6	0,006
41020100	7800	200	Beiträge an internationale Organisationen		0,021	100	0,021	0,021	100	0,021	0,003	100	0,003
41020402	7800	200	Beiträge an internationale Organisationen		0,060	15	0,009	0,060	15	0,009	0,045	15	0,007
41020500	7800	200	Beiträge an internationale Organisationen		0,020	15	0,003	0,020	15	0,003	0,033	15	0,005
41020500	7830	000	Laufende Transfers an Drittländer		0,442	15	0,066	0,442	15	0,066	0,418	15	0,063
41020601	7800	200	Beiträge an internationale Organisationen		0,050	50	0,025	0,050	50	0,025	0,034	50	0,017
41020700	7800	200	Beiträge an internationale Organisationen		0,570	20	0,114	0,530	20	0,106	0,519	20	0,104

			Summe UG41		**1,343**		**0,249**	**1,303**		**0,241**	**1,158**		**0,205**
			Summe BM für Verkehr, Innovation und Technologie		**59,467**		**58,373**	**60,447**		**59,385**	**57,945**		**56,992**
			BM für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft										
			UG42										
42010100	7800	100	Mitgliedsbeiträge an Institutionen im Ausland		0,017	50	0,009	0,005	50	0,003	0,003	50	0,002
42020202	7800	080	FAO-Beiträge		3,400	50	1,700	3,130	50	1,565	3,054	50	1,527
42020202	7800	081	FAO Welternährungsprogramm, Beiträge			50		0,350	50	0,175	0,218	50	0,109
42020202	7800	083	Int. Vertrag für pflanzengenetische Ressourcen		0,025	100	0,025				0,044	100	0,044
			Summe UG42		**3,442**		**1,734**	**3,485**		**1,743**	**3,319**		**1,682**
			UG43										
43010500	7800	000	Laufende Transferzahlungen an das Ausland					0,043	50	0,022	0,043	50	0,022
43010500	7800	090	ECE-EMEP-Konvention/Grenzüberschr. Luftverunrein.					0,031	100	0,031	0,031	100	0,031
43010500	7800	091	Umweltfonds der Vereinten Nationen					0,400	30	0,120	0,400	30	0,120
			Summe UG43					**0,474**		**0,173**	**0,474**		**0,173**
			Summe BM für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft		**3,442**		**1,734**	**3,959**		**1,916**	**3,793**		**1,855**
			Teil a -Summe		**108,919**		**96,598**	**115,140**		**100,032**	**105,668**		**93,390**

b) Bundesbudget Forschung - Finanzierungsvoranschlag
(ausgen. die bereits im Abschnitt a) ausgewiesen sind)

VA-Stelle	Konto	Ugl	Bezeichnung	Anm	Finanzierungsvoranschlag 2016			Finanzierungsvoranschlag 2015			Erfolg 2014		
					Insgesamt	hievon		Insgesamt	hievon		Insgesamt	hievon	
						%	Forschung		%	Forschung		%	Forschung
			Parlamentsdirektion										
			UG02										
02010500	7330	086	Nationalfonds für Opfer des Nationalsozialismus		3,500	5	0,175	3,500	11	0,385	2,550	10	0,255
			Summe UG02		**3,500**		**0,175**	**3,500**		**0,385**	**2,550**		**0,255**
			Summe Parlamentsdirektion		**3,500**		**0,175**	**3,500**		**0,385**	**2,550**		**0,255**
			Bundeskanzleramt										
			UG10										
10010100	7260	000	Mitgliedsbeiträge an Institutionen im Inland		0,508	50	0,254	0,658	50	0,329	0,453	50	0,227
10010100	7270	000	Werkleistungen durch Dritte		3,345	4	0,134	4,094	4	0,164	4,295	4	0,172
10010200			Zentralstelle	*	2,111	100	2,111	2,109	100	2,109	2,206	100	2,206
10010200	7260	000	Mitgliedsbeiträge an Institutionen im Inland		0,001	50	0,001	0,002	50	0,001	0,016	50	0,008
10010200	7270	000	Werkleistungen durch Dritte		3,515	4	0,141	4,626	4	0,185	4,480	4	0,179
10010401	7340	001	Pauschalabgeltung gem. § 32 Abs.5 BStatG		50,808	1	0,508	50,589	1	0,506	43,391	1	0,434
10010402			Österr. Staatsarchiv		14,524	1	0,145	14,282	2	0,286	13,991	1	0,140
			Summe UG10		**74,812**		**3,294**	**76,360**		**3,580**	**68,832**		**3,366**
			UG32										
32010300			Denkmalschutz		35,743	18	6,434						
32020300			Denkmalschutz					34,843	18	6,272	28,850	18	5,193
32030100			Bundesmuseen		122,932	23	28,274	122,932	23	28,274	109,128	23	25,099
			Summe UG32		**158,675**		**34,708**	**157,775**		**34,546**	**137,978**		**30,292**
			Summe Bundeskanzleramt		**233,487**		**38,002**	**234,135**		**38,126**	**206,810**		**33,658**
			BM für Inneres										
			UG11										
11020600			Bundeskriminalamt	*	15,234	8	1,219	13,332	8	1,067	12,999	8	1,040
			Summe UG11		**15,234**		**1,219**	**13,332**		**1,067**	**12,999**		**1,040**
			Summe BM für Inneres		**15,234**		**1,219**	**13,332**		**1,067**	**12,999**		**1,040**
			BM für Justiz										
			UG13										
13010200	7667	002	Institut für Rechts- und Kriminalsoziologie					0,130	100	0,130			
			Summe UG13					**0,130**		**0,130**			
			Summe BM für Justiz					**0,130**		**0,130**			
			BM für Landesverteidigung und Sport										
			UG14										
14010100	4691	000	Versuche und Erprobungen auf kriegstechn. Gebiet		0,035	10	0,004	0,035	10	0,004			
14010100	7270	000	Werkleistungen durch Dritte		0,868	58	0,503				0,361	26	0,094
14010100	7270	900	Werkleistungen durch Dritte		1,402	100	1,402				0,626	100	0,626
14010202			Heeresgeschichtliches Museum		6,550	20	1,310	6,280	20	1,256	7,970	20	1,594
14020100	4691	000	Versuche und Erprobungen auf kriegstechn. Gebiet		0,920	10	0,092	0,070	10	0,007	0,113	10	0,011
			Summe UG14		**9,775**		**3,311**	**6,385**		**1,267**	**9,070**		**2,325**
			Summe BM für Landesverteidigung und Sport		**9,775**		**3,311**	**6,385**		**1,267**	**9,070**		**2,325**
			BM für Finanzen										
			UG15										
15010100	6430	001	Arbeiten des WIIW		1,000	50	0,500	0,750	50	0,375	0,900	50	0,450
15010100	6430	002	Arbeiten des WSR		1,371	50	0,686	1,439	50	0,720	1,235	50	0,618
15010100	6430	003	Arbeiten des Wifo		4,000	50	2,000	3,925	50	1,963	3,850	50	1,925
15010100	7661	002	Institut für Finanzwissenschaft und Steuerrecht					0,014	50	0,007			

15010100	7662	002	Institut für höhere Studien und wiss. Forschung		3,336	50	1,668	3,523	50	1,762	3,283	50	1,642
15010100	7663	005	Forum Alpbach									50	
			Forschungswirksamer Lohnnebenkostenanteil		27,077	100	27,077	29,523	100	29,523	24,994	100	24,994
			Summe UG15		**36,784**		**31,931**	**39,174**		**34,350**	**34,262**		**29,629**
			Summe BM für Finanzen		**36,784**		**31,931**	**39,174**		**34,350**	**34,262**		**29,629**
			BM für Arbeit, Soziales und Konsumentenschutz										
			UG20										
20010101	7340	302	Überweisung an das AMS gem. § 41 (2) (zw)	*	411,612	1	3,510		1		395,000	1	3,950
20010201	7270	006	Werkleistungen durch Dritte (zw)	*	301,759		0,430	360,329	1	3,603	381,115		0,425
			Summe UG20		**713,371**		**3,940**	**360,329**		**3,603**	**776,115**		**4,375**
			UG21										
21010100	7270	000	Werkleistungen durch Dritte		1,950	5	0,098	2,104	5	0,105	2,389	4	0,096
21010100	7669	900	Zuschüsse für lfd.Aufwand an private Institutionen			100		0,001	100	0,001		100	
21010300	7270	000	Werkleistungen durch Dritte		0,825	16	0,132	1,080	16	0,173	0,754	2	0,015
21010300	7660	900	Zuschüsse f. lfd. Aufwand an private Institutionen		2,250	2	0,045	2,000	2	0,040	2,498	3	0,075
21010400	7262	001	Beitrag Europ. Zentrum Wohlfahrtspol.u.Sozialfor.		0,587	50	0,294	0,618	50	0,309	0,618	62	0,383
21010400	7270	000	Werkleistungen durch Dritte		1,769	7	0,124	2,247	7	0,157	1,588	64	1,016
21010400	7270	304	Werkleistungen EU-SILC		1,074	100	1,074	1,074	100	1,074	1,074	100	1,074
			Summe UG21		**8,455**		**1,767**	**9,124**		**1,859**	**8,921**		**2,659**
			Summe BM für Arbeit, Soziales und Konsumentenschutz		**721,826**		**5,707**	**369,453**		**5,462**	**785,036**		**7,034**
			BM für Gesundheit										
			UG24										
24010100			Zentralstelle	*	1,295	100	1,295	0,974	100	0,974	1,290	100	1,290
24010200	0806	001	Ernährungsagentur (Ges.m.b.H)					0,001	8				
24010200	7420	012	Transferzahlungen, Ernährungsagentur (Ges.m.b.H)		49,878	11	5,487	52,503	8	4,200	52,503	11	5,775
24030100	7270	000	Werkleistungen durch Dritte		3,935	4	0,157	1,935	2	0,039	0,900	19	0,171
24030100	7660	900	Zuschüsse f. lfd. Aufwand an private Institutionen	*				5,703	6	0,342			
24030200	7270	000	Werkleistungen durch Dritte		5,196	2	0,104	4,411	11	0,485	5,298	2	0,106
			Summe UG24		**60,304**		**7,043**	**65,527**		**6,040**	**59,991**		**7,342**
			Summe BM für Gesundheit		**60,304**		**7,043**	**65,527**		**6,040**	**59,991**		**7,342**
			BM für Familien und Jugend										
			UG25										
25010500	7270	006	Werkleistungen durch Dritte (zw)		0,650	48	0,312	0,800	39	0,312	0,672	57	0,382
25010500	7420	113	Familie und Beruf Management GesmbH.		2,140	33	0,706	2,140	33	0,706	2,140	33	0,706
25010500	7664	007	Forschungsförderung gem. § 39i FLAG 1967 (zw)		0,100	100	0,100	0,250	100	0,250		100	
25020100	7270	000	Werkleistungen durch Dritte		1,100	11	0,121	0,991	20	0,198	0,891	2	0,015
25020200	7270	000	Werkleistungen durch Dritte		1,882	10	0,188	1,882	10	0,188	1,468	1	0,015
			Summe UG25		**5,872**		**1,427**	**6,063**		**1,654**	**5,171**		**1,118**
			Summe BM für Familien und Jugend		**5,872**		**1,427**	**6,063**		**1,654**	**5,171**		**1,118**
			BM für Bildung und Frauen										
			UG30										
30010100			Zentralstelle	*							0,127	100	0,127
30010400			Qualitätsentwicklung und -steuerung	*	31,706	8	2,536	33,384	8	2,671	31,396	8	2,512
30010400	7340	000	Transferzahlungen an sonst. Träger öffentl.Rechtes		5,000	100	5,000	5,130	100	5,130	6,599	100	6,599
30010400	7340	003	Basisabgeltung (BIFIE)		13,000	80	10,400	13,000	80	10,400	13,000	80	10,400
30010500			Lehrer/innenbildung		218,388	10	21,839	213,379	10	21,338	208,491	10	20,849
30020700			Zweckgebundene Gebarung Bundesschulen	*	8,296	3	0,249	23,558	3	0,707	11,467	3	0,344

30030300			Denkmalschutz								3,651	18	0,657
30040100			Bundesmuseen und Österreichische Nationalbibliothek	*		23			23		19,980	23	4,595
			Summe UG30		**276,390**		**40,024**	**288,451**		**40,246**	**294,711**		**46,083**
			Summe BM für Bildung und Frauen		**276,390**		**40,024**	**288,451**		**40,246**	**294,711**		**46,083**
			BM für Wissenschaft, Forschung und Wirtschaft										
			UG31										
31010100			Zentralstelle und Serviceeinrichtungen		56,785	20	11,357	53,991	20	10,798	49,646	20	9,929
31010100	7686	007	Vortragstätigkeit im Ausland										
31020100			Universitäten		3.219,643	48	1.545,429	3.030,486	48	1.454,633	2.993,260	48	1.436,765
31020100	7270	000	Werkleistungen durch Dritte		0,330	48	0,158	0,300	48	0,144	0,052	48	0,025
31020100	7342	900	Universitäten - F&E-Mittel			100			100			100	
31020100	7353	440	Klinischer Mehraufwand (Klinikbauten)		19,649	50	9,825	48,642	50	24,321	43,367	50	21,684
31020100	7480	403	VOEST-Alpine Medizintechnik Ges.m.b.H. (VAMED)			50		0,001	50	0,001		50	
31020200			Fachhochschulen		281,633	15	42,245	264,940	15	39,741	255,399	15	38,310
31020300	7270	900	Werkleistungen durch Dritte		2,582	22	0,568	2,439	22	0,537	2,081	22	0,458
31030100			Projekte und Programme	*	13,365	100	13,365	14,371	100	14,371	13,072	100	13,072
31030100	7260	000	Mitgliedsbeiträge an Institutionen im Inland		0,001	100	0,001	0,001	100	0,001	0,002	100	0,002
31030100	7270	031	Med Austron			100		5,500	100	5,500	12,351	100	12,351
31030100	7270	034	Ersatzmethoden zum Tierversuch		0,465	100	0,465	0,395	100	0,395	0,168	100	0,168
31030100	7270	900	Werkleistungen durch Dritte		7,597	100	7,597	6,832	100	6,832	7,292	100	7,292
31030100	7662	311	Institut für höhere Studien und wiss. Forschung		0,300	100	0,300	0,270	100	0,270		100	
31030100	7665	007	Stiftung Dokumentationsarchiv		0,280	100	0,280	0,180	100	0,180	0,250	100	0,250
31030100	7679	120	Lfd. Transfers an sonstige juristische Personen		20,978	100	20,978	24,807	100	24,807	16,386	100	16,386
31030201			Zentralanstalt für Meteorologie und Geodynamik		24,021	37	8,888	23,637	37	8,746	22,322	37	8,259
31030202			Geologische Bundesanstalt		11,378	47	5,348	10,915	47	5,130	10,231	47	4,809
31030203			Wissenschaftliche Anstalten		5,035	52	2,618	5,526	52	2,874	4,815	52	2,504
31030204			Forschungsinstitutionen		7,038	100	7,038	7,184	100	7,184	7,308	100	7,308
31030204	7270	031	Med Austron		5,500	100	5,500						
31030204	7332	352	FWF Programme		170,200	100	170,200	190,200	100	190,200	175,243	100	175,243
31030204	7332	452	FWF Geschäftsstelle		10,300	100	10,300	9,800	100	9,800	9,420	100	9,420
31030204	7340	004	ISTA		53,500	100	53,500	54,500	100	54,500	31,813	100	31,813
31030204	7340	006	ÖAW Globalbudget		98,100	100	98,100	80,200	100	80,200	75,100	100	75,100
31030204	7340	010	ÖAW Beauftragungen und Programme		6,900	100	6,900	15,000	100	15,000	16,486	100	16,486
31030204	7661	022	Ludwig-Boltzmann-Gesellschaft		5,000	100	5,000	9,702	100	9,702	5,000	100	5,000
31030204	7679	007	Verein der Freunde der Salzburger Stiftung		1,000	100	1,000	1,000	100	1,000	1,000	100	1,000
31030204	7679	008	Inst. für die Wissenschaften vom Menschen		0,750	100	0,750	0,506	100	0,506	0,506	100	0,506
			Summe UG31		**4.022,330**		**2.027,710**	**3.861,325**		**1.967,373**	**3.752,570**		**1.894,140**
			UG33										
33010100			Kooperation Wissenschaft-Wirtschaft		40,000	100	40,000	45,000	100	45,000	38,069	100	38,069
33010200			Innovation, Technologietransfer		44,591	100	44,591	39,600	100	39,600	56,230	100	56,230
33010300			Gründung innovativer Unternehmen		17,000	100	17,000	17,000	100	17,000	23,698	100	23,698
			Summe UG33		**101,591**		**101,591**	**101,600**		**101,600**	**117,997**		**117,997**
			UG40										
40020100	7270	000	Werkleistungen durch Dritte		5,770	5	0,289	5,770	7	0,404	3,757	5	0,188
40020100	7660	900	Zuschüsse f. lfd. Aufwand an private Institutionen		0,580	6	0,035	0,375	10	0,038	1,329	10	0,133
40030100			Eich- und Vermessungswesen		83,192		0,200	83,558		0,200	81,892		0,200
			Summe UG40		**89,542**		**0,524**	**89,703**		**0,642**	**86,978**		**0,521**
			Summe BM für Wissenschaft,		**4.213,463**		**2.129,825**	**4.052,628**		**2.069,615**	**3.957,545**		**2.012,658**

			Forschung und Wirtschaft											
			BM für Verkehr, Innovation und Technologie											
			UG34											
34010200	0801	122	Österreichische Forschungsförderungs GmbH, Wien			100		0,001	100	0,001		100		
34010200	0801	123	Austria Wirtschaftsservice GmbH, Wien			100		0,001	100	0,001		100		
34010200	0801	360	AustriaTech-Ges.d.Bds. F. techn.polit. Maßn.mbH, W			100		0,001	100	0,001		100		
34010200	0810	380	Kärnt. Betr.ansiedlgs.- u. Beteil.gesmbH, Klgft.											
34010200	7340	100	Rat f. Forschung und Technologieentwicklung		1,800	100	1,800	1,800	100	1,800	1,800	100	1,800	
34010200	7413	001	Austrian Institute of Technology AIT-Förderungen			100		0,100	100	0,100	0,110	100	0,110	
34010200	7413	002	Austrian Institute of Technology AIT		51,893	90	46,704	51,158	90	46,042	48,646	90	43,781	
34010200	7413	003	Nuclear Engineering Seibersdorf NES		10,200	30	3,060	8,850	30	2,655	6,635	30	1,991	
34010200	7414	001	Austria Tech - Förderungen			100		0,001	100	0,001		100		
34010200	7414	002	Austria Tech		1,900	100	1,900	2,300	100	2,300	1,379	100	1,379	
34010200	7430	000	Lfd. Transfers an übrige Sektoren der Wirtschaft			100		0,001	100	0,001		100		
34010200	7660	075	F&T-Förderung		0,300	100	0,300	0,600	100	0,600	0,185	100	0,185	
34010200	7661	030	Österreichische Computergesellschaft		0,075	100	0,075	0,090	100	0,090	0,076	100	0,076	
34010200	7662	341	Joanneum Research Forsch.ges.m.b.H(Techn.schwerp)		2,350	100	2,350	2,350	100	2,350	1,920	100	1,920	
34010200	7663	104	Gesellschaft für Mikroelektronik		0,030	100	0,030	0,035	100	0,035	0,047	100	0,047	
34010200	7666	005	Österreichisches Institut für Nachhaltigkeit		0,045	100	0,045	0,035	100	0,035	0,046	100	0,046	
34010200	7667	006	Sonstige gemeinnützige Einrichtungen		1,255	100	1,255	0,845	100	0,845	1,148	100	1,148	
34010200	7668	040	Salzburg Research		0,300	100	0,300	0,320	100	0,320	0,330	100	0,330	
34010200	7668	050	Profactor		0,500	100	0,500	0,500	100	0,500	0,200	100	0,200	
34010200	7690	002	Preisverleihungen		0,010	100	0,010	0,018	100	0,018		100		
34010300	7260	000	Mitgliedsbeiträge an Institutionen im Inland		0,006	100	0,006	0,020	100	0,020	0,006	100	0,006	
34010300	7270	000	Werkleistungen durch Dritte		5,000	100	5,000	6,500	100	6,500	4,270	100	4,270	
34010300	7280	030	FTI-Projekte, Beauftragungen an Dritte		2,500	100	2,500	3,407	100	3,407	1,922	100	1,922	
34010300	7330	352	Translational research (F&E)		3,450	100	3,450	3,500	100	3,500	6,346	100	6,346	
34010300	7330	652	Fonds wissensch./Programmabw.		0,250	100	0,250	0,200	100	0,200	0,286	100	0,286	
34010300	7411	001	FFG - Basisprogramme		126,052	100	126,052	122,130	100	122,130	120,000	100	120,000	
34010300	7411	002	FFG - FTI-Programme, Förderungen		126,000	100	126,000	126,888	100	126,888	127,447	100	127,447	
34010300	7411	003	FFG - FTI-Programme (F&E-Dienstleist.,Sonst.WV)		15,000	100	15,000	15,000	100	15,000	13,007	100	13,007	
34010300	7411	004	FFG - Administrative Kosten		14,500	100	14,500	12,500	100	12,500	12,391	100	12,391	
34010300	7412	001	Austria Wirtschaftsservice GmbH AWS - Förderungen		5,350	100	5,350	4,998	100	4,998	3,949	100	3,949	
34010300	7412	002	Austria Wirtschaftsservice GmbH AWS			100		0,001	100	0,001		100		
34010300	7412	003	Austria Wirtschaftsservice GmbH AWS - Admin.Kost.		0,150	100	0,150	0,001	100	0,001	0,163	100	0,163	
34010300	7432	030	FTI-Projekte, Förderungen		0,200	100	0,200	2,000	100	2,000		100		
34010300	7480	001	Forschungsschwerpunkte (Unternehmungen)											
34010300	7480	002	Technologieschwerpunkte (Unternehmungen)			100		3,000	100	3,000		100		
34010300	7680	030	FTI-Projekte, Förderungen an phys. Pers.			100		0,001	100	0,001		100		
34010300	7830	000	Laufende Transfers an Drittländer					0,001	100	0,001				
			Summe UG34		**369,116**		**356,787**	**369,153**		**357,842**	**352,309**		**342,800**	

			UG41										
41010200	7330	080	Transferzahlungen an Klima- und Energiefonds		47,000	39	18,330	65,000	39	25,350	37,325	39	14,557
41020100	7270	000	Werkleistungen durch Dritte		1,728	80	1,382	1,765	80	1,412	1,480	80	1,184
41020100	7270	800	Elektromobilität		0,200	80	0,160	0,200	80	0,160	0,082	80	0,066
41020100	7270	801	E-Mobilität für alle: Urbane Elektromobilität		0,001	20					5,675		
41020100	7411	002	FFG - FTI-Programme, Förderungen		2,000	100	2,000	2,500	100	2,500	2,162	100	2,162
41020100	7411	003	FFG - FTI-Programme (F&E-Dienstleist.,Sonst.WV)		0,200	100	0,200	0,600	100	0,600	1,900	100	1,900
41020100	7411	004	FFG - Administrative Kosten		0,100	100	0,100	0,200	100	0,200		100	
41020100	7420	000	Lfd. Transfers an Unternehm. m. Bundesbeteiligung			80		0,001	80	0,001		80	
41020100	7480	501	Progr.Kombinierter Güterverk.Straße-Schiene-Schiff		3,300	50	1,650	3,000	50	1,500	2,434	50	1,217
41020100	7481	800	Technologieprogramme allgemein (sonst. Anlagen)			80		0,045	80	0,036			
41020100	7660	000	Zuschüsse f. lfd. Aufwand an private Institutionen		0,049	95	0,047	0,544	95	0,517	0,020	95	0,019
41020100	7668	055	Technisches Museum Wien		0,301	80	0,241				0,317	80	0,254
41020200	7270	000	Werkleistungen durch Dritte		0,599	100	0,599	0,636	100	0,636	0,043	100	0,043
41020200	7270	118	Eisenbahnspezifische Angelegenheiten										
41020200	7270	800	Elektromobilität										
41020300	7270	000	Werkleistungen durch Dritte		0,083	80	0,066	0,084	80	0,067	0,221	80	0,177
41020300	7411	002	FFG - FTI-Programme, Förderungen		0,001	50	0,001	0,001	50	0,001	4,624	50	2,312
41020300	7411	003	FFG - FTI-Programme (F&E-Dienstleist.,Sonst.WV)		0,001	100	0,001	0,001	100	0,001		100	
41020300	7411	004	FFG - Administrative Kosten		0,001	50	0,001	0,001	50	0,001	0,199	50	0,100
41020300	7489	001	Breitbandinitiative (admin. Aufwand)		0,001	50	0,001	0,001	50	0,001		50	
41020300	7489	002	Breitband - Förderungen		0,001	50	0,001	0,001	50	0,001	3,679	50	1,840
41020402	7270	000	Werkleistungen durch Dritte		0,804	5	0,040	1,050	5	0,053	0,619	5	0,031
41020402	7270	006	Werkleistungen durch Dritte (zw)		1,003	5	0,050	0,995	5	0,050	0,896	5	0,045
41020500	7270	116	Spezifische Luftfahrtangelegenheiten										
			Summe UG41		**57,373**		**24,870**	**76,625**		**33,087**	**61,676**		**25,907**
			Summe BM für Verkehr, Innovation und Technologie		**426,489**		**381,657**	**445,778**		**390,929**	**413,985**		**368,707**
			BM für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft										
			UG42										
42010100			Zentralstelle	*	1,390	100	1,390	1,051	100	1,051	1,266	100	1,266
42010200	7411	000	Lfd Transfers an verbundene Unternehmungen	*	37,303	31	11,564	66,303	19	12,598	37,302	31	11,564
42020300			Forschung und Sonstige Maßnahmen	*	1,500	100	1,500	2,013	90	1,812	1,838	100	1,838
42020300	7660	000	Zuschüsse f. lfd. Aufwand an private Institutionen					0,010	50	0,005	0,005	100	0,005
42020401			Landwirtschaftliche Schulen	*	45,550	21	9,566	43,342	21	9,102	43,232	21	9,079
42020402			Landwirtschaftliche Hochschule	*	4,310	3	0,129	4,370	3	0,131	4,010	3	0,120
42020403			Landwirtschaftliche Bundesanstalten		3,082	68	2,096	2,900	68	1,972	2,727	68	1,854
42020405			Bundesanstalt f. alpenländ. Milchwirtschaft Rotholz		5,082	1	0,051	4,182	1	0,042	4,234	1	0,042
42020501			HBLA für Wein- und Obstbau Klosterneuburg		10,810	46	4,973	9,305	46	4,280	10,867	46	4,999
42020502			Bundesamt für Weinbau		4,969	9	0,447	4,900	9	0,441	4,730	9	0,426
42030101	7270	000	Werkleistungen durch Dritte		0,898	30	0,269	0,540	30	0,162	0,685	30	0,206
42030101	7700	003	Erosion (Rutschungen und Steinschläge) (zw)					7,000	10	0,700			
42030104			Forschung und Sonstige Maßnahmen Forst	*	1,376	90	1,238	1,376	90	1,238	0,617	100	0,617
42030204			Planung, Forschung und Sonstige Maßnahmen		0,670	90	0,603	0,673	90	0,606	0,670	90	0,603
42030204	7270	000	Werkleistungen durch Dritte		1,230	90	1,107	1,127	90	1,014	1,208	11	0,133

42030205			Bundesamt für Wasserwirtschaft		5,330	38	2,025	5,000	38	1,900	5,057	38	1,922
			Summe UG42		**123,500**		**36,958**	**154,092**		**37,054**	**118,448**		**34,674**
			UG43										
43010200	7700	500	Investitionszuschüsse		48,268	1	0,483	48,868	1	0,489	57,801	1	0,578
43010300			Klima- und Energiefonds		37,820	12	4,538	49,167	39	19,175	50,000	12	6,000
43010500			Nachhaltiger Natur- und Umweltschutz		46,906	1	0,469	26,438	25	6,610	46,448	1	0,464
43010500	7270	080	Forschungsaufwendungen		0,200	100	0,200				0,220	100	0,220
43010500	7420	021	Transferzahlungen an die UBA Ges.m.b.H		14,956	3	0,449	14,956	3	0,449	14,956	3	0,449
43010600			Strahlenschutz					18,500	7	1,295	14,406	7	1,008
43020200	7700	500	Investitionszuschüsse	*	24,750		0,080	34,600	1	0,346	54,700		0,170
43020300	7700	251	Investitionsförderungen (zw)	*	348,638		0,700	334,547	1	3,345	343,593		0,687
			Summe UG43		**521,538**		**6,919**	**527,076**		**31,709**	**582,124**		**9,576**
			Summe BM für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft		**645,038**		**43,877**	**681,168**		**68,763**	**700,572**		**44,250**
			Teil b -Summe		**6.648,162**		**2.684,198**	**6.205,724**		**2.658,034**	**6.482,702**		**2.554,099**
			Gesamtsumme Teil a + b		**6.757,081**		**2.780,796**	**6.320,864**		**2.758,066**	**6.588,370**		**2.647,489**

BUNDESVORANSCHLAG 2016

Detailübersicht Forschungswirksame Mittelverwendungen des Bundes
Anmerkungen

Allgemeine Anmerkungen			
			*) F& E Koeffizienten geschätzt
Die Detailübersicht Foschungswirksame Mittelverwendung des Bundes:			
a) Beitragszahlungen aus Bundesmitteln an internationale Organisationen, die Forschung und Forschungsförderung (mit) als Ziel haben,			
b) Bundesbudget-Forschung - Finanzierungsvorschlag (ausgen. die bereits im Abschnitt a) ausgewiesen sind)			
Für die Aufstellung dieser Ausgaben ist in erster Linie der Gesichtspunkt der Forschungswirksamkeit maßgebend, der inhaltlich über den Aufgabenbereich 99 "Grundlagen-, angewandte Forschung und experimentelle Entwicklung" hinausgeht und auf dem Forschungsbegriff des Fascati-Handbuches der OECD beruht, wie er im Rahmen der forschungsstatistischen Erhebungen der STATISTIK AUSTRIA zur Anwendung gelangt.			
Forschungswirksame Anteile bei den Bundesausgaben finden sich daher nicht nur bei den Ausgaben des Aufgabenbereiches 99 "Grundlagen-, angewandte Forschung und experimentelle Entwicklung" sondern auch in zahlreichen anderen Aufgabenbereichen.			
Finanzierungsvoranschlag			
VA-Stelle	Konto	Ugl	Anmerkung
			Bundeskanzleramt
10010200			Teilbetrag der Voranschlagsstelle.
			BM für Inneres
11020600			* Teilbetrag
			BM für Arbeit, Soziales und Konsumentenschutz
20010101	7340	302	
20010201	7270	006	*) Forschungsanteil liegt unter 1 % (0,1%)
			BM für Gesundheit
24010100			Teilbetrag der Voranschlagsstelle
24030100	7660	900	Teilbetrag der Voranschlagsstelle
			BM für Bildung und Frauen
30010100			Teilbetrag der Voranschlagsstelle.
30010400			Teilbetrag der Voranschlagsstelle
30020700			Teilbetrag der Voranschlagsstelle
30040100			Teilbetrag der Voranschlagsstelle
			BM für Wissenschaft, Forschung und Wirtschaft
31030100			
			BM für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft
42010100			Teilbetrag der Voranschlagsstelle.
42010200	7411	000	Teilbetrag der Voranschlagsstelle
42020300			Teilbetrag
42020401			Teilbetrag für 2015
42020402			
42030104			Teilbetrag der Voranschlagsstelle.
43020200	7700	500	*) Forschungsanteil ist unter 1% (0,3 %).
43020300	7700	251	*) Forschungsanteil ist unter 1% (0,2 %).
Ergebnisvoranschlag			
VA-Stelle	Konto	Ugl	Anmerkung
			Keine Anmerkungen erfasst.

Table 5: Federal expenditure from 2000–2016 for research and research promotion by socioeconomic objectives

Breakdown of Annex T of the Auxiliary Document and the Detailed overview of research-related appropriation of federal funds (Parts a and b) for the Federal Finances Acts

Reporting years		Total federal expenditure for R&D	of which												
			Promotion of exploration and exploitation of earth and space	Promotion of agriculture and forestry	Promotion of trade, commerce and industry	Promotion of energy production, storage and distribution	Promotion of transport, traffic and communications	Promotion of schools and education	Promotion of the health care system	Promotion of social and socio-economic development	Promotion of environmental protection	Promotion of urban and physical planning	Promotion of national defence	Promotion of other objectives	Promotion of general knowledge advancement
2000[1]	in €1,000	1,287,326	86,343	79,177	194,247	21,365	29,644	14,299	291,038	89,881	43,301	10,006	336	11,502	416,187
	in %	*100.0*	*6.7*	*6.2*	*15.1*	*1.7*	*2.3*	*1.1*	*22.6*	*7.0*	*3.4*	*0.8*	*0.0*	*0.9*	*32.2*
2001[2]	in €1,000	1,408,773	92,134	78,480	251,049	25,093	36,435	15,342	306,074	94,474	43,909	10,739	174	11,939	442,931
	in %	*100.0*	*6.5*	*5.6*	*17.8*	*1.8*	*2.6*	*1.1*	*21.7*	*6.7*	*3.1*	*0.8*	*0.0*	*0.8*	*31.5*
2002[3]	in €1,000	1,466,695	94,112	85,313	243,301	26,243	42,459	16,604	315,345	97,860	45,204	11,153	21	12,579	476,501
	in %	*100.0*	*6.4*	*5.8*	*16.6*	*1.8*	*2.9*	*1.1*	*21.5*	*6.7*	*3.1*	*0.8*	*0.0*	*0.9*	*32.4*
2003[4]	in €1,000	1,452,124	96,812	86,018	241,728	25,960	39,550	15,787	316,273	92,762	49,487	10,665	4	12,966	464,112
	in %	*100.0*	*6.7*	*5.9*	*16.6*	*1.8*	*2.7*	*1.1*	*21.8*	*6.4*	*3.4*	*0.7*	*0.0*	*0.9*	*32.0*
2004[5]	in €1,000	1,537,890	84,670	61,182	308,316	25,716	41,489	10,846	362,961	73,670	41,336	13,260	163	15,724	498,557
	in %	*100.0*	*5.5*	*4.0*	*20.0*	*1.7*	*2.7*	*0.7*	*23.6*	*4.8*	*2.7*	*0.9*	*0.0*	*1.0*	*32.4*
2005[6]	in €1,000	1,619,740	85,101	57,618	347,841	28,320	35,275	9,557	362,000	73,978	46,384	13,349	243	16,165	543,909
	in %	*100.0*	*5.3*	*3.6*	*21.5*	*1.7*	*2.2*	*0.6*	*22.3*	*4.6*	*2.9*	*0.8*	*0.0*	*1.0*	*33.5*
2006[7]	in €1,000	1,697,550	76,887	57,698	411,462	20,951	42,795	18,997	379,776	81,812	53,279	9,602	126	-	544,165
	in %	*100.0*	*4.5*	*3.4*	*24.2*	*1.2*	*2.5*	*1.1*	*22.4*	*4.8*	*3.1*	*0.6*	*0.0*	-	*32.2*
2007[8]	in €1,000	1,770,144	80,962	64,637	435,799	28,001	40,013	19,990	373,431	90,639	56,075	9,673	27	894	570,003
	in %	*100.0*	*4.6*	*3.7*	*24.6*	*1.6*	*2.3*	*1.1*	*21.1*	*5.1*	*3.2*	*0.5*	*0.0*	*0.1*	*32.1*
2008[9]	in €1,000	1,986,775	87,751	66,273	525,573	24,655	39,990	37,636	422,617	90,879	57,535	12,279	142	-	621,445
	in %	*100.0*	*4.4*	*3.3*	*26.5*	*1.2*	*2.0*	*1.9*	*21.3*	*4.6*	*2.9*	*0.6*	*0.0*	-	*31.3*
2009[10]	in €1,000	2,149,787	104,775	66,647	538,539	32,964	47,300	42,581	456,544	97,076	67,985	14,522	133	-	680,721
	in %	*100.0*	*4.9*	*3.1*	*25.1*	*1.5*	*2.2*	*2.0*	*21.2*	*4.5*	*3.2*	*0.7*	*0.0*	-	*31.6*
2010[11]	in €1,000	2,269,986	103,791	67,621	587,124	39,977	56,969	50,648	472,455	99,798	67,114	12,792	123	-	711,574
	in %	*100.0*	*4.6*	*3.0*	*25.9*	*1.8*	*2.5*	*2.2*	*20.8*	*4.4*	*3.0*	*0.6*	*0.0*	-	*31.2*
2011[12]	in €1,000	2,428,143	107,277	63,063	613,692	41,294	54,043	59,479	510,359	115,792	77,578	20,170	99	-	765,297
	in %	*100.0*	*4.4*	*2.6*	*25.3*	*1.7*	*2.2*	*2.4*	*21.0*	*4.8*	*3.2*	*0.8*	*0.0*	-	*31.6*
2012[13]	in €1,000	2,452,955	103,432	60,609	607,920	55,396	47,934	65,537	499,833	121,570	86,776	20,338	120	-	783,490
	in %	*100.0*	*4.2*	*2.5*	*24.8*	*2.3*	*2.0*	*2.7*	*20.4*	*5.0*	*3.5*	*0.8*	*0.0*	-	*31.8*
2013[14]	in €1,000	2,587,586	108,966	70,897	641,851	76,014	53,713	83,087	542,560	117,714	83,556	21,985	280	-	786,963
	in %	*100.0*	*4.2*	*2.7*	*24.9*	*2.9*	*2.1*	*3.2*	*21.0*	*4.5*	*3.2*	*0.8*	*0.0*	-	*30.5*
2014[15]	in €1,000	2,647,489	113,173	60,714	689,214	64,582	64,675	81,354	566,058	119,780	48,381	22,639	961	-	815,958
	in %	*100.0*	*4.3*	*2.3*	*26.0*	*2.4*	*2.4*	*3.1*	*21.4*	*4.5*	*1.8*	*0.9*	*0.0*	-	*30.9*
2015[16]	in €1,000	2,758,066	117,986	62,875	691,024	78,064	64,505	81,526	576,597	122,308	71,738	23,276	249	-	867,918
	in %	*100.0*	*4.3*	*2.3*	*25.1*	*2.8*	*2.3*	*3.0*	*20.9*	*4.4*	*2.6*	*0.8*	*0.0*	-	*31.5*
2016[16]	in €1,000	2,780,796	122,399	64,954	706,637	72,499	63,002	83,393	584,342	126,978	48,560	24,229	2,254	-	881,549
	in %	*100.0*	*4.4*	*2.3*	*25.4*	*2.6*	*2.3*	*3.0*	*21.0*	*4.6*	*1.7*	*0.9*	*0.1*	-	*31.7*

As at: April 2016

Source: Statistics Austria (Bundesanstalt Statistik Österreich)

1) Annex T of the Auxiliary Document for the Federal Finances Act 2002, outlays. –2) Annex T of the Auxiliary Document for the Federal Finances Act 2003, outlays. –3) Annex T of the Auxiliary Document for the Federal Finances Act 2004, outlays. –4) Annex T of the Auxiliary Document for the Federal Finances Act 2005, outlays. –5) Annex T of the Auxiliary Document for the Federal Finances Act 2006, outlays. Revised data. –6) Annex T of the Auxiliary Document for the Federal Finances Act 2007, outlays. –7) Annex T of the Auxiliary Document for the Federal Finances Act 2008, outlays. Revised data. –8) Annex T of the Auxiliary Document for the Federal Finances Act 2009, outlays. –9) Annex T of the Auxiliary Document for the Federal Finances Act 2010, outlays. –10) Annex T of the Auxiliary Document for the Federal Finances Act 2011, outlays. –11) Annex T of the Auxiliary Document for the Federal Finances Act 2012, outlays. 12) Annex T of the Auxiliary Document for the Federal Finances Act 2013 (financing proposal), outlays Revised data. –13) Annex T of the Auxiliary Document for the Federal Finances Act 2014 (financing proposal), outlays. –14) Annex T of the Auxiliary Document for the Federal Finances Act 2015 (financing proposal), outlays. Revised data. – 15) Federal Finances Act 2016, Detailed overview of research-related appropriation of federal funds, outlays. – 16) Federal Finances Act 2016, Detailed overview of research-related appropriation of federal funds, financing proposal.

Table 6: Federal expenditure in 2014 for research and research promotion by socio-economic objectives and ministries

Breakdown of annual values for 2014 [1] from the Detailed overview of research-related appropriation of federal funds for the Federal Finances Act 2016 (Part a and Part b)

Ministries		Total federal expenditure for R&D	of which												
			Promotion of exploration and exploitation of earth and space	Promotion of agriculture and forestry	Promotion of trade, commerce and industry	Promotion of energy production, storage and distribution	Promotion of transport, traffic and communications	Promotion of schools and education	Promotion of the health care system	Promotion of social and socio-economic development	Promotion of environmental protection	Promotion of urban and physical planning	Promotion of national defence	Promotion of other objectives	Promotion of general knowledge advancement
BKA[2]	in €1,000	34,805	5,321	-	-	44	2	-	-	6,794	-	586	-	-	22,058
	in %	*100.0*	*15.3*	-	-	*0.1*	*0.0*	-	-	*19.5*	-	*1.7*	-	-	*63.4*
BMI	in €1,000	1,040	-	-	-	-	-	-	-	1,040	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-	-
BMBF	in €1,000	46,194	974	-	-	-	-	40,815	-	657	-	-	-	-	3,748
	in %	*100.0*	*2.1*	-	-	-	-	*88.4*	-	*1.4*	-	-	-	-	*8.1*
BMWFW	in €1,000	2,044,037	79,571	25,862	441,614	12,931	25,287	39,279	530,271	93,080	24,834	16,354	230	-	754,724
	in %	*100.0*	*3.9*	*1.3*	*21.6*	*0.6*	*1.2*	*1.9*	*25.9*	*4.6*	*1.2*	*0.8*	*0.0*	-	*37.0*
BMASK	in €1,000	7,034	-	-	-	-	-	-	-	7,034	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-	-
BMG	in €1,000	7,342	-	-	-	-	-	-	7,342	-	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	*100.0*	-	-	-	-	-	-
BMEIA	in €1,000	2,161	-	-	-	1,115	-	-	-	1,040	-	-	-	-	6
	in %	*100.0*	-	-	-	*51.6*	-	-	-	*48.1*	-	-	-	-	*0.3*
BMJ	in €1,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	in %	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BMLVS	in €1,000	2,325	-	-	-	-	-	-	-	-	-	-	731	-	1,594
	in %	*100.0*	-	-	-	-	-	-	-	-	-	-	*31.4*	-	*68.6*
BMF	in €1,000	29,629	1,016	1,008	4,686	209	372	1,074	6,596	6,049	372	256	-	-	7,991
	in %	*100.0*	*3.4*	*3.4*	*15.8*	*0.7*	*1.3*	*3.6*	*22.3*	*20.4*	*1.3*	*0.9*	-	-	*26.9*
BMLFUW	in €1,000	46,105	865	33,007	227	-	-	120	-	1,636	9,893	-	-	-	357
	in %	*100.0*	*1.9*	*71.5*	*0.5*	-	-	*0.3*	-	*3.5*	*21.5*	-	-	-	*0.8*
BMFJ	in €1,000	1,118	-	-	-	-	-	-	-	1,118	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-	-
BMVIT	in €1,000	425,699	25,426	837	242,687	50,283	39,014	66	21,849	1,332	13,282	5,443	-	-	25,480
	in %	*100.0*	*6.0*	*0.2*	*57.0*	*11.8*	*9.2*	*0.0*	*5.1*	*0.3*	*3.1*	*1.3*	-	-	*6.0*
Total	**in €1,000**	**2,647,489**	**113,173**	**60,714**	**689,214**	**64,582**	**64,675**	**81,354**	**566,058**	**119,780**	**48,381**	**22,639**	**961**	**-**	**815,958**
	in %	***100.0***	***4.3***	***2.3***	***26.0***	***2.4***	***2.4***	***3.1***	***21.4***	***4.5***	***1.8***	***0.9***	***0.0***	**-**	***30.9***

As at: April 2016

Source: Statistics Austria (Bundesanstalt Statistik Österreich)

1) Outlays. –2) Including the highest executive bodies.

Table 7: Federal expenditure in 2015 for research and research promotion by socio-economic objectives and ministries

Breakdown of annual values for 2015 [1] from the Detailed overview of research-related appropriation of federal funds for the Federal Finances Act 2016 (Part a and Part b)

Ministries		Total federal expenditure for R&D	of which												
			Promotion of exploration and exploitation of earth and space	Promotion of agriculture and forestry	Promotion of trade, commerce and industry	Promotion of energy production, storage and distribution	Promotion of transport, traffic and communications	Promotion of schools and education	Promotion of the health care system	Promotion of social and socio-economic development	Promotion of environmental protection	Promotion of urban and physical planning	Promotion of national defence	Promotion of other objectives	Promotion of general knowledge advancement
BKA[2]	in €1,000	39,360	5,994	-	-	48	1	-	-	8,030	-	679	-	-	24,608
	in %	*100.0*	*15.2*	-	-	*0.1*	*0.0*	-	-	*20.4*	-	*1.7*	-	-	*62.6*
BMI	in €1,000	1,067	-	-	-	-	-	-	-	1,067	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-	-
BMBF	in €1,000	40,277	-	-	-	-	-	40,277	-	-	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	*100.0*	-	-	-	-	-	-	-
BMWFW	in €1,000	2,103,894	82,098	26,183	430,400	15,476	23,274	39,899	540,147	95,256	25,274	16,572	238	-	809,077
	in %	*100.0*	*3.9*	*1.2*	*20.5*	*0.7*	*1.1*	*1.9*	*25.7*	*4.5*	*1.2*	*0.8*	*0.0*	-	*38.5*
BMASK	in €1,000	5,462	-	-	-	-	-	-	-	5,462	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-	-
BMG	in €1,000	7,307	-	71	-	-	-	-	7,234	2	-	-	-	-	-
	in %	*100.0*	-	*1.0*	-	-	-	-	*99.0*	*0.0*	-	-	-	-	-
BMEIA	in €1,000	2,305	-	-	-	1,120	-	-	-	1,176	-	-	-	-	9
	in %	*100.0*	-	-	-	*48.6*	-	-	-	*51.0*	-	-	-	-	*0.4*
BMJ	in €1,000	130	-	-	-	-	-	-	-	130	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-	-
BMLVS	in €1,000	1,267	-	-	-	-	-	-	-	-	-	-	11	-	1,256
	in %	*100.0*	-	-	-	-	-	-	-	-	-	-	*0.9*	-	*99.1*
BMF	in €1,000	34,350	1,208	1,139	5,567	249	442	1,182	7,821	6,499	442	304	-	-	9,497
	in %	*100.0*	*3.5*	*3.3*	*16.2*	*0.7*	*1.3*	*3.4*	*22.8*	*18.9*	*1.3*	*0.9*	-	-	*27.7*
BMLFUW	in €1,000	70,679	1,555	34,641	228	-	-	131	-	1,740	32,031	-	-	-	353
	in %	*100.0*	*2.2*	*49.0*	*0.3*	-	-	*0.2*	-	*2.5*	*45.3*	-	-	-	*0.5*
BMFJ	in €1,000	1,654	-	-	-	-	-	-	-	1,654	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-	-
BMVIT	in €1,000	450,314	27,131	841	254,829	61,171	40,788	37	21,395	1,292	13,991	5,721	-	-	23,118
	in %	*100.0*	*6.0*	*0.2*	*56.5*	*13.6*	*9.1*	*0.0*	*4.8*	*0.3*	*3.1*	*1.3*	-	-	*5.1*
Total	**in €1,000**	**2,758,066**	**117,986**	**62,875**	**691,024**	**78,064**	**64,505**	**81,526**	**576,597**	**122,308**	**71,738**	**23,276**	**249**	**-**	**867,918**
	in %	***100.0***	***4.3***	***2.3***	***25.1***	***2.8***	***2.3***	***3.0***	***20.9***	***4.4***	***2.6***	***0.8***	***0.0***	**-**	***31.5***

As at: April 2016

Source: Statistics Austria (Bundesanstalt Statistik Österreich)

1) Financing proposal. –2) Including the highest executive bodies.

Table 8: Federal expenditure in 2016 for research and research promotion by socio-economic objectives and ministries

Breakdown of annual values for 2016 [1] from the Detailed overview of research-related appropriation of federal funds for the Federal Finances Act 2016 (Part a and Part b)

Ministries		Total federal expenditure for R&D	of which												
			Promotion of exploration and exploitation of earth and space	Promotion of agriculture and forestry	Promotion of trade, commerce and industry	Promotion of energy production, storage and distribution	Promotion of transport, traffic and communications	Promotion of schools and education	Promotion of the health care system	Promotion of social and socio-economic development	Promotion of environmental protection	Promotion of urban and physical planning	Promotion of national defence	Promotion of other objectives	Promotion of general knowledge advancement
BKA[2]	in €1,000	39,095	5,994	-	-	46	2	-	-	8,056	-	530	-	-	24,467
	in %	*100.0*	*15.3*	-	-	*0.1*	*0.0*	-	-	*20.6*	-	*1.4*	-	-	*62.6*
BMI	in €1,000	1,219	-	-	-	-	-	-	-	1,219	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-	-
BMBF	in €1,000	40,059	-	-	-	-	-	40,059	-	-	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	*100.0*	-	-	-	-	-	-	-
BMWFW	in €1,000	2,163,212	85,225	27,818	450,127	16,444	24,727	42,070	548,475	100,136	26,532	17,630	253	-	823,775
	in %	*100.0*	*3.9*	*1.3*	*20.8*	*0.8*	*1.1*	*1.9*	*25.4*	*4.6*	*1.2*	*0.8*	*0.0*	-	*38.2*
BMASK	in €1,000	5,707	-	-	-	-	-	-	-	5,707	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-	-
BMG	in €1,000	7,043	-	-	-	-	-	-	7,043	-	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	*100.0*	-	-	-	-	-	-
BMEIA	in €1,000	2,151	-	-	-	1,117	-	-	-	1,034	-	-	-	-	-
	in %	*100.0*	-	-	-	*51.9*	-	-	-	*48.1*	-	-	-	-	-
BMJ	in €1,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	in %	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BMLVS	in €1,000	3,311	-	-	-	-	-	-	-	-	-	-	2,001	-	1,310
	in %	*100.0*	-	-	-	-	-	-	-	-	-	-	*60.4*	-	*39.6*
BMF	in €1,000	31,931	1,128	1,097	5,081	227	404	1,097	7,143	6,385	404	278	-	-	8,687
	in %	*100.0*	*3.5*	*3.4*	*15.9*	*0.7*	*1.3*	*3.4*	*22.4*	*20.0*	*1.3*	*0.9*	-	-	*27.2*
BMLFUW	in €1,000	45,611	911	35,187	239	-	-	129	-	1,700	7,068	-	-	-	377
	in %	*100.0*	*2.0*	*77.2*	*0.5*	-	-	*0.3*	-	*3.7*	*15.5*	-	-	-	*0.8*
BMFJ	in €1,000	1,427	-	-	-	-	-	-	-	1,427	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-	-
BMVIT	in €1,000	440,030	29,141	852	251,190	54,665	37,869	38	21,681	1,314	14,556	5,791	-	-	22,933
	in %	*100.0*	*6.6*	*0.2*	*57.2*	*12.4*	*8.6*	*0.0*	*4.9*	*0.3*	*3.3*	*1.3*	-	-	*5.2*
Total	**in €1,000**	**2,780,796**	**122,399**	**64,954**	**706,637**	**72,499**	**63,002**	**83,393**	**584,342**	**126,978**	**48,560**	**24,229**	**2,254**	**-**	**881,549**
	in %	***100.0***	***4.4***	***2.3***	***25.4***	***2.6***	***2.3***	***3.0***	***21.0***	***4.6***	***1.7***	***0.9***	***0.1***	**-**	***31.7***

As at: April 2016

Source: Statistics Austria (Bundesanstalt Statistik Österreich)

1) Financing proposal. –2) Including the highest executive bodies.

Table 9: General research-related university expenditure by the federal government ("General University Funds"), 2000–2016[1]

Years	General university funds	
	Total	R&D
	in € millions	
2000	1,956.167	842.494
2001	2,008.803	866.361
2002	2,104.550	918.817
2003	2,063.685	899.326
2004	2,091.159	980.984
2005	2,136.412	1,014.543
2006	2,157.147	1,027.270
2007	2,314.955	1,083.555
2008	2,396.291	1,133.472
2009	2,626.038	1,236.757
2010	2,777.698	1,310.745
2011	2,791.094	1,388.546
2012	2,871.833	1,395.130
2013	3,000.004	1,453.596
2014	3,059.949	1,481.744
2015	3,107.080	1,506.750
2016	3,264.854	1,580.644

As at: April 2016

Source: Statistics Austria (Bundesanstalt Statistik Österreich)

1) Based on Annex T of the Auxiliary Document and the Detailed overview of research-related appropriation of federal funds for the Federal Finances Act.

Table 10: Research promotion schemes and contracts awarded by the federal government in 2015 by sectors/areas of performance and awarding ministries
Analysis of the federal research database[1] without "major" global financing[2]

Ministries	Partial amounts 2015	of which awarded to																				
		Higher education sector						Government sector					Private non-profit sector			Business enterprise sector						
		Universities (including teaching hospitals)	Art universities	Austrian Academy of Sciences	Universities of applied sciences	Other higher education sector[3]	Total	Federal institutions (outside of the higher education sector)	Private non-profit facilities mostly run on public financing	Ludwig Boltzmann Gesellschaft	Other public sector[4]	Total	Private non-profit sector	Individual researchers	Total	Institutes' sub-sector ("Kooperativer Bereich") incl. competence centres (excluding AIT)	Austrian Institute of Technology GmbH – AIT	Company R&D sub-sector ("firmeneigener Bereich")	Total	Austrian Science Fund (FWF)	Austrian Research Promotion Agency (FFG)	Abroad
	in €	in %																				
BKA	45,024	-	-	-	-	-	-	-	*38.4*	-	-	*38.4*	-	-	-	-	-	*61.6*	*61.6*	-	-	-
BMASK	2,710,041	*12.9*	-	-	-	-	*12.9*	*45.5*	*26.2*	*0.1*	-	*71.8*	*4.2*	*2.5*	*6.7*	-	-	*7.4*	*7.4*	-	-	*1.2*
BMBF	8,818,564	*0.3*	-	-	-	-	*0.3*	*97.6*	*0.6*	-	-	*98.2*	*0.3*	-	*0.3*	-	-	*1.2*	*1.2*	-	-	-
BMEIA	137,639	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*31.7*	*31.7*	-	-	*68.3*
BMFJ	188,462	*43.6*	-	-	-	-	*43.6*	-	*14.4*	-	-	*14.4*	-	-	-	*7.6*	-	*23.8*	*31.4*	-	-	*10.6*
BMF	2,197,834	-	-	-	-	-	-	*62.9*	*30.7*	-	-	*93.6*	-	-	-	-	-	*1.9*	*1.9*	-	-	*4.5*
BMG	76,444	*100.0*	-	-	-	-	*100.0*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BMI	176,331	*40.9*	-	-	-	-	*40.9*	-	-	-	-	-	*4.7*	*23.1*	*27.8*	-	-	*28.5*	*28.5*	-	-	*2.8*
BMJ	124,023	-	-	-	-	-	-	-	*100.0*	-	-	*100.0*	-	-	-	-	-	-	-	-	-	-
BMLFUW	2,956,067	*51.9*	-	-	*1.4*	-	*53.3*	*11.6*	*4.0*	-	*0.5*	*16.1*	*8.4*	-	*8.4*	*9.0*	*2.5*	*3.1*	*14.6*	-	*6.5*	*1.1*
BMLVS	611,314	*11.2*	-	*1.2*	*17.5*	-	*29.9*	-	-	-	-	-	-	-	-	*42.6*	*18.1*	*9.4*	*70.1*	-	-	-
BMVIT	2,191,683	-	-	-	*0.2*	-	*0.2*	-	*61.1*	-	-	*61.1*	*10.3*	-	*10.3*	*8.0*	-	*20.4*	*28.4*	-	-	-
BMWFW	50,613,941	*4.5*	*0.2*	*0.1*	*0.2*	*0.1*	*5.1*	*9.8*	*13.2*	*0.1*	*0.1*	*23.2*	*4.0*	*0.1*	*4.1*	*0.2*	*0.0*	*1.2*	*1.4*	-	*0.0*	*66.2*
Total	**70,847,367**	***6.3***	***0.1***	***0.1***	***0.3***	***0.1***	***6.9***	***23.3***	***13.8***	***0.0***	***0.1***	***37.2***	***3.7***	***0.2***	***3.9***	***1.2***	***0.3***	***2.4***	***3.9***	-	***0.3***	***47.8***

As at: April 2016

Source: Statistics Austria (Bundesanstalt Statistik Österreich)

1) As at: 17 March 2016

2) i.e. excl. "major" global financing with funding amounts higher than €500,000.

3) Private universities, university colleges of teacher education, testing agencies at technical federal colleges and other facilities categorised within the higher education sector.

4) Regional government, local and chamber institutions as well as facilities of social insurance carriers.

Table 11: Research promotion schemes and contracts awarded by the federal government in 2015, broken down by socioeconomic objectives and awarding ministries
Analysis of the federal research database[1] without "major" global financing[2]

Ministries		Partial amounts 2015	of which											
			Promotion of research covering the earth, the seas, the atmosphere, and space	Promotion of agriculture and forestry	Promotion of trade, commerce, and industry	Promotion of energy production, storage and distribution	Promotion of transport, traffic and communications	Promotion of schools and education	Promotion of the health care system	Promotion of social and socio-economic development	Promotion of environmental protection	Promotion of urban and physical planning	Promotion of national defence	Promotion of general knowledge advancement
BKA	in €	45,024	-	-	-	-	-	-	-	45,024	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-
BMASK	in €	2,710,041	-	-	-	-	-	15,000	-	2,695,041	-	-	-	-
	in %	*100.0*	-	-	-	-	-	*0.6*	-	*99.4*	-	-	-	-
BMBF	in €	8,818,564	-	-	-	-	-	8,655,247	1,800	159,317	-	-	-	2,200
	in %	*100.0*	-	-	-	-	-	*98.2*	*0.0*	*1.8*	-	-	-	*0.0*
BMEIA	in €	137,639	94,030	-	-	-	-	-	-	43,609	-	-	-	-
	in %	*100.0*	*68.3*	-	-	-	-	-	-	*31.7*	-	-	-	-
BMFJ	in €	188,462	-	-	-	-	-	39,660	-	148,802	-	-	-	-
	in %	*100.0*	-	-	-	-	-	*21.0*	-	*79.0*	-	-	-	-
BMF	in €	2,197,834	-	-	-	-	-	-	-	2,197,834	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-
BMG	in €	76,444	-	76,444	-	-	-	-	-	-	-	-	-	-
	in %	*100.0*	-	*100.0*	-	-	-	-	-	-	-	-	-	-
BMI	in €	176,331	-	-	-	-	-	-	-	163,032	-	-	-	13,299
	in %	*100.0*	-	-	-	-	-	-	-	*92.5*	-	-	-	*7.5*
BMJ	in €	124,023	-	-	-	-	-	-	-	124,023	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-
BMLFUW	in €	2,956,067	172,130	1,564,395	502,800	25,000	-	-	108,554	179,192	304,608	-	-	99,388
	in %	*100.0*	*5.8*	*52.9*	*17.0*	*0.8*	-	-	*3.7*	*6.1*	*10.3*	-	-	*3.4*
BMLVS	in €	611,314	10,000	10,034	189,600	92,840	-	-	40,500	54,000	-	-	15,000	199,340
	in %	*100.0*	*1.6*	*1.6*	*31.0*	*15.2*	-	-	*6.6*	*8.8*	-	-	*2.5*	*32.7*
BMVIT	in €	2,191,683	158,340	-	718,285	92,000	267,500	-	-	246,855	-	-	-	708,703
	in %	*100.0*	*7.2*	-	*32.8*	*4.2*	*12.2*	-	-	*11.3*	-	-	-	*32.3*
BMWFW	in €	50,613,941	7,803,940	-	112,625	200	-	38,943	3,649,841	2,656,898	95,866	-	-	36,255,628
	in %	*100.0*	*15.4*	-	*0.2*	*0.0*	-	*0.1*	*7.2*	*5.2*	*0.2*	-	-	*71.7*
Total	**in €**	**70,847,367**	**8,238,440**	**1,650,873**	**1,523,310**	**210,040**	**267,500**	**8,748,850**	**3,800,695**	**8,713,627**	**400,474**	**-**	**15,000**	**37,278,558**
	in %	***100.0***	***11.6***	***2.3***	***2.2***	***0.3***	***0.4***	***12.3***	***5.4***	***12.3***	***0.6***	**-**	***0.0***	***52.6***

As at: April 2016

Source: Statistics Austria (Bundesanstalt Statistik Österreich)

1) As at: 17 March 2016

2) i.e. excl. "major" global financing with funding amounts higher than €500,000.

Table 12: Expenditure on research and experimental development (R&D), broken down by sectors of performance and sources of funds, 2004 to 2013

Sectors	2004		2006		2007		2009		2011		2013	
	in €1,000	in %	in €1,000	in %	in €1,000	in %	in €1,000	in %	in €1,000	in %	in €1,000	in %
Sectors of performance												
Total	**5,249,546**	**100.0**	**6,318,587**	**100.0**	**6,867,815**	**100.0**	**7,479,745**	**100.0**	**8,276,335**	**100.0**	**9,571,282**	**100.0**
Higher education sector [1]	1,401,649	26.7	1,523,160	24.1	1,637,277	23.8	1,951,845	26.1	2,117,553	25.6	2,327,754	24.3
Government sector[2]	269,832	5.1	330,232	5.2	367,300	5.3	399,093	5.3	425,222	5.1	424,885	4.4
Private non-profit sector[3]	21,586	0.4	16,519	0.3	17,377	0.3	35,905	0.5	40,719	0.5	40,223	0.4
Business enterprise sector	3,556,479	67.8	4,448,676	70.4	4,845,861	70.6	5,092,902	68.1	5,692,841	68.8	6,778,420	70.9
of which:												
Institutes' sub-sector ("kooperativer Bereich")[4]	347,703	6.6	428,492	6.8	468,219	6.8	482,719	6.5	625,650	7.6	763,758	8.0
Company R&D sub-sector ("firmeneigener Bereich")	3,208,776	61.2	4,020,184	63.6	4,377,642	63.7	4,610,183	61.6	5,067,191	61.2	6,014,662	62.9
Sources of funds												
Total	**5,249,546**	**100.0**	**6,318,587**	**100.0**	**6,867,815**	**100.0**	**7,479,745**	**100.0**	**8,276,335**	**100.0**	**9,571,282**	**100.0**
Public sector	1,732,185	33.0	2,071,310	32.8	2,260,857	32.9	2,661,623	35.6	3,014,526	36.4	3,269,850	34.2
Business enterprise sector	2,475,549	47.1	3,056,999	48.4	3,344,400	48.7	3,520,016	47.0	3,820,904	46.2	4,665,748	48.7
Private non-profit sector	25,201	0.5	26,928	0.4	32,316	0.5	42,179	0.6	39,236	0.5	45,473	0.5
Abroad	1,016,611	19.4	1,163,350	18.4	1,230,242	17.9	1,255,927	16.8	1,401,669	16.9	1,590,211	16.6
of which EU	86,974	1.7	103,862	1.6	101,094	1.5	111,470	1.5	150,259	1.8	180,660	1.9

Source: Statistics Austria. Survey of research and experimental development in 2013. Compiled on: 6 July 2015

1) Universities including hospitals, art universities, the Austrian Academy of Sciences, testing institutes at technical federal colleges, universities of applied sciences, private universities and the University for Continuing Education Krems. Including university colleges of teacher education (since 2007). As of 2009 also includes other institutions attributable to the university sector. –2) Federal institutions (not including those combined in the higher education sector), Regional government, local government and chamber institutions, R&D institutions of the social insurance carriers, public sector-financed and/or controlled private non-profit institutions as well as R&D institutions of the Ludwig Boltzmann-Gesellschaft; including regional hospitals. The regional hospitals were not surveyed by questionnaire, but instead Statistics Austria prepared an estimate of their R&D expenditures based on the reports of the offices of the provincial governments. –3) Private non-profit institutions whose status is predominantly private or under civil law, sectarian or other non-public. –4) Including The Austrian Institute of Technology GmbH and centres of excellence. –Rounding differences.

Table 13: Employees in research and experimental development (R&D), headcounts and full-time equivalents in 2013, by sectors of performance/survey areas, occupation and gender

Sectors, areas	Survey units carrying out R&D	Total		of which					
				Researchers		Technicians and equivalent staff		Other supporting staff	
		male	female	male	female	male	female	male	female
Headcounts									
Total	**4,882**	**81,324**	**35,719**	**50,303**	**21,145**	**24,917**	**8,962**	**6,104**	**5,612**
1. Higher education sector	**1,273**	**23,843**	**20,758**	**20,369**	**13,412**	**2,137**	**4,340**	**1,337**	**3,006**
of which:									
1.1 Universities (without hospitals)[1]	1,032	17,810	14,567	14,999	9,272	1,655	3,107	1,156	2,188
1.2 University hospitals	90	2,623	3,242	2,356	1,929	155	687	112	626
1.3 Art universities	65	736	710	692	568	21	90	23	52
1.4 Academy of Sciences	33	775	656	667	505	103	144	5	7
1.5 Universities of applied sciences	24	1,234	914	1,059	625	147	224	28	65
1.6 University colleges for teacher education	11	334	356	281	230	42	64	11	62
1.7 Pedagogical universities	15	110	180	107	168	3	10	-	2
1.8 Other higher education sector [2]	3	221	133	208	115	11	14	2	4
2. Government sector[3]	**236**	**3,175**	**3,057**	**1,884**	**1,588**	**600**	**613**	**691**	**856**
of which:									
2.1 Without regional hospitals	236	3,175	3,057	1,884	1,588	600	613	691	856
2.2 Regional hospitals	.	.	.	.	.	.	.	.	.
3. Private non-profit sector[4]	**47**	**420**	**470**	**315**	**237**	**65**	**153**	**40**	**80**
4. Business enterprise sector	**3,326**	**53,886**	**11,434**	**27,735**	**5,908**	**22,115**	**3,856**	**4,036**	**1,670**
of which:									
4.1 Institutes' sub-sector ("kooperativer Bereich")[5)]	65	5,525	2,287	3,652	1,132	1,350	606	523	549
4.2 Company R&D sub-sector ("firmeneigener Bereich")	3,261	48,361	9,147	24,083	4,776	20,765	3,250	3,513	1,121
Full-time equivalents									
Total	**4,882**	**50,294.0**	**15,892.2**	**31,139.2**	**9,286.3**	**16,047.2**	**4,262.5**	**3,107.5**	**2,343.3**
1. Higher education sector	**1,273**	**9,651.8**	**7,188.6**	**8,380.0**	**4,465.7**	**800.6**	**1,661.3**	**471.2**	**1,061.6**
of which:									
1.1 Universities (without hospitals)[1]	1,032	7,543.8	5,285.5	6,473.6	3,210.5	641.6	1,228.1	428.7	847.0
1.2 University hospitals	90	690.5	880.6	606.4	455.8	57.5	264.7	26.6	160.1
1.3 Art universities	65	138.7	134.6	129.9	101.1	3.9	21.5	4.8	12.0
1.4 Academy of Sciences	33	496.2	341.8	451.2	277.1	43.6	59.9	1.4	4.8
1.5 Universities of applied sciences	24	530.6	311.2	484.5	236.3	40.9	60.5	5.1	14.3
1.6 Private universities	11	97.8	121.5	83.2	79.3	11.5	21.5	3.1	20.7
1.7 University colleges for teacher education	15	24.2	38.7	23.2	37.3	1.0	1.3	-	0.1
1.8 Other higher education sector [2]	3	130.0	74.7	128.0	68.3	0.5	3.6	1.5	2.8
2. Government sector[3]	**236**	**1,362.0**	**1,175.6**	**903.3**	**663.5**	**172.6**	**206.9**	**286.0**	**305.3**
of which:									
2.1 Without regional hospitals	236	1,362.0	1,175.6	903.3	663.5	172.6	206.9	286.0	305.3
2.2 Regional hospitals	.	.	.	.	.	.	.	.	.
3. Private non-profit sector[4]	**47**	**190.8**	**205.6**	**157.9**	**102.8**	**18.4**	**76.7**	**14.5**	**26.0**
4. Business enterprise sector	**3,326**	**39,089.4**	**7,322.4**	**21,698.0**	**4,054.3**	**15,055.6**	**2,317.6**	**2,335.8**	**950.4**
of which:									
4.1 Institutes' sub-sector ("kooperativer Bereich")[5)]	65	3,669.5	1,202.8	2,649.0	652.4	656.0	247.8	364.5	302.5
4.2 Company R&D sub-sector ("firmeneigener Bereich")	3,261	35,419.9	6,119.6	19,049.0	3,401.9	14,399.6	2,069.8	1,971.3	647.9

Source: Statistics Austria. Survey of research and experimental development in 2013. Compiled on: 3 July 2015

1) Including the University for Continuing Education Krems. –2) Testing institutes at technical federal colleges as well as other programmes that can be attributed to the higher education sector (reported together to keep data confidential). –3) Federal institutions (not including those combined in the higher education sector), Regional government, local government and chamber institutions, R&D institutions of the social insurance carriers, public sector-financed and/or controlled private non-profit institutions as well as R&D institutions of the Ludwig Boltzmann-Gesellschaft; without regional hospitals. The regional hospitals were not surveyed by questionnaire, but instead Statistics Austria prepared an estimate of the R&D expenditures based on the reports of the offices of the provincial governments. For this reason there is no data about employees in R&D. –4) Private non-profit institutions whose status is predominantly private or under civil law, sectarian, or other non-public. –5) Including The Austrian Institute of Technology GmbH and competence centres. –Rounding differences

Table 14: Employees in research and experimental development (R&D) (in full-time equivalents) in all of the areas surveyed[1] 2013 broken down by state[2] and occupation categories

States	Survey units performing R&D	Full-time equivalents in R&D			
		Total	of which		
			Researchers	Technicians and equivalent staff	Other supporting staff
Austria	**4,882**	**66,186.1**	**40,425.6**	**20,309.7**	**5,450.9**
Burgenland	97	700.5	384.2	242.2	74.0
Carinthia	220	3,241.6	2,063.6	1,032.4	145.6
Lower Austria	515	5,630.5	2,971.4	2,186.2	473.0
Upper Austria	865	11,636.6	6,449.7	4,110.6	1,076.3
Salzburg	262	2,856.3	1,765.0	911.7	179.6
Styria	906	12,923.9	7,371.1	4,182.7	1,370.1
Tyrol	401	5,472.5	3,322.2	1,648.1	502.2
Vorarlberg	150	1,947.5	1,214.2	652.6	80.7
Vienna	1,466	21,776.8	14,884.2	5,343.1	1,549.4

Source: Statistics Austria. Survey of research and experimental development in 2013. Compiled on: 15 July 2015

1) The regional hospitals were not surveyed by questionnaire, but instead Statistics Austria prepared an estimate of the R&D expenditures based on the reports of the offices of the provincial governments. For this reason there is no data about employees in R&D. –2) Company R&D sub-sector ("firmeneigener Bereich"): Regional allocation by location of company headquarters. –Rounding differences.

Table 15: Financing of expenditure for research and experimental development (R&D) in 2013 by sectors of performance/ survey areas and financing sectors

R&D performed in the sectors, areas	Survey units performing R&D	Total	Promotion areas								
			Business enterprise sector	Public sector					Private non-profit sector	Abroad incl. international organisations (without EU)	EU
				Total	Federal government[1]	Regional governments[2]	Local governments[2]	Other[1]			
		in €1,000									
Total	**4,882**[3]	**9,571,282**	**4,665,748**	**3,269,850**	**2,428,439**	**307,450**	**7,678**	**526,283**	**45,473**	**1,409,551**	**180,660**
1. Higher education sector	**1,273**	**2,327,754**	**118,508**	**2,043,265**	**1,693,300**	**61,009**	**3,184**	**285,772**	**27,965**	**47,682**	**90,334**
of which:											
1.1 Universities (without hospitals)[4]	1,032	1,795,952	87,453	1,598,733	1,336,672	29,141	1,770	231,150	10,637	30,640	68,489
1.2 University hospitals	90	225,063	12,385	195,895	171,687	2,985	11	21,212	985	10,958	4,840
1.3 Art universities	65	34,029	659	32,748	30,139	229	39	2,341	123	141	358
1.4 Academy of Sciences	33	121,100	244	110,117	92,882	926	-	16,309	1,580	3,217	5,942
1.5 Universities of applied sciences	24	89,430	11,640	65,699	36,173	19,090	1,223	9,213	5,116	1,281	5,694
1.6 Private universities	11	25,837	5,735	8,880	1	4,898	109	3,872	9,355	1,040	827
1.7 University colleges for teacher education	15	8,509	392	7,875	7,799	27	12	37	103	-	139
1.8 Other higher education sector[5]	3	27,834	-	23,318	17,947	3,713	20	1,638	66	405	4,045
2. Government sector[6]	**236**[3]	**424,885**	**17,810**	**376,934**	**147,742**	**203,175**	**3,559**	**22,458**	**2,250**	**5,042**	**22,849**
of which:											
2.1 Without regional hospitals	236	266,827	17,810	218,876	147,742	45,117	3,559	22,458	2,250	5,042	22,849
2.2 Regional hospitals	.	158,058	.	158,058	.	158,058	.	.	.	.	.
3. Private non-profit sector[7]	**47**	**40,223**	**5,776**	**2,890**	**588**	**752**	**33**	**1,517**	**12,336**	**13,446**	**5,775**
4. Business enterprise sector	**3,326**	**6,778,420**	**4,523,654**	**846,761**	**586,809**	**42,514**	**902**	**216,536**	**2,922**	**1,343,381**	**61,702**
of which:											
4.1 Institutes' sub-sector ("kooperativer Bereich")[8]	65	763,758	137,864	205,817	108,153	28,538	280	68,846	482	395,534	24,061
4.2 Company R&D sub-sector ("firmeneigener Bereich")	3,261	6,014,662	4,385,790	640,944	478,656	13,976	622	147,690	2,440	947,847	37,641

Source: Statistics Austria. Survey of research and experimental development in 2013. Compiled on: 28 July 2015.

1) The funds from the research promotion funds and the R&D financing by the higher education sector are included under "Other". –2) Regional governments including Vienna. Local governments without Vienna. –3) Number of survey units not including regional hospitals. 4) Including the University for Continuing Education Krems. –5) Other programmes that can be attributed to the higher education sector. –6) Federal institutions (not including those combined in the higher education sector), regional government, local government and chamber institutions, R&D institutions of the social insurance carriers, public sector-financed and/or controlled private non-profit institutions as well as R&D institutions of the Ludwig Boltzmann-Gesellschaft; including regional hospitals. The regional hospitals were not surveyed by questionnaire, but instead Statistics Austria prepared an estimate of their R&D expenditures based on the reports of the offices of the provincial governments. –7) Private non-profit institutions whose status is predominantly private or under civil law, sectarian or other non-public. –8) Including The Austrian Institute of Technology GmbH and centres of excellence.

Table 16: Financing of expenditure on research and experimental development (R&D) in all survey areas[1], in 2013, by regional governments[2] and financing sectors

States	Survey units performing R&D[3]	Total	Promotion areas								
			Business enterprise sector	Public sector					Private non-profit sector	Abroad incl. international organisations (without EU)	EU
				Total	Federal government[4]	Regional governments[5]	Local governments[5]	Other[4]			
		in €1,000									
Austria	**4,882**	**9,571,282**	**4,665,748**	**3,269,850**	**2,428,439**	**307,450**	**7,678**	**526,283**	**45,473**	**1,409,551**	**180,660**
Burgenland	97	70,564	50,585	13,647	6,315	4,315	-	3,017	1	5,246	1,085
Carinthia	220	533,154	205,667	116,300	84,644	15,372	983	15,301	920	203,113	7,154
Lower Austria	515	726,591	488,582	166,328	99,137	41,385	782	25,024	6,725	50,234	14,722
Upper Austria	865	1,694,027	1,247,442	309,358	205,074	32,191	1,252	70,841	1,613	119,396	16,218
Salzburg	262	340,220	196,713	131,093	100,433	12,216	1,067	17,377	1,667	4,160	6,587
Styria	906	1,873,966	733,877	611,475	432,335	58,263	1,568	119,309	2,058	493,067	33,489
Tyrol	401	911,091	427,516	348,541	272,957	34,147	492	40,945	5,015	118,167	11,852
Vorarlberg	150	243,852	195,725	42,255	22,783	12,287	329	6,856	55	5,117	700
Vienna	1,466	3,177,817	1,119,641	1,530,853	1,204,761	97,274	1,205	227,613	27,419	411,051	88,853

Source: Statistics Austria. Survey of research and experimental development in 2013. Compiled on: 28 July 2015.

1) Including R&D expenditure estimate for regional hospitals. –2) In the company R&D sector ("firmeneigener Bereich"), the standard evaluation was performed by location of company headquarters. 3) Number of survey units not including regional hospitals. –4) The funds from the Austrian Research Promotion Fund and the R&D financing by the higher education sector are included under "Other". 5) Regional government including Vienna. Local governments without Vienna.

Table 17: Gross regional product (GRP), gross domestic expenditure on R&D and regional research intensity for 2013

Regions, regional governments (NUTS 1, NUTS 2)	Gross regional product ("regional GDP")[1]	Gross domestic expenditure on R&D [2]	
	in € millions	in € millions	in % of GRP
Austria	**322,595**	**9,571.28**	**2.97**
Eastern Austria	**140,816**	**3,815.89**	**2.71**
Burgenland	7,483	67.35	0.90
Lower Austria	50,500	809.84	1.60
Vienna	82,833	2,938.70	3.55
Southern Austria	**59,272**	**2,509.09**	**4.23**
Carinthia	17,665	506.77	2.87
Styria	41,607	2,002.32	4.81
Western Austria	**122,418**	**3,246.31**	**2.65**
Upper Austria	54,806	1,737.84	3.17
Salzburg	23,962	356.94	1.49
Tyrol	28,761	904.34	3.14
Vorarlberg	14,889	247.19	1.66
Extra-Regio [3]	89	-	-

Source: Statistics Austria. Survey of research and experimental development in 2013. Compiled on: 30 July 2015.

1) Konzept ESA 2010, national accounts revision date: September 2014. –2) Regional allocation according to the firm's R&D location(s) / the R&D location(s) of the survey units. –3) The "Extra-Regio" includes parts of the economic area which cannot be allocated directly to a region (embassies abroad). –Rounding differences.

Table 18: An international comparison of research and experimental development (R&D) in 2013

Country	Gross domestic expenditure on R&D in % of GDP	Financing of gross domestic expenditure of R&D by		Employees in R&D in full-time equivalents	Gross expenditure on R&D by the			
		Government	Business		Business enterprise sector	Higher education sector	Government sector	Private non-profit sector
		in %			in % of gross domestic expenditure on R&D			
Belgium	2.43	28.5	57.0	67,899	70.7	20.8	8.1	0.4
Denmark	3.06	30.4	57.9	58,246	64.0	33.2	2.3	0.4
Germany	2.83	29.1	65.4	588,615	67.2	17.9	14.9 o)	. n)
Finland	3.30	26.0	60.8	52,972	68.9	21.5	8.9	0.7
France	2.24	35.2	55.0	418,141	64.7	20.8	13.0	1.5
Greece	0.81	52.3	30.3	42,188	33.3	37.4	28.0	1.3
Ireland c)	1.54	25.9	53.6	24,129	73.4	22.0	4.7	0.0
Italy	1.31	41.4	45.2	246,764	54.7	28.3	14.0	3.0
Luxembourg	1.30	48.4	16.5	4,975	52.5	18.6	29.0 o)	. n)
Netherlands	1.96	33.3	51.1	123,206	55.7	32.1	12.2 o)	. n)
Austria 6	**2.96**	**34.2**	**48.7**	**66,186**	**70.8**	**24.3**	**4.4**	**0.4**
Portugal	1.33	46.4	42.3	46,711	47.5	44.6 a)	6.5	1.3
Sweden	3.31	28.3	61.0	80,957	69.0	27.1	3.7	0.2
Spain	1.26	41.6	46.3	203,302	53.1	28.0	18.7	0.2
United Kingdom	1.66	29.1	46.2	377,343	63.9	26.4	7.9	1.8
EU-15 b)	**2.07**	**32.6**	**55.5**	**2,401,633**	**63.7**	**23.4**	**11.9**	**1.0**
Estonia	1.71	47.2	42.1	5,858	47.7	42.3	8.9	1.1
Poland	0.87	47.2	37.3	93,751	43.6	29.3	26.8	0.3
Slovak Republic	0.83	38.9	40.2	17,166	46.3	33.1	20.5 d)	0.2
Slovenia	2.60	26.9	63.9	15,229	76.5	10.4	13.0	0.0
Czech Republic	1.91	34.7	37.6	61,976	54.1	27.2	18.3	0.3
Hungary	1.40	35.9	46.8	38,163	69.4 v	14.4 v	14.9 v)	0.0
Romania	0.39	52.3	31.0	32,507	30.7	19.7	49.2	0.4
EU-28 b)	**1.93**	**33.1**	**54.3**	**2,713,434**	**62.8**	**23.5**	**12.7**	**1.0**
Australia	2.11 c)	34.6 2	61.9 2	147,809 b)3)	56.3 c)	29.6 c)	11.2 c)	2.8 c)
Chile	0.39 y)	38.4	34.2	13,228	35.0	39.3	8.4	17.3
Iceland a)	1.87	35.0	39.2	2,766	56.8	35.4	6.5	1.4
Israel d)	4.09	12.7	36.5	77,143 c	84.3	12.7	1.9	1.1
Japan	3.47 y)	17.3 e)	75.5	865,523	76.1	13.5	9.2	1.3
Canada	1.69	34.7 c)	45.7	226,620	50.1 g	39.8	9.6	0.5
Korea	4.15	22.8	75.7	401,444	78.5	9.2	10.9	1.3
Mexico	0.50 c)	75.5 c)	22.2 c)	70,293 1	39.0 4	28.9 4	30.5 4	1.6 4
New Zealand	1.17 y)	39.8	39.8	24,900	46.4	30.4	23.2	0.0
Norway	1.65	45.8	43.1	38,536	52.5	31.5	16.0	0.0
Switzerland 5	2.97	25.4	60.8	75,476	69.3	28.2	0.8 h)	1.8
Turkey	0.94 y)	26.6	48.9	112,969	47.5	42.1	10.4	0.0
United States j)p)	2.74	27.8	60.9	.	70.6	14.2	11.2	4.1 c)
OECD total b)	**2.37**	**28.4**	**60.6**	**.**	**68.1**	**18.3**	**11.3**	**2.3**

Source: OECD (MSTI 2015-2), **Statistics Austria** (Bundesanstalt Statistik Österreich).

a) Break in the time series. –b) Estimate by the OECD Secretariat (based on national sources). –c) National estimate –d) R&D expenditure on national defence not included. –e) Results of national surveys, figures have been adjusted by the OECD Secretariat to fit the OECD standards. –g) Without research and development in the social sciences and humanities. –h) Only federal or central government funds. –j) Excluding investment expenditure. –n) Included elsewhere. –o) Includes other categories as well. –p) Preliminary values. –v) Sum of components does not equal total. –y) GDP according to System of National Accounts 1993.

1) 2007. –2) 2008. –3) 2010. –4) 2011. –5) 2012. –6) Statistics Austria; Results of the 2013 survey on research and experimental development.

Full time equivalent = person year.

Table 19: Austria's path from the 4th Framework Programme for research, technological development and demonstration activities up to Horizon 2020

	FP4	FP5	FP6	FP7	H2020
	1994–1998	1998–2002	2002–2006	2007–2013	Data as per 02/2016
Number of approved projects with Austrian participation	1,444	1,384	1,324	2,452	693
Number of approved Austrian participations	1,923	1,987	1,972	3,589	981
Number of approved projects coordinated by Austrian organisations	270	267	213	676	198
Promotion for approved Austrian partner organisations and researchers for which a contract has been signed, in € millions	194	292	425	1,192	391
Percentage of approved Austrian participations among all approved participations	2.3%	2.4%	2.6%	2.6%	2.9%
Percentage of approved Austrian coordinators among all approved coordinators	1.7%	2.8%	3.3%	2.7%	2.4%
Austrian share of approved funds	1.99%	2.38%	2.56%	2.63%	2.81%

Source: Proviso Overview report from fall of 2013 (FP4-FP6); EC 11/ 2015 (FP7); EC 02/2016 (H2020).

Processing and calculations: Austrian Research Promotion Agency (FFG).

Table 20: Austria's results in the 7th EU Framework Programme for research, technological development and demonstration activities

	All countries	Austria	Burgenland	Carinthia	Lower Austria	Upper Austria	Salzburg	Styria	Tyrol	Vorarlberg	Vienna	N/A
Projects	**25,363**	**2,452**	**10**	**110**	**233**	**210**	**92**	**509**	**218**	**25**	**1,501**	**-**
Participations	**135,922**	**3,589**	**10**	**142**	**253**	**255**	**106**	**636**	**254**	**29**	**1,902**	**2**
Higher education	50,581	1,312	0	31	51	88	55	262	146	5	674	
Non-university research	33,593	861	0	5	61	46	26	136	2	1	584	
Business enterprises	41,230	1,164	10	105	132	112	21	232	102	21	427	2
Public institutions	6,242	171	0	1	4	3	2	1	3	0	157	
Other	4,276	81	0	0	5	6	2	5	1	2	60	
Declared SME	25,171	776	10	43	101	52	8	161	73	12	315	
Not a declared SME	110,751	2,813	0	99	152	203	98	475	181	17	1,587	
Coordinations	**25,363**	**676**	**0**	**27**	**48**	**34**	**17**	**99**	**43**	**1**	**407**	**-**
Higher education	14,409	360	0	2	27	23	10	45	38	0	215	
Non-university research	7,013	163	0	0	7	7	6	26	0	1	116	
Business enterprises	3,056	133	0	25	14	3	1	28	5	0	57	
Public institutions	480	15	0	0	0	1	0	0	0	0	14	
Other	405	5	0	0	0	0	0	0	0	0	5	
Declared SME	1,854	81	0	18	10	1	1	18	5	0	28	
Not a declared SME	23,509	595	0	9	38	33	16	81	38	1	379	

Source: EC 11/2015. Status 11 Nov. 2015

Processing and calculations: Austrian Research Promotion Agency (FFG).

Note: The self-declaration of the SME classification by the organisation is defined by statistical sizes of organisations and is used for all types of organisations. The European Commission considers this to be a subgroup of the PRC sector ("private sector").

Table 21: Austrian results in Horizon 2020

	All countries	Austria	Burgenland	Carinthia	Lower Austria	Upper Austria	Salzburg	Styria	Tyrol	Vorarlberg	Vienna
Projects	**8,201**	**693**	**5**	**23**	**68**	**62**	**23**	**158**	**44**	**2**	**425**
Participations	**34,029**	**981**	**5**	**32**	**69**	**75**	**24**	**211**	**49**	**3**	**513**
Higher education	11,762	297	1	3	16	18	9	53	26	0	171
Non-university research institutions	7,514	215	2	2	13	16	3	56	0	0	123
Business enterprises	10,894	347	2	23	38	34	9	93	21	3	124
Public institutions	2,086	64	0	3	0	2	1	4	2	0	52
Other	1,773	58	0	1	2	5	2	5	0	0	43
Declared SME	7,049	229	3	8	29	20	2	75	12	0	80
Not a declared SME	26,980	752	2	24	40	55	22	136	37	3	433
Coordinations	**8,201**	**198**	**0**	**8**	**18**	**11**	**4**	**35**	**10**	**0**	**112**
Higher education	3,998	90	0	0	11	3	2	9	9	0	56
Non-university research institutions	1,751	39	0	0	3	5	0	10	0	0	21
Business enterprises	2,130	58	0	8	4	3	2	16	1	0	24
Public institutions	179	7	0	0	0	0	0	0	0	0	7
Other	143	4	0	0	0	0	0	0	0	0	4
Declared SME	1,835	46	0	5	4	6	0	14	1	0	16
Not a declared SME	6,366	152	0	3	14	5	4	21	9	0	96

Source: EC 2/2016. As at: 26 February 2016

Processing and calculations: Austrian Research Promotion Agency (FFG).

Note: The self-declaration of the SME classification by the organisation is defined by statistical sizes of organisations and is used for all types of organisations. The European Commission considers this to be a subgroup of the PRC sector ("private sector").

Table 22: Overview of projects and participations in Horizon 2020

Participations	Approved participation (all countries)	Approved Austrian participations	Austria's share of participation by all countries [in %]
Total	**34,029**	**981**	**2.9**
EC Treaty	33,606	976	2.9
Excellent Science	9,842	230	2.3
Industrial Leadership	8,515	280	3.3
Societal Challenges	14,195	422	3.0
Spreading excellence and widening participation	396	13	3.3
Science with and for Society	483	28	5.8
Cross-theme	175	3	1.7
Euratom	423	5	1.2

Projects	Approved projects (all countries)	Approved projects with Austrian participation	Austria's share of participation by all countries [in %]
Total	**8,201**	**693**	**8.5**
EC Treaty	8,178	690	8.4
Excellent Science	4,554	197	4.3
Industrial Leadership	1,379	153	11.1
Societal Challenges	2,057	300	14.6
Spreading excellence and widening participation	106	13	12.3
Science with and for Society	49	24	49.0
Cross-theme	33	3	9.1
Euratom	23	3	13.0

Source: EC 2/2016. As at: 26 February 2016

Processing and calculations: Austrian Research Promotion Agency (FFG).

Note: The Austrian Research Promotion Agency's analysis was commissioned by the Federal Ministry of Science, Research and Economy (BMWFW), the Federal Ministry for Transport, Innovation and Technology (BMVIT), and the Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW).

Table 23: Austrian Science Fund (FWF): Funding in the area of biology and medicine, 2015

	Total [in € millions]	Share [in %]
Biology	43.2	21.7
Medical/theoretical sciences, pharmaceutics	20.8	10.4
Clinical medicine	5.1	2.5
Health sciences	0.6	0.3
Medical biotechnology	0.1	0.1
Other human medicine, health sciences	0.5	0.2
Veterinary medicine	0.2	0.1
Total for biology and medicine	70.5	35.4
Total funding amount	**199.3**	**100.0**

Source: Austrian Science Fund (FWF).

Table 24: Austrian Science Fund (FWF): Funding in the area of natural sciences and engineering, 2015

	Total [in € millions]	Share [in %]
Mathematics	18.4	9.2
Computer science	8.8	4.4
Physics, astronomy	33.6	16.8
Chemistry	11.4	5.7
Geosciences	6.0	3.0
Other natural sciences	1.4	0.7
Construction	1.6	0.8
Electrical engineering, electronics, information technology	1.6	0.8
Manufacture of machinery and equipment	0.4	0.2
Chemical industry and petrol industry, basic materials chemistry	0.1	0.04
Medical engineering	0.2	0.1
Environmental engineering, applied geosciences	7.0	0.4
Industrial biotechnology	0.2	0.1
Nanotechnologies	0.6	0.3
Other engineering	0.8	0.4
Agriculture and forestry, fisheries	15.0	0.7
Livestock breeding, animal production	0.1	0.05
Agricultural biotechnology, food biotechnology	0.1	0.03
Other agricultural sciences	1.2	0.6
Total natural sciences and engineering	88.6	44.5
Total funding amount	**199.3**	**100.0**

Source: Austrian Science Fund (FWF).

Table 25: Austrian Science Fund (FWF): Funding in the area of humanities and social sciences, 2015

	Total [in € millions]	Share [in %]
Psychology	2.1	1.0
Economics	2.0	1.0
Pedagogy	0.4	0.2
Sociology	1.9	0.9
Jurisprudence	1.2	0.6
Political science	1.7	0.8
Human geography, regional geography, spatial planning	0.5	0.2
Media and communication sciences	0.3	0.2
Other social sciences	2.7	1.4
History, archaeology	7.8	3.9
Linguistics and literary studies	8.8	4.4
Philosophy, ethics, religion	3.4	1.7
Art sciences	6.3	3.1
Other humanities	1.2	0.6
n/a (can only be assigned on a higher level)	1.0	0.03
Total humanities and social sciences	40.2	20.2
Total funding amount	**199.3**	**100.0**

Source: Austrian Science Fund (FWF).

Table 26: Austrian Research Promotion Agency (FFG): Funding by regional government, including share from abroad, 2015

	Participations	Total funding [in €1,000]	Cash value [in €1,000]
Burgenland	52	5,924	4,019
Carinthia	166	26,999	17,712
Lower Austria	510	28,544	20,995
Upper Austria	690	99,265	63,068
Salzburg	159	14,834	10,009
Styria	1,061	137,543	108,014
Tyrol	253	27,667	17,136
Vorarlberg	60	8,192	5,088
Vienna	1,341	111,821	90,184
Abroad	164	6,360	6,360
Total result	**4,456**	**467,149**	**342,585**

Source: Austrian Research Promotion Agency (FFG).

Table 27: Austrian Research Promotion Agency (FFG): Project costs and funding by Subject Index Code, 2015

Subject Index Code	Total costs [in €1,000]	Total funding [in €1,000]	Cash value [in €1,000]
Industrial manufacturing	151,827	65,821	44,035
Advanced materials	93,879	48,742	28,810
Surface transport and technologies	86,764	46,612	38,858
Electronics, microelectronics	95,258	44,232	24,497
ICT applications	77,006	39,306	30,001
Energy storage, conversion and transport	41,919	26,199	24,867
Information processing, information systems	30,747	18,876	15,682
Medicine, health	29,217	17,933	10,164
Renewable energy sources	22,496	16,606	13,575
Energy savings	26,943	16,167	15,102
Construction engineering	25,052	13,952	9,088
Medical biotechnology	28,244	13,594	9,311
Other technologies	16,316	8,471	6,192
Biosciences	18,293	7,801	6,508
Measuring techniques	13,314	7,167	4,513
Automation	10,843	6,779	5,936
Safety	8,654	5,605	5,605
Aviation and technologies	9,230	5,547	4,854
Robotics	7,995	5,517	2,547
Mathematics, statistics	7,893	5,287	4,287
Nanotechnologies and nanosciences	5,619	4,030	4,030
Foodstuffs	10,469	3,894	3,252
Waste management	5,792	3,159	1,946
Research ethics	7,372	3,143	675
Environment	4,692	2,989	2,202
Economic aspects	3,857	2,518	1,494
Sustainable development	3,203	2,401	2,401
Meteorology	7,263	2,086	2,086
Telecommunications	3,586	2,070	1,050
Information, media	2,783	1,949	1,164
Business aspects	4,178	1,653	1,183
Geosciences	4,986	1,576	1,576
Industrial biotechnology	1,385	1,116	947
Agriculture	794	554	486
Social aspects	440	347	347
Network technologies	568	341	259
Other energy topics	406	226	226
Water resources and water management	198	139	84
Space	200	100	100
Agricultural biotechnology	466	88	88
Innovation, technology transfer	57	57	57
Coordination, cooperation	5	5	5
without classification	41,573	12,496	12,496
Total result	**911,781**	**467,149**	**342,585**

Source: Austrian Research Promotion Agency (FFG).

Table 28: Austria Wirtschaftsservice (aws): Grants for technology funding, 2015

	Funding commitments [Amount]	Total project values [in € millions]	Funding grants [in € millions]
	2015	2015	2015
Austria Wirtschaftsservice (aws) LISA PreSeed	6	2	1.0
Austria Wirtschaftsservice (aws) LISA Seedfinancing	7	25.1	4.4
Austria Wirtschaftsservice (aws) interims management	1	0.1	0.0
Austria Wirtschaftsservice (aws) PreSeed	13	3.1	2.0
Austria Wirtschaftsservice (aws) Seed financing	8	48.9	3.5
Austria Wirtschaftsservice (aws) ProTrans-4.0	17	11.8	3.7
FISA – Film location Austria[1]	29	267.5	7.5
impulse	46	6.6	3.5
Austria Wirtschaftsservice (aws) creative industries voucher	303	15	1.5
Total	**430**	**380.1**	**27.14**

As at the end of 2015

Source: Austria Wirtschaftsservice (aws).

1) Increase of total project volume at FISA compared to recent years due to major national and international productions (e.g. "The way of the Eagle", "James Bond", "The last Christmas").

Table 29: CDG: CD laboratories by university/research institution and JR Centres by university of applied sciences, 2015

University/research institution	Number of CD laboratories 2015	Budget 2015 [in €]
Medical University of Graz	1	173,680
Medical University of Innsbruck	2	191,000
Medical University of Vienna	11	3,283,837
University of Leoben	8	2,097,969
Graz University of Technology	5	1,062,612
Vienna University of Technology	16	5,136,719
University of Natural Resources and Life Sciences Vienna	9	3,425,742
University for Continuing Education Krems	1	186,000
University of Graz	1	222,537
University of Innsbruck	1	259,466
University of Linz	7	2,980,473
University of Salzburg	2	1,033,270
University of Vienna	2	449,334
University of Veterinary Medicine Vienna	2	699,552
Vienna University of Economics and Business	1	154,962
Austrian Academy of Sciences	1	333,065
Research Center for Non Destructive Testing GmbH	1	340,029
Forschungszentrum Jülich GmbH	1	418,749
University of Bochum	1	25,415
University of Göttingen	1	290,000
University of Cambridge	1	410,639
Total	**75**	**23,175,050**

University of applied sciences	Number of JR Centres 2015	Budget 2015 [in €]
Carinthia University of Applied Sciences –non-profit foundation	1	386,466
Fachhochschule Salzburg GmbH	1	163,340
Fachhochschule St. Pölten GmbH	1	308,626
University of Applied Sciences Technikum Wien	1	313,175
Fachhochschule Vorarlberg GmbH	2	526,046
FH OÖ Forschungs und Entwicklungs GmbH	1	308,941
Total	**7**	**2,006,594**

Source: CDG.

Note: The total amount of CD laboratories is 73; there are two CD laboratories with dual management at different universities.

Budget data 2015 are plan data as of 4 Dec. 2015

Table 30: CDG: Development of the CDG 1989–2015 and JR Centres 2012–2015

Year	Expenditure of the CD laboratories and JR Centres [in €]	Active CD laboratories	Active JR Centres	Active member companies
1989	247,088	5		
1990	1,274,682	7		
1991	2,150,389	11		
1992	3,362,572	16		
1993	2,789,910	17		
1994	3,101,677	18		
1995	2,991,214	14		
1996	2,503,325	14		6
1997	2,982,793	15		9
1998	3,108,913	18		13
1999	3,869,993	20		15
2000	3,624,963	18		14
2001	4,707,302	20		18
2002	7,295,957	31		40
2003	9,900,590	35		47
2004	10,711,822	37		63
2005	11,878,543	37		66
2006	12,840,466	42		79
2007	14,729,108	48		82
2008	17,911,784	58		99
2009	17,844,202	65		106
2010	19,768,684	61		110
2011	20,580,208	61		108
2012	22,167,259	64	1	114
2013	23,666,522	73	4	131
2014	25,634,725	71	5	129
2015	25,181,644	73	7	139

Source: CDG.

Note: Budget data 2015 are plan data as of 4 Dec. 2015

Table 31: CDG: CD laboratories and JR Centres by thematic cluster, 2015

Thematic clusters	Number of CD laboratories	Budget [in €]*
Chemistry	11	3,710,902
Life Sciences and environment	13	4,468,079
Manufacture of machinery and equipment, instruments	4	1,102,224
Mathematics, informatics, electronics	21**	7,579,976
Medicine	14	3,238,437
Metals and alloys	10	2,995,860
Non-metal materials	5***	1,656,205
Economics, social sciences and jurisprudence	2	429,960
Total	**80**	**25,181,644**

Source: CDG.

* Plan data as of 4 Dec. 2015

** incl. 6 JR centres

*** incl. 1 JR centre