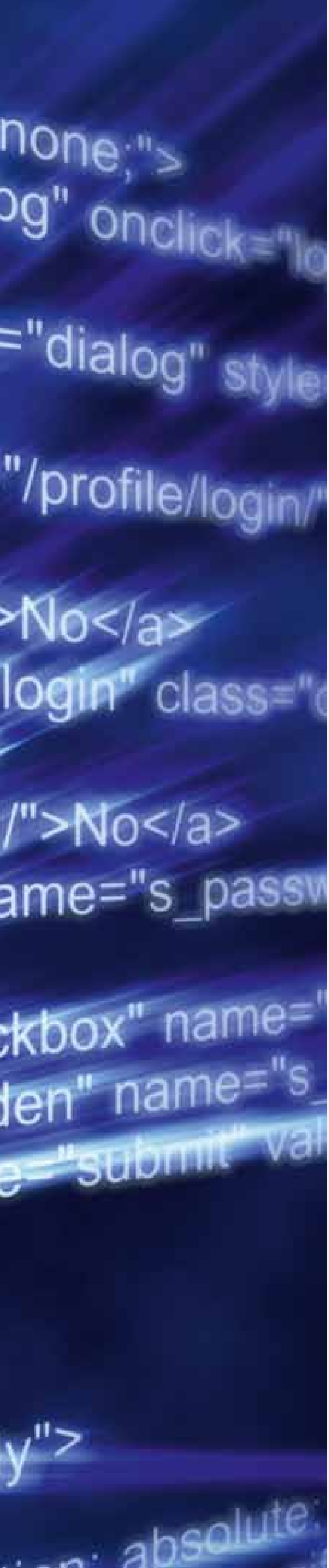

Austrian Research and Technology Report 2011

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

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This report was commissioned by the Federal Ministry of Science and Research (BMWF), the Federal Ministry for Transport, Innovation and Technology (BMVIT) and the Federal Ministry of Economy, Family and Youth (BMWFJ). It was written by Joanneum Research (JR), the Austrian Institute of Economic Research (WIFO), Austrian Institute of Technology (AIT) and with the participation of Statistik Austria.
Authors: Andreas Schibany (Coordinator, JR), Martin Berger (JR), Bernhard Dachs (AIT), Michael Dinges (JR), Helmut Gassler (JR), Jürgen Janger (WIFO), Franziska Kampik (AIT), Andreas Reinstaller (WIFO), Gerhard Streicher (JR), Sandra Turecek (AIT), Fabian Unterlass (WIFO), Georg Zahradnik (AIT).

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Preface

The Austrian Research and Technology Report 2011 provides an overall perspective on the Austrian innovation system, including current research- and technology-related topics and an analysis of developments in the field. The information provided here is intended to help react adequately to long-term research- and technology-related policy challenges. The federal government's strategy, approved in March 2011 and called "Tapping potentials, increasing dynamism, creating the future: Becoming an Innovation Leader", sets forth ambitious goals for which deep background knowledge, international comparisons and current analyses are indispensable.

One of the fixed research and technology policy goals is to increase the R&D intensity to 3.76% of the gross domestic product. The Austrian Research and Technology Report provides information every year about the development of research intensity over the long term, comparing this development with internationally relevant research locations. Austria's very pleasing and dynamic R&D intensity trend over the past decade places Austria above the average values of the EU-15 and EU-27, the OECD states, and since 2009, the USA. Within Europe, Austria's R&D intensity is one of the highest; only Sweden, Finland, Denmark, Switzerland, and by a slim margin Germany, have higher intensities. In order to attain an R&D intensity of 3.76% of GDP, massive public and private investments, and more dynamic development than was seen in 2000-2010, will be required. The RTI strategy contains a clear commitment to financing basic research, as well as funding for applied research and development from the public sector.

In 2011, Austria's R&D expenditures, according to the latest comprehensive estimates from Statistik Austria, exceeded the € 8 billion mark for the first time. With an anticipated total of € 8.286 billion - 5% over the previous year - this will translate to an R&D intensity of 2.76% of GDP. The R&D growth trend is therefore still underway. The public sector, above all the federal government, which has made major contributions to increasing R&D expenditure, will finance a share of 38.7% with approximately € 3.211 billion (+4.5% over 2010) in 2011. The state of research financing from the corporate sector is also very pleasing; it has resumed its upward trajectory in 2010 and 2011 after a slump in 2009. The corporate sector's share of financing increased year-on-year by 5.89% to € 3.698 billion, once again above the GDP growth rate (4.53%). The corporate sector therefore contributes 44.6% of overall R&D expenditure.

The mutual effects of international RTI strategies and national research policy alignments are described in detail in the presentations of the Europe 2020 strategy, the National Reform Programme, and the Austrian federal government's RTI strategy. This report also focusses on such topics as the best possible development and utilisation of human resources, of excellent pioneering research, the (organisational) frameworks for universities and universities of applied sciences, and the internationalisation of corporate RTI.

Dr. Karlheinz Töchterle
Federal Minister of Science
and Research

Doris Bures
Federal Minister of Transport,
Innovation and Technology

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1 Executive Summary

The Austrian Research and Technology Report 2011 is a status report to the Austrian parliament on the nation's federally funded research, technology and innovation. The report draws on current data to present an overview of specific trends in research, technology and innovation (RTI) and shows how Austria measures up internationally in select categories. This report was commissioned by the Federal Ministry of Science and Research (BMWF), the Federal Ministry for Transport, Innovation and Technology (BMVIT) and the Federal Ministry of Economy, Family and Youth (BMWFJ).

Current trends in R&D expenditure

According to the latest comprehensive estimates from Statistik Austria, total expenditure on research and development (R&D) in Austria will come to € 8.29 billion in 2011. There was a 5% nominal increase over 2010 in total R&D expenditures in Austria. The trend toward another surge in R&D expenditure, already discernible last year, continued after the temporary lull caused by the financial crisis. This year, Austria's R&D intensity is expected to reach 2.79% of the GDP. Revised values also show that the R&D intensity has remained almost unchanged at this level since 2009.

Corporate financing of R&D expenditures has experienced particularly propitious growth. This number only declined in absolute terms during the crisis-plagued year of 2009, although the decline of 1.11% was less severe than the 3.10% drop in the GDP. By 2010 the corporate sector's share of funding of R&D was already increasing again and was even strong enough to exceed (though only barely) the level for the pre-crisis year 2008. From 2010 to 2011 the growth rate, at 5.89%, exceeded GDP growth (4.53%), and corporate sector R&D expenditure in 2011 amounts to an absolute figure of € 3.7 billion (2010: € 3.49 billion).

During the crisis years the financing structure of R&D expenditure leaned towards the public sector, primarily at the federal level. The federal government's share of funding of R&D expenditure climbed from just over 28% in 2007 to 33% in 2011, amounting to € 2.73 billion (2010: € 2.6 billion). In reflection of this fact, the corporate sector's share of financing of R&D expenditure fell from just under 49% in 2007 to 44% in 2010. This trend has been stopped, however, with a renewed strong growth of corporate sector R&D financing in 2011. The corporate sector's share of financing has increased slightly again in 2011 to 44.6%.

The proportion of financing from abroad decreased markedly compared to the early 2000s (i.e., about 21.4% in 2002), yet stabilised during the crisis at approximately 16%, amounting to an estimated € 1.34 billion in 2011 (2010: € 1.29 billion). The private sector overall (firms plus from abroad) currently contributes about 61% to R&D financing.

The Austrian federal government's RTI strategy

With its publication of the strategic plan, "Tapping potentials, increasing dynamism, creating the future: Becoming an Innovation leader", the Austrian federal government has made a clear statement in favour of funding research, technology and innovation. The strategy was developed, together with relevant federal ministries and major stakeholders, to pursue the goal of taking Austria from the group of *Innovation Followers* into the group of *Innovation Leaders*, the most innovative countries in the EU. Austria can look back on very successful developments, the clearest indicator of which is the development of the R&D intensity, which has become one of the highest in Europe. To be able to adequately meet the long-term challenges (*Grand Challenges*) and ensure future viability, an overall perspective on the Austrian innovation system is needed that includes policies related to science, research and innovation. The basis of the strategy is therefore the strengthening of the "knowledge triangle" of education, research and innovation, along with the corresponding measures for operationalising these strategic objectives. The defined target of an R&D intensity of 3.76% of GDP by 2020 expresses our conviction that, in a developed national economy such as Austria's, the necessary potential for maintaining competitiveness can only be created through stronger investments in research and development.

Possible R&D approaches

Forecasts, as we have seen in recent years, are always full of uncertainty; a moderate margin of error must especially be assumed for GDP growth. Nevertheless, it is possible to state that reaching an R&D intensity of 3.76% of GDP, as well as increasing investments in basic research to the "level of leading research nations", will necessarily entail massive additional investments.

Total gross R&D spending would have to increase from the current level of € 8.29 billion to € 15.79 billion by 2020, which is predicated on average yearly growth of 7.43% (annual growth from 2000 to 2010 averaged 6.78%).

Even with a hypothetical approach that returns to a 33% share of public funding, additional annual expenditures averaging € 200 million would be necessary by the middle of the decade. With a stable share of 39% – which is currently the case – additional annual expenditures would have to reach an average of € 280 million by the middle of the decade.

For the private sector, this would mean, assuming constant development of the present financing share of 60.8%, additional annual expenditure averaging € 418 million in the coming years. By increasing the financing share – as the RTI Strategy argues – to two-thirds, additional annual expenditure would reach an average of € 480 million in the coming years.

The highest rates of growth, however, would have to be in basic research. The necessary rate of growth of expenditures over the entire time horizon would have to average 11.77% per year to reach spending volumes of approximately € 3.9 billion by 2020. Additional annual expenditure would amount to approximately € 200 million by the middle of the decade.

Clearly, the target of an R&D intensity of 3.76% by 2020 is a highly ambitious and wide-ranging goal. The approach to this objective implies much more dynamic development than we have seen in the last ten years.

Austria in the Innovation Union Scoreboard (IUS)

The IUS is the successor of the European Innovation Scoreboard (EIS) and represents an (altered) system of indicators that is meant to portray innovation development within the EU, and between the EU and other economies (primarily the USA and Japan). On the basis of 25 indicators, as well as a *Summary Innovation Index* (SII), Austria has shown solid results with a firm grip on seventh place. This is squarely within the (first half of the) group of *Innovation Followers* (together with the United Kingdom, Belgium, the Netherlands, Ireland, Luxembourg and France, in places 5 to 11). This group, however, is far behind the group of *Innovation Leaders* (Sweden, Denmark, Finland and Germany). These groupings have been very stable for years, and movements within these (partial) groups, which happen with every annual comparison, should not be considered all too important: For example, the difference in SII values between the 5th and 11th places is lower than the difference between 4th and 5th places, the threshold between *Leaders* and *Followers*.

The individual indicators confirm Austria's pattern of strengths and weaknesses, already familiar from the EIS: there are still weaknesses in tertiary education, venture capital availability and knowledge-intensive service exports. Strengths include scientific publications, R&D expenditure by firms, innovative SMEs, and intellectual property.

The IUS intends to capture structural aspects; accordingly, several indicators are oriented towards a long-term perspective. Therefore, we should not expect immediate reactions to changed policy measures.

The dynamism of R&D intensity

The R&D intensity has assumed a dominant position in the discourse on technology policy in recent years, not least as a new target in Austria (and at the EU level) for 2020. The central role of the R&D intensity derives from the important correlation between GDP per capita and a country's R&D intensity. However, it can be shown that the development paths of national economics, as well as the R&D intensity levels, are very different; i.e., even countries with similar levels of GDP per capita, such as Austria, exhibit significant differences in their R&D intensity and their dynamics over time. Because other factors have an effect on a country's growth dynamics (such as real estate or commodity prices), a comparison that focuses exclusively on R&D intensity has only limited significance. Development trajectories are too different and heterogeneous; the composition of national economies and their innovation systems are too specific; industrial structures and models of specialisation vary too widely.

The interpretation of R&D intensity in international comparisons is therefore only meaningful if the underlying structures and innovation systems are taken into account. The strong growth of Austrian R&D intensity therefore suggests a clearly recognisable change in the research orientation of its innovation system; this means that the Austrian innovation system is driven *sui generis* by research. The technological catching-up process of the 1980s and 1990s can now be considered complete.

The Europe 2020 Strategy

The Europe 2020 Strategy is very broad, and the RTI-related elements have become more important vis-a-vis the Lisbon Strategy, after closing gaps in performance ("competitiveness"), the increasing significance of mission orientation, and the completion of the integration process in innovation and education policy: labour markets and education systems must keep pace with the increasing requirements resulting from RTI policy.

The flagship initiative of the Europe 2020 Strategy, central to RTI, is the creation of an "Innovation Union" by 2020, defined by less fragmentation in the research landscape, a domestic market for innovation, and better coordination of EU-wide, national and regional research and innovation initiatives, research institutions and funding sources. The redoubling of integration efforts has become necessary because the EU expansion has starkly increased the diversity and development disparities between the EU member countries. The

European Commission is attempting to use this flagship initiative to coordinate initiatives among various Directorates-General better than was the case in the efforts to implement the Lisbon Strategy.

Crucial new elements include the focus on public procurement for the purpose of supporting innovation, striving to develop social innovation as an independent policy field, and the introduction of European innovation partnerships that should facilitate coordination of large projects in RTI policy across borders.

Another important flagship initiative is the "Digital Agenda", which aims to create a modern, high-performance broadband infrastructure. In the context of the dynamic developments of recent years, the Agenda is pursuing the goal of a digital domestic market that brings major benefits to the end-user (such as telemedical services).

Austria in the Lisbon Process

The structural indicators showed the indicator set that was meant to document the progress of the Lisbon Strategy and track the attainment of objectives. The Lisbon Strategy's targets, however, took on an unintended importance during the economic and financial crisis. But the entire European process of the last ten years provided important experience without which the new strategic prioritisations at the European level would have been very difficult. The report traces the developments of recent years on the basis of the structural indicators and describes Austria's specific position.

Internationalisation of research, technology and innovation (RTI)

There are many reasons for internationalising RTI: markets are becoming more demanding and fragmented, competition is going global and becoming stronger, and products and services are becoming more technologically intensive, with shorter life-cycles. In this context, firms have to ask themselves what the best form is for organising R&D.

The internationalisation of RTI by Austrian firms primarily means a Europeanisation with a specific focus on the German-speaking neighbouring countries of Germany and Switzerland. Outside of Europe, the only other location that plays a noteworthy role in R&D is the USA. These structures will probably not change over the medium term. The importance of emerging countries such as China remains low, but will certainly increase significantly. In comparison to other small, open national economics, such as Switzerland, Sweden, Finland or the Netherlands, the status of cooperation with partners outside of Europe has been limited thus far.

There is no empirical evidence that R&D activities are being off-shored to countries abroad. The primary motives for R&D activities abroad more often involve access to knowledge, support of production, and marketing abroad. The R&D funding system abroad, however, does not play a role in the R&D activities of Austrian firms abroad.

Yet at the same time, firms controlled from abroad have major significance for R&D activities in the Austrian corporate sector. More than half (53%) of all R&D expenditures in Austria is made by international firms. Seventy percent of these R&D expenditures can be attributed to firms in Germany and Switzerland. Austria therefore has a strongly internationalised economy that is woven primarily into the fabric of the domestic European market.

Academic research in Austria

One output category for scientific and academic knowledge production is publications in peer-reviewed journals. From 1995 to 2007, the number of these publications has grown worldwide to almost 785,000, at an annual growth rate of 2.72%. With about 4,800 publications in 2007, Austria has a share of less than one per cent of worldwide publications. Growth rates in the number of Austrian publications between 1995 and 2007, however, was significantly higher at 3.16% than in global comparison. Austrian medical research stands out in particular. At the same time, Austria was able to integrate itself more tightly in the increasingly globalised production of knowledge, as shown in the strong increase of Austrian co-publications with partners abroad. With regard to intensity (publications) and impact (measured in citations) of scientific output, Austria remains situated solidly in the midfield.

Austria has long been very successful in raising funds from the European Research Council (ERC). Measured in the number of applications submitted per capita, Austria is ranked in the middle; Austria, however, is in seventh place when it comes to the number of approved applications per capita. The Austrian success rate is among the highest in Europe (fourth place, together with the United Kingdom). These results are significant indications of the quality and international competitiveness of top Austrian research. The national promotion of excellent research by the Austrian Science Fund (FWF) has also increased noticeably in recent years. While in 2001 just under € 18 million went to the promotion of excellent research, funding volume in 2010 had already risen to € 45 million. Over the entire period of time from 2001 to 2010, FWF programmes of excellence have been funded with € 361 million.

The mobility of research personnel

Scientists and researchers often have careers that take them to different places at different times, and this enables the diffusion of knowledge. The mobility of research personnel is therefore an integral component of creating a European research area. In 2009, 56% of higher education researchers surveyed across the EU reported that they had worked at least once in their careers for more than three months in another country. The value for Austria was slightly below the EU average at 51%.

Important factors for international mobility are related to the research environment, such as opportunities for working together with leading experts. Austrian researchers identified financial motives and better career opportunities as important reasons for working abroad. The results on financial motivation appear to be driven by the larger number of younger researchers who are employed on fixed-term contracts, while career-related motives are likely to be based on the design of university careers and university organisation in Austria.

The USA continues to be the most attractive research location – one in four scientists names the USA as the most attractive place to do research. If country size is incorporated into the survey, Switzerland is often named as an attractive research location for scientists; Austria seems to appear only rarely as an attractive place to do research.

The organisational situation at universities

In addition to questions about university funding, organisational features are among the essential factors that determine the scientific quality of university research.

In scientific university research, there is a great deal of competition, which leads to a very unequal distribution of success (*winner takes it all*); often, small differences in ability or in resources have no relation to the sometimes major differences in scientific recognition. Internal university incentive and career models must be designed in such a way that they enable early opportunities for autonomous research. In addition to opportunities for independent research, assistant professors also want an attractive tenure track system that, with proper evaluations, can lead to long-term positions (*tenure*).

To guarantee the career progression of young researchers, successful universities are attending to the proper balance between teaching and research duties, and the *faculty* model (as opposed to the prevalent Austrian chair-based model) is being practised. The advantages of this model include the possibility of quickly integrating new fields of research, enabling a *bottom-up* reaction to new trends. To provide financing for young researchers, a university-supplied *start-up grant* is drawn against third-party funding so that no time is lost in the application phase. This enables young researchers to dedicate themselves fully to research without financial risk, before they are evaluated.

For established researchers, the availability of third-party funding is an important criterion of success because they already have experience in research management and the application process, and they can build on the impacts of their reputations. Third-party funding also ensures the quality of research projects.

The value of services in the innovation system

The strength with which tertiarisation continues to develop can also be observed in the area of research and development. The service sector's share of total R&D expenditure in Austria is continually growing, approaching the one-third mark. At the same time, it should be emphasised that it is not enough to make separate assessments of these sectors because of the many interrelationships between manufacturing and the service sector. On one hand, the service sector's research and development activities often have an explicit industrial orientation; on the other hand, R&D in some branches of manufacturing are also focussed on service-oriented R&D (especially ICT).

If we view innovation output in a broader sense (i.e., according to the conceptual guidelines of the OECD's Oslo Manual), then the service sector has a stronger orientation towards innovations in terms of organisational innovation and marketing. Innovations need not be driven by research, but rather can be understood as complex adaptation strategies that take place within firms.

Clusters as instruments of RTI policy

Basically, support for clusters aims at strengthening competitiveness and the innovation strength of participating firms, especially small and medium-sized firms (SMEs). The first efforts at cluster-oriented approaches in Austrian technology policy go back to the early 1990s. Appropriate initiatives developed very quickly from the bottom up, and their early successes (e.g. the automotive cluster in Styria and Upper Austria) served as a model for other initiatives and other Austrian states. The thematic spectrum covered by the Austrian cluster initiatives is dominated primarily by technology-specific – and therefore inter-industry – topics. These topics correspond primarily to Austria's economic and technological strengths. At the same time, the clusters include important technologies of the future (e.g. ICT, mechatronics, life sciences), social trends (health and wellness), and challenges (environmental technology, renewable energy sources).

Female Austrian inventors and patent activity

Measured by the number of patented inventions, women play only a small role in Austrian scientific and technological output. Depending on the counting method, this proportion lies between 3.5% and 8%, which is significantly lower than the proportion of women in scientific personnel or university studies. Patents by female inventors are found mainly in chemical technology, biotechnology and pharmaceuticals. Growth in the number of patents by female inventors has occurred primarily in these technologies in recent years. The pharmaceutical and chemical industries are the economic sectors with the highest share of women on scientific staff. International comparisons document the fact that fewer women participate in the process of invention in Austria than in other countries.

Evaluation of technology and innovation programmes

This chapter contains (i) the first preliminary results of the evaluation of the Laura Bassi Centres of Expertise, (ii) an evaluation of the pilot programme "Josef Ressel Centres", and (iii) an evaluation of the "Monitoring structures of the 7th framework programme and EUREKA and an analysis of the impacts of European research initiatives on the Austrian research and innovation system". The presentation of these evaluations focuses on the goals of the evaluations, the methods used, and the main results and recommendations of each spearate evaluation.

2 Current trends in research and technology

2.1 Trends in R&D expenditure in Austria – Global estimate 2011

According to the latest comprehensive estimates from Statistik Austria, total expenditure on research and development in Austria in 2011 will be € 8.286 billion. This means that, for the first time, Austria will exceed the € 8 billion mark in R&D expenditure in 2011. There was an increase of 5% over 2010. The trend toward another surge in R&D expenditure, already discernible last year, continued after the temporary lull caused by the crisis. The growth dynamics of the years before the crisis (with average rates of growth at 8.16% between 2000 and 2008) have not yet been reached. Statistik Austria estimates that Austria's GDP for 2011 will be € 296.87 billion. Austria's R&D intensity will therefore amount to about 2.79% in 2011 (see Figure 1).

The strongest growth in financing came from the corporate sector, increasing by 5.89% (and reaching € 3.7 billion), followed by 5.14% in growth in federal spending (see Table 1)[1]. Both of these funding sources grew faster than the GDP. In contrast, funding sources from abroad (up 3.79%), the Austrian states (up 1.09%) and other sectors (up 2.60%) did not keep pace with overall GDP growth.

It should be noted that this is an estimate and/or forecast with a high degree of uncertainty. In fact, during the course of the new comprehensive estimates, revisions were made to the figures for R&D expenditure in Austria in past years. These years were shaped primarily by the distortions of the global economic and financial crisis. Statistik Austria's revisions of R&D expenditure during the crisis years resulted in the following depiction of R&D development in Austria during this period:

Table 1: Growth rates in R&D expenditure in Austria by funding source

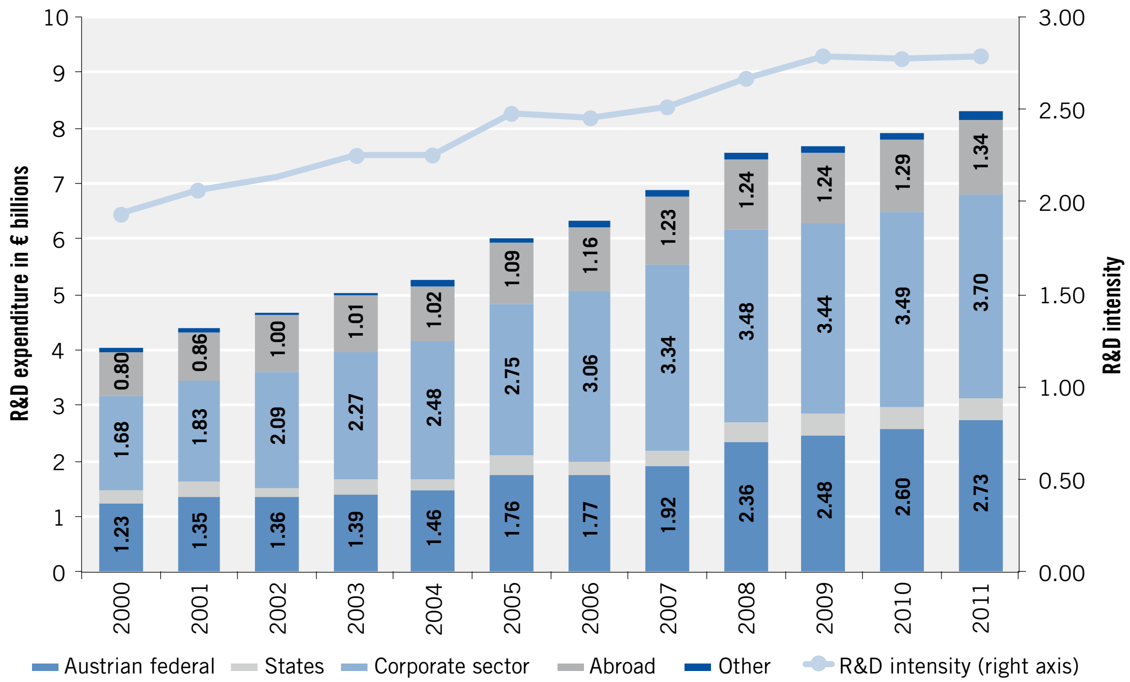
	Average annual rates of growth			
	2000 to 2008	2008/2009	2009/2010	2010/2011
Total R&D expenditure	8.16	1.45	3.04	5.01
by funding source:				
Federal	8.52	5.04	4.89	5.14
State	4.54	8.03	1.75	1.09
Corporate sector	9.5	–1.11	1.45	5.89
Abroad	5.64	0.03	4.24	3.79
Other	6.45	0.4	2.3	2.6
GDP growth	3.96	–3.1	3.53	4.53

Source: Statistik Austria, Global estimate 2011, calculations by Joanneum Research

- In the course of the crisis, there was a noticeable flattening of growth in overall R&D expenditure in contrast to the average annual growth rates of previous years, which from 2000 to 2008 amounted to approximately 8.16% per year. In the crisis year of 2009, the growth rate fell year-on-year by 1.45%; it has recovered to 5.01% in 2011. The enormous growth dynamics of the precrisis years has still not yet been attained.
- Due to the major drop in GDP in 2009 and the simultaneous slight increase in absolute R&D expenditure, the R&D intensity increased significantly from 2.67% in 2008 to

1 All of the rates of change are based on nominal values.

Figure 1: Research and development in Austria by funding source



Source: Statistik Austria, Global estimate 2011, calculations by Joanneum Research

2.79% in 2009. Since then, R&D expenditure has tended to increase in tandem with GDP, so that the R&D intensity has remained nearly unchanged since 2009 (2010: minimal decline in the intensity to 2.78%, see Figure 1).

- Corporate sector financing of R&D expenditure only declined in absolute terms during the actual crisis year 2009, although the decline of 1.11% was less severe than the 3.10% drop in GDP. Already in 2010, growth in the financial contribution from the corporate sector for R&D was so strong that it exceeded the value for the pre-crisis year 2008 (though only barely). From 2010 to 2011, growth of 5.89% exceeded GDP growth (4.53%).
- In all other funding sources, financial funding for R&D increased during the crisis. Remarkably, the decrease in R&D financing from abroad reported last year can no longer be confirmed in Statistik Austria's revised data. Actually, funding sources from abroad stagnated in 2009 and began growing again in 2010, slightly below the nominal GDP growth rate. Federal financing grew at an annual rate of 5% during the crisis years, allowing federal funding sources to exercise a major stabilising influence on research intensity.
- The financing structure for research and development expenditure shifted during the crisis years towards the public sector, primarily at the federal level (see Figure 2). The federal government's share of financing climbed from just under 28% in 2007 to 33% in 2011. In contrast, the corporate sector's share of financing for R&D spending fell from just under 49% in 2007 to 44% in 2010. This process has been reversed, how-

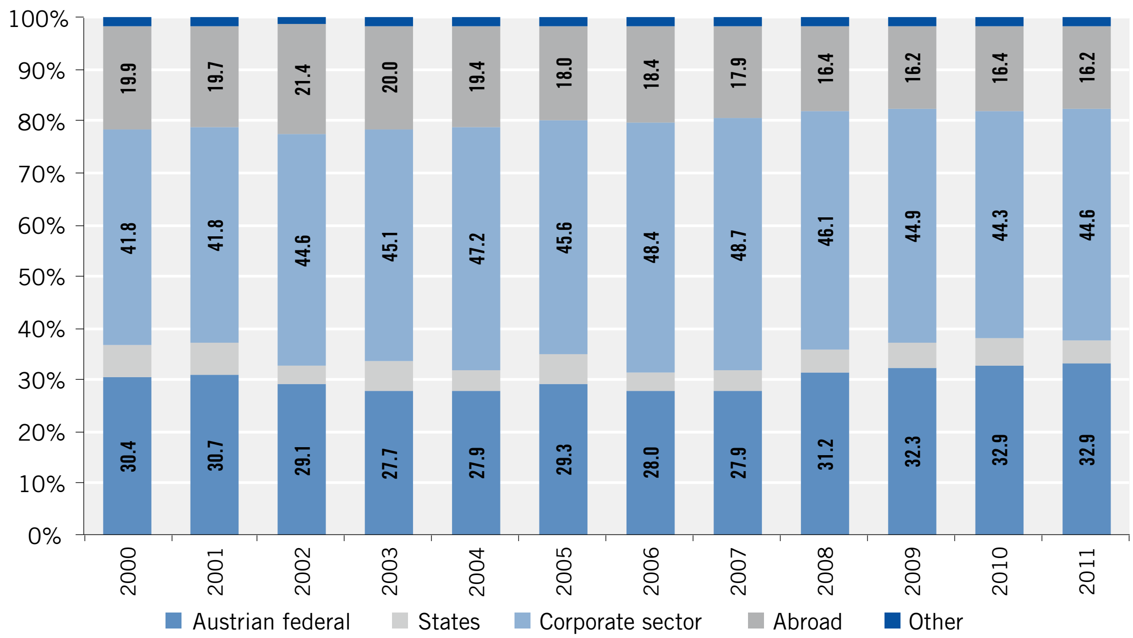
ever, with renewed strong growth in 2011 in corporate sector R&D financing. The corporate sector's share of financing has increased slightly again in 2011 to 44.6%. The proportion of financing from abroad has decreased markedly in comparison to the early 2000s (e.g. it was about 21.4% in 2002), yet stabilised during the crisis at approximately 16%. The Austrian states and "other" funding sources play much less of a role at 4-5% and 1.5% respectively.

International comparison of R&D intensity

Due to limited availability of data, an international comparison of R&D intensity was only possible for the period of time up to 2009 (for some countries and country groups, up to 2008) (see Figure 3). Once more, Austria's outstanding development was clear in terms of the R&D intensity dynamics. For several years, the Austrian R&D intensity has been above the average values of countries relevant for the sake of comparison, such as the EU-15 (and EU-27) and the OECD. In 2009, with an R&D intensity of 2.79%, Austria even managed to overtake the USA. Within the European Union, only Sweden, Finland, Denmark and Germany are ahead of Austria when it comes to their R&D intensity; within Europe, only Switzerland has a higher R&D intensity than Austria.

In addition to direct comparisons, the changes are also interesting. In this regard, Austria is in the top group by 0.81 percentage points thanks to the increase in its R&D intensity between 2000 and 2009. In addition to Austria, this group includes Portugal (plus 0.93 percentage points, although the country started from a very low basis; Portugal's R&D intensity remains significantly below the EU average) and Denmark (plus 0.84 percentage points). It is worth noting that, of the three large EU states,

Figure 2: R&D financing share in Austria by funding source



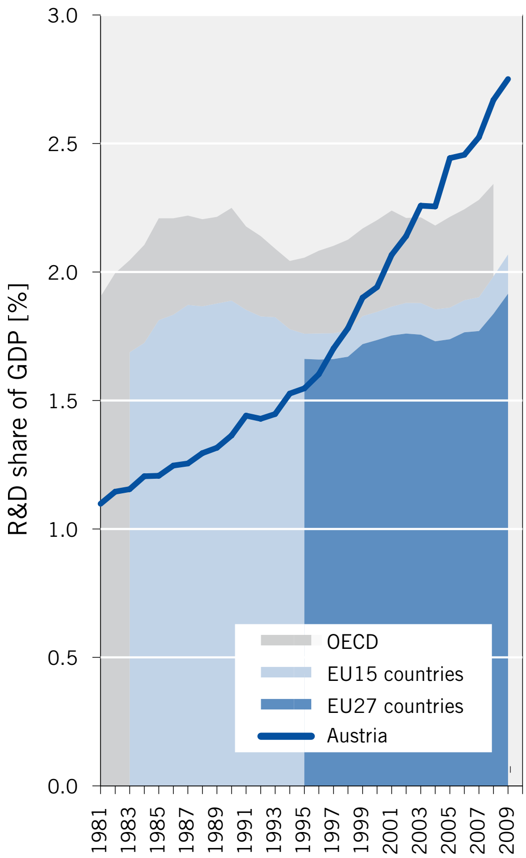
Source: Statistik Austria, Global estimate 2011, calculations by Joanneum Research only Germany was able to attain a noteworthy increase in its R&D intensity (plus 0.37 percentage points). France and the United Kingdom, however, both had stagnant R&D intensity (both climbed by 0.06 percentage points).

2.2 The Austrian federal government's RTI strategy

With the publication of "Becoming an Innovation Leader: Tapping potentials, increasing dynamism, creating the future" (RTI Strategy) on 8 March 2011, the federal government successfully concluded several years of intensive discussion and analysis concerning a strategy for research, technology, innovation and education in Austria with a time-frame of 2020. The resulting strategy plan quasi wraps up the multi-year process, which was defined by an intensive exchange of ideas and numerous detailed analyses of the many different aspects of the Austrian research and innovation system. Important starting points for this process were

- the Austrian Research Dialogue (2007–2008), which was designed to be a broad, nationwide process of discourse and consultations with Austrian stakeholders;
- the evaluation of Austrian research funding ("System Evaluation") in 2008–2009, which

Figure 3: Development of R&D expenditures as a percentage of gross domestic product by country



	2000	2009	Δ(2009-2000)
Belgium	1.97	1.96	- 0.01
Denmark	2.18 (1999)	3.02	+ 0.84
Germany	2.45	2.82	+ 0.37
Finland	3.35	3.96	+ 0.61
France	2.15	2.21	+ 0.06
Greece	0.60 (1999)	0.58 (2007)	- 0.02
United Kingdom	1.81	1.87	+ 0.06
Ireland	1.12	1.77	+ 0.65
Italy	1.05	1.27	+ 0.22
Netherlands	1.82	1.84	+ 0.02
Norway	1.64 (1999)	1.80	+ 0.16
Austria	1.94	2.75	+ 0.81
Poland	0.64	0.68	+ 0.03
Portugal	0.73	1.66	+ 0.93
Sweden	3.58 (1999)	3.62	+ 0.04
Slovak Republic	0.65	0.48	- 0.17
Republic of Slovenia	1.39	1.86	+ 0.47
Spain	0.91	1.38	+ 0.48
Czech Republic	1.21	1.53	+ 0.32
Hungary	0.79	1.15	+ 0.36
EU27 countries	1.74	1.92	+ 0.18
EU15 countries	1.84	2.07	+ 0.22
Canada	1.91	1.95	+ 0.05
Japan	3.04	3.44 (2008)	+ 0.40
Switzerland	2.53	3.00 (2008)	+ 0.47
USA	2.71	2.79 (2008)	+ 0.08
OECD	2.20	2.34 (2008)	+ 0.14
China	0.90	1.54 (2008)	+ 0.63

Source: The OECD's Main Science and Technology Indicators (MSTI), calculations by Joanneum Research

provided a profound assessment of the entire research promotion and funding activities, along with relevant recommendations for improvement by experts;
- the proposals and recommendations made by the Austrian Council for Research and Technology Development in the summer of 2009 for further development of the Austrian research and innovation system ("Strategy 2020").

Building on these preliminary projects, on continuous feedback discussions with the relevant stakeholders and social partners, and on an exchange of ideas with international experts, the working groups and ministries involved in the development and formulation of the federal government's strategy (the Federal Chancellery, the Federal Ministry of Finance, the Federal Ministry for Transport, Innovation and Technology, the Federal Ministry of Science and Research, the Federal Ministry of Economy, Family and Youth, and the Federal Ministry of Education, Arts and Culture) were able to build on a broad basis of analytical work and normative (strategic) recommendations. The government's strategy is thus the result of a consistent, evidence-based and interactive policy process.

One starting point is the successful development of the Austrian research and innovation system in recent decades, which has led to Austria being ranked at the forefront of "Innovation Followers" with some above-average system indicators. The best manifestation of Austria's positive development is its R&D intensity of 2.79% (2011), which is among the highest in Europe. On the other hand, new, short-term (consequences of the global financial and economic crisis) and long-term challenges ("Grand Challenges" such as global scarcity of energy and natural resources, climate change, demographic change) set the framework in which the strategy plan must function and for which adaptation strategies and development options must be developed by the institutions of science, research and technology.

The Austrian federal government's strategy plan for research, technology and innovation addresses these challenges by pursuing two prioritised objectives:

- *"We want to continue developing the potential of science, research, technology and innovation in Austria, thereby making our country one of the most innovative in the EU by 2020, strengthening the competitiveness of our economy and increasing the prosperity of our society.*
- *We want to continue expanding and leveraging the potential of science, research, technology and innovation in Austria, to tackle the great societal and economic challenges of the future."*

Against the background of these challenges, a vision for Austria in 2020 has been outlined in which Austria is solidly established among the EU's most innovative countries and is counted as one of Europe's Innovation Leaders. It sees Austria as a top location for research, technology and innovation, offering excellent researchers outstanding work and career opportunities and attracting research institutions and highly innovative firms from all over the world. Excellent research and radical innovation will be a matter of course in Austria, as will be the close collaboration between science, business and society. An overall policy perspective related to science, research and innovation helps to strengthen the three sides of the "knowledge triangle" (education, research and innovation) and to improve collaboration between them. The Austrian federal government's commitment to science, research, technology and innovation is clearly expressed in its goal to continue increasing Austria's R&D intensity over the next decade, up to 3.76% in 2020. In pursuit of this goal, the federal government has committed itself to the EU strategy process, Europe 2020, which sets individual goals for research intensity in the EU member countries.

Within this vision, the strategic framework defines five interrelated areas in which – building on specific structures, development trends and challenges – the strategy is to be implemented and operationalised using appropriate measures:

- **Education system:** A quantitatively and qualitatively well-equipped education system is an essential prerequisite for innovative thought and action. Access to and the permeability of the system should be fundamentally improved, providing performance fairness and equal opportunities, and concerning individual disposition and preference. The envisioned measures aim for a broad structural reform of the education system at all levels (from early childhood education to models of life-long learning). At the same time, improved integration procedures can do a better job of unlocking the human potential of Austria's population. Systematically increasing the mobility of students and graduates should ensure further internationalisation, which is an important indicator of the world-wide interconnection of the Austrian research and innovation system. At universities, the improved situation (such as transparent, performance-related awarding of professional positions, further development of the collective agreement, e.g. implementing a tenure track system, improving support for doctoral candidates and post-docs, etc.) should ensure that academic careers become more attractive and guarantee the continuity of excellent research staff. At the same, gender imbalances must be levelled out.
- **Basic research:** In a modern knowledge society, basic research, along with the ongoing expansion of the frontiers of scientific knowledge, is a fertile ground for the innovation system. In research and innovation policy basic research is consequently considered to be a key area of the government's responsibility. Accordingly, the institutions of basic research in Austria (universities, non-university research institutions focused on basic research, such as the Austrian Academy of Sciences, IST Austria, LBG, etc.) must be strengthened. In addition to improvements in infrastructure, essential packages of measures include reform of university financing, further development of performance agreements, the continued expansion of third-party financing via competitively evaluated projects while simultaneously covering overhead, and the implementation of an Austrian excellence initiative with up to ten different Clusters of Excellence by 2020. At the same time, the role of the universities as partners in the transfer of knowledge to businesses should be further expanded and strengthened, e.g. by establishing Knowledge Transfer Centres. Institutions for applied non-university (public) research will be aided and supported in their attempts at reform and international positioning.
- **Innovation and corporate research:** Innovations are a key element for firms that want to gain technological or market-oriented competitive advantages, thereby also assuring economic growth and new jobs. The prerequisite of such developments is intensifying ambitious research and development activities at firms, performed by highly skilled employees on the foundation of the latest scientific findings, guaranteed by constant and intensive knowledge transfer between scientists and businesses. The innovation capacity of Austrian firms and their employees is an essential factor for reaching the strategic goal of making Austria an Innovation Leader by 2020. The strategy accordingly includes the development of a

broad package of measures for increasing innovation performance in Austrian firms and the number of businesses engaged in R&D (objective: by 2013, a 10% increase, and by 2020, a 25% increase in the number of firms performing R&D). This package of measures includes, for example, the targeted expansion of direct funding, encouraging the foundation of innovative firms, improving access to private equity and venture capital, and demand-side innovation measures (as in the area of public procurement or in setting norms and standards), as well as further intensification of the links between science and business. Start-ups should be encouraged by eliminating administrative barriers, and a proactive competition policy should promote innovation in general.

- **Governance of the research and innovation system:** Now that the catching-up process has been successfully completed, the Austrian innovation system must face new challenges along the developmental path towards an Innovation Leader. Political governance cannot be restricted purely to research, technology and innovation policy in its narrower sense. In the face of new challenges, it can only be effective in mutual coordination and in cooperation with other policy areas, in particular educational policy, competition policy and a general policy of international openness and mobility. This new orientation of the framework conditions and governance structures thus aims for more efficient characteristics in terms of distributing areas of expertise, creating adequate mechanisms for defining focal points, a clear and transparent structuring of the funding system, and coherence in the distribution of responsibilities in a multi-level political system, from regional coordination to internationalisation. Not least, we are striving to create a mutually beneficial dialogue between science, business and society. This new orientation and further development of governance structures requires appropriate measures that can actively involve the relevant stakeholders, guaranteeing a dynamic political learning process. The envisioned measures therefore include establishing a high-level Task Force for Research, Technology and Innovation whose responsibilities will include the support, realisation and coordination of the implementation of the new RTI strategy; the strategic and system-oriented articulation and coordination of measures of individual ministries; and dealing with the recommendations of the Austrian Council for Research and Technology Development. The funding agencies in the area of RTI policy, working through performance agreements on the basis of output and impact goals, are essential pillars of the RTI strategy implementation. The new challenges ("Grand Challenges") are addressed in RTI policy by the establishment of new "inter-ministerial research, technology and innovation focal points". The focal points in question will be subject to accompanying evaluation and monitoring and will have short term impacts. When setting the focal points, however, it is essential that they are based on an improvement of Austria's competitiveness in the generic interdisciplinary fields of science and technology, while at the same time referencing existing areas of strength within Austrian science and business. The international and European networking of Austrian RTI stakeholders is actively supported, and cooperation with key countries (such as Central and Eastern Europe, North America, Southeast Asia, and the BRIC countries) is being strategically expanded.
- **Funding system:** The specific formulation and further development of the funding system plays a central role in the Austrian federal government's RTI strategy. In recent

years, Austria has developed a differentiated and broad system of funding that helped to initiate, support and drive forward Austria's extraordinarily successful catching-up process. This system covers everything from bottom-up funding-upon-application for all topics, to top-down thematically defined programmes and indirect (tax-related) funding instruments. This funding system must now be adjusted to fit the new strategic target: establishing Austria as an Innovation Leader. Emphasis here is placed on maximum efficiency and effectiveness of funding (high leverage), as well as the principle of competition-based funding allocation, which will take into consideration the specific requirements of basic research. Concrete measures include for example cleaning up programme diversity by concentrating resource allocation on a select few – broadly defined – focal points with strategic relevance; by continuing to streamline and harmonisation of instruments; working out a modern, standardised body of regulations for research funding to serve as the foundation of all federal funding; and by increasing the research premium in accordance with § 108c of the Austrian Income Tax Act from 8% to 10% (while simultaneously doing away with research tax allowances under § 4 Para 4 of the Austrian Income Tax Act). This should make it possible by 2020 to achieve a distribution of public and private financing in which one-third is public and the other two-thirds are private. The contribution of the public sector should, after the necessary phase of consolidation resulting from the financial crisis and budget consolidation, hereby be stabilised on a path where it can support the desired research intensity with this ratio of private and public research financing.

2.3 Possible ways to achieve R&D objectives

Austria's federal government has set the RTI strategy goal of increasing the R&D intensity to 3.76% by 2020. In pursuit of this goal, the federal government has committed itself to the EU2020 strategy. In addition to the overall intensity target, the dynamism of private investments in R&D should be increased further "...to reach at least 66% research intensity or even, if possible, as the most successful international examples show, 70% by 2020" (p. 7). According to the strategy, investments in basic research "should be increased by 2020 to the level of leading research nations" (p. 21). The following section maps out different scenarios for attaining these strategic targets.

According to comprehensive estimates from Statistik Austria, a research intensity of 2.79% was attained in 2011. To sketch a path toward the achievement of these objectives, a constant annual rate of growth in the R&D intensity was assumed, which leads to attainment by 2020. In terms of the GDP growth rates, the following assumptions were made on the basis of forecasts by the Austrian Institute of Economic Research (WIFO):

For 2011 and 2012, an annual nominal GDP growth rate of 3.8% (Ederer 2011) for both years is assumed; for 2013 to 2014, a rate of 3.8 - 4%; and for 2015 to 2020, a rate of 4%, in line with long-term Austrian growth trends (see Gaggl and Janger 2009).[2]

Figure 4 shows that the R&D intensity target of 3.76% implies a very dynamic rate of growth. Absolute R&D spending would almost double in nominal terms from € 8.2 to 15.79 billion.

The trajectories of overall R&D expenditure, depending on how public and private sector participation develops, are very different:

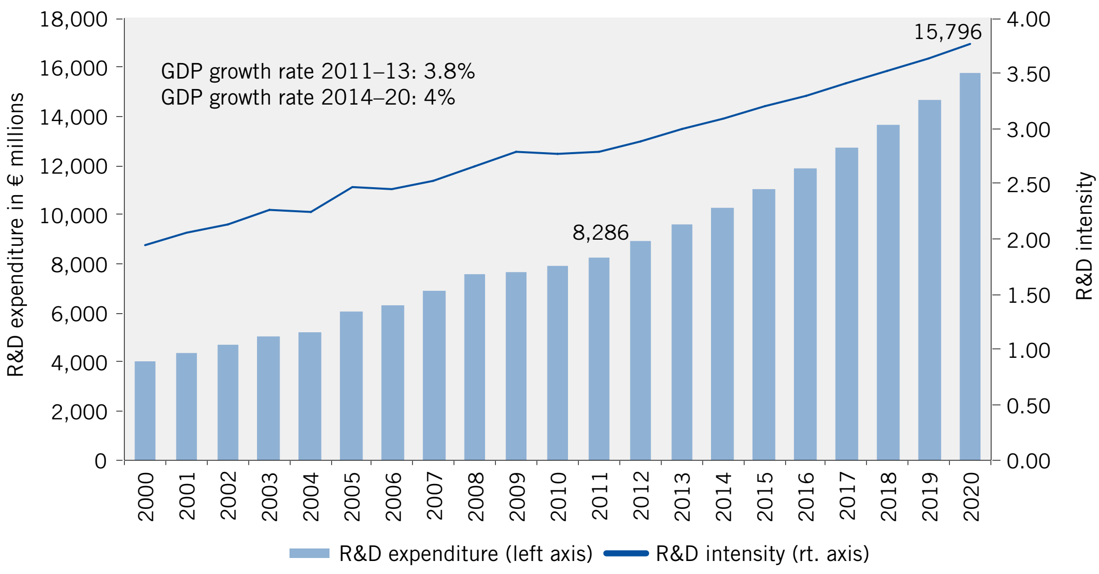
2 Calculations with a pessimistic (GDP growth of 3%) and an optimistic scenario (GDP growth of 5%) show a moderate margin of error for R&D expenditure of +/– 3%).

due to the financial crisis of 2008-2010, private R&D expenditure stagnated or even declined, while public spending increased. For 2011, Statistik Austria estimates that the public share of overall spending reached 39.17%.

Table 2 gives an overview of possible scenarios in spending development:

- Under the (uncertain) assumptions for GDP development in the coming years, total R&D expenditure would have to grow by an average annual rate of growth of 7.43% to reach the target intensity of 3.76% of GDP by 2020. This means a very dynamic development if one considers that in the last decade total R&D spending has already grown by an average of 6.78% per annum.
- If the public sector were to maintain its current share of financing for total R&D expenditure at 39.17%, then public expenditure, currently at € 3.24 billion, would have to rise to € 6.18 billion by 2020. Additional annual expenditure would amount on average to € 280 million by 2015. Additional annual expenditure would amount to an average of € 390 million from 2015 to 2020.
- Even with a hypothetical approach that returns to a 33% share of financing from the public sector, additional annual expenditures averaging € 200 million would be necessary by the middle of the decade.
- Private expenditure mirrors public expenditure; in order to maintain the current 60.83% share of private financing of overall R&D spending, the private sector would have to increase its R&D spending by an average of € 418 million each year until 2015. In 2020, the private sector would reach a spending volume of € 9.6 billion, which corresponds to an annual rate of growth of 7.43%.
- In a scenario in which the private sector increases its financing share to 66%, this would mean annual additional expenditures of an average of € 480 million in the coming years.

Figure 4: Gross domestic expenditure for R&D and R&D intensity, 2000–2020



Source: Statistik Austria, calculations by Joanneum Research

Table 2: Scenarios for R&D expenditure up to 2020

	Nominal GDP (in € millions)	R&D expenditure (in € millions)	R&D intensity	Funding from the public sector Constant share = 39.17%	Funding from the public sector Share by 2020 = 33%	Change in share of public sector	Funding from the private sector Constant share = 60.83%	Financing private sector Share by 2020 = 66%	Change in share of private sector
2011	296,870	8,286	2.79	3,246	3,246	39.17	5,040	5,040	60.83
2012	308,151	8,902	2.89	3,487	3,425	38.48	5,415	5,470	61.45
2013	319,861	9,564	2.99	3,746	3,614	37.79	5,817	5,937	62.08
2014	332,016	10,274	3.09	4,025	3,814	37.12	6,249	6,443	62.71
2015	345,296	11,038	3.20	4,324	4,025	36.46	6,714	6,993	63.36
2016	359,108	11,858	3.30	4,645	4,247	35.81	7,213	7,590	64.00
2017	373,472	12,739	3.41	4,991	4,481	35.18	7,749	8,237	64.66
2018	388,411	13,686	3.52	5,361	4,729	34.55	8,325	8,940	65.32
2019	403,948	14,703	3.64	5,760	4,990	33.94	8,943	9,703	65.99
2020	420,106	15,796	3.76	6,188	5,265	33.33	9,608	10,531	66.67
Growth 2011–2020	3.93	7.43		7.43	5.52		7.43	8.53	
For comparison:									
Growth 2000–2011	3.31	6.78		6.99			6.78		

Source: Statistik Austria, calculations by Joanneum Research

These calculations are based on constant rates of growth. If, due to budget consolidation measures, public sector expenditure would initially decline, then even higher spending would be required in later years. Depending on how the approach is managed, sums may become necessary that exceed the innovation system's ability to absorb them, because research personnel, and other determinants of the efficiency and effectiveness of expenditures, exhibit fundamentally sluggish behaviour. Furthermore, the leveraging effect of public spending on private expenditure must be taken into consideration, which of course takes some time to take effect. In event of major increases in the second half of the decade, the effect of private spending can already affect the period after 2020.

Figure 5 shows the adjustment path to basic research if a target value of 0.94% of GDP is to be reached by 2020.[3] From 2011 to 2020, basic research would have to almost triple in absolute numbers, from € 1.4 billion to € 3.9 billion. The share of basic research in total spending would climb from 17.5% to 25% by 2020.

3 0.94 % has changed to 1% of GDP, the Federal Ministry of Science and Research's original target for basic research, from 3.76% to 4%.

Table 3: Current trends in expenditure on basic research

	R&D expenditure (in € millions)	Basic research (in € millions)	Share of basic research (%)
2011	8,286	1,450	17.50
2012	8,902	1,621	18.21
2013	9,564	1,812	18.94
2014	10,274	2,025	19.71
2015	11,038	2,263	20.51
2016	11,858	2,530	21.34
2017	12,739	2,828	22.20
2018	13,686	3,161	23.09
2019	14,703	3,533	24.03
2020	15,796	3,949	25.00

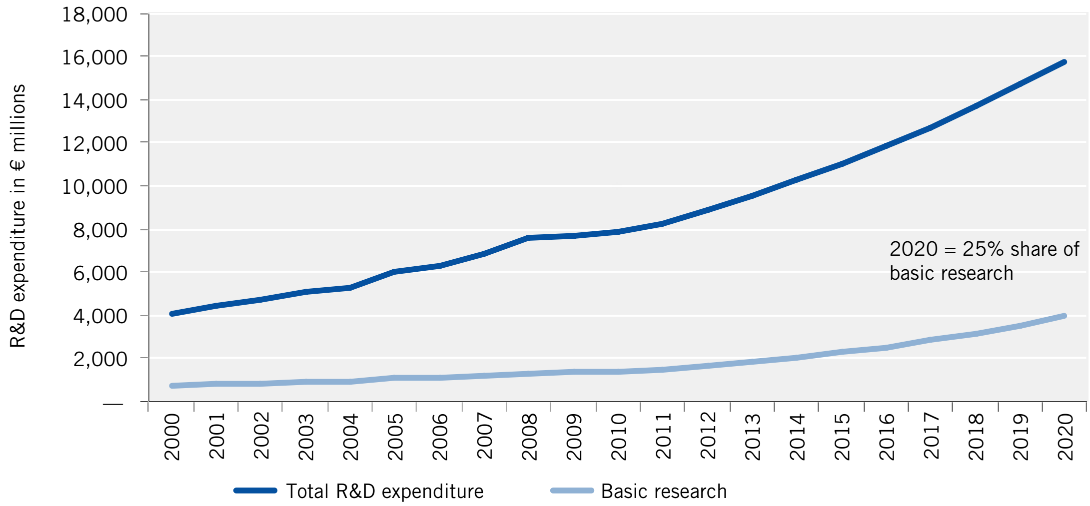
Source: Statistik Austria, calculations by Joanneum Research

Please note that the last full survey took place in 2007. The value for the share of basic research in total research spending was extended from 2007 to 2011. Basically, the difference in research spending by research type is blurry because the strict division of applied and basic research was not always absolutely clear. As is the case for public sector expenditure, the absorption capacity of institutions conducting basic research must be kept in mind.

2.3.1 Summary

The R&D intensity target is a highly ambitious and far-reaching goal. The adjustment path calls for more dynamic development than has been observed in the increases of the last decade. If the share of public sector financing fell to one-third by 2020, then additional annual expenditures averaging € 200 million would be required by the middle of the decade. The private sector would have to increase its spending significantly, to about € 480 million. These calculations are based on constant rates of growth. If growth is interrupted for longer periods of time, then annual increases would be required to make up for the shortfall. The ability of the sector performing the research to absorb this funding would have to be considered.

Figure 5: Spending on basic research relative to total R&D expenditure, 1998–2020



Source: Statistik Austria, calculations by Joanneum Research

2.4 Austria's position in the Innovation Union Scoreboard

The Innovation Union Scoreboard (IUS) is a system of indicators meant to portray innovation development within the EU, and enable comparisons between the EU and other markets (primarily the USA and Japan). It is a further development of the European Innovation Scoreboard (EIS), which was used up until one year ago.

2.4.1 The Innovation Union Scoreboard

Both the EIS and the IUS provide a (quantifiable) representation of performance based on specific indicators that have been fine-tuned over the years for the purpose of creating a realistic picture of innovation development.[4] Improvements in the data base and the constant development of the analytical methods (and, of course, the increasing length of the observation period) have made the countries more and more comparable, which in turn raises the significance of the IUS/EIS. Despite these improvements, however, we must keep in mind that an indicator-based depiction of an innovation system has its limitations, especially when the individual indicators used in the IUS/EIS are combined into a Summary Innovation Index (SII). This means we must be very cautious when interpreting this number because obviously not all determining factors and influencing variables can be measured using quantifiable indicators. However, considering these limits, the IUS/EIS has proved to be a suitable instrument for tracing developments and positioning them in specific contexts. See Schibany and Streicher for a comprehensive discussion of these aspects (2008).

In recent years, the IUS/EIS has been changed and improved; critique and discussion points concerning how to improve its methodology were incorporated in the development of a new set of indicators and new methods of analysis (see Hollanders and van Cruysen 2008), resulting in better data generation and thus better comparability. This meant the EIS 2008 was based on new indicators which increasingly took into account the non-technological aspects of innovation. Its database is now more stable, transparent and comprehensible. The trends in the EIS 2008 also became more meaningful, as they no longer reflected the EU average but rather the five-year averages of the absolute values.

For the 2010 reporting year, IUS/EIS was subjected to another substantial reform: the most striking of these is its new title, the Innovation Union Scoreboard (IUS). This is based on an even clearer structuring of the list of applied indicators: The 30 EIS indicators were reduced to 25[5], but they should allow research and innovation performance to be better presented. Eighteen of the old EIS indicators were also retained in the IUS (12 of them unchanged), and seven new indicators were added[6].

Table 4 shows the list of new indicators as well as a comparison with the EIS list of indicators[7] (i.e. whether the indicator in question is new, was included in a similar or identical definition, or whether it has been defined more broadly or more narrowly).

Because the indicators for the new IUS were calculated back to 2006, it is possible to com-

4 See the Austrian Research and Technology Report 2008 (p. 17ff.) for a comprehensive discussion of the EIS.
5 Although an indicator was not operationalised due to the lack of a definition.
6 For more details, see the documentation at http://www.proinno-europe.eu/metrics
7 Since the IUS homepage does not offer an "official" German version, the following indicator descriptions are provided in English.

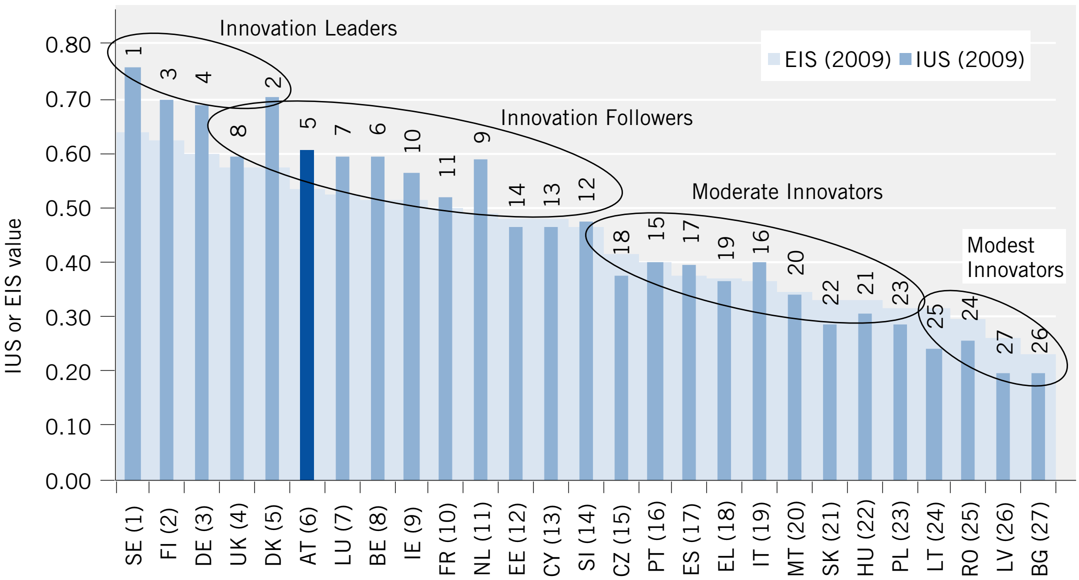
Table 4: IUS 2010 Indicators

ENABLERS	**Human resources**	
	New doctorate graduates (ISCED 6) per 1000 population aged 25–34	broader
	Percentage population aged 30–34 having completed tertiary education	narrower
	Percentage youth aged 20–24 having attained at least upper secondary level education	identical
	Open, excellent and attractive research systems	
	International scientific co-publications per million population	new
	Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country	new
	Non-EU doctorate students as % of total doctorate students of the country	new
	Finance and support	
	Public R&D expenditures as % of GDP	identical
	Venture capital (early stage, expansion and replacement) as % of GDP	identical
FIRM ACTIVITIES	**Firm investments**	
	Business R&D expenditures as % of GDP	identical
	Non-R&D innovation expenditures as % of turnover	identical
	Linkages & entrepreneurship	
	SMEs innovating in-house as % of SMEs	identical
	Innovative SMEs collaborating with others as % of SMEs	identical
	Public-private co-publications per million population	identical
	Intellectual Assets	
	PCT patents applications per billion GDP (in PPS€)	new
	PCT patent applications in societal challenges per billion GDP (in PPS€) (climate change mitigation; health)	new
	Community trademarks per billion GDP (in PPS€)	similar
	Community designs per billion GDP (in PPS€)	similar
OUTPUTS	**Innovators**	
	SMEs introducing product or process innovations as % of SMEs	identical
	SMEs introducing marketing or organisational innovations as % of SMEs	identical
	Economic effects	
	Employment in knowledge-intensive activities (manufacturing and services) as % of workforce	new
	Medium and high-tech product exports as % of total product exports	identical
	Knowledge-intensive services exports as % of total services exports	identical
	Sales of new to market and new to firm innovations as % of turnover	similar
	Licence and patent revenues from abroad as % of GDP	similar

Source: InnoMetrics; presentation by Joanneum Research pare with the EIS 2009. This reveals slight changes in the country rankings (Figure 6).

The correlation is high (98% for both values and rankings); changes in ranking are moderate and for the most part limited to shifts within the innovation groups. One exception

Figure 6: Comparison between countries for 2009 based on EIS and IUS



Source: InnoMetrics, calculations by Joanneum Research

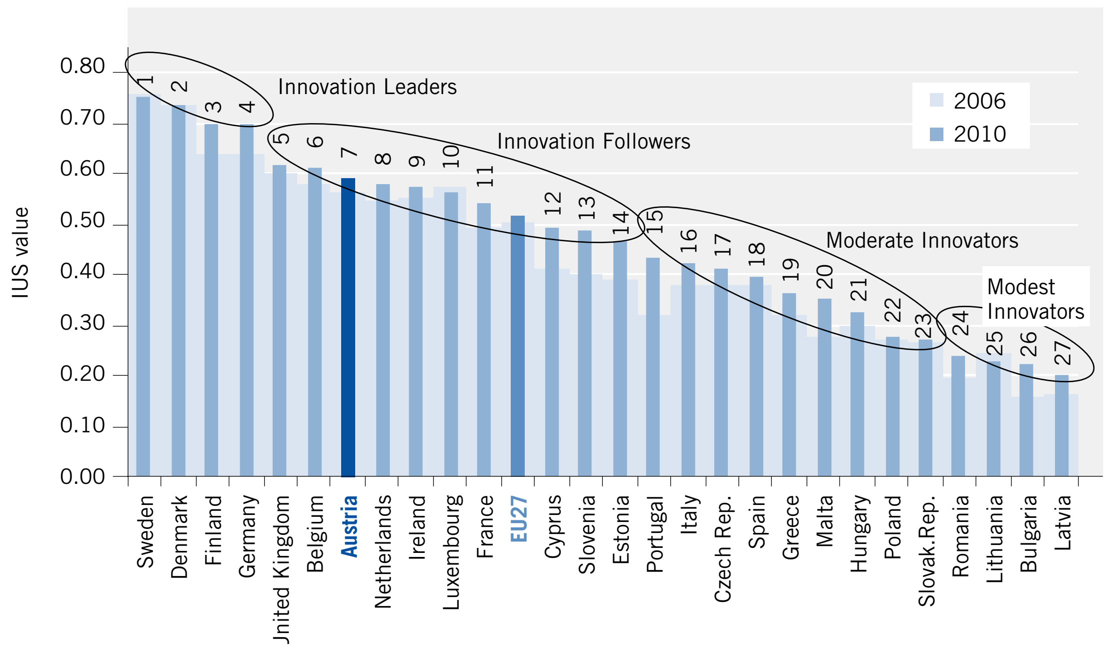
is the United Kingdom, which left the shrinking group of "Innovation Leaders" (now with four countries) and fell into the "Innovation Followers" group; another exception is the group of "Modest Innovators", which grew to four countries after Lithuania's drop. According to the new IUS definition, Austria would be in fifth place, after "only" having been in sixth place according to the then-valid EIS definitions. This difference, however, is ephemeral and provides further confirmation that a country's ranking must be interpreted with caution. In general, the differences between the rankings are often quite minor; for example, the IUS values for the countries ranked from 5 to 9 are in such a narrow range that they could practically be considered "identical" (although there are uncertainties in the individual indicators).

2.4.2 Austria in the IUS 2010

The basic order of EU Member States in the EIS has largely remained unchanged since the benchmark was introduced: the group comprising the "Innovation Leaders" includes four to five countries Sweden, Finland, Germany, Denmark and the UK (the latter of which is now an "Innovation Follower" in the new IUS). The group of "Innovation Followers" comprises ten countries that still exceeded (or were just under) the average of the 27 EU member states. In addition to the United Kingdom, this group includes Belgium, Austria, the Netherlands, Ireland, Luxembourg, France, Cypress, Slovenia (new to this group), and Estonia.

The group of "Moderate Innovators" includes Portugal, Italy, the Czech Republic, Spain, Greece, Malta, Hungary, Poland and the Slovakian Republic (positions 15–23); the group of "Modest Innovators" consists of Romania, Lithuania, Bulgaria and Latvia.

Figure 7: Comparison between countries based on IUS 2010 (2010 vs. 2006)



Source: InnoMetrics, calculations by Joanneum Research

As we have already mentioned, these groups are quite stable; changes in the relative positioning of the countries take place primarily inside the groups. In 2009, according to the old EIS definition, Austria was in sixth place (according to the new IUS definition, Austria would have come in fifth). The current seventh place is therefore, nominally speaking, a deterioration. Upon closer observation, however, caution is required when interpreting these positions (equally so to position changes): in the IUS values, the difference between 5th and 11th place is less than the difference between 4th and 5th place (i.e., the threshold between "Leaders" and "Followers"). The countries ranked from 5 to 11 could therefore really be defined as one group. The fact that Austria is in 7th place is relatively "incidental"; it could also be in 5th or 10th place. The "deterioration" from 6th to 7th place is therefore merely academic: Austria continues – as in practically every year since 2005 – to remain firmly anchored in the group of "Innovation Followers".

2.4.3 The individual indicators

At the level of individual indicators, the IUS now has a total of 24 indicators split into three groups:

- "Enablers" encompass human resources and financing, as well as the openness, excellence and attractiveness of the research system, and form the external basis for innovations in firms;
- "Corporate activities" primarily cover firm-specific activities that lead to innovations. These include investments, cooperations and intellectual property rights;
- "Outputs" comprise both the percentage of innovative firms and economic effects (employment, exports, turnover).

A look at the individual indicators (Figure 8[8]) reveals that Austria is only significantly (i.e., more than 10%) below the EU-27 average in six (one-quarter of) the individual indicators. In another six indicators, Austria is within a +/– 10% margin of the average. For 12 indicators, Austria has significantly above-average values.

The profile of Austria's strengths and weaknesses fits a familiar pattern: in the area of human resources, the indicators document a relatively low percentage of academics. Tertiary degrees – now more narrowly defined for 30-34-year-olds instead of for 25-64-year-olds remains far below the EU average (-27%) in Austria, while Austria's share of the population with at least an upper secondary school certificate is somewhat above average. In addition, as in previous years, the indicator of venture capital's relation to GDP (financing) shows significant weaknesses: the Austrian figure here was 75% below the EU average.

However, in the new area of "open, excellent and attractive research landscape", the indicator for international co-publications is significantly above average. The number of publications in the most-cited professional journals is higher than the EU-27 average. In contrast, the number of doctoral candidates from non-EU countries is almost 60% below average, although the high values for individual countries such as the United Kingdom, Switzerland and France pull the the EU average upwards. This indicator does not capture the very high share of Master and Bachelor students from other EU countries, especially from Germany.

Legal protections for intellectual property (patents and trademarks), as well as the innovator ratio among small- and medium-sized enterprises, are also strengths. Austria's position, however, is weaker when it comes to exports in high-tech services, turnover from innovative products[9], and license revenues from abroad.

2.4.4 Summary

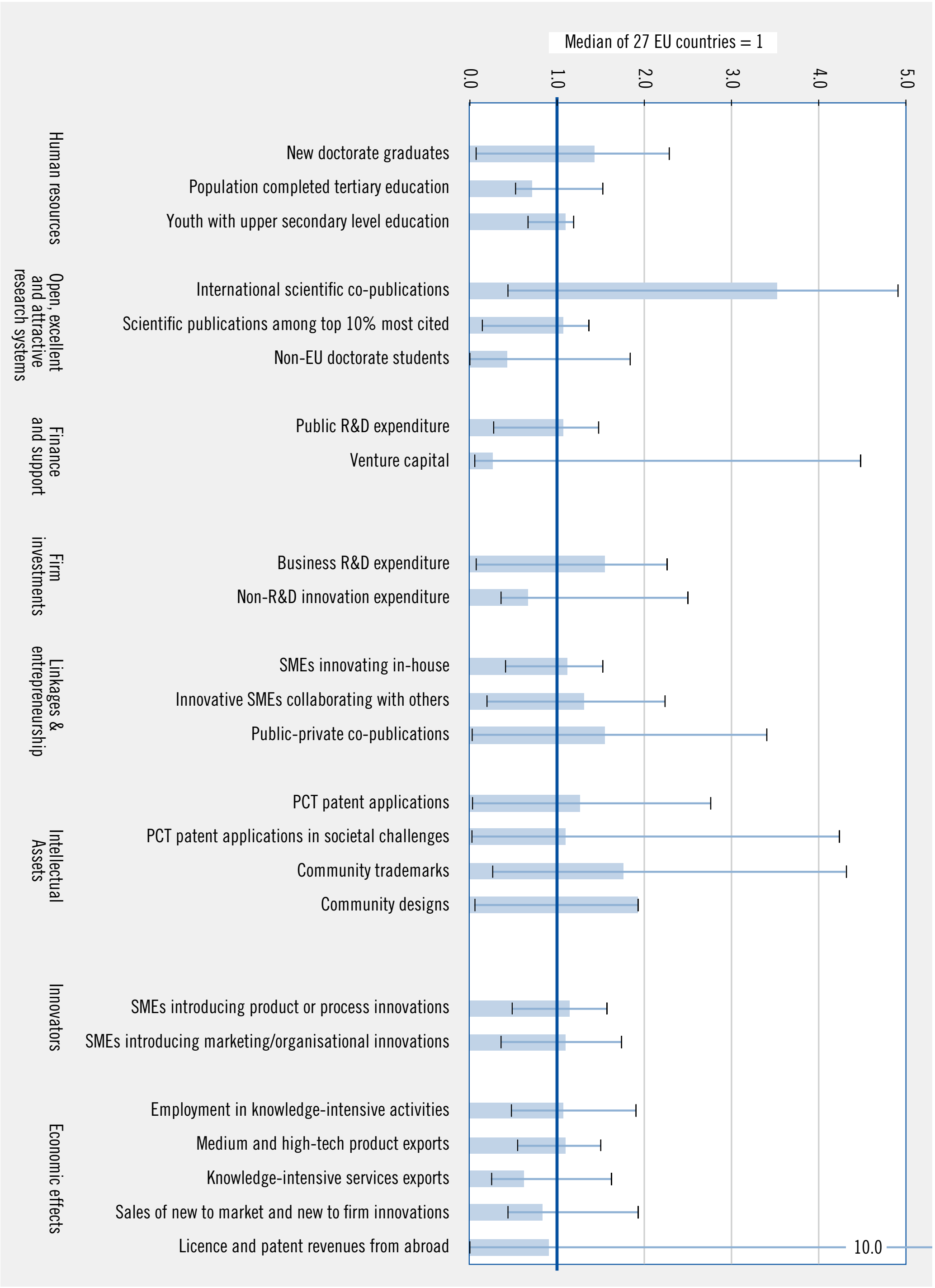
Between 2009 and 2010, the European Innovation Scoreboard (EIS) went through major changes: it now has 24 indicators and has been renamed the Innovation Union Scoreboard (IUS).

A comparison of country rankings according to old and new definitions shows (slight) differ-

8 In the figure below, the Austrian values are shown together with the minimums and maximums of the EU 27, each based on the average for the available EU 27.

9 This indicator, like the four indicators aimed at SME as well as the indicators for non-R&D innovation spending, are taken from the Community Innovation Survey (CIS); as survey results, these indicators are subject to certain statistical problems that contribute to slightly higher variability over time, as well as certain limitations on international comparability.

Figure 8: Detailed results of IUS 2010; Austria vs. minimum/maximum of the EU 27 (Index EU 27=1)
Source: InnoMetrics, calculations by Joanneum Research



ences in the exact positioning (in 2009, Austria held 5th place under the IUS definition and 6th under the EIS definition). The innovator groups have remained largely stable: There have hardly been any shifts among the groups of *Innovation Leaders*, *Innovation Followers* (to which Austria belongs), *Moderate* and *Modest Innovators*.

This suggests that the country rankings should be interpreted with caution: The scoreboard consists of many individual indicators that are summarised to a single number, the *Summary Innovation Index* (SII). Slight changes in individual indicators[10] can causeshifts in the exact rankings, above all within the country groups whose SII value is relatively close.

In the latest Innovation Union Scoreboard (IUS 2010), Austria is in 7th place, thereby firmly positioned in the (upper half of) the group of *Innovation Followers*. These groupings have been very stable for years, and movements within these (partial) groups, which happen with every annual comparison, should not be considered all too important in light of the above considerations: this applies, of course, not just to "deteriorations" but also to improvements. Austria holds a solid position within the *Innovation Followers* (in the upper half of this group, together with the United Kingdom, Belgium, the Netherlands, Ireland, Luxembourg and France, in places 5 to 11). However, the group still lags far behind the *Innovation Leaders* (Sweden, Denmark, Finland, Germany) – and, the difference in SII values between 5th and 11th place is less than the difference between 4th and 5th place, the threshold between *Leaders* and *Followers*.

The individual indicators confirm Austria's pattern of strengths and weaknesses, already familiar from the EIS: Weaknesses still exist in tertiary education, venture capital availability and knowledge-intensive service exports[11]. Strengths include scientific publications, R&D expenditure by firms, innovative SMEs, and intellectual property.

Furthermore, the IUS aims to capture structural aspects; accordingly, several indicators have a long-term perspective. Immediate reactions to changed policy measures, in the form of substantial short-term improvements in the IUS, are therefore not to be expected. Instead, the IUS (like other similar benchmark studies) aims to illuminate structural strengths and weaknesses in order to derive long-term prospects for the future.

2.5 The R&D intensity, reassessed

The recent discourse on research and technology policy in Austria was dominated by its R&D intensity. In the late 1990s, an increase in the intensity was cast as a quantitatively established target (then 2.5% by 2005) in official government statements. With the explicit objective of an EU-wide R&D intensity increase to 3%, a similar strategic objective was then established at the overall European level as a central target. The recent developments can be summarised as follows: While Austria exhibited impressive growth in its R&D intensity, development at both the European and OECD levels stagnated (Figure 9), so that Austria exceeded the EU-15 average already in 1998 and the OECD average in 2003.

10 And there are some for which the basis is not optimal, statistically speaking, i.e. those taken from the Community Innovation Survey (CIS).

11 The IUS does not show a "weakness" in pure high-tech exports because medium- to high-tech exports were included here, thereby incorporating Austria's relative strengths in the "medium-tech" industries of mechanical engineering, mechanical equipment and vehicle technology.

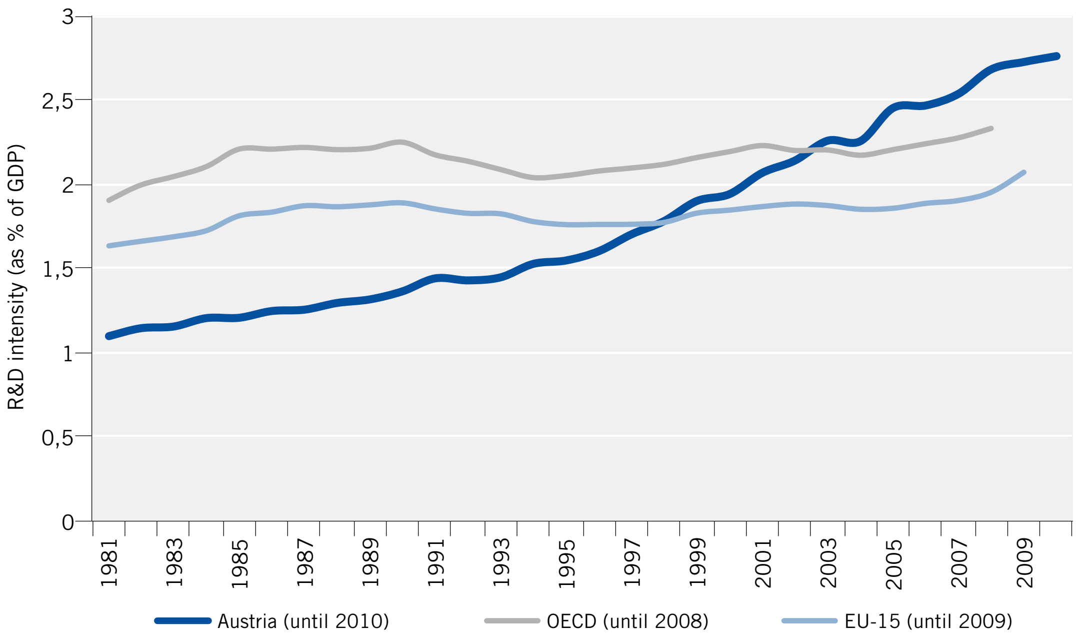
Even in the recession year of 2009, in the middle of the global financial and economic crisis, the R&D intensity increased even further – although at a significantly weaker pace – by 2.67 % (2008) to an estimated 2.79% (according to the revised global estimates from Statistik Austria) in 2011[12]. In the following, the dynamic development of the Austria R&D intensity will be examined in comparison with other countries and within the context of general economic growth (GDP per capita) within a country and its R&D intensity (see Gassler and Schibany 2010).

2.5.1 The long-term development of Austria's R&D intensity in international comparison

The point of departure is the observation by Figure 10 that there is a significant correlation between GDP per capita and a country's R&D intensity[13].

The development paths of national economics, as well as their R&D intensity levels, are very different; i.e., even countries with similar levels of GDP per capita, exhibit significant differences in their R&D intensity and their dynamics over time. This pronounced differ-

Figure 9: Development of R&D intensity in the last three decades



Source: OECD/MSTI, Statistik Austria, calculations by Joanneum Research

12 Please note, however, that the R&D intensity has climbed because of a major fall in GDP. The corporate sector and international sources of funds recorded a major decrease in R&D funding support, at –2.97% and –5.41% respectively. A situation also observed in other European countries (i.e., Germany and Denmark) where the leap in the R&D intensity between 2008 and 2009 was particularly high. Germany's R&D intensity increased from 2.68% in 2008 to 2.82% in 2009. At the same time, Germany suffered a 5% drop in its GDP (the denominator for calculating the intensity).

13 The correlation coefficient between GDP per capita and the R&D intensity amounted to 0.6 for the 38 selected countries during the period from 1995 to 2008.

entiation is exemplary for the countries shown in Figure 11, which displays the development of R&D intensity (Y-axis) against GDP per capita (X-axis) from 1995 to 2008. The steep growth curve for the Austrian R&D intensity is impressive. Starting from a position far below other countries of similar development level (in terms of GDP per capita), Austria was able to work its way up to a leading position in R&D intensity during the period under observation. Finland had a similar development (although the R&D intensity began growing rapidly at an earlier point in time, and therefore reached a plateau of 3.5% earlier as well), Denmark (R&D intensity growth has been interrupted since 2002), and South Korea (the Asian crisis of 1997 and 1998 led to a brief interruption here). China delivered a major surprise with its enormous dynamism, tripling its R&D intensity between 1995 and 2008. Even with its very low GDP per capita level, China now has a higher R&D intensity than Spain or Italy. In fact, both Spain and Italy are indicative of development dynamics specific to Southern Europe, which in the past decade enjoyed strong GDP growth without any remarkable R&D dynamism (despite enormous catching-up potential due to the low baseline levels of their R&D intensity).

The three largest countries in the EU – Germany, France and the United Kingdom – had divergent growth trends. France and the United Kingdom posted partially declining R&D intensity. Germany, however, was able to improve its R&D intensity, above all in the second half of the 1990s. As of 2000, however, the German R&D intensity has been stagnant. The degree to which the increase at the end of

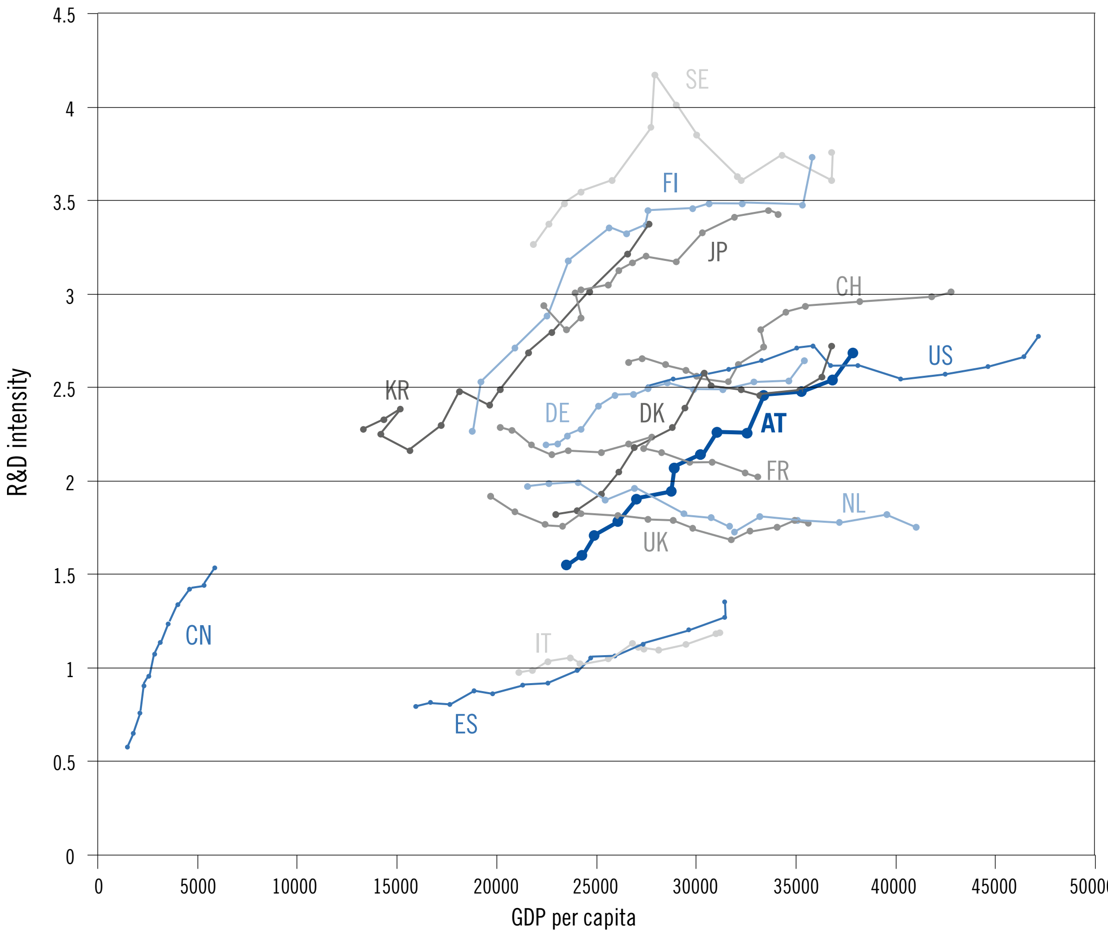
Figure 10: Correlation between GDP per capita* and the R&D rate (38 countries between 1995 and 2008)

* GDP per capita in purchasing power parity (PPP)
Source: OECD/MSTI; calculations by Joanneum Research

the observation period is sustainable remains to be seen[14]. In recent years, the USA posted a slightly climbing (and, for a short while, slightly falling) R&D intensity. The strong GDP per capita growth as of 2002, visible in Figure 3, is based more on the real estate bubble than on scientific and technological innovations.

A theoretical "benchmark R&D intensity", based on GDP per capita, is being calculated for Austria (as well as for a series of other selected countries) on the basis of the observed correlation between a country's GDP per capita and its R&D intensity[15]. We should keep in mind that the term "benchmark" does not

Figure 11: Development of GDP per capita and R&D intensity in selected countries (1995–2008)



Source: OECD/MSTI; calculations by Joanneum Research

14 For the sake of completeness, it should be mentioned that there are plausible arguments that the German R&D intensity is systematically underestimated. Experts assume in (very careful) estimates that Germany's actual R&D intensity could currently be just over 3%. The reason for this is the underrepresentation of R&D activities in the corporate sector.

15 To determine the benchmark R&D intensity (FB) of a country i, a simple regression formula for the years 1995 to 2008 is calculated on the basis of the correlation between GDP per capita (GDPcap) and the R&D intensity in a total of 38 countries: $F^B = const + \beta GDP_{cap}$

mean optimum here; instead, it refers to the R&D intensity that should correspond "on average" to a specific GDP per capita. Countries that have R&D intensity over their "benchmark" would then be said to have above-average performance. Finally, a country's actual R&D intensity can be compared with its benchmark R&D intensity over time, creating a new perspective on a country's R&D intensity development dynamics in international comparison. Due to the different levels of GDP per capita, different countries will also have different benchmark R&D intensity. We expect that "poor" countries will have a lower benchmark R&D intensity than "rich" countries.

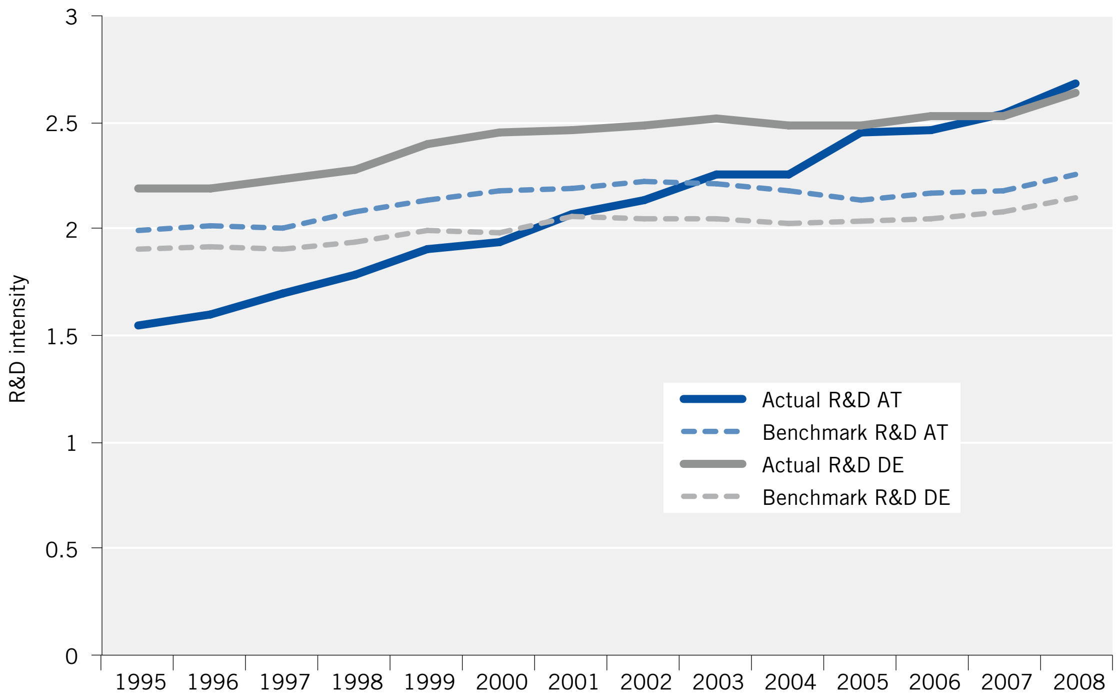
Each country is shaped by specific innovation systems in which certain patterns of specialisation and path dependency predominate. In brief, countries are idiosyncratic and a "naive" comparison that does not include unique country-specific features and development paths provides a distorted view. The economic development of European countries in recent decades supplies a wealth of examples of such country-specific topics: Finland's structural shift towards a research-intensive and high-tech-oriented export economy after the economic crisis of the early 1990s (which also was a direct result of the political and economic transformation of the Soviet Union); the catching-up process in Ireland in the 1990s (a result of the favourable local conditions as a European location for North American corporations); the structural crisis in Germany due to reunification and the subsequent abandonment of "Rhine capitalism"; the boom phase in Ireland, Spain and the United Kingdom after overcoming the New Economy crisis, which was then reversed by the speculative bubble in the real estate market, etc.

Due to these country-specific idiosyncrasies, we cannot expect that every country will meet its theoretical benchmark R&D intensity. A few countries have traditionally invested less in Frascati-relevant R&D, as their innovation potential may lie in other areas (such as design, fashion, services, etc.), while other countries may have particularly R&D-rich economic structures (such as a higher share of the IT sector or generally high significance of basic research-oriented industrial sectors), yet their actual R&D rate is above their benchmark R&D intensity. The thesis here is that each national innovation system has genuinely different research affinities. A direct comparison of observed R&D intensity between countries, however, hides these differences, while a comparison of a country's actual R&D intensity with its benchmark R&D intensity illuminates the innovation system's different research affinity (and its development over time).

Figure 12 illustrates the dynamics of the actual R&D intensity in Austria against the background of its benchmark R&D intensity, derived from GDP per capita. In addition, the corresponding development for Germany is depicted. Germany was chosen for comparison because Austria's industrial structures are similar (importance of medium-tech sectors) and Austria is highly interconnected with Germany (corporate property relations, export and import streams); at the same time, however, Germany, with its larger size, is less "susceptible" to outliers (in comparison, for example, to the comparatively small Scandinavian countries), thereby representing a "benchmark" sui generis. In addition, Germany has traditionally been one of Europe's leaders in science and technology.

Initially, the development of the benchmark R&D intensity is meant to be assessed in the Figure 12. On one hand, this depends on the level of GDP per capita in the affected country (i.e., countries with a higher GDP per capita are expected to have a higher benchmark R&D intensity, which is why the Austrian benchmark R&D intensity is slightly above Germany's); on the other hand, this also depends on a year-specific regression formula[16]. GDP per capita growth alone causes an increase in the anticipated benchmark R&D intensity. At the same time, the slope of the regression line decreases, i.e. the correlation between GDP per capita and R&D intensity becomes weaker[17], leading to an overall drop in the benchmark R&D intensity between 2002 and 2005. This situation is surprising, because typically it is assumed that the production of new knowledge (R&D) is supposed to assume increasing importance in a knowledge-based society. One explanation for this surprising trend (especially since 2000) is that many countries had strong GDP growth[18] that was not based on scientific or technological innovations[19]. A number of countries, for example, had extremely high rates of growth due to the real

Figure 12: The dynamism of the R&D intensity and the benchmark R&D intensity: Austria and Germany in comparison (1995–2008)



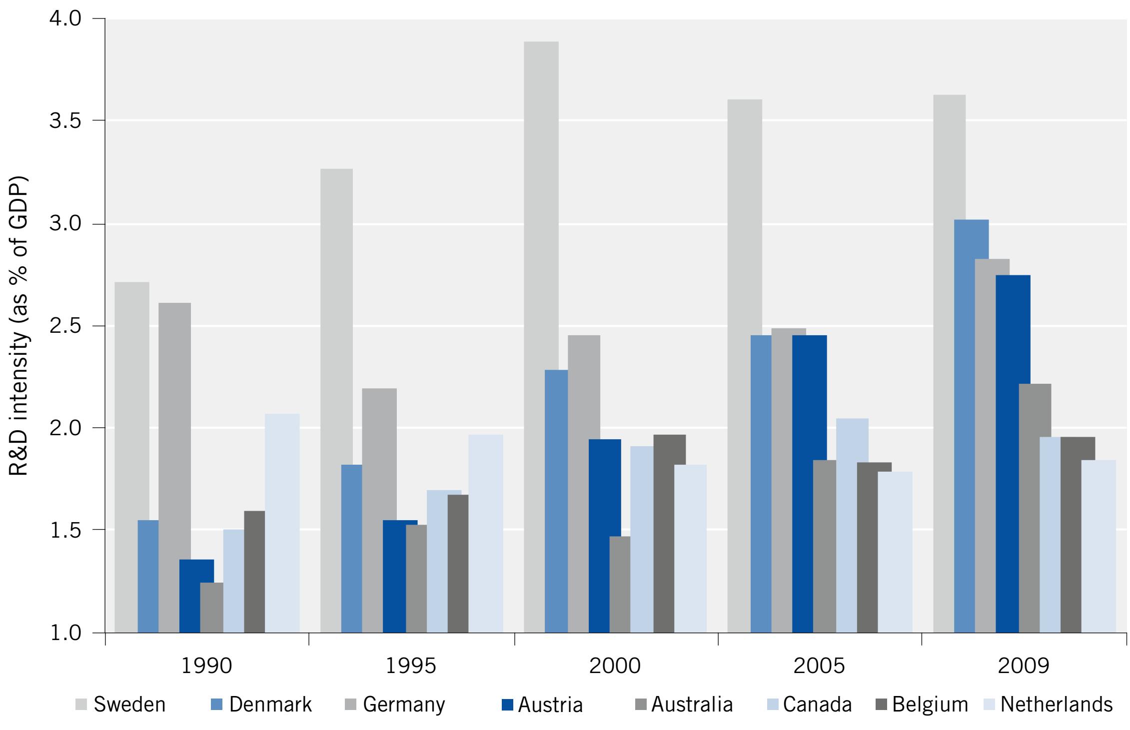
Source: OECD/MSTI; calculations by Joanneum Research

16 of year t $Ft_B = {}^{const}t + ß_t GDPcapt$
17 The correlation coefficient decreased from 0.70 in 1995 to 0.52 in 2008.
18 At the same time, the rapid increase in China's R&D intensity, accompanied by a comparatively low GDP per capita level, exhibits a tendency to lower the regression lines and reduce the correlation coefficient between GDP per capita and the R&D intensity.
19 For example, in the 1990s, a major driver of productivity in the USA was efficiency improvements in retail, caused not least by the expansion of Wal-Mart stores.

estate boom (Ireland and Spain are prime examples of this). Other countries (such as Norway) profited from a strong increase in commodity prices. This confirmed once more that R&D (and technological change in general) is an essential source of growth over the long term, but that short- and medium-term factors can influence the role of a growth driver.

If we assess Austria's development, we again see an impressive catching-up process. In the mid-1990s, Austria's R&D intensity was still far below the value expected because of GDP per capita. The actual R&D intensity was a mere 1.55%, while the benchmark intensity stood at 2%. Figure 13 shows the R&D intensity over time for those countries that had a level of GDP per capita similar to Austria's (countries were chosen that stayed within a margin of +/- 10% of Austria's GDP per capita). In the first half of the 1990s (1990 and 1995), Austria had an R&D intensity of just 1.36%, placing it just in front of last place among these countries (just in front of Australia). The top country, Sweden, came in at 2.71%, followed by Germany at 2.61% and the Netherlands at 2.1%. Since then, there have been noteworthy

Figure 13: The dynamism of the R&D intensity – comparison between countries (1990–2010)



The selection of countries is limited to those with a GDP per capita within +/– 10% of the Austrian level
Source: OECD/MSTI; calculations by Joanneum Research

shifts in terms of the R&D intensity and rankings within this group of countries. Sweden was able to expand its lead even further and is significantly ahead with 3.62% (2009). Denmark and Austria, however, delivered the biggest surprises. In the 1990s, both of these countries were at the bottom of the scale, yet they were able to increase their R&D intensity quickly. In 2009, Denmark came to 3.02% and Austria to 2.79%.

Austria obviously completed a radical system change during the period under observation. Formerly a research-extensive country (meaning a country whose innovation and growth processes are only driven to a small degree by R&D), Austria transformed itself into a research-intensive country between 1995 and 2008. In the meantime, in a continuously climbing trend since 2003, Austria's actual R&D intensity is higher than those that one would expect from Austria's GDP per capita levels. Austria is now a member of the exclusive club of countries whose innovation systems are based on a high level of R&D activities. This group also includes all of the Nordic countries, Switzerland, the Asian industrialised nations (Japan, South Korea, Taiwan), Germany and the USA.

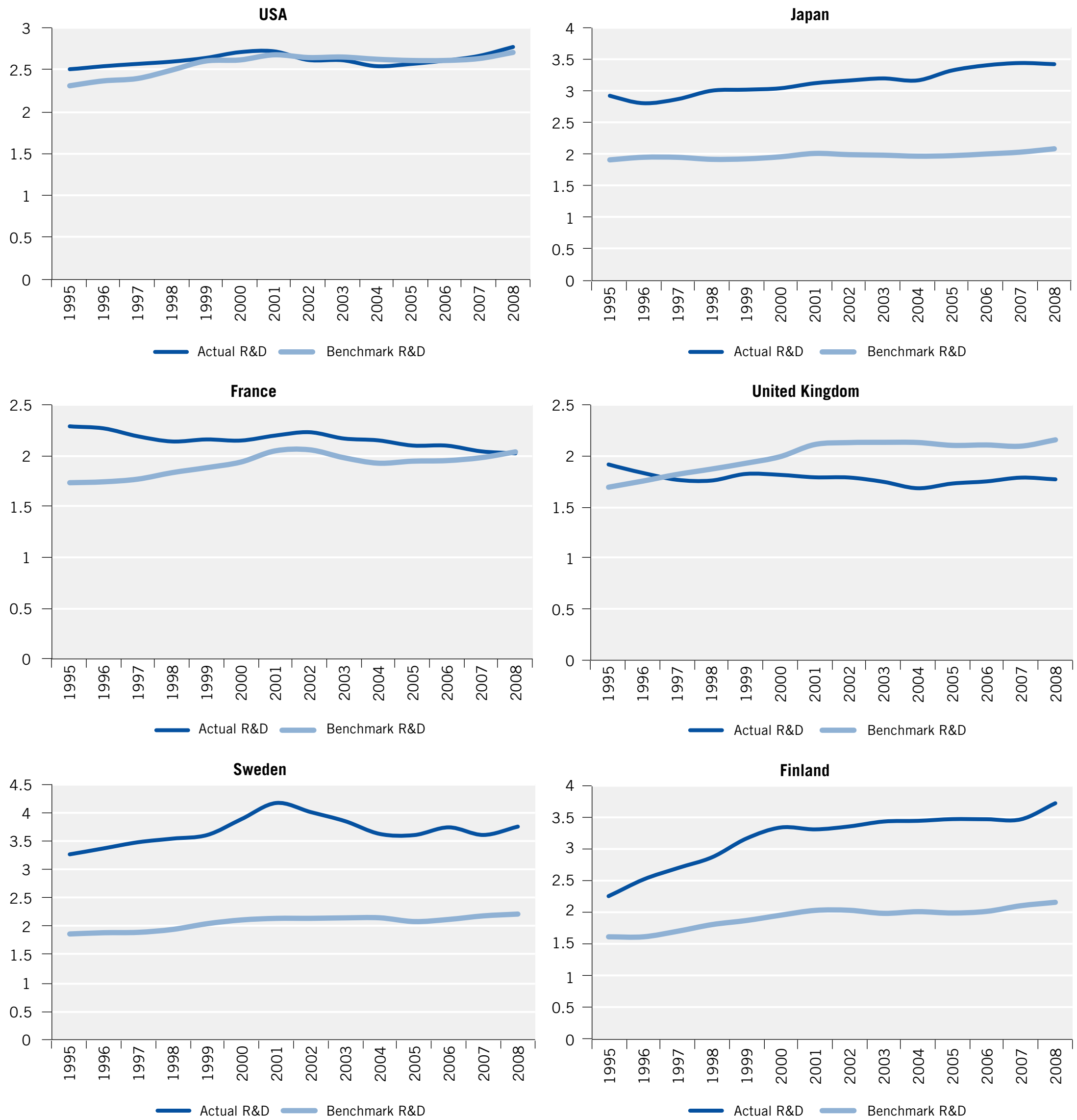
This result is impressive insofar as it implies a fundamental structural change, the extent of which will not become clear in the otherwise typical modes of observation (namely observation at the sector or industry level). This complements the diagnosis (Berger 2010) that Austria's positive RTI performance is attributable to a general improvement in all industries, not just to a shift to specific industries.

In conclusion, a graph of actual and benchmark R&D intensity for a series of countries is provided for purposes of comparison (Figure 14 and Figure 15). This comparison demonstrates that the innovation systems in countries with similar GDP per capita levels have very different R&D orientations. Countries whose R&D intensity is significantly above the theoretical benchmark R&D intensity are understood as specifically research-oriented, and vice versa. These R&D-intensive countries include Japan, Sweden, Finland, South Korea and Switzerland. In recent years, Denmark, like Austria, has developed a research-intensive innovation system. On the other side, there are countries whose observed R&D intensity are significantly below the expected levels. In addition to the Southern European countries of Italy and Spain, this group includes Ireland. The rapid GDP growth in Ireland (the "Celtic tiger") strongly increased its benchmark R&D intensity, especially in the 1990s, and the actual R&D intensity could not keep up the pace. The economic dynamics of Ireland – which was shaped primarily by foreign investment, especially from U.S. firms, and then driven by a real estate boom – was not accompanied by a focus on modernising the economy via R&D. The development of the second- and third-largest (after Germany) economies in the EU, namely France and the United Kingdom, is also remarkable.

2.5.2 Summary

In conclusion, Austria is one of the few EU countries to have achieved successful development towards the 3% target (R&D intensity). The empirical assessment of the development trend of recent years makes it clear, though, that a comparison of R&D intensity only has limited meaning. Development trajectories have been too different and heterogeneous since the mid-1990s; the composition of national economies and their innovation systems are too specific; industrial structures and models of specialisation vary too widely. Accordingly, despite the recognisably positive correlation between GDP per capita and the R&D intensity, even for highly developed national economies, there are very different paths. The interpretation of R&D intensity in international comparisons is therefore only meaningful if the underlying structures and innovation systems are taken into account. The strong growth of the Austrian R&D intensity therefore suggests a clearly recognisable change in the research orientation of its innovation system. In the mid-1990s, Austria's R&D intensity was still far below the values for other countries with similar GDP per capita. In the

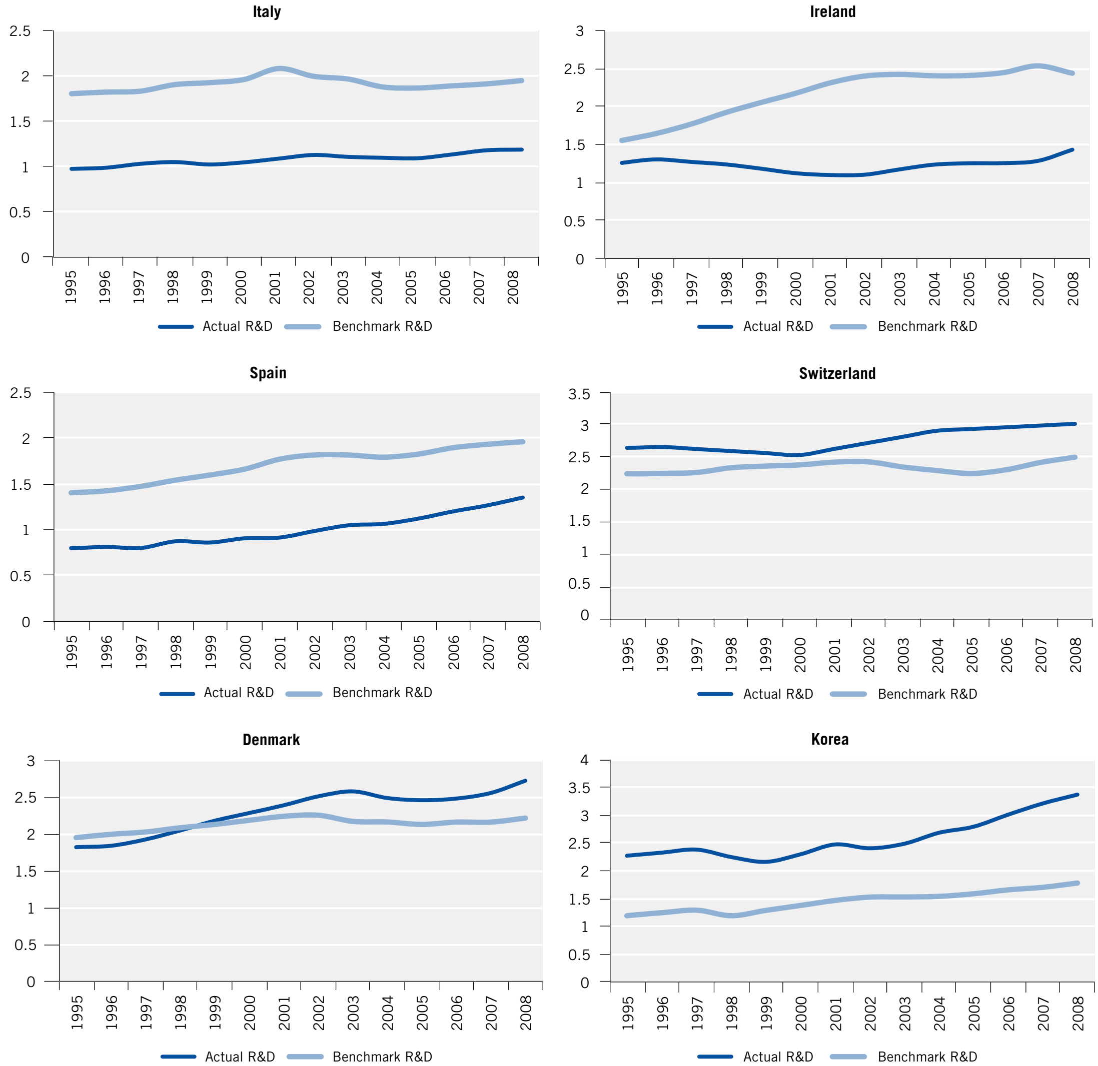
Figure 14: The dynamism of the current and benchmark R&D intensity – comparison between countries (1995–2008), part 1



Source: OECD/MSTI; calculations by Joanneum Research

meantime, Austria's R&D intensity is not just above the average values of the EU and the OECD; it is also above the level that would be expected due to the global correlation between GDP per capita and R&D. This development suggests that the Austrian innovation system is now driven sui generis by research. In a nutshell, the technological catching-up process of the 1980s and 1990s can now be considered complete.

Figure 15: The dynamism of the current and benchmark R&D intensity – comparison between countries (1995–2008), part 2



Source: OECD/MSTI; calculations by Joanneum Research

2.6 Funding R&D – FFG and FWF

2.6.1 The Austrian Research Promotion Agency (FFG)

The founding of the Austrian Research Promotion Agency (FFG) on 1 September 2004 created the most important national funding centre for applied research in Austria.[20] As a "one-stop-shop" with a broad and targeted programme portfolio, the Agency offers domestic firms and research institutes access to unbureaucratic and rapid funding for research projects.

Total funding volume (including liability) in 2010 was just over € 554 million, which corresponds to a cash value of € 431 million. Currently, the Austrian Research Promotion Agency's portfolio encompasses over 40 programmes and more than 100 programme lines. This diversity and differentiation, which has grown out of the single programme logic, increasingly shows the limits of tax incentives and above all the limits of a universal portfolio management. From the perspective of funding recipients, the situation has become so differentiated that it is difficult to have an overview. Against this background, the Austrian Research Promotion Agency has restructured the management of its instrument portfolio. The objective of the new concept is to establish an efficient and clearly structured portfolio of instruments with which research- and innovation-related policies can be addressed in terms of topics and structures. This new concept does away with defining funding instruments at the individual programme level. Instead, topics access a uniform, standardised set of Austrian Research Promotion Agency instruments. This ensures that the same rules apply (evaluation procedures, funding conditions) across all topics. Furthermore, a centrally managed announcement calendar is an essential element in this concept, ensuring funding recipients an opportunity to plan and orient themselves better. The first implementation steps for the restructured portfolio are planned for 2011.

A funding volume of € 554 million was able to subsidise € 1.1 billion in research projects. 3,084 participants were involved in the 2,950 projects that received funding. On average, each project involved 1.8 people.

An assessment by funding topics shows that, in addition to the grants of the bottom-up type that are so important for small- and medium-sized enterprises (which account for 50% of overall funding volume), a significant portion of 22% (€ 123.4 million) flows into cooperative ventures between science and business. The COMET programme (including the previous programmes, K-ind and Kplus) has the greatest share at € 85 million.

An analysis at the level of organisation type mirrors the development of research topics within Austrian RTI policy, i.e. the funding of cooperative agreements between science and business, which has also led to an increased diversity of the participants in the Austrian Research Promotion Agency (FFG). The strong presence of non-business research organisations in the structural and in the general programmes (such as BRIDGE) has increased the percentage of research institutions and universities that receive funds to 42%.

The percentage of firms in participations also sank from 79% in the year the Research Promotion Agency was founded to 55% (3,072 participations) in 2010. This corresponds to a cash value share of 55.2% in funding volumes.

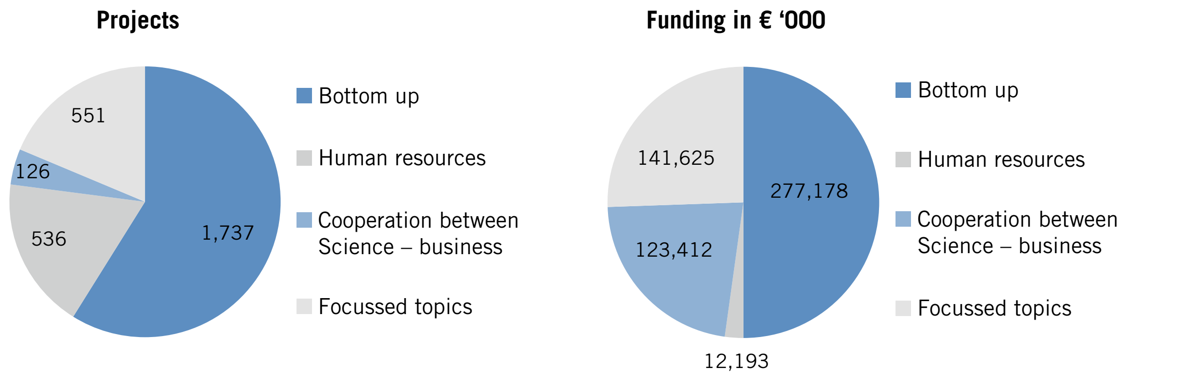
20 See also: http://www.ffg.at/

Table 5: Austrian Research Promotion Agency (FFG) funding at a glance [2010]

		Projects	Players	Participations	Total costs [in 1,000 €]	Funding incl. Liability [in 1,000 €]	Cash value [in 1,000 €]
BP	Open-topic funding	630	509	652	408,123	226,448	108,162
	Service innovations	31	33	33	9,916	5,271	4,452
	Headquarters	37	35	39	86,545	27,193	27,193
	High-tech start-up	29	29	29	16,616	11,601	7,631
	BRIDGE	60	129	147	19,639	11,841	11,841
	EUROSTARS	7	9	9	3,035	1,478	1,478
	Innovation voucher	761	1054	1522	3,810	3,810	3,810
	Total	1,555	1,798	2,431	547,684	287,642	164,567
EIP		242	143	242	1,830	1,376	1,376
SP	AplusB	2	2	2	8,307	2,781	2,781
	brainpower austria	4	1	4	300	300	300
	COIN	41	111	127	34,210	22,730	22,730
	COMET	22	591	650	264,548	84,885	84,885
	FEMtech	19	45	48	3,983	2,453	2,453
	Gender Award	8	36	38	85	85	85
	General innovation internships	499	355	499	3,024	1,860	1,860
	SELP	1	1	1	1,879	855	855
	wfFORTE	6	25	25	11,365	6,637	6,637
	Total	602	1,167	1,394	327,702	122,584	122,584
TP	Alpine Schutzhütten	2	2	2	530	297	297
	AT:net	48	57	59	16,601	5,596	5,596
	benefit	36	64	74	9,833	6,413	6,413
	ENERGIE DER ZUKUNFT	52	86	136	12,025	7,254	7,254
	FIT-IT	65	90	117	41,182	18,096	18,096
	GEN-AU	26	34	53	1,304	1,304	1,304
	IEA	25	19	35	1,692	1,669	1,669
	IV2Splus	101	213	354	31,424	20,395	20,395
	KIRAS	29	99	137	16,698	11,499	11,499
	Beacons for eMobility	1	15	15	19,933	8,490	8,490
	NANO	5	10	11	2,488	1,796	1,796
	NAWI	1	3	3	92	52	52
	Neue Energien 2020	120	250	372	75,764	42,168	42,168
	TAKE OFF	15	45	51	16,849	8,979	8,979
	Total	526	987	1,419	246,414	134,007	134,007
ALR	ASAP	25	40	59	8,070	6,193	6,193
Commissions						2,605	2,605
FFG – Total		**2,950**	**3,048**	**5,545**	**1,131,699**	**554,408**	**431,332**

BP=general programmes; EIP=European and international programmes; SP=structure programmes; TP=technology programmes; ALR=Agency for Aerospace and Aeronautics
Source: FFG

Figure 16: Funding foci of the Austrian Research Promotion Agency (FFG) [2010]



Source: FFG

Table 6: Austrian Research Promotion Agency (FFG) funding by organisational type [2010] [in € 1,000]

	Participa-tions	Total funding	Cash value	Cash value share
Firms	3,072	357,295	236,450	*55.2%*
Research institutions	872	118,241	116,216	*27.1%*
Universities	1,330	63,641	63,641	*14.8%*
Intermediaries	58	5,596	5,431	*1.3%*
Other	213	7,030	6,988	*1.6%*
Total result	5,545	551,803	428,727	*100.0%*

Source: Austrian Research Promotion Agency (FFG)

Within the corporate sector, small- and medium-sized enterprises (SMEs) are an important target group for government R&D funding. Without federal funding measures, the market may fail to finance research projects, thus inhibiting the growth of the research basis (in the sense of new firms that start up R&D activities). SME market entry in research and innovation must be made easier. The Austrian Research Promotion Agency (FFG) therefore offers sufficient funding opportunities that have led to more than 1,600 SMEs participating in projects receiving FFG support amounting to € 131 million in 2010.

2.6.2 The Austrian Science Fund (FWF)

The Austrian Science Fund (FWF - Fonds zur Förderung der wissenschaftlichen Forschung)[21] is Austria's central institution for the promotion of basic research. Basic research is a "building block" of the innovation system, and in highly developed countries it forms an important foundation for future growth.

In Austria, the Science Fund supports the further development of the sciences at a high international level, thereby contributing to cultural development, to building a knowledge-based society, and to increasing Austria's value and prosperity.

The goals of the Austrian Science Fund are:

- Strengthen Austria's scientific performance in international comparison and its attractiveness as a place to do research, above all by funding top research by individuals and teams, as well as contributing to the improvement of competitiveness of research institutions and Austria's science system.

21 See also:http://www.fwf.ac.at/

- Qualitative and quantitative expansion of research potential according to the principle of "educate by research".
- Strengthened communication and enhancement of the mutual effects between science and all other areas of cultural, economic and social life; systematic publicity work should reinforce acceptance of science.

In 2010, the Austrian Science Fund funded € 171.8 million in basic research. Total funding volumes covered a variety of funding venues, although the Austrian Science Fund focusses primarily on stand-alone projects. At € 83 million, approved stand-alone projects accounted for nearly 50% of total funding volume, offering scientists maximum flexibility in designing their research projects: there are no formal limits to project size or the number of projects that can be conducted simultaneously. Furthermore, national and international cooperative ventures can also be supported in the context of stand-alone projects. Of the 995 stand-alone project applications, 310 were approved, which is an acceptance rate of 31%.

Table 7: The Austrian Science Fund (FWF) funding at a glance [2010]

Funding programme	Appli-cations	New approvals	subsidy applications	approved applications
	Number	Number	Total in € million	Total in € million
Stand-alone projects	995	310	278.9	83.0
SRA*	50	39	19.6	15.0
SRA extension	31	7	9.9	3.8
NRN*	18	10	7.3	4.3
NRN extension	7	0	2.5	0.0
International programmes	229	92	48.6	14.9
DC-plus*	6	5	12.3	8.2
DC-plus extension	7	5	14.9	8.9
Schrödinger	129	56	11.7	5.6
Meitner	76	29	8.7	3.9
Translational research	166	31	53.7	8.4
Translational Brainpower	13	3	4.6	1.1
Richter	40	15	11.2	4.5
PEEK	48	7	12.2	1.7
Publication funding	105	62	1.1	0.7
START	45	6	46.6	3.6
START extension	0	0	0.0	0.0
Wittgenstein	22	1	33.0	1.5
Firnberg	50	13	10.1	2.7
Total	2037	691	587.0	171.8

* two-stage process; the figures shown here correspond to sub-projects of complete applications (2nd stage)
Publication funding: independent publications, translation costs, refereed publications
International programmes: International programmes, procurement of international cooperation, etc.

Source: FWF

The special research areas (SRAs) and national research networks (NRNs) are large research projects from all scientific disciplines in which several research groups work together on research projects that are interdisciplinary, complex, and conducted over the medium term. Although both programmes were originally designed with different objectives, we have seen a certain convergence in the development of the two programmes in recent years. Both programmes pursue similar objectives:

- Building research networks with high international visibility;
- Working on expensive, complex research projects with a medium-term (6-12 years) time horizon;
- Pursuing interdisciplinary research approaches with a clear strategic impact;
- Concentration and coordination of personnel and material resources;
- Educating the next generation of scientists in a high-quality scientific environment;
- Increasing the attractiveness of scientific research for the best scientists.

Due to these similarities, and in the context of streamlining the programme portfolio, the Austrian Science Fund decided to combine both programmes, which in future will be a single programme for financing excellence networks in the SRA pattern.

Human resources are an important foundation for the success of all types of research. Educating next-generation scientists, especially doctoral students, is becoming increasingly important. In 2010, the Austrian Science Fund financed 976 post-docs and a total of 1,683 doctoral candidates. If we include the stipend programmes (such as the Schrödinger, Meitner, Firnberg, and Richter programmes) and affiliated personnel, then the Austrian Science Fund provided funding for 3,405 people.

Table 8: Research personnel funded by the Austrian Science Fund [2010]

	Post-docs	Doctoral candidates	Total*
2010	976	1683	3405
2009	951	1619	3314
2008	830	1526	3033

*) including the Schrödinger, Meitner, Firnberg and Richter programmes, and other research personnel
Source: FWF

The Austrian Science Fund offers a "level playing field" for all scientists and researchers, meaning that its funding criteria are solely related to the scientific quality of the funding applications and their treatment is independent of any predetermined distribution key. This kind of competitive research financing represents an important prerequisite for the genesis of new research areas and is a signal for Austria's attractiveness as a place to do research. However, an international comparison shows that this type of (competitive) funding of basic research receives noticeably higher funds than in other countries than in Austria. For example, in countries like Denmark, the Netherlands and Switzerland, the share of third-party funding in university financing is higher than Austria's. The following Table 9 shows that, in countries with high scientific achievement, the funding organisations that disburse funds for basic research on a competitive basis have much higher endowments than the Austrian Science Fund.

Table 9: Funding volumes in funding organisations [2009]

Funding organisation	Budget in € million	Expenditure per capita in €
FWF	145.2	17.5
SNF (Switzerland)	410.7	54.1
AKA (Finland)	309	58.2
NWO (Netherlands)	550	33.3
RCUK (United Kingdom)	1,815	30
DFG (Germany)	2,200	26.8

Source: FWF

Basic research focusses on the long term, is burdened with high risk (uncertainty) that affects output, is guided by self-established quality and excellence criteria, and cannot seriously estimated its economic outcome ex ante. At the same time, cross-cutting technologies are inconceivable without basic research. Scientific foundations are therefore indispensable for technological developments, and they mean new ideas and technological opportunities for firms. The expansion of knowledge reserves, the development of new scientific findings and well-educated research personnel (i.e., human capital) are therefore key features of highly developed economies.

3 Austria and Europe 2020

Introduction

At the beginning of 2010, the European Commission (2010a) presented the new growth and employment strategy Europe 2020, which was approved on 17 June 2010 by the European Council. Because this strategy will profoundly shape RTI policy discussions over the next ten years, this chapter examines the content, implementation processes and potential effects on Austria. The EU2020 Strategy builds upon the Lisbon Strategy, which was agreed on in 2000 by the heads of the European governments and guided the European Union's strategic direction until 2010.

The basic ways in which economic policy functions, including RTI policy, is laid out contractually in the European Union.[22] In RTI policy, as well as in other policy areas relevant to reaching its goals, such as education and employment policy, the European level has relatively low competencies in comparison to the member countries. Policy areas that fall exclusively under the purview of the European Union, such as domestic market strategy, would not be in a position to pass the reforms necessary for attaining these goals. Due to close economic interrelationships, however, strategies at the national level run the danger of not being able to sufficiently take into consideration the potential reciprocal effects between policy measures in member countries. Coordination processes therefore play a special role in areas for which the member countries are responsible (such as general and professional education), and in areas of shared responsibility between the Union and the member countries (such as research, technological development, environment and energy). In these areas, then, the Union cannot issue binding legal acts, however member countries are obligated to coordinate their activities.[23] The Lisbon Agenda already created a new form of coordination, one that EU2020 has further refined: the open method of coordination.

The EU2020 Strategy and the Lisbon Agenda should be understood as politico-economic reform strategies that explicitly strive for improvements in performance (measured in terms of predefined performance indicators) while implicitly attempting to accelerate reforms at the national and European levels. Due to the lack of appropriate jurisdictions, these reforms could not be crafted directly at the European level; instead, they were referred to independent national commissions within the broader context of the European Union. Europe 2020 attempts to answer the question of how it is possible to increase contributions at the European level to the quantity and quality of reforms if reform competence lies overwhelmingly with the member countries.

22 In the "Treaty on the European Union" (TEU) and in the "Treaty on the Functioning of the European Union" (TFEU). The Lisbon Treaty's coming into force on 1 December 2009 did not bring any changes in these areas. The treaties establish the jurisdictions and responsibilities of the Union and the member countries in the individual policy fields (Articles 2-6 TFEU).

23 Article 5 TFEU declares that the member countries coordinate their economic and employment policies within the Union. The coordination of economic policy in the context of the Europe 2020 Strategy is based generally on Articles 121 and 148 TFEU.

The approach for Europe 2020: economic policy coordination

The attainment of shared goals (as defined in the Lisbon Strategy and the EU2020 Strategy) is predicated on measures enacted by member countries in areas in which the European Union has little or no legal powers. Instead of binding legal acts, coordination processes were developed in the context of the Lisbon Agenda under the term "open method of coordination" (OMC) (Hodson and Maher 2001, Pollak and Slominski 2006). The following procedural elements are also being implemented in Europe 2020:

- Setting shared, quantitative and qualitative goals;
- Developing guidelines for measures to reach these goals;
- Defining indicators and *benchmarks* and creating reports in the Commission (innovation scoreboard, mobility scoreboard, etc.) to compare national progress;
- Reports on reform plans and implementation of reforms at the national level, to be sent to the Commission and/or the other member countries
- Discussion and evaluation of these reports and the progress of member countries (multilateral monitoring and reform assessment), delivery of country-specific recommendations;
- Exchanging or promoting the diffusion of *best practices;*
- *Peer pressure* in the (European) Council, i.e. documenting progress in reforms and progress should motivate heads of government and ministers to adopt measures.

Every potential effect of the open method of coordination on national policy formation therefore depends on political will at the national level to implement measures to reach these goals. Such coordination processes offer the advantage of not having to transfer legal powers to the European level. Studies on the reform effects of the open method of coordination (Heidenreich and Zeitlin 2009, Hemerijck and Visser 2001) demonstrated that the OMC reform incentives essentially work via framing policy initiatives in a consensual way among the participants involved in the coordination process (ministries, social partners, etc.). The effect of multilateral monitoring and/or integrated guidelines is manifested primarily in a strengthening of national reform forces. The OMC is therefore more successful in encouraging reforms than, for example, OECD- or IMF-style reforms, in the sense of preparing reform recommendations without involving the affected countries. Coordination processes can lead to reforms by involving the national level in the formulation of these reforms. In this way, they signal an expansion of classical EU integration methods of competence transfer to the European level to include "integration via coordination".

Despite the potential positive effects attributed to the OMC, the available evidence also shows overall that the overwhelming portion of member countries used the OMC during the Lisbon Agenda more as a reporting instrument and less as a policy formation instrument (European Commission 2010i).

The following factors were successful for the OMC, and have contributed positively to reforms and gone through further development in the course of the EU2020 Strategy, (see European Commission 2010i, Janger 2006 for Austria):

- Definition of clear and measurable goals at the national level;
- Definition of national priorities when implementing guidelines;
- A uniform methodological approach to reforming reform evaluation and monitoring to increase the credibility and traceability of country-specific recommendations;

- Public awareness of the Lisbon Agenda (often correlates with attitudes towards the EU);
- Precise description of measures.

The Europe 2020 process makes strong improvements on the Lisbon Agenda, above all in terms of the first three elements. Thanks to the efforts of the working group of the Economic Policy Commission (EPC) for the Lisbon method, a methodological approach to reform evaluation is available for several policy areas, including tertiary education and innovation policy. The last three elements are primarily country-specific in nature. We can therefore assume that the significance of the European level will increase for national policy formation in the Europe 2020 process vis-a-vis the Lisbon Agenda.

3.1 Europe 2020: The new European growth strategy

3.1.1 Cornerstones

Europe 2020 was developed and announced against the backdrop of the massive economic and financial crisis of the years 2008 to 2010. The crisis revealed several of Europe's structural problems and illuminated the need for corresponding reforms, such as economic imbalances between "surplus" and "deficit" countries. The European Commission's proclamations on the urgency of reform have increased accordingly. At the same time, the design of a strategy for the future and the setting of ambitious goals pose a dilemma for the member countries of the European Union because they include obligations for public budgets, which in times of crisis are impacted by rapidly climbing debt and the concomitant need for consolidation. This applies particularly to RTI policy, which in the next ten years will be shaped, both in terms of content and procedure (comprehensive coordination), by the European growth strategy.

This section describes the content-related cornerstones and implementation process of EU2020. The strategy's cornerstones are comprised of three priorities, five targets and seven guideline initiatives (see Figure 17).[24]

Priorities

The content-related cornerstones of the new strategy consist of three priorities:
- Intelligent growth – an economy based on knowledge and innovation;
- Sustainable growth – promotion of an economy that uses its resources efficiently, is more environmentally friendly, and able to compete;
- Integrative growth – an economy with high employment and economic, social and territorial cohesion.

24 All documents can be downloaded at ec.europa.eu/europe2020/index_en.htm.

Figure 17: Components of the Europe 2020 Strategy

Smart Growth	Sustainable Growth	Integrative Growth	Crisis management
Core target: • 3% R&D intensity • 40% University graduates	**Core target:** • 20% energy efficiency • 20% greenhouse gas emissions • 20% renewable energies	**Core target:** • 75% employment rate • 10% early school leavers • -25% at risk of poverty	
Guideline initiatives: • Innovation union • Youth in motion • Digital Agenda	**Guideline initiatives:** • Resource-conserving Europe: Europe • Industrial policy in the age of globalisation	**Guideline initiatives:** • New competences and new employment opportunities • European platform for fighting poverty	
Guidelines: • GL4 R&D and innovation promotion • GL9 education systems	**Guidelines:** • GL5 resource efficiency • GL6 modernisation industrial basis	**Guidelines:** • GL7 employment • GL8 education and labour market • GL10 poverty	**Guidelines:** • GL1 public finances • GL2 Macroeconomic imbalances • GL 3 Imbalances

Source: Adapted from European Commission 2010a.

Because of the crisis, these three priorities were expanded to include one more priority, namely direct crisis management. The objectives of this fourth priority are:

- Reform of the financial system to re-establish a stable financial sector that is able to finance the real economy;
- An "intelligent" consolidation of domestic budgets with a view to growth and employment, meaning that reducing budget deficits should go hand in hand with setting priorities for growth- and employment-oriented measures;
- Coordination of the economic and currency union to avoid macroeconomic imbalances and increase the competitiveness of member countries.

Targets

The priorities are embodied in five primary targets:

- The employment rate of men and women between the ages of 20 and 64 should be increased to 75%. This should be attained by increased participation in the workforce by young people, older workers, and workers with limited skills, as well as stronger integration of legal immigrants. The corresponding Lisbon Strategy goal was an employment rate of 70% among 15- to 64-year-olds.
- Private and public expenditure for research and development should amount to 3% of GDP. This is identical to the Lisbon Strategy target.

- Greenhouse gas emissions should be reduced by 20% of 1990 levels; renewable energy sources should increase to 20% of total energy consumption; and energy efficiency should be increased by 20%. The European Union is committed to reducing greenhouse gas emissions by 30%, if the other industrialised countries agree to comparable mandatory emissions reductions and if developing countries agree to make an "adequate" contribution to reducing greenhouse gases.
- The percentage of school dropouts[25] should be reduced to less than 10%, and the percentage of 30- to 34-year-olds with a completed tertiary education should reach at least 40%.
- The number of people threatened by poverty should sink by at least 20 million[26].

Guideline initiatives

The Commission has proposed seven guideline initiatives within the individual priorities to bring about progress:

- Innovation union: Takes into account the framework conditions for innovation, smart specialisation, and European innovation partnerships (European Commission 2010k).
- Youth in motion: Increase the performance and international attractiveness of Europe's institutions of higher education; improve the quality of general and professional education in the EU (European Commission 2010b).
- Digital Agenda for Europe: Create a digital domestic market based on the Internet, as well as a broadband connection for everyone and higher Internet speeds (European Commission 2010l).
- Resource-conserving Europe: Transition to a low-emission, resource-conserving economy (European Commission 2011a).
- Industrial policy in the age of globalisation: Better framework conditions for firms, especially for SMEs, for an internationally competitive industry structure (European Commission 2010c).
- Agenda for new skills and new employment opportunities: Modernise the job markets, increase the level of employment, and guarantee the sustainability of social models (European Commission 2010d).
- European platform for fighting poverty: Guarantee economic, social and territorial cohesion (European Commission 2010e).

These seven guiding principles should be binding for the EU and its member countries. At the EU level, mainly the instruments of the domestic market, the EU budget and EU international policy should be placed in the service of the strategy. Tasks in the context of the initiatives are also being defined for the member countries. The "Digital Agenda for Europe" was introduced as the first guiding principle, approved in June 2010 by the European Council; the last guiding principle, which addresses resource conservation, was presented at the end of January 2011.

Implementation process

The implementation process is transmitted via the "European Semester", which defines

25 In accordance with the European definition, youths between 18 and 24 who do not have diplomas beyond mandatory schooling and are not enrolled in an educational institution.

26 To define persons at risk of poverty, the member countries can choose from one of three indicators: The border at which one is at risk of poverty can be defined as 60% of the national median income; material destitution; or the number of unemployed households.

the chronological sequence in which national reports are to be produced, the collective discussion of these reports, previous reform progress, and the handover of European recommendations. The first step in the implementation of the Europe 2020 Strategy was taken by the European Council on 27 April 2010 with the "integrated guiding principles" for economic and employment policy in the member countries. The previous 24 guiding principles of the Lisbon Agenda were distilled into a total of 10. The five main targets of the Europe 2020 strategy are reproduced in the guiding principles and supplemented by guiding principles in the areas of public finance, imbalances, domestic market and SMEs, as well as improving the education of the working populace.

The integrated guiding principles are (European Commission 2010f):

1. Guarantee the quality and long-term viability of public finances;
2. Settle macroeconomic imbalances;
3. Dismantle imbalances in the eurozone;
4. Optimise R&D and innovation funding, strengthen the "knowledge triangle" (i.e. research, education and innovation), and unleash the potential of the digital economy;
5. Improve resource efficiency and reduce greenhouse gas emissions;
6. Improve the framework conditions for entrepreneurs and consumers, and modernise the industrial basis;
7. Increase the employment rate and reduce structural unemployment;
8. Enable education and further training of workers to meet the needs of the labour market, promote workplace quality and life-long learning;
9. Increase performance of the general and professional education systems at all levels and improve access to university education;
10. Fight the mechanisms of social exclusion and poverty.

The objective is to leave the integrated guiding principles unchanged until 2014 and to focus attention on their implementation.

National reform programme (NRP)

In the second step, the five primary EU targets are translated into national goals and an appropriate adjustment path (depending on the current situation) is implemented. The countries define their own national growth priorities, and address these priorities and the guidelines by proposing appropriate measures. Priorities and proposed measures are reported in the annual NRP to the European level. A draft of the respective NRP was sent to the Commission in November 2010; the final version followed in April 2011. Two major improvements on the Lisbon process are national goals and the definition of growth priorities. They are meant to increase the importance of national reform programmes and of the Europe 2020 Strategy for national policy development.

In the third step, the commission and the member countries monitor the content of structural reforms (multilateral monitoring). The Europe 2020 Strategy corresponds closely to the former process of the Lisbon Agenda. On the basis of the delivered NRP, the Commission and Council evaluate progress on growth priorities and the attainment of (national) primary targets. In addition, there are also evaluations as to whether economic policy agrees with integrated guidelines. If progress is insufficient or the guidelines are not maintained, then country-specific recommendations are formulated. Each respective member state determines for itself how these are to be reached. If the member state does not respond to the recommendation, then the Commission can issue a warning.

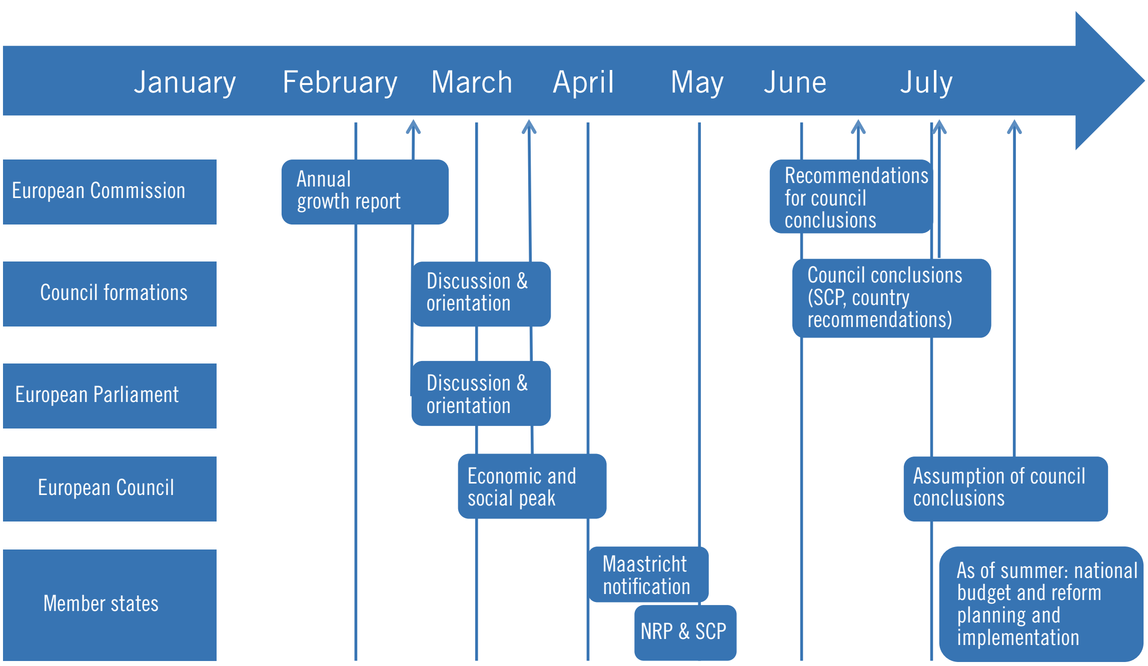
Country monitoring provides the basis for an overall assessment of the progress towards achieving the EU goals. Performance is compared with trading partners, and reasons for possibly insufficient progress are analysed. Progress on the major initiatives are also evaluated at the European and national level.

Timeline

The "European Semester" provides a regulated timeline for the annual sequencing of these elements (Figure 18). The previous processes of economic policy coordination in Europe should be more strongly integrated: in future the Stability and Convergence Programme (SCP), which includes the budget planning of the member countries and builds on the Stability and Growth Pact and the National Reform Programme (NRP), which includes the planned reforms for growth and employment and touches on the Europe 2020 Strategy, will be simultaneously submitted and evaluated. This means that the planning of budgets and the planning of programmes for growth and employment, i.e. the content-based design and budgetary allocations for measures, should take place at the same time. Moreover, these will be expanded to include the monitoring of macroeconomic imbalances. The European Semester should place a stronger emphasis on coordination *ex ante*: the agreement of national plans with EU targets is ensured by respective governments before taking budget decisions (European Commission 2010g).

The cycle of the European Semester begins in January with the "Annual Growth Survey", or AGS, from the European Commission, which sets forth the economic challenges for the EU and the eurozone. At the end of Febru-

Figure 18: The chronological order of coordination steps within Europe 2020 ("European Semester")



Source: Adapted from European Commission 2011b.

ary, the Council decides on the strategic guidelines for the SCP and NRP. The member countries submit both reports in April. At the beginning of July, the Council formulates its country-specific recommendations, which the member countries are supposed to take up in the preparation of their budgets for the coming year. In the second half of the year, the member countries are concluding their budget planning. In the AGS of the following year, the European Commission will then conduct an evaluation of the extent to which the member countries have incorporated considerations of the strategic guidelines.

The European Commission's first annual growth report (2011b) is delivering an assessment of the drafts of the national reform programmes. Even if they do not permit any final conclusions, the European Commission has voiced concerns that the national goals are not ambitious enough, and that the planning and reform horizons are too short-term. "The Commission is aware that this is a new concept that will be implemented for the first time this year, and establishing ambitious goals parallel to domestic budget consolidation among the member countries presents special problems" (European Commission 2011b, p. 8). European Commission calculations have shown that, according to the current status of the national reform programmes, the EU targets cannot be reached. In a conflation of the national targets, the European Commission identified a range of 2.7 – 2.8% for the R&D intensity (R&D expenditures as a percentage of GDP), a value of approx. 72.5% for the employment rate, and an increase in energy efficiency of 10% rather than the envisioned 20%. This means the last area, in particular, is not sufficiently ambitious in the NRPs. Currently, according to the European Commission, there are no "answers to the central macroeconomic challenges and obstacles to growth" in the NRP drafts.

3.1.2 Elements of the Europe 2020 strategy relevant to RTI policy

This section addresses those elements of the Europe 2020 strategy that affect Austrian RTI policy and which will require aspects of RTI policy to implement because they either provide directives or options or propose initiatives and projects. Figure 19 illustrates that elements affecting RTI are in nearly every guideline or flagship initiative, where the various gradations are based on expert assessments. Of primary importance to RTI strategy are 'Guideline 4' and the flagship initiatives 'Innovation Union' and 'Digital Agenda'.

Relevance of the guidelines to RTI policy

First, the RTI-relevant elements of the guidelines, in a broad sense, will be described in more detail, on which the national reform programmes will build.

Guideline 1: Guarantee the quality and long-term sustainability of public finances

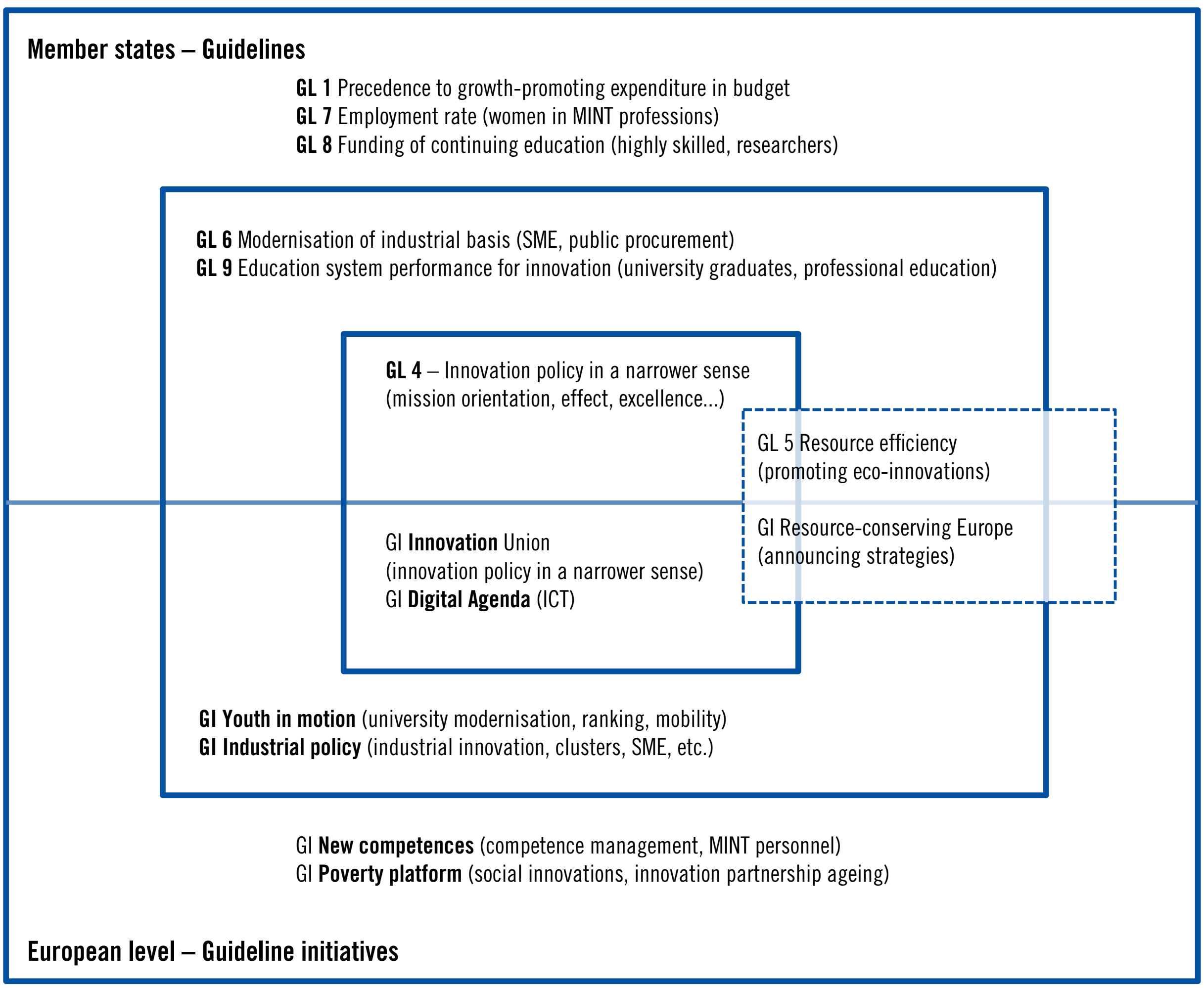
- In the context of budgetary consolidation, priority will be given to taxes that do not restrict growth and to growth-enhancing expenditures (education, qualification and the promotion of employability, research and development, innovation, investments in network infrastructure such as high-speed Internet).

Guideline 4: Optimise R&D as well as promotion of innovation, reinforcement of the knowledge triangle and unleashing the potential of the digital economy

- Review national (and regional) structures of R&D and innovation to identify appropriate and effective public investments, orient toward growth and focus on societal challenges (energy, resource efficiency, climate change, social cohesion, ageing, health and security);

- All reforms should promote excellence, smart specialisation, cooperation between all partners (universities, firms, research institutions, etc.) and the development of networks for the transfer of knowledge;
- Improve the governance of research facilities; Modernise university-based research, develop world-class infrastructures, promote attractive careers and the mobility of researchers;
- Federal research assistance and procurement systems should be adapted and simplified to ease cross-boundary collaboration, knowledge transfer and competitive awarding of services;
- R&D and innovation policy should be placed in a European context; public and private funds should be bundled and synergies generated with EU funds to achieve an appropriate scale and prevent fragmentation;
- All policy areas should factor in and promote innovation, including non-technological innovations;

Figure 19: RTI-relevant elements of the Europe 2020 Strategy



Source: Austrian Institute of Economic Research (WIFO) presentation

- Conditions for private investment in research and innovation should be enhanced, tax incentives for R&D and other financial instruments should be combined with measures easing access to private financing of R&D (including venture capital); demand for innovation should be strengthened, especially green innovation, for example through public procurement and standards; in addition, innovation-friendly markets and regulations should be ensured, and efficient, effective and feasible options for protecting intellectual property should be provided.
- In accordance with guidelines 8 and 9, a broad foundation for qualifying innovation should be facilitated, and a sufficient number of mathematical, technical and life science degrees should be ensured; curricula should focus on promoting creativity, innovation and an entrepreneurial spirit;
- The expansion and acceptance of high-speed Internet is being pursued; conditions for expanding the digital marketplace should be established (see Guide Initiative, Digital Agenda); public financing (including EU resources from structural funds) should prioritise regions that are not fully serviced by private institutions; the use of modern Internet services should be promoted by e-government, electronic proofs of identity and payment options.

Guideline 5: Improve the efficient use of resources and reduce greenhouse gas emissions

- Tools of the market economy, taxes in particular, should be employed to support green growth and to stimulate the use of renewable energy and clean, climate-friendly technologies and to promote energy savings and green innovations;
- In accordance with Guideline 4, information and communication technology should be used to enhance productivity.

Guideline 6: Improve conditions for entrepreneurs and consumers and modernisation of the industrial base.

- The following is planned: Promotion of SMEs in agreement with the Small Business Act, i.e., ensured access to financing options (especially venture capital) and feasible protection of intellectual property; in addition, the promotion of internationalisation, entrepreneurial activity, the upgrading of qualifications, all types of innovation, participation in research promotion programmes, cluster initiatives and active IPR management in and by SMEs;
- Public procurement policy should also provide innovation incentives, especially for SMEs.

Guideline 7: Increase the employment rate and reduce structural unemployment

- Measures to enhance the compatibility of family and work should aim to increase the rate of employment; this especially holds true for young and old employees and for women, and women in particular should be retained in scientific and technical fields of activity.

Guideline 8: Train workers who can respond to the needs of the job market, promote workplace quality and lifelong education

- Promote continuing education, the qualification and professional experience of highly qualified workers including researchers;

Guideline 9: Increase the efficiency of general and occupational education systems on all levels, improve access to university education

- Reforms at all levels of education are envisioned to promote the acquisition of expertise in the science-related economic sector;
- The number of college graduates should be increased.

Overall, the elements of the guidelines relating to RTI cover nearly the entire spectrum of this policy. The number of guidelines were reduced from 24 to 10, however a large number of subpoints were incorporated into the individual guidelines.

A good example of a benchmark envisioned by the Commission for RTI Policy is the self-evaluation tool that clearly and succinctly defines the goals of the guidelines:[27]

Box: Characteristics of functioning national and regional systems for research and innovation

1. Funding research and innovation is a central political instrument for enhancing competitiveness and creating workplaces, for solving important social challenges and improving the quality of life, and it is presented to the public as such.
2. The development and implementation of political measures for research and innovation takes place on the highest political level and is based on a multi-year strategy. The political measures and instruments seek to employ existing or incipient national and regional strengths in the context of the European Union ('smart specialisation').
3. Innovation policy is broadly defined and extends beyond technological research and its applications.
4. Appropriate and reliable public investments in research and innovation exist that in particular seek to mobilise private investments.
5. Excellence is a key criterion of research and education policy.
6. The educational and training systems offer the correct mix of qualifications.
7. Partnerships between institutions of higher learning, research centres and firms are actively promoted on a regional, national and international level.
8. The existing situation promotes corporate investment in research and development, an entrepreneurial spirit and innovation.
9. Public support for research and innovation in firms is easy, easily accessible and effective.
10. The public sector is at the cutting edge of innovation

Source: European Commission 2010h.

The Europe 2020 strategy is broadly conceived, and the RTI-relevant elements have multiplied in comparison to the Lisbon strategy after performance shortfalls were surmounted ('competitiveness'), the mission orientation gained in importance and innovation and education policy became interconnected: Job markets and education systems need to keep pace with the increasing requirements resulting from RTI policy, and not just by increasing the number of appropriately trained experts, but also by coordinating the qualifications offered better with the market's demand ("skill-biased technological change").

In the next step, the two central flagship initiatives for RTI policy will be presented, i.e., the 'Innovation Union' and 'Digital Agenda.'

3.2 Flagship initiative: Innovation Union

The Innovation Union is one of the seven flagship initiatives of the "Europe 2020" strategy (European Commission 2010a). In addition to the "Digital Agenda" and the flagship initiative "Youth on the Move", it is incorporated in the strategic focus "intelligent growth" of the "Europe 2020" strategy. With this focus, the European Commission is pursuing the goal of establishing a growth model founded on science and research. The flagship initiatives serve as a framework for coordinating individual measures[28], on the level of the Union and the member countries, with which important sub-goals are to be achieved.

The objectives of the flagship initiative "Innovation Union" include:
1. Improving conditions for innovation,
2 .Increasing the effects on welfare by innova-

27 Only the headings are provided in the text box; these are more closely described in European Commission (2010h).
28 The European Commission envisions 34 "commitments" for implementation. For more information, see the overview at http://www.era.gv.at/space/11442/directory/21218.html

tion by promoting the smart specialisation of the member countries and regions;
3. Introducing European innovative partnerships;
4. Measuring and monitoring progress;

Innovation is broadly defined. In this initiative, the concept of innovation covers both technical innovations and "innovations of business models, organisation, market policy and services"... "that result in benefits to the user" (European Commission2010a, 8). These goals are being implemented to create 'Innovation Union' by 2020 to reduce the fragmentation of the research landscape, create an internal market for innovation and improve coordination between EU-wide, national and regional research and innovation initiatives, research facilities and sources of financing.

This section provides a brief overview of the most important aspects of the "Flagship initiative of the Europe 2020 Strategy – Innovation Union" (European Commission 2010k) which is chiefly concerned with improving the underlying conditions for innovations. The fundamentals for excellent academic research need to be improved, and known deficits in market-related research and development need to be overcome.

Outstanding research achieved through development of the European Research Area

A primary goal in the establishment of conditions for outstanding scientific research is to realise the "European research area" by 2014. The aim is to create mobility for researchers and establish the free exchange of ideas as a "fifth basic freedom" of the European Union. This will create a domestic market for research that will overcome the fragmentation of the research landscape in the EU. In many areas of research, it will allow critical thresholds to be reached for the establishment and continuous development of excellence. At present, universities, research facilities and individual researchers are frequently subjected to regulatory restrictions when they operate across borders within the European Union. Frequently researchers have to overcome administrative barriers such as achieving recognition of their degrees or fighting for pensions in a different member country.

Another important factor in the realisation of the European research area is the establishment of a reliable infrastructure for excellent research. Both the complexity and cost of research in many areas are increasing. For this reason, the advantages of size will be exploited, and national research projects will be combined on the European level. Important progress has been achieved in this regard by the European Strategy Forum on Research Infrastructures (ESFRI) that has been coordinating projects aimed at creating a common research infrastructure since 2002.

Planned measures for realising the European research area: The European Commission plans to submit a uniform approach for the European research area by 2012 which will eliminate major restrictions on mobility and foster transnational research activities. By 2015, the European Commission together with the member countries will ensure that 60% of the investment projects proposed by the ESFRI will be implemented. The Commission thereby hopes to enhance the innovation potential within Europe.

Improved conditions for financing innovative firms

According to the European Commission, there is a gap of approximately €15 billion annually in venture capital made available in Europe as compared to the US. Banks are reluctant to grant loans to knowledge-based firms since they generally cannot provide any collateral.

Innovative firms should be financed more strongly through private capital whenever possible. The European Commission is of the opinion, however, that public funds must be employed to finance innovative firms when banks cannot provide sufficient funds and there are financing shortfalls. The European Commission has emphasised three such shortfalls.

1. The first shortfall arises during the period shortly after a firm is founded (start-up phase). In this phase, many firms fail since public funding dries up, and there is not enough private capital available. This phase is frequently termed the 'Valley of Death'.
2. The second shortfall arises during the expansion phase. In this instance, surviving firms are frequently unable to expand internationally since the venture capital funding is frequently too small to work on a transnational basis.
3. The third shortfall relates to loans for high risk projects. Even established firms have difficulty obtaining outside financing for such projects since banks are incapable of correctly estimating corporate assets in the form of knowledge such as intellectual property.

Planned measures for improving access to financing for innovative firms: The European Commission will review by 2011 the Community framework for research, development and innovation aid to determine how innovation can be appropriately promoted. By 2012, it will ensure that venture capital funds from all member countries can operate without restriction within the entire EU. By 2014, it intends to introduce new financing instruments to mobilise more private capital to overcome the cited shortfalls. The European Commission will collaborate with the European Investment Bank (EIB), national research institutions and private investors.

Creating a domestic market for innovation

From the perspective of the European Commission, the market for innovative products, and not just scientific research, is overly fragmented within the EU. A step towards overcoming this situation will be achieved by improving the process for awarding public contracts, which comprise 17% of the GDP within the EU. This will give Europe significant potential for promoting innovation by awarding public contracts and creating international markets. Intelligent regulation (standards) can also be an important engine of innovation, especially in the field of environmental technologies that can reduce market fragmentation and create EU-wide markets. However, it it has taken an excessive amount of time to agree upon standards within the EU.

Another identified problem is the expensive patenting procedures that precede the launching of new products. Within the EU, patent applications are approximately 15 times as expensive as within the United States. Not having a European patent has the same effect as a tax on innovation.

Planned measures for creating a domestic market for innovation: Starting in 2011, the member countries and regions will pay special attention to innovative products and services when awarding public contracts. This will also apply to 'pre-commercial' contracts for developing new products and services. Annually, the European Commission funds contracts totalling at least €10 billion throughout the EU. In addition, the European Commission will review whether international public procurement can be made easier through new regulations. In 2011, the European Commission will submit a proposal to accelerate standardisation. In the same year, the European Commission wishes to present a plan of action for green innovations specifying how environmental goals can be achieved through innovation. The first European patent will be issued in 2014. Proposals regarding European patents, the regulation of languages and a uniform dispute resolution procedure will be adopted by the European Parliament and European Council. In March 2011, the responsible ministers of the EU Competitiveness Council drafted a far-reaching resolution regarding uniform EU patents. With the exception of Italy and Spain, the member countries supported the European Commission on the path to enhanced cooperation between member countries.[29]

In addition to creating a domestic European market for new products, the EU also wants to promote knowledge markets and the transfer of knowledge within the corporate sphere. From this effort, the EU expects to increase growth potential since many firms base their innovations on existing technologies and develop new business models for services from them. Consequently, the simplification and strengthening of the transfer of knowledge within the EU will unleash significant stimuli, especially within the creative industries.

Planned measures for promoting the transfer of knowledge: The Commission will promote free access to the results of research supported by public funds. This will be a basic principle for projects that are promoted by EU framework programmes for research. The European Commission will furthermore investigate if and to what degree the use of intellectual property rights for anti-competitive purposes can be suppressed through policy governing competition. By the end of 2011, the European Commission will present proposals on the creation of a European knowledge market for patents and licenses.

Increasing the effects on social welfare from innovation through promoting the smart specialisation of the member countries and regions

The level of development of the member countries and individual regions within the member countries varies widely. This gap will be closed by resources from European structural funds that will also be increasingly employed for R&D. For example, €82 billion was set aside for R&D through the structural funds between 2007 and 2013. Using these resources, the member countries and regions will concentrate on their relative strengths to achieve peak performance ('smart specialisation').

Another goal of the European Commission is to achieve greater societal benefit through innovation. To support this goal, the European Commission will develop social innovations as an important new field. Social innovations are to be understood as new political approaches to pressing problems for which private firms and the public sector cannot achieve satisfactory results. The European Commission will pay increasing attention to charities or social businesses.

Planned measures for enhancing the effects on welfare through innovation: To promote the goal of smart specialisation, the European Commission will establish a forum for smart specialisation by 2012. The European Commission will start a 'Social Innovation' pilot project in Europe and provide stronger support to social innovations through the European Social Fund (ESF). Starting in 2011, it will also support a new research programme for the public sector and social innovations. A European innovation scoreboard for the public sector is already being worked on.

29 http://www.patentamt.at/Das_Oesterreichische_Patentamt/News/Verstaerkte_Zusammenarbeit_fuer_die_Schaffung_eines_einheitlichen_EU-Patents/

European innovation partnerships

In fields where state involvement is justified, the European Commission will establish European innovation partnerships with the goal of addressing major societal challenges. Examples are improving the quality of life of the elderly or reducing CO_2 emissions. These partnerships will form committees consisting of all the relevant interest groups under the oversight of the European Commission and will build on existing instruments (such as The Joint Programming Initiative). They will focus on social benefits and quickly modernise the associated economic sectors and markets. They will increase and enhance the coordination of investments in R&D, identify necessary regulations and standards early on, and better harmonise public procurement procedures. This will accelerate the introduction of innovations in the market.

Planned measures for implementing European innovation partnerships: The European Commission will propose a partnership on 'active and healthy ageing' as a pilot project. The goal of this partnership is to increase the number of healthy years of life by two years by 2020 and thereby improve the sustainability and efficiency of the welfare and healthcare systems.

Measuring and monitoring the progress of innovation

The European Commission believes that in addition to measures at the European level, the quality of national research and innovation systems is essential to the success of the 2020 strategy. In many respects, the European Commission feels that it is necessary to reform measures and instruments on the regional and national level. Progress along the path to the Innovation Union will be measured by means of an R&D investment target and a new indicator.

Planned measures for reforming national research and innovation systems and for measuring progress: The member countries have been asked to evaluate themselves using a series of indicators and to incorporate critical reforms in their national reform programmes by April 2011. Progress within the member countries will be monitored in the context of planned coordination of economic policy (European semester). In order for the monitoring to do justice to the broad-based and integrative research and innovation approach chosen by the European Commission, numerous indicators are required. The European Commission will measure the overall progress of the member countries with additional indicators and continuously develop the innovation scoreboard (IUS). Within this context, the European Commission will develop together with the OECD and Eurostat a new indicator by 2012 that will include 'quickly growing innovative firms' in the measurement of innovative progress.

3.2.1 Summary

The primary theme of the flagship initiative of the Innovation Union is to lower or eliminate fragmentation in various economic and political sectors and thereby promote efforts at integration. This has become necessary since the expansion of the European Union has increased the variety and contrasting developmental levels among the member countries of the Union. With this flagship initiative, the European Commission is attempting to better coordinate political initiatives through a variety of administrative authorities than was the case in the effort to implement the Lisbon strategy.

Major new elements are the focus on public procurement to foster innovation, the goal of developing social innovation as an independent political area, and the introduction of European partnerships in innovation that can coordinate major RTI policy projects internationally.

3.3 Flagship initiative: Digital Agenda for Europe

The Digital Agenda is one of the seven flagship initiatives of the Europe 2020 strategy (European Commission 2010l). It is based on a series of consultations and resolutions by different committees of the EU, of which Europe's Digital Competitiveness Report and the initiative report of the European Parliament on a new Digital Agenda for Europe can be cited as examples.[30] With the Digital Agenda, the European Commission is pursuing the goal of maximising economic and social benefits of information and communication technologies (ICT), especially broadband technologies and the Internet. A greater use of this technology is required to achieve this aim. The European Commission notes in this context that an EU-wide market for digital services has not been successfully established to date.

3.3.1 The effect of broadband networks on growth and employment

Broadband networks are a key infrastructure that is penetrating and changing all areas of social and economic activity. There is a widespread consensus in the scientific literature that broadband networks and broadband-supported technologies can (and will) exercise long-term effects on our way of life, while also working against undesirable social developments (Firth and Mellor 2005). For example, broadband networks have the potential to stem the tide of migration to the cities and the concomitant decline of rural areas, where private and public services, jobs (teleworking), and shopping options are increasingly available via the Internet. In the areas of administration, health and education, important areas of application exist, both today and even more in future: telemedicine technologies could lead to a reduction of health care costs, and broadband-supported technologies could be used in the education sector to improve support for pupils and to help them individually (OECD 2008c).

As we assess the economic significance and impact of broadband technologies, we must differentiate between the direct effects of investment in the infrastructure and the indirect effects of broadband service applications. All current studies document positive effects resulting from investments in broadband infrastructure. A recent study in Austria (Fritz and Streicher 2009) calculated that an investment volume of € 1.5 billion results in 64,200 new jobs. Or to put it another way, every € 100,000 invested yields approx. 4.3 jobs.

Studies on the effects of using broadband networks point to an important connection to growth and employment. Crandall et al. (2007), for example, have estimated that an increase in broadband penetration rates (the ratio of the number of connections to the total population) by 10% leads to an increase of employment growth by 2% to 3%.The latest estimates from the World Bank also show that, in advanced national economies such as Austria, an increase in broadband penetration rates by 10% brings along an increase in the average growth rate of real GDP per capita by 1.2% per year (margin of error 0.3% to 2%) (Qiang et al. 2009).

A study by MICUS (2008), which also assessed job losses caused by relocating production facilities and structural shifts between in-

30 All of the publications related to the Digital Agenda are available under http://ec.europa.eu/information_society/eeurope/i2010/index_en.htm.

dustries, resulted in the finding that forward projection of the current development of broadband penetration rates forecasts an approximate 0.71% rate of growth in real GDP per capita, EU-wide. For the group of countries that includes Austria, this value even reached 0.89%.

Overall, all of the available scientific studies show that investment in broadband technologies and their use are a significant factor for growth. Correspondingly, the European Council is assigning major significance to the expansion and utilisation of this infrastructure in the Europe 2020 Strategy (European Commission 2010a).

3.3.2 The most important objectives of the "Digital Agenda"

In order to understand the catalogue of measures in the Digital Agenda, it is important to envision how the distribution of broadband is defined by the interplay between existing infrastructure and the introduction of supplementary new services. This means that decisions about expanding the broadband infrastructure are linked to decisions users make. Users include firms that offer broadband-supported content and products, as well as end-users that use this content and these products.

For firms that offer broadband-supported content and products, the decision to make such investments depends upon a number of factors. Typically, firms have voiced such concerns as the protection of intellectual property rights and the associated problems of digital piracy, the availability of bandwidth, and the problem of fragmented standards for different technological platforms (e.g. data transmission protocols, standards for displaying content on different browsers, etc.). For end-users, investing in broadband depends on costs, up- and download speeds, the number, quality and security of available services and content, networking effects (e.g., the number of other users of communication services or social networks), and their ability to use Internet-based technologies and ICT in general.

The Digital Agenda is accordingly defined on a very broad basis. Emphasis is placed on the following target areas for key actions:

1. Improving and strengthening the digital domestic market
2. Fast and "ultra-fast" Internet access
3. Interoperability and standards
4. Research and innovation
5. IT skills and qualifications
6. ICT-supported advantages for the EU community

1. Improving and strengthening the digital domestic market

The European Commission has criticised the various obstacles that prevent access to broadband and other ICT services throughout the EU. For example, in the audiovisual sector, licences are typically only distributed for one country. This means that a provider who wants to offer their products and services throughout the EU must deal with 27 different royalties collection societies [31]. This makes transaction costs very high. Furthermore, the Commission is of the opinion that the demand for online trade remains limited because digital payments are too complicated and, on the other hand, because many consumers have concerns about payment security and data protection.

31 In the area of regulations for electronic communication networks, the European Parliament and the European Council created the Body of European Regulators for Electronic Communications (BEREC) in early 2010. This is a committee that is meant to coordinate the activities of national regulatory agencies with the objective of implementing an internal market for electronic communication, thereby mitigating fragmentation. In the area of royalty collecting societies, there have not yet been any comparable developments.

The European Commission therefore would like to strengthen the digital domestic market by
- opening up access to content,
- providing EU-wide regulations for electronic payments,
- promoting measures for building trust in online business, and
- removing the price differences between national and international telephone rates.

A series of key actions are planned to attain the performance targets for the digital domestic market (Text box 1):
- The European Commission will deliver a guiding framework for the collective administration of rights and EU-wide licensing.
- A uniform Single Euro Payments Area (SEPA) should be guaranteed and completed.
- A recommendation for eSignature guidelines, which pursues the goal of international recognition and interoperability between electronic authentication systems, should be distributed during 2011.
- The European Commission is reviewing the EU's regulatory framework for data protection with the goal of creating an EU-online certificate of trust for retail websites over the long term. A proposal for modernising the European Network and Information Security Agency is currently underway. This should increase trust among citizens and strengthen their rights.
- Proposals for measures and legislative initiatives for strengthening network and information security, as well as for fighting cyber-crime, are being worked on. Regulations governing jurisdiction in virtual space should be delivered by 2013 for both the European and international levels.

2. Fast and "ultra-fast" Internet access

Some of the Commission's important goals on the Digital Agenda are about comprehensively providing broadband Internet connections to the population. By 2015, transmission rates of 30 Mbit/s should be standard, and by 2020, half of all households should have access to ultra-fast connections of over 100 Mbit/s. The European Commission expects these measures to lead to positive effects for the entire economy. The Commission emphasises that, without state intervention, the broadband network will only be profitable in a few densely populated regions, for private infrastructure operators. This situation therefore justifies a "decisive public intervention" to guarantee comprehensive provisioning. For this purpose, the Commission intends to develop a common framework for measures at the EU and member-state levels that incorporate the following elements:
- Financing instruments from the member states in combination with EU instruments (e.g., the Competitiveness and Innovation Framework Programme, CIP);
- Because terrestrial radio and satellite connections can ensure broadband access, frequencies that come available during the transition to digital television ("digital dividends") should be allocated for wireless broadband services as of a fixed point in time.
- The framework conditions for developing "Next Generation Access" (NGA) networks should be improved[32]. The regulation of access to this infrastructure should make sure that access fees are high enough to offer investment incentives for infrastructure providers.

32 In the special guidelines of the BBA_2013 initiative, these are defined as follows (Federal Ministry of Transport, Innovation and Technology 2010, p. 9): "NGA networks are based partially or entirely upon the use of optical or electro-optical technology. Thus, this includes networks based on glass fibre technology (FTTH), next-generation modernised cable networks (HFC), and next-generation modernised dual-pair copper networks (FTTC, FTTB), to an equal measure. Insofar as satellite or mobile networks are able to provide symmetric high-performance broadband services, they also represent NGA networks."

3. Interoperability and standards

The European Commission is of the view that, in a "digital society", there must be an effective interoperability of different IT standards and services to guarantee seamless usage. Norms and standards are needed that must keep pace with technological change without limiting it. The European Commission therefore intends to continue reviewing EU standardisation policy and to take steps towards modernisation.

4. Research and innovation

The ICT share of R&D expenditure in the European Union is currently at just 17%, while in the USA 29% of R&D funds flow into the ICT sector (European Commission 2010l). For this reason, the European Commission argues that more investment must be channelled into ICT-related research and development in the EU. The Digital Agenda therefore defines the performance target that, by 2020, should lead to a doubling of public expenditure for ICT-related R&D, up to € 11 billion. Furthermore, private investments should be mobilised with various instruments, such as increasing the ICT budget by 20% each year for the duration of the Seventh Framework Programme.

5. IT skills and qualifications

The European Commission refers to studies that show that, by 2015, more than 700,000 jobs in the information and telecommunications industries will remain unoccupied because of a lack of skilled workers (European Commission 2010l). The Commission therefore wants to incorporate "digital competency" into the regulations via EU social funds, thereby strengthening education and continuing education measures in information and telecommunications technology.

6. ICT-supported advantages for the EU community

The European Commission sees opportunities in the intelligent use of technologies for solving pressing social problems, such as climate change and demographic change. For example, "intelligent energy networks" can be used to guide the behaviour of energy producers and consumers and increase efficiency. The European Commission believes that similar goals can be attained with an "intelligent traffic system". The introduction of relevant technologies could affect CO_2 emissions in the EU. Furthermore, the proportion of the population that uses electronic government agency services could be increased.

Box: Important performance targets for the Digital Agenda

Digital domestic market:

By 2015: 50% of the population aged 16-74 should make online purchases at least once a year (in 2009, this value was at 37%) by 2015, 20% of purchases should cross borders (in 2009, this was at 8%).
By 2015: 33% of SMEs should derive at least 1% of their turnover from online sales (sales and purchases) (in 2008, this value was at 24% for purchases and 12% for sales)
By 2015: the differences between roaming and national tariffs should be removed for telecommunications services

Broadband targets:

By 2013: 100% broadband provisioning to EU citizens (DSL provisioning was at 93% in 2008).
By 2020: fast broadband services with 30 Mbit/s or more for all EU citizens (at the start of 2010, 23% of broadband connections had transmission rates of 10 Mbit/s).
By 2020: 50% of European households should have access to broadband connections of 100 Mbit/s or more.

Research and innovation:

By 2020: State funding allocations or expenditures (GBAORD) for ICT-related R&D should double EU-wide, climbing from a nominal € 5.7 billion in 2007 to € 11 billion.

Digital integration:

The proportion of persons in the overall population who regularly use the Internet should climb from 60% to 75%, and in disadvantaged groups this number should rise from 41% to 60%.
By 2015: the proportion of the population that has not yet used the Internet should sink from 30% to 15%.

Public services:

By 2015: The proportion of 16- to 74-year-olds who use electronic government agency services should increase from 38% in 2009 to 50%.
By 2015: For a list of public services, to be agreed upon in 2011, 100% of them should be online.

Low CO_2 economy:

By 2020: Lower energy consumption for illumination purposes by 20%.

Source: European Commission (2010l)

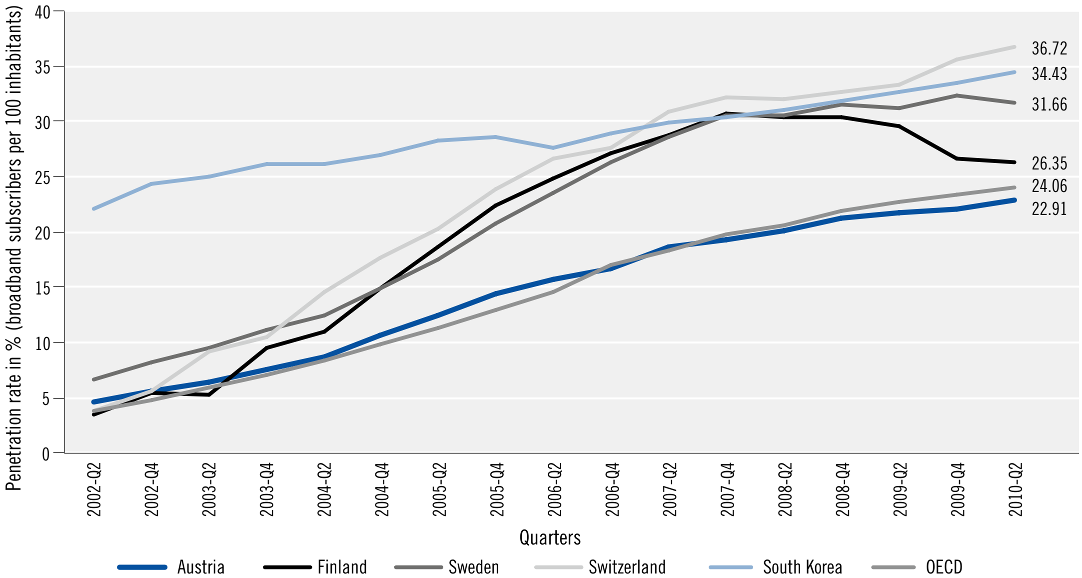
3.3.3 The spread of broadband utilisation in Austria

The foundation for attaining most of the Digital Agenda's performance targets is a high-performance broadband infrastructure that can be used widely by firms and citizens. Because broadband penetration rates describe the distribution of broadband connections[33], this is one of the most significant indicators for the Digital Agenda.

If we assess the development of broadband penetration rates (connections/population) over time in Austria, we see that broadband usage has developed in tandem with the OECD average. In comparison to countries with the highest rates of broadband penetration, however, this development was slower (Figure 20). In 2002, these countries were all in a similar situation, yet by 2010, a gap of between 5% and 13% opened up between Austria and countries such as Sweden, Finland and Switzerland. Along with South Korea, these countries belong to the top leaders in the application and distribution of broadband technologies. Figure 21 shows that household broadband connections have experienced more rapid distribution there than in Austria. The base level in 2003, with the exception of South Korea, was the same.

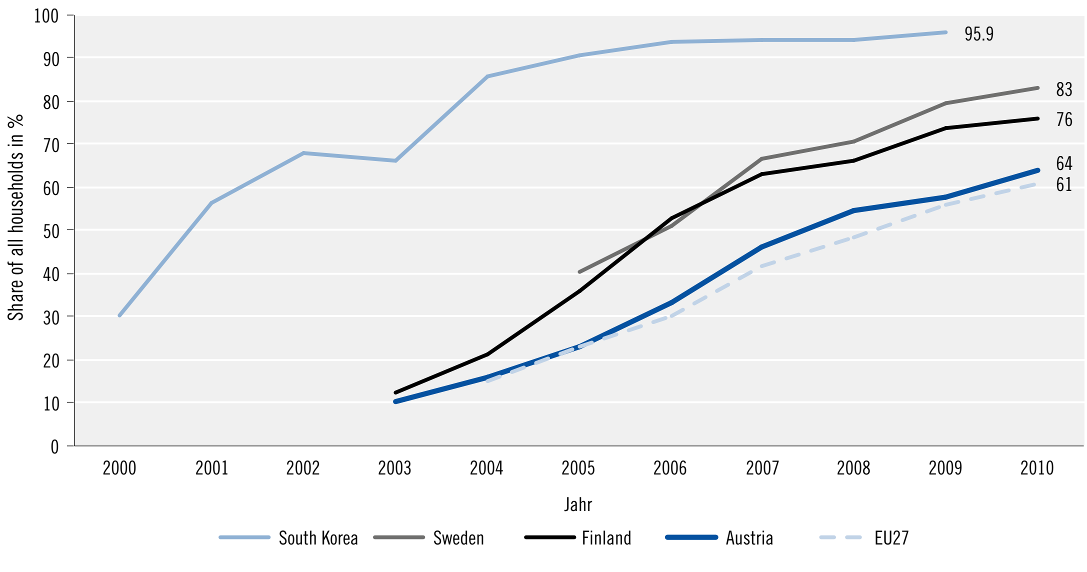
The development of the number of firms with broadband access, however, follows a different pattern (see Figure 22). In 2003, the number of firms in Austria that had broadband access was already lower than in those countries that had the highest broadband distribution. This difference could not be offset by the end of 2009, despite rapid strides.

Figure 20: Broadband penetration in Austria and comparable countries across time (2002-2010)



Source: OECD Broadband Statistics 2010, Austrian Institute of Economic Research (WIFO) presentation

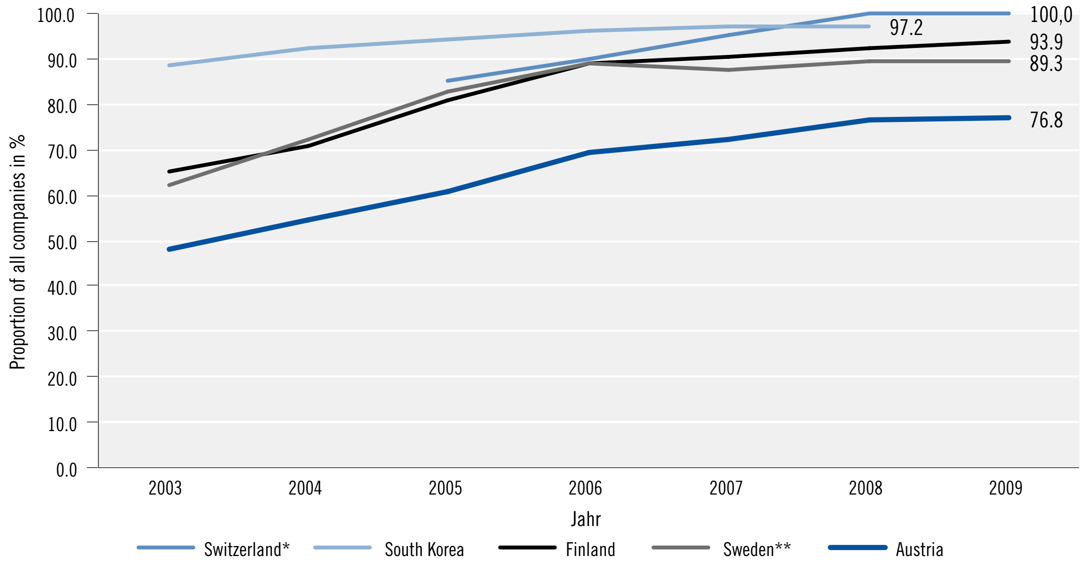
Figure 21: Households with broadband access in Austria and comparable countries across time (2000–2010)



Source: OECD Broadband Statistics 2010, Eurostat EuroCronos 2011, Austrian Institute of Economic Research (WIFO) presentation

33 Broadband here means a permanent Internet connection, with a recurring fee structure that is not dependent on usage, with high transmission rates. Opinions diverge as to what transmission rate should serve as a benchmark, as technological change in this sector is very rapid. In Sweden, broadband means connections with transmission rates of at least 2 Mbit/s; given the status of the technology (with commercially available rates of up to 200 Mbit/s), this is a plausible number. The OECD, however, includes connections with transmission speeds of 256 Kbit/s or higher as broadband connections. For the purposes of international comparability, this representation follows the OECD definition.

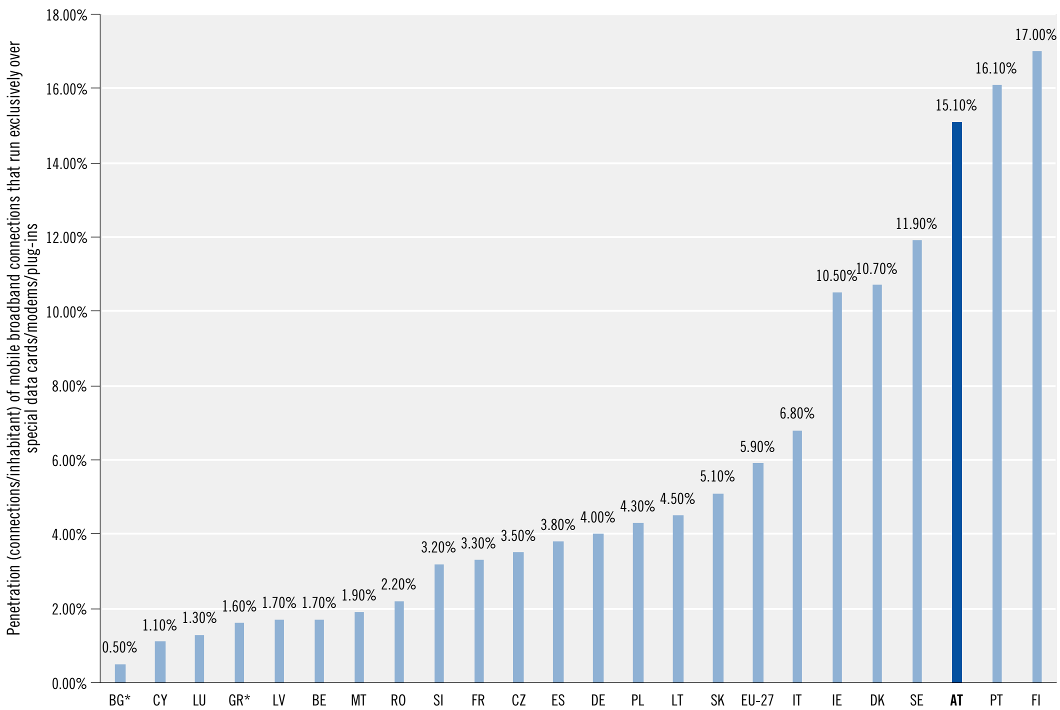
Figure 22: Firms with broadband access in Austria and comparable countries across time (2003–2009)



Notes: * Values for 2006 and 2007 interpolated, ** Values for 2004 interpolated. Last available data for 2009

Source: OECD Broadband Statistics 2010, Eurostat EuroCronos 2011, Austrian Institute of Economic Research (WIFO) presentation.

Figure 23: Penetration of mobile broadband connections



Note: Penetration of mobile broadband connections that run exclusively over special data cards / modems / plug-ins;
* Values for 2009. As at January 2010.

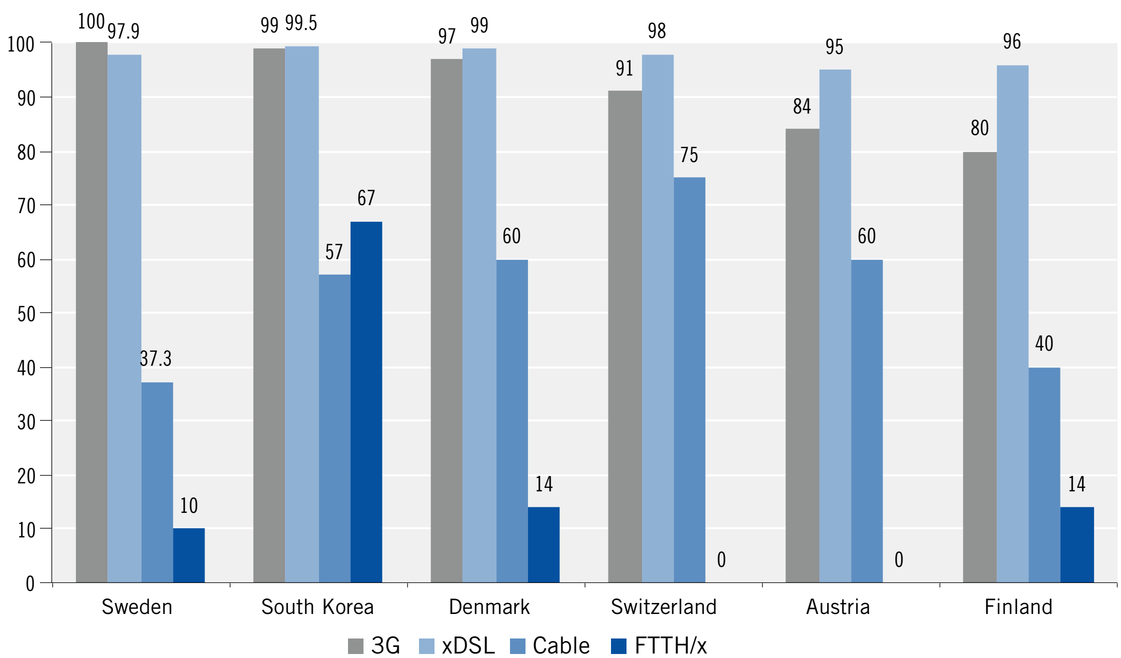
Source: European Commission, KOM(2010) 253 applicable.

In contrast, mobile broadband connections are very widely distributed in Austria (Figure 23). Austria is among the EU leaders in this area.

Figure 24 shows the coverage of the existing broadband infrastructure in a few leading nations and in Austria. Coverage gives the percentage of the population for which access to a broadband connection via the mentioned technologies is technically possible. Overall, the superimposition of xDSL on the existing telephone landline network has enabled the highest degree of coverage. Mobile broadband technologies (3G) are in second place. Connections building on fibre technology generally attain a low degree of coverage (with the exception of South Korea), due primarily to the high investment costs for this kind of connection. According to the current status of technology, fibre networks in which fibre cables are laid all the way to the end-user (FTTH/x) enable the highest upload and download speeds (over 100 Mb/s). In Austria, this technology was not accessible for end-users until very recently. There have been attempts lately to promote this technology more aggressively to end-users. This is done by local energy providers, among others. Figure 24 shows that, despite the high degree of xDSL and 3G coverage, Austrian figures are lower than they are for Sweden, South Korea, Denmark and Switzerland. This suggests a somewhat lower degree of penetration.

As stated at the beginning, the costs of a broadband connection and the quality of data transmission are both important criteria for the ex-

Figure 24: Coverage of broadband technologies



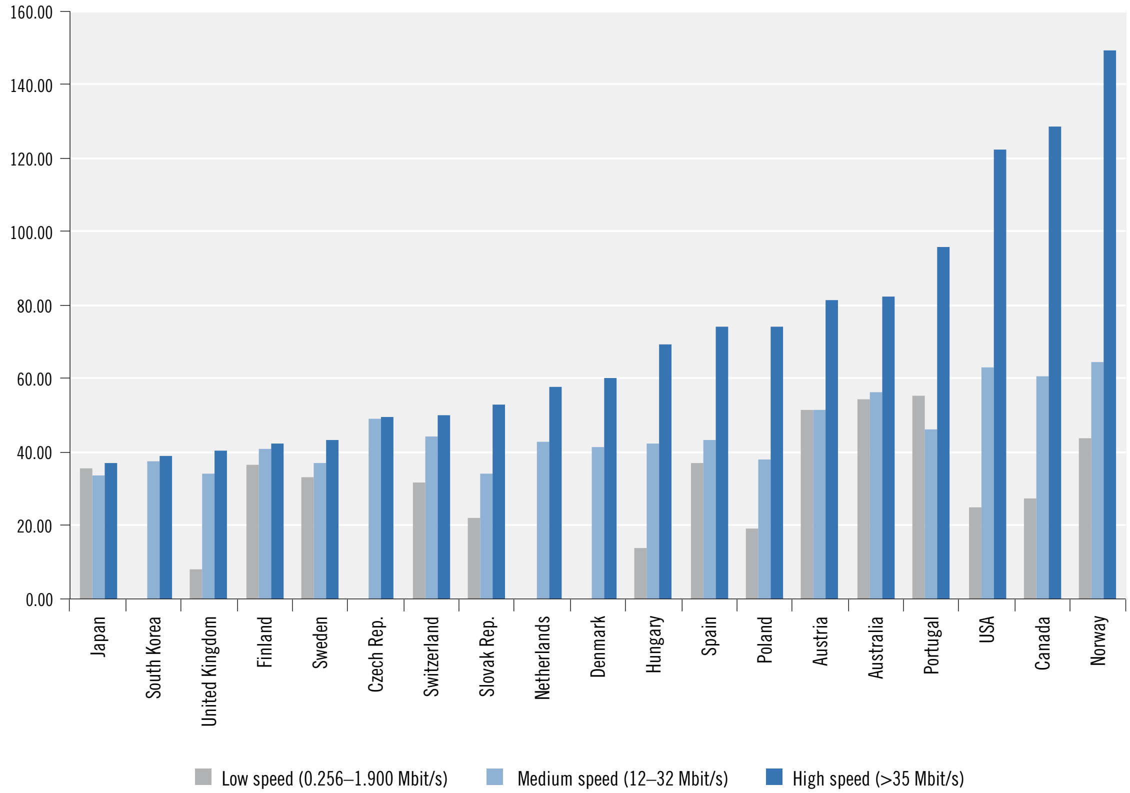
Note: Coverage of broadband technologies (last available information between 2007 and 2010).

Source: OECD Broadband Statistics 2010, Austrian Institute of Economic Research (WIFO) presentation.

pansion of this infrastructure. Figure 25 shows that in the comparison year 2008 broadband access, especially for high bandwidth, was relatively expensive in Austria compared to leading countries such as Sweden, South Korea, Finland and the Netherlands[34]. This can exercise a sustained influence on broadband penetration rates because less potential users use the technology, thereby delaying its application and effects.

Higher prices can be explained on one hand by the topography and population densities of a country; on the other hand, competition and competition policy, which regulates the broadband provider market, also play a significant role. Population density affects costs because the local loop length, i.e. the average distance from a distribution point to an end-user, plays a significant role in determining the cost.[35] The more broadly a country's population is

Figure 25: Median prices for different connections in USD to purchasing power parities 2008



Note: As at October 2009

Source: OECD Broadband Statistics 2010, Austrian Institute of Economic Research (WIFO) presentation

34 More recent data were not yet available at the time of publication.

35 Atkinson et al. 2008 argue that, for example, around 2/3 of the differences in broadband penetration (beyond the United States) can be attributed to geographic dispersion. A simple estimate, based on the data represented here, suggests that a 10% higher population density implies an approximately 1.7% higher broadband penetration rate (if real GDP per capita is held constant). This number, however, is a guide at best. More precise analyses are required (Reinstaller 2010).

36 Measured in terms of land mass occupied by 50% of the population, population density in Switzerland is 1.5 times higher than in Austria, in Finland 2.2 times higher, in Sweden 2.8 times higher and in South Korea 4.2 times higher (OECD Broadband Statistics).

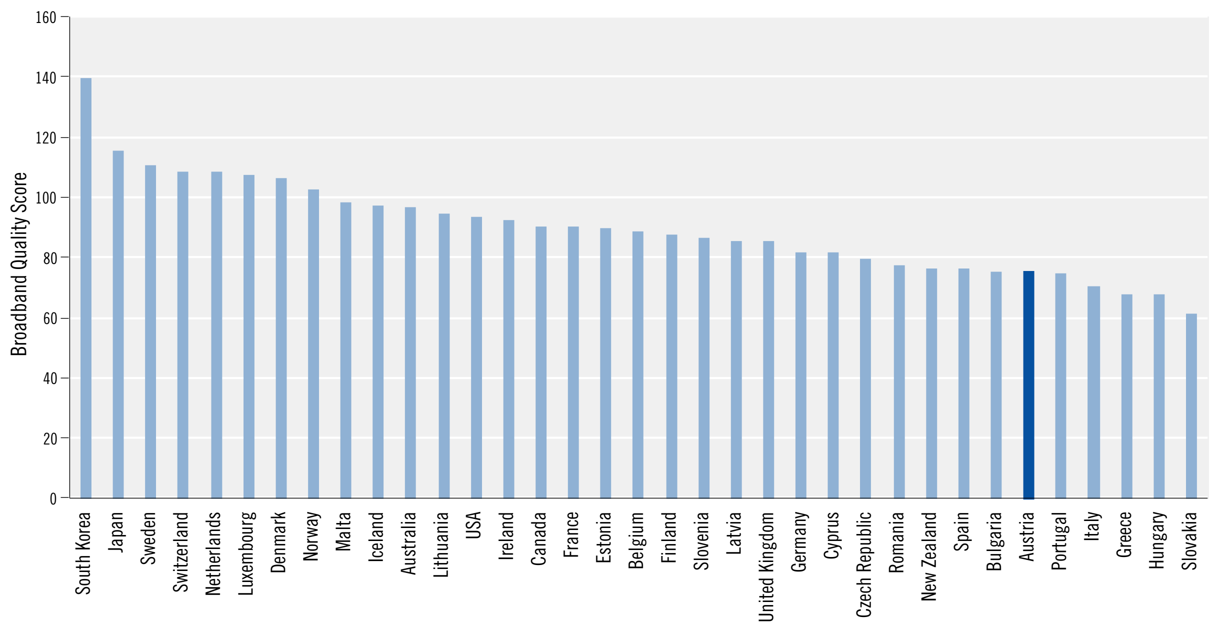
dispersed, the greater this distance will be. In Austria, this distribution is rather unfavourable, and the higher costs of infrastructure provisioning reflect this.[36] Calculations suggest, however, that this factor has a much less powerful effect on pricing than does the competition among providers (see Reinstaller 2010). Accordingly, regulating of competition among broadband providers is extremely important. In Austria, there is potential for improvement in this area in terms of regulatory quality and the competitive situation on the broadband market (Reinstaller 2010).

Figure 26 provides an exemplary indicator for the quality of Austrian broadband access in international comparison. Quality is measured on the basis of the speeds at which data can be uploaded and downloaded into the network, while also incorporating so-called latency time, meaning the average time that a data packet requires to travel from the sender to the receiver. Austria is lagging in this indicator. The reason for this is that some of the broadband connections available in Austria have below-average data transfer speeds, both for uploads and downloads.

To sum up, despite the dynamic development of broadband usage in Austria in the last ten years, a gap in broadband penetration rates has opened up to leading nations such as Sweden or Denmark. If we take the results of the World Bank study cited above (Qiang et al. 2009) and apply them to the observed difference in broadband penetration, the lag may have caused a growth differential in real per capita GDP between 0.5% and 1.5% annually. This will cause the economic differences to these countries to increase over time.

On the basis of currently available data, it is not possible to attribute differences in growth rates to differences in broadband penetration

Figure 26: Quality of broadband access (Broadband Quality Score), 2009



Source: Said Business School Oxford University – Universidad de Oviedo. Note: Broadband Quality Score 2009, BQS considers upload and download quality, as well as latency; Austrian Institute of Economic Research (WIFO) representation or investment rates. A great deal does suggest, however, that leading nations are benefiting from a combination of advanced education and RTI policy, along with an embedded, forward-looking broadband strategy - all of which contributes significantly to higher growth rates.

The data also show that, in Austria, the costs for a broadband connection – regardless of bandwidth – have moved during the period under observation within the upper third of OECD countries. This contrasts with merely average quality of service (upload and download speeds) in international comparison. Accordingly, this suggests that there are still qualitative and quantitative improvements that can be tapped.

3.3.4 Promotion of broadband usage in Austria

The previous section, which presented data on broadband development in Austria, indicated the necessity of making improvements in extending the broadband infrastructure and expanding the base of broadband users. Important indicators for the development of economic and infrastructure policy options come from the character of broadband technologies: To promote penetration of broadband technologies and broadband use, the parallel application of both supply- and demand-side measures will be necessary.

In past years, several strategic proposals have been prepared by different institutions. In 2004, "ARGE Broadband Austria" and the Austrian Council for Research and Technology Development presented strategy papers that addressed the diffusion and innovation of ICT in Austria. Then RTR (the Austrian radio and telecommunications regulator) and the Federal Ministry of Transport, Innovation and Technology (BMVIT) presented their ICT Master Plan in 2005, which identified problem areas and provided an extensive discussion of best practices in various areas.

The ICT Master Plan explicitly presented both supply- and demand-side measures. On the supply side, the foremost recommendations involved support for local broadband initiatives and strengthening competition; on the demand side, awareness-raising measures were assigned high priority. These measures include among others distributing ICT information and E-services, supporting the acquisition of computers in specific target groups, and creating a centre for security questions. Finally, the "Austrian Internet Declaration" was published at the beginning of 2010, in which interest groups, scientific institutions and firms proposed a catalogue of measures that aimed to position Austria among the leading ICT countries. This document takes up the essential points of the ICT Master Plan with regard to awareness-raising and usage and develops them further.

In its 2008 programme, the government obligated itself to implement the ICT Master Plan in its updated version of the year 2007. This programme set the primary target of guaranteeing broadband connection availability, at a minimum speed of 25 Mbit/s, to the entire population by 2013.

Furthermore, the development of modern communication technologies should be promoted in areas that are insufficiently provisioned (Federal Chancellery 2008). To realise these objectives, the federal government relies primarily on free-market mechanisms and the pro-competitive influence of the independent regulatory agency [37]. But the government programme also envisions improved coordination

37 As Reinstaller (2010) points out, the quality of regulations, as well as relevant agreements and framework conditions, can still be improved upon in many areas in Austria.

of activities and measures in ICT policy, as well as specific support measures. At the beginning of 2010, the Council of Ministers decided to create a "Centre of Excellence for the Internet Society" dedicated to coordinating ICT policy across ministries.

A series of support instruments are being used in the implementation of the programme's goals. The Federal Ministry of Transport, Innovation and Technology (BMVIT) provides support for various aspects of broadband distribution via the Austrian Research Promotion Agency (FFG) with three programmes.

- Since 2007, the "austrian electronic network" (AT:net for short) has promoted the introduction of innovative broadband services and applications, as well as plans that aim to increase access to broadband infrastructure and the use of digital electronic services in all parts of society. In 2009, 85 projects were supported by AT:net with a total of € 8 million, which unleashed an investment volume of ca. € 33 million. Overall, by the end of 2010, € 22.8 million in funding was contractually allocated, of which € 10 million has been paid out.
- At the same time, the "FIT-IT" programme is also accelerating basic research in the field of information and communication technologies, while the "benefit" programme supports projects that are meant to increase the quality of life among the elderly by means of ICT.
- Since 2011, "Broadband Austria Twenty-Thirteen" (BBA_2013) has rounded out the infrastructure funding programme portfolio. The programme, supported by federal, state and EU funds, stimulates competition for building broadband infrastructure in rural areas. By 2013, funding of around € 30 million will be allocated, thereby initiating an investment volume of up to € 100 million. Support is provided for measures that construct, expand or modernise broadband infrastructures, including measures that aim to build Next Generation Access (NGA) networks or passive broadband infrastructures in defined areas. The programme is being implemented by the states on behalf of the federal government.

A 2009 amendment of the telecommunications law aimed to improve framework conditions. Right-of-way was improved (acceleration of the processes) and the sharing of existing rights-of-way (fees for cable shafts and empty pipes) was regulated.

3.3.5 Summary

A modern, high-performance broadband infrastructure provides the foundation for implementing the Digital Agenda's objectives. Only if increasing volumes of data can be transmitted in real time, securely and without problems, can many of the objectives with regard to the digital domestic market, digital integration and public services be technically realised, or realised in a form that is acceptable to end-users. It is only through secure broadband networks with high transmission rates that the advantages offered by ICT, such as new telemedicine services, can be realised.

The Digital Agenda's broadband targets require full-coverage broadband provisioning by 2013, a minimum bandwidth of 30 Mbit/s for all EU connections by 2020, and a bandwidth of over 100 Mbit/s for at least 50% of all connections by 2020. To attain these goals, further measures are necessary in Austria. The data show that the degree of broadband coverage is very high, at 95% in the xDSL field and 84% in the mobile broadband field, yet there are still areas that are not sufficiently equipped. Through the "Broadband Austria Twenty-Thirteen" initiative, the federal government is providing funds that should close these provisioning gaps by 2013 and improve the quality of the broadband infrastructure.

Investments required to meet the broadband targets can partially be funded by the Austrian Research Promotion Agency's AT:net programme. The available funds, however, are rather low in terms of the necessary investment volumes[38]. The federal government is relying on entrepreneurial initiative and the efficiency-stimulating effects of regulation. The Digital Agenda makes the case here for improving regulatory situation so that the high investment risk can be better distributed among infrastructure operators and alternative providers. The current regulations governing fee schedules must therefore be reviewed and adjusted if necessary. On the other hand, the available data show that the quality of regulations, as well as relevant agreements and framework conditions, can be improved upon in multiple areas in Austria.

In conclusion, there have been very dynamic developments in the construction and expansion of the broadband infrastructure and the usage of broadband networks in recent years in the context of the Digital Agenda. These activities have laid important groundwork for the transition to an information society, which will now be strengthened by additional support measures.

38 This shows, for example, a comparison with Sweden. Approximately € 650 million were invested there by 2008 (see Atkinson et al. 2008, Appendix G). Of this, approximately € 200 million was used as grants to local governments. Another € 200 million were provisioned for tax breaks for households to supply connections in the "last mile". The public sector therefore carried about 50% of the costs of providing these connections. This programme was extended again in 2008. From 2009 to 2013, another € 400 million is budgeted to spend on hooking up the last areas without such connections. This allowed them to attain high penetration rates with a very high-quality infrastructure. Reinstaller (2010) points out, however, that the Swedish approach is not technology-neutral nor is it able to remove market distortions at the regional level.

4 Austria in the Lisbon Process – a retrospective

4.1 Introduction

In March 2000, the heads of state and government defined a strategic goal for Europe that provided orientation for nearly all measures in the RTI field. This goal stated that by 2010 the Union would strive "...to become the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion".[39]

Of course, this noble goal has taken on an unintended significance in the face of the economic and financial crisis of recent years; nevertheless, the Lisbon Process was an important process that laid the foundation in two ways for future strategic processes at the European level:
(i) indicator systems were developed and constantly enhanced, thereby facilitating comparisons between countries, and (ii) a specific new method – the Open Method of Coordination (OMC), described above – was introduced in European policy. The interplay of indicators and the OMC has since developed an interesting dynamism in some policy fields, although the breadth of the targets and policy fields, as well as the unusual public focus on the Lisbon Process, stand out in particular. The Europe 2020 Strategy is in essence based on the experience gleaned from the Lisbon Process. The following comments should therefore provide, on the basis of indicator sets as developed in the course of the Lisbon Process, a comprehensive view of the development of the EU as well as selected member countries during the period of time from 2000 to 2010.

4.2 Structural indicators

The European Council of Feira requested in June 2000 that the European Commission produce a list of structural indicators that would form the basis of discussion and evaluation of progress towards the Lisbon targets. First of all, the range of the list of indicators is striking: even if we leave out gender and age differentiation, the current list contains nearly 80 different indicators.

To be able to better and more transparently document structural progress in the EU, the European Commission developed 14 "leading indicators" (the so-called "short list") to facilitate assessment of economic policy goal attainment in the EU. However, for the synthesis report that it must product annually, the European Commission continues to use the longer indicator list. The "long list" is still divided into sub-lists on "general economic background", "innovation and research", "economic reform", "employment", "social cohesion" and "environment" (this division is also used to structure the "short list"). In addition to the leading indicators, the present report also considers the detailed indicators from "innovation and research".

The structural indicators are presented in a comparative, cross-sectional graph in the fol-

39 European Council (2000), Presidency conclusions; 23 and 24 March, Lisbon.

lowing, without addressing the methodical problems of such comparisons.

4.2.1 Description of indicators

The 14 leading indicators ("short list") taken from the complete list of structural indicators can be seen in Table 10.

The data basis comes from the publicly accessible database of the European Commission[40]. The figures from the years before the expansion to the EU27 were also included. The detailed form, however, only covers the EU15 countries.

The second list consulted for this report was the one which summarises the R&D-relevant indicators (Table 11)

Table 10: The leading indicators of the Lisbon Agenda

General economic background	
GDP per capita in purchasing power parity	(PPP)
Labour productivity	(GDP per employed person in PPS)
Innovation and research	
Youth education attainment level	(% of 20-24-year-olds having completed at least upper secondary education)
Gross domestic expenditure for R&D	(in % of GDP)
Economic reform	
Comparative price levels	(Final consumption)
Business investment	(in % of GDP)
Employment	
Employment rate	(% of 15-64-year-olds)
Employment rate of older workers	(% of 55-64-year-olds)
Social cohesion	
At-risk-of-poverty rate	(% of the population living below the poverty risk line)
Long-term unemployment rate	(% of active working population)
Dispersion of regional employment rates	(variation coefficient of employment rates at NUTS2 level)
Environment	
Greenhouse gas emissions	(Kyoto base year=100)
Energy intensity of the economy	(Energy consumption in oil equivalents/GDP)
Volume of freight transport relative to GDP	(Index 2000=100)

Source: Eurostat

40 http://epp.eurostat.ec.europa.eu/portal/page/portal/structural_indicators/indicators

This list overlaps slightly with those used by the Innovation Union Scoreboard (see Chapter 2.4), but is much shorter[41].

The following sections provide a comparison of Austria with the EU15 countries (excluding Luxembourg – this "city-state" constitutes an exception in several areas), with the average of the EU15 and EU27, and with the USA.

Table 11: Sub-indicators for "Innovation and research"

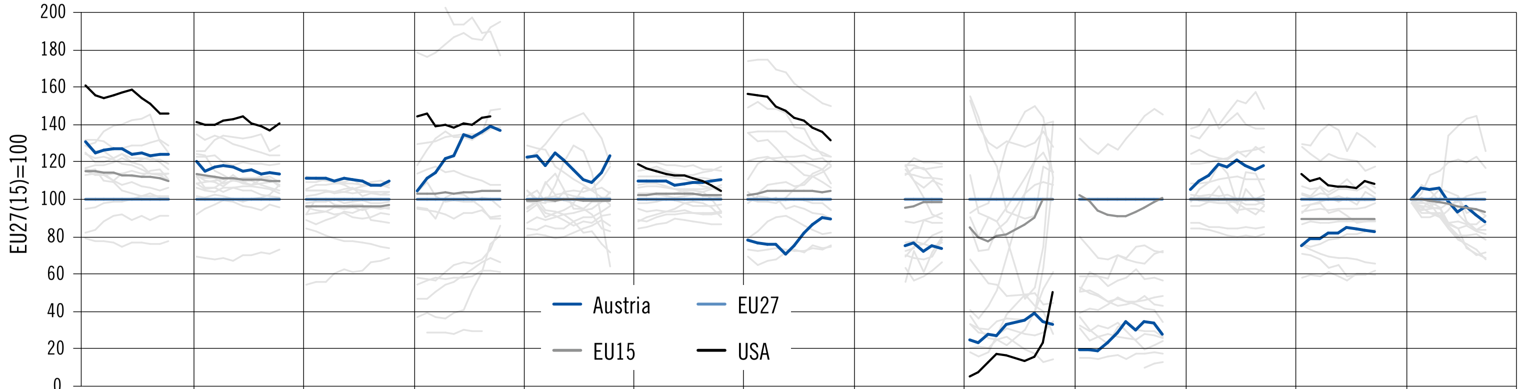
Spending on human resources:	**Spending on human resources (total public expenditure on education) as a % of GDP**
Gross domestic R&D expenditures:	as a percentage of GDP
Gross domestic R&D expenditures by financing source:	as a percentage of GERD
Internet access density – households:	Households with Internet access in % of total households
Tertiary degrees in scientific and technical subjects:	Proportion of graduates from scientific and technical disciplines per thousand of population between 20 and 29 years old
Patent registrations at the European Patent Office (EPO):	Patent registrations per one million citizens
Patent approvals at the United States Patent and Trademark Office (USPTO):	Patent approvals per one million citizens
Venture capital by type of investment phase:	as a percentage of GDP
ICT expenditures by type:	as a percentage of GDP
e-Commerce via the Internet:	Proportion of electronic transactions via the Internet of total firm turnover
Online availability of e-Government:	Percentage of online availability for 20 basic public services
Usage of e-Government by individual persons:	Percentage of persons between the ages of 16 and 74 who use the Internet to interact with government agencies
Usage of e-Government by enterprises:	Percentage of firms that use the Internet to interact with state agencies
Broadband penetration:	Number of broadband connections per 100 population
High technology exports:	Export of high-tech products as share of total exports

Source: Eurostat

41 Even if some aspects are much more detailed: the structural indicators also take into account gender-specific differences, but these were excluded for the purposes of this report.

Figure 27: Leading indicators, current status and development 2000–2010

Source: Eurostat; Calculations Joanneum Research



	GDP per capita			Labour productivity			Youth education attainment level			R&D expenditures (GERD)		
	Value	Year	Ranking	Value	Year	Ranking	Value	Year	Ranking	Value	Year	Ranking
Austria	**124**	2009	**3**	**113**	2009	**4**	**86.0**	2009	**3**	**2.8**	2009	**5**
EU27	100	2009		100	2009		78.6	2009		2.0	2009	
EU15	110	2009		110	2009		76.1	2009		2.1	2009	
USA	146	2009		141	2009					2.8	2008	
Belgium	116	2009	6	126	2009	2	83.3	2009	6	2.0	2009	7
Denmark	121	2009	4	103	2009	12	70.1	2009	12	3.0	2009	3
Germany	116	2009	6	105	2009	11	73.7	2009	11	2.8	2009	4
Finland	113	2009	8	109	2009	9	85.1	2009	4	4.0	2009	1
France	108	2009	10	121	2009	3	83.6	2009	5	2.2	2009	6
Greece	93	2009	13	98	2009	13	82.2	2009	7	0.6	2007	14
Ireland	127	2009	2	131	2009	1	87.0	2009	1	1.8	2009	10
Italy	104	2009	11	112	2009	5	76.3	2009	10	1.3	2009	13
Netherlands	131	2009	1	111	2009	6	76.6	2009	9	1.8	2009	9
Portugal	80	2009	14	75	2009	14	55.5	2009	14	1.7	2009	11
Sweden	118	2009	5	110	2009	7	86.4	2009	2	3.6	2009	2
Spain	103	2009	12	110	2009	8	59.9	2009	13	1.4	2009	12
UK	112	2009	9	107	2009	10	79.3	2009	8	1.9	2009	8

	Investments by firms			Employment rate			Employment rate of older workers			At-risk-of-poverty rate		
	Value	Year	Ranking	Value	Year	Ranking	Value	Year	Ranking	Value	Year	Ranking
Austria	**20.0**	2009	**1**	**71.6**	2009	**4**	**41.1**	2009	**11**	**12.0**	2009	**13**
EU27	16.2	2009		64.6	2009		46.0	2009		16.3	2009	
EU15	16.1	2009		65.9	2009		47.9	2009		16.1	2009	
USA				67.6	2009		60.6	2009				
Belgium	19.4	2009	3	61.6	2009	11	35.3	2009	14	14.6	2009	8
Denmark	16.1	2009	8	75.7	2009	2	57.5	2009	2	13.1	2009	11
Germany	16.0	2009	9	70.9	2009	5	56.2	2009	4	15.5	2009	6
Finland	16.7	2009	6	68.7	2009	7	55.5	2009	5	13.8	2009	9
France	17.2	2009	4	64.1	2009	9	38.8	2009	12	12.9	2009	12
Greece	13.8	2009	12	61.2	2009	12	42.2	2009	10	19.7	2009	1
Ireland	10.7	2009	14	61.8	2009	10	51.0	2009	7	15.0	2009	7
Italy	16.5	2009	7	57.5	2009	14	35.7	2009	13	18.4	2009	3
Netherlands	15.2	2009	10	77.0	2009	1	55.1	2009	6	11.1	2009	14
Portugal	17.1	2009	5	66.3	2009	8	49.7	2009	8	17.9	2009	4
Sweden	14.2	2009	11	72.2	2009	3	70.0	2009	1	13.3	2009	10
Spain	19.6	2009	2	59.8	2009	13	44.1	2009	9	19.5	2009	2
UK	11.9	2009	13	69.9	2009	6	57.5	2009	2	17.3	2009	5

	Long-term unemployment rate			Dispersion of regional employment rates			Greenhouse gas emissions			Energy intensity of the economy			Volume of freight transport relative to GDP		
	Value	Year	Ranking	Value	Year	Ranking	Value	Year	Ranking	Value	Year	Ranking	Value	Year	Ranking
Austria	**1.0**	2009	**12**	**3.3**	2009	**9**	**110**	2008	**5**	**138**	2008	**11**	**91**	2008	**7**
EU27	3.0	2009		11.8	2009		93	2008		167	2008		104	2008	
EU15	3.0	2009		11.9	2009		93	2008		150	2008		97	2008	
USA	1.5	2009								181	2008				
Belgium	3.5	2009	4	8.7	2009	3	91	2008	11	200	2008	2	73	2008	13
Denmark	0.5	2009	14	1.8	2009	13	92	2008	10	103	2008	14	74	2008	12
Germany	3.4	2009	6	4.3	2009	7	78	2008	14	151	2008	9	110	2008	3
Finland	1.4	2009	10	5.3	2009	6	99	2008	7	218	2008	1	76	2008	11
France	3.3	2009	8	6.9	2009	4	94	2008	9	167	2008	7	83	2008	10
Greece	3.9	2009	3	3.4	2009	8	119	2008	4	170	2008	6			
Ireland	3.4	2009	6				121	2008	3	107	2008	13	97	2008	5
Italy	3.5	2009	4	17.4	2009	1	105	2008	6	143	2008	10	92	2008	6
Netherlands	0.9	2009	13	2.3	2009	12	97	2008	8	172	2008	5	89	2008	8
Portugal	4.3	2009	1	3.3	2009	9	130	2008	2	182	2008	3	133	2008	1
Sweden	1.1	2009	11	3.1	2009	11	89	2008	12	152	2008	8	97	2008	4
Spain	4.3	2009	1	8.8	2009	2	140	2008	1	176	2008	4	124	2008	2
UK	1.9	2009	9	5.9	2009	5	81	2008	13	114	2008	12	87	2008	9

4.2.2 The leading indicators

The diagram in Figure 27 shows the development of each indicator over time (related to the EU27 countries, or, if data were not available for the EU27, then for the average of the EU15 countries). The following table shows the latest values, the affiliated year for the data, and the position within the EU15 (excluding Luxembourg).

In most of the leading indicators, Austria is on the "good" side of the EU country average (both the EU15 and the EU27): above average in indicators based on monetary values, below average in social "problem indicators". The indicators in detail:

The **general economic background** looks very good: in *GDP per capita* and *labour productivity*, Austria is at third and fourth place in the EU14. The trend falls over time against the EU27 average – for all countries under observation – indicating a convergence of these numbers in Europe (and this is certainly a very welcome development). In both figures, however, Europe still lags behind the USA.

Innovation and research reveals an above-average *educational attainment among youths* (86% have completed at least upper secondary education, versus under 80% in the EU27 and the EU15)[42]. *R&D expenditure* in Austria increased nicely and was able to exceed the EU15 level (1.9%) in 2000 to the current figure of 2.76% (about a third above the EU15 average, corresponding to fifth place within the EU15).

In **economic reform**, Austria is somewhat below the EU15 average (but above the EU27 average) in *comparative price levels*, although price increases in 2008 and 2009 lie above the EU15 average. *Business investments*, in contrast, were not only (significantly) above the EU averages, but also in the top group of comparison countries (the current first-place ranking is however an exception).

The indicators summarised under the keyword **employment**, however, convey a somewhat contradictory picture: Although Austria's overall employment rate is above average, among *older workers*, this rate is significantly below average (though with a slight upward trend; from 2000 to 2009, this value has risen from 29% to 41%; in the EU15, however, it has increased from 38% to 48%). An additional increase is necessary, not just for the financial viability of the pension system, but also to alleviate the anticipated lack of (highly) skilled workers.

The results in **social cohesion** are pleasing: all three indicators – *the at-risk-of-poverty rate, the long-term unemployment rate, regional distribution of employment* – place Austria significantly under the EU average, typically in the top group within the EU15[43].

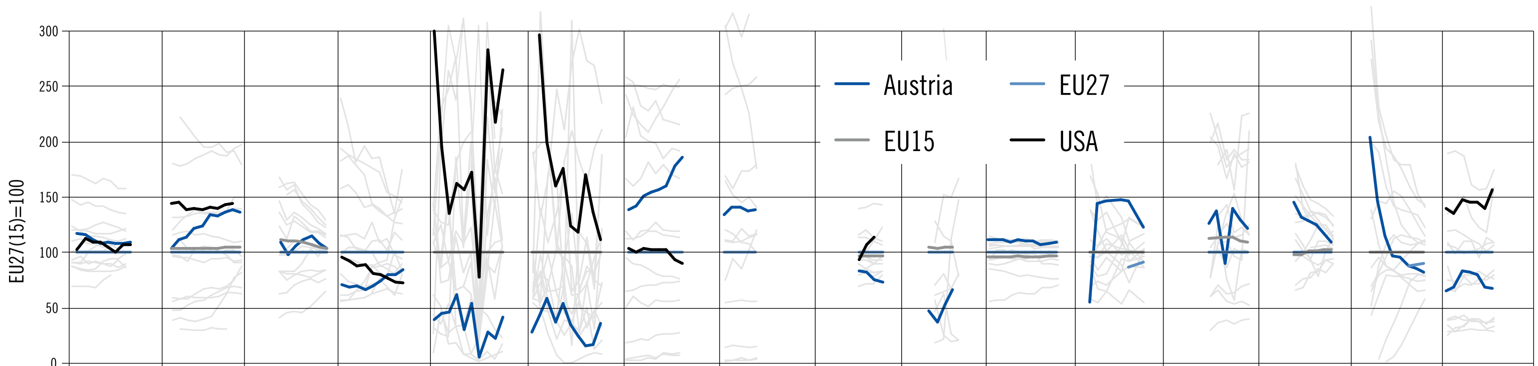
The last three indicators, which illuminate aspects of "sustainability", reveal a divergent development: in *greenhouse gas emissions*, Austria scores consistently at 20% above the EU average; in *energy intensity of the economy*, however, Austria falls below the EU average, with a mostly upward trend (there has been a slight regression in the last two years). A clearly falling trend is seen in *volume of freight transport*; currently, Austria is below the average of both the EU15 and the EU27.

42 This good placement in the formal qualification should not, however, conceal the fact that international comparative studies (such as the PISA test) identify certain lapses in education quality.

43 Although it must be pointed out here that good performance in the *long-term unemployment rate* (to some degree) is the flip side of poor performance in *employment of older workers.*

Figure 28: R&D indicators, current status and development 2000–2010

Source: Eurostat; Calculations Joanneum Research



	Spending on human resources			R&D expenditures (GERD)			Internet access density - households			scientific / engineering tertiary degrees			Venture capital: Start-up phase			Venture capital: Expansion phase			Patent filings EPO			Patent approvals USPTO		
	Value	Year	Ranking	Value	Year	Ranking	Value	Year	Ranking	Value	Year	Ranking	Value	Year	Ranking	Value	Year	Ranking	Value	Year	Ranking	Value	Year	Ranking
Austria	5.4	2007	6	2.8	2009	5	73.0	2010	8	11.8	2008	9	0.007	2004	11	0.027	2009	11	217.0	2007	5	44.9	2004	6
EU27	5.0	2007		2.0	2009		70.0	2010		13.9	2008								116.5	2007		32.3	2004	
EU15				2.1	2009		73.0	2010					0.017	2009		0.074	2009							
USA	5.3	2007		2.8	2008					10.1	2007		0.045	2009		0.083	2009		105.8	2007		273.8	2004	
Belgium	6.0	2007	3	2.0	2008	7	73.0	2010	8	11.6	2008	10	0.039	2009	1	0.139	2009	3	139.0	2007	7	38.0	2004	8
Denmark	7.8	2007	1	3.0	2009	3	86.0	2010	3	15.5	2008	6	0.036	2009	3	0.054	2009	8	194.1	2007	6	45.5	2004	5
Germany	4.5	2007	11	2.8	2009	4	82.0	2010	4	12.5	2008	8	0.018	2008	8	0.025	2009	12	290.7	2007	2	83.3	2004	2
Finland	5.9	2007	4	4.0	2009	1	81.0	2010	5	24.3	2008	1	0.033	2009	4	0.137	2009	4	250.8	2007	3	104.3	2004	1
France	5.6	2007	5	2.2	2009	6	74.0	2010	7	20.2	2001	3	0.019	2009	6	0.085	2009	6	132.4	2007	8	37.6	2004	9
Greece	4.0	2005	14	0.6	2001	14	46.0	2010	14	11.2	2008	13	0.002	2004	14	0.007	2003	14	9.8	2007	14	1.8	2004	13
Ireland	4.9	2007	10	1.8	2009	10	72.0	2010	10	19.5	2008	4	0.018	2009	8	0.016	2009	13	66.8	2007	11	38.8	2004	7
Italy	4.3	2007	13	1.3	2009	13	59.0	2010	11	11.3	2008	12	0.003	2009	13	0.041	2009	10	86.4	2007	10	18.1	2004	11
Netherlands	5.3	2007	8	1.8	2009	9	91.0	2010	1	8.8	2008	14	0.019	2009	6	0.075	2009	7	223.5	2007	4	57.7	2004	3
Portugal	5.3	2007	9	1.7	2009	11	54.0	2010	13	20.7	2008	2	0.018	2009	8	0.090	2009	5	11.4	2007	13	1.4	2004	14
Sweden	6.7	2007	2	3.6	2009	2	88.0	2010	2	13.2	2008	7	0.038	2009	2	0.156	2009	2	298.4	2007	1	56.8	2004	4
Spain	4.4	2007	12	1.4	2009	12	59.0	2010	11	11.6	2008	10	0.004	2009	12	0.052	2009	9	32.6	2007	12	5.0	2004	12
UK	5.4	2007	7	1.9	2009	8	80.0	2010	6	17.6	2007	5	0.026	2009	5	0.174	2009	1	89.2	2007	9	32.4	2004	10

	Expenditure for communication			e-Commerce via the Internet			Youth educational attainment level			Online availability of e-Government			Usage of e-Government by individual persons			Usage of e-Government by enterprises			Broadband penetration			High technology exports		
	Value	Year	Ranking	Value	Year	Ranking	Value	Year	Ranking	Value	Year	Ranking	Value	Year	Ranking	Value	Year	Ranking	Value	Year	Ranking	Value	Year	Ranking
Austria	2.2	2008	14	2.8	2007	7	86	2009	3	100	2007	1	39.0	2008	7	79.0	2009	9	21.8	2009	9	11.2	2006	9
EU27	3.0	2006		4.2	2007		79	2009		74	2009		32.0	2010		72.0	2009		23.9	2009		16.6	2006	
EU15	2.9	2006		4.4	2007		76	2009		81	2009		35.0	2010		74.0	2009		26.4	2009				
USA	3.3	2008																	0.0			26.1	2006	
Belgium	2.8	2007	7	3.4	2007	5	83	2009	6	70	2009	12	32.0	2010	10	81.0	2009	7	28.3	2009	8	6.7	2006	11
Denmark	2.5	2009	10	4.4	2004	4	70	2009	12	84	2009	6	72.0	2010	1	90.0	2008	2	37.2	2007	2	12.8	2006	8
Germany	2.7	2009	8	3.3	2007	6	74	2009	11	74	2007	11	37.0	2009	8	65.0	2009	13	29.4	2009	5	14.1	2006	6
Finland	2.5	2006	10				85	2009	4	89	2009	5	58.0	2010	5	96.0	2009	1	30.5	2009	4	18.1	2006	4
France	2.9	2009	5				84	2009	5	80	2009	8	37.0	2010	8	75.0	2009	11	29.2	2009	6	17.9	2006	5
Greece	3.3	2008	3	0.9	2007	9	82	2009	7	45	2007	14	13.0	2010	14	81.0	2005	7	15.6	2009	14	5.7	2006	13
Ireland	2.9	2009	5	9.8	2007	1	87	2009	1	83	2009	7	67.0	2010	2	89.0	2007	3	21.3	2009	10	29.0	2006	1
Italy	2.7	2007	8	0.9	2007	9	76	2007	10	70	2007	12	17.0	2007	13	83.0	2009	5	19.8	2009	12	6.4	2006	12
Netherlands	2.5	2007	10				77	2009	9	79	2009	10	59.0	2010	4	83.0	2009	5	37.7	2009	1	18.3	2006	3
Portugal	4.3	2009	1	2.7	2006	8	56	2009	14	100	2009	1	23.0	2010	12	77.0	2009	10	17.6	2009	13	7.0	2006	10
Sweden	2.4	2009	13				86	2009	2	95	2009	4	62.0	2010	3	86.0	2009	4	32.5	2008	3	13.4	2006	7
Spain	3.2	2008	4	6.2	2007	3	60	2009	13	80	2009	8	32.0	2010	10	65.0	2009	13	20.7	2009	11	4.9	2006	14
UK	3.7	2009	2	7.0	2007	2	79	2009	8	100	2009	1	40.0	2010	6	68.0	2009	12	28.8	2009	7	26.5	2006	2

4.2.3 The R&D-relevant indicators

Figure 28 shows the development and status of Austria's position among the R&D indicators.

Austria holds above-average positions among many of the indicators (although no top positions). Traditional weak points are science/engineering tertiary degrees, venture capital, ICT expenditures, and high-tech exports; strengths include R&D expenditures, patents, educational status and the Internet indicators.

The indicators in detail:

There is a slight downward trend in *spending on human resources*, although this indicator remains above the EU average, just like *education level among youths* (see notes in the discussion of the leading indicators). The reverse is true for *tertiary degrees in scientific and engineering disciplines*: although Austria still remains below the EU average, since 2000 it has made up some ground (in 2008, with 11.8 per thousand 20-29-year-olds, this figure was about 15% below the EU27 average, versus 30% in 2000).

The evaluation of *venture capital* expenditures is difficult, for both founding and expansion phases: both phases show high volatility internationally; Austria continues, however, to rank below the international average. A final evaluation of this matter is difficult and is the subject of several studies.

In contrast, though, the *patent indicators* are unambiguously positive: both applications to the EPO and approvals at the USPTO are significantly above the EU average, with even an upward trend for EPO applications.

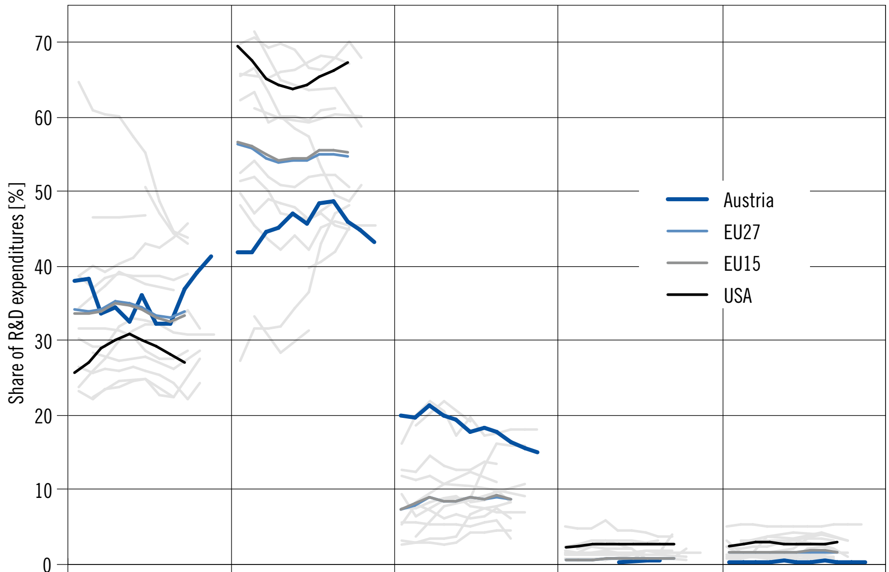
Expenditure on information technology and *communication* are somewhat below the EU average. In the case of communication expenditure, though, this can be attributed, at least partially, to the relatively low communication costs. Furthermore, Austria was significantly above the EU average in *broadband penetration*; the EU average has increased significantly in the meantime, which is why Austria's relative position has deteriorated. The same applies for *availability of e-Government*: here, Austria is the only country in its comparison group to have attained the maximum value of 100 since 2007; the "falling trend" can only be explained by the catching-up process of the other countries. Although Austria leads in its offerings, and the *usage of e-Government* is above average, interestingly, Austria is still far behind the group leaders; this applies to use by both enterprises and individuals.

A familiar (and often lamented) phenomenon is Austria's "weakness" in *proportion of high-tech exports*. This conceals, however, one of Austria's strengths, namely the general export success of Austrian firms. As the indicator shows, high-tech products account for a below-average proportion of exports; "high technology", however, is (also) a question of how "high-tech" is defined. The OECD, the originator of the definition, only applies this moniker to manufacturing firms, not to firms that generate "technological value added". "Intelligent" products such as mechanical engineering products, a field in which Austria holds a solid position, do not have a positive effect on this indicator, because mechanical engineering is defined as "only" medium-high technology[44,45].

44 Moreover, these values for the ratio of high-tech exports to total exports sink, because while they appear in the numerator, they do not show up in the denominator.

45 In the Innovation Union Scoreboard (IUS), medium- and high-tech exports are included, not just high-tech exports; in this report, Austria is above the average (see Chapter 2.4)

Figure 29: Financing share of total R&D expenditures; development since 2000 and current values



	R&D expenditures: State share			R&D expenditures: Corporate sector share			R&D expenditures: International share			R&D expenditures: University share			R&D expenditures: Private organisation share		
	Value	Year	Ranking	Value	Year	Ranking	Value	Year	Ranking	Value	Year	Ranking	Value	Year	Ranking
Austria	**41.2**	2010	**5**	**43.3**	2010	**13**	**15.0**	2010	**4**	**0.6**	2007	**9**	**0.4**	2010	**13**
EU27	33.9	2008		54.8	2008		8.7	2008		0.9	2008		1.7	2008	
EU15	33.3	2008		55.3	2008		8.8	2008		0.9	2008		1.7	2008	
USA	27.0	2008		67.3	2008					2.7	2008		3.0	2008	
Belgium	22.2	2007	14	61.4	2007	3	13.0	2007	5	2.8	2007	3	0.7	2007	10
Denmark	28.4	2009	10	60.2	2009	4	8.7	2009	8	0.3	2007	11	2.7	2009	4
Germany	28.4	2008	10	67.3	2008	2	4.0	2008	13				0.3	2008	14
Finland	24.0	2009	13	68.1	2009	1	6.6	2009	11	0.1	2009	13	1.1	2009	8
France	38.9	2008	6	50.7	2008	7	8.0	2008	9	1.2	2008	7	1.1	2008	8
Greece	46.8	2005	1	31.1	2005	14	19.0	2005	1	1.7	2005	4	1.5	2005	7
Ireland	31.5	2009	8	50.8	2009	6	15.6	2009	3	1.6	2009	5	0.5	2009	12
Italy	42.9	2008	4	45.2	2008	11	7.8	2008	10	1.3	2008	6	2.8	2008	3
Netherlands	36.8	2007	7	48.8	2007	8	10.6	2007	6	0.2	2007	12	3.6	2007	2
Portugal	43.7	2008	3	48.1	2008	9	3.0	2008	14	3.6	2008	1	1.7	2008	6
Sweden	27.3	2009	12	58.9	2009	5	10.5	2009	7	0.6	2009	9	2.6	2009	5
Spain	45.6	2008	2	45.0	2008	12	5.7	2008	12	3.2	2008	2	0.6	2008	11
UK	30.7	2010	9	45.4	2010	10	17.7	2010	2	1.2	2010	7	4.9	2010	1

Source: Eurostat; calculated by Joanneum Research

R&D financing

In conclusion, we will assess in detail the structure of R&D financing (Figure 29): In general, Austria has an average government share in this financing, above-average share in financing from abroad, and – in direct opposition – below-average shares from firms[46]. However, we must proceed on the assumption that international financing comes primarily through international firms; the "66%" target given in the Lisbon Agenda for the share of financing from firms was therefore – in Austria as in the EU – practically fulfilled before the crisis of 2008 erupted; since then, the state share has climbed significantly (current figures are not available for the EU level, because the most current figures for most states are from 2007 or 2008). Those states for which more recent data are available, however – with the exceptions of the United Kingdom and Ireland – show marked increases in state shares (Denmark, Finland, Sweden).

The fact that a share of financing for overall R&D expenditure falls to the higher education sector – even if it is a low share of financing – may be surprising at first glance. This is a minimal amount in Austria (ca. € 43 million), which is subsumed nationally under "financing by the government sector" and only reported separately at the EU level.[47]

4.2.4 Summary

Austria's position in the 14 leading indicators is good: for most of them, Austria is on the "good side" (sometimes very much so) of the EU average. Austria only has poor positions in the employment of older workers (although this is offset, at least partially, by a good position in long-term unemployment), as well as greenhouse gas emissions.

The picture is somewhat more divergent in the R&D-relevant indicators: in addition to clear strengths (R&D expenditures, patents, Internet indicators), there are also clear weaknesses (tertiary education in scientific and engineering disciplines, venture capital). The weaknesses in high-tech exports and in ICT expenditures, however, require a more nuanced interpretation.

46 As is also the case for the comparison countries, higher education institutions and private non-profit organisations make only a small contribution to financing.

47 We are speaking here of the university sector's own funds that it uses to pay for research. These funds are mainly third-party funds e.g. from certifications, clinical tests, non-clinical tests, and investigations on behalf of third parties; also income from donations, sponsoring and other sources do not require (research) services.

5 Internationalisation of RTI

Multi-/international firms are the main drivers of research, technology and innovation (RTI). The features of today's global economy are behind this trend: markets are becoming more demanding and more fragmented and the competition more global and stronger; products and services are becoming more technology-intensive with shorter life cycles. One consequence is that firms have less time to develop products to reach market maturity and invest more in R&D, the costs of which have to amortise quickly. This faces firms with the question of the best way to organise R&D: should it all be done centrally at firm headquarters or locally in important markets or at attractive centres of knowledge? Should they work on their own or cooperate with partners from the business and academic worlds? Which R&D work should be done in-house and which contracted out?

This means that firms are making decisions at overall and individual project level about how and where (in-house, externally or in cooperation with others) they can best carry out their R&D. Common buzzwords here are "outsourcing" and "offshoring": "outsourcing" means buying primary products and services from other firms regardless of whether these firms are based at home or abroad. "Offshoring" on the other hand describes the process of buying primary products and services abroad regardless of whether these firms are subsidiaries or third parties (Kirkegaard 2004, OECD 2008b). In addition, there are hybrid organisational forms, such as joint ventures, cooperation agreements and technological alliances (Hatzichronoglou 2008) (Table 12).

Table 12: Ways of managing R&D

	National	International (Offshoring)
***Between firms* (outsourcing)**	Outsourcing at home	Outsourcing abroad
Cooperation/Alliances	Cooperation at home	International Cooperative
Within one firm (insourcing)	Insourcing at home	Insourcing abroad

Source: OECD 2008b, p. 17, amended

Economies of scale and economies of scope arising from the bundling of activities favour centralising all R&D measures at one location. The proximity also makes it easier to control and manage the work and makes coordination and communication more efficient. And this prevents undesirable leaks of knowledge. Such a central strategy also saves firms the costs of establishing, maintaining and coordinating local R&D units, relying instead on organically developed competencies, networks and institutional strengths (Narula and Zanfei 2006, Gammeltoft 2006, OECD 2008b).

At the same time, aiming at a global market often means localising R&D, both physically and organisationally, which has only just become at all feasible as a result of the latest information and communication technology, the formalisation and modularisation of products and processes (Gammeltoft 2006). Motives favouring a local strategy may be summarised as follows:

- Market requirements: Penetrating/cultivating large and dynamic markets abroad with their own customer requirements make it necessary for products to be adapted or developed locally.

- Supporting production abroad: Production processes are not always standardised but frequently have to be adapted to local conditions and raw materials. And production processes cannot always be developed away from the actual production facility. Both tasks make a local R&D unit advantageous.
- Access to knowledge and technologies: A presence in different locations allows firms to acquire knowledge that is inextricably linked to the localities and people living there. This transfer of knowledge takes place by cooperating with local universities and research institutes, participating in and informally exchanging knowledge in knowledge networks and recruiting highly qualified personnel.
- The proximity to customers and suppliers not only provides access to knowledge but facilitates cooperation in joint R&D projects.
- Reducing costs: Global differences in pay for R&D personnel and the costs of establishing/maintaining research facilities enable firms to efficiently outsource resources when R&D is organised locally; direct or indirect R&D subsidies can also be used to optimise costs.
- Shortening project times: Taking advantage of wage differences and distributing R&D over various time zones make it possible to employ more R&D staff and to work 24/7.
- Overall political/institutional conditions: Establishing R&D units abroad is occasionally motivated by national governments linking market penetrations subject to conditions, such as establishing R&D competencies or transfers of technology. Tax relief, financial subsidies, legal restrictions (e.g. on stem cell research) or the opportunity for large-scale trials (e.g. clinical tests) may also determine the decision (see Bielinski 2010, OECD 2008b, Hakanson and Nobel 1993a, b, Le Bas and Sierra 2002, Edler et al. 2003, Belitz 2004, Ambos 2005).

Obviously, the specific features of a firm or external factors can also sway decisions on internationalising R&D. For instance, it is easier for large firms than small ones to establish capacity abroad, as they have more resources (Belderbos 2001) and often possess the necessary organisational competencies for coordinating locations away from central headquarters (Castellani and Zanfei 2004). The sector concerned or a firm's position in production networks can also affect matters: for instance, the activities of suppliers' major customers often determine their efforts at internationalisation (Narula 2002). The technological capacities in the country of origin versus the target market can also have a major influence on the strategic decision. For example, international R&D can help firms from small countries of origin overcome the limited diversity and heterogeneity of their knowledge base. (Narula 2003).

This means that internationalisation of R&D continues to be concentrated on certain sectors and regions: the main players in international R&D investments come from the pharmaceutical, chemicals, automotive, electronics and computer sectors (Hatzichronoglou 2008, OECD 2006), and their R&D activities are mainly restricted to the US, Europe and – to a lesser extent – Japan. However, more recently emerging markets, such as China and India, have been increasingly benefiting from this trend, as may be seen from firm surveys and case studies (Veugelers et al. 2005, UNCTAD 2005, United Nations 2005, Narula and Zanfei 2004, OECD 2006, Reddy 2000, Thursby and Thursby 2006, Berger et al. 2010, Karlsson 2006).

We shall now take a closer look at the R&D activities of Austrian firms abroad (the "outward dimension"), so that we can then analyse the significance of firms controlled from abroad on R&D activity in Austria (the "inward dimension").

5.1 Internationalisation of operational R&D by Austrian firms

Despite the great scientific and political interest in the internationalisation of R&D, the level of data on the foreign R&D activities of domestic firms is unsatisfactory and does not allow a comprehensive picture of the internationalisation of R&D to be painted. For instance, there are practically no data on the subject in the relevant OECD or Eurostat databases and when there are any – as in the case of the OECD database on the outward R&D activities of multinational firms – detailed information is restricted to very few countries (Japan and the US). That is why the analysis of the R&D activities of Austrian firms initially has to consider individual indicators (innovation cooperation and patents) and purely national sources (off-shoring R&D abroad). In order to have a better insight, we then present selected results of the (unrepresentative) firm survey on "Internationalisation of R&D", which Joanneum Research first carried out under a mandate from the Federal Ministry of Transport, Innovation and Technology in 2010 (Berger et al. 2010).

5.1.1 International innovation cooperation

The European Community Innovation Survey (CIS) asked a random selection of firms in all EU member states about their innovation activities. Firms that had introduced product or process innovations within the last three years, were currently working on them or had ceased to do such work were asked with whom they had performed such innovation cooperation and in which region their partner was resident. Naturally, the term "innovation" is much broader than the term "R&D". But we may assume that the geographical spread of R&D cooperation is not significantly different to that of innovation cooperation. Figure 30 shows for selected countries the proportion of countries active in innovation that claim, when they have innovation collaboration, to cooperate with partners from the same country, from Europe, the US, China/India or the rest of the world.

The figures demonstrate across Europe a significant concentration of innovation cooperation within the same country and the European Research Area. Accordingly, 34% of firms active in innovation in Austria report that they cooperate with domestic partners and 24% with European partners. Cooperation with firms outside Europe – the US (3%), China/India (2%) or the rest of the world (3%) – is very rare. This pattern generally relates to all the countries and demonstrates convincingly the significance of (relative) proximity for these forms of cooperation.

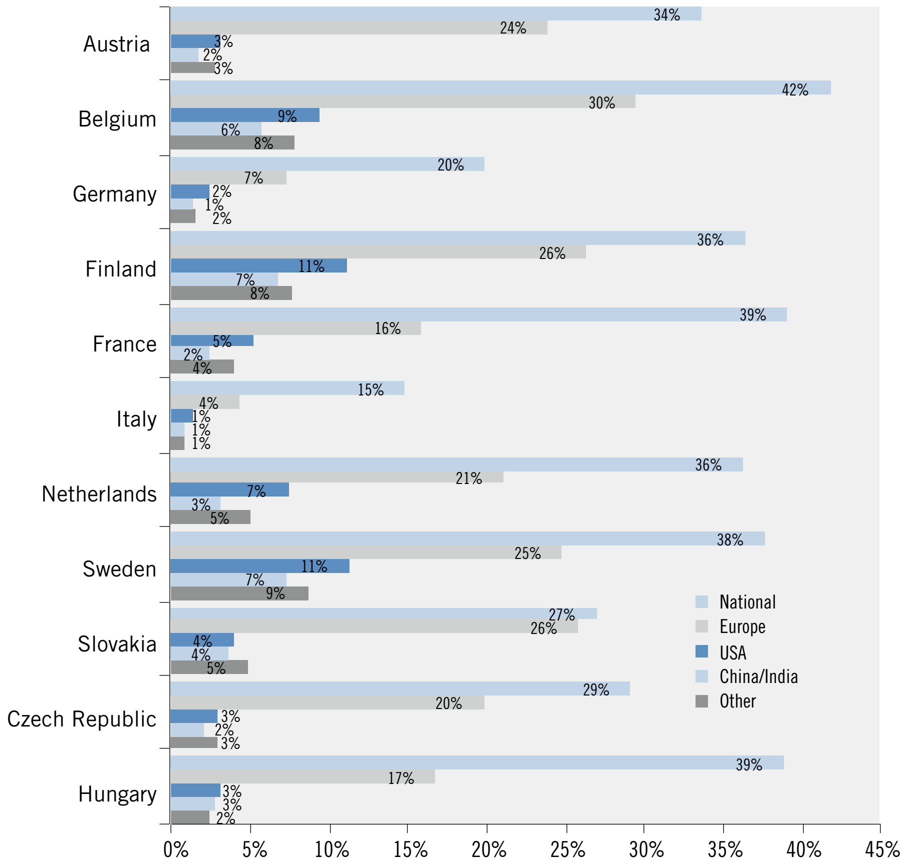
There were, however, differences in the individual ratios for countries: for example, firms in some Scandinavian countries had much higher cooperation ratios with partners from outside Europe, and firms in some small countries cooperate more frequently with European partners than firms from big countries. The reasons for these differences may be found in the size and economic structure of the national economies, the number of innovative firms and research facilities in them and their historical level of international orientation. In addition, the term "cooperation" may be assumed to have different connotations in different languages, ranging from informal to "contractually sealed", with a corresponding effect on the way the questions were answered.

5.1.2 Identifying research locations on the basis of patent data

Patent data allow conclusions to be drawn on firms' research locations. Since patent filings require the name and address of both the applicant (usually a firm) as well as the inventor, the locations of the development work for patent filings by Austrian firms can be identified.

In all, 23% of the approx. 3,800 Austrian applications to the European Patent Office (EPO) and 26% of the almost 3,100 applications to the World Intellectual Property Organisation (WIPO; via PCT procedure[48]) between 2005 and 2007 registered at least one foreign inventor. While the number of patent filings rose by 70% (EPO)/135% (WIPO/PCT), the proportion of patents with foreign inventors actually fell:

Figure 30: Proportion of firms active in innovation[1] that carry out innovation cooperation with partners[2] from the following regions (2006–2008)



1 Firms with technological innovations ((product and process innovations, ongoing and cancelled product and process innovations)

2 Every partner category (other firms within the group, suppliers of equipment, raw materials, primary products or software, contractors or customers, competitors or other firms from the same sector, consultants, commercial laboratories or private R&D facilities, universities, universities of applied sciences or other tertiary centres of education, other government or public-sector research facilities)

Source: CIS2008, Eurostat 2010, calculations by Joanneum Research

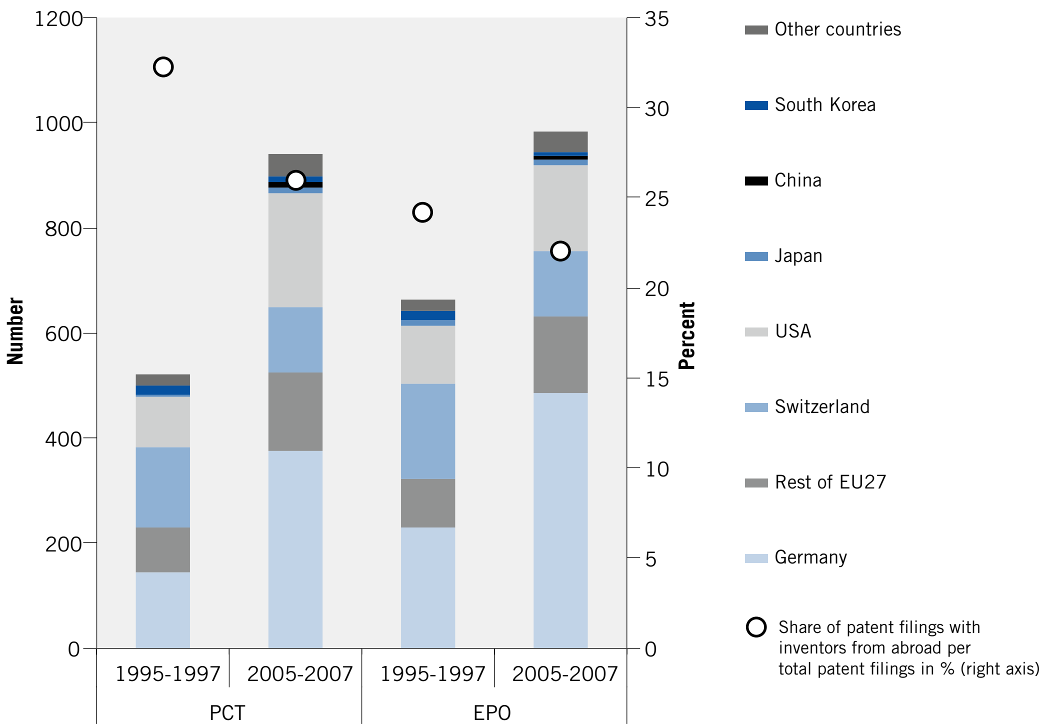
48 Patent Cooperation Treaty, where patents can be listed through a central international registration at the WIPO. Although the patents still have to be registered with the national patent offices, the PCT procedure gives the applicant more time to do so. These days, this is considered to be the most popular procedure for registrants that have an eye on global markets (OECD 2009).

between 1995 and 1997, 32% (EPO)/24% (WIPO/PCT) of the applications registered foreign inventors.

These results mean, first, the bulk of the research that ends up with patent filings by Austrian firms is carried out in Austria. Second, it indicates that there is no evidence that the expansion of R&D abroad has led to a reduction in research in Austria. One should, however, take into account that patent filings are "lagging" indicators, as it takes a relatively long time until (newly established) research activities generate patentable knowledge, and up to 18 months can pass before a patent filing is published.

Applications including participation by foreign inventors show a heavy concentration on just three countries (Figure 31): Germany, Switzerland and the US account for the bulk of the foreign discoveries filed as patents by Austrian firms, making them the most significant research locations for R&D units. Overall, European locations predominate: inventors from the EU 27 participate in around two-thirds of all Austrian PCT filings and three-quarters of all EPO filings with at least one foreign inventor. Although the significance of emerging markets, such as China and India, has risen, it is still extremely low.

Figure 31: Proportion of Austrian patent filings with foreign inventors and country of origin of the foreign inventors[1] (1995–1997 and 2005–2007 with WIPO/PCT and EPO)



1 Several inventors from different countries may be participants in the same filing, which is why the number here is higher than the total number of patent filings with foreign inventors; the dates relate to the Priority Date.

Source: OECD.StatExtracts - Patent Statistics 12/2010, calculations by Joanneum Research

A comparison with selected countries (Table 13) shows that the proportion of patent filings of Austrian firms with foreign inventors is still relatively low among smaller European countries: Finland, Sweden and the Netherlands but, above all, Ireland and Switzerland all have much higher figures. This is one indication that internationalisation of R&D is much further advanced in these countries and that more research capacity is being established abroad. On the other hand, the proportion of patent filings with foreign inventors is typically lower in large economies (see Guellec and van Pottelsberghe 2001), as the figures for Germany and the US demonstrate. The Czech Republic also registers a lower proportion.

The geographical pattern is comparable between the different countries. Although the concentration on European research locations (inventors) is even heavier in Austria than in the other European countries being compared, the reason for this is likely to be found in the prominent role played by Germany. The very close economic, cultural and linguistic ties explain this; Swiss filings also register a large number of German inventors. As far as the participation of Asian inventors is concerned, the figures for Austria are relatively low: when it comes to the involvement of Japanese or Chinese inventors, only Ireland, Switzerland and, to an extent, the Czech Republic report a similarly low level. For most of the countries being compared, India's significance was extremely low – exceptions here are the US, the Netherlands and the Czech Republic.

Overall, the evaluations of the above indicate that the level of internationalisation of R&D in Austria compared with other small, open economies (Switzerland, Sweden, Finland and the Netherlands) is not yet very advanced. In addition, internationalisation amounts primarily to Europeanisation with a significant focus on Germany and – to a lesser extent – on Switzerland. Outside Europe, only the US currently plays a role as R&D location. This also tends to apply in the other European countries, even if occasionally to a lesser extent.

Table 13: Proportion of PCT patent filings from selected countries with foreign inventors[1] (2005–2007)

Inventor / Applicant	AT	CZ	DK	FI	DE	IE	NL	SE	CH	US
Proportion of all patent filings										
Number of foreign inventors/ aggregate number of inventors	25.9	14.1	20.4	31.1	17.1	49.7	42.8	33.7	63.9	14.5
Proportion of patent filings with foreign inventors										
EU27	*66.3*	*67.3*	*58.3*	*58.4*	*53.5*	*59.8*	*53.8*	*58.0*	*67.2*	*53.8*
Germany	47.4	21.8	10.4	16.5	---	6.5	16.5	14.1	29.6	14.2
USA	27.1	12.7	30.1	25	24.3	37.1	38.2	29	30.8	---
Switzerland	15.8	5.5	1.9	1.8	9.3	2.7	3.8	1	---	2.8
Japan	1.4	5.5	3.1	6.6	3.2	0.8	3.2	3	1.6	7.9
China	1.3	0	2.9	6.8	3.6	0.6	4.2	3.5	1.7	6
India	0.4	3.6	0.4	0.6	0.9	0.5	2.9	0.6	1	4.2

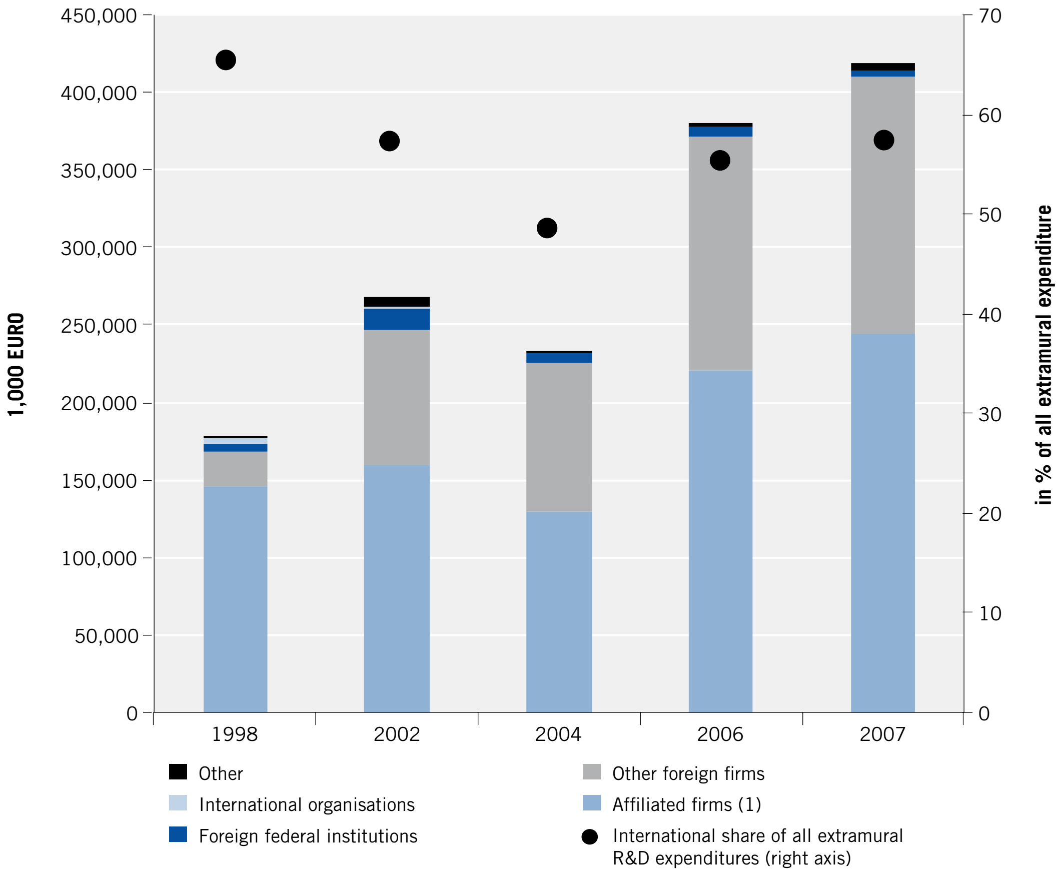
1 As several inventors from different countries may have participated in one filing, the totals for the proportions do not add up to 100; the dates relate to the Priority Date.
Source: OECD.StatExtracts – Patent Statistics 12/2010, calculations by Joanneum Research

5.1.3 Granting R&D mandates abroad

In the survey on research and experimental development, firms running R&D activities were also asked about the research mandates they grant. A distinction was made between mandates granted to affiliated firms, other firms and other facilities, both at home and abroad. Figure 32 shows that the absolute figure for R&D mandates granted abroad has risen significantly over the last ten years – despite a drop in 2004. This also applies to expenditures paid to affiliated (subsidiary) firms. The proportion of expenditures abroad of the total amount of external R&D expenditures remains, however, relatively constant at just under 60%, showing a robust structure over time.

Of these external R&D expenditures, in 1998 around 80% went to affiliated firms and a good 10% to other firms. Since 2004, a significant increase in the outsourcing of R&D activities to other firms may be observed. In the meantime, only just under 60% of the external R&D expenditures abroad go to affiliated firms while 40% go to other firms. Other contractors, such as government facilities or

Figure 32: Expenditures for external R&D in a firm's own area paid to foreign contractors by type of contractor (at constant 2000 prices)*



* Based on implicit GDP Price Indices from the OECD MSTI database Includes the categories "Subsidiaries or affiliated firms" and "Joint ventures" (1998); "Foreign affiliated firms" (2002, 2004); and "Foreign subsidiaries" and "Other foreign affiliated firms" (2007)

Source: Bauer et al. 2001, Messmann and Schiefer 2007, Schiefer 2006, 2008, 2009; OECD MSTI 2/2010, calculations by Joanneum Research

international organisations only play a marginal role.
Manufacturing firms were the prime ones granting R&D mandates abroad, accounting for 90% of external R&D expenditures abroad in reporting year 2007. Historically, the focus here has been on the segments "Electrical machinery and generators" (30%)[49], "Motor vehicles and parts for motor vehicles" (26%) and "Pharmaceutical products" (16%).

There is no information on the target regions for the R&D mandates granted abroad. That is why the main results of the firm survey on the internationalisation of R&D (Berger et al. 2010) are presented below, containing in addition comments on motives, effects and obstacles.

5.1.4 Internationalisation of R&D from a business perspective

With the aim of being able to make specific comments on current and future activities abroad, Joanneum Research interviewed around 5,700 Austrian firms in 2010 that had applied for a research grant with the Austrian Research Promotion Agency (Forschungsförderungsgesellschaft GmbH) since 2005[50]. 410 of these firms took part in the survey (7% response rate), which did not claim to be representative of Austrian business[51] but only to give some insight into the behaviour of these firms.

In all, 88% of the firms that replied reported carrying out R&D in Austria between 2007 and 2009. Research here includes internal research, the granting of R&D mandates to third parties (external R&D) and participating in R&D cooperation or alliances. The most common form of research was internal (85% of the firms do their own research in Austria), followed by forms of R&D cooperation (62%) and the granting of R&D mandates (51%).

Just under half of the firms that responded (45%) also carried out one or other of these research activities abroad. Predominant here were forms of cooperation/alliances (37% of all the firms), ahead of external R&D (27%) and internal R&D at subsidiaries (15%). Whether firms do research abroad mainly depends on their size: larger firms tend much more to do research abroad.

Forms of R&D cooperation and alliances are heavily concentrated on Germany: 75% of the firms with one or more forms of cooperation/alliances declared that they worked with (at least) one partner in Germany. France (16%), Switzerland (15%), Italy (13%) and other European partners – not least presumably because of the EU Framework Programmes – are other countries where cooperation partners often have their registered offices. Forms of cooperation outside Europe are mainly with the US (13%) and only very rarely the odd case of cooperation with other countries outside Europe.

R&D mandates also mainly go to Germany. 69% of the firms with external R&D have German contractors. Next comes the US (12%), Switzerland (10%) and France (7%). Emerging markets like China, India and Brazil only play a very small role in either form of R&D abroad.

This picture changes when we look at the

49 In the surveys taken before 2007, a similarly high portion fell to the branches radio, television and telecommunication equipment. The cause of the shift is probably mainly due to the new classification of one major corporation.
50 In this process, all funding applications were considered no matter whether they were approved or not. Applicants for the innovation voucher were also considered.
51 Compared to the 2007 R&D survey, there are larger deviations in particular in trade (which was under- represented in the survey about internationalisation of R&D – IFE 2010) and the economic services (over- represented in the IFE 2010). As regards R&D expenditure and R&D personnel, the IFE 2010 sample is also obviously shaped most strongly by firms from the pharmaceutical industry and ICT services.

locations of firms' own R&D units abroad (subsidiaries). Although Germany is here once again the most popular location (42% of all firms with internal R&D abroad) ahead of the US (19%), they are followed up by China (11%) with the Czech Republic close behind (11%). Besides other European countries like Switzerland and Hungary, there are also reports of the odd case of locations in India, Singapore, Canada and Brazil.

Motives

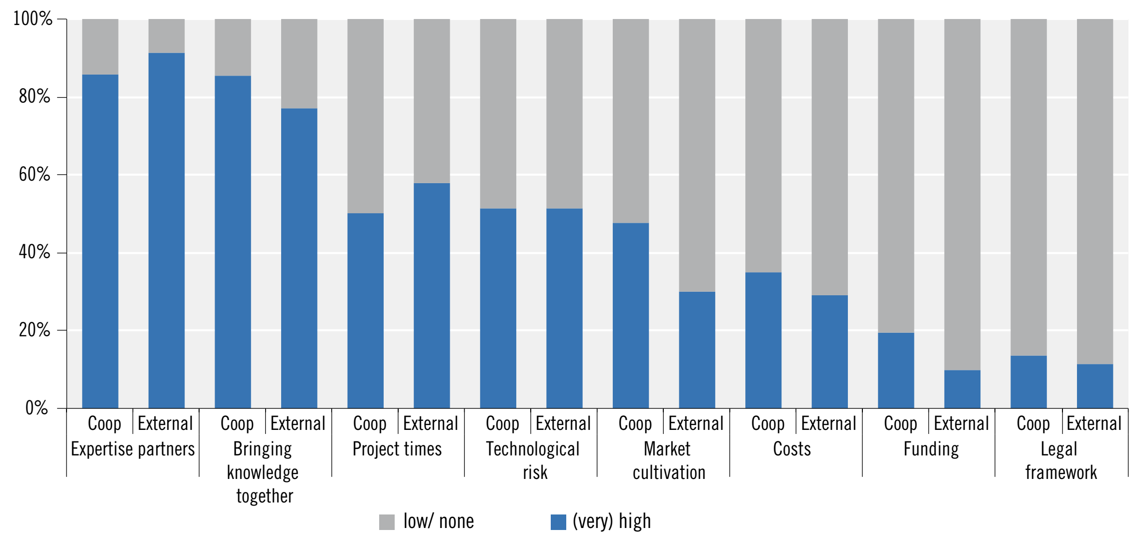
The main factor with forms of R&D cooperation and R&D mandates is access to knowledge (the expertise of the partners) or bringing sources of knowledge together. Firms also want to use this to shorten the length of projects and reduce technological risks (Figure 33).

It is somewhat different with internal research carried out abroad: here it is marketing arguments that predominate: on the one hand, the (present or future) significance of the market and, on the other, the proximity of the production facilities. But knowledge-relevant factors, such as the availability of R&D personnel and the proximity of innovative firms, also tempt Austrian firms abroad (Figure 34). A geographical pattern emerges here: the motive for carrying out R&D outside Europe is often the proximity to production. While the R&D headquarters at a firm's registered office can look after production facilities within Europe, this is no longer so easy in other continents owing to the greater distance. For locations in Asia, Eastern and Southeastern Europe, market potential, lower costs and necessity all favour following the customers.

An important motive for R&D in Western Europe is access to knowledge. One element that makes this clear is the fact that strategic research and new developments for the global market are overwhelmingly carried out in Western Europe while specific development and construction or developments and adaptations for local markets are carried out globally.

One fact that became very clear from the

Figure 33: (Very) important motives for R&D cooperations and R&D mandates abroad



Source: Berger et al, 2010

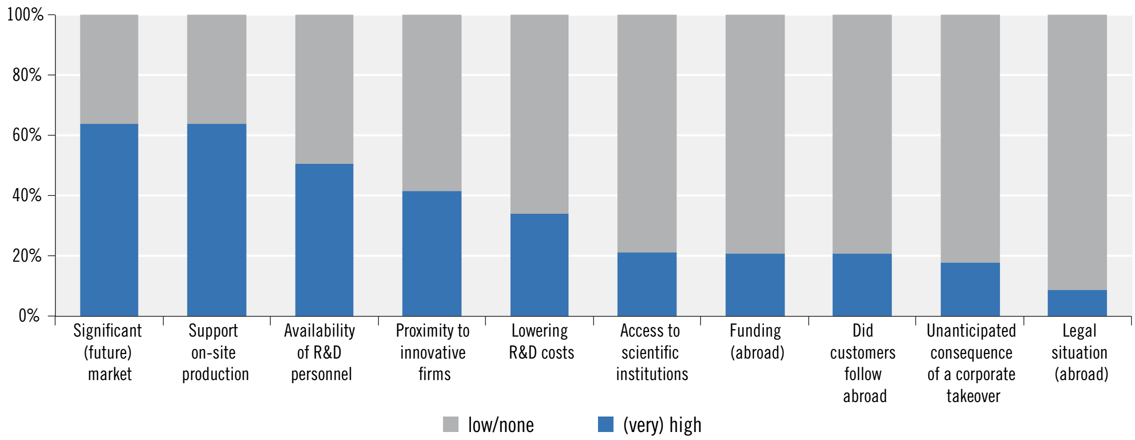
survey was that R&D funding abroad does not play much of a role either for internal or external R&D.

Effects and obstacles

By far the most frequently quoted effect of R&D abroad is that it gave firms access to knowledge and/or technologies that they would not otherwise have had (Figure 35). Taken together with the previously reported most important reasons for forms of R&D cooperation or mandates (expertise of the partners and bringing sources of knowledge together), this is a clear sign that R&D abroad triggers or at least enables substantial flows of knowledge into Austria. There is no evidence of major problems with undesirable outflows of knowledge: only a very small number of firms report the outsourcing of competencies abroad. And firms with experience of R&D abroad are precisely the ones that are less concerned about outflows of knowledge than firms without such experience.

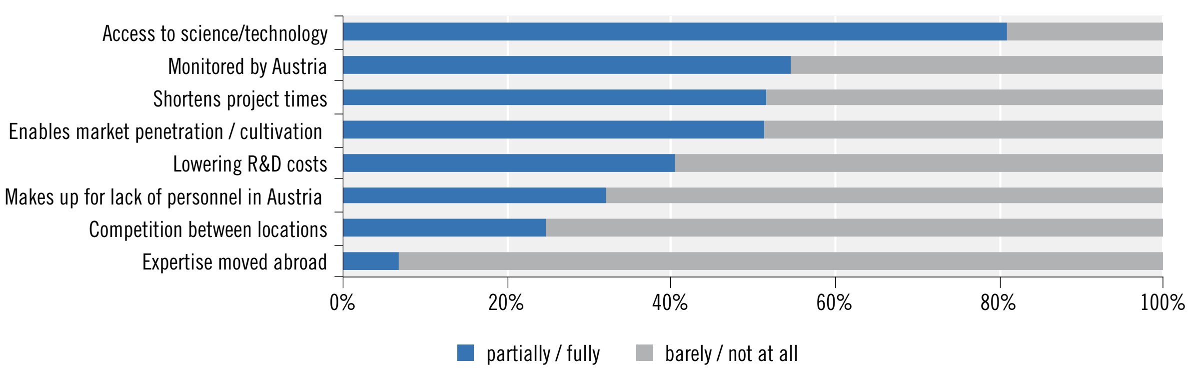
The biggest obstacle to establishing or augmenting R&D abroad is that firms simply do

Figure 34: (Very) important motives for in-house R&D at subsidiaries abroad



Source: Berger et al, 2010

Figure 35: Results of R&D activities abroad

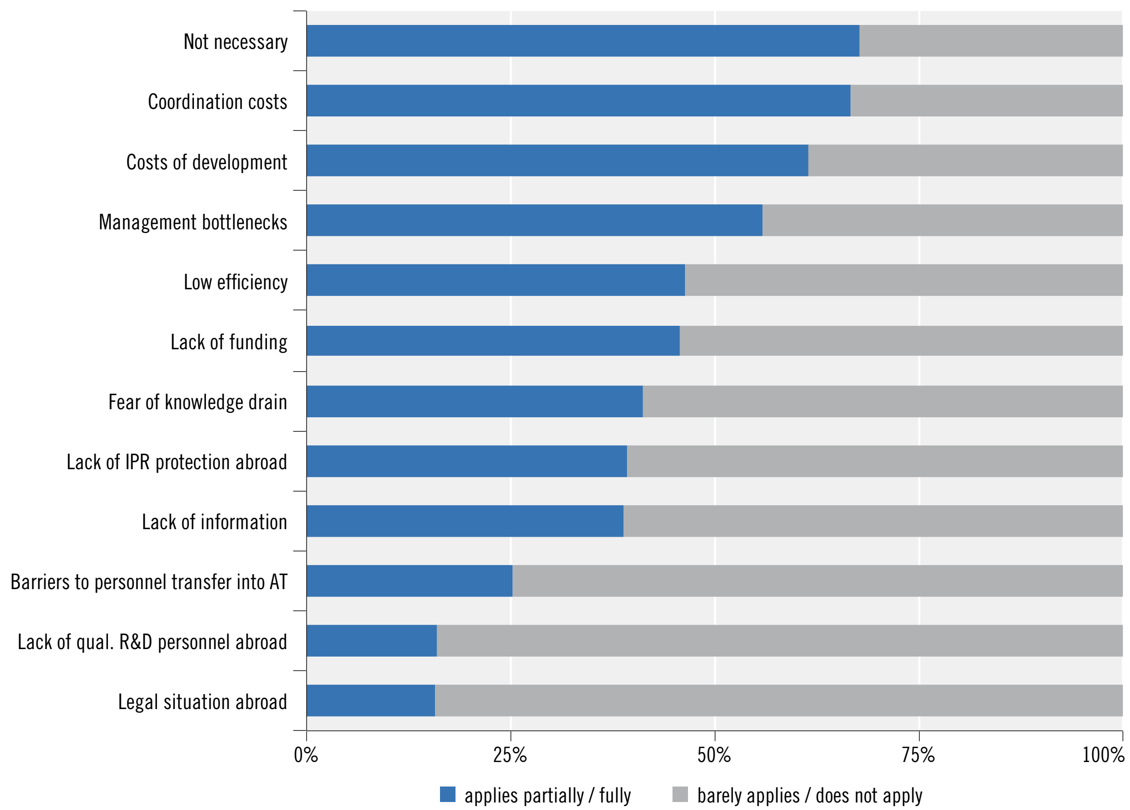


Source: Berger et al, 2010

not consider it necessary to be (more) active in this field. However, transaction costs also play a major role in establishing, coordinating and financing R&D abroad. Further barriers are presented by the inefficient exchange of knowledge between different locations/partners and by management bottlenecks (Figure 36). Additional qualitative interviews with firms also make clear how very relevant geographical (and cultural) proximity to colleagues, cooperation partners and contractors is, as this makes working together so much easier.

Despite a number of obstacles, more than half of the firms asked are planning to establish or augment R&D abroad. Of the firms that are already active abroad, they form the overwhelming majority. Most commonly they are interested in R&D cooperation. They are continuing to concentrate heavily on Europe for their planned investments in new or expanded R&D. Nevertheless, one in four firms are (also) intending to look for cooperation partners or contractors outside Europe. Target regions for this are primarily the US, China and India. Besides the concentration on Europe, it is notable how widely spread the target regions are: the firms surveyed named 45 different countries for future partners in forms of cooperation or for R&D mandates and 28 countries for internal R&D locations.

Figure 36: Obstacles to (more) R&D abroad



Source: Berger et al, 2010

5.1.5 Summary

This chapter shows that domestic cooperation continues to be the dominate form of innovation cooperation. The internationalisation of RTI by Austrian firms primarily means a Europeanisation with a specific focus on the German-speaking neighbouring countries of Germany and Switzerland. Outside Europe, only the US currently plays a role as an R&D location. These structures will likely remain the same in the medium term. The importance of emerging countries such as China remains low, but will certainly increase significantly. Compared to other small, open economies like Switzerland, Sweden, Finland and the Netherlands, the level of internationalisation is so far still low.

There is no empirical evidence that R&D activities are being outsourced to countries abroad. The proportion of Austrian inventors in patent filings by Austrian firms has even risen over the last ten years and the proportion of R&D mandates granted abroad has remained constant for years. The main motive for R&D abroad is rather the access to knowledge and support for production and/or marketing abroad. But the system of R&D grant subsidies prevailing abroad has no role in R&D activities abroad.

5.2 R&D activities by foreign firms in Austria

Austria is a small open economy and very well integrated internationally. One sign of this integration is, for instance, the rise in the amount of direct investments from abroad in recent decades. In addition to these direct investments, the proportion taken up by foreign firms in research and development (R&D) in the corporate sector has risen substantially.

This fact leads to questioning the effects of such a strongly internationally integrated economy. The high proportion taken up by foreign firms is, first, evidence of Austria's attraction as a location; but it also carries potential risks for the domestic system of innovation.

We consider in more detail below some aspects of the involvement of foreign firms in research and development in Austria. Specifically, this section will look into the following questions:

- How are the R&D activities of foreign firms in Austria distributed by sector and country of origin?
- How do foreign firms in Austria finance their research and development?
- What effects has the global economic and financial crisis had on the R&D research activities of foreign firms in Austria?

All of these questions are of direct political relevance. One of the motives for multinational firms choosing where to settle might be tax implications. For instance, the Austrian system of R&D promotion and funding might be a major reason for foreign firms to carry out R&D in Austria. As a consequence of the economic crisis, foreign firms might cut back their R&D expenditures more than domestic ones, as it is easier to make cuts abroad than at home.

We make a distinction below between firms controlled from abroad and Austrian firms: the former are defined as being more than 50% under foreign control (hereinafter also simply referred to as foreign firms). By contrast, Austrian firms are defined as firms where more than 50% is under the control of domestic firms or Austrian citizens (hereinafter also referred to as domestic firms for short). Only firms are taken into account that have their registered offices in Austria. The data relate to the corporate sector, which comprises both firms and cooperatives and, unless otherwise stated, to 2007. Sectors were investigated that have a share of more than 1% of total R&D expenditures in Austria.

5.2.1 Sectoral structure of the R&D firms in Austria controlled from abroad

Multinationals that are active in research sectors are usually large firms with well-trained personnel and a high level of research intensity (Markusen 1995). So it comes as no surprise that a significant part of research and development in Austria is carried out by foreign firms. The table below (Table 14) shows that more than 80% of all firms based in Austria and carrying out research are domestic firms. If, however, we base the count on R&D expenditures, we see that a total of 53% of these expenditures are made by foreign firms. In the manufacturing sector, this proportion even rises to 63% although this only represents 13% of all the firms in this sector. This confirms the assumption that foreign firms in Austria are mainly large firms that are in turn in a position to spend more on R&D.

Foreign firms are more often to be found in the manufacturing sectors, which are more active in research, than in the service sector (Figure 37). The figure shows sectors in the order of their proportion of R&D expenditures of firms managed from abroad and also presents the absolute R&D expenditures of the sector and the proportion of that branch compared to total R&D expenditures of the corporate sector.

The highest proportions of total R&D expenditures may be found for foreign firms in the sectors pharmaceutical products (93%), electronic components (87%), motor vehicles and parts of motor vehicles (86%) and electrical machinery and generators (74%). These four sectors alone make up 35.3% of all R&D expenditures in Austria. These are primarily sectors where the intensity of the technology is medium to high. Domestic firms, by contrast, are particularly well-represented in the metal products, non-metallic mineral products, research & development, precision and optical instruments sectors.

Taking up 56.3% of total R&D expenditures in Austria by foreign-controlled firms, Germany is the biggest country of origin (Figure 38). Switzerland is a long way behind with 11.9%. Other important countries with high pro rata expenditures in R&D include the US and Canada. Firms from other EU countries account for the bulk of the remaining R&D expenditures. Asian countries, such as China or India, do not play a role, neither in the number of firms controlled from abroad nor in respect of the amount of R&D expenditures in Austria.

Table 14: Distribution of R&D expenditures comparing domestic firms and firms under foreign control by economic sector

Economic sector	Number foreign firms[1]	Number domestic firms[2]	Total R&D expenditure[3]	R&D expenditure foreign firms	R&D expenditure domestic firms
Manufacturing industry (NACE 15–37)	322	1,069	3,383,191	63%	37%
Service sector (NACE 50–93)	127	896	1,425,013	31%	69%
Total (NACE 01–93)	459	2,062	4,845,861	53%	47%

1) Number of firms controlled from abroad active in R&D. 2) Number of firms active in R&D under Austrian ownership. 3) in EUR 1,000.

Source: Statistics Austria, R&D Survey 2007, calculations by AIT

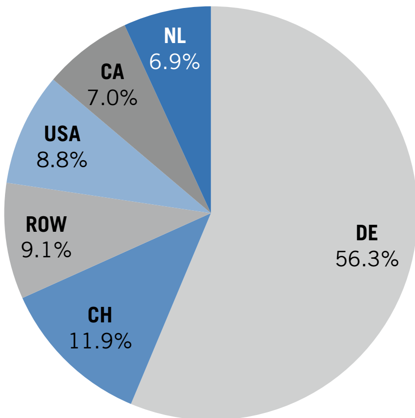
Figure 37: Proportions and total of expenditure for R&D in firms controlled from abroad and in Austrian firms by economic branch

Economic branch[1]	R&D expenditure: Proportions of foreign vs. domestic firms[2] – Foreign firms	Domestic firms	Total[3]	%[4]
Pharmaceuticals, medicinal chemicals and botanical products (24,4)	261.326	18.797	280,123	5.8
Electronic components (32.1)	328.752	47.054	375,806	7.8
Motor vehicles, trailers and semi-trailers (34)	345.074	56.107	401,181	8.3
Electronic technology (31)	481.651	165.302	646,953	13.4
Chemicals (24 without 24.4)	100.808	41.575	142,383	2.9
Medical instruments (33.1)	51.094	21.788	72,882	1.5
Trade (50–52)	147.943	76.963	224,906	4.6
Manufacture of other transport equipment (35)	77.012	45.705	122,717	2.5
Radio, television and communication equipment (32 without 32.1)	48.726	41.352	90,078	1.9
Machinery and equipment (29)	275.236	278.184	553,420	11.4
EDV & data bases (72)	90.585	164.250	254,835	5.3
Real estate, renting and business-related services (70+71+74)	104.151	312.857	417,008	8.6
Rubber and plastic products (25)	24.603	82.762	107,365	2.2
Metal products (28)	21.727	79.469	101,196	2.1
Precision technologies, optical instruments (33 without 33.1)	18.028	68.517	86,545	1.8
R&D services (73)	94.573	363.076	457,649	9.4
Non-metallic mineral products (26)	12.354	60.375	72,729	1.5
Basic metals (27)	16.800	100.253	117,053	2.4

1 Economic branches (ÖNACE-2003-departments/groups/classes, according to the OECD/Frascati Manual) with more than 1% of the entire R&D expenditure of the corporate sector in Austria.
2 Proportions (by amount of expenditures) and total (in EUR 1,000) of R&D expenditure of firms controlled from abroad and of Austrian firms in the various economic branches.
3 Total expenditure for R&D in the corporate sector in Austria by economic branch. 4) Proportion of the expenditure on R&D in the various economic branches of total R&D expenditure.

Source: Statistics Austria, R&D Survey 2007, calculations by AIT

Figure 38: Countries of the headquarters of the R&D firms in Austria controlled from abroad, by expenditures for R&D



ROW Rest of the world

Source: Statistics Austria, R&D Survey 2007, calculations by AIT

In a global context, the internationalisation of Austrian corporate research looks more like regional integration. Expenditures by the neighbouring countries of Germany and Switzerland are substantial, accounting for close to 70% of all R&D expenditures by firms controlled from abroad. Despite Austria's economic integration in the overall European domestic market, no other European country can show such close ties with Austria as does Germany. This leads to the conclusion that cultural and geographical proximity are still of major significance to firms' internationalisation strategies. It also confirms findings in the latest literature, showing that cross-border R&D activities decline proportionately as the distance grows (Guellec and van Pottelsberghe de la Potterie 2001; Dachs and Pyka 2010).

5.2.2 Financing structure of firms controlled from abroad

What role does the Austrian system of R&D funding play in the R&D activities of firms controlled from abroad in Austria? Do firms controlled from abroad finance their R&D activities in Austria to a disproportionately high degree with R&D funding?

Empirical evidence from other countries does not initially support this assumption. Studies clearly show that tax reliefs and funding have only little relevance for decisions on R&D locations (Cantwell and Mudambi 2000; Thursby and Thursby 2006; Kinkel and Maloca 2008; IPTS 2009). On the contrary, location factors relevant to R&D activities by foreign firms are: well-educated research personnel, internationally relevant research activities at universities, political stability and a good outlook for growth.

Data on R&D financing in Austria also fail to give many indications that the assumption above is correct. Two-thirds of firms' R&D expenditures are financed from their own funds[52] (Figure 39). This is followed by financing from abroad[53] covering just under a quarter of all expenditures; funding by the public sector[54] adds up to only 10%.

This picture does not change substantially when firms controlled from abroad are viewed separately from domestic firms. R&D activities of both domestic firms and firms controlled from abroad are mainly financed by the firms themselves. The absolute amounts are virtually equal for both groups. As might be

52 This self financing contains for the most part the firms' own funds. In addition there are funds raised on the capital markets and loans from public sector develop and funds.

53 All sources of funds from abroad are allocated to the financing sector abroad. This includes both EU funds and money from international organisations as well as financing by foreign firms; however it does not include funds from firms based in Austria that belong to foreign owners. These can, though not necessarily, be associated with firms that are controlled from abroad but based in Austria such as a corporate group or a group.

54 Financing by the public sector includes subsidies that do not need to be paid back, awarded directly in the framework of funding programmes, indirectly from public funds or from other institutions of project funding; also payments for research projects commissioned by the government.

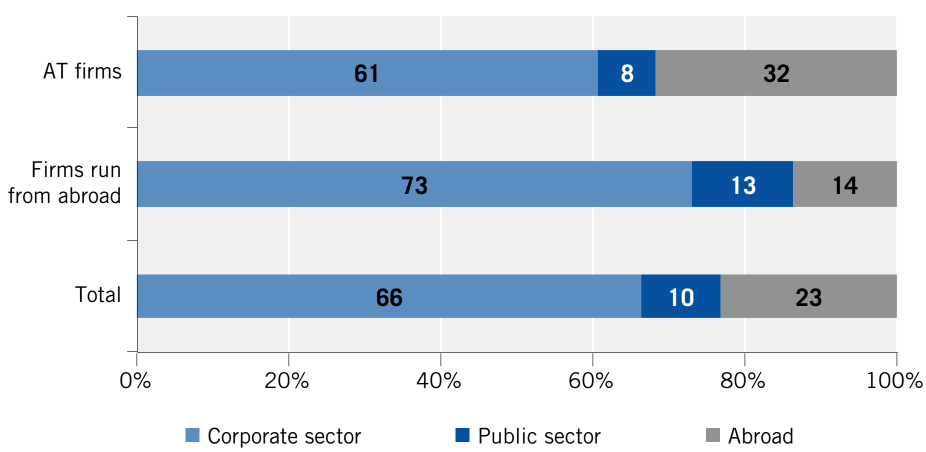
expected, financing from abroad plays a relatively larger role for firms controlled from abroad than for domestic firms (32% for firms controlled from abroad and 14% for domestic firms).

By contrast, financing by the public sector is more significant for domestic firms. Public funding accordingly plays a smaller role in financing R&D with foreign firms than with domestic firms This still applies when NACE 73 (Research and Development; this includes organisations like AIT and Joanneum Research) are taken out of the picture. 13.5% of R&D expenditures by domestic firms are financed by the public sector; excluding NACE 73, the percentage of public funding drops to 8.8%. The figures for firms controlled from abroad are 7.6% for all firms and 7.5% when firms in NACE 73 are excluded. This means that firms controlled from abroad – in terms of their total R&D expenditures – are less heavily subsidised with public-sector funds than firms controlled domestically. If public funding really were an important motive for firms controlled from abroad to carry out R&D activities in Austria, we would see a different result here. However we should note that the data do not include any information on the amount of the research tax allowances made and, ideally, domestic and foreign firms should have been compared at individual firm level.

When we look in detail at the financing structure of firms by different public-sector fields and instruments, we find substantial differences between domestic and foreign firms (Figure 40). R&D statistics distinguish here between funding from the research premium, the Austrian Research Promotion Agency (FFG) programmes and other public-sector financing as well as funds distributed directly by the federal or state governments under, for example, research projects mandated directly by them or the financing of cooperatives (AIT, ACR, Joanneum).

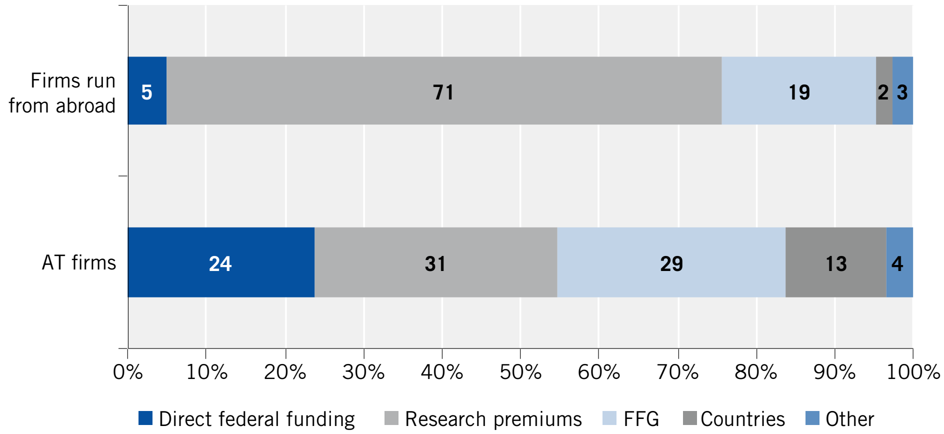
Compared to firms controlled from abroad, domestic firms are much more heavily fi-

Figure 39: Financing structure of domestic firms and firms controlled from abroad by source and field of funding



Source: Statistics Austria, R&D Survey 2007, calculations by AIT

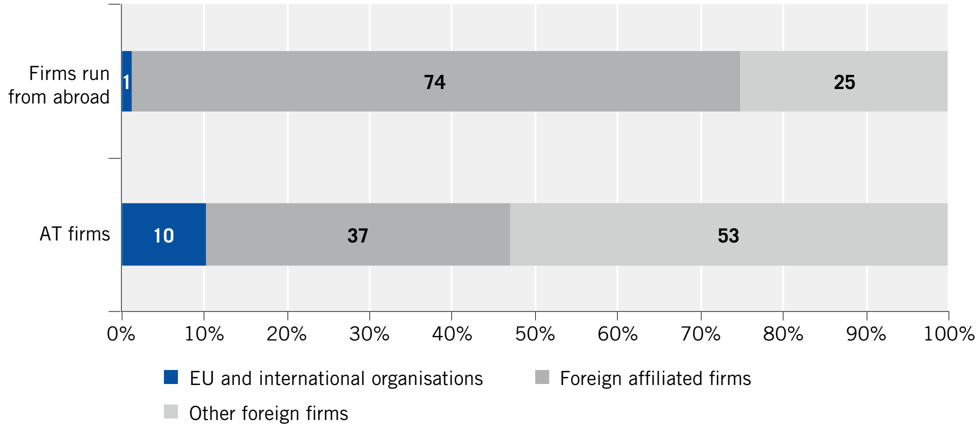
Figure 40: Structure of R&D in the corporate sector financed by the public sector* broken down into domestic firms and firms controlled from abroad



* Public-sector financing only includes (in compliance with the Frascati Manual) subsidies that are not subject to repayment. Loans at favourable interest rates that have to be repaid fall under own funds and are accordingly allocated to the corporate sector. Financing by the government and the Austrian states are direct subsidies and are accordingly shown separately from financing by the Austrian Research Promotion Agency (FFG).

Source: Statistics Austria, R&D Survey 2007, calculations by AIT

Figure 41: Financing from abroad by source of funding



Source: Statistics Austria, R&D Survey 2007, calculations by AIT

nanced directly by state and provinces, which account for 37% of public funding for domestic firms. For firms controlled from abroad, the percentage of financing coming directly from the government or the states is 7% (excluding the research premium, FFG or other public funding) of all public-sector R&D financing.

For firms controlled from abroad, the research premium accounts for by far the largest part (71%) of their financing by the public sector. The same might apply to the research tax allowances. In absolute terms, too, firms controlled from abroad receive a higher amount (€139 million) than domestic firms (€94 million). This means that, both for domestic firms and firms controlled from abroad, the research premium makes up the largest part of public-sector R&D financing.

Finally, R&D activities are subsidised by funds from the Austrian Research Promotion Agency (FFG). The significance of these funds is much greater for domestic firms (29% of total public-sector financing) than for firms controlled from abroad (19% of total public-sector financing).

Financing of R&D from abroad (Figure 41), as expected, is rated more highly by firms controlled from abroad than by domestic firms. But domestic firms also receive a substantial part of the R&D funding from abroad. These funds are roughly equal in volume to public-sector R&D funding for domestic firms.

Of the total figure for financing from abroad of research and development, 73% comes from firms controlled from abroad. Both for domestic and foreign firms it is a fact that the EU and other international organisations only finance a relatively small part of R&D (10% and 1% respectively). For firms controlled from abroad, affiliated firms play, as expected, a greater role while, for domestic firms, the funding comes from other foreign firms.

5.2.3 R&D by firms controlled from abroad and the financial crisis

Innovations are closely linked to economic developments and accordingly also to economic crises. This leads to the question about the effects of the financial crisis on the research and development of a country and in our case about the effects on R&D activities of firms controlled from abroad in Austria.

A number of studies in recent years agree that the crisis has led to a fall in R&D expenditures. But there is disagreement on how strong this effect has been as well as on the issue of whether the drop was more extreme for domestic or for foreign firms (De Backer and Hatem 2010, Filippetti and Archibugi 2010, IPTS 2010). The fact that foreign direct investments in general have fallen sharply in the wake of the financial crisis would suggest a sharper drop in firms controlled from abroad. We have mentioned before that multinationals often leave their long-term R&D activities in the country of origin; faced with the choice of making adaptations for foreign markets or putting an end to these activities, most firms would presumably opt for the former. In addition, multinationals are often confronted with much heavier public pressure in their country of origin: faced with the choice of reducing R&D in the country of origin or abroad, firms opt more frequently to make the reductions at foreign locations.

On the other hand, there are several arguments indicating that R&D expenditures by firms controlled from abroad are more stable in a crisis: multinationals are less dependent on credit markets and more internal resources enabling them to continue financing their R&D activities, even in times of crisis. R&D activities by multinationals are frequently not just oriented towards the outlook for growth in the respective host country but the outlook for growth globally in a particular field. Ultimately multinationals can distribute risks over several projects and locations better than firms that are only active in one country.

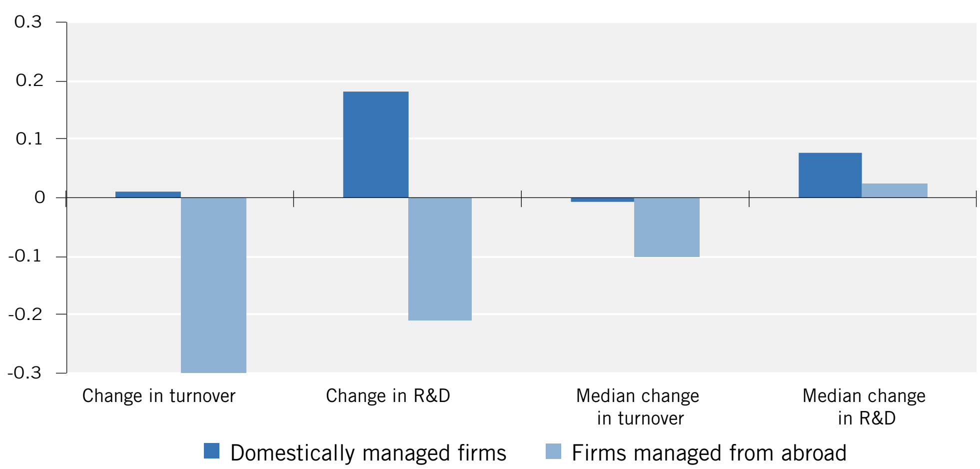
As there are not any results in yet from the 2009 R&D survey on the changes in R&D expenditures by domestic and foreign firms, we shall attempt here to make a rough assessment of changes between 2007 and 2009. The basis for these estimates are the balance sheet data of domestic and foreign firms collected by the Trend publishing house for an annual overview of Austria's 500 largest firms. Firms whose R&D data were not included in the Trend 500 were asked to provide a supplement. In all, the sample covers 50% of all R&D expenditures by the Austrian corporate sector in 2007.

The data show that firms controlled from abroad in Austria suffered significant falls in sales between 2007 and 2009, while the sales of the domestic firms in the survey actually went up over this period (Figure 42). This can be explained by the much higher level of exports at the foreign firms, making these firms disproportionately more crisis-prone. There is also a significant drop in R&D expenditures by firms controlled from abroad while R&D expenditures by domestic firms actually went up. Overall, the R&D expenditures by firms controlled from abroad dropped less sharply than their sales, generating a higher R&D ratio for these firms.

A second glance at the data shows, however, that the drop in R&D expenditures by firms controlled from abroad during the crisis can mainly be attributed to heavy falls in a firm's total R&D expenditures. This fall can, in turn, be attributed to internal restructurings and a sharp fall in the size of individual divisions. To adjust for this one-off effect, the figure not only shows the change in the total figures for R&D expenditures by domestic and foreign firms but also the median of the rates of change of each individual firm (see the right-hand column in Figure 42). The median is made up by ordering all the firms by the size of growth in their sales and R&D. The median is the figure for that firm, for which there are an equal number of firms with higher and lower growth.

This indicates that R&D expenditures by firms controlled from abroad rose by an average of 2% during the crisis and those of domestic firms by 8%. Growth in the majority of firms controlled from abroad in the survey

Figure 42: Proportions of R&D expenditures by source of funding 2007 to 2009



Source: Trend Top 500; calculations by AIT was, however, not sufficiently strong to make up for the falls at the one firm. This clearly shows how much, as a result of the great concentration of R&D activities controlled from abroad, individual firms can affect the overall development of Austrian R&D expenditures. The latest figures on R&D expenditures by domestic firms confirm the results of these estimates. Statistics Austria shows a rise in R&D expenditures between 2007 and 2009 of 3%. Domestic firms are not shown separately from firms controlled from abroad. This shows that the feared drop in R&D expenditures as a result of the economic and financial crisis has not occurred.

5.2.4 Summary

Firms controlled from abroad are of great significance for research and development in the Austrian corporate sector. More than half (53%) of all R&D expenditure in Austria is made by international firms. Seventy percent of this R&D expenditure can be attributed to firms from Germany and Switzerland. Austria therefore has a strongly internationalised economy that is woven primarily into the fabric of the European domestic market. R&D expenditures by foreign firms are concentrated in a few sectors.

R&D activities are mostly funded, at both domestic firms and firms controlled from abroad, mainly by the corporate sector. Funding from abroad, as expected, plays a larger role for firms that are controlled from abroad than for domestic firms; tax reliefs (primarily through the research premium) are also of greater significance to firms controlled from abroad.

Besides many other areas, the economic and financial crisis has also had an impact on firms' R&D. A sample of domestic and foreign firms, covering half of all R&D expenditures by the Austrian corporate sector, shows a sharp drop in R&D expenditures by foreign firms between 2007 and 2009. This trend can, however, be attributed to one large firm. At the majority of foreign firms in the survey, R&D expenditures rose over this period.

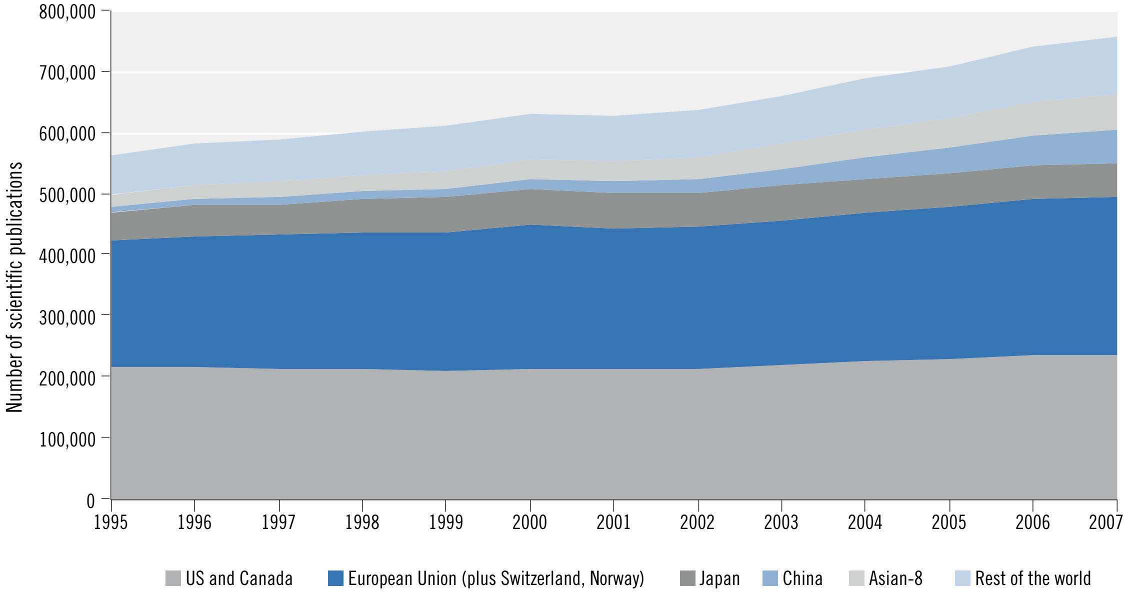
6 Academic research in Austria

6.1 The international context

The global output of scientific and academic knowledge production has increased continuously in recent years. The number of scientific publications in peer-reviewed journals – as an internationally comparable yardstick for academic research – stood at about 565,000 worldwide in 1995 and climbed to 758,000 in 2007: an increase of 34%, or an annual average growth rate of about 2.7% (Figure 43). This implies a doubling of the number of scientific publications in a period of 26 years. This growth is on one hand the consequence of globally increased inputs in the form of R&D spending (annual growth of about 7% in the same period[55]) as well as ever stronger "publish or perish" imperatives that are shaping the academic world more and more.

At the same time, there were significant shifts in the volume of publications by traditional "knowledge producers" (Figure 44). If

Figure 43: Development of world shares of publications by major regions (1995–2007)



Asian 8: India, Indonesia, Malaysia, Philippines, Singapore, South Korea, Taiwan, Thailand

Source: National Science Board based on data from ISI Thomson, calculations by Joanneum Research

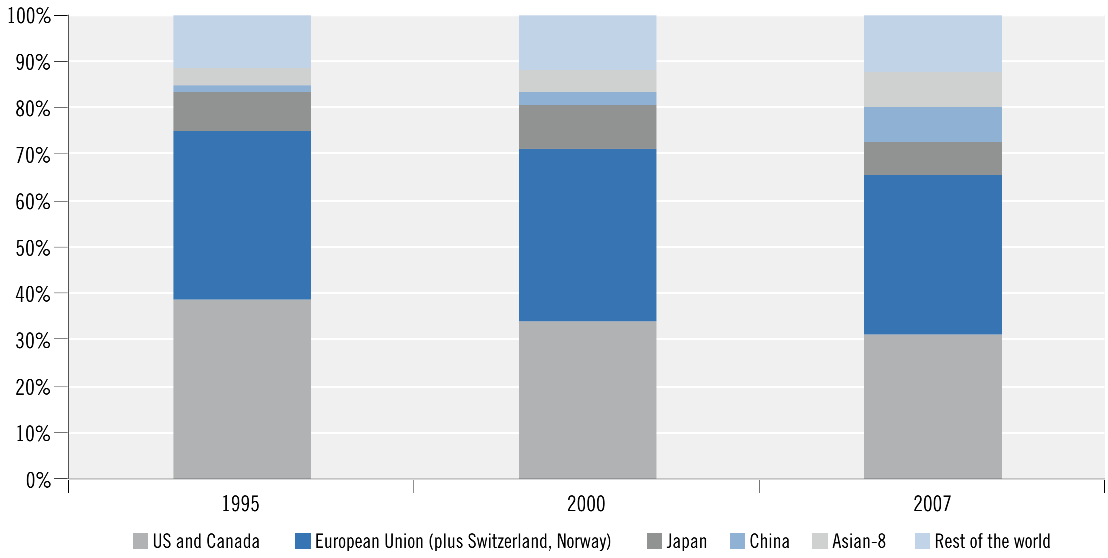
55 Nominal growth. Furthermore, this growth is related to overall R&D spending, including R&D expenditure in the private corporate sector, which in most countries has grown much stronger than those of the public sector.

we observe developments at the level of major regions, we see a relative shift in publication shares away from traditional centres (North America, i.e. the USA and Canada), which had the lowest growth rates (average annual rate of just 0.82%) of scientific publications of all the major regions assessed here. These below-average growth rates reduced North America's share of publications from 38% to 31% during the period under observation. Even Japan registered a clearly below-average growth rate of 1.07%, which caused Japan's share of publications to fall from 8% to 7%.

The European share (shown here with the EU-27 using a "back-calculation" to cover the entire period, plus Norway and Switzerland) also fell slightly, from 36.4% to 34.2%. Because growth in European publications was more than double as high for comparable figures in the USA (2.11% versus 0.87%), Europe was able to establish itself as the greatest "knowledge producer" during the period under observation (Europe overtook the USA in 1997).

The highest rates of growth are found in the dynamic economies of Asia. With its substantial growth rates (an average annual growth rate of 18.2%), China was able to post enormous gains in the global production of academic knowledge. China's share of worldwide publication volume nearly quintupled during the period under observation (from 1.6% to 7.5%). This means that China recently overtook Japan in this regard. But the upwardly striving, dynamic economies of the Asian 8 (India, Indonesia, Malaysia, Philippines, Singa-

Figure 44: Development of world shares of publications by major regions



Asian 8: India, Indonesia, Malaysia, Philippines, Singapore, South Korea, Taiwan, Thailand

Source: National Science Board based on data from ISI Thomson, calculations by Joanneum Research pore, South Korea, Taiwan and Thailand) also recorded strong growth in their publication numbers. With an average annual rate of growth of 9.8%, their share of publications worldwide increased from 3.6% (1995) to 7.4% (2007), thereby surpassing Japan's share.

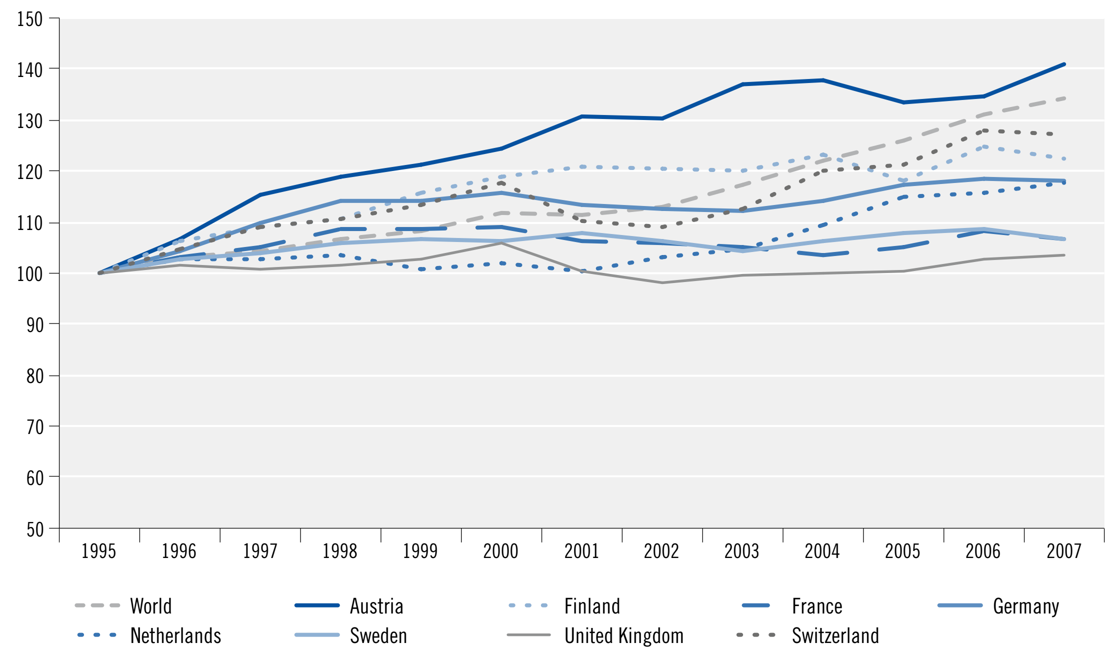
6.2 Developments in Austria

How are developments in Austria playing out against the backdrop of these global developments? First, Austria has a share of less than one per cent of worldwide publications. This means that, when it comes to pace and (thematic) direction of knowledge production – like all other small countries – Austria is dependent on megatrends at the global level and cannot exercise an influence on these trends, unlike the "global players" such as the USA, Japan, and to an increasing extent China. This situation is also clear from the absolute numbers: of about 758,000 publications worldwide in 2007, 4,800 came from Austria.

However, it is worth noting that Austria, in comparison to other European countries, was able to post significantly above-average rates of growth in its publication output. With an average annual rate of growth of 3.16% (in the period from 1995 to 2007), Austria even grew faster than the global growth trend (2.72%). In the period under observation, this led to an increase in Austria's publication share – however small – from 0.61% (in 1995) to 0.64 % in 2007.

Within the European Union, the Austrian rate of growth in publications was among the highest. We find even higher rates of growth in the new member states, whose national science systems – which started from a lower baseline – are still undergoing modernisation and transformation processes. During the pe-

Figure 45: Development of publications in selected countries in comparison to Austria (Index 1995 = 100)

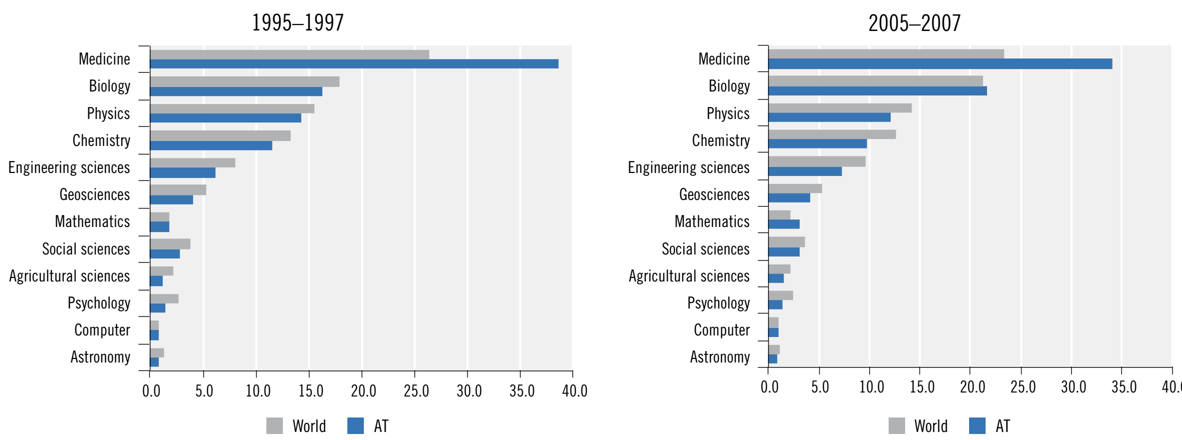


Source: NSB based on data from ICI Thomson, calculations by Joanneum Research riod under observation, countries such as the Czech Republic, Poland or Hungary attained growth rates of 5.9% (Czech Republic), 4.2% (Poland) and 3% (Hungary). In the "old" EU, countries such as Ireland (6.7%), Spain (5.8%) and Italy (3.7%) surpassed Austria's rate of growth.

Those (Western) European countries with "mature" science systems, however, consistently had lower rates of growth than Austria (Figure 45). The rates of growth are particularly low in Europe's three largest science systems in absolute numbers: Germany in creased the publication level by 1.5%, France by 0.6% and the United Kingdom by only 0.3%. Smaller EU countries with highly developed "mature" systems, such as the Netherlands (1.5%) and Sweden (0.6%), posted lower rates of growth than Austria. This can be interpreted on one hand as Austria's catching-up process, not least due to significantly increased resources for R&D, and on the other hand as a "normalisation process" in which the Austrian science system becomes more and more aligned with the typical conditions for international scientific inquiry (namely, publication in international peer-reviewed journals, typically in English).

The following Figure 46 shows the per cent share of publications against the total number for specific discipline groups. The developments of the mid-1990s are compared with those of 2005 to 2007. For both points in time, Austria has an outstanding position in medical research. The share of medicine-related publications in overall publications from Austria in 1995–1997 was about 38%; worldwide, this number only amounted to about 26%. Although the Austrian share of medicine-related publications fell to 34% (world share: 23%) in

Figure 46: Publications according to discipline groups: Comparison Austria – World



Source: Thomson Reuters, SCI and SSCI, National Science Foundation, calculated by Joanneum Research

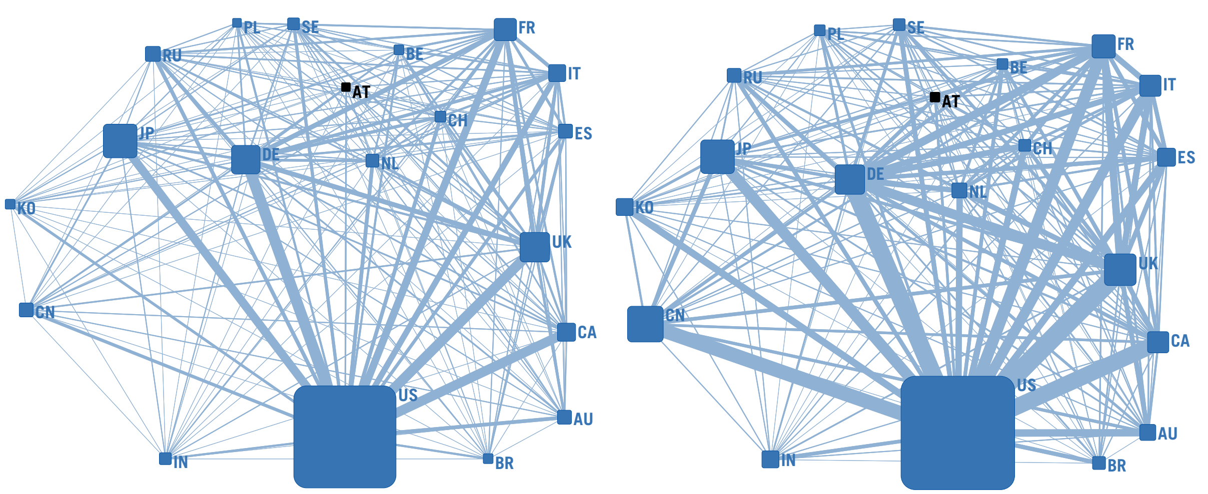
2005–2007, this was still the largest share. Austria has a clear specialisation in publications in the medical field. Furthermore, it is striking that Austria, in both medicine and mathematics, has an above-average share of publications, although this specialisation in mathematical research has only emerged very recently. Austria was able to attain the world average in biology; in computer science, Austria already had an average share in the mid-1990s.

Co-publications

There is a general trend in knowledge production towards international co-production, e.g. scientific gains in knowledge (and their documentation in the form of publications) takes place in the context of international collaboration among scientists from different nations. This trend is most clearly illustrated in the rapid rates of growth in international co-publications (which grew much faster than the overall number of publications). Global knowledge production today is therefore shaped by a variety of co-publication relationships between scientists from a broad array of countries that in sum can be described as knowledge production networks (Figure 47). The results of this kind of network analysis basically show that (i) despite losses in share, the USA still retains its central position as the world's leading knowledge producer and leading publication partner in international co-productions, (ii) the "compression" of relationships between the countries assessed here, and (iii) the increasing significance of the South and East Asian countries (above all China), and (iv) the surfacing of new "hot spots" in the global research landscape (especially in Brazil), also outside the three leading large regions of North America, Europe and Asia.

If we examine the "size" of countries, measured in terms of their total number of publications, then factors such as the geographical and linguistic "proximity" (i.e., a shared language) of two countries exert a major influence on the number of co-publications between

Figure 47: Co-publication networks 1998 (left) and 2008 (right)

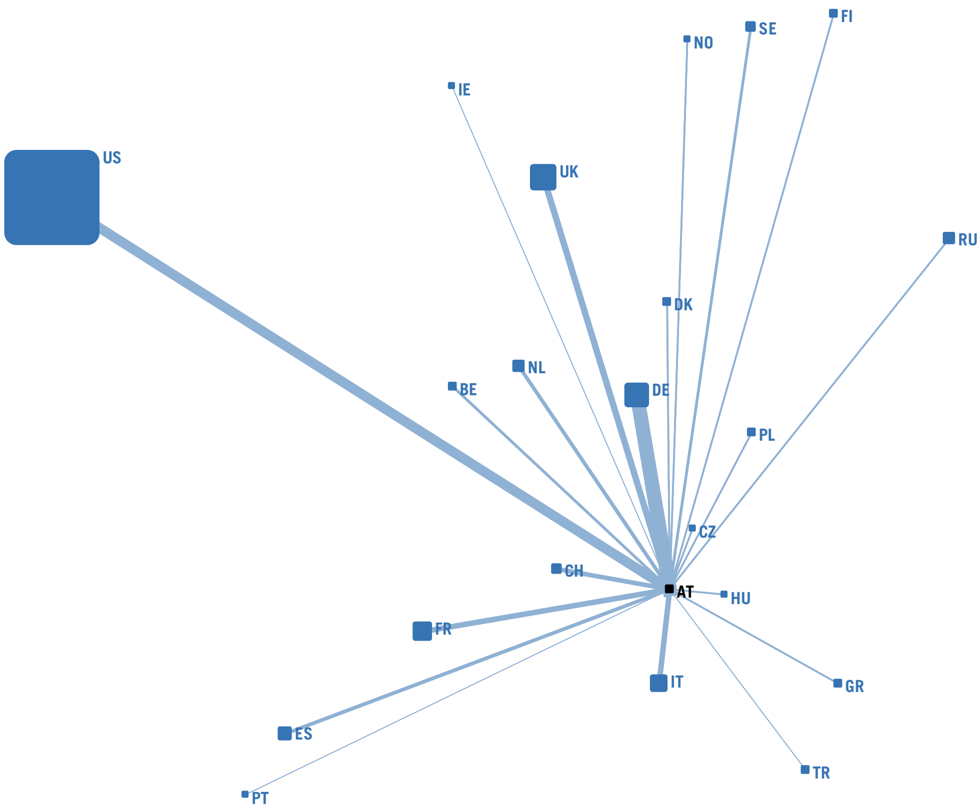


Source: NSB/ISI Thomson, calculated by Joanneum Research those two countries[56]. Therefore, it is not surprising that, for example, almost 50% of co-publications in Austria are conducted with the (German-speaking) neighbouring countries of Germany (37%) and Switzerland (11%) (Figure 48). The USA, thanks to their outstanding role in the global publication landscape, are also an important partner for the co-publications of Austrian scientists. 25% of all international co-publications are with US scientists.[57]

The "value" of scientific publications: Citations

Unlike the number of publications, the number of citations captures the relevance of a scientific project for other scientists and is therefore an indicator in the broadest sense for the quality and impact of scientific research.[58] In Figure 49, world shares of scientific publications are shown with their corresponding world share of citations. If the relationship of

Figure 48: Austria's international co-publication network (2008)



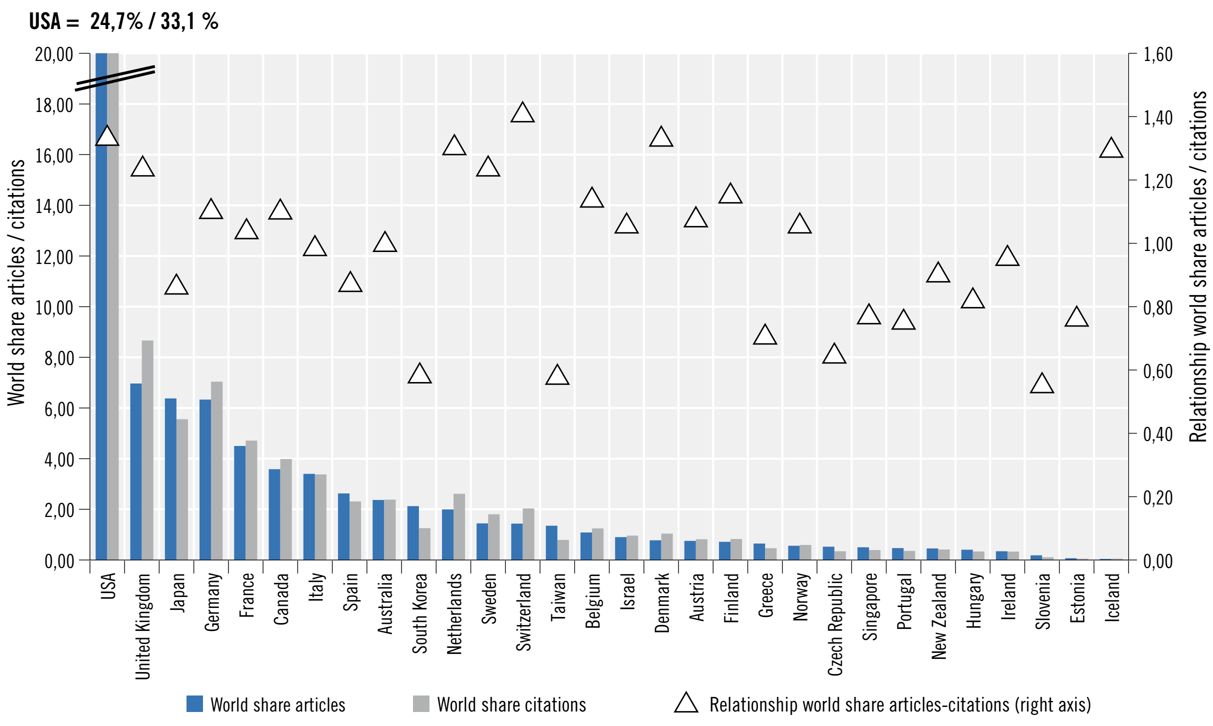
Notes: The size of the countries refers to their total number of publications; the line width refers to the co-publications between Austria and the respective country
Source: NSB/ISI Thomson, calculated by Joanneum Research

56 These essential determinants for co-publications between countries was estimated by using the theoretical gravitation regression model, which models the number of co-publications between two countries as a function of the 'mass' of publications in the affected countries, the geographical distance between the countries, linguistic commonalities (shared language or shared English language), and, as an alternative to linguistic commonality, the average performance on the TOEFL test. The model's accuracy is very high with R-square values of 0.80 or 0.84 for both model variants.
57 The values for other countries were 15% for the UK, 13% for France and 13% for Italy.
58 See also in this regard the Austrian Research and Technology Report 2009, p. 93ff.

world share of citations of publications is over 1, then this indicates that a country has an above-average "impact" of scientific output (normed with the absolute size of output). Switzerland is the leader in this measurement. Their share of overall citations, at somewhat more than 2%, is one and a half times as large as their share of total articles worldwide (world share approx. 1.6%). Other countries with an above-average quality of scientific research are the Scandinavian countries (Denmark, Sweden), the Netherlands, and the Anglo-American countries (USA, United Kingdom). Austria's share of citations is only somewhat higher (0.82%) than the corresponding share of publications (0.76%). This means that Austria's scientific output is cited at neither above nor below average rates.

Figure 50 represents further figures, although the corresponding values were normed to the population numbers to account for the differing sizes of the individual countries. Switzerland as well as the Scandinavian countries (Sweden and Denmark) are in the lead – both in the number of publications (per population unit) and the number of citations (also per population unit). These countries thereby combine their outstanding intensity in terms

Figure 49: World shares of scientific articles and citations for selected countries



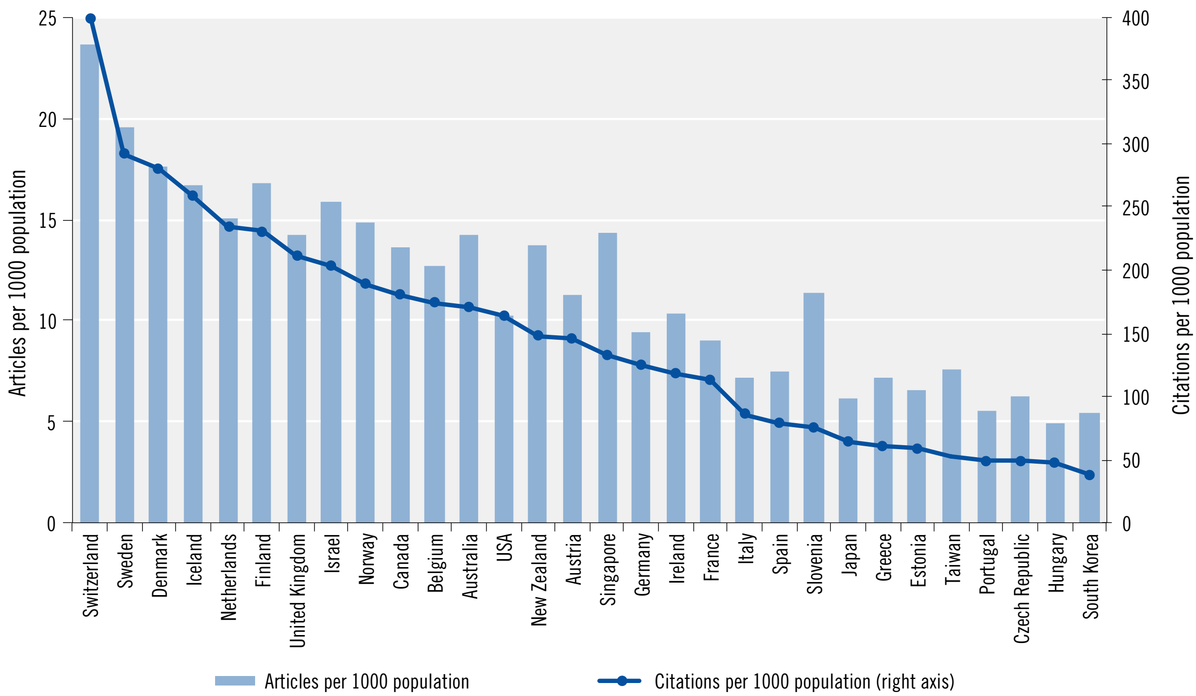
Source: ISI "Essential Science Indicators" (2000–2011), calculated by Joanneum Research of publication volume with a relatively high impact (measured in citations / population unit). Austria is positioned in the middle of the field, although Austria has a somewhat higher output intensity than impact.

Highly-cited scientists

Another indicator for positioning research output for countries in international comparison is the highly cited researcher[59]. This indicator was developed by ISI Thomson. It originally listed the 250 most-cited scientists according to 21 discipline groups, focussing on publications between 1981 and 2008.[60] These highly cited researchers comprise a total of less than 0.5 per cent of all publishing scientists and therefore represent a very rarefied selection of internationally visible leading researchers.

Figure 51 shows country shares of the total number of highly cited researchers in a cumulative representation. The extreme concentration of these researchers in a few countries is especially clear. Approximately 66% of highly cited researchers are found in the US[61]. The United Kingdom, Japan and Germany follow, each with a share of just under five per cent. A share of 82% of all highly cited researchers are

Figure 50: Intensity of scientific outputs and impacts (2000 to 2010)



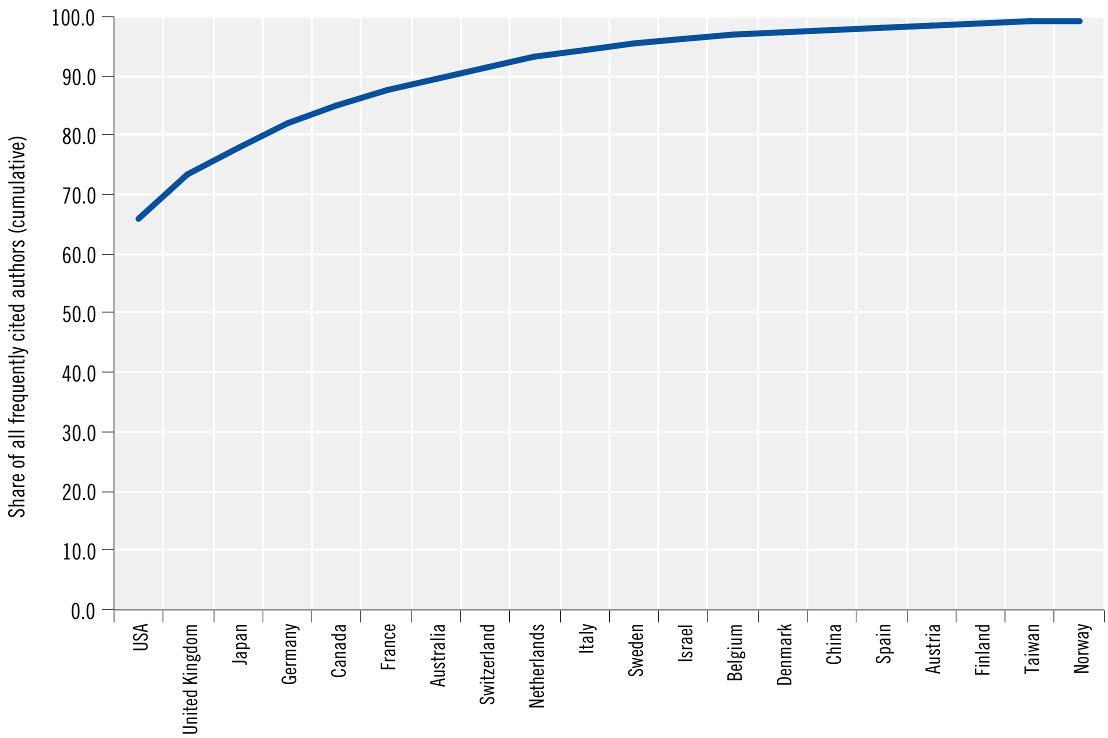
Source: ISI "Essential Science Indicators" (2000–2011), calculated by Joanneum Research

59 This indicator is available online at ISIHighlyCited.com.
60 Because the running updates of this indicator does not remove scientists once they have been included, the number of highly cited researchers is now 250; it only changes the observed time span of publications so that new researchers will be included in future.
61 The highly cited researchers are assigned to the country in which they are working at the point in time at which the indicator is adjusted.

located in the first four countries. Austria is in seventeenth place, just behind Spain and Finland. It should be noted that the absolute numbers for these rankings are still very low (currently 20 people in Austria), meaning that high international mobility and the regular appearance of "new" highly cited researchers can cause rapid shifts in the rankings.

The relative intensities (number of highly cited researchers normed with the respective population numbers) are shown in Figure 52. Once more, we find Switzerland leading the relative rankings, followed by the US and – far behind – the United Kingdom, Sweden and Israel. Austria is in the middle of the field here. It is worth pointing out that those countries

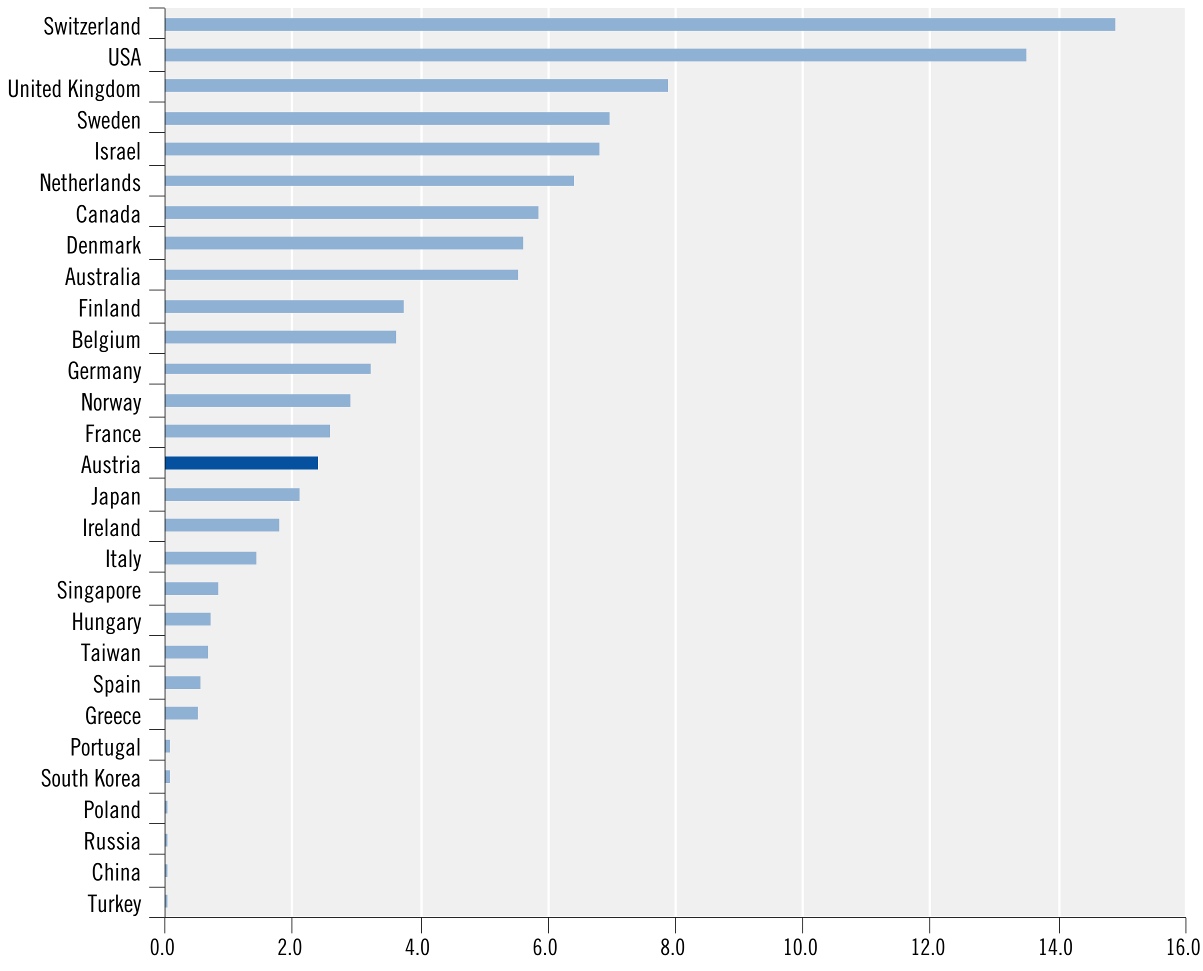
Figure 51: Cumulative share of all highly cited researchers by country



Source: ISIHighlyCited.com; calculated by Joanneum Research that currently have the strongest rates of growth in publications (especially China) have not yet appeared in the rankings for highly cited scientists. This may be due to the fact that citations have a *time-lag*, and that older research results and scientific publications necessarily have more citations than recent publications. Actually, highly cited researchers are overwhelmingly a group of older people who have generated research output for over a decade (with the corresponding impact in the form of citations) [62].

Figure 53 shows the distribution of highly cited researchers by their institutions.[63] On one hand, the strong concentration in Vienna (and nearby) is striking; on the other hand, so

Figure 52: Highly cited researchers (per million population) in selected countries

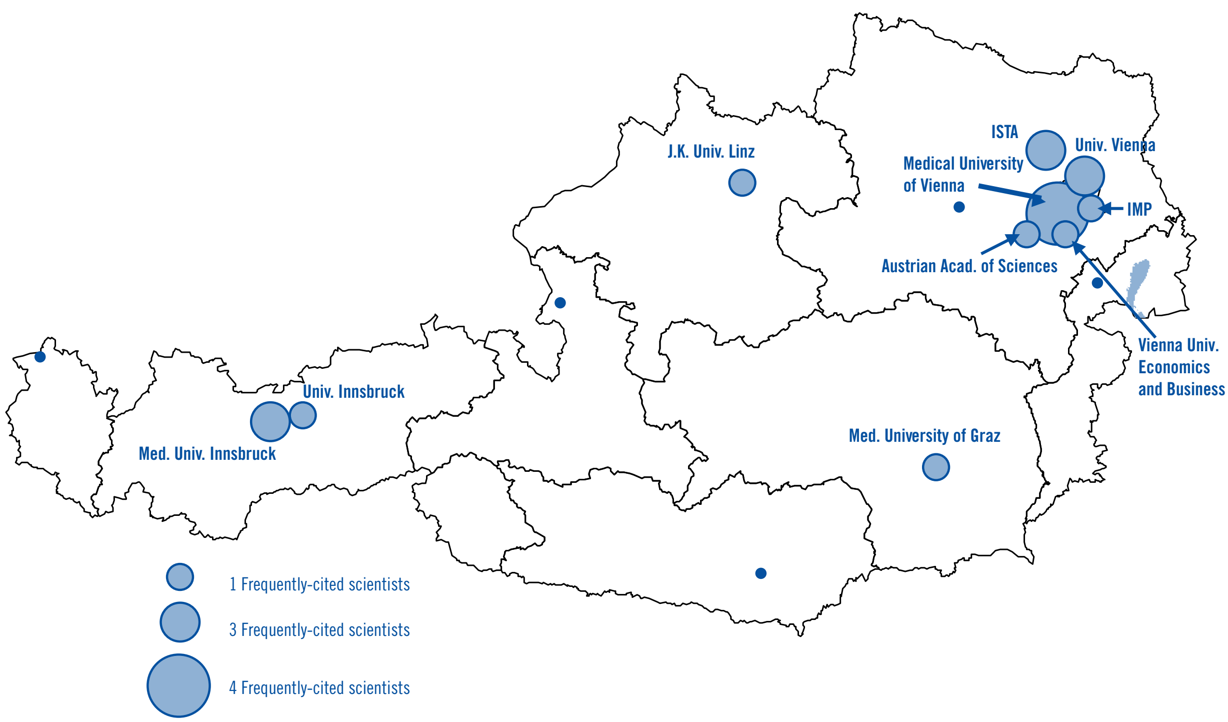


Source: ISIHighlyCited.com; calculated by Joanneum Research

62 In March 2011, HighlyCited.com listed only 28 highly cited researchers for China (versus 20 in Austria). China's population is approximately 160 times as high as Austria's.
63 Status as of March 2011.

is the strong role that the medical universities play. It is also remarkable that IST Austria (Institute of Science and Technology, Austria) in Klosterneuburg was already able in the start-up phase to attract a series of highly cited researchers, thereby securing Austria a fixed place in the "landscape" of leading scientific institutions within a short amount of time.

Figure 53: Austria's highly cited researchers: distribution by institution



Source: HighlyCited.com; calculated by Joanneum Research

Box:

The Institute of Science and Technology Austria (ISTA)

The Austrian Institute of Science and Technology (IST Austria) in Klosterneuburg was established by the Austrian federal government and Lower Austria in 2009 as a post-graduate scientific institution oriented towards basic research in the life sciences, physics, chemistry, mathematics and computer science. In addition to the inclusion of new research fields, IST Austria also provides high-quality post-graduate education and has established its own PhD programme. By 2016, there will 40 to 50 professors and about 500 researchers at IST Austria. The first president of IST Austria is Thomas A. Henziger, a leading computer scientist and former professor at the University of California at Berkeley and the ETH Lausanne in Switzerland.

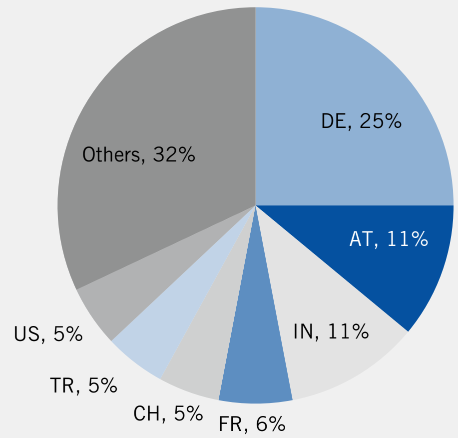
In order to facilitate research-oriented work, professorships are not established with a fixed scientific orientation, which actively encourages interdisciplinary cooperation and can rapidly expand the Institute in new scientific directions. The researchers working at IST Austria were recruited without exception in an international process, exclusively on the basis of their scientific qualifications and their development potential. The work is organised in independent research groups that are led by a professor or assistant professor. After a start-up phase, an average of about 10 doctoral and post-doctoral students will work in a research group. Promotions in line with the U.S. tenure track system are decided solely on the basis of scientific achievement, which is evaluated with international scientific certificates.

In 2010, there were already 12 professors and a total of 105 people working at IST Austria. The scientific personnel comes from 22 nations – a symbol for the Institute's international orientation and global recruitment policy.

Human resources at IST Austria	Individuals
Professors	12
Postdocs	19
PhD Students	20
Staff Scientists	1
Scientific Support	24
Administration	29
Total	105

Research Grants	€ million
ERC	8
FWF	0.9
DFG (GERMANY)	0.48
EU	0.31
NSF	0.12
Total	9.8

Nationality of the scientists



The Institute receives funding from four pillars: public financing, research funds through the peer-review process, technology licensing and donations. At the end of 2010, the Institute had already acquired € 17 million in donations and third-party funding grants (research grants) amounting to € 9.8 million. By 2016, public funding volume will increase to about € 430 million, and up to € 95 million in third-party financing is planned.

See also:http://www.ist.ac.at/

6.2.1 Summary

Austria has a share of less than one per cent of worldwide publications. Growth rates in Austria in recent years, however, were significantly higher than in other Western European countries, even higher than in a global comparison between 1995 and 2007. At the same time, Austria was able to integrate itself more tightly in the increasingly globalised production of knowledge, as shown in the strong increase of Austrian co-publications with partners abroad. With regard to intensity (publications) and impact (measured in citations) of scientific output, Austria remains situated solidly in midfield.

6.3 Funding excellent basic research in Austria

The definition of excellent research is not a simple undertaking; the term excellence cannot be viewed separately from institutional and discipline-specific facts. At the same time, there is the problem that "excellence" in research can often only be determined by assessing its impact on research traditions within each discipline (i.e., contribution to the creation of new research paradigms, new fields and horizons of research, etc.). This requires a time-lag between research and research evaluation.[64] Due to these conceptual difficulties with the term excellence, we have developed a pragmatic approach in the following that defines as "excellent" basic research that was successful in competing for especially scarce resources in a selection process defined by internationally recognised criteria (especially the peer-review process). According to this criterion, the following two funding channels were selected for Austria:

- Grants from the European Research Council (ERC), and
- specific funding vehicles from the Austrian Science Fund (Start Programme, the Wittgenstein Prize, Special Research Areas, National Research Networks).

The European Research Council (ERC)

The establishment of the European Research Council certainly represents a milestone in the promotion of excellent basic research. The ERC was created in 2007 for the explicit purpose of promoting "frontier research" projects. In the project selection process, the only evaluation criteria are scientific excellence and innovation potential; indicators such as nationality, applicant age or research field do not play a role. Furthermore, once the researcher receives the grant, they are allowed to move about to institutions within the EU and associated countries and take the grant with them, so that research institutions with better conditions are privileged. This highly competitive selection process at the European level means that ERC projects meet the criteria for excellent research to a particularly high degree. In the following, two central funding vehicles are assessed:

- ERC Starting Grants are awarded to young scientists with major development potential: Starting Grants can include up to € 2 million in research funds and have a term of five years.

64 Here is an illustrative example from economics: the American Economic Association has recently set up a commission of prestigious members to select the "best" articles from the portfolio of journals from the last century. The selected articles – all of which should be undisputed masterpieces of science from the last hundred years – were overwhelmingly published several decades ago. This should not, however, lead to the conclusion that excellent work in economics has not been published in the last two decades. Rather, it is not yet clear which recently published works will actually make a major contribution to the research tradition that is felt decades later.

- ERC Advanced Grants, however, are oriented towards established researchers with a proven "track record" and are meant to assist in the establishment of cutting edge research fields and groups with the right scientific potential ("pioneering frontier research"). The maximum funding volume is € 3.5 million with a maximum term of five years.

Overall, ERC grants provide outstandingly well endowed funding mechanisms that also enable medium- and long-term research horizons. The highly competitive character of these funding vehicles is clear in the low award rate. Of a total of about 19,000 applications (2007–2010), only 1,800 were approved, corresponding to an approval rate of 9%.

Austria has been able to position itself well in this regard, with an above-average approval rate of 12%. Austria is in fourth place behind Switzerland (22%), Israel (15%) and France (14%) – at the same level with the United Kingdom, which also has a success rate of 12%. Overall, Austrian research institutes were able to bring in 45 grants from 2007 to 2010 (from a total of 366 Austrian applications). Four researchers have also taken their grants with them to an Austrian research institution (see Table 15).[65]

Table 15: Approved ERC Grants according to Austrian research institutions (Status: Feb. 2011)

	Advanced Grants	Starting Grants	Total
University of Vienna	7 (+1)	4 (+1)	11 (+2)
Vienna University of Technology	2	2 (+1)	4 (+1)
University of Innsbruck	1	3	4
Research Institute for Molecular Pathology	1	2	3
The Institute of Science and Technology Austria (ISTA)	3	0 (+1)	3 (+1)
Austrian Academy of Sciences	4	5 (-1)	9 (-1)
IIASA – International Institute for Applied Systems Analysis	1	1	2
Medical University of Innsbruck	1	1	2
Medical University of Vienna		1	1
Austrian Archaeological Institute		1	1
University of Natural Resources and Applied Life Sciences, Vienna		1	1
University of Graz	1		1
University of Klagenfurt		1	1
University of Veterinary Medicine Vienna		1	1
University of Linz	1	0 (+1)	1 (+1)
Total	22 (+1)	23 (+3)	45 (+4)

Note:The numbers in brackets represent those projects that have been added or removed because of portability (a change in host institutions during contract negotiations). For the Starting Grant 2010 and Advanced Grant 2010 applications, portability is not considered because the contract negotiations are not yet finished For two of the listed ERC grants, the applicable research institution assumes the additional role of host institution (HO2).

Source: European Commission data; processed by PROVISO

65 The ERC grants are based on the "money follows the researcher" principle, meaning that the applicant's nationality and the location of their institution are always considered separately. The numbers used in the text indicate host institutions.

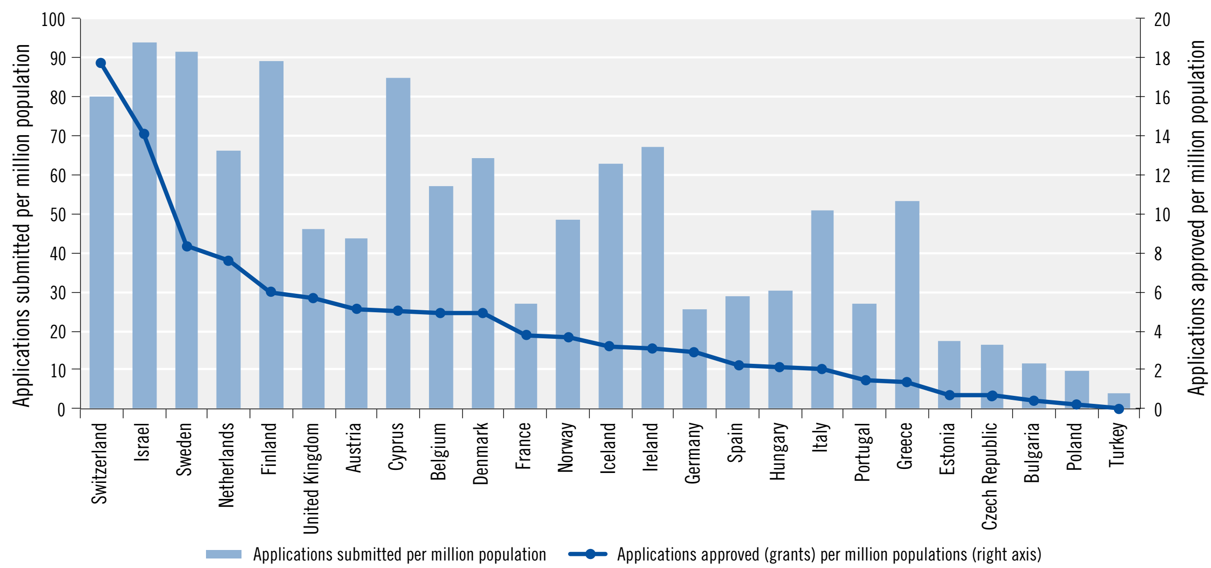
The following Figure 54 provides an overview of the placement of participating countries in terms of their ERC grant applications and approvals; the figures were already adjusted to account for varying country sizes (population) (i.e., the figures are represented in terms of one million population). There are enormous differences, both in terms of applications and approvals (in relation to population size). These differences result on one hand from the different orientation of science systems toward basic research (Switzerland and Israel have a particularly high basic research orientation) and the presence of excellent research groups on the other. In terms of approved grants per capita, Switzerland takes the lead, followed by Israel, providing evidence of the excellent placement of both science systems. Austria is in seventh place, just behind the United Kingdom.

The funding vehicles of the Austrian Science Fund (FWF)

Within Austria, the Science Fund (FWF) plays a major role in the area of funding excellent basic research. In the following, we provide an overview of a selection of Austrian Science Fund programmes. The aforementioned definition of excellent basic research applies to the entire FWF portfolio; with an approval rate of less than 25 % all grants are highly competitive and are awarded on the basis of an international peer-review process. Moreover, to focus on the "high end" of the Austrian Science Fund (FWF), we include the following Austrian Science Fund programmes:[66]

- Special Research Areas (SFBs),
- National Research Networks (NFNs),
- the Start Programme,
- the Wittgenstein Prize.

Figure 54: ERC applications to Austrian research institutions (starting and advanced grants) 2007–2010 and approvals per one million population



Source: ERC, calculated by Joanneum Research

66 See also: http://www.fwf.ac.at/de/projects/index.html

These are all programmes in which a) the competitive aspect is emphasised especially, b) the disbursed funding amounts per project are significantly above average, and c) the award is assumed to exercise a structure-building effect in the scientific landscape.

The "Special Research Areas" and "National Research Networks" are oriented towards the creation of location-centred "Centres of Excellence" (SFB) and Excellence Networks (NFN). The 2004 evaluation of these programmes showed that the programme goals are being attained to a high degree, and that the scientific achievements in these programmes, completely in the sense of promoting excellence, lies significantly above the Austrian average. Another programme evaluation is planned for 2012. In the sense of streamlining the programme portfolio, the Austrian Science Fund has decided to combine the two programmes. The NFN programme ran out with a submission deadline of 2010 (the last approvals will take place in 2011); the SFBs will assume a new form as of the submission deadline in autumn 2011, creating a comprehensive and flexible programme for creating scientific priorities and excellent research units at Austrian research locations. This is a measure that simplifies the Austrian Science Fund's funding structure, a move that is not often found in the Austrian research landscape.

The Start Programme and the Wittgenstein Prize are by far the most competitive Austrian Science Fund (FWF) programmes. The large sums that are given to prize-winners mean that working groups can be built up that are capable of having a major impact. This shows that Austrian Science Fund funding is an important foundation both for the Start Programme and the Wittgenstein Prizes, as well as for successful ERC grants: 86% of the prize-winners who resided in Austria at the time of their application have an Austrian Science Fund track record. Almost one-third of all 45 ERC prize-winners were also successful in the Start Programme and/or the Wittgenstein Prize. It is noteworthy that even a few ERC prize-winners who have recently "immigrated" to Austria have experience with Austrian Science Fund projects. These are people who began their scientific careers in Austria, continued their careers abroad – sometimes with support from Austrian Science Fund Schrödinger stipends – and then returned on an ERC grant.

An additional funding vehicle that meets the excellence criteria described above is the Doctoral Programme (DK). These courses are meant to form educational centres for highly qualified young academics from the national and international scientific community, and to support the prioritisation and promotion of excellence at Austrian research institutions. The DK doctoral programme therefore fulfils the existing excellence criteria due to its highly competitive and structure-supporting character, yet the programme pursues a different objective above all: it supports first and foremost young scientists.

The DKs finance a professionalised doctoral student education in the sense of the EU Charta and Code requirements, as well as the UNIKO recommendations[67] with regard to contemporary doctoral education. The huge demand underlines the great need for this kind of financing and the significance that Austrian universities assign to this sector. Including the various programme categories of Austrian Sci-

67 "European charter for researchers" and the "Code of Conduct for hiring researchers", referred to here as the "Charter and Code" (http://ec.europa.eu/eracareers/pdf/eur_21620_de-en.pdf) and the Austrian University Conference, December 2007 (http://www.reko.ac.at/upload/Universities_Austria.Recommendations.doctoral_studies.March08.pdf)

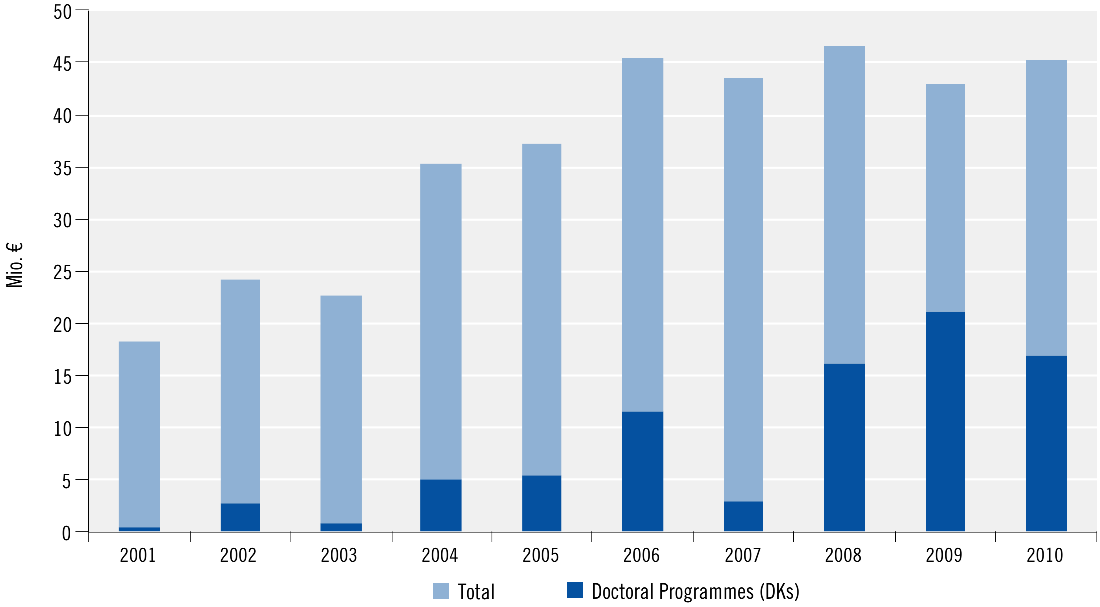
ence Fund-funded doctoral students, there were almost 1,700 doctoral students on the Austrian Science Fund "payroll" on 31 December 2010. This is the most important funding source for a high-quality, competitive doctoral education system with close connections to internationally recognised scientific research.

The Doctoral Programme (DK) has seen the largest climb in demand by far among the programmes that call for project submissions from scientific consortia.

The following Figure 55 shows the development of overall funding volume in the five Austrian Science Fund programmes named above (SFB, NFN, Start, Wittgenstein Prize and DK). This give an impression of the promotion of excellence in Austria. The rapid rise in funding volume between 2001 and 2006 is clear. In this period of time, funding volumes tripled for these programmes (from about € 18 million in 2001 to somewhat more than € 45 million in 2006). However, since 2006 there has not been an additional increase, so that the absolute funding amount between 2006 and 2010 averaged € 44.6 million per year. Cumulatively over the period of time from 2001 to 2010, € 362 million were invested in promoting excellence.

An analysis of the distribution of the funds in these programmes by scientific discipline shows that, during the period from 2001 to 2010, the two disciplinary groups of natural sciences / technology and human medicine, followed by the life sciences, accounted for about 80% of total funding in the excellence

Figure 55: Approved funding totals SFB, NFN, StaWi, DK



Notes: SFB (special research areas); NFN (national research networks); StaWi (start-, Wittgenstein prize-winners); DK (doctoral programmes)

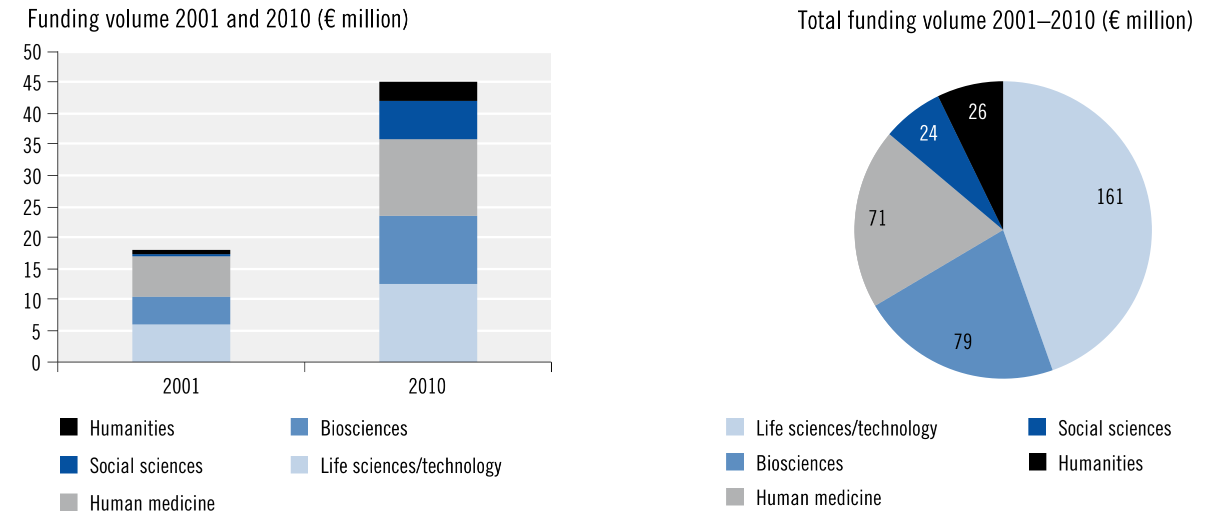
Source: FWF, Calculations by Joanneum Research programmes. It is also worth pointing out the increase in the share held by the social sciences. With a total funding volume of € 6 million in 2010, they were able to increase their portion of overall funding volume to 13.6% (2001: 1.8%). The humanities and social sciences together were thus able to post a clear increase in their share of the excellence programmes. This rise means the humanities and social sciences attained a share in the years 2009 and 2010 that reflected their share of the total budget (18–22%), which has been stable for years.

Over the entire period of time from 2001 to 2010, life science / technology programmes have been funded with € 161 million. The life sciences have received € 79 million, and human medicine has received € 71 million.

6.3.1 Summary

Austria has long been very successful in raising funds from the European Research Council (ERC). Measured by the number of applications submitted per capita, Austria is ranked in the middle; Austria, however, is in seventh place when it comes to the number of approved applications per capita. The Austrian success rate is among the highest in Europe (fourth place, together with the United Kingdom). These results are significant indications of the quality and international competitiveness of top Austrian research. The national funding of excellent research by the Austrian Science Fund (FWF) has also developed very positively in recent years. While in 2001 just under € 18

Figure 56: Approved funding totals SFB, NFN, StaWi, DK by scientific discipline



Notes: SFB (special research areas); NFN (national research networks); StaWi (start-, Wittgenstein prize-winners); DK (doctoral programmes)

Source: FWF, Calculations by Joanneum Research million went to excellent research, the funding volume was already up to € 45 million by 2010. Over the entire period of time from 2001 to 2010, Austrian Science Fund (FWF) excellence programmes have been funded with € 361 million.

6.4 Mobility of research personnel in the Austrian university sector in EU comparison

In the context of the current debate about knowledge- and research-based growth models for highly developed economies (Aghion et al. 2009), the mobility of researchers has assumed major importance. The mobility of personnel – and especially for researchers – spreads knowledge between firms and non-university research institutions, as well as between geographic regions. This accelerates technological progress (Almeida and Kogut 1999) in that, on one hand, firms and research institutions use the knowledge and abilities that researchers bring to the table, and on the other hand, individual researchers learn additional skills and accumulate further knowledge. Mobility thereby unleashes pro-growth effects at both the individual and overall economic level.

Another aspect is that the mobility of researchers and the resulting exchange of knowledge counteracts the fragmentation of research projects across several countries. For this reason, the promotion of mobility has become a foundational pillar of European research agendas that are pursuing the goal of eliminating the fragmentation of research in Europe and thereby creating a general European research area (Macguiness and Carroll 2011).

In this area, three major initiatives have been started since the turn of the century: the "visa package for scientists", the national EURAXESS Service Centres for supporting mobile researchers in the context of the Europewide "EURAXESS – Researchers in Motion" (previously ERA-MORE) programme, and "European charter for researchers and the code of conduct for hiring researchers". These provide the regulatory framework for improving the employment of researchers and removing obstacles to mobility. With the "better career possibilities and more mobility: a European partnership for researchers" memorandum of 2008 (European Commission 2008a), the European Commission is also pursuing the goal of creating a framework for shared measures at the member-country level to improve the hiring process, to create retirement pensions and social insurance for mobile researchers, and to make employment and working conditions more attractive. These objectives were undertaken in the "Innovation Union" guideline initiative, and the Europe 2020 Strategy will continue to follow up on them (European Commission 2010a).

The purpose of this chapter is to establish the central features of the mobility of researchers in the Austrian university sector and compare them in European context.

6.4.1 Definitions and data

The data that form the basis of this section were collected during the MORE Project[68] on behalf of the European Commission. On one hand, the survey was meant to provide a more precise picture of researcher mobility; on the other hand, it was also supposed to ascertain the motives of mobile and non-mobile researchers. Relying on the definition from the

68 The final report and the partial studies of this project are available online at http://ec.europa.eu/euraxess/index.cfm/general/research-Policies. The acronym MORE stands for "MObility of Researchers in Europe".

Frascati Manual (see OECD 2002), this survey defined researchers as:

"Specialists who are involved in the design and production of new knowledge, products, processes, methods and systems, or who are involved directly in the management of research projects."

This does not limit the definition of specialists to those with an academic education.

Another important definition that guided the survey was that of the term, mobility. As mentioned earlier, the European Commission is not only using its mobility strategy to pursue the generation of external effects through the exchange of knowledge; instead, this strategy is also meant to counteract the profound fragmentation of the European research area. Accordingly, the surveys of the MORE Project designed the term 'mobility' in such a way that it could capture cross-border exchanges between scientists and researchers among member states, as well as between the EU and other countries.

Researchers were categorised as mobile
"*if, after the completion of their highest academic degree, they worked as a researcher or scientist for at least three months in a country other than the country in which they earned that degree."*

This definition is shaped by the idea that researchers and scientists are initially integrated into a national research environment and enabled to do research by virtue of their most recent academic degree. This assumes that phases of mobility that occur after completing an education has a direct effect on research activities and the research environment, thereby exercising an indirect effect on the European research area. Earlier phases of mobility, however, are related to education and therefore have only a limited effect on later research activities. The relatively short period of three months for defining a phase of mobility should enable the statistics to capture research semesters and other brief stays abroad for research purposes. In addition to this category, the survey included changes of employment between the public and private sector, as well as between different jobs.

The MORE Project conducted four surveys among scientists and researchers in universities, firms and non-university research institutions, as well as among researchers who work in other countries. Only the surveys of the higher education sector were representative at the country level and by scientific branches[69], which is why this data can be incorporated into calculations of country-specific indicators and for comparisons between EU member countries[70]. For this reason, this chapter focuses primarily on university researchers, meaning researchers who work either at universities or at universities of applied science in Austria. Additional survey results from researchers in countries outside the EU were only included in the presentation of the attractiveness of research locations, barriers, and framework conditions.

69 The scientific areas are: life sciences and engineering, human medicine, agriculture and forestry, veterinary medicine, and the social sciences and humanities.

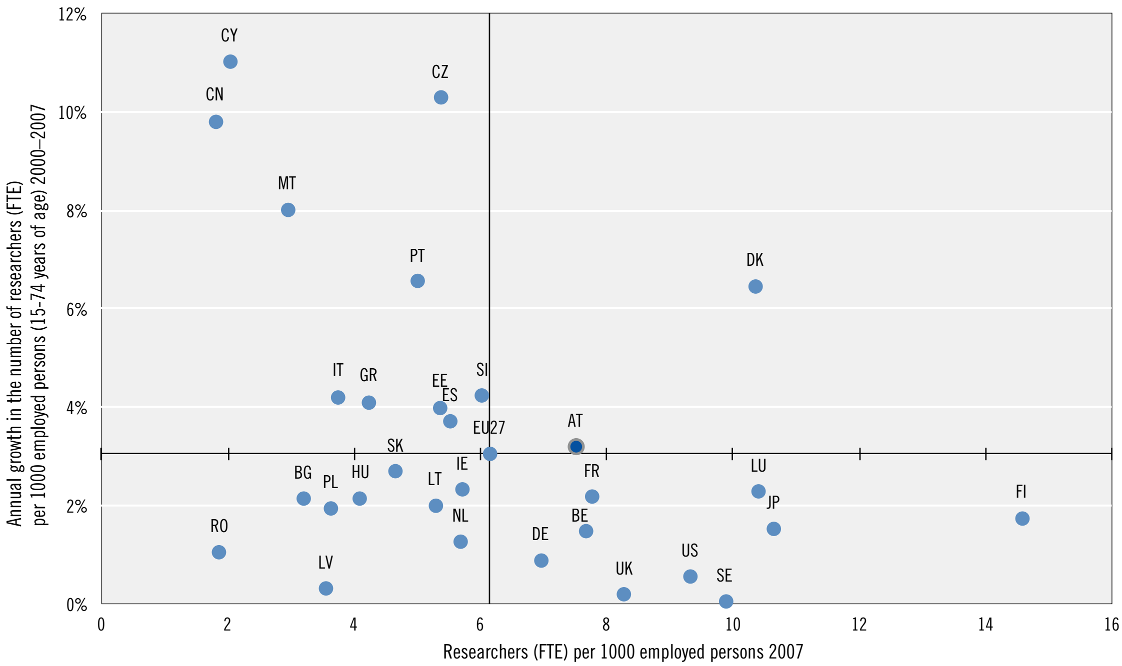
70 The MORE Project survey was conducted between June and October 2009. 41,857 researchers were surveyed in the EU-27 countries, and 721 of these were in Austria. The Europe-wide response rate was 10.8% (4,538 valid responses) and 15% in Austria (109 valid responses). The baseline for the survey was 22,648 (Austria: 330) academic units at around 1,660 universities (Austria: 25) in the EU-27 countries. The margin of error in the survey data for the entire data set was +/- 1.6% at a confidence level of 95%; for Austria, the margin of error was +/- 7.2% (this means, for example, that the average number of mobile researchers surveyed for Austria was 51% (see Table 9) with a 95% likelihood between 43.8% and 58.2%). A more precise description of the survey methodology is available in the final report of the MORE Project (see IDEA Consult 2010a), available at: http://ec.europa.eu/euraxess/pdf/research_policies/MORE_final_report_final_version.pdf

6.4.2 Researchers in Austria in European comparison

Within the European Union, 2.2 million people were employed in 2007 as researchers. This corresponds to 1.4 million full-time equivalents[71]. This number continues to grow: Between 2000 and 2007, it increased by 3.9% each year, which yields an overall increase of 31%. Measured in the share of researchers of the working-age population (researcher ratio), Austria occupies the middle of the European field, ahead of Germany (Figure 57). Within the EU-27, Finland has the highest ratio (at 15 researchers per 1,000 employees), followed by Luxembourg, Denmark, Sweden (ca. 10) and the United Kingdom.

In international comparison, the researcher ratio in the EU-27 is significantly lower than in the USA (9) and Japan (11). Only Luxembourg, Denmark and Sweden have a similarly high ratio. In contrast, the value for China, at about 2 researchers per 1,000 employed persons, is at the level of Romania or Cypress. However, we must keep in mind here that, due to the sheer volume of employed persons in China, the absolute number of researchers is very large. Additionally, the researcher ratio in China grew at around 10% each year, more than three times as fast as the ratios for the EU-27 (3.1%) and more than five times as fast as in Japan and the USA. Austria, with an annual growth rate of 3.2%, is just above the EU average.

Figure 57: Number and annual rate of growth of researchers (in FTE) per 1,000 employed persons in the EU-27 countries (2000–2007)



Source: MORE – IISER, EUROSTAT data; calculations by the Austrian Institute of Economic Research (WIFO)

71 These figures are based on the IISER indicators, surveyed in the context of the aforementioned EU study (see IDEA Consult 2010b). The study is available at: http://ec.europa.eu/euraxess/pdf/research_policies/MORE_final_IISER_update_report_final_version.pdf.

6.4.3 Mobility in the Austrian university sector in EU comparison

The results of the representative survey of the MORE Project show that in 2009 56% of researchers in the higher education sector in the EU-27 have worked for more than three months outside the EU at least once in their career outside of the country in which they earned their highest academic degree (Table 16). The value for Austria was slightly below the EU average at 51%. The values for Germany (50%) and the United Kingdom (49%) are similar to those for Austria. Due to the lack of comparable data and mobility definitions for other periods and countries, these numbers are difficult to assess. Nonetheless, the figures suggest that it is completely typical for scientists and researchers to have phases of mobility at different points in their careers.

If we assess the personal and demographic characteristics of mobile researchers, Table 16 shows that the majority of them are male (67% on average in the EU-27). In Austria, this proportion is even higher at 76%.

Table 16 also shows that, across the EU, about 30% of mobile researchers working in the university sector have already spent time abroad during their studies. Among non-mobile researchers, only 22% were mobile during their studies. This result underlines results from other studies (De Grip et al. 2009) that demon-

Table 16: Proportion of mobile researchers in the university sector and their characteristics, selected EU countries in 2009

Country	% proportion of mobile researchers among all respondents	Characteristics of mobile researchers						
		Highest qualification Share in % Doctorates	Gender Distribution Share in % male researchers	Age: average Age	Age: Share in % under 40	Married % share of surveyed researchers	Children % share of surveyed researchers	Mobile as student % share of surveyed researchers
Austria	51%	80%	76%	42	48%	76%	57%	35%
Belgium	52%	98%	76%	46	39%	84%	76%	41%
Czech Republic	44%	85%	75%	42	55%	73%	60%	20%
Germany	50%	96%	70%	45	38%	72%	60%	37%
Denmark	44%	72%	70%	42	61%	80%	57%	37%
Spain	61%	91%	65%	42	46%	70%	54%	25%
Greece	73%	100%	76%	52	18%	87%	80%	22%
Hungary	57%	96%	84%	50	24%	88%	76%	36%
Ireland	61%	75%	55%	42	53%	68%	45%	20%
Italy	60%	85%	62%	48	28%	76%	59%	30%
Netherlands	58%	90%	60%	43	49%	79%	58%	35%
Poland	55%	96%	68%	46	38%	73%	66%	37%
Portugal	70%	96%	46%	46	30%	76%	60%	30%
Romania	44%	100%	71%	44	45%	86%	74%	40%
Sweden	56%	93%	63%	45	37%	74%	65%	28%
United Kingdom	49%	95%	68%	46	38%	80%	53%	22%
EU-27	**56%**	**91%**	**67%**	**45**	**39%**	**76%**	**61%**	**30%**

Source: MORE Higher Education Survey, data survey by European Commission; calculations by the Austrian Institute of Economic Research (WIFO) strate that mobility during university study increases the likelihood that a researcher's later career will take them abroad.

As Table 16 shows, throughout the EU, 76% of mobile researchers are married and 61% have children. The literature generally argues that these demographic factors act as an obstacle to mobility (Dickmann et al. 2008), to the extent that these figures seem very high. However, these numbers refer to the mobility of a researcher throughout the entirety of their previous career. Factors that limit mobility, though, are of course only relevant at the point in time at which decisions regarding mobility are taken. If we compare the results with the demographic characteristics of the researchers who have been mobile within the last three years, then we see that a significantly smaller proportion of mobile researchers have children or are married: The share of married persons in this group drops to 71% and the share of parents to 50% (IDEA Consult 2010a).

Table 17 characterises the employment conditions of the researchers who were surveyed. The first two data columns show the share of researchers who are employed on the basis of a fixed-term contract. This applies to about a third of researchers across Europe. These persons are on average 39 years old. If we compare these numbers with the figures for Austria, we find that a strikingly higher proportion (53.4%) of Austrian researchers report that they are working on temporary employment contracts. Their average age is also below the EU average. The last two data columns present the number of respondents who are employed full-time. EU-wide, 91.5% of respondents are employed full-time. Their average age is 45. In Austria, the share of researchers who are not employed on a part-time basis is at 80%.

Table 17: Employment conditions for researchers in 2009

	Employment conditions			
	Fixed-term contract		Full-time employment	
	% share of those surveyed	average age	% share of those surveyed	average age
Austria	53.4%	32	79.7%	39
Czech Republic	75.5%	41	88.2%	43
Germany	38.1%	37	84.3%	45
Denmark	74.9%	36	95.4%	41
Spain	37.2%	39	95.2%	43
Finland	67.6%	40	90.5%	45
Italy	12.6%	44	94.2%	48
Netherlands	42.9%	37	75.2%	42
Poland	41.1%	39	97.3%	44
Sweden	39.6%	39	89.3%	46
United Kingdom	21.1%	39	91.8%	45
EU-27	**32.6%**	**39**	**91.5%**	**45**

Source: MORE – Higher Education Survey, data survey by European Commission; calculations by the Austrian Institute of Economic Research (WIFO)

Overall, these data suggest that temporary and part-time employment seem to be characteristic of the early phases of a research career. Austria has an above-average proportion of researchers who either have work contracts of limited duration or are only working part-time in their capacity as a researcher. On one hand, this indicates that the early phases of a research career in Austria are strongly influenced by temporary and/or part-time work contracts, which could also be an important incentive for taking a job abroad (Criscuolo 2005). On the other hand, these numbers are shaped by the fact that the share of doctoral candidates surveyed in Austria, at 37%, is very high; EU-wide, only 12% of respondents were doctoral students[72].

An explanation specific to Austria also lies in the transfer of personnel management to the autonomous universities on the occasion of the 2002 University Law and the associated shift to employment conditions regulated by the Salaried Employees Act. As long as no collective agreement was effective new employees where hired according to the laws regulating the employment conditions for members of research staff (Novelle des Vertragsbedienstetengesetzes) in force since 2001. These laws did provide only for fixed term contracts.[73] The late conclusion of a collective agreement among the contractual partners – the collective agreement for universities came into force on 1 October 2009 – also helps to explain the higher share of temporary work contracts for university staff in 2009.

6.4.4 Geographical mobility and the attractiveness of various destination countries

Geographical mobility is understood as a job change that significantly changes the job's location. This category includes, is not exclusively comprised of, cross-border employment changes. For a few countries, this form of mobility represents a cornerstone for the research and economic systems, because a major share of the population with tertiary education were born abroad. Freeman (2009) shows, for example, that the USA depends very strongly on the immigration of highly skilled and highly educated workers to maintain its dominant position in science and research. Yet while national economies such as the USA profit from his influx, the substantial 'brain drain' of highly qualified scientists negatively impacts the economic and scientific competitiveness of other countries, including Austria (Bock-Schappelwein et al. 2008). Highly developed countries are therefore engaged in global competition for talent (OECD 2008d), and the attractiveness of a research location is a major criterion for decision-making in this regard.

The survey conducted under the auspices of the MORE Project on the mobility of researchers between Europe and the USA confirmed that mobility between these two economic areas is primarily unidirectional. The EU supplies the USA with scientists and technicians who are offered a better research location there. This is also reflected in what researchers say about the attractiveness of possible desti-

72 Whether this is a characteristic of scientists employed in the university sector, or is a distortion in the survey, is difficult to evaluate. The official data, provided by the Data Warehouse of the Federal Ministry of Science and Research, divide up university personnel in different ways. Doctoral students are not explicitly identified in the scientific personnel. Nevertheless, the share of assistants and other scientific personnel, without lecturers, is 85%; assistants financed with third-party funding constitute 26% of total scientific personnel. Due to this distribution of features, the characteristics identified in the MORE Project for researchers working in Austria appear plausible.

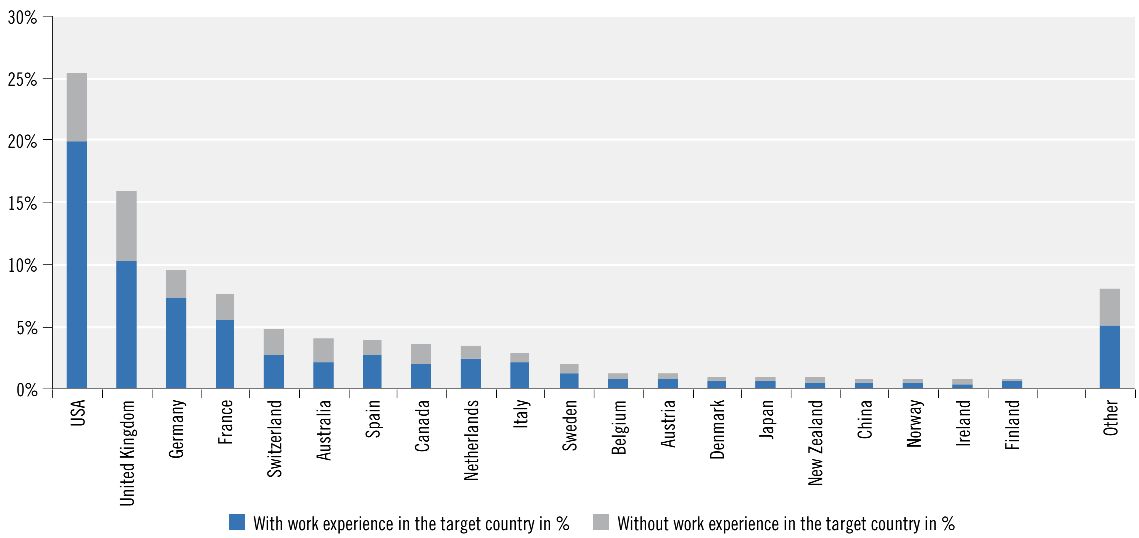
73 See BMBWK (ed.), Report on aid for young talent and the development of university personnel structures, in accordance with § 121(19) UG 2002, Vienna 2006, p. 16ff.

nation countries. In the general sample – consisting of U.S. researchers who work in the EU and European researchers who work either in the USA or in the EU – every fourth respondent said that the USA was the most attractive country, while about 16% would prefer the United Kingdom and only 10% would prefer Germany. Austria is not among the top ten most popular countries (Figure 58). This ranking is influenced by country size because larger countries are better known and more researchers work there, thereby earning a country its reputation for scientific production and increasing the degree to which the location is recognised.

Personal relations, particularly previous experience in the country at hand, plays a very strong role in this assessment. To filter out this influence, Figure 58 differentiates between statements by those researchers who work or have worked in the named country (the lighter-shaded segments of the bar) and those who have no personal experience with the country (the dark-shaded portion of the bar). This distinction provides an insight into the reputation of each destination country, which each enjoys primarily in accordance with the level of personal exchange.

We see here that certain countries are viewed as attractive by a relative majority of respondents, although they have never worked there. These are (by number of mentions) the United Kingdom, the USA, Germany, Switzerland, France, Australia and Canada. If country size is considered, then the frequent mention of Switzerland becomes particularly significant. Austria, however, seems to be a less attractive destination for researchers, both in terms of absolute and relative mention by people who have no experience with Austria. For example, while 43% of researchers named Switzerland as the most attractive country without ever having worked there, only 29% said the same of Austria.

Figure 58: The most attractive destination countries for future mobility among researchers



Source: MORE – survey outside the EU. Data survey by European Commission. Share of mentions (in %) within sample. Underlying questions: “From your perspective, which country is the most attractive location in terms of your potential future mobility?”, calculations by the Austrian Institute of Economic Research (WIFO)

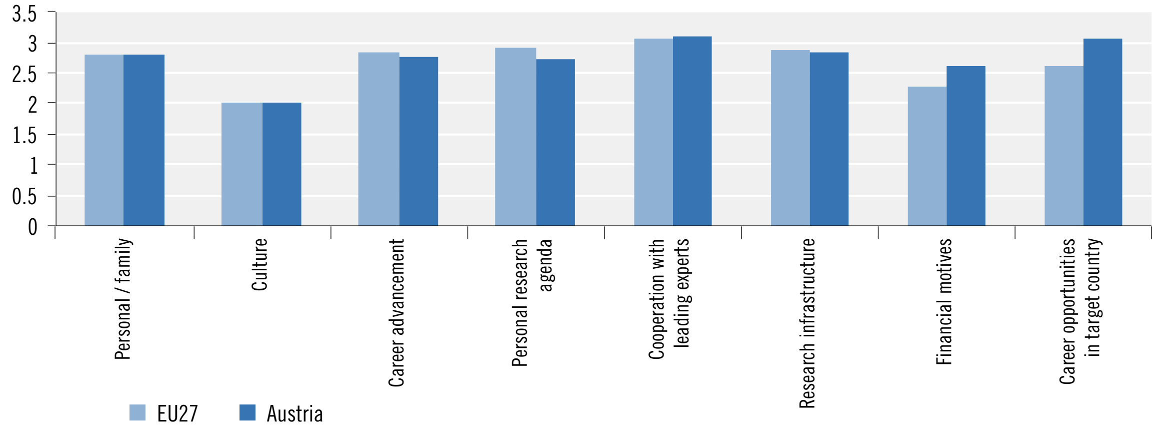
In terms of the attractiveness of Austria as a research location, and above all the lure of its universities, the results from Janger and Pechar (2010) permit a conclusion: in this study, researchers with an Austrian connection who worked in the USA were asked about forms of university organisation that encourage excellent research. A majority named organisational models that did not match those of Austrian universities. Their criticisms focussed on insufficient career opportunities due to the lack of tenure-track positions and limited options for being able to conduct independent research early in their careers.[74]

6.4.5 Incentives and motivation for border-crossing mobility

The data of the MORE Project enable a more precise illustration of the factors that motivate researchers in universities to go mobile and cross borders, as well as the factors that make a country an attractive destination in the eyes of researchers. The economic literature has shown in this regard that highly skilled people begin to contemplate working abroad whenever the monetary and non-monetary gain, in contrast to the (monetary and non-monetary) remuneration in the country of origin, is higher than the costs associated with the change. The mobility costs here should be understood in the broadest possible sense, extending from direct costs (i.e., higher living costs, lost insurance periods for pensions) to "psychological" costs (leaving a social environment, cultural differences, etc.). This means that countries are attractive when they offer highly skilled individuals significantly better pay and better non-monetary incentives (Heckman and Honoré 1990, Borjas 1999, OECD 2008d).

The survey results show (Figure 59) that researchers in the university sector, throughout the EU, assign less importance to financial motives. Important factors for border-crossing mobility are related instead to the research en-

Figure 59: Motivation for border-crossing mobility in the university sector



Source: MORE – Higher Education Institutes Survey. Data survey by European Commission. Scaling: 1 – unimportant, 2 – somewhat unimportant, 3 – important, 4 – very important; survey question: "How important was the following factor for your decision to pursue an internationally mobile career?" and for immobile researchers: "How important was the following factor to prevent you from pursuing an international career?"; "culture" factor only surveyed among mobile researchers, calculations by the Austrian Institute of Economic Research (WIFO)

74 See also the following chapter.

vironment: working with leading experts is named as the most important motive, followed by personal research agendas, career progression and available research infrastructure. Private or family-related motives are valued somewhat less.

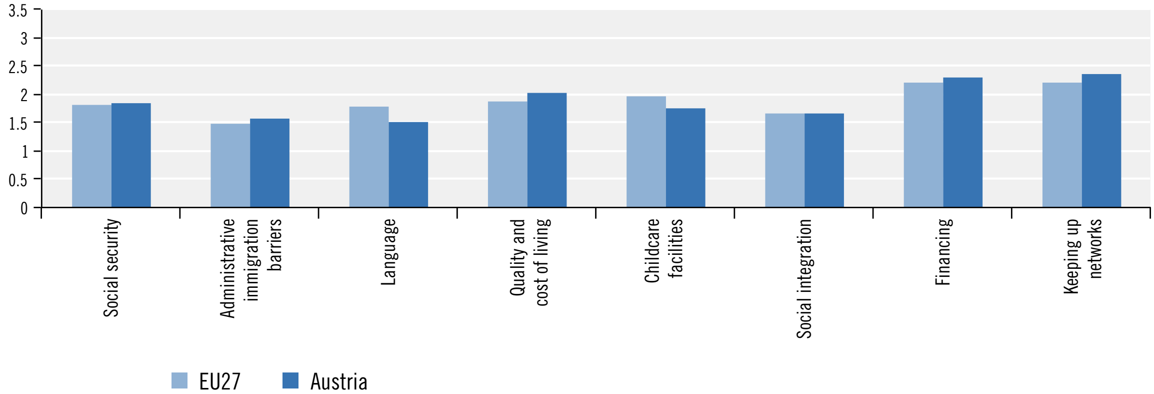
If we observe the motives of researchers working in Austria, the values barely deviate from the EU average. However, researchers classify financial motives and career opportunities as an important determinants of mobility at a level above the EU average. In view of the average high level of pay for researchers in Austria (European Commission 2007), the fact that financial motives are mentioned seems at first glance to be implausible. Yet it must be considered that the evaluation of this motive does not depend on a country's average salary level; instead, it depends on the salary increases that a researcher can get via mobility. Accordingly, it is important to keep in mind the fact that a relative high percentage of people surveyed in Austria are employed on temporary or a part-time basis. This aspect is also important in the evaluation of career motives. The form of university careers and university organisation in Austria can also play a role here (Janger and Pechar 2010).

There are hardly any statistically significant differences between men and women in the motives for international mobility. However, women do assign a slightly greater importance to familial motives, working with leading scientists, research infrastructure and career opportunities, while they assign slightly less significance to their own personal research agenda.

6.4.6 Barriers and obstacles for border-crossing mobility

Barriers and obstacles represent real or imagined costs that enter into considerations about becoming internationally mobile. Some of these costs depend on the legal and socio-political situation in the destination country, while others, such as leaving behind friends and family, are not country-specific; the latter set of costs depend on the personal attitudes and circumstances of potential migrants. Stroh (1999)

Figure 60: Obstacles for border-crossing mobility in the university sector



Source: MORE – Higher Education Institutes Survey. Data survey by European Commission. Scaling (for mobile / immobile researchers): 1 – no difficulties / no influence, 2 – few difficulties / little influence, 3 – some difficulties / strong influence, 4 – major difficulties / very strong influence; underlying questions (for mobile / immobile researchers) "Did the following factor cause difficulties for your internationally mobile career?" and for immobile researchers: "To what degree did the following factor influence your decision to not become internationally mobile?", calculations by the Austrian Institute of Economic Research (WIFO) argues, for example, that children and relationship status play an important role: couples have to coordinate with each other, while the readiness to move to a new country often depends on the partner's prospects of finding a job there (Dickmann et al. 2008).

Figure 60 shows how researchers in the university sector, both in the EU and in Austria, assess obstacles to mobility. Financing and the potential loss of professional and private networks are identified as the most important obstacles. These problems are followed by difficulties with child care, with the right to claim social insurance, calculations of insurance periods, and fears about quality of life and associated costs. Researchers working in Austria assign a slightly greater significance than the EU average to financing questions, maintaining networks, living costs and administrative barriers to immigration. Fundamentally, however, all of the obstacles are considered as rather low.

A gender-based comparison (not shown in the figure) shows that women assign a slightly greater importance than men to finding sufficient childcare facilities, adequate financing for the mobility phase, taking along social insurances (pensions etc.), and maintaining networks.

6.4.7 Summary

MORE project data has shown that careers take scientists and researchers to different places at different points in their careers. In 2009, 56% of higher education researchers surveyed across the EU reported that they had worked at least once in their careers for more than three months in another country. The value for Austria was slightly below the EU average at 51%.

The group of mobile researchers is dominated by men. Across the EU, two-thirds of mobile researchers are men; in Austria, this number is 76%. On one hand, this suggests that women are more limited in terms of professional mobility; on the other hand, Austria's figures reflect the fact that the share of women among human resources for science and technology is very low in European comparison.

Among the researchers surveyed in Austria, the share of temporary or part-time working arrangements were above average in European comparison. This can be a significant incentive, especially for young and talented researchers, to leave Austria. This is also mirrored in the motives named by mobile researchers: Austrian researchers identified financial motives and better career opportunities as important reasons for working abroad. The results on financial motivation appear to be driven by the larger number of younger researchers who are employed on temporary work contracts, while career-related motives are ostensibly based on the design of university careers and university organisation in Austria.

6.5 Organisational framework conditions for academic quality at universities

Due to the increasing significance of knowledge production in knowledge-based societies and the connections between scientific research and economic prosperity, universities are becoming an important component of national strategies for the future. Knowledge transfer from the academic sector to the economic sector travels over several different paths:

in addition to the direct effect of research performance for firms, the utilisation of academic knowledge leads to new start-ups. The presence of outstanding researchers can also lead to a geographic concentration of outstanding colleagues in the same subject (Darby and Zucker 2007). University research in general has both direct and indirect positive effects on the innovation efforts of firms: directly on the number of corporate patents, and indirectly on the R&D spending of local firms (Jaffe 1989).

Which factors influence the scientific quality of academic research? Questions about financing play an essential role in efforts to strengthen university research performance (Aghion et al. 2007). But the organisation of universities also proves in empirical analyses to be a significant explanation of differences in scientific productivity. Bauwens et al. (2008) use the variables of 'English skills' and 'forms of university organisation specific to universities in the Anglo-Saxon world'[75] to explain differences in scientific productivity. Both are statistically significant; the latter is even more significant than the level of GDP, human capital indicators and R&D budgets. According to their view, the organisational design of academic institutions is at least as important as the amount of allocated funds.

Which organisational features are primarily responsible for differences in scientific quality? An important element, the autonomy of universities, was already widely implemented in Austria under the auspices of the University Law of 2002: many of the building blocks of autonomy recommended by Aghion et al. (2007) now exist in Austria under the 2002 University Law. To classify the organisational features discussed in the relevant literature, we rely on the following two major driving forces of scientific research:

First, the incentive system in the sciences are based on the recognition that researchers earn from the scientific community for making new scientific discoveries (*priority*)[76]. This has several implications: Science becomes a *winner-takes-it-all* competition in which there is no second or third place. The awareness that someone else is working simultaneously on the same problem, serves as an incentive to work as fast as possible[77] and turns the selection of problems on which a scientist works into a risk: if only the first place finishers are rewarded, then years of work and resources can quickly be rendered worthless. The *winner-takes-it-all* mentality also leads to situations in which small differences in ability or in resources and equipment can make major differences in the likelihood of success: if only the initial discoverers receive scientific recognition, then other researchers who may have been on the verge of a breakthrough come away empty-handed; differences in their abilities and in their equipment has no relation to the differences in scientific recognition. This is an explanatory component for cumulative processes in science, meaning the ability to translate past success into new research financing. Reputation effects play a major role, partly for reasons of efficiency, partly because of the mechanism described above. This also partially causes the observed inequality of distribution of the number of publications per scientist[78].

The second driving factor is that scientists benefit from the time that they actively invest in solving a problem. They are intrinsically motivated and also extrinsically motivated by the recognition that the scientific community will grant to new discoveries. Salaries and material awards also play a role (Stephan 1996).

75 Operationalised as historical colonial relations to England.

76 See Merton 1957, cited in Stephan, 1996, p. 1201. Recognition can take place in different ways: as an eponym (the scientist's name is associated with the discovery), a prize (i.e., Wittgenstein, Nobel Prize), admission to an exclusive scientific society (i.e., Royal Academy of Sciences), as well as the frequency with which the publication that documents the discovery is cited. Publications are the lowest form of recognition, yet are a requirement for *priority*, or being the first scientist to publish such findings (Stephan 1996).

77 "Science is like a forward transaction on the oil market. If you're not first, then you can leave it alone." Wittgenstein award winner for 2006 Jörg Schmiedmayer,http://science.orf.at/science/news/142312

78 "Science is like a forward transaction on the oil market. If you're not first, then you can leave it alone." Wittgenstein award winner for 2006 Jörg Schmiedmayer,http://science.orf.at/science/news/142312

For the organisation of universities, this means that, after researchers have been hired, there should be as few barriers as possible standing in their way. Important elements include fast financial support for new research projects; mechanisms that enable researchers to deal with risk; and decision-making processes that guarantee that scientists can quickly research new topics that they believe are promising. Scientists should therefore be able to make independent decisions about their research.

How will international universities rise to the occasion? Which mechanisms will they consider most important to promote scientific quality? To more precisely address this question, Janger and Pechar (2010) conducted a survey to identify, in the context of a coherent study, specific and quality-promoting organisational features[79] at different stages of career development. The survey was meant to find out what universities do to win over the most talented scientists at every level, and what kinds of work or research conditions they then offer to these scientists. The basic concept of scientific quality follows the peer review principle, "*you can't define excellence, but you recognise it when you see it*" (also based on the *peer review* procedure), and the respondent was left to interpret the question – scientists know what constitutes scientific quality. The survey was sent to three groups of Austrian and non-Austrian researchers[80].

The respondents' profile is equally distributed (Table 18): The distribution of disciplines and researcher positions (between junior and senior) are balanced[81]. The average age is 41 (median 38.5). In addition, the institutions were evaluated on the basis of Lombardi et al. (2007) and the available citation studies from CEST (2004) for the university level: half of the respondents work in the world's Top 50 research institutions, and almost one-fifth of them work in the Top 20.

Table 18: The profile of responding researchers

	Number	Proportion of all respondents
Life science / technical disciplines	78	86%
of which: Life Sciences	43	47%
Non-life-science / technical disciplines	11	12%
Junior researchers	39	43%
Senior researchers	47	52%
Faculty member	55	60%
Top 50 Institution	45	49%
Top 20 Institution	16	18%

Values lower than 100% are due to missing personal information from individual researchers.

Source: Janger and Pechar (2010).

79 See for example Ben-David 2008, Gibbons et al. 2004, Harari et al. 2006, Herbst et al. 2002; Hollingsworth 2004, Hölzl 2006, Leitner et al. 2007, Lombardi et al. 2002, but this also details the university organisational statutes available on the Internet that differentiate high-quality research (i.e., MIT 2008).

80 Questionnaires went through the OSTINA network to 1,133 Austrian scientists currently working in North America, to non-Austrian scientists at selected international universities, and, as a control group, to 47 Start and Wittgenstein award winners from the years 2000 to 2007, who are overwhelmingly employed at Austrian institutions and universities. Overall, 92 researchers responded, a response rate (Ostina 7%, Wittgenstein 33%) that permits robust statements; despite multiple attempts, non-Austrian scientists (2 responses) scarcely responded. This need not be a major problem, though, since a few of the Ostina respondents are Austrians who work as senior faculty at some of the strongest research universities in the world: they have the advantage of being able to compare their experiences in Austria with the international system. They have successfully gone through the strict hiring practices of international universities and have done successful research, so that their perspectives on scientific quality do not represent a specific, insular Austrian perspective.

81 The balance of disciplines was evaluated roughly on the basis of the distribution of research funds among different disciplines at 200 American research universities (Lombardi et al. 2007): life sciences received 55%, and non-life sciences / technology disciplines received 7%. Although the latter are less cost-intensive, its share of research activity is underestimated; in the survey, the share was 12%. All positions up to and including assistant professor were classified as junior research positions; positions from associate professor (or university professor pro tem) upwards were classified as senior.

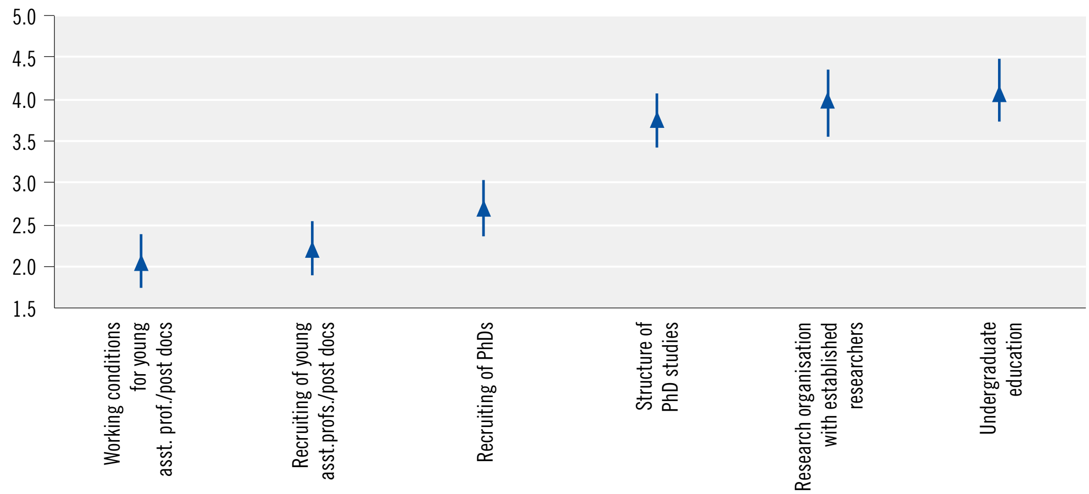
The survey results overall, as well as the subsamples, proved to be robust. This supports the meaningfulness of the results and suggests that there seem to be universal principles of success in the approaches to the organisation of university research (see also Mohrman et al. 2008). In the following, only the average is shown across all respondents.

Figure 61 shows the relative significance of individual steps in the promotion of scientific quality. The respondents were able to give rankings to the relative importance of individual steps, from 1 (most important) to 6 (least important), thereby arranging the six organisational steps into a hierarchy. The results are clear: the most important are working conditions for young researchers and their recruitment. The recruitment of doctoral students follows closely behind. Less significant are the structure of doctoral study, the organisation of research among established researchers, and undergraduate education.

Entering doctoral studies was often described as the first point of entry into a research career. Four elements were described ex aequo as very important (Figure 62): the scientific reputation of the teachers responsible for the doctoral programme, the amount of available financial support for students, international recruitment of doctoral students, and the scientific reputation of the university or the department in question. The opportunities for participating in research groups and the competitive awarding of doctoral financing fell far behind in the respondents' ratings. The selection of doctoral students under a formal procedure came in last.

The highest marks in evaluating the structure of doctoral study went to the elements "established researchers guarantee that doctoral students make progress and do not use them for administrative tasks unrelated to their course of study", as well as environmental effects in the form of the quality of other doctoral students (Figure 63). Following at a distance were the obligation that programme participants publish, as well as employment and stipend options to finance doctoral study.

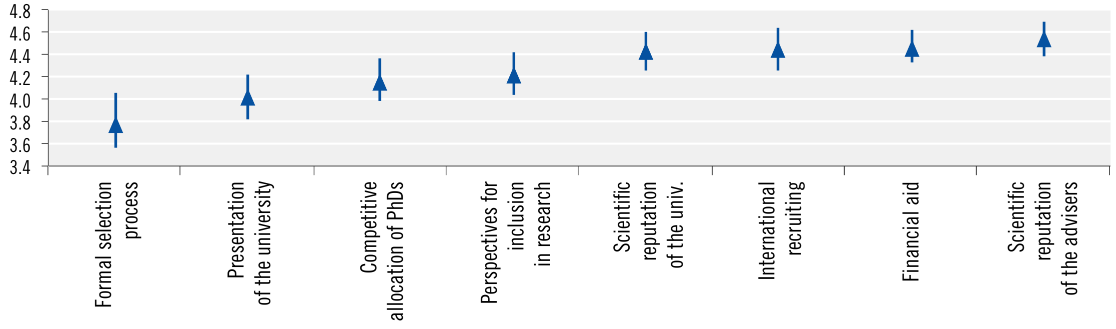
Figure 61: Significant of development steps for promotion of scientific quality



1=most important ... 6=least important
The figure represents the mean value as well as a 95% confidence interval.

Source: Janger and Pechar (2010).

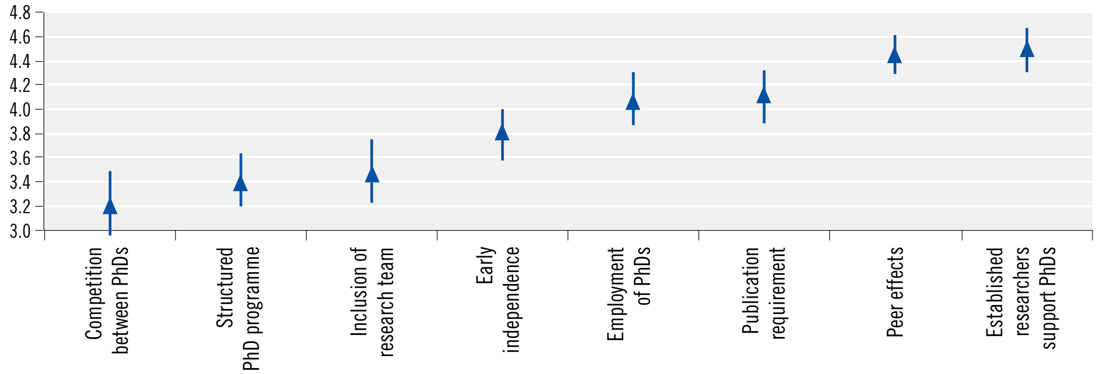
Figure 62: Evaluation of organisational features for the recruiting of doctoral students



5=very important ... 1=not important
The figure represents the mean value as well as a 95% confidence interval.

Source: Janger and Pechar (2010).

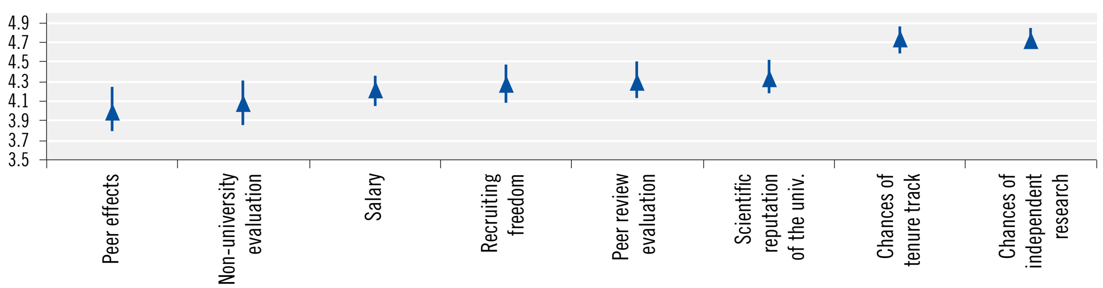
Figure 63: Evaluation of organisational features of doctoral study



5=very important ... 1=not important
The figure represents the mean value as well as a 95% confidence interval.

Source: Janger and Pechar (2010).

Figure 64: Evaluation of organisational features in the recruitment of young researchers



5=very important ... 1=not important
The figure represents the mean value as well as a 95% confidence interval.

Source: Janger and Pechar (2010).

Opportunities for independent research and the offer of *tenure track* positions were scored highest for the recruitment of young assistant professors (Figure 64). This was followed by the scientific reputation of the university or department, the evaluation of candidates by means of *peer review*, the university's financial ability to accept highly qualified candidates at any time (and not just when a position becomes open), as well as salary levels. The respondents assigned the lowest value to evaluating candidates through people inside and outside the university, as well as the so-called peer effect, which states that talented researchers hire talented researchers.[82]

In the responses to the question, "Which working conditions best promote the quality of scientific research among young assistant professors and post-doc researchers?", three elements were considered very important (Figure 65):

- Adequate balance between research and teaching;
- Facilitation of full-fledged, independent research projects;
- Career path models that, after positive evaluations, lead to *tenure* or a permanent position.

The following three elements (adequate research infrastructure, availability of third-party funds, and the peer effect) are classified as important. At a distance follow the availability of internal university financing, the promotion of interdisciplinary work, and participation in the research team.

For established researchers, organisational features that encourage quality include above all such elements as more easily using available third-party funding for new research areas, and to receive the necessary administrative support for this (when acquiring new financing sources, getting infrastructure, teaching, etc.). Environmental effects also represent a highly regarded feature of quality in the sense of 'the more talented researcher there are at an institution, the better the exchange of results and ideas will be'.

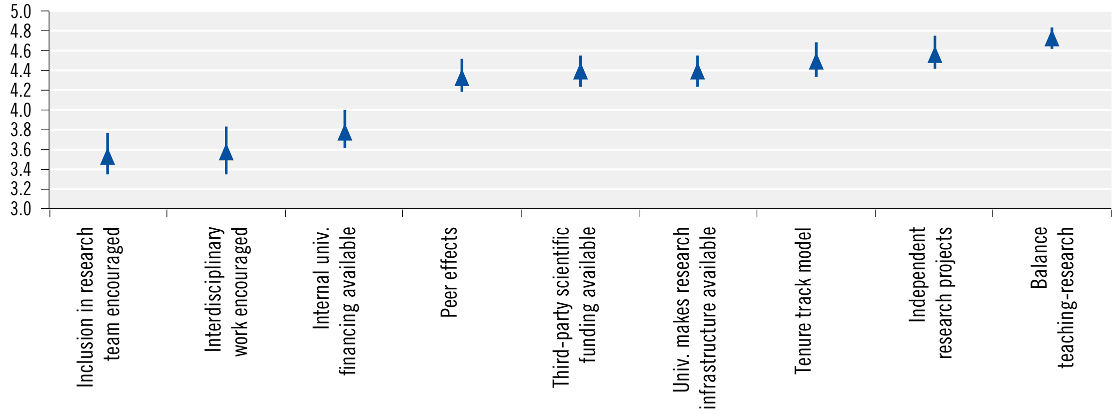
The survey results paint a relatively clear picture. To recruit young researchers, working conditions must be designed in such a way that they enable early opportunities for autonomous research. This takes for granted that independent research will be facilitated early on in an appropriate course of doctoral study. To attract the best and brightest at this stage, successful universities recruit internationally and make available sufficient financial support. After doctoral students have actively worked in research projects with established researchers, the high quality of doctoral students increases along with the quality of research at the university. As in other stages, this generates ripple effects – once a high standard of scientific quality has been attained, it is easier to maintain.

In addition to opportunities for independent research, assistant professors also want an attractive tenure track system that, with proper evaluations, can lead to long-term positions (*tenure*). In countries with an established *tenure* model, though, evaluation standards are strict and based on international *peer review*: The evaluation is important because young researchers must know, as early as possible, where they stand and whether a career in science makes sense for them. The search for candidates is made easier when the university has available funds to hire talented candidates at any time by offering them an appropriate salary.

To guarantee the career progression of young researchers, universities are attending to the

82 For reasons of space, only the most important elements are shown here; see Janger and Pechar (2010) for a full display.

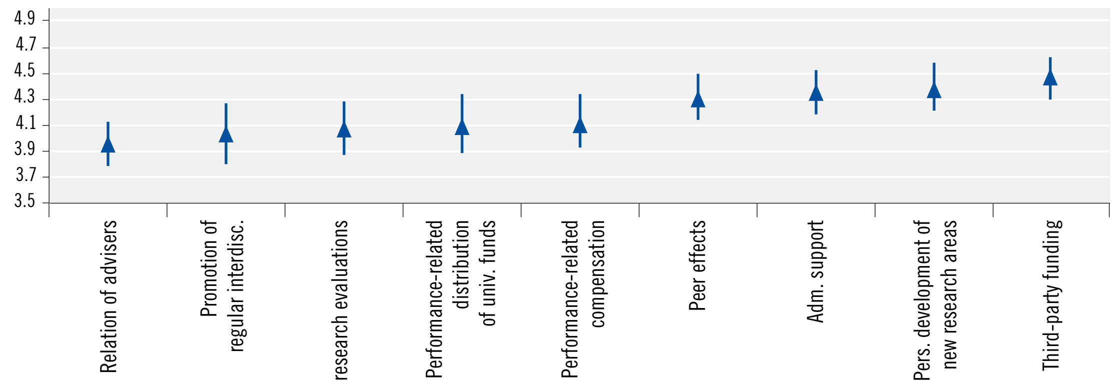
Figure 65: Evaluation of working conditions for young assistant professor and post-doc positions



5=very important ... 1=not important
The figure represents the mean value as well as a 95% confidence interval.

Source: Janger and Pechar (2010).

Figure 66: Evaluation of features of research organisation among established researchers



5=very important ... 1=not important
The figure represents the mean value as well as a 95% confidence interval.

Source: Janger and Pechar (2010).

proper balance between teaching and research duties, and the *faculty* model (instead of the prevalent Austrian professorship model) is being practised: hierarchical independence in research projects, the same rights and privileges as established professors, opportunities to manage their own research projects without interference from established professors, and opportunities for permanent positions. The advantages of this model include the possibility of quickly integrating new fields of research, enabling a *bottom-up* reaction to new trends (Herbst et al. 2002). Also, horizontal interactions between researchers, and thereby exchange of ideas, becomes more likely (Hollingsworth 2004). To provide financing for young researchers, a university-supplied *start-up grant* is drawn against third-party funding so that no time is lost in the application phase. This enables young researchers to dedicate themselves fully to research without financial risk, before they are evaluated. In international comparison, the *faculty* model and *start-up* financing are essential features of a flexible organisation that enables rapid adjustments to new trends and working on the leading edge of science.

For established researchers, the availability of third-party funding is an important criterion of success, because they already have experience in research management and the application process, and they can also build on the effect of their reputations. Third-party financing is significantly easier for them to acquire than young researchers who are at the beginning of their careers. Third-party funding also has the advantage of ensuring the quality of research projects and more strongly promoting productivity among scientists over the project's life cycle, more so than systems that rely upon internal mechanisms of university funding allocation (Herbst 2007)[83]. Another influential factor is the acquisition of new research fields guided by teachers and researchers, and not by the traditionally situated disciplines at a university. The *faculty* model has also demonstrated its advantages over the professorship system in this regard.

6.5.1 Summary

The current organisational model of Austrian universities implements quality assurance for university research primarily at the level of established researchers or by hiring professors. The study by Janger and Pechar (2010) implies that the promotion of scientific quality for university research, as it is explicitly addressed in the Europe 2020 Strategy, could take the form of strengthening the early career stages of university researchers, beginning with the recruitment of doctoral students. The respondents assigned central importance to recruiting young assistant professors , which can best be done by creating opportunities for early, independent research and seamless career models. In both of these points, the current Austrian chair-based model has notable disadvantages vis-a-vis the *faculty* model at most Anglo-Saxon universities, because young assistant professors are not placed on an equal level with professors due to the lack of internationally competitive hiring processes; this leads to young researchers only being able to conduct limited research. At the same time, the survey suggests how financing for university research can be adjusted: To increase scientific productivity, it could be advantageous to provide more university financing to young researchers while established researchers find it easier to procure funding through the competitive application process.

83 Leitner et al. (2007) do not find a clear answer to the question of the optimal relationship between internal and third-party funding. This work suggest the advantage of the faculty model in combination with internal university funding for junior researchers, as well as third-party funding for established researchers. Yet organisational models based on internal university financing show strong quality components in evaluation criteria (as in Switzerland or the Netherlands).

7 Aspects of innovation

7.1 The importance of services in the Austrian innovation system

The growing importance of the tertiary sector in the overall economy – a phenomenon known as "tertiarisation" – has been the subject of study and debate for decades. Given the key role the service sector plays in the economy as a whole, the focus in recent years has turned increasingly to examining its research base and innovative potential.

R&D expenditures by Austria's service sector have in fact posted above-average growth in recent years and now account for about 29% of total R&D expenditure by the corporate sector (compared to 22% in 1998). But the complexity of the tertiarisation process cannot be adequately described by a strictly sectoral analysis. Many manufacturing companies are also active service providers, with technology- and knowledge-intensive services playing an especially prominent role. Meanwhile, the service sector often provides technology- and knowledge-intensive or innovation-related preliminary services to industry, including direct research and development (engineering analyses, etc.), creative services or business-related services (business consulting, etc.).

In this context, the purpose of this chapter is to outline the significance of the various service segments and their innovation services within Austria's system of innovation and how they contribute to this system. We will examine not only the R&D and innovation activities of service sector enterprises but also the interaction between the manufacturing and service sectors.

7.1.1 R&D expenditures in the service sector

Given the complex and multidimensional nature of innovations in the service sector, one can assume that research and development spending in the strict sense accounts for only a portion of the service sector's overall innovation efforts. The definition of R&D in the Frascati Manual (OECD 2002) offers a comparatively narrow concept of innovation in the service sector, so that this definition covers only part of the overall innovation activity in the service sector – less than in manufacturing[84]. This is especially apparent in the fact that for quite a few of Austria's important and innovative service industries, such as tourism, no R&D expenditure as defined by Frascati is recorded statistically. Nevertheless, R&D statistics (R&D surveys conducted by Statistik Austria) are a valuable and essential source of data for analysing the service sector, even if one needs to take this limitation into account when interpreting the data.

R&D expenditure in Austria's service sector

84 The assumption here is that the correlation between in-house R&D expenditure and innovation activities in the service sector is less significant than in manufacturing or that innovations in the service sector are less dependent on in-house R&D spending than in manufacturing.

has since grown to impressive proportions quantitatively as well. In 2007, the 1,023 service sector units that conducted R&D spent some € 1.4 billion on research and development (Table 19). This represents 40.6% of all R&D units and accounts for 29% of all R&D expenditure in Austria's corporate sector.

Compared to 2002, both R&D expenditure and the number of units conducting R&D have increased considerably. R&D expenditure grew 72% since 2002, while the number of R&D units rose 48%, making R&D growth more dynamic in the service sector than in manufacturing in the period under review. This means that the share of the service sector in overall corporate-sector R&D has further increased – a trend that was already evident in the previous periods: the service sector's share of R&D expenditures was 22% in 1998 and rose to 26% in 2002. The comprehensive process of tertiarisation (in the sense of the growing importance of the service sector itself) is also reflected in research and development.

An examination of R&D expenditures within the service sector reveals a pronounced concentration in just a few service segments (Table 20). The "research & development" industry alone (NACE 73) accounts for nearly € 458 million or 32% of the service sector's R&D expenditures (or 9.4% of total R&D spending in Austria). But this also highlights a problem with R&D statistics, which is that this industry – due to the nature of its primary business activities – includes units funded through Kplus/COMET. Such units are usually part of manufacturing companies, how-

Table 19: Indicators of R&D activities in Austria by sector

Sector	2007						2002					
	Number of units conducting R&D	R&D expenditure [€ million]	Gross value added (GVA) [€ billion]	R&D as component of GVA [%]	Share in R&D expenditures [%]	Share in GVA [%]	Number of units conducting R&D	R&D expenditure [€ million]	Gross value added (GVA) [€ billion]	R&D as component of GVA [%]	Share in R&D expenditures [%]	Share in GVA [%]
Agriculture and forestry, fisheries	4	1	4	0.0	0	2	4	2	4	0.1	0	2
Mining	9	8	1	0.8	0	0	9	3	1	0.3	0	0
Manufacturing	1391	3383	49	6.8	70	20	1169	2273	40	5.7	73	20
High-Tech	298	1067	7	15	22	3	229	1029	6	18.6	33	3
Medium Tech	802	2123	27	7.8	44	11	672	1114	19	5.7	36	10
Other material goods	291	193	15	1.3	4	6	268	130	15	0.9	4	7
Electricity, gas and water supply	23	9	6	0.1	0	3	17	14	4	0.3	0	2
Construction	71	20	18	0.1	0	7	53	12	15	0.1	0	7
Services	**1023**	**1425**	**166**	**0.9**	**29**	**68**	**690**	**828**	**135**	**0.6**	**26**	**68**
High-tech knowledge-intensive	**498**	**712**	**4**	**19.5**	**15**	**2**	**299**	**373**	**3**	**11.1**	**12**	**2**
Other services	**525**	**713**	**162**	**0.4**	**15**	**66**	**391**	**455**	**131**	**0.3**	**15**	**66**
Total	2521	4846	245	2.0	100	100	1942	3131	198	1.6	100	100

Source: R&D survey, Statistik Austria, calculations by Joanneum Research ever (typically outsourced subsidiaries). They also provide services directly to manufacturers by conducting research projects but are recorded statistically under the service sector. This effect (which results from the specific construction of the aforementioned technology funding programmes) "artificially" increases the service sector's R&D. Private-sector, non-university research institutions (such as AIT and Joanneum Research) are also classified under this industry.

With R&D expenditure of € 417 million, the very diverse industry of business services (NACE 70, 71 and 74) is in second place, with about 29% of R&D in the service sector. This industry has been very dynamic overall in recent decades and grown considerably in importance in the face of a deepening division of labour between industry and the service sector, the diversity of outsourcing processes and increased demand for specific, higher-quality services (business consulting, public relations, etc.). The innovation services of this industry are clearly also reflected in correspondingly high R&D expenditure.

The commercial sector (including automotive maintenance and repair) occupies third place in terms of absolute R&D expenditure at € 225 million. This is surprising at first glance, but it can be at least partially explained by the fact that some major (industrial) companies are regarded statistically as commercial enterprises because their revenues derive primarily from commerce, even though they also have their own production facilities (with corresponding R&D).

Table 20: R&D in the service sector by industry (2007)

	Units conducting R&D			R&D expenditure		
	Number	Percentage in service sector	Percentage overall	in € million	Percentage in service sector	Share overall
Total services	**1023**	**100.0**	**40.6**	**1,425.0**	**100.0**	**29.4**
of which						
Wholesale and retail trade; maintenance and repair of motor vehicles	199	19.5	7.9	224.9	15.8	4.6
Hotels and restaurants	-	-	-	-	-	-
Transport and communication	27	2.6	1.1	51.8	3.6	1.1
Banking and insurance	6	0.6	0.2	8.4	0.6	0.2
Business services	275	26.9	10.9	417.0	29.3	8.6
IT	45	4.4	1.8	56.2	3.9	1.2
Software companies	241	23.6	9.6	198.6	13.9	4.1
Research and development	212	20.7	8.4	457.6	32.1	9.4
Other services	18	1.8	0.7	10.4	0.7	0.2

Source: R&D survey, Statistik Austria, calculations by Joanneum Research

This is followed by the two ICT-related industries of "software companies" (NACE 72.2) and "IT" (NACE 72 without 72.2) with shares of 14% and 4%, respectively. Together they account for € 255 million in R&D expenditure, which would actually put them in third place, ahead of the commercial sector. So overall, nearly one in five euros spent on research in the service sector falls under ICT services in the strict sense. Their joint share of 13% of overall R&D spending in Austria is also impressive and shows how highly ICT-related business activities are regarded.[85]

The other service sector industries, on the other hand, account for only a comparatively small share of R&D spending. "Transport and communication" accounts for € 52 million or just under 4%. The R&D expenditures of Austria's banking and insurance industry are surprisingly small – just € 8 million.

In 2007, a total of 37,990 employees (full-time equivalents) worked predominantly in research and development in Austria, including 10,930 in the service sector (Table 21). The trend in R&D employment has been decidedly dynamic in recent years, mirroring the rise in R&D expenditure and the R&D intensity in Austria. Overall, R&D employment in Austria rose nearly 82% in the decade from 1998 to 2007. Growth in the service sector grew even faster at just under 132%.

In absolute numbers, "research and development" is the strongest industry in the service sector with 3,625 full-time equivalents. One must remember, however, that this figure also includes R&D centres funded by Kplus or COMET and the quantitatively significant non-university research centres AIT and Joanneum Research.

The strongest growth was in "software com-

Table 21: Trend of R&D employment in the service sector

Sector/industry	Employees in R&D (full-time equivalents)				
	1998	2002	2004	2006	2007
Total	**20,384.6**	**26,727.5**	**29,142.6**	**34,125.8**	**36,988.6**
Services	**4,718.3**	**7,358.9**	**7,852.7**	**10,031.1**	**10,931.9**
of which					
Wholesale and retail trade; maintenance and repair of motor vehicles	546.4	868.1	774.3	1,373.1	1,373.5
Hotels and restaurants	-	-	-	-	-
Transport and communication	382.5	329.5	244.7	397.6	506.0
Banking and insurance	196.3	64.2	368.2	289.8	80.5
Business-related services	1,750.5	2,479.5	1,894.8	2,338.7	2,506.5
Data processing and database activities	118.3	228.3	255.2	265.6	575.9
Software companies	288.3	1,127.5	1,358.0	1,904.7	2,192.0
Research and development	1,422.2	2,226.0	2,890.9	3,378.7	3,624.7
Other services	13.8	35.9	66.7	82.8	72.7

Source: R&D survey, Statistik Austria, calculations by Joanneum Research

85 ICT-oriented industries also play a key role in R&D within manufacturing. The "electronic components" industry (NACE 32.1) is in fourth place behind "electrical machinery," "machine construction" and "vehicles" when it comes to the absolute value of R&D expenditure within manufacturing.

panies" with a nearly seven-fold increase in R&D employees in the period under review[86]. It is worth noting that employment in "business-related services," with just 43% growth, showed far less movement than the average (even compared to the dynamics of R&D employment in general).

7.1.2 Functional perspective of services

The above analyses examined services strictly from a sectoral perspective, looking only at those industries defined as services according to statistical conventions. Such an approach often falls short, however, since it excludes the functional perspective. A functional perspective is based not on a company's classification within a certain industry (and thus sector) – a definition based on an evaluation of the primary business activity of the firm – but looks instead at the entire spectrum of a company's activities (or the collected activities of a group of companies). This type of functional perspective is more important, because firms engage in a variety of business activities that fall under a wide range of functional categories. Manufacturing companies also offer services, for example, or link their goods to complementary services – installation and/or maintenance services for complex machinery and systems, targeted training programmes, etc.

Unfortunately, economic statistics often provide an insufficient basis for a functional perspective. OeNB export statistics (2009), which are based on company surveys (in cooperation with Statistik Austria), offer one possible approach, however. These statistics include the export income from services provided by manufacturing companies, which are broken down into various service categories and sorted by relevance. Table 22 shows the three most important types of services for each manufacturing industry based on that industry's service exports.

What we see is that manufacturing exports are dominated by complementary technology- and knowledge-intensive services (blue and light blue background in the figure). This is especially true of technology-intensive industries within manufacturing (machinery, office equipment and computers, telecommunication equipment, medical technology, automotive and other transport equipment). Research and development services, architectural services and technical services (including assembly, maintenance and training) play a key role in these industries.

It can therefore be assumed that such complementary services play a key role in the international competitiveness of the respective industries, since the combination of goods export and complementary services helps differentiate the products and creates a distinct competitive edge over companies that merely export goods. The combination of goods exports and the export of R&D services suggests that Austrian companies are integrated into complex networks (such as supplier-customer relationships) in which R&D activity is a response to differentiated customer needs. The literature (Pavitt 1984, Castellacci 2008, etc.) refers repeatedly to the critical importance of user-producer links, especially with regard to research and development, and in particular for certain segments of industry such as automotive suppliers, which have an important status in Austria. Looking at the results from a functional perspective also reveals that man-

86 The "software companies" industry saw a nearly fourfold increase in R&D jobs between 1998 and 2002 alone. This period includes the final years of the "new economy" hype, during which there was an extraordinary surge of employment (and other economic indicators) in all ICT-oriented industries. But statistical artefacts (regrouping, changes to how firms are classified into certain industries, etc.) may also be responsible for this sharp increase.

Table 22: Manufacturing and exports of complementary services (“system packages”)

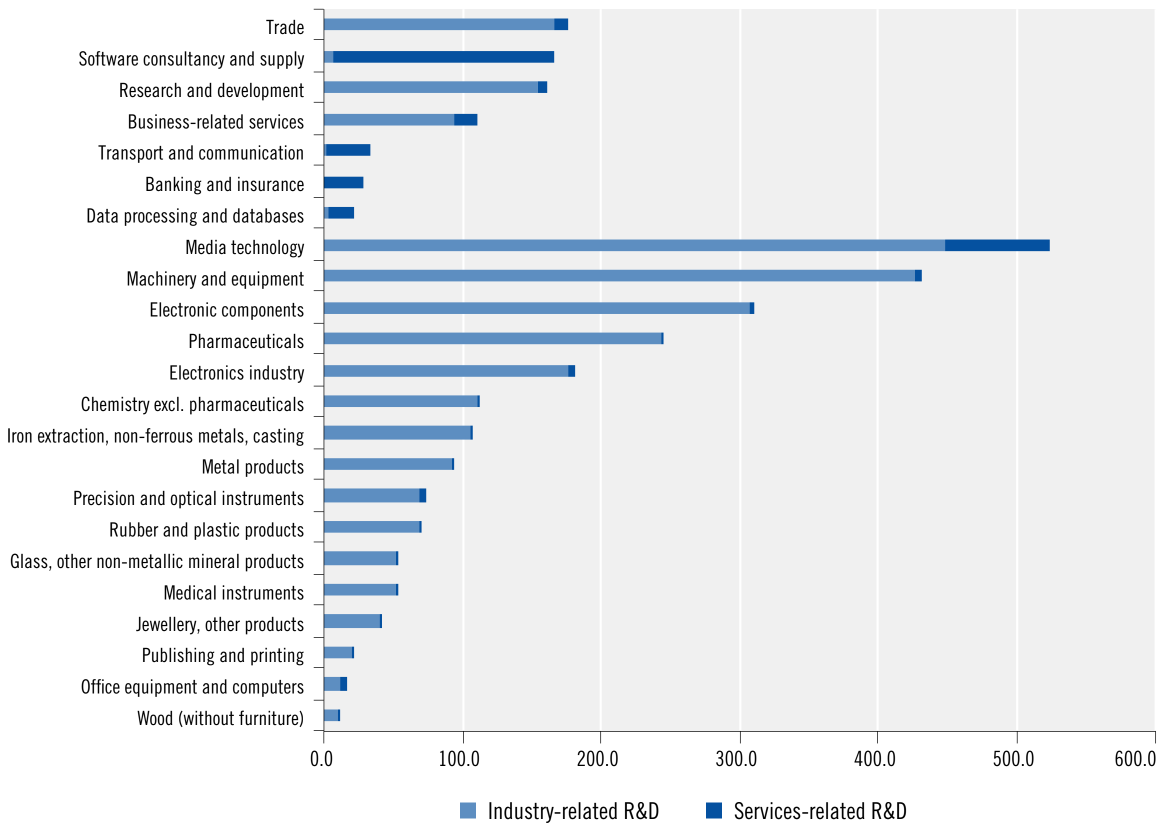
Manufacturing industry	Type of service		
Foods and luxury foods	Patents and licenses	Transit and other commerce	Advertising and market research
Textile industry	Research and development	Transit and other commerce	IT and information
Clothing industry	Transit and other commerce	IT and information	Business consulting
Tanning and leather processing	Transport	Transit and other commerce	IT and information
Wood processing	Patents and licenses	IT and information	Architecture and technical services
Paper industry	Transit and other commerce	IT and information	Architecture and technical services
Publishing and printing	Advertising and market research	IT and information	Research and development
Coke, refined petroleum products	Research and development	Patents and licenses	Transit and other commerce
Rubber and plastic products	Architecture and technical services	Research and development	Transport
Glass and minerals	Advertising and market research	Transit and other commerce	IT and information
Manufacture of basic metals	Transit and other commerce	Research and development	Architecture and technical services
Metal goods	Construction	Architecture and technical services	Transport
Machinery and equipment	Architecture and technical services	Research and development	Transport
Office equipment and computers	Research and development	IT and information	Transport
Electrical generation and distribution equipment	Architecture and technical services	Transport	IT and information
Radio, television and telecommunication equipment	Research and development	Communication	Architecture and technical services
Medical technology, metrology, optics	Architecture and technical services	IT and information	Research and development
Automotive manufacturing	Research and development	Leasing	Architecture and technical services
Manufacture of other transport equipment	Architecture and technical services	Transport	Patents and licenses
Furniture, jewellery, other goods	Research and development	Architecture and technical services	Transit and other commerce

Source: OeNB

ufacturers offer various services and engage in corresponding innovation activities.

The R&D survey in its original form (until 2006[87]), which categorises corporate R&D expenditures by the sector (or industry) in which the R&D results are applied, also makes it possible to draw conclusions on the functional allocation of R&D spending. The corresponding results from the R&D survey of 2006 are presented in Figure 67, with the relevant (R&D-active) service sector industries in the top third of the figure. Only a few industries show an appreciable share of service-related (in the functional sense) R&D. As one might expect, it is primarily the service sector industries whose research activities are focused functionally on services. Topping the list with a share of 100% is the banking and insurance industry, followed by transport and communication (92.5%)and the ICT-related industries of software companies (96.3%) and IT/computers (87.8%). The commercial sector and the "research and development" and "business-related services" industries focus their research ef-

Figure 67: Functional classification of R&D by product group in Austria (2006)



Source: R&D survey 2006, Statistik Austria, calculations by Joanneum Research

87 In the interest of streamlining administration, the volume of mandatory questionnaires was reduced. This affected the R&D survey as well. The question about product classification was removed from the 2007 survey questionnaire, so that a functional view of R&D based on more recent R&D surveys is no longer possible. It should be noted, however, that the results are to be interpreted with caution, since according to Statistik Austria, the surveyed companies interpreted the relevant question differently.

forts largely on manufacturing[88]. Within manufacturing, appreciable service-related R&D expenditures are found only in media technology (radio, television and telecommunication equipment), though here the volume of € 76 million (14.5%) is indeed considerable. The € 5 million in service-related R&D from "office equipment and computers" is low in absolute terms but at 32.3% represents the strongest focus on service-related R&D in the entire industrial sector.

7.1.3 Intersectoral R&D interactions

Funding data from the Austrian Research Promotion Agency (FFG) offers another option for empirical analysis of R&D-related sectoral interaction, since the FFG categorises the project submissions it receives by the (anticipated) area of application under the ÖNACE system of classification. In 2009, the Austrian Research Promotion Agency (FFG) also assigned the corresponding ÖNACE classifications[89] to the firms it funded. This enables the following analysis of the extent to which the research projects of the applicant companies can be found within the same sector (or at the disaggregated level within the same two-digit ÖNACE code) in which the business is primarily active.

Table 23 depicts the results at the sectoral level, differentiating four sectors: (i) primary sector (agriculture and forestry; mining); (ii) manufacturing; (iii) infrastructure (energy and water supply; construction) and (iv) tertiary sector (services). Note that both companies and (to a lesser extent) projects lack classifications. In other words, the industry classification of some of the firms (projects) is unknown. The table lists both the cash values (upper portion) and the number of funded projects (lower portion).

Nearly two thirds of the cash value of funding (€ 202.5 million or 64.4%) goes to manufacturing, while one third (€ 106.1 million or 33.7%) goes to the service sector. Primary-sector and infrastructure firms play only a minor role among funding applicants. An examination of the project classification shows that most projects from manufacturing firms also deal with manufacturing: Among the € 202.5 million in funding for manufacturing firms, € 192.8 million (95.2%) goes to "industrial" projects, with only € 6.6 million (3.3%) for service sector projects. This shows a clear dominance of intrasectoral projects among companies in the industrial sector.

The breakdown among companies in the service sector is markedly different. Service sector companies receive € 71.9 million (67.8%) for "industrial" projects compared to € 29.3 million (27.6%) for service projects. This means that the majority of FFG-funded projects in the service sector actually relate to industrial topics. The R&D activity of the service sector is thus closely linked to the industrial sector: most of the research conducted by the service sector relates to industry.

Generally, there is a high level of R&D interaction between the service sector and the industrial sector, but it is focused on a few industries – specifically, "research and development," "engineering" and "ICT services." Also worth mentioning is wholesale, which also conducts a significant volume of industry-oriented R&D (Table 24). This may be largely a statistical artefact, however, since the wholesale classification includes companies with

88 A statistical artefact may be the cause in the case of the commercial sector, though, since producing firms are assigned to the (wholesale) commercial sector if their commercial activities account for a greater share of revenues.
89 This classification was undertaken by Statistik Austria on the basis of a comparison with the business register.

their own production activities (including industry-oriented R&D) whose primary revenue derives from commerce.

7.1.4 Innovation activities of the service sector

As mentioned earlier, research and development activities as defined by Frascati are a rather narrow concept for the service sector, since service sector innovations (such as organisational or marketing innovations) are often not based on genuine R&D efforts or are the result of the adoption (and adaptation) of innovative solutions that arose outside the service sector.

To measure innovative output, we will now examine the results of the sixth European survey on innovation (CIS 2008), conducted in Austria by Statistik Austria and covering the period from 2006 to 2008[90]. The survey bases

Table 23: Sectoral classification of the projects and firms funded by the Austrian Research Promotion Agency (FFG)

Firms	Cash values in € millions Project classification						
	Agriculture/ mining	Manufacturing	Infrastructure/ construction	Services	Total	Not classified	Total
Agriculture/mining	0.1	0.2	0.0	0.0	**0.2**	0.0	0.2
Manufacturing	0.0	192.8	3.0	6.6	**202.5**	4.0	206.5
Infrastructure/construction	0.0	2.7	2.1	0.6	**5.4**	0.6	6.0
Services	1.7	71.9	3.3	29.3	**106.1**	1.5	107.6
Total	**1.8**	**267.6**	**8.4**	**36.5**	**314.3**	6.0	320.3
Not classified	0.1	94.0	3.3	15.7	113.2	2.0	115.2
Total	2.0	361.6	11.8	52.2	427.5	8.0	435.5

Firms	Number of projects funded Project classification						
	Agriculture/ mining	Manufacturing	Infrastructure/ construction	Services	Total	Not classified	Total
Agriculture/mining	3	6	0	0	**9**	0	9
Manufacturing	1	1031	40	69	**1141**	51	1192
Infrastructure/construction	0	34	27	9	**70**	12	82
Services	10	440	46	365	**861**	44	905
Total	**14**	**1511**	**113**	**443**	**2081**	107	2188
Not classified	4	480	37	153	674	34	708
Total	18	1991	150	596	2755	141	2896

Note: Funded company projects in the general programmes without a headquarters programme or innovation voucher; covers the survey period of 2007 until October 2010.
Source: FFG, calculations by Joanneum Research

90 In Austria, CIS is based on a sampling of some 5,400 firms (though only firms with more than nine employees were included in the underlying base population). Note that some relevant service sector industries in Austria – such as research and development (ÖNACE 2008 72), business consulting (70) and market research (73) – were not included.

Table 24: Project classification of selected service sector industries

		Cash value of funding in € millions					
		Industrial projects				Projects in Service industries	
	Service sector firms	Pharmaceutical (C21)	Computers (C26)	Machine construction (C28)	Industrial projects Total	IT (J62 + J63)	Service projects Total
M72	Research and development	17.2	2.0	0.9	25.4	0.3	0.8
M71	Architecture and engineering firms; technical, physical and chemical analysis	2.9	7.4	1.5	20.5	0.7	1.2
J62 + J63	ICT services	0.1	2.0	0.0	3.1	20.9	21.1
G46	Wholesale	3.2	1.0	2.4	17.0	1.0	1.3

Source: FFG, calculations by Joanneum Research

its concept of innovation on the Oslo Manual (OECD 2005) and defines it as follows:

> "new or noticeably improved products or services that your firm introduced to the market or new and noticeably improved processes or procedures, organisational innovations or marketing innovations that have been introduced in your firm. *The innovation must be new for your company but does not need to have been developed by your company itself."*

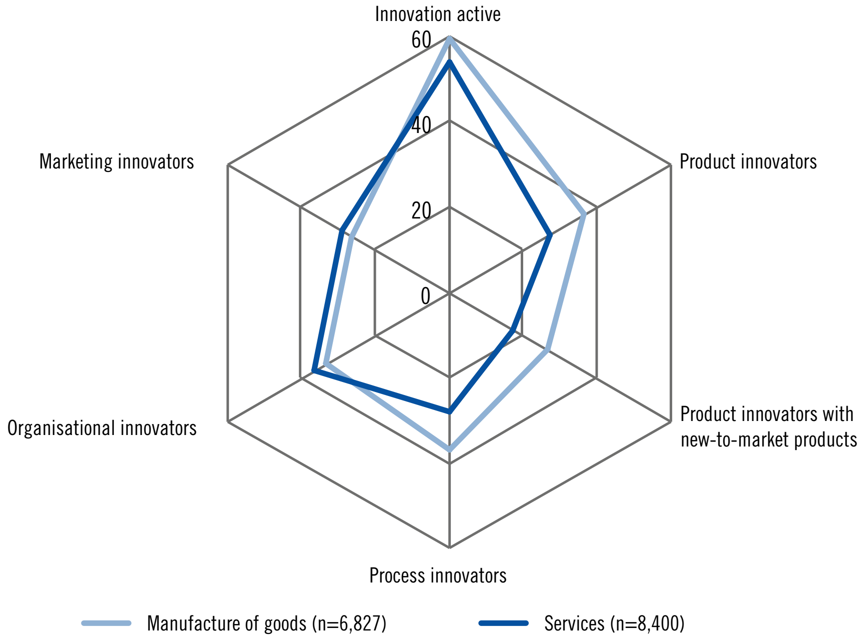
Figure 68 compares innovative output data from service segment firms to that of manufacturing companies[91]. The data shows clearly that a smaller percentage of service sector companies introduced product or process innovations in the period from 2006 to 2008, whereas the differences in organisational and marketing innovations are minor or the innovator ratio in the service sector is even slightly above that of the manufacturing sector. So the results confirm the above argument that the structure of innovation activities in the service sector is characterised more by "intangible" innovations (such as in organisation and marketing) whose development and implementation typically require no genuine R&D expenditures as defined by Frascati.

There are significant differences among the various industries. For example, the percentage of product innovators in publishing/ICT is among the highest of all the industries studied (including goods-producing industries), exceeded only by "manufacture of computers, electronic and optical products; electrical equipment" (IT/electronics/optics). But at the same time, the two industries with the lowest percentage of product innovators ("transport and storage" and "financial and insurance services") also belong to the service sector (Figure 69).

Among the process innovators as well, the percentage of innovators in the service sector as a whole is lower than in manufacturing. One exception is again publishing/ICT, where about half of all firms have implemented a pro-

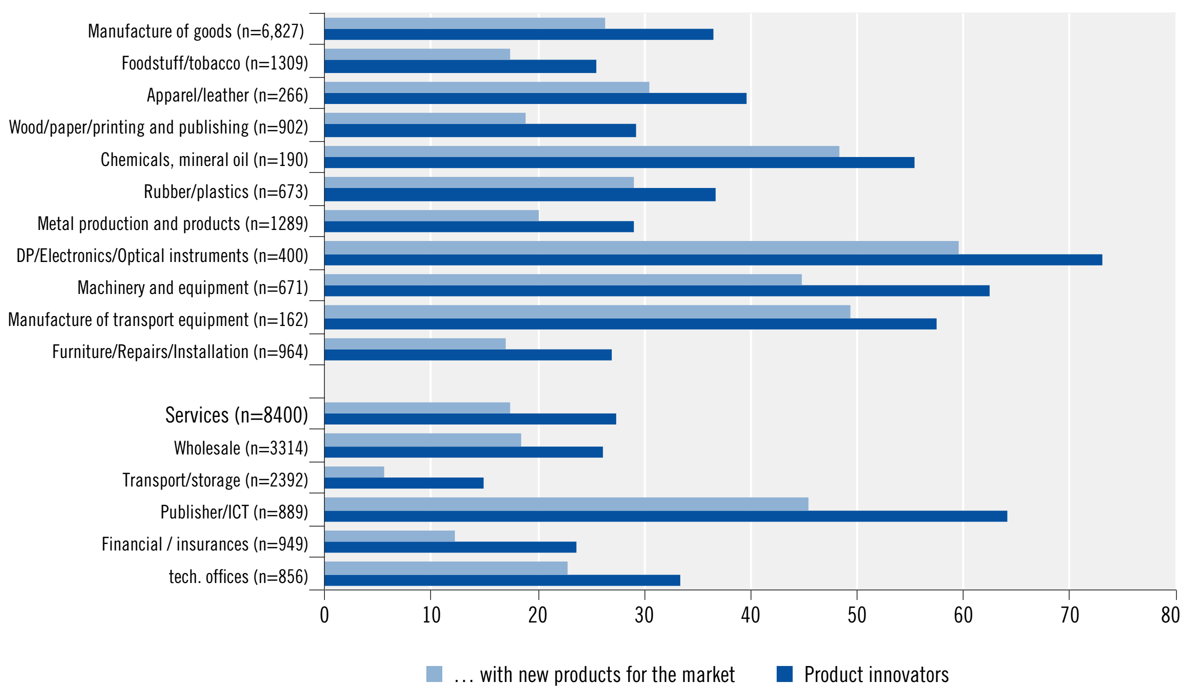
91 In the ÖNACE 2008 classification on which CIS 2008 is based, this category is now called "manufacture of goods."

Figure 68: Percentage of companies with innovation activities



Source: CIS 2008, weighted for base population, calculations by Joanneum Research

Figure 69: Percentage of product innovators by industry

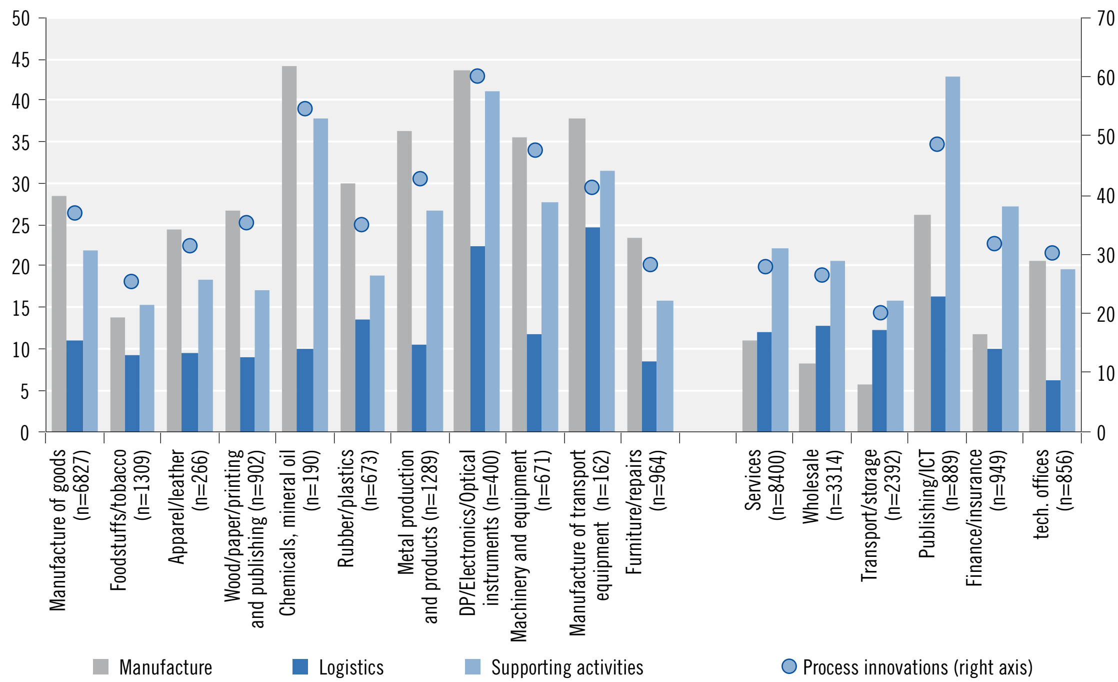


Source: CIS 2008, weighted for base population, calculations by Joanneum Research cess innovation (Figure 70). A breakdown by the type of process innovation shows clearly that innovations in production methods are predominant in manufacturing, followed by supporting activities (such as procurement, accounting or IT activities). In the service sector, it is the second category of supporting process innovations that dominates; innovations in production methods and logistics are typically implemented much less often. Once again, publishing/ICT and also technical offices are something of an exception here. Though the supporting process innovations are predominant, there is also a high percentage of firms that have improved production processes.

When it comes to the industry-specific percentage of firms that have received public innovation funding, a sharp discrepancy can be seen between goods production (53%) and the service sector (26%) (Figure 71). Only publishing/ICT and technical offices reach a percentage at the level of the – less innovative – manufacturing industries. The explanation for this may be that innovation funding in Austria is often linked to formal R&D activities that are not so common in the service sector.

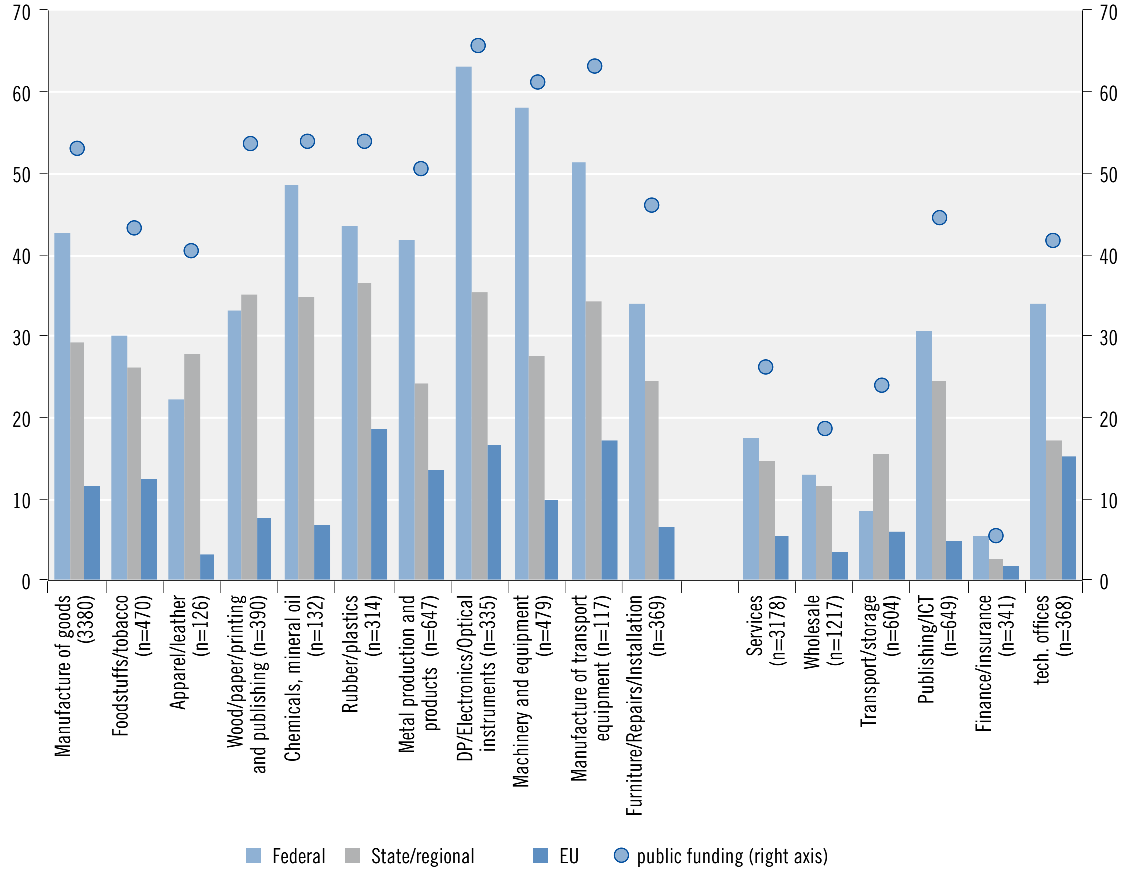
A breakdown by funding source shows that federal funding (research premium or FFG funding, for example) is relevant for 31% of firms, followed by funding at the state or local level (22%) and – far behind – at the EU level (9%). This pattern is present in nearly all industries. It is worth noting, however, that funding at the state/local level has a relatively greater importance for service sector firms than for those in goods production. The num-

Figure 70: Percentage of firms with process innovations



Source: CIS 2008, weighted for base population, calculations by Joanneum Research

Figure 71: Proportion of companies with public funding (as a percentage of all firms with technological innovations)



Source: CIS 2008, weighted for base population, calculations by Joanneum Research

bers suggest that "R&D-friendly," technology-intensive industries are more likely to request federal funding (the difference between the rate of federal and state funding is higher), whereas less "R&D-friendly" industries that are less technology-intensive tend to receive state or local funding (the difference between the rate of federal and state funding is lower). Accordingly, the percentage of firms in publishing/ICT and especially technical offices funded at the state level is lower than the percentage receiving federal funding.

7.1.5 Summary

In summary, it can be said that the dynamics of the process of tertiarisation is advancing in the field of research and development as well. The service sector's share of total R&D expenditures in Austria is continually growing, approaching the one-third mark. At the same time, it should be emphasised that separate assessments for these sectors is insufficient because of the manifold interrelationships between manufacturing and the service sector.

On one hand, the service sector's research and development activities often have an explicit industrial orientation; on the other hand, R&D in some branches of the manufacturing business are also focussed on service-oriented R&D (especially ICT).

Looking at innovation output in the broader sense (i.e., based on the conceptual specifications of the OECD's Oslo Manual) shows that innovations in the service sector are more strongly focused on organisational and marketing innovations. Innovations need not be driven by research, but rather can be understood as complex adaptation strategies within firms.

7.2 Clusters as a tool of Austrian technology policy

In Austria's economic and technology policy, "cluster-oriented" instruments, described in the work of American management expert Michael E. Porter (1990), have become popular ever since the early 1990s. Porter's initial question was why nations are particularly competitive in very specific economic sub-sectors, and why this competitiveness holds up over long periods of time. At the same time, Porter points out that several of these competitive clusters appear to be geographically concentrated within a national economy. The term "cluster" can therefore be defined as a group of geographically adjacent firms in a specific branch of economic activity that have a mutual relationship (via supplier and sales networks, information networks, technology networks, service networks, etc.) and use specialised infrastructure facilities (as in the education or research sectors, or technical infrastructure and state administration). If we replace the participants themselves with the relationships between the participants, making the latter the centre of the cluster definition, then a cluster can be described as the regional concentration of overlapping nodes of corporate and institutional networks (see Tichy 1997). Corporate participation in such networks enables firms to profit from network externalities, i.e. positive external effects that result from the activities of other firms or the existence of specific infrastructures (public resources). The impact of many of these external effects decreases as the distance to other firms in the network and to infrastructure facilities increases (Glaeser et al. 1992). This means that there are positive incentives to select a location that is geographically close to other firms in a network. Because many positive externalities arise from simultaneous participation in several networks ("network synergies"), these incentives are strengthened into geographically concentrated areas. In summary, a cluster is defined by the following qualities:

- a tight network of supplier and sales relationships among firms,
- an education network oriented toward the needs of firms, and the resulting availability of workers,
- a research network between firms and universities,
- a comprehensive offering of specialised services,
- support via economic policy and infrastructure measures
- and finally the ability of firms to use favourable framework conditions for innovations, which leads to a generally high tendency toward innovation among firms within the cluster ("innovative milieu").

At the beginning of the 20th century, the English economist Alfred Marshall (1920) described the basic advantages that result from this geographical concentration of firms in related and complementary economic sectors and can therefore lead to the creation of a cluster. Marshall identified three different mechanisms that in combination drive forward cluster formation, namely labour market advantages, input-output advantages, and technological externalities:

- labour market advantages (labour market pooling) arise from the demand (from firms within the cluster) for workers with similar or related skills. The great demand for workers with special skills creates a labour market for specialised abilities, which makes it attractive for workers to invest in these skills and promotes the immigration of workers with the appropriate skills. This effect is amplified even more by public institutions of training and education that, depending on the size of the cluster, are also oriented towards corporate skill requirements. Unlike a firm in an isolated location, firms within a cluster are spared part of the costs of education and training, as well as the costs of searching for suitably skilled workers. Firms within a cluster, however, profit from the mobility of workers between the individual firms. Specific knowledge gained in one firm is then quickly transferred to other firms. The technology transfer and learning effects that result from this increase the innovation capacity and competitiveness of all firms in the cluster. Workers also profit from the existence of a cluster because there is a broad offering of opportunities for both work and advancement within their region, and firms want and will pay for their cluster-specific qualifications. The multitude of potential employers also makes employees less independent on the success of a single (or a few) firm(s).
- Input-output advantages stem from the geographical concentration of firms in a specific economic sector, which creates a large market for very specific goods and services. This allows individual firms to specialise in a very small product spectrum and concentrate all of their resources on improving their offerings in this small segment. The geographical proximity between supplier and purchaser promotes close coordination of supply and demand. Particularly in the service branch and in productions that require close contact with purchasers (i.e., mechanical engineering), this can lead to competitive advantages because intensive supplier-purchaser cooperations make it easier to find innovative solutions to specific problems; both of the firms involved in this relationship derive a profit from this process (for example, if a supplier develops a new product that it can sell on the export markets, and the purchaser can produce the product cheaper or at a higher level of quality). The specialisation of firms in a cluster enables an efficient distribution of labour. Firms that offer highly specialised products can also use the advantages of producing in larger units (scaling effects). Furthermore, the broad availability of different suppliers and the demand from several purchasers increases the flexibility of firms in the cluster because they can choose among different suppliers and purchasers.
- Technological externalities describes the advantages that accrue to firms because they can quickly leverage what they learn from other firms, as well as the knowledge that is created in other firms or in research institutions, for their own purposes. Because new knowledge (for example, in the form of new products, new production methods or new forms of organisation) is difficult to keep secret, firms profit from the research and development activities of others: they can apply this new knowledge without having to pay for it themselves. What is decisive here, however, is the ability to recognise this new knowledge and its possible applications and to apply it productively within a firm. This ability to absorb knowledge is increased by the geographical proximity of firms. It facilitates the creation and maintenance of formal and informal information networks in which

both codified knowledge (in written form) and non-codified ("tacit") knowledge are exchanged. This tacit knowledge is contained in the experience of workers and in certain work processes and cannot be readily written down or passed on. Moreover, the mobility of qualified workers among firms, and the collaboration with specialised research institutions, promoted the ability to learn (because research institutions cooperate with several firms and thereby indirectly produce knowledge transfer between companies).

The European Commission has long viewed regional cluster activities as an instrument for strengthening innovation and competitiveness, especially among small and medium-sized firms[92]. In the last decade, cluster-specific measures have been implemented with increasing intensity in European regional, research and innovation policies. At the end of the 1990s, a series of INTERREG projects, which focused on cluster- and network-building measures, were financed with structural funds. The EU's Seventh Research Framework Programme, "Regions of Knowledge"[93], strengthens the research potential of European regions and supports the formation of research-driven clusters. The Directorate General Enterprise and Industry, which in recent years announced several cluster-specific programmes (i.e., INNO-nets, innovation platforms), established the "High Level Cluster Advisory Group" in 2005, a European group of experts that made recommendations on the role of clusters in European innovation policy in the "European Cluster Memorandum"[94]. A subsequent strategy group focused on management excellence in clusters, internationalisation, and the founding of "world-class clusters"[95,96]. The EU Strategy 2020 views clusters as instruments of industrial and innovation policy. The remarks on the "Innovation Union"[97], one of seven European flagship initiatives, introduced multiple cluster-oriented instruments to drive forward the transfer of knowledge and technology, to support regional strategies of growth and specialisation, and to promote environmental innovations[98].

7.2.1 Economic and technology policy instruments in Austria's cluster policy

The instruments and mechanisms of Austria's cluster policy are very diverse. Basically, funding for clusters aims at strengthening competitiveness and the innovation strength of participating firms, especially small and medium-sized enterprises (SMEs). The following supporting measures in economic policy are applied to establish and promote such clusters:

- Organisation of a union of firms and other cluster-relevant institutions (including education and research institutions) and formation of an umbrella organisation with active cluster management (in the form of an association, an independent firm, or a sub-organisation within existing institutions, such as the chamber of commerce or economic development agency at the state or federal level);
- Marketing support: market analyses, advertising, trade fair participation, development of common markets and advertising strate-

92 EU-KOM (2008): The Concept of Clusters and Cluster Policies and their Role for Competitiveness and Innovation
93 http://cordis.europa.eu/fp7/capacities/regions-knowledge_en.html
94 EU-KOM (2007): The European Cluster Memorandum
95 EU-KOM (2008): Towards world-class clusters in the European Union: Implementing the broad-based innovation strategy
96 EU-KOM (2010): The European Cluster Policy Group. Final Recommendations. A Call for Policy Action.
97 EU-KOM (2010): Europe 2020 Flagship Initiative Innovation Union.
98 EU-KOM (2011): Regional policy contribution to sustainable growth in the context of the Europe 2020 Strategy.

gies; Information provisioning: compilation of possible customers and projects, information about the spectrum of services and the willingness of firms in the cluster to cooperate, access to expert pools and consulting services;

- Promotion of cooperative innovation projects: most Austrian states have established instruments to promote cooperative innovation projects. These projects focus on the development of new products, the improvement of value creation chains, and organisational and process-related innovations. SME participation is envisioned;
- Improvement of technological and quality standards in participating firms: support and advice during the introduction of new product technologies, quality certifications, introduction of seals of quality, development of new products that are produced by several firms, consulting with regard to apply for R&D funding;
- Education and research measures: shared education programmes for employees in the form of seminars or workshops, cooperative research activities, create cooperative research relationships with universities.

7.2.2 The national cluster platform

Austria is recognised as an "early mover" in cluster policy, having undertaken its initial cluster activities in the early 1990s. Depending upon the definition and the method of counting, there are currently 51 cluster and network initiatives whose numerous activities contribute to the strengthening of innovation power and international competitiveness among Austrian firms, especially SME. The cluster landscape wasn't always as organised as it is today. In 2008, the national cluster platform[99] was founded in an initiative from the Ministry of Economics with inter-ministerial cooperation and inclusion of essential stakeholders (among them the Council for Research and Technology Development). In addition to creating a structured working level for federal and state stakeholders, the platform's goal is to initiate shared topics and further develop them in working groups, to support the development and implementation of Austria RTI policy, and to shape connections to EU cluster activities. Moreover, work is progressing on the establishment of an optimal structure for active participation in European opinion formation and strategy processes, as well as in calls for proposals for programmes in Austria.

The stakeholders participating in the national cluster platform include federal institutions (BMWFJ, BMVIT), federal funding agencies (FFG, aws), the Austrian Council for Research and Technology Development (RFT), the Austrian Chamber of Commerce (including Austria's Foreign Trade Organisation), and the relevant organisations in the Austrian states (primarily state economic development agencies and additional cluster-specific umbrella organisations and associations).

This broad institutional composition enables the inclusion of all relevant stakeholders and thereby guarantees an exchange of information and expertise among the participants. Within the national cluster platform, four working groups have been established to address the following topics on an ongoing basis:

WG 1: Transmission function of clusters and their role in the national innovation system

WG 2: Clusters as drivers of research and innovation

WG 3: European linkages to Austrian cluster policy

WG 4: Clusters and internationalisation

99 www.clusterplattform.at

7.2.3 Cluster initiatives in Austria

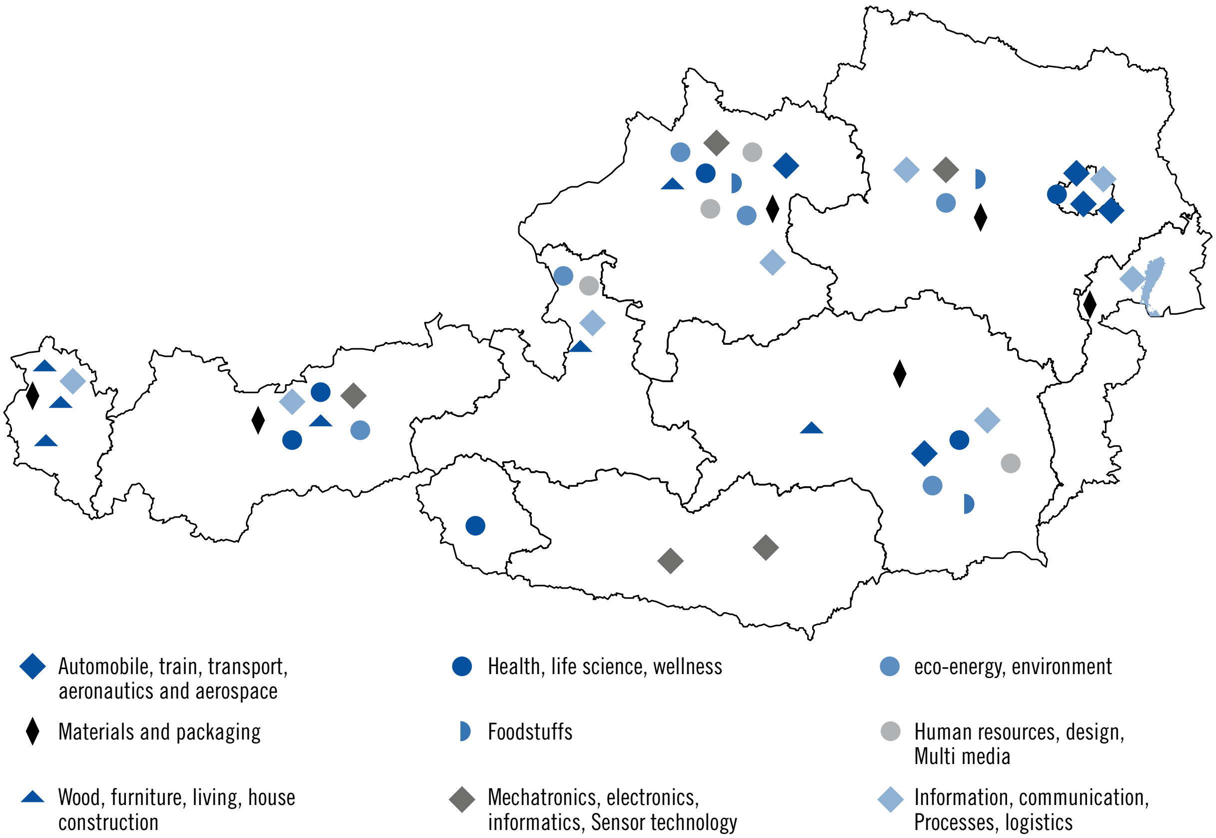
A total of 51 cluster initiatives are distributed throughout the states at different densities. The numbers run from two clusters in Burgenland and in Carinthia to twelve in Upper Austria (Figure 72).

These 51 cluster initiatives are assigned to different technological (and economic) fields as follows:

- eight initiatives are assigned to the topics of "information, communications, processes, logistics",
- seven each to "wood, furniture, living, house construction" and "eco-energy, environment"
- six each to "health, life sciences, wellness" and "materials and packaging",
- five each to "mechatronics, electronics, information, sensor technology" and "automobile, train, transport, aeronautics and aerospace",
- four to "human resources, design, multimedia" and finally
- three to "food".

Overall, this is a balanced portfolio based on technological themes that have a somewhat generic character in that they cover a broad spectrum of different economic sectors. Well-known fields of specialisation and expertise in Austrian industry (i.e., transportation, wood,

Figure 72: Distribution of cluster initiatives in Austria by state



Source: National cluster platform, Austria environmental technology) are also clearly identifiable.

These cluster initiatives are all organised as their own entities[100] and therefore have accordingly independent management. As member organisations (or partners) – for low and graduated member fees – firms have access to a broad array of services, stretching from information services to networking activities to the availability of expert pools (i.e., free initial consulting).

The size of these initiatives range from relatively small networks (ca. 30 partners) to federal-level clusters with up to 400 partner firms and members that also have corresponding regional economic weight in their state.

When assessing the economic relevance of cluster initiatives in Austria, we must keep in mind that the positive effects of clustering (labour market effects, input-output synergies, technological spill-overs) do not just benefit the officially registered members and partners of the cluster initiatives; instead, a broader effect unfolds. On the other hand, all of these positive effects (insofar as these are even measurable or quantifiable) cannot be directly attributed to the influence of cluster initiatives. Currently, we estimate that the number of partner and member firms stands at about 6,500[101], representing both very small and small firms (such as in the creative industries or in retail and skilled crafts) and major industrial corporations. Austria's different cluster initiatives therefore range across a broad spectrum of the Austrian economy and, at least theoretically[102], generates a high multiplicator effect.

7.2.4 Summary

The first efforts at cluster-oriented approaches in Austrian technology policy go back to the early 1990s. Appropriate initiatives developed very quickly from the bottom up, and their early successes (e.g. the automotive cluster in Styria and Upper Austria) served as a model for other initiatives and other Austrian states. The thematic spectrum covered by the Austrian cluster initiatives is dominated primarily by technology-specific – and therefore inter-industry – topics. These topics correspond primarily to Austria's economic and technological strengths. At the same time, the clusters cover important technologies of the future (e.g. ICT, mechatronics, life sciences), social trends (health and wellness), and challenges (environmental technology, renewable energy sources). The founding of the national cluster platform guarantees a regular exchange of information (for example in the national cluster conference), as well as mutual learning processes, between states, clusters and the federal government. The number of initiatives and their size (measured in terms of number of members) have developed dynamically in recent years and ensured broad penetration and consolidation of the cluster principle in the Austrian economy.

Due to the breadth of innovation-supporting measures in the clusters, as well as the intensive network contacts between firms and the management of clusters, a targeted inclusion of regional clusters in the national innovation system makes sense.

100 Yet partially under infrastructure – and staff-related – connections to existing institutions, especially state economic development agencies.
101 A related study from 2007 on the cluster initiatives in Austria (Clement and Welbich-Macek, 2007) came to total membership numbers of ca. 3500 in 2006 among the then-extant 43 cluster initiatives.
102 We assume here that the individual member firms actually use the various services of the cluster initiative in different ways and to different extents.

7.3 Female Austrian inventors and patent activity

7.3.1 Background

To ensure economic growth and prosperity in the future, national economies must optimally leverage their potentials in research, development and innovation. Increased participation from women in these activities is indispensable. Earlier editions of the Austrian Research and Technology Report have already conducted thorough analyses of the participation and role of women in research and development. These contributions, however, concentrated above all on the input side of research and development, such as on the percentage of women on research staff, or the number of female professors at Austrian universities. This chapter expands these analyses by including an assessment of the output side. Patents are used as an indicator for the output of research, development and innovation.[103] In the following, we evaluate the female participation rate in all of the patents invented in Austria, and how this rate has developed over time.

From a political perspective, observing output is of major relevance because specific contributions to economic and social development are expected from research and development, thereby justifying significant funds for R&D. Alongside publications, patents are the most important indicator for the output of research, development and innovation. Although there are numerous points of criticism in the literature[104] on patent indicators (Griliches 1990, Patel and Pavitt 1995, Bassecoulard and Zitt 2004, Smith 2005), they are a common data foundation for working on scientific and technological problems. Patent information is more readily available, has a detailed classification scheme for technology, and allows for the identification of the applicant and/or inventor. Furthermore, patent data is subject to uniform and consistent standards, and is available for a long period of time. Patents depict specific technological inventions that are typically the result of R&D activities, especially of applied research and technology development (Grupp and Mogee 2004).

Women have made crucial contributions in the past to scientific and technological development, but their efforts often go unrecognised (Jaffé 2006). International research has also only recently begun to confront the gender-specific aspects of the patent process (Bunker Whittington and Smith-Doerr 2005, Frietsch et al. 2008). Austria has only participated in this discourse in a very limited way (an exception is Busolt et al. 2008). Empirical studies show that women in many countries engage in inventions and patents less often than men (Bunker Whittington and Smith-Doerr 2005, Frietsch et al. 2008).

'Inventors' are not members of a defined profession; they can work in scientific organisations and universities, in firms, or as individuals without organisational affiliations. There is no demographic data for Austria on male and female inventors to provide assistance in interpreting the results of the follow-

103 See also in this regard the Austrian Research and Technology Report 2009, p. 158 ff. on the topic of start-up firms run by women.

104 An initial point of criticism of patent indicators is that not all inventions meet the criteria for patentability, and patents have varying efficacy as mechanisms for protecting intellectual property in different industries. For example, software cannot be patented because it is not a component of a technical product or process. Second, not every invention leads necessarily to a patent. The decision about whether to patent an invention often depends on a firm's strategic decisions. The high costs of a patent application, especially for small and medium-sized enterprises, also represents a barrier. Third, the value of patents is extremely uneven. There are several patents that have no industrial application and therefore have little or no economic value; in contrast, there a very few patents that have tremendous economic value. Fourth, 18 months must elapse between patent filing and publication, and the final issuance of a patent often takes several years, so that patent indicators cannot be measured against the latest developments.

ing analysis. The results of the PatVal Survey (Giuri et al. 2007), a questionnaire survey of patent inventors, provide insights into the socio-economic situation of inventors in different European countries. The survey found that 70% of inventors in the surveyed countries work for large firms, with 9% working for medium-sized firms and 13% working for small firms. The 'hobbyists' who develop inventions alone in their garage is not a valid picture of the bulk of invention activity in Europe. There is ostensibly a relatively low portion of invention activity associated with entrepreneurship and the founding of firms.

Moreover, according to the results of Giuri et al. (2007), only 3.2% of inventors work at universities. There are no comparable figures for Austria, but this proportion may also be similarly low in Austria. Increasingly, however, universities are also acknowledging the importance of patents for their organisation (see Morgan et al. 2001).[105] Along with publications, patents are important building blocks for a career at universities, which also is another incentive for patent filings by university employees (Bunker Whittington and Smith-Doerr 2005). Policy plays a role in creating measures to increase patent activity at universities.[106]

Giuri et al. (2007) further demonstrate that the average age of inventors in Europe is 45. Patents are therefore typically invented only in the later phases of a typical scientific career. Finally, 77% of European inventors have a university degree. Even if this proportion may be lower in Austria due to the prevalence of vocational schools for technicians (the HTL), we can still assume that a majority of Austrian inventors also have an academic education.

7.3.2 Identifying female inventors in patent documents

Patent data is used to identify and count the number of male and female inventors. Patent documents contain the names and addresses of the inventors and applicants in order to protect their intellectual property rights effectively. Patent documents from the European Patent Office (EPO) that show at least one female inventor or an inventor residing in Austria form the basis of this analysis. The date of the first submission (priority date) is used as the reference date.

The next figure shows a patent document from the European Patent Office. It lists one female inventor and six male inventors. The addresses for the inventors listed in the patent documents are their residential addresses. The person's citizenship cannot be derived from this information; a French or Czech inventor would therefore be included in this analysis because they reside in Austria.

Furthermore, the patent document also identifies the applicant or owner of the patent. In this example it is a German firm. Because this study does not differentiate between patents for which the applicants were Austrian or from abroad, this information is not relevant. The sample incorporated without distinction all patents from inventors with an Austrian residential address (which will be shortened in the following to "Austrian inventors").

105 In the ongoing negotiations of the Federal Ministry for Science and Research with the universities, assurances were given that reliable and sustainable intellectual property and utilisation strategies would be developed that enable partners from the economy to formulate long-term research targets. In the context of the IP National Contact Points, in accordance with the European Commission's IP recommendation, national measures related to knowledge transfer between non-university research institutions and the private sector shall be coordinated, thereby making an important contribution to creating the best possible circumstances for a successful transfer of knowledge.

106 The Universities Act 2002 [UG 2002 §106(3)] gives Austrian universities the right to allow their employees to patent their own inventions, which should lead to an increase in university patent applications (BMWF 2009). Because this law is so new, its effects will hardly be seen in the patent data used here.

Figure 73: Patent document from the European Patent Office

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 071 034 A3**

(12) **EUROPÄISCHE PATENTANMELDUNG**

(88) Veröffentlichungstag A3:
18.09.2002 Patentblatt 2002/38

(51) Int Cl.7: **G06K 9/00**, G06K 9/62

(43) Veröffentlichungstag A2:
24.01.2001 Patentblatt 2001/04

(21) Anmeldenummer: **00113705.8**

(22) Anmeldetag: **28.06.2000**

(84) Benannte Vertragsstaaten:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Benannte Erstreckungsstaaten:
AL LT LV MK RO SI

(30) Priorität: **28.06.1999 DE 19929670**

(71) Anmelder: **SIEMENS AKTIENGESELLSCHAFT
80333 München (DE)**

(72) Erfinder:
- **Egger, Robert
8605 Kapfenberg (AT)**
- **Haselsteiner, Ernst
8010 Graz (AT)**
- **Heschgl, Kurt
A-8043 Graz (AT)**
- **Windisch, Claudia
8565 St. Johann O. H. (AT)**
- **Hribernig, Gerd
8046 Graz (AT)**
- **Marius, Wolfgang
8043 Graz/Kroisbach (AT)**
- **Raunegger, Arno
8047 Graz (AT)**

(54) **Enrollment von Fingerprints**

(57) Ein Verfahren für das Enrollment von Fingerprints, bei welchem aus einer Menge von $n = N_{max}$ Fingerprints sämtliche Kombinationen von Fingerprints mit einer Anzahl z gebildet werden, wobei $z \leq N_{max}$ ist, innerhalb jeder Kombination für die darin bildbaren Paare von Fingerprints ein Match-Score-Wert m gebildet wird, alle Kombinationen, bei welchen der Match-Score-Wert aller Paare nicht zwischen einer vorgebbaren unteren und einer vorgebbaren oberen Grenze liegt, verworfen werden, für die verbleibenden Kombinationen eine Kostenfunktion als Linearkombination gewichteter Qualitätsbeiträge C_i berechnet wird, und jene Fingerprints, welche die Kostenfunktion minimieren als Satz zur Referenzdarstellung herangezogen werden.

Source: European Patent Office

Because gender is not indicated in the patent documents, the person's gender had to be identified on the basis of their first name. To do this, a list was produced of all first names in the patent documents and then sorted for gender. In ambiguous cases, an Internet search was performed to identify the person in question. Due to the manual classification, over 95% of all first names could be identified.

The investigation assessed patents from 1978 to 2007. The long period under observation should show changes in patent activities over time, because gender-specific patent studies for Austria have only existed for a few years (i.e., Frietsch et al. 2008, Busolt et al. 2008). Furthermore, the study will more closely assess the technological fields in which women appear as inventors. In order to establish the relationship between input and output, the results of the gender-specific patent analysis will be compared with data on R&D personnel in the corporate sector.

7.3.3 The development of women's invention activities over time

From 1978 to 2007, 26,336 patents were identified in which Austrian inventors participated (and 23,323 if the fractional counts method is applied). A female inventor was involved in an average of 1.8 patents, while a male inventor had worked on about 1.5 patents.

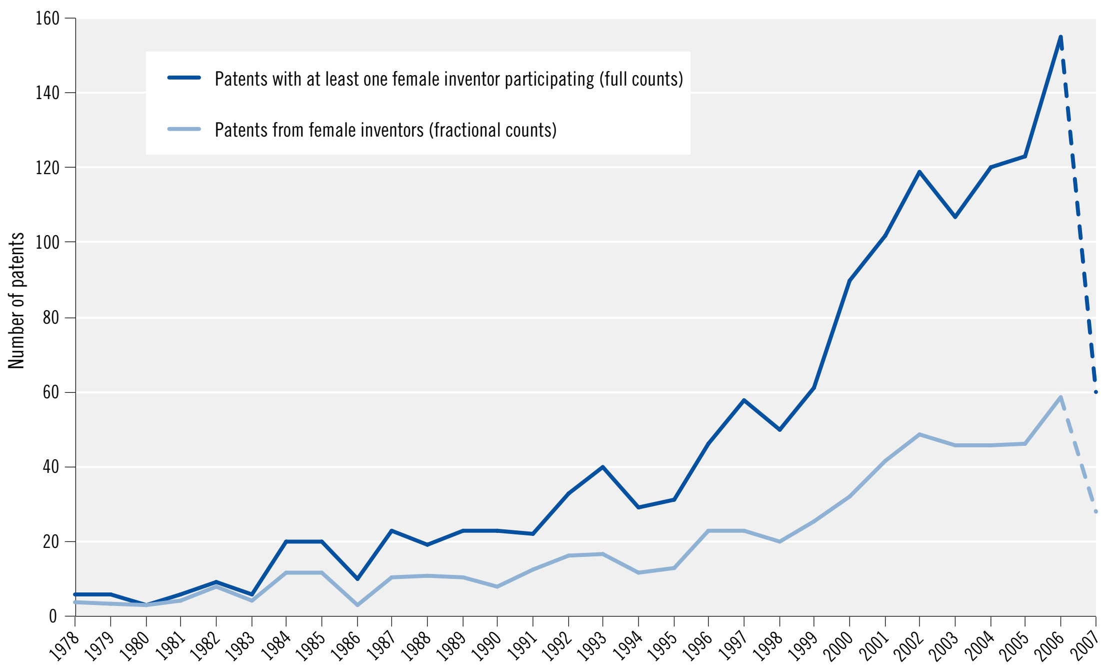
Figure 74 shows both the number of patents per year in which at least one female inventor was involved (full counts) and the number of patents by female inventors using the fractional counts method. Over the entire period from 1978 to 2007, a total of 1,420 patents showed at least one female inventor, corresponding to 601 patents (fractional counts).

Both curves clearly show that invention activities by women, after a slow start, have increased significantly since the mid-1990s. During this period of acceleration, there was

Box: full counts vs. fractional counts

Patent inventions can be counted according to two methods. In the "full count" approach, a patent is counted as one invented by a women when at least one women is named as an inventor in the patent documentation. Patents by female inventors in the "full count" approach are therefore patents in which one or more of the women involved resides in Austria. The "fractional count" approach is different, apportioning patents to several male and female inventors according to the number of participants. A patent document that for example names one female inventor and two male inventors is counted as a one-third female and two-thirds male patent. "Fractional counts" and "full counts" have specific advantages and disadvantages. "Full counts" can lead to an overemphasis of female inventors in comparison to their male counterparts. Unlike the "fractional count" approach, however, the "full count" method avoids fractional results, which does not seem appropriate for data related to persons. Furthermore, the "full count" approach reflects the fact that patent documents do not provide any information about the extent to which the individual actually participated in the invention process. If a female inventor and two male inventors are named in a patent document, this does not necessarily mean that each of these persons did one-third of the work on the invention. In the following, both methods of calculation are applied, thereby providing an impression of the breadth of female inventor activity in Austria.

Figure 74: Number of patents with at least one female inventor and patents by female inventors, 1978 to 2007



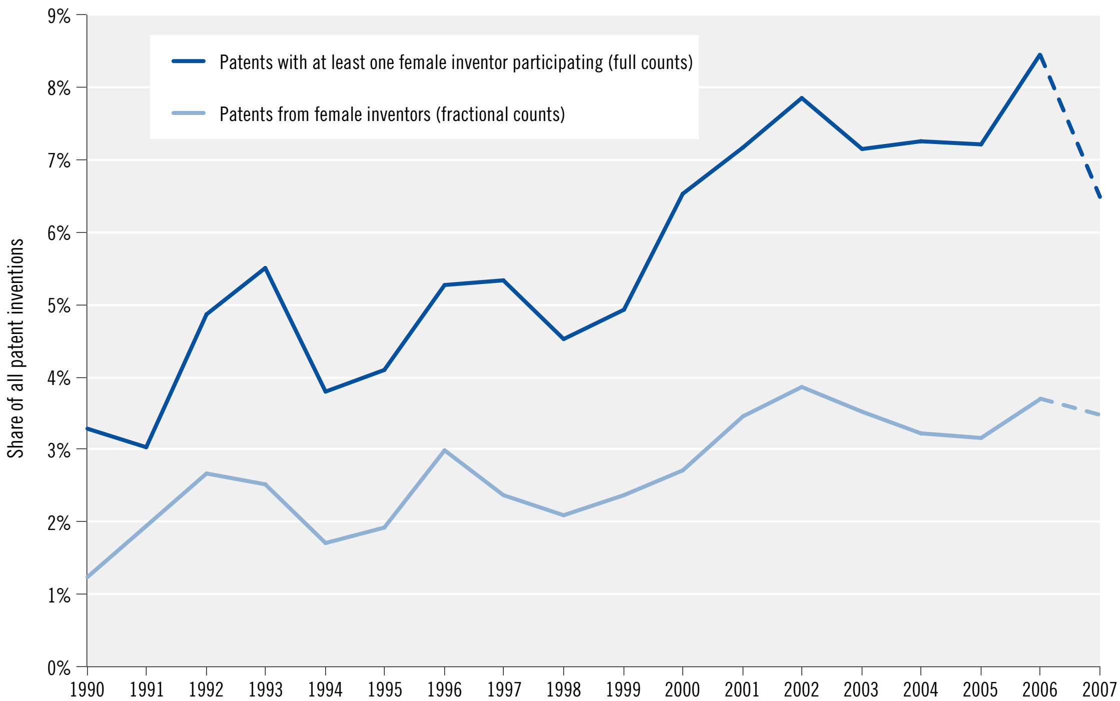
Source: European Patent Office, calculations by AIT

an overall rise in patent activity in Austria; this increase does not necessarily indicate an increase in female participation in research and development in Austria. The significant fall in the number of patent applications between 2006 and 2007 is a statistical artefact and can be attributed to the long waiting period between filing and publishing a patent at the European Patent Office. This period lasts at least 18 months. The fall in the number of patent applications should therefore not be interpreted as a fall in the invention activity of women.

The proportion of female inventors in overall invention activity is shown in Figure 75 to take into account general growth in patent applications. We see here that inventions by women climbed relatively (from 1990 to 2007), although the most significant change in both curves occurred between 1998 and 2002. Near the end of the period under observation, the proportion of patents with female inventors stagnated. The climb in relative numbers is however less significant than in absolute values. Especially in the counting according to the fractional counts method, the proportion of female inventors since the peak in 1996 seems to have climbed very slowly. The wave-like movement of patents by women over time is explained by the low number of patents by female inventors.

Overall, female inventors in Austria account for 3–4% of all patent inventions. At least one women participated in 8% of Austrian patent inventions. In contrast, women occupied 24% of all R&D employment catego-

Figure 75: Number of patents with at least one female inventor and share of patents by female inventors in all patents invented in Austria, 1978 to 2007



Source: European Patent Office, calculations by AIT

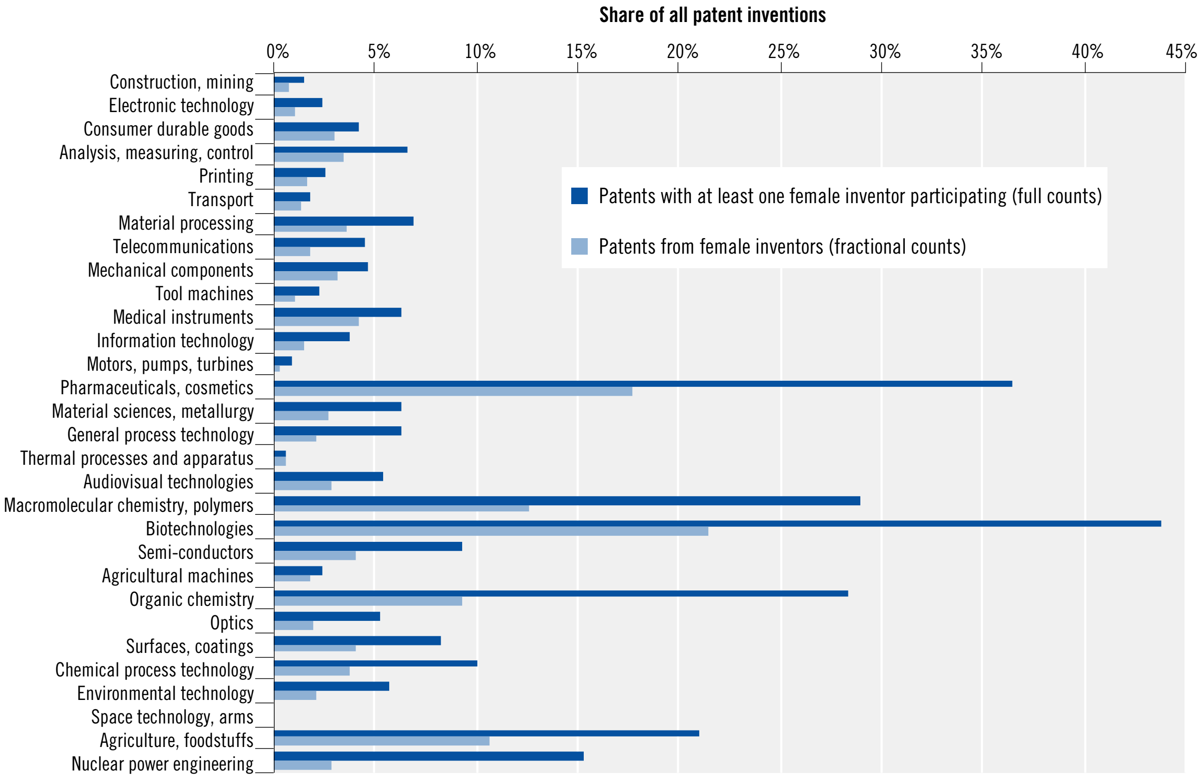
ries in 2006 (full-time equivalent; see Austrian Research and Technology Report 2009, 38 ff.).

7.3.4 Female inventor activity by technology

These imbalances are also mirrored in invention activity by technology. Figure 76 shows female invention activity broken down by technology areas. Female inventors attain the highest proportions in biotechnology, pharmaceuticals, different chemistry disciplines, agriculture and food technologies. In biotechnologies, women are involved in almost every second patent as inventors. About half of inventions by women fall within the aforementioned technologies, while the proportion of these technologies among all Austrian invention activity only reaches 10%. From a technological perspective, female inventors are significantly more specialised than their male counterparts. This focus on chemistry, biotechnologies and pharmaceuticals is also found among female inventors in other countries (Frietsch et al. 2008).

Women have very low participation rates in invention activity in electrical engineering and electronics, in various branches of engineering and mechanical engineering, and in

Figure 76: Share of patents with at least one female inventor and share of patents by female inventors by technology, 2003 to 2007

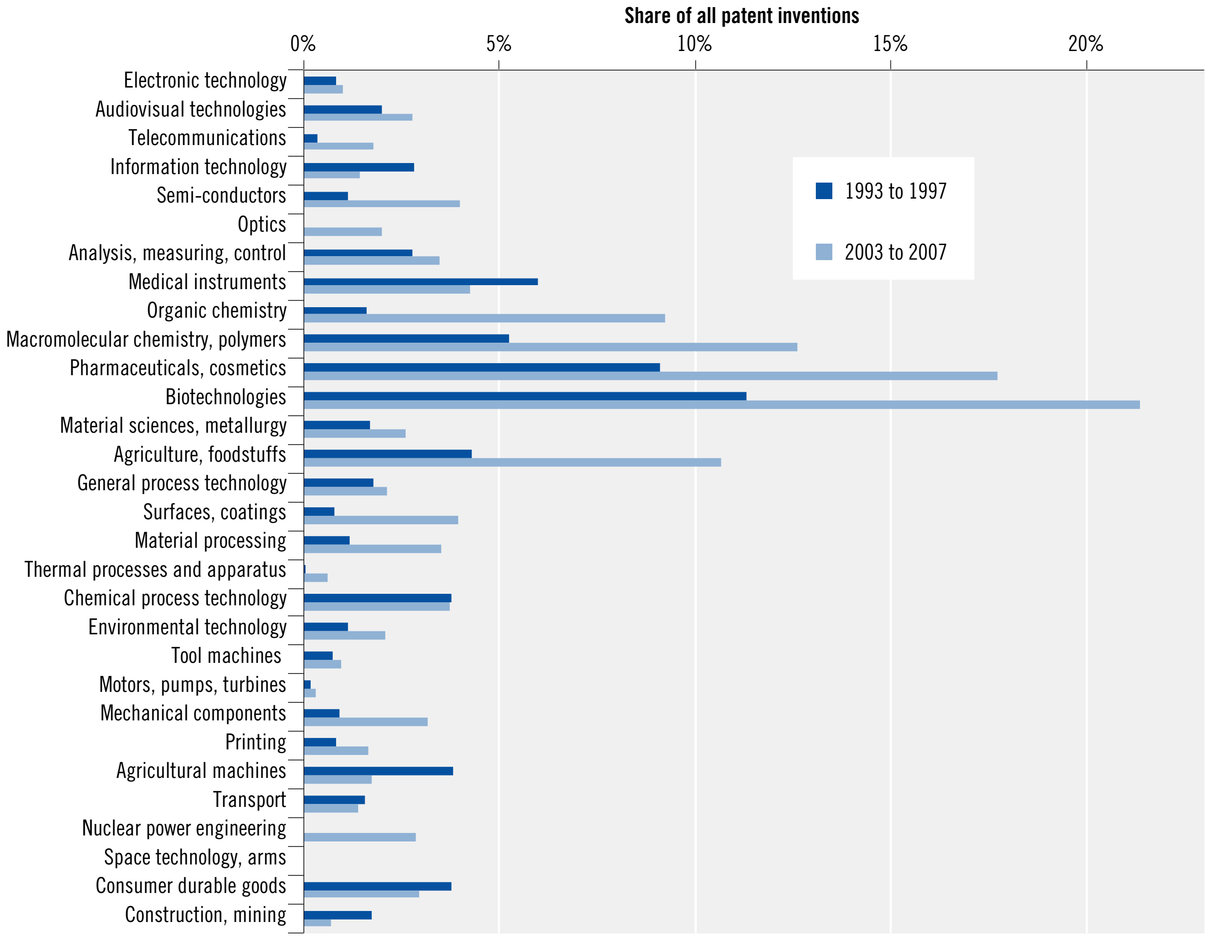


Source: European Patent Office, calculations by AIT

materials sciences. These technologies are Austria's traditional strengths and are responsible for a large share of Austrian patent inventions (Austrian Research and Technology Report 2007). In Austria, for example, a total of 3,941 or 60% of all Austrian patent inventions (fractional counts) between 2003 and 2007 fell within engineering and mechanical engineering, electrical engineering, electronics and process technology. Of these, however, only 74 patent inventions (or 2% of the total patent inventions in these fields) came from women. This is why the high proportion of female inventors in chemistry, biotechnologies and pharmaceuticals does not correspond to a higher share of women in overall invention activity.

The strong specialisation among female inventors in chemistry, biotechnologies and pharmaceuticals is a relatively new phenomenon. Figure 77 clearly shows that the proportion of women engaged in invention activity in chemistry, biotechnologies and pharmaceuticals more than doubled between 1993/97 and

Figure 77: Share of patents with at least one female inventor and share of patents by female inventors by technology, 1993 to 1997 and 2003 to 2007



Source: European Patent Office, calculations by AIT

2003/07. We also see clear gains in other technologies; however, the number of patent inventions is only large enough in the aforementioned areas to explain the described growth among patents by female inventors. In other words, the proportion of women n Austrian patent inventions has in good part increased because of growth in the biological and life sciences.

In addition to chemistry, biotechnologies and pharmaceuticals, women have also been able to significantly increase their participation in other technologies. In some technologies, however, a relative decrease in invention activity among women has been observed. These areas include two of the three technologies with the highest number of Austrian patent inventions (construction, mining and consumer durable goods). In electrical engineering, another technology with several Austrian patent inventions, the proportion of women has only slightly increased. The increase in invention activity by women described above has therefore not been accompanied by a broadening of the specialisation profile, nor by a general rise in the activities of female inventors across all technologies.

7.3.5 Female inventor activity by industry

Patent inventions can be assigned to economic sectors[107] using a method proposed by Schmoch et al. (2003). This makes it possible to directly compare the proportion of women involved in invention activity with the proportion of women on research staff at the industry level (Figure 78). Research staff here includes scientists and engineers. According to Giuri et al. (2007), three-quarters of European inventors have a university degree and therefore fall into this category.

The distribution of both indicators is very similar. In both cases, the highest proportion of women is found in the pharmaceuticals industry, followed by the food industry, textiles, clothing and leather, as well as other chemical industries. In three of these four sectors, women's share of research staff is at least 15%; in the pharmaceuticals industry, this number is even over 40%.

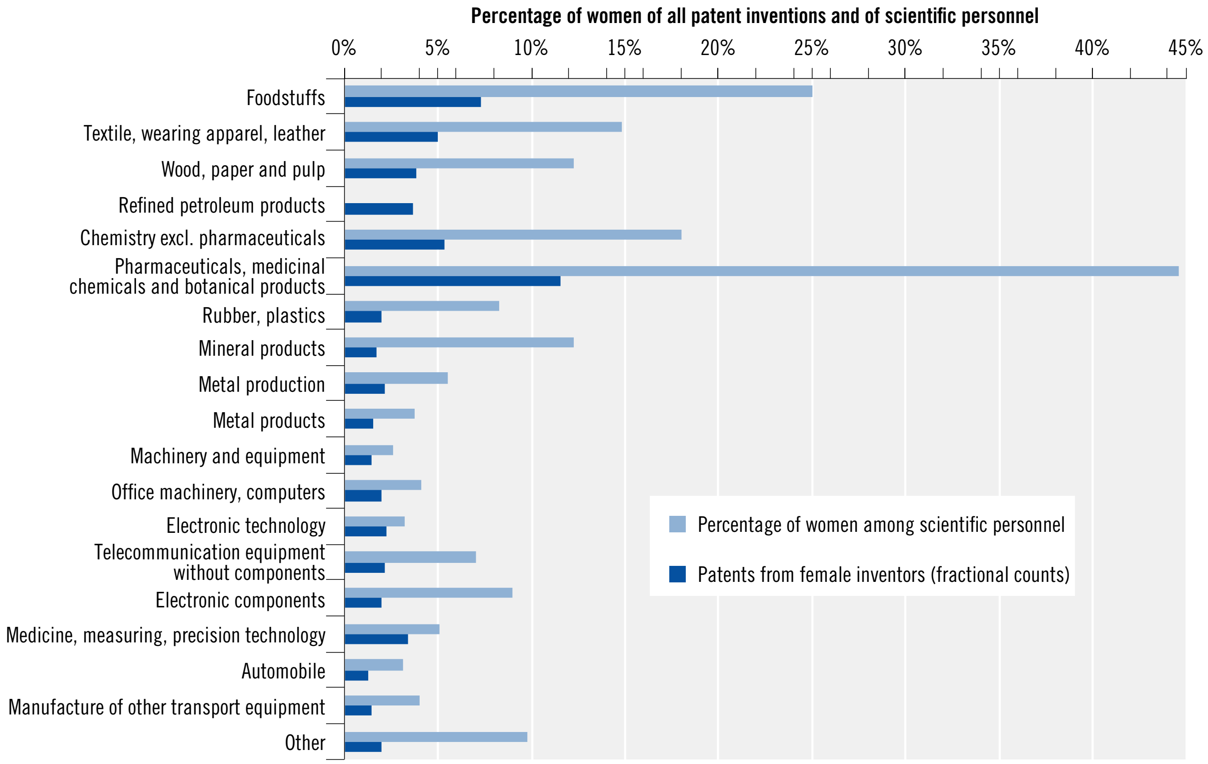
In all of these industries, women's share of R&D output (inventions) lags significantly behind their share of input (R&D personnel) (Figure 78). While the percentage of women among research staff in manufacturing rose from 7.5% (1998) to around 10% (2006), women's involvement in invention activity increased from 2.1% (1998) to 3.7% (2006). Between 1998 and 2006, the proportion of women among inventors grew much faster than the proportion of women among R&D personnel. Despite this, there is no industry in which the proportion of women among inventors even approaches women's share of research personnel. In most industries, the proportion of female researchers is about one-fifth of the share of women among research staff. In most industries, women constitute no more than three per cent share of inventors.

7.3.6 Austria in international comparison

International comparisons of the role of women in science and research regularly find that the share of women in Austrian research personnel is significantly below the EU average. The She Figures of the European Commission (2009, 28) for Austria show that women are 25% of total research personnel in Austria, which means that Austria is fourth from the bottom among the EU countries under comparison.

107 in the NACE Rev. 1.1 classification (ÖNACE 2003)

Figure 78: Proportion of female inventors for all patent inventions and proportion of women on scientific staff* in the corporate sector by economic class, 1998–2006



* in full-time equivalents

Source: European Patent Office, calculations by AIT

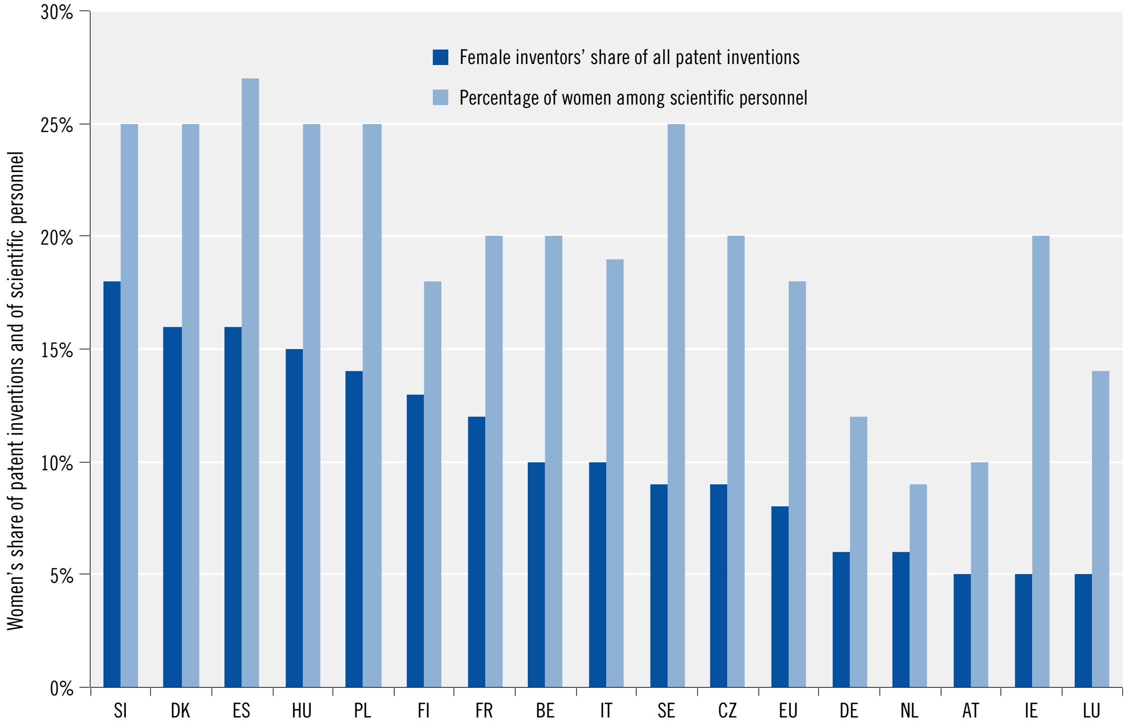
Studies that compare the proportion of female inventors in other European Union countries come to a similar conclusion. According to Frietsch et al. (2008) and Busolt et al. (2008), Austria is distinguished by the (nearly) lowest share of female inventors in Europe (Figure 79). The share of women in scientific personnel, also low in international comparison, therefore corresponds to the share values for female inventors.

7.3.7 Why is the proportion of female inventors so low?

There is no study that comprehensively examines the reasons why women rarely appear in the role of inventor. On the basis of existing literature on the role of women in science and technology, however, there are a few explanations for the low participation of women in invention activity in Austria (Mayer et al. 2011 provides an overview). We can assume, agreeing with the literature, that there is no single explanation for the situation described in this section. The reasons have multiple factors and are interconnected.

The low participation rate of women in patent inventions has, on one hand, structural reasons such as employment structures and the choices women make about their course of study. Women are significantly under-represented in patent-intensive areas of scientific work. The share of women among research staff in the university sector stands at more

Figure 79: Proportion of women among patent inventions and among scientific personnel in the corporate sector, 2003



Data for Austria and Finland: 2002. Data for Poland: 2000

Source: European Commission 2006, 28; Kugele 2010, 20

than 40%. In the corporate sector, however, only 16% of R&D employees are women (Austrian Research and Technology Report 2009, 38 ff). Although universities are increasingly involved in patent activity, the overwhelming majority of patent applications come from firms. The higher proportion of men among corporate sector research personnel has a direct effect on the proportion of women involved in patent inventions. There still is no comprehensive gender-specific analysis of publications at Austrian universities[108]. An evaluation on the basis of 250 academic journals did show, however, that the share of women in these publications was around 18% (Frietsch et al. 2009).

Another structural reason is the fact that women are significantly under-represented in technical scientific fields, particularly in comparison with medicine, the humanities, the social sciences and economics (European Commission 2009, 79). Statistics for Austria on courses of study and degrees attained by men and women show that male students in technical courses of study significantly outnumber women (see Statistik Austria 2011, 135/138). In the winter semester 2009/2010, there were 29,516 students enrolled in technical subjects

108 A major obstacle to such an analysis is the fact that a leading provider of databases for scientific literature abbreviates the first names of its authors.

in Austria, yet only 7,358 of them were women. Women therefore only have a share of 20%. The proportion of women who finish technical degrees at Austrian universities and universities of applied sciences was also low during this period. In comparison, the proportion of women among all university students (regardless of subject) was 55% in the winter semester 2009/2010. Yet it is precisely the technical disciplines that are responsible for a good portion of domestic patent inventions; an increase in the proportion of women among those studying technical subjects would doubtless lead to higher numbers of female inventors.

In addition to structural causes, there is another reason, at the individual level, for the low number of women in various branches of science and research, and thereby also patent inventions. Various studies indicate the importance of positive role models for a scientific career. Women are only seldom able to fulfil this role due to their low numbers in science and technology. Statistics show that in Austria the proportion of women in academic research in the highest classifications ("Grade A staff") is far below the EU average for the 55+ age cohort (European Commission 2009, 81). There are also arguments that the negative influence caused by the lack of female role models is aggravated by the male-dominated culture of science and research. Busolt et al. (2008), for example, point to Austria's predominant organisational forms as explanations, as they are shaped by gender-specific stereotypes and strict hierarchies.

Another explanation to add to these arguments is the question of compatibility between family and career among researchers. Patents are not typically invented in the early stages of one's career. Morgan et al. (2001) demonstrate that patent activity climbs along with age. According to Giuri et al. (2007), the average age of an inventor of a patent at the European Patent Office is 45 years. Because the phase of starting a family falls within the same timeframe as starting a scientific career, and because women most often take over the majority of child care responsibilities, this can preclude later patent inventions (Riesenfelder et al. 2007). The low proportion of women among Austria research staff in the 1980s and 1990s led directly to the lower number of patents by female inventors, as the data show. We also see here another aspect of the oft-described "leaky pipeline". This term illustrates the fact that the proportion of women who have positions with increasing responsibilities and functional scope is constantly decreasing.

7.3.8 Summary

Measured in the number of patented inventions, women play only a small role in Austrian science and technology output. Depending on the methodology, this proportion lies between 3.5% and 8%, which is significantly lower than the proportion of women in scientific personnel or university studies. Patents by female inventors are found primarily in chemical technology, biotechnology and pharmaceuticals. Growth in the number of patents by female inventors has occurred primarily in these technologies in recent years. The pharmaceutical and chemical industries are the economic sectors with the highest share of women on scientific staff. International comparisons document this fact: there are much fewer women in Austria participating in the process of invention than in other countries.

8 Results of selected evaluations of RTI support measures in Austria

In the meantime, evaluations have become, both in the legal regard and in daily practice, an important part of the life cycle of research and technology policy support measures. The primary legal basis for the process was created by 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: §§ 6–9), and guidelines on the promotion of research[109] based upon these laws and for the promotion of commercial-technical research and technology development, the so-called RTD guidelines.[110] For the first time, the Research and Technology Promotion Act (FTF-G § 15 Para. 2) has standardised the evaluation principles at a legislative level as being a minimum requirement for the guidelines. The guidelines stipulate that "a written evaluation plan must be created for all subsidy programmes and measures based upon the RTD Guidelines. This plan must include the purpose, objectives, and procedures, as well as deadlines for verifying the achievement of the subsidy objectives, and must define appropriate indicators. An appropriate monitoring system must be created to collect the necessary information" (Para. 2.2., p. 4). Evaluation functions are therefore further anchored in the subsidising institutions FFG and FWF established through the aforementioned laws, which can act in a largely independent manner.

Not least thanks to this statutory basis almost all research and technology programmes now include evaluations in their programme planning (*ex-ante* evaluations), their programme implementation (monitoring and interim evaluations) and their programme conclusion (*ex-post* evaluations). To give a periodic overview of the evaluation activity of the past years, recent evaluations have, since 2009, been presented in the Austrian Research and Technology Report. The following criteria have been used for selecting which ones to present in the Austrian Research and Technology Report:

- The evaluations are primarily relevant to federal policy;
- An approved report/partial report of the evaluations is available;
- The evaluation report must be accessible to the public: i.e., the report has been published in the evaluation database of the research and technology evaluation platform.[111]

In the following, we will present the first interim results of the accompanying evaluation of the "Laura Bassi Centres of Expertise" (commissioned by the Federal Ministry of Science and Research), the evaluation of the pilot programme "Josef Ressel Centres" (commissioned by the Federal Ministry of Science and Re-

109 Federal government guidelines on granting and executing subsidies pursuant to §§ 10–12 FOG, Federal Gazette No. 341/1981

110 Guidelines for the Promotion of Economic-Technical Research (RTD Guidelines) pursuant to § 11 Z 1 to 5 of the Research and Technology Funding Act (FTFG) of the Federal Minister for Transport, Innovation, and Technology dated 27 September 2006 (GZ 609.986/0013-III/I2/2006) and of the Federal Minister for Economics and Labour dated 28 September 2006 (GZ 97.005/0012-C1/9/2006)

111 www.fteval.at

search) and the evaluation of the "supervision structures of the FP7 and EUREKA and efficacy analysis of the European Research programmes on the Austrian innovation system" (commissioned by the Federal Ministry of Science and Research and other ministries along with the Austrian Federal Economic Chamber). The presentation of these evaluations focuses on the evaluation targets, the applied methods, and the main results and recommendations for each respective evaluation.

8.1 Evaluation of the "Laura Bassi Centres of Expertise" campaign

The "Laura Bassi Centres of Expertise" are a BMWFJ programme that has established centres of excellence under the leadership of female scientists. The programme's objectives are:

- to strengthen the visibility of the research accomplishments of highly-skilled women in the target areas of research, management and career;
- to work as a learning and teaching instrument to contribute to increased equality of opportunity in Europe's scientific landscape.

In the course of preparing the programme, a study by the Austrian Society for Environment and Technology asked which factors are relevant for the career development of highly qualified women, and what conditions best allow female scientists to realise their potential. In the preparatory phase of the "Laura Bassi Centres of Expertise", particular attention was focused on the conditions that best support the work of female researchers. In summer 2009, the programme's selection process came to an end and eight centres were founded.

The programme's accompanying evaluation[112] is designed to provide strategic in-process support with a strong focus on learning opportunities and feedback loops, as well as clear recommendations for programme management and development. It contains several elements for a formative evaluation that, in the sense of a transparent depiction of successes and deficits, should provide an empirical foundation for managing the programme, for the evaluative steps at the level of the centres, for reviewing programme documents in 2011, and for the continuation of the programme after 2014.

From a methodological perspective, the accompanying evaluation is shaped by considering the perspectives of different actors so that substantiated results and instructions can be provided for the ongoing management of the programme and for gender-conscious models for technology policy interventions, especially for RTI funding. The evaluation relies primarily on qualitative analysis methods (document and literature analyses, interviews with experts and focus groups, workshops) and a standardised online survey.

The analytical focus of the evaluation performed during this first year of implementation focused especially on the selection process chosen for the Laura Bassi Centres. Cursory attention was paid to other aspects, such as the perception of the programme or of the Laura Bassi "brand" in general, or expectations with regard to a new research culture.

The results from previous editions of the accompanying evaluation offer a comprehensive overview of the programme's genesis and an assessment of the people involved in the design and development of the selection process.

112 SME Research Austria (2011): Evaluation of the Laura Bassi Centres of Expertise campaign – first preliminary results, Vienna.

The selection process

The two-stage selection process used by the Laura Bassi Centres of Expertise considers both the scientific achievements of applicants as well as their ideas regarding management, team leadership, and career planning. The steps in the process can be characterised as follows:

Jury panel 1:
Short application – peer review

Jury panel 2:
Full application – economic assessment, interview process for assessing the scientific quality of applications and for evaluating the quality of ideas regarding management, team leadership and career planning.

The applications undergo a formal check at every level before being submitted for certification.

The entire selection process is documented in the form of an evaluation manual that, like a guide, is submitted to the jury. The following overview briefly characterises the selection process.

The evaluation provides an interim summary of the implementation of the selection process, based on the views of the jury members and other experts involved in the programme's design and implementation.

Figure 80: Selection process of the Laura Bassi Centres of Expertise campaign

Process LEVEL 1: Assessment of short applications						
Procedure	**Eligibility check**	**Assessment of content**	**Peer-review procedure**		**Jury meeting**	**Decision**
Focus (what?)	Formal requirements	Laura Bassi Centres of Expertise programme objectives	Scientific quality and consortium quality		Recommendation regarding submission of full applications	Decision to invite a full application
Implementation (who?)	FFG experts	FFG programme management	External evaluators (peers) FWF experts or representatives		Jury panel 1	Federal Ministry for Economics and Labour
Results	Test report	Test report	2 written expert opinions per application		Protocol of jury meeting and written recommendation	Written Decision
Process LEVEL 2: Assessment of full applications						
Procedure	**Eligibility check**	**Economic assessment**	**Interview process**		**Jury meeting**	**Decision**
Focus (what?)	Formal requirements	Economic quality & consortium quality	Scientific quality	Future potential; Research management & career development	Funding recommendation incl. constraints and cutbacks	Funding decision
Implementation (who?)	FFG experts	FFG experts	External evaluators (perhaps incl. FWF experts and representatives)	Experts on organisation and personnel development (convelop company)	Jury panel 2	Federal Ministry for Economics and Labour
Results	Test report	1 written expert opinion per application in provided Evaluation Sheet	Written advisory opinion and summary for each application	Written advisory opinion for each application and summary for each application	Protocol of jury meeting and written recommendation	Written decision

Source: Evaluation manual of the Laura Bassi Centres of Expertise campaign from December 2008, p. 4.

The following interim findings were verified in the evaluation:

The evaluation of **scientific quality** is an essential condition for the acceptance and perception of the programme and the scientists it finances. The current data show that this has been achieved and communicated in the selection process. The people interviewed were unanimous in describing the programme as singular in its consideration of scientific excellence AND equality AND management aspects as this is facilitated by the selection criteria and process. Dealing with questions about management and personnel development, however, represented a major challenge for the applicants; these skills would have to be further developed. The previously developed model for the selection process has proven itself well-suited for "...evaluating competencies and capacities in terms of scientific, economic and management skills, not just with regard to previous achievements, but also in the sense of **potential for future development**."

In terms of implementing the selection process, it was determined that the strong structuring of the process and **the equal treatment of applicants and jury members and their competencies** contributed to the fact that the evaluation remained focused on the programme's defined criteria in a well-structured procedure that ranged from hearing to jury discussions. Nevertheless, a balance was found between open discussion and steering and focussing on arguments and criteria relevant to the programme.

The efforts required for the selection process were comparatively high, yet were accepted by the jury members because of their great interest in the programme. With regard to the higher expense of the two-stage selection process, and above all the longer duration of such processes, two elements must be evaluated: a) the expected number of applications and b) the estimated total expense for the application procedure. In order to take into account the specific criteria for the programme objectives (scientific quality, equality and management/career), the requirement for the clearest and most transparent possible communication of specific criteria and objectives was conveyed to both potential applicants and peers and jury members. At this point, the evaluation seems to have fulfilled this goal.

8.2 Evaluation of the "Josef Ressel Centres" pilot programme

The Josef Ressel Centres (JRZ) pilot programme of the Federal Ministry of Economy, Family and Youth (BMWFJ) is oriented towards universities of applied science (FHs) that have experience in research and work with firms on multi-year research programmes. The "Josef Ressel Centres" research promotion programme therefore focuses on the establishment of long-term, structural partnerships between universities of applied science with outstanding levels of research in broad connections to teaching and science. The programme is directed at FHs that have scientific potential and are located in a regional corporate environment that is in a position to work on longer-term research projects and solutions to problems. At this time, there are three universities of applied science that have set up a JRZ:

- CFD Centre – Optimisation of building, energy and environmental process technology using Computational Fluid Dynamics [courses of study at FH Burgenland]
- Heureka! – Heuristic optimisation [FH Upper Austria]
- OptimUns – Optimisation under uncertainty [FH Vorarlberg]

The programme pursues the following objectives:

- Establish a stable, longer-term cooperative relationship between the universities of applied science and regional firms.
- Strengthen the research abilities of firms that have access to well-founded scientific expertise and can thereby optimise and innovate with their products and processes.
- Develop research competence at the universities of applied science. JRZ knowledge must flow into the educational offerings at FHs; this affects both teaching and R&D work. Basic research questions are meant to be addressed via inter-university cooperation. Overall, R&D with a high standard of excellence should support the expansion of research groups at FHs.

The aim of the "Evaluation of the Josef Ressel Centres pilot programme"[113], which took place from July to September 2010, was to analyse the pilot programme's design and processes and to support the JRZ's strategic management and positioning for the BMWFJ on the basis of the following aspects:

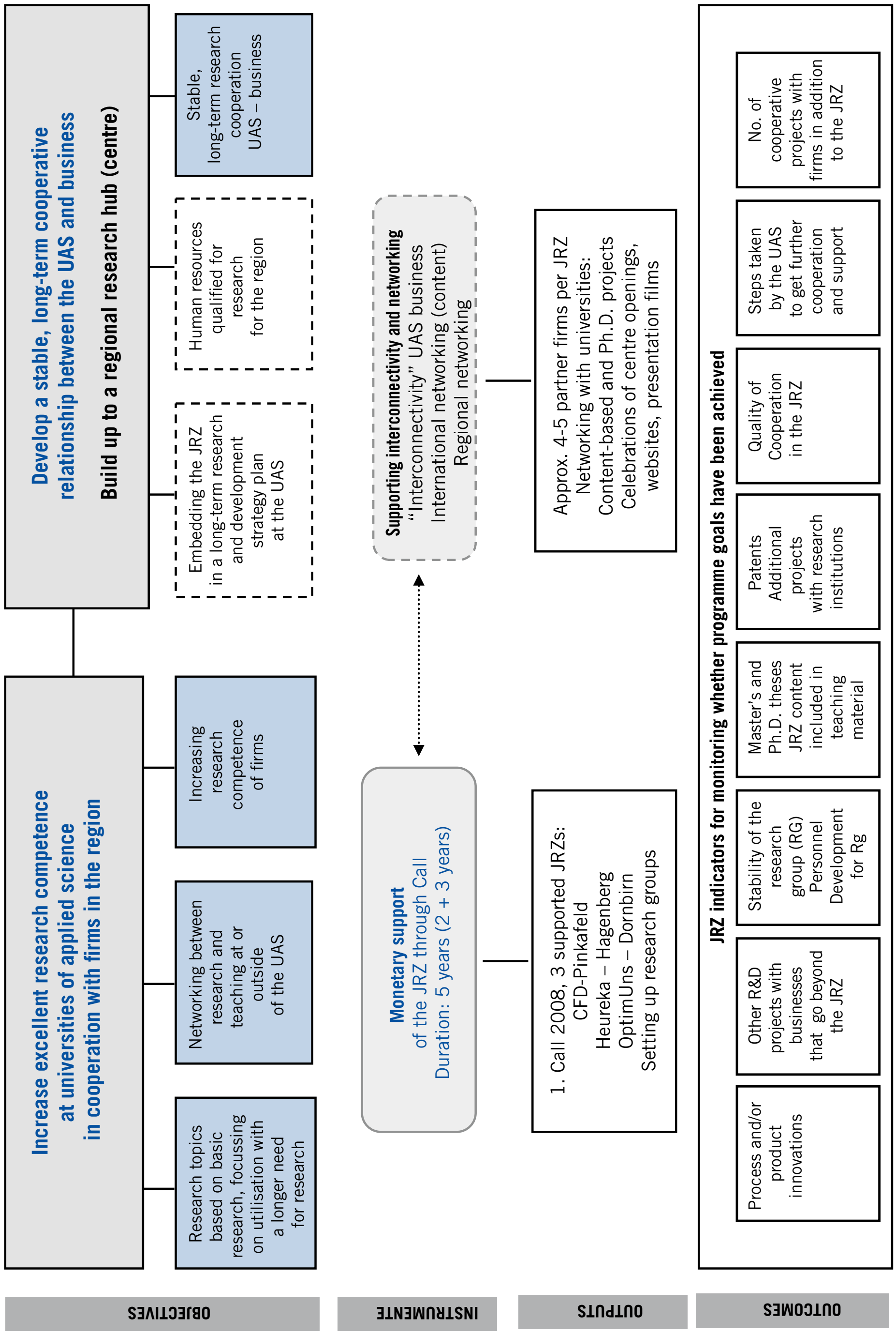
- An evaluation of the JRZ's activities to date and the programme supervision by the Austrian Research Promotion Agency (FFG);
- Appraisals of universities of applied science and participating universities: Interviews with project leaders and FH directors as well as firms that are active in a consortium in JRZ;
- Embedding in the research, technology and innovation funding policy landscape via analysis and interviews with RTI policy stakeholders.

The programme was given a two-year pilot phase because it was not initially fitted into an existing programme, and research at FHs was affected by a "structural gap in responsibilities". The programme evaluation, conducted two years after the start of the pilot programme, was meant to provide clarity over the continuation and optimisation of the programme.

From a methodological perspective, the evaluation design is based on a substantial engagement with the programme documentation and other materials, as well as a portrayal of various participants' perspectives on the entire programme. This foundation was meant to guarantee a balanced evaluation of the pilot programme and a realistic assessment in terms of the need for adaptation and future positioning. The evaluation should present perspectives to the BMWFJ that guide further action and provide information on how to organise the programme beyond the pilot phase.

This evaluation uses a logic chart that shows the connections between the programme's targets, instruments, outputs and outcomes. The "dotted line elements" suggest that these are implicitly contained in the programme document, yet they are not explicit enough.

113 Convelop (2010): Evaluation of the "Josef Ressel Centres" pilot programme in Graz.



Note:
"Dotted-line" frameworks, targets in black print: contained implicitly

Source: Convelop (2010)

The following summarises the central conclusions in relation to impact development and sustainability, programme management and implementation, and the evaluation's funding policy recommendations.

The funding programme affects an area that was built in the last twelve years and now needs specific priorities: research-related cooperation between universities of applied science and the economy. There is still a development need here for science-intensive research content and efficient, sustainable interconnectivity for both FHs and firms. The evaluation examines both the Centre and programme levels to see whether the programme's core objectives are appropriate and can be achieved during the overall timeframe.

The programme's orientation was able to exercise a certain mobilisation effect on the target groups. The JRZ programme serves to strengthen the scientific intensification in applied research, thereby offering regional firms new types of knowledge and raising the profile of the FHs. The application process enables a "selection of the best". The programme motivates FHs with a focus on research and the corresponding infrastructure to engage in intensive scientific research, with an emphasis on applied science, in cooperation with firms, mobilising the FH landscape to a very high degree of applied research. The programme's fixation on SMEs as corporate partners, as experience has shown, cannot be sustained in the intended form because SMEs have little capacity for five-year research processes. This is why leading regional operations are better-suited for cooperative ventures. Firms are thereby motivated to enter into longer-term research cooperation and work in a scientifically more intensive way. Regional integration is essential for the firms (having an "on-site point of contact" is also decisive for firms with more research experience).

In terms of the temporal and financial dimensions, the evaluation confirms that the programme was properly designed to emphasise application-oriented scientific research and thereby set standards for the regional knowledge base. Federal funding of a maximum of 40% (max. € 350,000 for two years) has created diverse incentives and effects that stimulate and support further research activities at the FH, corporate and regional levels. In interviews conducted during the evaluation, it was emphasised that the five-year duration offered universities of applied science a solid basis for substantial research projects with medium-term planning security, and that this represents a manageable period of time for research for firms.

The evaluation considers it necessary that the programme document needs to be more specific with regard to the objectives and functions of the Centres, as well as the programme's sustainability. The significance of human resource development, as well as the JRZ's regional function, also need to be highlighted. A more function-oriented programme objective would be the establishment of regional research nodes in the two dimensions "research-qualified human resources for the region" and "inclusion of the Centres in a long-term research and development strategy for FHs". Due to the programme's structure-strengthening characteristics, the evaluations sees that particular attention is paid to the question of sustainability, because the question currently remains open: what happens after the five years of funding elapse? Considerations of the subject of sustainable support should be pursued because otherwise the intended further effects, especially regional, could evaporate.

The evaluation identifies room for adaptations in the execution and formation of the funding programme in the following areas:

- emphasis on the centre-like character of the Centres (in applications, organisations should be described as Centres, and the sig-

nificance of strategic prioritisation at the FHs in relation to sustainability after the end of funding),
- selection of a multi-firm cooperative approach (turning away from single-firm participation in the Centres),
- opening up for all thematic research directions at the FHs (no limitations to "scientific-technological" subjects), and
- addition of a maximum limit of two applications per university of applied science receiving aid.

Furthermore, the evaluation recommends delaying the interim evaluation of the Centres (which is supposed to happen every 1.5 to 2 years) by up to three years, because the focus in the first phase is at the level of developing a scientific methodology, and not enough visible results can be expected. Additional projects and corporate partners should be called in after the third year. Beginning at this point, SME participation would be easier. In the Centres' fourth year, a strategic concept should be developed to secure the continuation of the Centres' work beyond the funding period.

Because research at FHs currently lives on stand-alone projects that are rather arbitrary and do not offer planning security in terms of building of specific areas of knowledge, and because the Josef Ressel Centres programme FHs are striving to set up strategic points of focus while taking into consideration a consistent teaching offer in cooperation with firms, the evaluation recommends that the programme be continued as an independent programme under the auspices of the the BMWFJ. The programme enables science-intensive, application-oriented research at FHs in cooperation with the corporate sector, which represents a significant upgrade to previous research achievements at FHs and to the research results of regional firms. In addition to the direct effects for research, there are also positive indirect effects in terms of a stimulus-inducing profiling of the FH sector and improved interconnectivity between FHs and the regional economy.

8.3 Evaluation of the supervision structures of the 7th Framework Programme and Eureka, and efficacy analysis of the European Research Programmes on the Austrian innovation system

The evaluation[114] analyses on one hand the effects of European research initiatives on the Austrian RTI system, and on the other it assesses Austria's supervision structures for the 7th European research framework programme (FP7) and EUREKA. The evaluation of supervision structures refers primarily to the European and International Programme (EIP) area of the Austrian Research Promotion Agency (FFG). The purpose of the study was to develop recommendations on how to improve the quality and relevance of services in the EIP (as well as in the entire structure of supervision within Austria) and to exercise an influence on future European research initiatives. The study is also supposed to make suggestions for the development of an Austrian position on upcoming changes in the European research area, especially in the transition from the 7th FP to the 8th FP.

From a methodological perspective, a mix of quantitative and qualitative methods were applied to the evaluation question responses. In addition to a document analysis, logic charts and a logic framework analysis were applied, together with input from leading EIP employ-

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ees, to produce a detailed picture of the EIP, its mission, its tasks and goals, its instruments and activities, and the effects it is striving to achieve. A logic framework analysis was also produced for the FP and EUREKA. The portfolio of qualitative methods includes group interviews with people from different departments and levels of the EIP hierarchy, individual interviews (both in person and via telephone) with stakeholders, and eight topic-specific focus groups with EIP customers as well as participants in European research programmes and case studies of organisations active in research. The quantitative analysis is based on secondary statistical analysis and two standardised online questionnaires, one directed at FP and EUREKA participants and one at a control group consisting of active research actors who primarily use national, but not FP and EUREKA, funding.

Effects of the European Research Framework Programme

The evaluation, based on high Austrian participation in the FP (in FP6, returns amounted to 130%), determined that Austria has especially high rates of participation in seven areas of the FP7. In five areas ('coherent development of research agendas', 'special activities in international cooperation', 'information and communication technologies', 'the humanities and social and economic sciences', and 'science and society'), this can be attributed to an above-average number of applications, while in the areas of 'security and space', above-average success rates for applications caused high participation. The relatively low participation in the European Research Council (ERC) can again be traced to a low number of Austrian applications; the success rate for Austrian applications to the ERC, however, is above average.

Despite high participation rates, Austrian researchers describe the national programmes as more relevant than the European programmes. Of the various European programmes, the FP cooperation projects are most relevant. The newer FP instruments, such as Joint Technology Initiatives (JTIs) and ERA Nets, however, were scarcely noticed by very experienced FP participants.

Because the FP is a pre-competitive programme in which favoured universities and extra-university research institutions participate, research outputs are more important for participants than innovation outputs. The main motivation for participation is access to research funds, although the FP is a highly complex programme with high administrative hurdles and low rates of successful application. There are, however, hardly any alternatives when it comes to public funds for international research projects.

The most important effects of the FP is a stronger networking of new or already known partners, as well as the establishment and maintenance of European research partnerships (networking effect). Other important effects are a heightened reputation as well as an increase in scientific and technological expertise and the ability to conduct R&D. Radical innovations are not one of the FP 's important effects. Most of the participants surveyed thought that, because of its design and selection process, the FP cannot systematically bring forth radical innovations. Although the analysis of the control group results shows that international research cooperation, often self-funded, also takes place outside of international research programmes, the FP nevertheless remains the most attractive public source of financing for such activities.

Participation in the framework programme also saw professionalisation of FP participants, which was expressed in a shift in demand for services from the EIP. The FP is highly competitive; therefore, only the 'fit' can successfully participate. Qualification for participation in European programmes takes place entirely in national programmes, which serves as an indication of the complementarity between national and European programmes. This complementarity, however, varies according to discipline. Particularly in the humanities and social sciences, there are scarcely any national programmes, so several researchers, especially from research institutions outside the universities, avoid the FP s. Three-quarters of Austrian research organisations have a strategy for using national and regional programmes, and two-thirds have strategies for using the FP. Most firms have a strategy for the entire organisation. Universities, in contrast, tend to have different strategies at different levels because of the varying thematic orientation of departments and the academic freedom among researchers.

Nearly two-thirds of Austrian FP participants value the benefit from participating in the FP more than the resulting costs. Interestingly, researchers from different organisations (universities, research institutes, firms) viewed the cost-benefit relationship in a similar manner.

Effects of EUREKA

Eighty-three per cent of EUREKA participants also participated in the 6th or 7th FP. This means that two target groups overlap, although EUREKA is more market-oriented than the FP. Austrian participation in EUREKA, with less than 50 projects per year, is low in comparison to participation in the FP. EUREKA is perceived as less weighty in administrative terms than the FP (especially the EUREKA clusters in comparison with the JTIs). EUREKA, however, has synchronisation problems: at the national level (if researchers attempt to obtain national funding for EUREKA projects) and at the international level due to the different amounts of funding allocated to each country.

The most important effects of EUREKA are a stronger networking of new or already known partners, and the establishment and maintenance of European research partnerships. Increasing technological and scientific knowhow is also another important effect. As is to be expected from a market-oriented programme, EUREKA participants report more frequently on market effects than do FP participants.

In comparison to the control group, however, the evaluation shows that participation in EUREKA does not increase the reputation of researchers more than autonomous R&D cooperative projects. In this regard, EUREKA cannot have any additional effects, which calls EUREKA's added value into question. In that EUREKA has a positive cost-effect relationship, more than half of its participants report that the benefits exceed the costs of participating. Overall then, it appears that, compared with the FP, the effects of EUREKA in Austria are weak. According to the evaluation results, the programme lacks a strategy and a clear brand. It is often unclear what the value of EUREKA is for the participants, compared to cooperative R&D projects undertaken on one's own initiative. It thus makes sense that EUREKA – with the exception of Eurostars – does not finance any research. There also is no standardised procedure at the national level that would allow EUREKA participants to apply for national funds. EUREKA seems to fit rather poorly in the Austrian funding landscape. Given this, Austria should redefine its position in EUREKA: either reduce its commitment with it or increase its commitment by working out EUREKA's added value and tailoring the programme for a better fit in the national funding landscape.

Evaluation of Austrian supervision structures

In terms of the evaluation of Austrian supervision structures, the evaluation described the services of the EIP-FFG as outstanding, an assessment also founded in very high customer satisfaction. EIP-FFG has committed and highly motivated employees, and they are systematically expanding and improving their services.

The EIP's mission – for Austrian organisations to participate at a high rate, successfully and sustainably in European and international programmes – has not changed over the years, but EIP has expanded its services and activities and adjusted to new needs and circumstances. Two of these new services are the strategic talks and the FFG Academy. EIP leads strategic talks with top Austrian firms, universities and research institutions to sound out strategies and opportunities for these organisations to participate more fully in the FP (and in other European programmes). The evaluation views the strategic talks as positive because they deal with organisations, not with individuals, and contribute to an improvement in strategic planning. The FFG Academy offers courses in which standard information is conveyed to groups of people, which in comparison to individual meetings translates into a gain in efficiency.

As its commissions dictate, the EIP focuses on the FP – and therefore particularly on cooperative projects – and on EUREKA. In future we should expect that those instruments that are currently on the periphery, such as JTIs and ERA Nets, as well as new instruments such as Joint Programming, will become increasingly important. Both the commissions and the EIP will have to adjust in such cases to changed conditions. The EIP has established itself well in its role as a central node in the supervisory network with the regional contact points (RKS). The next step towards a coherent Austrian supervision system that is flexible enough to adapt to changing international cooperative opportunities, is a functional integration of the EIP and RKS into a single network with a shared strategy.

Many of the EIP's activities should be continued. This applies in particular to general information services (events, mailings, informational material) and new instruments (strategic talks and the FFG Academy). EIP has the right strategies and instruments to identify "expandable potential". There are also indications that Austria does not have much untapped potential. EIP activities for identifying new R&D actors (i.e., junior researchers, new firms) are sufficient to handle these changes over time. Need for improvement was identified, however, in some specific activities, such as searching for partners, international activities and NCP projects.

The services of the EUREKA office, as well as other EIP services, are outstanding. The evaluation therefore points out that the process of forwarding clients to other areas of the FFG to obtain national funding could be improved. Collaboration across FFG areas should be improved.

Procurement financing for science and business both show remarkably high corollary effects. The evaluation recommends ending this venue of funding. The evaluation finds, however, that for a minority of actors – especially research institutions outside of universities – there are no internal funds for preparing an FP application. For this minority, procurement financing certainly generates added value. The evaluation recommends that the structural problems of these institutions be solved directly by the responsible ministries, not via procurement financing.

The evaluation further assumes that the professionalisation of research services at the universities and research institutes will free up resources in the EIP. This will allow the EIP to redirect its activities and concentrate more on preparing 'strategic intelligence' and helping new clients and first-time participants in international R&D initiatives to learn quickly.

Evaluation recommendations

The evaluation suggests that public funding of internationalisation (with information, advice, funding) should be oriented towards behavioural additionality. International orientation must not be a separate, bounded-off specialty; instead, it must become a "mainstream" feature of national research and innovation policy.

At the ministerial level, there needs to be a general coordination office for all ministries dealing with Austrian research and innovation policy. The main tasks of this EU general coordination office should be:

- to analyse, understand, coordinate and communicate national needs for international cooperation, nationally and internationally;
- to present Austria's needs and positions at the European level;
- to convey the European and global dimensions of research and innovation policy, as well as the threats and opportunities to actors in Austria, and thereby to contribute to setting the agenda;
- to ensure, as a principal or "intelligent customer", that national supervisory structures are adequately designed.

The evaluation recommends a new strategy for the EIP that assigns a stronger role to the FFG area that includes understanding and analysing the shifting opportunities and constellations in R&D cooperation at European and global levels. At the same time, the EIP should supply policymakers and administrators, as well as research and innovation communities, with corresponding information. The EIP should come to an agreement with the universities in which it downplays its role as the single supplier of routine information and services and emphasises its role as a "wholesaler" of "strategic intelligence" – both to other clients and to firms. In this sense, the division of labour between the universities and the EIP must be redefined. It is crucial for the universities that they shore up their internal capacities and resources for sustainable research management.

The EIP has the level of resources appropriate to the fulfilment of its mission, which has in large part been accomplished. The EIP's resources should be evaluated and adapted in light of new strategies and activities. The EIP should play a central role in developing its new strategy and actively offer this to its client ministries. The current commissions between the EIP and its clients should be viewed as a moving framework: the EIP's expenditures should be re-negotiated on a yearly basis within the agreed-upon financial limits with the client ministries. This "rolling approach" should help the EIP gradually step away from the tasks that are by and large complete, and from customer segments in which the required learning effects have already taken place, so that the EIP can dedicate itself to its new supervisory tasks.

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Statistical Annex

1 Financing of gross domestic expenditure on R&D and research intensity 2011 (Tables 1 and 2)[115]

According to an estimate by Statistik Austria, for the first time more than EUR 8 billion are expected to be spent in Austria in 2011 on research and experimental development (R&D). Compared to 2010, the total amount of Austrian R&D spending has increased by 5.0% to EUR 8,286 billion, and thus 2.79% of gross domestic product (GDP). For 2010 research intensity is estimated to be 2.78%; this means it will only rise slightly in 2011.

Of the total research spending for 2011, 44.6% (approx. € 3.70 billion), i.e. the largest share of such spending, is being financed by businesses. Financing by the corporate sector, after a decrease in 2009 and a slight rise in 2010, will increase noticeably in the year 2011 by 5.9%. The public sector is contributing 38.7% (approx. € 3.21 billion total; approx. € 2.73 billion from the federal government, approx. € 394 million from the federal states, and approx. € 87 million from other public institutions such as local governments, chambers and social insurance carriers). This corresponds to a 4.5% increase compared to 2010. 16.2% will be financed from abroad and 0.4% (about € 35 million) by the private non-profit sector. The financing from abroad (about € 1.34 billion) comes mainly from international groups whose domestic subsidiaries do research in Austria and includes the returns from the EU Framework Programmes for research, technological development and demonstration.

Based on information available to Statistik Austria concerning the development of R&D-relevant budget components and additional R&D subsidies – in particular refunds by the federal government to firms in connection with the research premium, the financing of research by the federal government in 2011 will continue to climb, up to € 2.73 billion. With an increase of 5.1% compared to 2010, the rise in financing by the federal government is slightly over the expected nominal increase in the gross domestic product.

For comparison, the gross domestic expenditures for R&D are expressed as a percentage of gross domestic product ("research intensity"). This has gone up for Austria since the year 2000 from 1.94% to an estimated 2.79% in 2011. However, since 2009 the research intensity has remained at almost the same level. Because of the decline in the gross domestic product in 2009 and a simultaneous moderate rise in Austrian research expenditures, from

115 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 estimates and year-end closing data of the national government and the states, Statistik Austria annually creates the "Total estimate of the Austrian Gross Domestic Expenditures for R&D." Under this annual creation 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).

2008 to 2009 there was already a strong rise in research intensity from 2.67% to 2.79%, which corresponds exactly to the value of 2011.

This means Austria clearly outdoes the research intensity of the EU-27, is clearly above the EU average of 2.01% for the comparison year 2009 (the last year for which comparative figures are available) and is in the same group as Finland, Sweden, Denmark and Germany, i.e. the countries with a research intensity higher than 2.5%.

In estimating the Austrian gross domestic expenditures on R&D in 2011, the preliminary results of the R&D survey by Statistik Austria among firms about the reporting year 2009 was taken into consideration, along with the estimates and year-end closing data of the national government and the states, as well as current economic data.

2 Federal R&D spending in 2011

2.1 The federal expenditure shown in Table 1 for R&D carried out in Austria in 2011 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 Annex T in the Auxiliary Document for the Federal Finances Act 2011. The estimate also includes the funds from the National Foundation for Research, Technology, and Development available for 2011 as well as the estimates of the payout for research premiums expected for 2011 which are based on the information available in April 2011 (Source: Federal Ministry of Finance).

2.2 In addition to its expenditures for R&D in Austria, in 2011 the federal government will pay **contributions to international organisations** aimed at research and the promotion of research amounting to € 97.8 million. They are shown in Annex T/Part a, but according to the domestic concept these are not included in the Austrian gross domestic expenditure on R&D.

2.3 The federal government expenditures summarised in **Annex T (Part a and Part b)** that impact research and which includes its research-effective share in contributions to international organisations (cf. above pt. 2.2), are traditionally included under the title "**Expenditures of the federal government for research and the promotion of research**." These correspond to what is called the "GBAORD" concept [116] that is used by the OECD and the EU on the basis of the Frascati Handbook, 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 socio-economic objectives as required for reporting to the EU and OECD.

In 2011 the following socio-economic goals will receive the largest portions of federal spending for research and research funding:
Promotion of general knowledge advancement: 29.8%
Promotion of trade, commerce, and industry: 25.6%
Promotion of health care: 21.6%
Promotion of research covering the earth, oceans, atmosphere
and space: 5.1%
Promotion of social and socio-economic development: 4.4%
Promotion of environmental protection: 3.6%
Promotion of agriculture and forestry: 2.8%

116 GBAORD: Government Budget Appropriations or Outlays for R&D = (official EU translation).

3 R&D expenditure of the regional governments

The research financing by the Austrian government as collated in *Table 1* is listed from the state budget-based estimates of R&D expenditure reported by the offices of the state governments. The R&D expenditures of the regional hospitals are estimated annually by Statistik Austria by a methodology agreed on with the state governments.

4 An international comparison of 2008 R&D expenditure (Table 13)

The overview table 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 2010-2).

List of Tables

Table 1. Global estimate for 2011: Gross domestic expenditure on R&D Financing of research and experimental development carried out in Austria in 1993–2011

Financing	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
1.Gross domestic expenditure on R&D (in € million)	**2,303.31**	**2,550.73**	**2,701.68**	**2,885.55**	**3,123.21**	**3,399.83**	**3,761.80**	**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**	**7,657.67**	**7,890.68**	**8,286.30**
of which financed by:																			
Federal government[1]	957.12	1,075.14	1,092.28	1,066.46	1,077.59	1,097.51	1,200.82	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	2,475.55	2,596.71	2,730.28
State governments[2]	129.67	158.69	153.89	159.06	167.35	142.41	206.23	248.50	280.14	171.26	291.62	207.88	330.17	219.98	263.18	354.35	382.82	389.51	393.76
Corporate sector [3]	1,128.40	1,179.42	1,233.50	1,290.76	1,352.59	1,418.43	1,545.25	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	3,442.06	3,491.93	3,697.61
Abroad [4]	59.69	106.52	190.10	337.00	478.21	684.63	738.91	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	1,240.95	1,293.56	1,342.59
Other [5]	28.42	30.96	31.91	32.27	47.47	56.86	70.59	70.23	64.08	58.09	71.29	87.49	96.32	106.20	113.04	115.83	116.29	118.97	122.06
2. Nominal GDP [6] (in € billion)	**159.16**	**167.01**	**174.61**	**180.15**	**183.48**	**190.85**	**197.98**	**207.53**	**212.50**	**218.85**	**223.30**	**232.78**	**243.58**	**256.95**	**272.01**	**283.09**	**274.32**	**284.00**	**296.87**
3.Gross domestic expenditure on R&D as a % of GDP	***1.45***	***1.53***	***1.55***	***1.60***	***1.70***	***1.78***	***1.90***	***1.94***	***2.07***	***2.14***	***2.26***	***2.26***	***2.48***	***2.46***	***2.52***	***2.67***	***2.79***	***2.78***	**2.79**

Status: 19 April 2011 Source: STATISTIK AUSTRIA (Bundesanstalt Statistik Österreich)

[1]) 1993, 1998, 2002, 2004, 2006 and 2007: Survey results (federal government including the Austrian Science Fund, the two research promotion funds and in 1989, 1993 1998 and 2002 also including ITF)1994-1997, 1999–2001, 2003, 2005, 2008 and 2009: Annex T/Part b of the Auxiliary Document for the Federal Finances Act (actual).2005: In addition: € 84.4 million National Foundation for Research, Technology and Development and € 121.3 million research premiums paid out.2008: In addition: € 91.0 million National Foundation for Research, Technology and Development and € 340.6 million research premiums paid out.2009: In addition: € 67.5 million National Foundation for Research, Technology and Development and € 337.8 million research premiums paid out.2010: Preliminary draft of Annex T/Part b based on preliminary result 2010 (Federal Minister of Finance, as per April 2011). In addition: € 74.6 million National Foundation for Research, Technology and Development and € 328.8 million research premiums paid out.2011: Annex T/Part b of the Auxiliary Document for the Federal Finances Act 2011 (budget). In addition: € 70.0 million National Foundation for Research, Technology and Development, as well as € 350.0 million for research premiums expected to be paid out based on information currently available (source: Federal Ministry of Finance (BMF).

[2] 1993, 1998, 2002, 2004, 2006 and 2007: survey results. 1994–1997, 1999–2001, 2003, 2005 and 2008–2011: Based on the estimates of R&D expenditure reported by the state government offices.

[3]) Funding by business.1993, 1998, 2002, 2004, 2006 and 2007: survey results. 1994–1997, 1999–2001, 2003, 2005 and 2008–2011: Estimates made by Statistik Austria.

[4]) 1993, 1998, 2002, 2004, 2006 and 2007: survey results. 1994–1997, 1999–2001, 2003, 2005 and 2008–2011: Estimates made by Statistik Austria.

[5]) 1993, 1998, 2002, 2004, 2006 and 2007: survey results. 1994–1997, 1999–2001, 2003, 2005 and 2008–2011: Estimates made by Statistik Austria.

[6]) 1993–2010: Statistik Austria. 2011: Austrian Institute of Economic Research (WIFO) April 2011.

Table 2. Global estimate for 2011: Gross domestic expenditure on R&D Financing of research and experimental development carried out in Austria in 1993–2011 (in percent of GDP)

Financing	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
1. Gross domestic expenditure on R&D (in % of GDP)	**1.45**	**1.53**	**1.55**	**1.60**	**1.70**	**1.78**	**1.90**	**1.94**	**2.07**	**2.14**	**2.26**	**2.26**	**2.48**	**2.46**	**2.52**	**2.67**	**2.79**	**2.78**	**2.79**
of which financed by:																			
Federal government[1]	0.60	0.64	0.63	0.59	0.59	0.58	0.61	0.59	0.64	0.62	0.62	0.63	0.72	0.69	0.70	0.83	0.90	0.91	0.92
State governments[2]	0.08	0.10	0.09	0.09	0.09	0.07	0.10	0.12	0.13	0.08	0.13	0.09	0.14	0.09	0.10	0.13	0.14	0.14	0.13
Corporate sector [3]	0.71	0.71	0.71	0.72	0.74	0.74	0.78	0.81	0.86	0.96	1.02	1.06	1.13	1.19	1.23	1.23	1.25	1.23	1.25
Abroad [4]	0.04	0.06	0.11	0.19	0.26	0.36	0.37	0.39	0.41	0.46	0.45	0.44	0.45	0.45	0.45	0.44	0.45	0.46	0.45
Other [5]	0.02	0.02	0.02	0.02	0.03	0.03	0.04	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
2. Nominal GDP [6] (in € billion)	**159.16**	**167.01**	**174.61**	**180.15**	**183.48**	**190.85**	**197.98**	**207.53**	**212.50**	**218.85**	**223.30**	**232.78**	**243.58**	**256.95**	**272.01**	**283.09**	**274.32**	**284.00**	**296.87**

Status: 19 April 2011 Source: STATISTIK AUSTRIA (Bundesanstalt Statistik Österreich)

Footnotes cf. Table 1.

Table 3: Federal expenditure on research and research promotion, 2008 to 2011
Breakdown of Annex T of the Auxiliary Document for the Federal Finances Act 2010 and 2011

Ministries [1]	Actual figures				Budget			
	2008[2]		2009[3]		2010[3]		2011[3]	
	€ million	%	€ million	%	€ million	%	€ million	%
Federal Chancellery (BKA)[4]	1.651	*0.1*	1.799	*0.1*	2.072	*0.1*	2.043	*0.1*
Federal Ministry of the Interior (BMI)	0.693	*0.0*	0.758	*0.0*	0.680	*0.0*	0.804	*0.0*
Federal Ministry for Education, Arts and Culture (BMUKK)	56.010	*2.8*	55.719	*2.6*	57.909	*2.4*	62.353	*2.6*
Federal Ministry of Science and Research (BMWF)	1,344.447	*67.6*	1,563.797	*72.8*	1,745.792	*72.5*	1,720.972	*71.4*
Federal Ministry for Social Affairs and Consumer Protection (BMSK)	1.842	*0.1*	.	.	.	.	.	.
Federal Ministry of Labour, Social Affairs and Consumer Protection (BMASK)	.	.	2.130	*0.1*	2.536	*0.1*	2.300	*0.1*
Federal Ministry for Health, Family and Youth (BMGFJ)	5.253	*0.3*	.	.	.	.	.	.
Federal Ministry for Health (BMG)	.	.	4.391	*0.2*	5.229	*0.2*	5.022	*0.2*
Federal Ministry for European and International Affairs (BMEIA)	2.038	*0.1*	1.869	*0.1*	1.905	*0.1*	2.383	*0.1*
Federal Ministry of Justice (BMJ)	0.103	*0.0*	0.114	*0.0*	0.130	*0.0*	0.130	*0.0*
Federal Ministry of Defence (BMLV)	1.764	*0.1*	.	.	.	.	.	.
Federal Ministry of Defence and Sports (BMLVS)	.	.	2.072	*0.1*	2.396	*0.1*	2.453	*0.1*
Federal Ministry of Finance (BMF)	32.960	*1.7*	32.045	*1.5*	33.031	*1.4*	33.204	*1.4*
Federal Ministry for Agriculture, Forestry, Environment and Water Management (BMLFUW)	55.207	*2.8*	62.915	*2.9*	75.430	*3.1*	79.440	*3.3*
Federal Ministry for Economics and Labour (BMWA)	79.255	*4.0*	.	.	.	.	.	.
Federal Ministry of Economy, Family and Youth (BMWFJ)	.	.	83.691	*3.9*	109.590	*4.5*	102.676	*4.3*
Federal Ministry for Transport, Innovation and Technology (BMVIT)	405.552	*20.4*	338.487	*15.7*	372.927	*15.5*	394.274	*16.4*
Total	**1,986.775**	***100.0***	**2,149.787**	***100.0***	**2,409.627**	***100.0***	**2,408.054**	***100.0***

Status: April 2011 Source: STATISTIK AUSTRIA (Bundesanstalt Statistik Österreich)

1) In accordance with the applicable version of the Act Governing Federal Ministries of 1986 (2008: Federal Law Gazette I No. 6/2007; 2009, 2010, 2011: Federal Law Gazette I No. 3/2009).
2) Auxiliary Document for the Federal Finances Act of 2010.
3) Auxiliary Document for the Federal Finances Act of 2011.
4) 2009, 2010, 2011: including the highest executive bodies.

Table 3:

ANNEX T

of the Auxiliary Document for the Federal Finances Act of 2011

Federal expenditure on research from 2009 to 2011 by ministry

The following overviews for 2009–2011 are divided into two sections:

1. Contributions from federal funds paid to international organisations, which (i.a.) aim at research and research promotion **(Part a)**

2. Other federal expenditures on research and research promotion **(Part b, Federal research budget)**

This list is made out primarily with a view to the research impact, which in its concept goes beyond Item 12 "research and science" and which is based on the research concept as used by the OECD's Frascati manual and applied by STATISTIK AUSTRIA in its research statistical surveys. Portions of federal spending that have an impact on research can thus be found not only under expenditures on item 12 "research and science", but also under other items.

Please note:
The notes on the following overviews can be found in the annex to Annex T.

Statistik Austria (Bundesanstalt Statistik Österreich)

Beilage T

B U N D E S V O R A N S C H L A G 2 0 1 1
Forschungswirksame Ausgaben des Bundes (*)
(Beträge in Millionen Euro)

a) Beitragszahlungen aus Bundesmitteln an internationale Organisationen, die Forschung und Forschungsförderung (mit) als Ziel haben

VA-Ansatz	AB	VA-Post Nr.	Ugl	Bereich-Ausgaben Bezeichnung	Anm.	Bundesvoranschlag 2011 Insgesamt	hievon %	hievon Forschung	Bundesvoranschlag 2010 Insgesamt	hievon %	hievon Forschung	Erfolg 2009 Insgesamt	hievon %	hievon Forschung
				Bundeskanzleramt:										
1/10007	43	7800	101	Mitgliedsbeitrag für OECD		2,650	20	0,530	....	...	....	....	...	....
		7800	102	OECD-Energieagentur (Mitgliedsbeitrag)		0,230	20	0,046	....	...	....	....	...	....
		7800	*001*	*Mitgliedsbeitrag für OECD*		....	...	....	3,150	20	0,630	2,919	20	0,584
		7800	*003*	*OECD-Energieagentur (Mitgliedsbeitrag)*		....	...	....	0,230	20	0,046	0,226	20	0,045
1/10008	43	7800	103	OECD-Beiträge zu Sonderprojekten		0,010	20	0,002	....	...	....	....	...	....
		7800	*009*	*OECD-Beiträge zu Sonderprojekten*		....	...	....	0,020	20	0,004	0,016	20	0,003
				Summe Bereich 10...		2,890		0,578	3,400		0,680	3,161		0,632
				BM für europäische und internationale Angelegenheiten:										
1/12036	43	7840	030	Inst. der VN für Ausbildung und Forschung (UNITAR)		0,020	40	0,008	....	...	....	....	...	....
		7840	054	Beitrag zum Budget des EUREKA-Sekretariates		0,001	52	0,001	....	...	....	....	...	....
		7840	056	Drogenkontrollprogramm der VN (UNDCP)		0,500	20	0,100	....	...	....	....	...	....
		7801		*Institut der VN für Ausbildung und Forschung (UNITAR)*		....	...	....	0,030	40	0,012	0,030	40	0,012
		7831		*Beitrag zum Budget des EUREKA-Sekretariates*		....	...	....	0,001	52	0,001	....	...	....
		7841		*Drogenkontrollprogramm der VN (UNDCP)*		....	...	....	0,550	20	0,110	0,449	20	0,090
1/12037	43	7840		Internationale Atomenergie-Organisation (IAEO)		3,252	35	1,138	....	...	....	....	...	....
		7840	002	Organisation der VN für industr.Entwicklung (UNIDO)		0,940	46	0,432	....	...	....	....	...	....
		7840	003	Org. VN Erziehung,Wissensch.u.Kultur(UNESCO)		2,346	30	0,704	....	...	....	....	...	....
		7260		*Internationale Atomenergie-Organisation (IAEO)*		....	...	....	3,000	35	1,050	3,036	35	1,063
		7801		*Organisation der VN für industr.Entwicklung (UNIDO)*		....	...	....	0,940	46	0,432	0,935	46	0,430
		7802		*Organisation d.VN f.Erziehung,Wissenschaft u.Kultur (UNESCO)*		....	...	....	1,000	30	0,300	0,913	30	0,274
				Summe Bereich 12...		7,059		2,383	5,521		1,905	5,363		1,869
				BM für Arbeit, Soziales und Konsumentenschutz:										
1/21008	43	7800	030	Europarat - Teilabkommen		0,001	20	0,000	....	...	....	....	...	....
		7802		*Europarat - Teilabkommen*		....	...	....	0,001	20	0,000	....	...	....
				Summe Bereich 21...		0,001		....	0,001		....	....		....
				BM für Gesundheit:										
1/24007	43	7800	040	Europ. Maul- u. Klauenseuchenkommission		0,012	50	0,006	....	...	....	....	...	....
		7800	041	Internat.Tierseuchenamt		0,130	50	0,065	....	...	....	....	...	....
		7800	042	Weltgesundheitsorganisation		4,220	30	1,266	....	...	....	....	...	....
		7802		*Weltgesundheitsorganisation*		....	...	....	3,698	30	1,109	2,951	30	0,885
		7807		*Europ. Maul- u. Klauenseuchenkommission*		....	...	....	0,010	50	0,005	0,009	50	0,005
		7808		*Internat.Tierseuchenamt*		....	...	....	0,108	50	0,054	0,112	50	0,056
1/24008	43	7800	043	Europarat Teilabkommen		0,088	20	0,018	....	...	....	....	...	....
		7802		*Europarat Teilabkommen*		....	...	....	0,165	20	0,033	....	...	....
				Summe Bereich 24...		4,450		1,355	3,981		1,201	3,072		0,946
				BM für Unterricht, Kunst und Kultur:										
1/30008	11	7800	104	OECD-Schulbauprogramm		0,029	100	0,029	....	...	....	....	...	....
		7800	*001*	*OECD-Schulbauprogramm*		....	...	....	0,028	100	0,028	0,025	100	0,025
				Summe Bereich 30...		0,029		0,029	0,028		0,028	0,025		0,025
				BM für Wissenschaft und Forschung:										
1/31117	12	7270	032	Verpflichtungen aus internationalen Abkommen		0,093	50	0,047	....	...	....	....	...	....
		7271		*Verpflichtungen aus internationalen Abkommen*		....	...	....	0,092	50	0,046	0,115	50	0,058

B U N D E S V O R A N S C H L A G 2 0 1 1

Beilage T

Forschungswirksame Ausgaben des Bundes (*)
(Beträge in Millionen Euro)

a) Beitragszahlungen aus Bundesmitteln an internationale Organisationen, die Forschung und Forschungsförderung (mit) als Ziel haben

VA-Ansatz	AB	VA-Post Nr.	Ugl	Bereich-Ausgaben Bezeichnung	Anm.	Bundesvoranschlag 2011 Insgesamt	hievon %	hievon Forschung	Bundesvoranschlag 2010 Insgesamt	hievon %	hievon Forschung	Erfolg 2009 Insgesamt	hievon %	hievon Forschung
				(Fortsetzung)										
1/31117	43	7800	200	Beiträge an internationale Organisationen		0,700	50	0,350	...	...	...	...	...	...
		7801		*Beiträge für internationale Organisationen*		...	...	...	0,700	50	0,350	0,677	50	0,339
1/31118	12	7800	105	OECD-CERI-Mitgliedsbeitrag		0,001	100	0,001	...	...	...	...	...	...
		7271		*Verpflichtungen aus internationalen Abkommen*		...	...	...	0,564	50	0,282	0,686	50	0,343
		7800		*OECD-CERI-Mitgliedsbeitrag*		...	...	...	0,001	100	0,001	...	...	...
1/31178	43	7260		Mitgliedsbeiträge an Institutionen im Inland		0,648	100	0,648	...	...	...	...	...	...
		7263		*Mitgliedsbeiträge*		...	...	...	0,648	100	0,648	0,694	100	0,694
1/31187	12	7800	062	ESO		4,900	100	4,900	...	...	...	...	...	...
		7805		*ESO*		...	...	...	4,900	100	4,900	3,588	100	3,588
	43	7800	063	Europ. Zentrum für mittelfristige Wettervorhersage		1,000	100	1,000	...	...	...	...	...	...
		7800	064	Molekularbiologie - Europäische Zusammenarbeit		2,100	100	2,100	...	...	...	...	...	...
		7800	065	World Meteorological Organisation		0,507	50	0,254	...	...	...	...	...	...
		7800	242	Beitrag für die CERN		16,893	100	16,893	...	...	...	...	...	...
		7801		*Beitrag für die CERN*		...	...	...	16,893	100	16,893	16,395	100	16,395
		7802		*Molekularbiologie - Europäische Zusammenarbeit*		...	...	...	2,100	100	2,100	2,227	100	2,227
		7803		*World Meteorological Organisation*		...	...	...	0,400	50	0,200	0,360	50	0,180
		7804		*Europäisches Zentrum für mittelfristige Wettervorhersage*		...	...	...	1,000	100	1,000	0,876	100	0,876
1/31188	12	7800	066	Forschungsvorhaben in internationaler Kooperation		3,000	100	3,000	...	...	...	...	...	...
		7800	200	Beiträge an internationale Organisationen		0,800	50	0,400	...	...	...	...	...	...
		7800		*Forschungsvorhaben in internationaler Kooperation*		...	...	...	0,040	100	0,040	0,036	100	0,036
		7803		*Beiträge für interationale Organisationen*		...	...	...	0,800	50	0,400	...	...	...
				Summe Bereich 31...		30,642		29,593	28,138		26,860	25,654		24,736
				BM für Wirtschaft, Jugend und Familie:										
1/40007	43	7800	100	Internationales Büro für Maße und Gewichte (BIPM)		0,132	80	0,106	...	...	...	...	...	...
				Internationale Organisation f.d. gesetzliche Meßwesen (OIML)		0,014	80	0,011	...	...	...	...	...	...
		7800	100	Internationales Institut für Kältetechnik (IIF)		0,010	80	0,008	...	...	...	...	...	...
				Internationale Union für Geodäsie und Geophysik (UGGI)		0,005	80	0,004	...	...	...	...	...	...
		7810		*Internationales Büro für Maße und Gewichte (BIPM)*	*	...	...	...	0,123	80	0,098	0,123	80	0,098
				Internationale Organisation f.d. gesetzliche Meßwesen (OIML)	*	...	...	...	0,013	80	0,010	0,013	80	0,010
				Internationales Institut für Kältetechnik (IIF)	*	...	...	...	0,008	80	0,006	0,008	80	0,006
				Internationale Union für Geodäsie und Geophysik (UGGI)	*	...	...	...	0,004	80	0,003	0,004	80	0,003
				Summe Bereich 40...		0,161		0,129	0,148		0,117	0,148		0,117
				BM für Verkehr, Innovation und Technologie:										
1/34338	12	7800	200	Beiträge an internationale Organisationen		0,060	100	0,060	...	...	...	...	...	...
		7801		*Beiträge für internat. Organisationen*		...	...	...	0,060	100	0,060	0,116	100	0,116
	43	7800	602	OECD-Energieagentur		0,050	100	0,050	...	...	...	...	...	...
		7800		*OECD-Energieagentur (Beitrag zu den Projektkosten)*		...	...	...	0,050	100	0,050	0,000	100	0,000
1/34377	12	7800	600	ESA-Pflichtprogramme		16,439	100	16,439	...	...	...	...	...	...
		7800		*ESA - Beitrag*		...	...	...	15,969	100	15,969	15,399	100	15,399
	43	7800	601	EUMETSAT		0,001	100	0,001	...	...	...	...	...	...
		7800	602	OECD-Energieagentur		0,060	100	0,060	...	...	...	...	...	...
		7801		*EUMETSAT*		...	...	...	0,001	100	0,001	...	...	...
		7802		*OECD-Energieagentur*		...	...	...	0,060	100	0,060	0,068	100	0,068
1/34378	12	7800	601	EUMETSAT		4,367	100	4,367	...	...	...	...	...	...
		7800	603	ESA-Wahlprogramme		40,755	100	40,755	...	...	...	...	...	...
		7802		*ESA-ARIANE V*		...	...	...	0,571	100	0,571	0,878	100	0,878
		7803		*ESA-DRTMArtemis*		...	...	...	0,076	100	0,076	...	...	...
		7806		*ESA-EOPP*		...	...	...	0,165	100	0,165	...	...	...
		7807		*ESA-ENVISAT*		...	...	...	0,750	100	0,750	...	...	...
		7808		*ESA-METOP*		...	...	...	0,001	100	0,001	...	...	...
		7809		*ESA-GSTP*		...	...	...	2,000	100	2,000	1,877	100	1,877
		7810		*ESA-FESTIP*		...	...	...	0,001	100	0,001	...	...	...
		7811		*ESA-MSG*		...	...	...	0,075	100	0,075	...	...	...

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B U N D E S V O R A N S C H L A G 2 0 1 1
Forschungswirksame Ausgaben des Bundes (*)
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a) Beitragszahlungen aus Bundesmitteln an internationale Organisationen, die Forschung und Forschungsförderung (mit) als Ziel haben

VA-Ansatz	AB	VA-Post Nr.	Ugl	Bereich-Ausgaben Bezeichnung	Anm.	Bundesvoranschlag 2011 Insgesamt	hievon %	hievon Forschung	Bundesvoranschlag 2010 Insgesamt	hievon %	hievon Forschung	Erfolg 2009 Insgesamt	hievon %	hievon Forschung
				(Fortsetzung)										
1/34378	12	7812		ESA-ARTES		....	...	....	1,201	100	1,201	4,682	100	4,682
		7813		ESA-EOEP		....	...	....	3,582	100	3,582	3,538	100	3,538
		7815		Neue ESA-Programme		....	...	....	1,542	100	1,542	10,539	100	10,539
		7816		ESA-AURORA		....	...	....	1,000	100	1,000	1,876	100	1,876
		7817		ESA-ELIPS		....	...	....	0,300	100	0,300	0,752	100	0,752
		7818		ESA-Earth Watch GMES		....	...	....	1,169	100	1,169	1,831	100	1,831
		7819		ESA-GalileoSat		....	...	....	6,000	100	6,000	6,585	100	6,585
		7840		EUMETSAT		....	...	....	4,067	100	4,067	1,278	100	1,278
				Summe UG 34...		61,732		61,732	38,640		38,640	49,419		49,419
1/41007	43	7800	200	Europäische Konferenz der Verkehrsminister (CEMT)	*	0,084	6	0,005	....	...	....	....	...	....
				Internationale Zivilluftfahrtorganisation (ICAO)	*	0,426	20	0,085	....	...	....	....	...	....
				Europäische Zivilluftfahrtskonferenz (ECAC)	*	0,038	10	0,004	....	...	....	....	...	....
		7800		Europäische Konferenz der Verkehrsminister (CEMT)	*	....	...	....	0,084	6	0,005	0,084	6	0,005
				Internationale Zivilluftfahrtorganisation (ICAO)	*	....	...	....	0,426	20	0,085	0,379	20	0,076
				Europäische Zivilluftfahrtskonferenz (ECAC)	*	....	...	....	0,038	10	0,004	0,038	10	0,004
1/41008	43	7800		Institution für den Lufttransport (ITA)	*	0,001	40	0,000	0,001	40	0,000	0,001	40	0,000
				Ständige Internat. Vereinigung f.Schiffahrtskongresse(AIPCN)	*	0,002	50	0,001	0,002	50	0,001	0,002	50	0,001
		7800	200	Institution für den Lufttransport (ITA)	*	0,001	40	0,000	....	...	....	....	...	....
				Ständige Internat. Vereinigung f.Schiffahrtskongresse(AIPCN)	*	0,002	50	0,001	....	...	....	....	...	....
1/41027	43	7800	200	Beiträge an internationale Organisationen		0,391	20	0,078	....	...	....	....	...	....
		7800		Beiträge an internationale Organisationen (UIT)		....	...	....	0,391	20	0,078	0,358	20	0,072
1/41248	33	7800	200	Beiträge an internationale Organisationen		0,021	100	0,021	....	...	....	....	...	....
		7800		Beiträge an internationale Organisationen		....	...	....	0,025	100	0,025	....	...	....
				Summe UG 41...		0,966		0,195	0,967		0,198	0,862		0,158
				Summe Bereich 41...		62,698		61,927	39,607		38,838	50,281		49,577
				BM für Land- u.Forstwirtschaft,Umwelt u.Wasserwirtschaft:										
1/42007	43	7800	080	FAO-Beiträge		3,130	50	1,565	....	...	....	....	...	....
		7801		FAO-Beiträge		....	...	....	3,130	50	1,565	2,984	50	1,492
1/42008	43	7800	100	Internationales Weinamt		0,028	50	0,014	....	...	....	....	...	....
				Europäische Vereinigung für Tierproduktion	*	0,014	50	0,007	....	...	....	....	...	....
				Europäische Pflanzenschutzorganisation	*	0,021	50	0,011	....	...	....	....	...	....
				Internationale Kommission für Be- und Entwässerungen	*	0,002	50	0,001	....	...	....	....	...	....
				Internationales Weinamt	*	....	...	....	0,028	50	0,014	0,028	50	0,014
				Europäische Vereinigung für Tierproduktion	*	....	...	....	0,011	50	0,006	0,011	50	0,006
				Europäische Pflanzenschutzorganisation	*	....	...	....	0,020	50	0,010	0,020	50	0,010
				Internationale Kommission für Be- und Entwässerungen	*	....	...	....	0,002	50	0,001	0,002	50	0,001
				Summe UG 42...		3,195		1,598	3,191		1,596	3,045		1,523
1/43007	43	7800	090	ECE-EMEP-Konvention/Grenzüberschr. Luftverunrein.		0,040	100	0,040	....	...	....	....	...	....
		7817		ECE-EMEP-Konvention/Grenzüberschreitende Luftverunreinigung		....	...	....	0,051	100	0,051	0,038	100	0,038
1/43106	21	7800	091	Umweltfonds der Vereinten Nationen		0,400	30	0,120	....	...	....	....	...	....
		7810		Umweltfonds der Vereinten Nationen		....	...	....	0,523	30	0,157	0,400	30	0,120
1/43108	21	7800		RAMSAR - Abkommen	*	0,021	50	0,011	0,021	50	0,011	0,021	50	0,011
				Wetlands Interntional		0,022	50	0,011	0,022	50	0,011	0,022	50	0,011
				Summe UG 43...		0,483		0,182	0,617		0,230	0,481		0,180
				Summe Bereich 42...		3,678		1,780	3,808		1,826	3,526		1,703
				Summe Abschnitt a)...		**111,608**		**97,774**	**84,632**		**71,455**	**91,230**		**79,605**

B U N D E S V O R A N S C H L A G   2 0 1 1
Forschungswirksame Ausgaben des Bundes (*)
(Beträge in Millionen Euro)

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b) Ausgaben des Bundes **(ausgen. die bereits im Abschnitt a) ausgewiesen sind)** für Forschung und Forschungsförderung (Bundesbudget-Forschung)

VA-Ansatz	AB	VA-Post Nr.	Ugl	Bereich-Ausgaben Bezeichnung	Anm.	Bundesvoranschlag 2011 Insgesamt	hievon %	hievon Forschung	Bundesvoranschlag 2010 Insgesamt	hievon %	hievon Forschung	Erfolg 2009 Insgesamt	hievon %	hievon Forschung
				Bundesgesetzgebung:										
1/02106	43	7330	086	Nationalfonds für Opfer des Nationalsozialismus .		3,500	5	0,175	3,500	5	0,175	3,500	5	0,175
				Bundeskanzleramt:										
1/10008	43	7260		Mitgliedsbeiträge an Institutionen im Inland		0,460	50	0,230	0,010	50	0,005	0,006	50	0,003
		7270		Werkleistungen durch Dritte		9,962	4	0,398	....	...	....	....	...	....
		7280	*300*	*Werkverträge, Veranstaltungen, Veröffentl. - Raumplanung*		....	...	....	0,850	15	0,128	0,189	15	0,028
		7285		*Raumordnungskonferenz*		....	...	....	0,450	50	0,225	0,207	50	0,104
1/1010				Staatsarchiv und Archivamt		7,923	2	0,158	7,098	5	0,355	7,057	5	0,353
1/102				Bundesstatistik		50,393	1	0,504	50,393	1	0,504	50,391	1	0,504
				Summe Bereich 10...		68,738		1,290	58,801		1,217	57,850		0,992
				BM für Inneres:										
1/1172	42			Bundeskriminalamt	*	10,055	8	0,804	8,504	8	0,680	9,473	8	0,758
				BM für Justiz:										
1/13006	12	7667	002	Institut für Rechts- und Kriminalsoziologie		0,130	100	0,130	....	...	....	....	...	....
		7667		*Institut für Rechts- und Kriminalsoziologie*		....	...	....	0,130	100	0,130	0,114	100	0,114
				Summe Bereich 13...		0,130		0,130	0,130		0,130	0,114		0,114
				BM für Landesverteidigung und Sport:										
1/14108	41	4691		Versuche und Erprobungen auf kriegstechn. Gebiet		0,245	10	0,025	0,250	10	0,025	0,340	10	0,034
1/144	12			Heeresgeschichtl. Museum, Militärhistorisches Institut		5,923	41	2,428	5,782	41	2,371	4,970	41	2,038
				Summe Bereich 14...		6,168		2,453	6,032		2,396	5,310		2,072
				BM für Finanzen:										
1/15008	43	6430	001	Arbeiten des WIIW		0,966	50	0,483	....	...	....	....	...	....
		6430	002	Arbeiten des WSR		1,230	50	0,615	....	...	....	....	...	....
		6430	003	Arbeiten des Wifo		3,600	50	1,800	....	...	....	....	...	....
		6441		*Arbeiten des Wifo*		....	...	....	3,630	50	1,815	3,490	50	1,745
		6443		*Arbeiten des WIIW*		....	...	....	0,928	50	0,464	0,893	50	0,447
		6444		*Arbeiten des WSR*		....	...	....	1,183	50	0,592	1,135	50	0,568
1/15296	43	7661	002	Institut für Finanzwissenschaft und Steuerrecht .		0,012	50	0,006	....	...	....	....	...	....
		7662	002	Institut für höhere Studien und wiss. Forschung .		1,601	50	0,801	....	...	....	....	...	....
		7663	005	Forum Alpbach		0,051	50	0,026	....	...	....	....	...	....
		7661		*Institut für Finanzwissenschaft und Steuerrecht* .		....	...	....	0,011	50	0,006	....	...	....
		7662		*Institut für höhere Studien und wiss. Forschung* .		....	...	....	1,189	50	0,595	1,193	50	0,597
		7663		*Forum Alpbach*		....	...	....	0,049	50	0,025	0,044	50	0,022
				Summe UG 15...		7,460		3,731	6,990		3,497	6,755		3,379
1/.....				Forschungswirksamer Lohnnebenkostenanteil	*	29,473	100	29,473	29,534	100	29,534	28,666	100	28,666
				Summe Bereich 15...		36,933		33,204	36,524		33,031	35,421		32,045
				BM für Arbeit, Soziales und Konsumentenschutz:										
1/20118	22			Arbeitsmarktpolitische Maßnahmen gemäß AMFG und AMSG		0,250	100	0,250	0,250	100	0,250	....	...	....

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B U N D E S V O R A N S C H L A G 2 0 1 1
Forschungswirksame Ausgaben des Bundes (*)
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				(Fortsetzung)										
1/20118	*12*			*Arbeitsmarktpolitische Maßnahmen gemäß AMFG und AMSG*		...	...	...	0,250	100	0,250	0,102	100	0,102
				Summe UG 20...		0,250		0,250	0,500		0,500	0,102		0,102
1/21006	12	7669	900	Zuschüsse für lfd.Aufwand an private Institutionen		0,001	100	0,001	0,001	100	0,001	0,013	100	0,013
1/21008	43	7261	001	Mitgliedsb. an Forschungsinst. Orthopädie-Technik		0,184	100	0,184	...	...	...	...	...	...
		7262	001	Beitrag Europ. Zentrum Wohlfahrtspol.u.Sozialfor.		0,619	50	0,310	...	...	...	...	...	...
		7270		Werkleistungen durch Dritte		6,510	20	1,302	...	...	...	...	...	...
		7261		*Mitgliedsbeitr. an d.Forschungsinst. f. Orthopädie-Technik*		...	...	...	0,190	100	0,190	0,183	100	0,183
		7262		*Beitrag a.d. Europ. Zentrum f. Wohlfahrtspol. u. Sozialfor.*		...	...	...	0,619	50	0,310	0,618	50	0,309
		7280		*Sonstige Leistungen v. Gewerbetreib., Firmen u. jur. Pers.*		...	...	...	4,951	4	0,198	2,801	4	0,112
	12	*4035*	*900*	*Handelsw. z. unentgeltl. Abgabe gem. § 1 d. VO zu § 32 KOVG*		...	...	...	0,001	100	0,001	...	...	...
		7271	*900*	*Entgelte f. sonst. Leistungen an Einzelpers.IF*		...	...	...	0,001	100	0,001	...	...	...
		7276		*Entgelte f. sonst. Leist. v. Einzelpers./Grundsatzforschung*		...	...	...	0,001	100	0,001	...	...	...
		7281	*900*	*Sonstige Leistungen von Gew.firm. u. jur.Pers.IF*		...	...	...	0,001	100	0,001	0,023	100	0,023
		7286		*S. Leist. v. Gew., Firm. u. jur. Pers./Grundsatzforschung*		...	...	...	1,123	100	1,123	1,185	100	1,185
1/21816	43	7660	900	Zuschüsse f. lfd. Aufwand an private Institutionen		2,247	2	0,045	2,268	2	0,045	2,175	2	0,044
1/21818	43	7270		Werkleistungen durch Dritte		0,987	16	0,158	...	...	...	...	...	...
		7280		*Sonstige Leistungen v. Gewerbetreib., Firmen u. jur. Pers.*		...	...	...	0,736	16	0,118	0,872	16	0,140
1/21828		7270		Werkleistungen durch Dritte		1,004	5	0,050	...	...	...	...	...	...
		7280		*Sonstige Leistungen v. Gewerbetreib., Firmen u. jur. Pers.*		...	...	...	0,945	5	0,047	0,375	5	0,019
				Summe UG 21...		11,552		2,050	10,837		2,036	8,245		2,028
				Summe Bereich 21...		11,802		2,300	11,337		2,536	8,347		2,130
				BM für Gesundheit:										
1/24000				Zentralleitung		0,567	100	0,567	0,567	100	0,567	0,464	100	0,464
1/24107	21	7420	012	Transferzahlungen, Ernährungsagentur (Ges.m.b.H)		32,704	4	1,308	...	...	...	...	...	...
		7420		*Laufende Transferzahlungen, Ernährungsagentur (Ges.m.b.H)*		...	...	...	32,704	4	1,308	32,703	4	1,308
1/24108	21	7270		Werkleistungen durch Dritte		0,999	4	0,040	...	...	...	...	...	...
		7420	012	Transferzahlungen, Ernährungsagentur (Ges.m.b.H)		0,001	100	0,001	...	...	...	...	...	...
		7280	*100*	*Leistungen der AGES/PharmMed*		...	...	...	3,100	4	0,124	2,911	4	0,116
		7420		*Transferzahlungen, Ernährungsagentur (Ges.m.b.H)*		...	...	...	0,001	100	0,001	...	...	...
1/24206	21	7660	900	Zuschüsse f. lfd. Aufwand an private Institutionen		4,709	6	0,283	4,824	6	0,289	4,591	6	0,275
		7663	*900*	*Zuschüsse für lfd.Aufwand an private Institutionen*		...	...	...	0,050	100	0,050	0,150	100	0,150
1/24208	21	7270		Werkleistungen durch Dritte		10,362	2	0,207	0,098	6	0,006	0,053	6	0,003
		7280		*Vorsorgemedizin; Grundlagenermittlung*		...	...	...	3,060	6	0,184	0,564	6	0,034
1/24226	21	7660	900	Zuschüsse f. lfd. Aufwand an private Institutionen		1,956	10	0,196	1,956	10	0,196	1,943	10	0,194
1/24228	21	7270		Suchtgiftmißbrauch; Grundlagenermittlung		0,187	10	0,019	0,010	10	0,001	0,006	10	0,001
		7280		*Sonstige Leistungen v. Gewerbetreib., Firmen u. jur. Pers.*		...	...	...	0,246	10	0,025	0,113	10	0,011
1/24316				*Veterinärwesen*		...	...	...	0,456	1	0,005	0,387	1	0,005
1/24318				Veterinärwesen		5,400	7	0,378	6,035	10	0,604	4,347	6	0,261
1/24328				Lebensmittel- und Chemiekalienkontrolle		0,419	61	0,256	0,419	61	0,256	0,344	61	0,210
1/24336				Gentechnologie		0,005	20	0,001	0,005	20	0,001	0,000	20	0,000
1/24338				Gentechnologie		0,327	70	0,229	0,327	70	0,229	0,296	73	0,216

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Beilage T

Forschungswirksame Ausgaben des Bundes (*)

(Beträge in Millionen Euro)

b) Ausgaben des Bundes **(ausgen. die bereits im Abschnitt a) ausgewiesen sind)** für Forschung und Forschungsförderung (Bundesbudget-Forschung)

VA-Ansatz	AB	VA-Post		Bereich-Ausgaben		Bundesvoranschlag 2011			Bundesvoranschlag 2010			Erfolg 2009		
							hievon			hievon			hievon	
		Nr.	Ugl	Bezeichnung	Anm.	Insgesamt	%	Forschung	Insgesamt	%	Forschung	Insgesamt	%	Forschung
				(Fortsetzung)										
1/24348				Strahlenschutz		0,380	48	0,182	0,380	48	0,182	0,290	68	0,197
				Summe Bereich 24...		58,016		3,667	54,238		4,028	49,162		3,445
				BM für Unterricht, Kunst und Kultur:										
1/3000	43			Zentralleitung (Verwaltungsbereich Bildung)	*	3,898	100	3,898	3,872	100	3,872	3,127	100	3,127
1/30006	43	7669	400	Bildm.d.EU (ESF-3 nat.A) (F&E-Offensivprogramm) .		0,001	100	0,001	0,001	100	0,001	....	...	....
1/3011	13			Kulturangelegenheiten		192,333	16	30,773	....	...	....	....	...	....
1/3013				Kulturangelegenheiten (zweckgeb. Gebarung)		7,107	16	1,137	....	...	....	....	...	....
1/30207	11	7340	003	Basisabgeltung (BIFIE)		13,000	80	10,400	....	...	....	....	...	....
		7340		*Basisabgeltung (BIFIE)*		....	...	....	6,500	80	5,200	6,500	80	5,200
1/30208	11			Allgemein-pädagogische Erfordernisse		27,265	4	1,079	37,530	3	1,079	27,170	4	1,079
1/3080				Technische und gewerbliche Lehranstalten	*	536,727	0	0,073	550,356	0	0,073	541,241	0	0,073
1/3083	11			Technische und gewerbl. Lehranstalten (zweckgeb. Gebarung)	*	8,198	3	0,246	8,198	3	0,246	8,708	3	0,246
1/3090				Pädagogische Hochschulen		146,856	10	14,686	150,067	10	15,007	135,607	10	13,561
1/3095				Pädagogische Hochschulen (zweckgeb. Geb.)		0,308	10	0,031	0,308	10	0,031	1,571	10	0,157
				Summe UG 30...		935,693		62,324	756,832		25,509	723,924		23,443
1/3201				*Kulturangelegenheiten*		....	...	....	192,920	16	30,867	197,005	16	31,521
1/3204	*13*			*Kulturangelegenheiten (zweckgeb. Gebarung)*		....	...	....	7,107	16	1,137	4,346	16	0,695
				Summe UG 32...		....		....	200,027		32,004	201,351		32,216
				Summe Bereich 30...		935,693		62,324	956,859		57,513	925,275		55,659
1/40233	13	0635	457	Wien 1,Burgring 5, Kunsthist.Museum,Gen.San.(BT)		0,001	23	0,000	0,100	23	0,023	....	...	....
		0635	458	Wien 1, Burgring 7, Naturhist.Museum, Gen.San.(BT)		0,001	23	0,000	1,500	23	0,345	0,150	23	0,035
		0635	*464*	*Wien14,Mariahilf.str.212,Techn.Mus,Gen.San.u.Erwe*		....	...	....	0,001	23	0,000	....	...	....
				Summe Bereich 30 einschl. Bauausgaben ...		935,695		62,324	958,460		57,881	925,425		55,694
				BM für Wissenschaft und Forschung:										
1/3100				Zentralleitung		30,470	30	9,141	31,027	30	9,308	31,626	30	9,488
1/31018	12	7024	110	Normmieten		4,479	53	2,374	4,290	53	2,274	4,284	53	2,271
		7024	111	Zuschlagsmieten		0,001	53	0,001	0,001	53	0,001	....	...	....
		7024	112	Mieterinvestitionen		0,080	53	0,042	0,080	53	0,042	....	...	....
		7024	113	Betriebskosten		0,440	53	0,233	0,440	53	0,233	0,412	53	0,218
1/3103				Universitäten; Träger öffentlichen Rechts		2.815,888	46	1.295,308	2.713,088	46	1.248,020	2.521,162	46	1.159,735
1/31038	12	7342	900	Transferzahl.a.Träger öffentl. Rechts (F&E-Mittel)		20,000	100	20,000	43,000	100	43,000	16,382	100	16,382
1/31048	12	7270	000	Werkleistungen durch Dritte		0,815	46	0,375	....	...	....	....	...	....
		7353	440	Klinischer Mehraufwand (Klinikbauten)		50,675	50	25,338	....	...	....	....	...	....
		7480	403	VOEST-Alpine Medizintechnik Ges.m.b.H. (VAMED) ..		2,600	50	1,300	....	...	....	....	...	....
		7280	*000*	*Externe Gutachten und Projekte*		....	...	....	0,815	46	0,375	0,144	46	0,066
		7353	*400*	*Klinischer Mehraufwand (Klinikbauten)*		....	...	....	79,845	50	39,923	32,603	50	16,302
		7480	*423*	*VOEST-Alpine Medizintechnik Ges.m.b.H. (VAMED)* ..		....	...	....	2,600	50	1,300	20,113	50	10,057
1/31108	12	7020		Sonstige Miet- und Pachtzinse		1,134	60	0,680	....	...	....	....	...	....
		7270	900	Werkleistungen durch Dritte		12,555	22	2,762	....	...	....	....	...	....
		7686	007	Vortragstätigkeit im Ausland		2,200	60	1,320	....	...	....	....	...	....
		7020	*001*	*Institut für angewandte Systemanalyse*		....	...	....	0,778	100	0,778	0,723	100	0,723
		7271	*001*	*Fulbright-Kommission*		....	...	....	0,560	60	0,336	0,254	60	0,152
		7279	*013*	*fForte Universitäten*		....	...	....	0,017	100	0,017	....	...	....
		7280	*013*	*fForte Universitäten*		....	...	....	2,400	100	2,400	1,956	100	1,956
		7330	*052*	*Hertha Firnberg Programm*		....	...	....	1,425	100	1,425	....	...	....
		7684		*Studientätigkeit im Ausland*		....	...	....	1,001	60	0,601	1,761	60	1,057
		7686		*Vortragstätigkeit im Ausland*		....	...	....	2,200	60	1,320	1,533	60	0,920
		7689		*EU-Bildungsprogramme*		....	...	....	2,000	60	1,200	2,586	60	1,552
1/3111				Wissenschaftliche Einrichtungen		2,326	30	0,698	4,861	30	1,458	4,757	30	1,427
1/31126	12			Bibliothekarische Einrichtungen		0,081	30	0,024	0,162	30	0,049	0,165	30	0,050
1/3113				Forschungsvorhaben		1,050	100	1,050	5,520	100	5,520	2,945	100	2,945
1/31146	12			Wissenschaftliche Forschung		121,930	100	121,930	102,480	100	102,480	102,305	100	102,305

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B U N D E S V O R A N S C H L A G 2 0 1 1
Forschungswirksame Ausgaben des Bundes (*)
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b) Ausgaben des Bundes **(ausgen. die bereits im Abschnitt a) ausgewiesen sind)** für Forschung und Forschungsförderung (Bundesbudget-Forschung)

VA-Ansatz	AB	VA-Post Nr.	VA-Post Ugl	Bereich-Ausgaben Bezeichnung	Anm.	Bundesvoranschlag 2011 Insgesamt	hievon %	hievon Forschung	Bundesvoranschlag 2010 Insgesamt	hievon %	hievon Forschung	Erfolg 2009 Insgesamt	hievon %	hievon Forschung
				(Fortsetzung)										
1/31148	12	7332	352	Fonds zur Förd. der wissenschaftlichen Forschung		9,000	100	9,000	....	...	....	8,300	100	8,300
		7332	*252*	*Excellenz Wissenschaft*		....	...	....	19,750	100	19,750	....	...	....
1/3116	12			Forschungseinrichtungen		49,300	100	49,300	51,001	100	51,001	43,992	100	43,992
1/3117	12			Österr. Akademie der Wissenschaften und Forschungsinstitute		80,871	100	80,871	80,871	100	80,871	79,905	100	79,905
1/31186	12			Forschungsvorhaben in internationaler Kooperation		3,539	100	3,539	11,092	100	11,092	5,429	100	5,429
1/31188	12	7260		Mitgliedsbeiträge an Institutionen im Inland		0,001	100	0,001	0,001	100	0,001	....	...	....
		7270		Werkleistungen durch Dritte		1,201	100	1,201	....	...	....	....	...	....
		7270	031	Med Austron		15,000	100	15,000	....	...	....	....	...	....
		7271		*IIASA-Stipendien*		....	...	....	0,004	100	0,004	0,005	100	0,005
		7274		*Verpflichtungen aus WTZA*		....	...	....	0,400	100	0,400	0,560	100	0,560
		7275		*Stimulierung bilat. Wiss.beziehungen (EP)*		....	...	....	0,001	100	0,001	....	...	....
		7279		*Entgelte für sonstige Leistungen von Einzelpersonen*		....	...	....	0,500	100	0,500	0,339	100	0,339
		7280	*001*	*Leistungen v. Gewerbetreibenden, Firmen und jur. Personen*		....	...	....	23,172	100	23,172	23,341	100	23,341
		7280	*002*	*Entgelte an universitäre Einrichtungen*		....	...	....	0,300	100	0,300	2,071	100	2,071
		7280	*003*	*Med Austron*		....	...	....	12,498	100	12,498	0,065	100	0,065
		7281		*Internationale Forschungskooperation*		....	...	....	0,200	100	0,200	0,087	100	0,087
		7282		*Vorträge, Seminare, Tagungen (Unt.)*		....	...	....	0,500	100	0,500	0,166	100	0,166
		7284		*Sonst. Leist. v. Gew., Firmen u. jur.Pers.(Inter)*		....	...	....	0,001	100	0,001	....	...	....
		7285		*Stimulierung bilat. Wiss.beziehungen (Unt.)*		....	...	....	0,050	100	0,050	....	...	....
		7665		*Stiftung Dokumentationsarchiv*		....	...	....	0,167	100	0,167	....	...	....
		7681		*START-Wittgenstein-Programme*		....	...	....	9,200	100	9,200	4,620	100	4,620
1/3123				Bibliotheken		2,122	53	1,125	2,096	53	1,111	2,103	53	1,115
1/3124				Wissenschaftliche Anstalten		34,481	53	18,275	34,113	53	18,080	31,747	53	16,826
1/3125				Wissenschaftliche Anstalten (zweckgebundene Gebarung)		0,028	53	0,015	0,028	53	0,015	0,003	53	0,002
1/31606	12			Fachhochschulen, Förderungen		234,433	13	30,476	215,058	13	27,958	189,475	13	24,632
				Summe Bereich 31...		3.496,700		1.691,379	3.459,593		1.718,932	3.137,919		1.539,061
				BM für Wirtschaft, Jugend und Familie:										
1/25118	22	7270		Werkleistungen durch Dritte		0,997	20	0,199	....	...	....	....	...	....
		7270	*002*	*Entgelte für Leistungen von Einzelpersonen*		....	...	....	0,074	20	0,015	0,031	20	0,006
		7280	*002*	*Entgelte an Unternehmungen und jur. Personen*		....	...	....	0,923	10	0,092	1,194	10	0,119
1/25386	22	7664	007	Forschungsförderung gem. § 39i FLAG 1967		0,250	100	0,250	....	...	....	....	...	....
		7664		*Forschungsförderung gem. § 39i FLAG 1967*		....	...	....	0,250	100	0,250	0,076	100	0,076
1/25387	22	7420	013	Familie und Beruf Management GesmbH.		2,140	33	0,706	....	...	....	....	...	....
		7420		*Familie und Beruf Management GesmbH.*		....	...	....	2,140	33	0,706	2,140	33	0,706
1/25388	22	7270		Werkleistungen durch Dritte		1,016	39	0,396	0,145	39	0,057	0,038	39	0,015
		7280		*Entgelte an Unternehmungen und jur. Personen*		....	...	....	0,871	39	0,340	0,663	39	0,259
1/25418	11	7270		Werkleistungen durch Dritte		1,473	10	0,147	0,313	10	0,031	0,129	10	0,013
		7280		*Sonstige Leistungen v. Gewerbetreib., Firmen u. jur. Pers.*		....	...	....	1,190	5	0,060	0,886	5	0,044
				Summe UG 25...		5,876		1,698	5,906		1,551	5,157		1,238
1/3317				Technologie- und Forschungsförderung		96,900	100	96,900	104,600	100	104,600	76,424	100	76,424
1/4009				Bundesamt für Eich- und Vermessungswesen	*	81,782	0	0,200	84,971	0	0,200	80,947	0	0,200
1/40156	36	7660	900	Zuschüsse f. lfd. Aufwand an private Institutionen		1,086	10	0,109	1,576	10	0,158	3,208	10	0,321
1/40158	36	7270		Werkleistungen durch Dritte		7,279	50	3,640	0,230	50	0,115	0,085	50	0,043
		7280	*100*	*Werkleistungen von gewerbl. Betrieben, Firmen u. jur. Pers.*		....	...	....	5,598	50	2,799	3,396	50	1,698
		7282		*Werkleistungen von Betrieben, Firmen u. jur. Pers. (TV)*		....	...	....	0,050	100	0,050	0,007	100	0,007
1/4016				Klima- und Energiefonds		0,001	33	0,000	0,001	33	0,000	11,040	33	3,643
				Summe UG 40...		90,148		3,949	92,426		3,322	98,683		5,912
				Summe Bereich 40...		192,924		102,547	202,932		109,473	180,264		83,574

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Forschungswirksame Ausgaben des Bundes (*)
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VA-Ansatz	AB	VA-Post Nr.	Ugl	Bereich-Ausgaben Bezeichnung	Anm.	Bundesvoranschlag 2011 Insgesamt	hievon %	hievon Forschung	Bundesvoranschlag 2010 Insgesamt	hievon %	hievon Forschung	Erfolg 2009 Insgesamt	hievon %	hievon Forschung
				BM für Verkehr, Innovation und Technologie:										
1/34133	12	0806	122	Forschungsförderungs GmbH		0,001	100	0,001	0,001	100	0,001	...	...	...
		0806	123	Austria Wirtschaftsservice GmbH		0,001	100	0,001	0,001	100	0,001	...	...	...
1/34338	12	4000		Geringwertige Wirtschaftsgüter		0,001	100	0,001	0,001	100	0,001	...	...	...
		4110		Handelswaren zur unentgeltlichen Abgabe		0,080	100	0,080	...	...	...	...	...	...
		4570		Druckwerke		0,006	100	0,006	0,006	100	0,006	0,013	100	0,013
		5710		Freie Dienstverträge Z		0,001	100	0,001	0,001	100	0,001	...	...	...
		5710	830	DGB/Freie Dienstverträge Z		0,001	100	0,001	0,001	100	0,001	...	...	...
		5710	870	DGB - Mitarbeitervorsorgek. (Fr. Dienstverträge) Z		0,001	100	0,001	0,001	100	0,001	...	...	...
		6210		Sonstige Transporte		0,002	100	0,002	0,002	100	0,002	...	...	...
		6300		Leistungen der Post		0,001	100	0,001	0,001	100	0,001	...	...	...
		7020		Sonstige Miet- und Pachtzinse		0,034	100	0,034	0,035	100	0,035	0,037	100	0,037
		7232		Repräsentationsausgaben		0,020	100	0,020	0,020	100	0,020	...	...	...
		7260		Mitgliedsbeiträge an Institutionen im Inland		0,020	100	0,020	0,020	100	0,020	0,011	100	0,011
		7270		Werkleistungen durch Dritte		5,791	100	5,791	...	...	...	...	...	...
		7273		Rat für Forschung und Technologieentwicklung		1,712	100	1,712	...	...	...	...	...	...
		7420	016	Lfd. Transferzahlungen a. Untern. m. Bundesbet.		0,001	100	0,001	...	...	...	...	...	...
		4035		*Handelswaren zur unentgeltlichen Abgabe*		...	...	...	0,001	100	0,001	...	...	...
		4036		*Handelswaren zur unentgeltlichen Abgabe (Druckwerke)*		...	...	...	0,080	100	0,080	0,084	100	0,084
		7272		*Vorträge, Seminare und Tagungen (Einzelpersonen)*		...	...	...	0,001	100	0,001	...	...	...
		7279		*Entgelte für sonstige Leistungen von Einzelpersonen*		...	...	...	0,050	100	0,050	0,087	100	0,087
		7279	*001*	*Technologieschwerpunkte (Einzelpersonen)*		...	...	...	0,010	100	0,010	...	...	...
		7279	*002*	*Forschungsschwerpunkte (Einzelpersonen)*		...	...	...	0,080	100	0,080	...	...	...
		7280		*Sonstige Leistungen v. Gewerbetreib., Firmen u. jur. Pers.*		...	...	...	3,857	100	3,857	4,167	100	4,167
		7280	*001*	*Technologieschwerpunkte (Unternehmungen)*		...	...	...	0,783	100	0,783	0,148	100	0,148
		7280	*002*	*Forschungsschwerpunkte (Unternehmungen)*		...	...	...	0,740	100	0,740	0,214	100	0,214
		7280	*003*	*Entgelte an universitäre Einrichtungen*		...	...	...	0,050	100	0,050	0,087	100	0,087
		7282		*Vorträge, Seminare und Tagungen (Unternehmungen)*		...	...	...	0,020	100	0,020	0,001	100	0,001
		7283		*Rat für Forschung und Technologieentwicklung*		...	...	...	1,712	100	1,712	1,856	100	1,856
		7420		*Lauf. Transferzahl. an Untern. m.Bundesbet. (Technologiemill)*		...	...	...	0,200	100	0,200	...	...	...
	43	*7280*	*004*	*Umweltprojekt Donaubecken*		...	...	...	0,001	100	0,001	...	...	...
1/34346	12	7330	661	ERP-Fonds (F&E-Offensive)		0,054	100	0,054	0,554	100	0,554	...	...	...
		7420	900	Zahlungen an Untern. m. Bundesbet. (F&E-Offensive)		0,150	100	0,150	0,150	100	0,150	0,431	100	0,431
		7430	900	Forschung und Entwicklung (F&E-Offensive)		0,992	100	0,992	0,992	100	0,992	...	...	...
		7432	900	Lfd.Transfz.a.d.übr.Sektoren d. Wirtsch. (F&E Off.)		2,654	100	2,654	1,150	100	1,150	0,895	100	0,895
		7680	900	Sonst.Zuw. ohne Gegenleistung an physische Pers.		0,150	100	0,150	0,150	100	0,150	0,196	100	0,196
		7420	*000*	*Lauf. Transferzahl. an Untern. m.Bundesbet. (Technologiemill)*		...	...	...	0,001	100	0,001	...	...	...
		7430	*000*	*Lauf. Transferz.a.d.übrigen Sektoren d.Wirtsch.(Tech.mill.)*		...	...	...	0,001	100	0,001	...	...	...
		7431		*Fachhochschulen-Kooperationen (Technologiemilliarde)*		...	...	...	0,001	100	0,001	...	...	...
		7670		*Verein zur Förderung der wiss. Forschung (Technologiemill.)*		...	...	...	0,001	100	0,001	...	...	...
1/34348	12	7280	900	Werkleistungen (durch Dritte)(F&E Offensive)		4,100	100	4,100	4,000	100	4,000	3,955	100	3,955
		7330	661	ERP-Fonds (F&E-Offensive)		0,001	100	0,001	0,001	100	0,001	...	...	...
		7420	900	Zahlungen an Untern. m. Bundesbet. (F&E-Offensive)		2,898	100	2,898	2,895	100	2,895	...	...	...
		7430	900	Forschung und Entwicklung (F&E-Offensive)		0,001	100	0,001	0,001	100	0,001	...	...	...
		7279	*900*	*Rat f. Forsch. u. Technologieentw.(F&E-Offensive)*		...	...	...	0,100	100	0,100	0,122	100	0,122
		7280	*001*	*Sonst. Leist. v. Gewerbetreib.u.jur.Pers. (Technologiemill.)*		...	...	...	0,001	100	0,001	0,021	100	0,021
		7283	*900*	*Rat f. Forschung u. Technologieentw. (F&E-Offensive)*		...	...	...	0,001	100	0,001	...	...	...
		7480		*Impulsprogramme (Technologiemilliarde)*		...	...	...	0,001	100	0,001	...	...	...
1/34376	12	7480	001	Forschungsschwerpunkte (Unternehmungen)		2,700	100	2,700	2,861	100	2,861	0,144	100	0,144
		7480	002	Technologieschwerpunkte (Unternehmungen)		5,658	100	5,658	...	...	...	...	...	...
		7480		*Technologieschwerpunkte (Unternehmungen)*		...	...	...	6,239	100	6,239	4,327	100	4,327
1/34378	12	7270		Werkleistungen durch Dritte		0,382	100	0,382	...	...	...	...	...	...
		7279	*000*	*Technologieschwerpunkte (Einzelpersonen)*		...	...	...	0,001	100	0,001	...	...	...
		7279	*001*	*Forschungsschwerpunkte (Einzelpersonen)*		...	...	...	0,001	100	0,001	...	...	...
		7280		*Technologieschwerpunkte (Unternehmungen)*		...	...	...	0,594	100	0,594	0,306	100	0,306

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B U N D E S V O R A N S C H L A G   2 0 1 1
Forschungswirksame Ausgaben des Bundes (*)
(Beträge in Millionen Euro)

b) Ausgaben des Bundes **(ausgen. die bereits im Abschnitt a) ausgewiesen sind)** für Forschung und Forschungsförderung (Bundesbudget-Forschung)

VA-Ansatz	AB	VA-Post Nr.	Ugl	Bereich-Ausgaben Bezeichnung Anm.	Bundesvoranschlag 2011 Insgesamt	hievon %	hievon Forschung	Bundesvoranschlag 2010 Insgesamt	hievon %	hievon Forschung	Erfolg 2009 Insgesamt	hievon %	hievon Forschung
				(Fortsetzung)									
1/34378	*12*	*7280*	*001*	*Forschungsschwerpunkte (Unternehmungen)*	...	...	...	0,086	100	0,086	...	...	...
1/34416	12	7425	010	AWS	0,001	100	0,001	...	...	...	...	...	...
		7425	012	AWS - Programmabwicklung	0,001	100	0,001	...	...	...	...	...	...
		7425		*AWS*	...	...	...	0,001	100	0,001	...	...	...
		7425	*002*	*AWS - Programmabwicklung*	...	...	...	0,001	100	0,001	...	...	...
1/34418	12	7425	010	AWS	0,001	100	0,001	...	...	...	...	...	...
		7425	011	AWS - Administrative Kosten	0,001	100	0,001	...	...	...	...	...	...
		7425	012	AWS - Programmabwicklung	0,001	100	0,001	...	...	...	...	...	...
		7425		*AWS*	...	...	...	0,001	100	0,001	...	...	...
		7425	*001*	*AWS - Administrative Kosten*	...	...	...	0,001	100	0,001	...	...	...
		7425	*002*	*AWS - Programmabwicklung*	...	...	...	0,001	100	0,001	...	...	...
1/3442	12			Technologie- u. Forschungsförderung (wissenschaftl.)/FWF	9,200	100	9,200	7,708	100	7,708	7,193	100	7,193
1/34456	12	7422	004	AIT-Austrian Institute of Technology	0,001	100	0,001	...	...	...	...	...	...
		7426		*AIT-Austrian Institute of Technology*	...	...	...	45,852	90	41,267	...	...	...
		7426	*001*	*ARC - Forschungsprogramme*	...	...	...	0,001	100	0,001	...	...	...
		7426	*002*	*ARC - Technologietransfer*	...	...	...	0,001	100	0,001	...	...	...
		7476		*ARC - Investitionskostenzuschuss*	...	...	...	3,225	85	2,741	...	...	...
		7686		*ARC - Humanressourcen-Programm*	...	...	...	0,001	100	0,001	...	...	...
1/34458	12	7420	016	Lfd.Transferzahl.a.Untern.m.Bundesbet. (Techn.mill)	0,001	100	0,001	...	...	...	...	...	...
		7422	004	AIT-Austrian Institute of Technology	46,658	90	41,992	...	...	...	...	...	...
		7422	005	Nukleare Dienste (NES)	7,729	30	2,319	...	...	...	...	...	...
		7420		*Lauf. Transferzahl. an Untern. m.Bundesbet. (Technologiemill)*	...	...	...	0,001	95	0,001	...	...	...
		7421		*Nukleare Dienste (NES)*	...	...	...	7,459	79	5,893	8,010	79	6,328
		7422	*000*	*AIT - laufende Transferzahlungen*	...	...	...	0,000	90	0,000	48,079	90	43,271
1/34486	12	7425	020	Forschungsförderungs GmbH	0,001	100	0,001	...	...	...	...	...	...
		7425	900	FFG - Programmabwicklung (F&E)	96,999	100	96,999	97,839	100	97,839	81,556	100	81,556
		7425	*000*	*Forschungsförderungs GmbH*	...	...	...	0,001	100	0,001	...	...	...
1/34488	12	7425	020	Forschungsförderungs GmbH	83,000	100	83,000	...	...	...	...	...	...
		7425	021	Leistungen der FFG (F&E)	0,001	100	0,001	...	...	...	...	...	...
		7425	022	FFG - Administrative Kosten	12,400	100	12,400	...	...	...	...	...	...
		7425	900	FFG - Programmabwicklung (F&E)	19,020	100	19,020	46,949	100	46,949	16,489	100	16,489
		7280	*005*	*Sonstige Leistungen der FFG*	...	...	...	0,653	80	0,522	1,799	80	1,439
		7425		*Leistungen des Bundes an die FFG*	...	...	...	58,310	100	58,310	85,018	100	85,018
		7425	*001*	*Leistungen der FFG (F&E)*	...	...	...	0,001	100	0,001	...	...	...
		7425	*002*	*FFG - Administrative Kosten*	...	...	...	11,600	85	9,860	10,106	85	8,590
1/3449				Sontige Forschungsunternehmen	6,436	100	6,436	6,436	100	6,436	4,626	100	4,626
				Summe UG 34...	308,864		298,788	313,499		304,993	279,978		271,612
1/41118	33	7270		Werkleistungen durch Dritte	1,557	100	1,557	...	...	...	...	...	...
		7270	116	Spezifische Luftfahrtangelegenheiten	0,150	100	0,150	...	...	...	...	...	...
		7270	117	Wasserstrassenspezifische Angelegenheiten	0,127	100	0,127	...	...	...	...	...	...
		7270	118	Eisenbahnspezifische Angelegenheiten	0,671	100	0,671	...	...	...	...	...	...
		7270	800	Elektromobilität	0,070	100	0,070	...	...	...	...	...	...
		7280	*300*	*Sonstige Verkehrsprojekte*	...	...	...	1,462	100	1,462	0,654	100	0,654
		7280	*301*	*Generalverkehrsplan*	...	...	...	0,012	20	0,002	...	...	...
		7280	*500*	*Grundlagenuntersuchungen - Schiene*	...	...	...	0,002	100	0,002	0,017	100	0,017
		7280	*502*	*Sonstige Leistungen am Eisenbahnsektor*	...	...	...	0,690	35	0,242	0,299	35	0,105
	12	*7280*	*600*	*Unfallforschung*	...	...	...	0,001	100	0,001	...	...	...
1/41246	12	7660		Zuschüsse f. lfd. Aufwand an private Institutionen	0,100	95	0,095	0,260	95	0,247	0,086	95	0,082
	33	7480	501	Progr.Kombinierter Güterverk.Straße-Schiene-Schiff	2,926	50	1,463	2,672	50	1,336	2,464	50	1,232
1/41248	33	7270		Werkleistungen durch Dritte	0,170	80	0,136	...	...	...	...	...	...
		7279		*Entgelte für sonstige Leistungen von Einzelpersonen*	...	...	...	0,092	80	0,074	...	...	...
		7280		*Sonstige Leistungen v. Gewerbetreib., Firmen u. jur. Pers.*	...	...	...	0,080	80	0,064	0,091	80	0,073
1/41256	12	7489	002	Breitbandinitiative	0,001	50	0,001	...	...	...	...	...	...
		7660		Zuschüsse f. lfd. Aufwand an private Institutionen	0,398	95	0,378	0,266	95	0,253	0,270	95	0,257
		7489		*Breitbandinitiative*	...	...	...	0,001	50	0,001	5,249	50	2,625
	36	7420	020	Kärnt. Betriebsansied.- u. Beteiligungs GmbH BABEG	0,001	50	0,001	...	...	...	...	...	...
		7480	810	IWP Gmünd/Ceske Velenice (sonst.Anlagen)	0,150	80	0,120	...	...	...	...	...	...

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B U N D E S V O R A N S C H L A G 2 0 1 1
Forschungswirksame Ausgaben des Bundes (*)
(Beträge in Millionen Euro)

b) Ausgaben des Bundes **(ausgen. die bereits im Abschnitt a) ausgewiesen sind)** für Forschung und Forschungsförderung (Bundesbudget-Forschung)

VA-Ansatz	AB	VA-Post Nr.	Ugl	Bereich-Ausgaben Bezeichnung	Anm.	Bundesvoranschlag 2011 Insgesamt	hievon %	hievon Forschung	Bundesvoranschlag 2010 Insgesamt	hievon %	hievon Forschung	Erfolg 2009 Insgesamt	hievon %	hievon Forschung
				(Fortsetzung)										
1/41256	36	7420		Kärntner Betriebsansiedlungs- u. Beteiligungs GmbH BABEG		...	...	...	0,001	50	0,001	...	...	...
		7480	800	IWP Gmünd/Ceske Velenice (sonst.Anlagen)		...	...	...	0,300	80	0,240	0,029	80	0,023
1/41258	12	7270		Werkleistungen durch Dritte		0,295	80	0,236	...	...	...	...	...	...
		7270	006	Sonstige Leistungen für IKT (Einzelpersonen)		...	...	...	0,030	80	0,024	...	...	...
		7280	006	Sonstige Leistungen für IKT (jur. Personen)		...	...	...	0,068	80	0,054	0,059	80	0,047
		7489		Breitbandinitiative (admin. Aufwand)		...	...	...	0,001	50	0,001	...	...	...
	36	5710	000	Freie Dienstverträge Z		0,001	80	0,001	0,001	80	0,001	...	...	...
		5710	830	DGB/Freie Dienstverträge Z		0,001	80	0,001	0,001	80	0,001	...	...	...
		7420		Lfd. Transfers an Unternehm. m. Bundesbeteiligung		0,146	80	0,117	0,064	80	0,051	0,000	80	0,000
		7489	001	Breitbandinitiative (admin. Aufwand)		0,001	50	0,001	0,001	50	0,001	...	...	...
		7279		Werkverträge, Studien, Untersuchungen (Einzelpersonen)		...	...	...	0,001	80	0,001	...	...	...
		7280		Werkverträge, Studien, Untersuchungen (jur. Personen)		...	...	...	0,292	80	0,234	0,156	80	0,125
1/4127				Klima- und Energiefonds		72,776	39	28,383	75,000	33	24,750	34,017	33	11,226
1/4167	12			Straßenforschung		0,005	100	0,005	0,005	100	0,005	0,696	100	0,696
1/41708	32	7270		Werkleistungen durch Dritte		0,914	5	0,046	...	...	...	...	...	...
		7280		Sonstige Leistungen v. Gewerbetreib., Firmen u. jur. Pers.		...	...	...	0,960	5	0,048	2,719	5	0,136
				Summe UG 41...		80,460		33,559	82,263		29,096	46,806		17,298
				Summe Bereich 41...		389,324		332,347	395,762		334,089	326,784		288,910
				BM für Land- u.Forstwirtschaft,Umwelt u.Wasserwirtschaft:										
1/42000	43			Zentralleitung		0,616	100	0,616	0,616	100	0,616	0,636	100	0,636
1/42027		7420	012	Transferzahlungen, Ernährungsagentur (Ges.m.b.H)		21,802	4	0,872	...	...	...	...	...	...
		7422	003	Transfer a.d.Bundesforsch.u.Ausbildungsz. für Wald		15,500	62	9,610	...	...	...	...	...	...
		7421		Transfer an die Ernährungsagentur GmbH		...	...	...	21,802	4	0,872	21,802	4	0,872
		7422		Transfer a.d.Bundesforsch.u.Ausbildungsz. für Wald		...	...	...	15,500	62	9,610	15,500	62	9,610
1/42028		7420	012	Transferzahlungen, Ernährungsagentur (Ges.m.b.H)		0,001	4	0,000	...	...	...	...	...	...
		7420		Laufende Transferz.a.d. österr. Ernährungsagentur GmbH		...	...	...	0,001	4	0,000	2,880	4	0,115
1/42038		7270		Werkleistungen durch Dritte		4,325	30	1,298	...	...	...	...	...	...
	34	7280	035	Wasserw.Planungen u.Untersuchungen, Entg.an Unternehm.		...	...	...	0,644	30	0,193	0,897	30	0,269
		7280	039	Wasserw.Grundsatzkonzepte, Entg. an Unternehmungen		...	...	...	0,020	30	0,006	...	...	...
		7280	040	Wasserw. Unterlagen; Entgelte an Unternehmungen		...	...	...	0,100	30	0,030	0,028	30	0,008
		7280	900	Agrarische Maßnahmen		...	...	...	4,781	24	1,147	5,516	21	1,147
1/42056	34	7660		Zuschüsse f. lfd. Aufwand an private Institutionen		0,030	50	0,015	...	...	...	...	...	...
		7660	009	Sonstige Ausgaben, Institut.		...	...	...	0,030	50	0,015	0,051	50	0,026
1/42176	12			Forschungs- und Versuchswesen		0,064	100	0,064	0,064	100	0,064	0,020	100	0,020
1/42178	12			Forschungs- und Versuchswesen		2,489	100	2,489	2,489	100	2,489	4,386	100	4,386
1/4250	11			HBLA und Bundesamt für Wein- und Obstbau	*	8,142	46	3,745	8,403	46	3,865	8,403	46	3,865
				HBLA für Gartenbau	*	5,898	10	0,590	7,023	10	0,702	7,023	10	0,702
				Höhere Bundeslehr- u. Forschungsanstalt für Landwirtschaft		15,147	50	7,574	14,327	50	7,164	14,327	50	7,164
				Höh.Bundeslehr-u. Forschungsanst.f. Landw., Landt.u.Lebensm.		14,379	25	3,595	13,369	25	3,342	13,369	25	3,342
1/4254	12			Bundesanstalt für Agrarwirtschaft		1,641	60	0,985	1,823	60	1,094	1,766	60	1,060
1/4255				Bundesanstalt für alpenländische Milchwirtschaft		3,106	1	0,031	3,106	1	0,031	3,527	1	0,035
1/4256	12			Bundesanstalt für Bergbauernfragen		0,936	55	0,515	1,040	55	0,572	1,020	55	0,561
1/4257				Bundesamt für Weinbau		3,508	14	0,491	3,820	14	0,535	4,243	14	0,594
1/4258	12			Bundesamt für Wasserwirtschaft		5,101	22	1,122	5,278	22	1,161	5,931	22	1,305
1/4261				Hochschule für Agrar- und Umweltpädagogik		2,767	3	0,083	2,554	3	0,077	2,793	3	0,084
1/42726	34	7700	001	Erheb.,Projekt.u.Betr.in Wäldern m.Schutz.,Invest.		0,001	10	0,000	0,010	10	0,001	...	...	...
		7700	004	Forstl. Maßnahmen, Egata/Vergaltschlawine, Invest.		0,001	10	0,000	0,001	10	0,000	...	...	...
1/42728	34	7270		Werkleistungen durch Dritte		3,498	30	1,049	0,081	30	0,024	0,018	30	0,005

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(Beträge in Millionen Euro)

b) Ausgaben des Bundes **(ausgen. die bereits im Abschnitt a) ausgewiesen sind)** für Forschung und Forschungsförderung (Bundesbudget-Forschung)

VA-Ansatz	AB	VA-Post Nr.	Ugl	Bereich-Ausgaben Bezeichnung	Anm.	Bundesvoranschlag 2011 Insgesamt	hievon %	hievon Forschung	Bundesvoranschlag 2010 Insgesamt	hievon %	hievon Forschung	Erfolg 2009 Insgesamt	hievon %	hievon Forschung
				(Fortsetzung)										
1/42728	*34*	*7280*		*Entgelte für sonstige Leistungen von Unternehmungen*		...	...	...	3,403	30	1,021	3,164	30	0,949
				Summe UG 42...		108,952		34,744	110,285		34,631	117,300		36,755
1/43007	21	7420	021	Transferzahlungen an die UBA Ges.m.b.H		15,356	5	0,768	...	...	...	...	...	...
		7420		*Transferzahlungen an die UBA Ges.m.b.H*		...	...	...	15,356	5	0,768	15,356	5	0,768
1/4310	21			Umweltpolitische Maßnahmen		24,867	25	6,217	28,766	25	7,192	32,425	25	8,106
1/43126	21	7700	500	Investitionszuschüsse		17,271	1	0,228	24,388	1	0,228	31,942	1	0,228
1/43136	37	7700	251	Investitionsförderungen		338,060	1	3,381	...	...	...	...	...	...
		7700	*201*	*Investitionsförderungen*		...	...	...	348,700	1	3,487	313,000	1	3,130
1/43138	*37*	*7280*	*000*	*Entgelte an Unternehmungen (Maßnahmen gem. UFG)*		...	...	...	0,230	100	0,230	...	...	...
1/43146	37	7700	500	Investitionszuschüsse		82,721	1	0,827	86,926	1	0,869	83,804	1	0,838
1/43158	21			Strahlenschutz		15,552	8	1,244	11,853	8	0,948	8,482	8	0,679
1/4317				Klima- und Energiefonds		75,001	39	29,250	75,001	33	24,750	31,266	33	10,318
1/4319				Forschungs- und Versuchsvorhaben		1,001	100	1,001	0,501	100	0,501	0,390	100	0,390
				Summe UG 43...		569,829		42,916	591,721		38,973	516,665		24,457
				Summe Bereich 42...		678,781		77,660	702,006		73,604	633,965		61,212
				Summe Abschnitt b)...		**5.888,766**		**2.310,280**	**5.897,819**		**2.338,172**	**5.373,534**		**2.070,182**
				Gesamtsumme...		**6.000,374**		**2.408,054**	**5.982,451**		**2.409,627**	**5.464,764**		**2.149,787**

Beilage T/Anhang

B U N D E S V O R A N S C H L A G 2 0 1 1
Forschungswirksame Ausgaben des Bundes (*)

Anmerkungen zur Beilage T

*) F & E Koeffizienten geschätzt

Die Beilage T ist aufgegliedert nach:
a) Beitragszahlungen aus Bundesmitteln an internationale Organisationen, die Forschung und Forschungsförderung (mit) als Ziel haben,
b) sonstigen Ausgaben des Bundes für Forschung und Forschungsförderung (Bundesbudget-Forschung)

Für die Aufstellung dieser Ausgaben ist in erster Linie der Gesichtspunkt der Forschungswirksamkeit maßgebend, der inhaltlich über den Aufgabenbereich 12 'Forschung und Wissenschaft' hinausgeht und auf dem Forschungsbegriff des Frascati-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 12 'Forschung und Wissenschaft', sondern auch in zahlreichen anderen Aufgabenbereichen (z. B. 11/Erziehung und Unterricht, 13/Kunst, 34/Land und Forstwirtschaft, 36/Industrie und Gewerbe, 43/Übrige Hoheitsverwaltung), bei denen die Zielsetzungen des betreffenden Aufgabenbereiches im Vordergrund stehen.

VA-Ansatz	AB	VA-Post Nr.	Ugl	A n m e r k u n g
1/1172	42			Forschungsanteil: Pauschalbetrag
1/3000	43			Forschungsanteil: Pauschalbetrag
1/3080				Forschungsanteil: Pauschalbetrag.
1/3083	11			Forschungsanteil: Pauschalbetrag
1/4009				Forschungsanteil: Pauschalbetrag.
1/41007	43	7800		Teilbetrag der VA-Post.
		7800	200	Teilbetrag des VA-Kontos. Teilbetrag des VA-Kontos. Teilbetrag des VA-Kontos.
1/41008	43	7800		Teilbetrag der VA-Post.
		7800	200	Teilbetrag des VA-Kontos. Teilbetrag des VA-Kontos.
1/42008	43	7800		Teilbetrag der VA-Post.
		7800	100	Teilbetrag des VA-Kontos. Teilbetrag des VA-Kontos. Teilbetrag des VA-Kontos.
1/4250	11			Von den übrigen landwirtschaftlichen Bundeslehranstalten werden Forschungs- und Versuchsaufgaben derzeit nicht durchgeführt.
1/43108	21	7800		Teilbetrag der VA-Post.
1/.....				F&E-Anteil an den Lohnnebenkosten der in Forschungseinrichtungen tätigen Bundesbeamten. Imputation nach OECD-Richtlinien.

Table 5: Federal expenditure in 1995 to 2011 on research and research promotion by socio-economic objectives
Breakdown of Annex T of the Auxiliary Document for the Federal Finances Act (Parts a and b)

Reporting years		Total federal expenditure on R&D	of which: Promotion of research of earth, oceans, 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 education	Promotion of health care	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
1995[1]	in € 1,000	1,150,418	55,288	49,073	169,867	16,869	32,760	15,350	270,121	75,571	47,665	6,531	82	11,037	400,206
	in %	*100.0*	*4.8*	*4.3*	*14.8*	*1.5*	*2.8*	*1.3*	*23.5*	*6.6*	*4.1*	*0.6*	*0.0*	*1.0*	*34.7*
1996[2]	in € 1,000	1,123,669	54,154	47,560	163,642	17,052	28,159	15,488	248,314	79,359	44,173	6,188	73	10,856	408,653
	in %	*100.0*	*4.8*	*4.2*	*14.6*	*1.5*	*2.5*	*1.4*	*22.1*	*7.1*	*3.9*	*0.6*	*0.0*	*1.0*	*36.3*
1997[3]	in € 1,000	1,132,901	54,939	49,177	155,087	21,884	30,385	15,713	265,641	79,076	43,121	6,433	31	11,178	400,236
	in %	*100.0*	*4.8*	*4.3*	*13.7*	*1.9*	*2.7*	*1.4*	*23.4*	*7.0*	*3.8*	*0.6*	*0.0*	*1.0*	*35.4*
1998[4]	in € 1,000	1,207,908	85,538	69,262	173,102	22,694	34,064	14,514	270,452	86,414	41,747	10,090	57	11,549	388,424
	in %	*100.0*	*7.1*	*5.7*	*14.3*	*1.9*	*2.8*	*1.2*	*22.4*	*7.2*	*3.5*	*0.8*	*0.0*	*1.0*	*32.1*
1999[5]	in € 1,000	1,281,498	91,387	75,421	188,151	25,314	32,337	15,552	280,577	91,162	42,771	10,136	12	11,348	417,329
	in %	*100.0*	*7.1*	*5.9*	*14.7*	*2.0*	*2.5*	*1.2*	*21.9*	*7.1*	*3.3*	*0.8*	*0.0*	*0.9*	*32.6*
2000[6]	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[7]	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[8]	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[9]	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[10]	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[11]	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[12]	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[13]	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[14]	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[15]	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[16]	in € 1,000	2,409,627	112,822	67,651	621,061	44,556	40,711	46,125	522,457	104,298	85,089	15,929	137	-	748,791
	in %	*100.0*	*4.7*	*2.8*	*25.8*	*1.8*	*1.7*	*1.9*	*21.7*	*4.3*	*3.5*	*0.7*	*0.0*	-	*31.1*
2011[16]	in € 1,000	2,408,054	121,765	68,404	615,770	48,369	54,080	51,777	519,813	104,933	85,512	16,364	147	-	721,120
	in %	*100.0*	*5.1*	*2.8*	*25.6*	*2.0*	*2.2*	*2.2*	*21.6*	*4.4*	*3.6*	*0.7*	*0.0*	-	*29.8*

Status: April 2011 Source: STATISTIK AUSTRIA (Bundesanstalt Statistik Österreich)

1) Annex T of the Auxiliary Document for the Federal Finances Act 1997, actual figures. - 2) Annex T of the Auxiliary Document for the Federal Finances Act 1998, actual figures. - 3) Annex T of the Auxiliary Document for the Federal Finances Act 1999, actual figures. - 4) Annex T of the Auxiliary Document for the Federal Finances Act 2000, actual figures. Revised data. - 5) Annex T of the Auxiliary Document for the Federal Finances Act 2001, actual figures. Revised data. - 6) Annex T of the Auxiliary Document for the Federal Finances Act 2002, actual figures. - 7) Annex T of the Auxiliary Document for the Federal Finances Act 2003, actual figures. - 8) Annex T of the Auxiliary Document for the Federal Finances Act 2004, actual figures. - 9) Annex T of the Auxiliary Document for the Federal Finances Act 2005, actual figures. - - 10) Annex T of the Auxiliary Document for the Federal Finances Act 2006, actual figures. Revised data. - 11) Annex T of the Auxiliary Document for the Federal Finances Act 2007, actual figures. - 12) Annex T of the Auxiliary Document for the Federal Finances Act 2008, actual figures. Revised data. - 13) Annex T of the Auxiliary Document for the Federal Finances Act 2009, actual figures. - 14) Annex T of the Auxiliary Document for the Federal Finances Act 2010, actual figures. - 15) Annex T of the Auxiliary Document for the Federal Finances Act 2011, actual figures. - 16) Annex T of the Auxiliary Document for the Federal Finances Act 2011, budgeted figures.
Rounding differences.

Table 6: Federal expenditure in 2009 for research and research promotion by socioeconomic objectives and ministries
Breakdown of annual values for 2009 [1] from Annex T of the Auxiliary Document for the Federal Finances Act 2011 (Part a and Part b)

Ministries		Total federal expenditure on R&D	of which: Promotion of research of earth, oceans, 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 education	Promotion of health care	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	1,799	-	-	-	45	-	-	-	1,263	-	135	-	-	356
	in %	*100.0*	-	-	-	2.5	-	-	-	*70.2*	-	*7.5*	-	-	*19.8*
BMI	in € 1,000	758	-	-	-	-	-	-	-	758	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-	-
BMUKK	in € 1,000	55,719	2,651	-	319	-	-	20,022	-	8,039	-	-	-	-	24,688
	in %	*100.0*	*4.8*	-	*0.6*	-	-	*35.9*	-	*14.4*	-	-	-	-	*44.3*
BMWF	in € 1,000	1,563,797	82,773	28,227	262,499	7,389	21,392	21,860	410,612	73,987	27,273	12,418	99	-	615,268
	in %	*100.0*	*5.3*	*1.8*	*16.8*	*0.5*	*1.4*	*1.4*	*26.3*	*4.7*	*1.7*	*0.8*	*0.0*	-	*39.3*
BMASK	in € 1,000	2,130	-	-	-	-	-	-	183	1,947	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	*8.6*	*91.4*	-	-	-	-	-
BMG	in € 1,000	4,391	-	61	-	-	-	-	4,064	-		-	-	-	266
	in %	*100.0*	-	*1.4*	-	-	-	-	*92.5*	-	-	-	-	-	*6.1*
BMEIA	in € 1,000	1,869	-	-	-	1,063	-	-	-	794	-	-	-	-	12
	in %	*100.0*	-	-	-	*56.9*	-	-	-	*42.5*	-	-	-	-	*0.6*
BMJ	in € 1,000	114	-	-	-	-	-	-	-	114	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-	-
BMLVS	in € 1,000	2,072	-	-	-	-	-	-	-	-	-	-	34	-	2,038
	in %	*100.0*	-	-	-	-	-	-	-	-	-	-	*1.6*	-	*98.4*
BMF	in € 1,000	32,045	1,262	854	5,837	168	505	421	7,834	4,444	645	281	-	-	9,794
	in %	*100.0*	*3.9*	*2.7*	*18.2*	*0.5*	*1.6*	*1.3*	*24.4*	*13.9*	*2.0*	*0.9*	-	-	*30.6*
BMLFUW	in € 1,000	62,915	403	35,574	-	-	-	84	-	1,492	24,981	-	-	-	381
	in %	*100.0*	*0.6*	*56.6*	-	-	-	*0.1*	-	*2.4*	*39.7*	-	-	-	*0.6*
BMWFJ	in € 1,000	83,691	-	-	78,801	3,643	-	-	-	1,238	-	-	-	-	9
	in %	*100.0*	-	-	*94.1*	*4.4*	-	-	-	*1.5*	-	-	-	-	*0.0*
BMVIT	in € 1,000	338,487	17,686	1,931	191,083	20,656	25,403	194	33,851	3,000	15,086	1,688	-	-	27,909
	in %	*100.0*	*5.2*	*0.6*	*56.4*	*6.1*	*7.5*	*0.1*	*10.0*	*0.9*	*4.5*	*0.5*	-	-	*8.2*
Total	**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***

Status: April 2011 Source: STATISTIK AUSTRIA (Bundesanstalt Statistik Österreich)

1) Actual figures. - 2) Including the highest executive bodies.

Table 7: Federal expenditure in 2010 for research and research promotion by socioeconomic objectives and ministries
Breakdown of annual values for 2010[1] from Annex T of the Auxiliary Document for the Federal Finances Act 2011 (Part a and Part b)

Ministries		Total federal expenditure on R&D	of which												
			Promotion of research of earth, oceans, 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 communica-tions	Promotion of education	Promotion of health care	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	2,072	-	-	-	46	-	-	-	1,309	-	358	-	-	359
	in %	*100.0*	-	-	-	*2.2*	-	-	-	*63.2*	-	*17.3*	-	-	*17.3*
BMI	in € 1,000	680	-	-	-	-	-	-	-	680	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-	-
BMUKK	in € 1,000	57,909	3,013	-	319	-	-	21,346	-	8,236	-	-	-	-	24,995
	in %	*100.0*	*5.2*	-	*0.6*	-	-	*36.9*	-	*14.2*	-	-	-	-	*43.1*
BMWF	in € 1,000	1,745,792	91,012	30,984	288,652	8,112	23,483	24,063	473,188	79,902	29,938	13,567	112	-	682,779
	in %	*100.0*	*5.2*	*1.8*	*16.5*	*0.5*	*1.3*	*1.4*	*27.1*	*4.6*	*1.7*	*0.8*	*0.0*	-	*39.1*
BMASK	in € 1,000	2,536	-	-	-	-	-	-	190	2,346	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	*7.5*	*92.5*	-	-	-	-	-
BMG	in € 1,000	5,229	-	59	-	-	-	-	4,528	33	-	-	-	-	609
	in %	*100.0*	-	*1.1*	-	-	-	-	*86.7*	*0.6*	-	-	-	-	*11.6*
BMEIA	in € 1,000	1,905	-	-	-	1,050	-	-	-	842	-	-	-	-	13
	in %	*100.0*	-	-	-	*55.1*	-	-	-	*44.2*	-	-	-	-	*0.7*
BMJ	in € 1,000	130	-	-	-	-	-	-	-	130	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-	-
BMLVS	in € 1,000	2,396	-	-	-	-	-	-	-	-	-	-	25	-	2,371
	in %	*100.0*	-	-	-	-	-	-	-	-	-	-	*1.0*	-	*99.0*
BMF	in € 1,000	33,031	1,366	912	5,984	173	518	431	8,022	4,591	662	288	-	-	10,084
	in %	*100.0*	*4.1*	*2.8*	*18.1*	*0.5*	*1.6*	*1.3*	*24.3*	*13.9*	*2.0*	*0.9*	-	-	*30.5*
BMLFUW	in € 1,000	75,430	359	33,562	-	-	-	77	-	1,565	39,528	-	-	-	339
	in %	*100.0*	*0.5*	*44.5*	-	-	-	*0.1*	-	*2.1*	*52.4*	-	-	-	*0.4*
BMWFJ	in € 1,000	109,590	-	-	108,030	-	-	-	-	1,551	-	-	-	-	9
	in %	*100.0*	-	-	*98.6*	-	-	-	-	*1.4*	-	-	-	-	*0.0*
BMVIT	in € 1,000	372,927	17,072	2,134	218,076	35,175	16,710	208	36,529	3,113	14,961	1,716	-	-	27,233
	in %	*100.0*	*4.6*	*0.6*	*58.4*	*9.4*	*4.5*	*0.1*	*9.8*	*0.8*	*4.0*	*0.5*	-	-	*7.3*
Total	**in € 1,000**	**2,409,627**	**112,822**	**67,651**	**621,061**	**44,556**	**40,711**	**46,125**	**522,457**	**104,298**	**85,089**	**15,929**	**137**	**-**	**748,791**
	in %	***100.0***	***4.7***	***2.8***	***25.8***	***1.8***	***1.7***	***1.9***	***21.7***	***4.3***	***3.5***	***0.7***	***0.0***	**-**	***31.1***

Status: April 2011 Source: STATISTIK AUSTRIA (Bundesanstalt Statistik Österreich)

1) Actual figures. - 2) Including the highest executive bodies.

Table 8: Federal expenditure in 2011 for research and research promotion by socioeconomic objectives and ministries
Breakdown of annual values for 2011[1] from Annex T of the Auxiliary Document for the Federal Finances Act 2011 (Part a and Part b)

Ministries		Total federal expenditure on R&D	of which												
			Promotion of research covering the earth, oceans, 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 education	Promotion of health care	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	2,043	-	-	-	46	-	-	-	1,209	-	628	-	-	160
	in %	*100.0*	-	-	-	*2.3*	-	-	-	*59.2*	-	*30.7*	-	-	*7.8*
BMI	in € 1,000	804	-	-	-	-	-	-	-	804	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-	-
BMUKK	in € 1,000	62,353	2,665	-	319	-	-	26,226	-	8,215	-	-	-	-	24,928
	in %	*100.0*	*4.3*	-	*0.5*	-	-	*42.0*	-	*13.2*	-	-	-	-	*40.0*
BMWF	in € 1,000	1,720,972	92,940	31,567	295,391	8,285	23,938	24,789	470,945	79,939	30,514	13,810	122	-	648,732
	in %	*100.0*	*5.4*	*1.8*	*17.2*	*0.5*	*1.4*	*1.4*	*27.4*	*4.6*	*1.8*	*0.8*	*0.0*	-	*37.7*
BMASK	in € 1,000	2,300	-	-	-	-	-	-	184	2,116	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	*8.0*	*92.0*	-	-	-	-	-
BMG	in € 1,000	5,022	-	71	-	-	-	-	4,555	18	-	-	-	-	378
	in %	*100.0*	-	*1.4*	-	-	-	-	*90.7*	*0.4*	-	-	-	-	*7.5*
BMEIA	in € 1,000	2,383	-	-	-	1,138	-	-	-	1,236	-	-	-	-	9
	in %	*100.0*	-	-	-	*47.8*	-	-	-	*51.8*	-	-	-	-	*0.4*
BMJ	in € 1,000	130	-	-	-	-	-	-	-	130	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-	-
BMLVS	in € 1,000	2,453	-	-	-	-	-	-	-	-	-	-	25	-	2,428
	in %	*100.0*	-	-	-	-	-	-	-	-	-	-	*1.0*	-	*99.0*
BMF	in € 1,000	33,204	1,365	843	5,984	173	518	431	8,028	4,825	662	288	-	-	10,087
	in %	*100.0*	*4.1*	*2.5*	*18.0*	*0.5*	*1.6*	*1.3*	*24.2*	*14.5*	*2.0*	*0.9*	-	-	*30.4*
BMLFUW	in € 1,000	79,440	347	33,809	-	-	-	83	-	1,565	43,308	-	-	-	328
	in %	*100.0*	*0.4*	*42.6*	-	-	-	*0.1*	-	*2.0*	*54.5*	-	-	-	*0.4*
BMWFJ	in € 1,000	102,676	-	-	100,966	-	-	-	-	1,698	-	-	-	-	12
	in %	*100.0*	-	-	*98.3*	-	-	-	-	*1.7*	-	-	-	-	*0.0*
BMVIT	in € 1,000	394,274	24,448	2,114	213,110	38,727	29,624	248	36,101	3,178	11,028	1,638	-	-	34,058
	in %	*100.0*	*6.2*	*0.5*	*54.1*	*9.8*	*7.5*	*0.1*	*9.2*	*0.8*	*2.8*	*0.4*	-	-	*8.6*
Total	**in € 1,000**	**2,408,054**	**121,765**	**68,404**	**615,770**	**48,369**	**54,080**	**51,777**	**519,813**	**104,933**	**85,512**	**16,364**	**147**	**-**	**721,120**
	in %	***100.0***	***5.1***	***2.8***	***25.6***	***2.0***	***2.2***	***2.2***	***21.6***	***4.4***	***3.6***	***0.7***	***0.0***	**-**	***29.8***

Status: April 2011 Source: STATISTIK AUSTRIA (Bundesanstalt Statistik Österreich)

1) Budget. - 2) Including the highest executive bodies.

Table 9: General research-related university expenditure by the federal government in 1999 – 2011[1] "General University Funds"

Years	General university expenditure	
	Total	R&D
	€ million	
1999	1,960.216	834.529
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	1,326.757
2010	2,874.592	1,366.358
2011	2,934.633	1,375.849

Status: April 2011 Source: STATISTIK AUSTRIA (Bundesanstalt Statistik Österreich)

1) Based on Annex T of the Auxiliary Document for the Federal Finances Act.

Table 10: Research funding and research contracts of the federal offices in 2009 by sectors/areas of performance and awarding ministries
Analysis of the federal research database[1)] without "major" global financing[2)]

Ministries	Partial amounts in 2009	of which awarded to: Higher education sector							Government sector						Private non-profit sector			Corporate sector				Funds for the Promotion of Scientific Research	Österreichische Forschungsförderungsgesellschaft mbH	Abroad
		Universities (including teaching hospitals)	Art universities	Austrian Academy of Sciences	Universities of Applied Science	Pedagogical universities	Testing institutes of technical colleges	Total	Federal institutions (outside the university level)	State institutions	Chambers	Largely publicly-financed private non-profit facilities	Ludwig Boltzmann Gesellschaft	Total	Private non-profit sector	Individual researchers	Total	Cooperative sector incl. centres of expertise (excluding ARC)	Austrian Research Centres GmbH – ARC	business sector	Total			
	in €	in %																						
BKA	463,288	18.9	-	-	-	-	-	18.9	21.4	-	-	25.8	-	47.2	6.2	7.1	13.3	-	-	17.4	17.4	-	-	3.2
BMI	165,074	-	-	-	-	-	-	-	-	-	-	70.4	-	70.4	26.0	-	26.0	-	-	3.6	3.6	-	-	-
BMUKK	5,514,314	0.9	-	-	-	-	-	0.9	97.1	-	-	0.3	-	97.4	0.8	0.6	1.4	-	-	0.3	0.3	-	-	-
BMWF	70,556,881	13.4	0.1	2.6	0.2	0.1	0.0	16.4	0.8	0.2	0.0	10.3	0.1	11.4	14.7	0.9	15.6	0.5	0.1	5.0	5.6	-	17.7	33.3
BMSK	12,092	-	-	-	-	-	-	-	-	-	-	-	-	-	87.6	-	87.6	-	-	12.4	12.4	-	-	-
BMASK	1,613,330	5.6	-	-	-	-	-	5.6	70.4	-	-	11.0	-	81.4	2.4	0.2	2.6	0.3	-	10.1	10.4	-	-	-
BMGFJ	157,000	79.6	-	-	-	-	-	79.6	20.4	-	-	-	-	20.4	-	-	-	-	-	-	-	-	-	-
BMG	473,467	64.8	-	-	-	-	-	64.8	7.6	-	-	-	-	7.6	10.1	17.5	27.6	-	-	-	-	-	-	-
BMEIA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BMJ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BMLV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BMLVS	80,400	10.0	-	-	41.0	-	-	51.0	-	-	-	-	-	-	-	8.0	8.0	-	-	41.0	41.0	-	-	-
BMF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BMLFUW	3,416,632	57.2	-	-	-	-	-	57.2	18.5	-	-	6.9	-	25.4	2.6	1.0	3.6	0.5	7.1	6.2	13.8	-	-	-
BMWA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BMWFJ	1,009,360	8.3	-	-	-	-	-	8.3	7.8	-	-	13.1	-	20.9	8.5	-	8.5	15.2	-	41.3	56.5	-	-	5.8
BMVIT	5,665,589	2.3	-	-	-	-	-	2.3	-	-	-	16.2	-	16.2	8.2	0.8	9.0	33.6	2.0	34.4	70.0	-	1.5	1.0
Total	**89,127,427**	**13.7**	**0.1**	**2.1**	**0.2**	**0.1**	**0.0**	**16.2**	**8.9**	**0.1**	**0.0**	**10.1**	**0.1**	**19.2**	**12.6**	**1.0**	**13.6**	**2.7**	**0.4**	**7.3**	**10.4**	-	**14.1**	**26.5**

Status: April 2011 Source: STATISTIK AUSTRIA (Bundesanstalt Statistik Österreich)

1) Formerly facts documentation of the federal offices; as of November 2010.
2) i.e. excluding global financing for: the Austrian Science Fund, Österreichische Forschungsförderungsgesellschaft mbH, Ludwig Boltzmann Gesellschaft, Austrian Academy of Sciences, AIT Austrian Institute of Technology GmbH.

Table 11: Research funding and research contracts of the federal offices in 2009 by socio-economic objective and awarding ministries
Analysis of the federal research database[1)] without "major" global financing[2)]

Ministries		Partial amounts in 2009	of which											
			Promotion of research of earth, oceans, 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 education	Promotion of health care	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 €	463,288	-	-	-	10,000	-	-	-	435,183	-	18,105	-	-
	in %	*100.0*	-	-	-	*2.2*	-	-	-	*93.9*	-	*3.9*	-	-
BMI	in €	165,074	-	-	-	-	-	-	-	165,074	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-
BMUKK	in €	5,514,314	-	-	-	-	-	5,045,241	-	72,093	-	-	-	396,980
	in %	*100.0*	-	-	-	-	-	*91.5*	-	*1.3*	-	-	-	*7.2*
BMWF	in €	70,556,881	4,070,215	70,062	1,444,487	133,929	105,458	248,431	17,103,151	5,834,520	290,258	108,000	15,000	41,133,370
	in %	*100.0*	*5.8*	*0.1*	*2.0*	*0.2*	*0.1*	*0.4*	*24.2*	*8.3*	*0.4*	*0.2*	*0.0*	*58.3*
BMSK	in €	12,092	-	-	10,592	-	-	-	-	1,500	-	-	-	-
	in %	*100.0*	-	-	*87.6*	-	-	-	-	*12.4*	-	-	-	-
BMASK	in €	1,613,330	-	-	724	-	-	1,925	43,316	1,554,815	-	-	-	12,550
	in %	*100.0*	-	-	*0.0*	-	-	*0.1*	*2.7*	*96.4*	-	-	-	*0.8*
BMGFJ	in €	157,000	-	-	-	-	-	-	157,000	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	*100.0*	-	-	-	-	-
BMG	in €	473,467	21,825	242,310	25,358	-	-	-	82,474	-	-	-	-	101,500
	in %	*100.0*	*4.6*	*51.2*	*5.4*	-	-	-	*17.4*	-	-	-	-	*21.4*
BMEIA	in €	-	-	-	-	-	-	-	-	-	-	-	-	-
	in %	-	-	-	-	-	-	-	-	-	-	-	-	-
BMJ	in €	-	-	-	-	-	-	-	-	-	-	-	-	-
	in %	-	-	-	-	-	-	-	-	-	-	-	-	-
BMLV	in €	-	-	-	-	-	-	-	-	-	-	-	-	-
	in %	-	-	-	-	-	-	-	-	-	-	-	-	-
BMLVS	in €	80,400	-	-	-	-	-	-	-	42,400	-	-	-	38,000
	in %	*100.0*	-	-	-	-	-	-	-	*52.7*	-	-	-	*47.3*
BMF	in €	-	-	-	-	-	-	-	-	-	-	-	-	-
	in %	-	-	-	-	-	-	-	-	-	-	-	-	-
BMLFUW	in €	3,416,632	265,942	2,227,227	96,590	100,000	-	-	147,259	189,471	195,733	-	-	194,410
	in %	*100.0*	*7.8*	*65.3*	*2.8*	*2.9*	-	-	*4.3*	*5.5*	*5.7*	-	-	*5.7*
BMWA	in €	-	-	-	-	-	-	-	-	-	-	-	-	-
	in %	-	-	-	-	-	-	-	-	-	-	-	-	-
BMWFJ	in €	1,009,360	104,972	-	53,533	-	-	-	-	719,757	-	-	-	131,098
	in %	*100.0*	*10.4*	-	*5.3*	-	-	-	-	*71.3*	-	-	-	*13.0*
BMVIT	in €	5,665,589	164,233	3,000	2,221,211	177,642	1,911,540	-	60,000	326,452	109,500	-	-	692,011
	in %	*100.0*	*2.9*	*0.1*	*39.2*	*3.1*	*33.7*	-	*1.1*	*5.8*	*1.9*	-	-	*12.2*
Total	**in €**	**89,127,427**	**4,627,187**	**2,542,599**	**3,852,495**	**421,571**	**2,016,998**	**5,295,597**	**17,593,200**	**9,341,265**	**595,491**	**126,105**	**15,000**	**42,699,919**
	in %	***100.0***	***5.2***	***2.9***	***4.3***	***0.5***	***2.3***	***5.9***	***19.7***	***10.5***	***0.7***	***0.1***	***0.0***	***47.9***

Status: April 2011 Source: STATISTIK AUSTRIA (Bundesanstalt Statistik Österreich)

1) Formerly facts documentation of the federal offices; as of November 2010.
2) i.e. excluding global financing for: the Austrian Science Fund, Österreichische Forschungsförderungsgesellschaft mbH, Ludwig Boltzmann Gesellschaft, Austrian Academy of Sciences, AIT Austrian Institute of Technology GmbH.

Table 12: Research funding and research contracts of the federal offices in 2009 by scientific branches and awarding ministries
Analysis of the federal research database[1] without "major" global financing[2]

Ministries		Partial amounts in 2009	Analysis of the facts documentation of the federal offices for 2008[1] without the "major" global financing schemes[2]					
			of which					
			1.0 Life sciences	2.0 Engineering	3.0 Human medicine	4.0 Agriculture and forestry, veterinary medicine	5.0 Social sciences	6.0 Humanities
BKA	in €	463,288	-	10,000	-	-	453,288	-
	in %	*100.0*	-	*2.2*	-	-	*97.8*	-
BMI	in €	165,074	-	-	-	-	165,074	-
	in %	*100.0*	-	-	-	-	*100.0*	-
BMUKK	in €	5,514,314	-	-	-	-	5,117,334	396,980
	in %	*100.0*	-	-	-	-	*92.8*	*7.2*
BMWF	in €	70,556,881	54,225,696	1,684,151	2,939,003	144,398	9,346,707	2,216,926
	in %	*100.0*	*76.9*	*2.4*	*4.2*	*0.2*	*13.2*	*3.1*
BMSK	in €	12,092	-	10,592	-	-	-	1,500
	in %	*100.0*	-	*87.6*	-	-	-	*12.4*
BMASK	in €	1,613,330	-	31,040	13,000	-	1,569,290	-
	in %	*100.0*	-	*1.9*	*0.8*	-	*97.3*	-
BMGFJ	in €	157,000	-	-	157,000	-	-	-
	in %	*100.0*	-	-	*100.0*	-	-	-
BMG	in €	473,467	68,018	25,700	120,000	259,749	-	-
	in %	*100.0*	*14.4*	*5.4*	*25.3*	*54.9*	-	-
BMEIA	in €	-	-	-	-	-	-	-
	in %	-	-	-	-	-	-	-
BMJ	in €	-	-	-	-	-	-	-
	in %	-	-	-	-	-	-	-
BMLV	in €	-	-	-	-	-	-	-
	in %	-	-	-	-	-	-	-
BMLVS	in €	80,400	33,000	-	-	-	47,400	-
	in %	*100.0*	*41.0*	-	-	-	*59.0*	-
BMF	in €	-	-	-	-	-	-	-
	in %	-	-	-	-	-	-	-
BMLFUW	in €	3,416,632	654,709	219,154	-	2,284,786	257,983	-
	in %	*100.0*	*19.2*	*6.4*	-	*66.8*	*7.6*	-
BMWA	in €	-	-	-	-	-	-	-
	in %	-	-	-	-	-	-	-
BMWFJ	in €	1,009,360	126,705	47,800	-	-	784,521	50,334
	in %	*100.0*	*12.6*	*4.7*	-	-	*77.7*	*5.0*
BMVIT	in €	5,665,589	512,909	4,633,523	-	3,000	488,157	28,000
	in %	*100.0*	*9.1*	*81.7*	-	*0.1*	*8.6*	*0.5*
Total	**in €**	**89,127,427**	**55,621,037**	**6,661,960**	**3,229,003**	**2,691,933**	**18,229,754**	**2,693,740**
	in %	***100.0***	***62.4***	***7.5***	***3.6***	***3.0***	***20.5***	***3.0***

Status: April 2011 Source: STATISTIK AUSTRIA (Bundesanstalt Statistik Österreich)

1) Formerly facts documentation of the federal offices; as of November 2010.
2) i.e. excluding global financing for the Austrian Science Fund, Österreichische Forschungsförderungsgesellschaft mbH, Ludwig Boltzmann Gesellschaft, Austrian Academy of Sciences, AIT Austrian Institute of Technology GmbH.

Table 13: An international comparison of research and experimental development (R&D) in 2008

Country	Gross domestic expenditure on R&D as a % of GDP	Financing of gross domestic expenditure of R&D by		Employees in R&D as full-time equivalents	Gross expenditure on R&D by the			
		State	Business		Business sector	University sector	State sector	Private non-profit sector
		%			as a % of gross domestic expenditure on R&D			
Belgium	1.96 [p)]	22.2 [2)]	61.4 [2]	60,129 [p)]	67.6 [p)]	22.8 [p)]	8.3 [p)]	1.3 [p)]
Denmark [a)]	2.87	25.9 [a)o)2)]	61.0 [a)2)]	58,589 [c)]	69.9	27.2	2.6	0.3
Germany	2.68	28.4	67.3	522,688	69.2	16.7	14.0 [o)]	. [n)]
Finland	3.72	21.8	70.3	56,698	74.3	17.2	8.0	0.5
France	2.11	38.9	50.7	384,513	62.8	20.0	15.9	1.2
Greece	0.58 [c)2)]	46.8 [1]	31.1 [1]	35,629 [c)2)]	26.9 [c)2)]	50.4 [c)2)]	21.4 [c)2)]	1.3 [c)2)]
Ireland [p)]	1.45	33.9	48.6	20,363	64.5	28.7	6.9	.
Italy	1.23	42.9	45.2	239,016	52.7	31.6	12.5	3.2
Luxembourg	1.56	18.2 [c)2)]	76.0 [c)2)]	4,652	77.9	6.1	16.0	0.0 [c)p)2)]
Netherlands	1.76	36.8 [2]	48.8 [2]	93,369	50.1	37.9	12.0 [o)]	. [n)]
Austria [c)p)]	**2.67** [3]	**37.0** [3)]	**46.1** [3]	**58,077**	**70.6**	**23.8**	**5.3**	**0.3**
Portugal [a)]	1.50	43.7	48.1	47,882	50.1	34.5	7.3	8.1
Sweden	3.70 [c)]	24.9 [2]	62.3 [2]	77,549 [c)]	74.1 [c)]	21.3 [c)]	4.4 [c)]	0.2 [c)]
Spain [a)]	1.35	45.6	45.0	215,676	54.9	26.7	18.2	0.2
United Kingdom	1.77	30.7	45.4	342,086 [c)]	62.0	26.5	9.2	2.4
EU 15 [b)]	**1.98**	**33.3**	**55.1**	**2,218,334**	**63.5**	**23.2**	**12.0**	**1.2**
Estonia	1.29	50.0	39.8	5,086	43.2	42.9	11.8	2.1
Poland	0.60	59.8	30.5	74,596	30.9	33.6	35.3	0.1
Slovak Republic	0.47	52.3	34.7	15,576	42.9	24.3	32.8 [d)]	0.1
Slovenia [a)]	1.65	31.3	62.8	11,594	64.6	13.4	21.9	0.1
Czech Republic	1.47	41.3	52.2	50,808	61.9	16.8	20.9	0.4
Hungary	1.00	41.8	48.3	27,403	52.6 [v]	22.0 [v]	23.4 [v]	.
EU 25 [b)]	**1.87**	**33.9**	**54.5**	**2,424,782**	**62.8**	**23.4**	**12.6**	**1.1**
Romania	0.58	70.1	23.3	30,390	30.0	28.9	41.0	0.2
EU-27 [b)]	**1.84**	**34.2**	**54.3**	**2,472,391**	**62.5**	**23.4**	**12.9**	**1.1**
Australia	2.21	34.9	61.4	136,696	60.8	24.2	12.3	2.7
Iceland	2.65 [p)]	38.8 [p)]	50.3 [p)]	3,117	54.6 [p)]	25.1 [p)]	17.8 [p)]	2.5 [p)]
Israel [d)]	4.66 [p)]	14.2 [2]	79.5 [2]	.	80.5 [p)]	12.1 [g)p)]	4.5 [p)]	2.8 [p)]
Japan [a)]	3.44	15.6 [e)]	78.2	882,739	78.5	11.6	8.3	1.6
Canada [p)]	1.84	32.4 [c)]	47.6	228,679 [c)2)]	54.2	35.0	10.2	0.6
Korea	3.36	25.4	72.9	294,440 [a)]	75.4	11.1	12.1	1.4
Mexico [2)]	0.37	50.2	45.1	70,293	47.4	26.1	25.2	1.3
New Zealand 2)	1.18	42.7	40.1	24,700	42.7	30.0	27.3	.
Norway	1.64	44.9 [2]	45.3 [2]	35,967	53.9	31.5	14.5	.
Switzerland	3.00	22.8	68.2	62,066	73.5	24.2	0.7 [h)]	1.6
Turkey	0.73	31.6 [a)]	47.3 [a)]	67,244	44.2	43.8	11.9	.
United States j)p)	2.79	27.1	67.3 [o)]	.	72.6	12.8	10.6 [h)]	3.9
OECD total b)	**2.34**	**27.7**	**64.5**	**.**	**69.6**	**17.0**	**10.9**	**2.4**

Source: OECD (MSTI 2010-2), Statistik Austria (Bundesanstalt Statistik Österreich)

a) Break in the time series. - b) Estimate by the OECD Secretariat (based on national sources). - c) National estimate, where necessary the OECD Secretariat has adjusted them to meet the OECD standards. - 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. - 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.

1) 2005. - 2) 2007. - 3) Statistik Austria; according to R&D global estimate 2011.

Full time equivalent = person year.

Table 14: Path from the 4th to the 7th EU Research Framework Programme

	FP4	FP5	FP6	FP7[1]
	1994–1998	1998–2002	2002–2006	Data as per 11/2010
Number of approved projects in which Austrian are participating	1,444	1,384	1,324	**1,141**
Number of approved Austrian participations	1,923	1,987	1,972	**1,558**
Number of approved projects coordinated by Austrian organisations	270	267	213	**189**
Amount of subsidies that approved Austrian participations receive (in € million)	194	292	425	**490**[2]
Percentage of approved Austrian participations among all approved participations	2.3%	2.4%	2.6%	**2.4%**
Percentage of approved Austrian coordinators among all approved coordinators	1.7%	2.8%	3.3%	**3.4%**
Percentage of subsidies received by Austrian participations among all of the subsidies that were paid out (indicator of return flow)	1.99%	2.38%	2.56%	**2.57%**
Subsidies received by approved Austrian participations measured against the contribution Austria makes to the EU household (return flow ratio)	70%	104%	117%	**126%**

Data: European Commission; **processed and calculated by** PROVISO, a project of the BMWF, BMVIT, BMWA and BMLFUW

1 As of 11/2010, PROVISO only had part of the information about the results of the project negotiations. Because experience shows that there can be changes during the course of the contract negotiations (i.e. a contract for an approved project is not signed, consortiums change within a projects, the "requested" subsidy amounts are reduced), this information must be seen as a reference only.

2 As of 11/2010 the results are available for 80% of the contractual negotiations of the currently approved projects; accordingly € 347 million of the € 490 million are currently tied up for Austrian holdings.

Source: M. Ehardt-Schmiederer, V. Postl, C. Kobel, D. Milovanović, C. Naderer, F. Boulmé, J. Brücker, F. Hackl, L. Schleicher: 7. EU Framework Programme for research, technological development and demonstration (2007–2013) PROVISO overview report autumn 2010, Vienna 2010

Table 15: Austrian results in FP7

	7th EU Framework Programme [1]											
	Total	AT										
		AT Total	B	K	N	UA	S	ST	T	V	V	n/A[2]
Projects	10,565	1,141	3	43	119	87	45	216	103	15	654	56
Participations	63,658	1,558	3	53	134	101	50	244	113	17	787	56
Universities, Higher education	*N/A*	*600*	*0*	*18*	*10*	*42*	*30*	*115*	*81*	*4*	*300*	*0*
Public research institutions	*N/A*	*322*	*0*	*3*	*55*	*14*	*7*	*47*	*0*	*0*	*196*	*0*
Large companies (over 250 employees)	*N/A*	*118*	*0*	*12*	*11*	*14*	*3*	*32*	*3*	*7*	*36*	*0*
Small and medium-sized enterprises (up to 249 employees)	*N/A*	*248*	*3*	*19*	*25*	*23*	*6*	*42*	*26*	*5*	*99*	*0*
Other categories	*N/A*	*270*	*0*	*1*	*33*	*8*	*4*	*8*	*3*	*1*	*156*	*56*
Coordinators [3]	5,509	189	0	11	15	12	6	34	11	0	100	0
Universities	*N/A*	*68*	*0*	*0*	*0*	*4*	*4*	*17*	*10*	*0*	*33*	*0*
Public research institutions	*N/A*	*56*	*0*	*0*	*12*	*4*	*2*	*7*	*0*	*0*	*31*	*0*
Large firms (over 250 employees)	*N/A*	*5*	*0*	*0*	*0*	*0*	*0*	*5*	*0*	*0*	*0*	*0*
Small and medium-sized enterprises (up to 249 employees)	*N/A*	*34*	*0*	*11*	*1*	*2*	*0*	*4*	*1*	*0*	*15*	*0*
Other categories	*N/A*	*26*	*0*	*0*	*2*	*2*	*0*	*1*	*0*	*0*	*21*	*0*

Data: European Commission; **processed and calculated by** PROVISO, a project of the BMWF, BMVIT, BMWA and BMLFUW

1 As of 11/2010, PROVISO only had part of the information about the results of the project negotiations. Because experience shows that there can be changes during the course of the contract negotiations (i.e. a contract for an approved project is not signed, consortiums change within a projects, the "requested" subsidy amounts are reduced), this information must be seen as a reference only.

2 Individual researchers in the people pillar (researchers, scholarship recipients/award winners in the people pillar) and the ideas pillar (principal investigators)

3 does not include projects of the idea pillar or individual scholarships and awards of the people pillar

Source: M. Ehardt-Schmiederer, V. Postl, C. Kobel, D. Milovanović, C. Naderer, F. Boulmé, J. Brücker, F. Hackl, L. Schleicher: 7. EU Framework Programme for research, technological development and demonstration (2007–2013) PROVISO overview report autumn 2010, Vienna 2010

Table 16: Overview of projects and investments in FP7

	Approved projects (Total)	Approved projects with AT investments	Percentage of approved projects with AT investments in approved projects (total)
Cooperation	3,582	749	20.9%
Ideas	1,503	49	3.3%
People	4,465	182	4.1%
Experts	1,015	161	15.9%
Total	**10,565**	**1,141**	**10.8%**

Data: European Commission; **processed and calculated by** PROVISO, a project of the BMWF, BMVIT, BMWA and BMLFUW; data as of 11/2010

	Approved investments (Total)	Approved Austrian investments	Percentage of approved investments (AT) in approved investments (total)
Cooperation	39,394	1,043	2.6%
Ideas	3,186	63	2.0%
People	11,128	238	2.1%
Experts	9,950	214	2.2%
Total	**63,658**	**1,558**	**2.4%**

Data: European Commission; **processed and calculated by** PROVISO, a project of the BMWF, BMVIT, BMWA and BMLFUW; data as of 11/2010

1 As of 11/2010, PROVISO only had part of the information about the results of the project negotiations. Because experience shows that there can be changes during the course of the contract negotiations (i.e. a contract for an approved project is not signed, consortiums change within a projects, the "requested" subsidy amounts are reduced), this information must be seen as a reference only.

2 Individual researchers in the people pillar (researchers, scholarship recipients/award winners in the people pillar) and the ideas pillar (principal investigators)

3 does not include projects of the idea pillar or individual scholarships and awards of the people pillar

Source: M. Ehardt-Schmiederer, V. Postl, C. Kobel, D. Milovanović, C. Naderer, F. Boulmé, J. Brücker, F. Hackl, L. Schleicher: 7. EU Framework Programme for research, technological development and demonstration (2007–2013) PROVISO overview report autumn 2010, Vienna 2010

Note: According to the data of 11/2010, PROVISO only had a part of the information about the results of the project negotiations. Since experience shows us that there can be changes in the course of the contract negotiations, this information should be seen as a guideline only.

Table 17: FFG: Subsidy statistics 2010 – General overview
Contracts signed in the year under review; amounts in € 1,000

Area	Programme	Projects	Participants	Investment	Total costs	Funding including liability	Cash value
ALR	ASAP	25	40	59	8,070	6,193	6,193
		25	**40**	**59**	**8,070**	**6,193**	**6,193**
BP	General programme	630	509	652	408,123	226,448	108,162
	-- Line: Service innovations	31	33	33	9,916	5,271	4,452
	-- Line: Headquarters	37	35	39	86,545	27,193	27,193
	-- Line: High-tech start-up	29	29	29	16,616	11,601	7,631
		727	*588*	*753*	*521,200*	*270,513*	*147,437*
	BRIDGE	60	129	147	19,639	11,841	11,841
	EUROSTARS	7	9	9	3,035	1,478	1,478
	Innovation voucher	761	1,054	1,522	3,810	3,810	3,810
		1,555	**1,670**	**2,431**	**547,684**	**287,642**	**164,567**
EIP	AF-Wiss	242	143	242	1,830	1,376	1,376
		242	**143**	**242**	**1,830**	**1,376**	**1,376**
SP	AplusB	2	2	2	8,307	2,781	2,781
	brainpower austria	4	1	4	300	300	300
	COIN	41	111	127	34,210	22,730	22,730
	COMET	22	591	650	264,548	84,885	84,885
	FEMtech	19	45	48	3,983	2,453	2,453
	Gender Award	8	36	38	85	85	85
	General innovation internships	499	355	499	3,024	1,860	1,860
	SELP	1	1	1	1,879	855	855
	wfFORTE	6	25	25	11,365	6,637	6,637
		602	**1,037**	**1,394**	**327,702**	**122,584**	**122,584**
TP	Alpine Schutzhütten	2	2	2	530	297	297
	AT:net	48	57	59	16,601	5,596	5,596
	benefit	36	64	74	9,833	6,413	6,413
	ENERGIE DER ZUKUNFT	52	86	136	12,025	7,254	7,254
	FIT-IT	65	90	117	41,182	18,096	18,096
	GEN-AU	26	34	53	1,304	1,304	1,304
	IEA	25	19	35	1,692	1,669	1,669
	IV2Splus	101	213	354	31,424	20,395	20,395
	KIRAS	29	99	137	16,698	11,499	11,499
	Beacons for eMobility	1	15	15	19,933	8,490	8,490
	NANO	5	10	11	2,488	1,796	1,796
	NAWI	1	3	3	92	52	52
	Neue Energien 2020	120	250	372	75,764	42,168	42,168
	TAKE OFF	15	45	51	16,849	8,979	8,979
		526	**852**	**1,419**	**246,414**	**134,007**	**134,007**
Austrian Research Promotion Agency (FFG)		**2,950**	**3,084**	**5,545**	**1,131,699**	**551,803**	**428,727**
FFG authorisations						2,605	2,605
Austrian Research Promotion Agency (FFG) total: operational funds allocated in 2010						**554,408**	**431,332**

Table 18: FFG: Funding statistics by state (in € 1,000)

	Investments	Total promotion	Cash value	Cash value share
Burgenland	44	3,532	2,937	*0.7%*
Carinthia	227	29,743	18,442	*4.3%*
Lower Austria	583	63,201	56,177	*13.1%*
Upper Austria	788	99,626	62,465	*14.6%*
Salzburg	265	20,537	15,681	*3.7%*
Styria	1,070	144,144	113,464	*26.5%*
Tirol	268	27,239	22,715	*5.3%*
Vorarlberg	167	24,304	16,718	*3.9%*
Vienna	1,931	137,222	117,874	*27.5%*
Abroad	202	2,255	2,255	*0.5%*
Total	5,545	551,803	428,727	*100.0%*

Table 19: FFG: Funding statistics by type of organisation (in € 1,000)

	Investments	Total promotion	Cash value	Cash value share
Firms	3,072	357,295	236,450	*55.2%*
Research institutions	872	118,241	116,216	*27.1%*
Universities	1,330	63,641	63,641	*14.8%*
Intermediaries	58	5,596	5,431	*1.3%*
Other	213	7,030	6,988	*1.6%*
Total result	5,545	551,803	428,727	*100.0%*

Table 20: FFG: Funded projects in the area of general programmes according to the classification of economic activities

Name	NACE_2008	Projects	% Projects	Investments	Total costs	Total promotion	% Total funding	Cash value	% Cash value
Agriculture, hunting and associated activities	01	11	0.7%	15	1,805	1,023	0.36%	855	0.5%
Manufacture of food and feed products	10	37	2.4%	60	8,030	3,854	1.34%	2,642	1.6%
Manufacture of beverages	11	5	0.3%	8	684	381	0.13%	311	0.2%
Manufacture of textiles	13	18	1.2%	28	5,231	2,656	0.92%	1,313	0.8%
Manufacture of wearing apparel	14	7	0.5%	9	1,002	553	0.19%	227	0.1%
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	16	18	1.2%	30	2,912	1,222	0.42%	1,222	0.7%
Manufacture of paper and paper products	17	10	0.6%	14	1,444	811	0.28%	692	0.4%
Manufacture of chemical products	20	40	2.6%	46	18,906	12,481	4.34%	5,188	3.2%
Manufacture of pharmaceutical products	21	46	3.0%	49	59,539	32,622	11.34%	17,786	10.8%
Manufacture of rubber and plastic products	22	42	2.7%	63	7,851	4,452	1.55%	2,090	1.3%
Manufacture of glass, glass products, ceramics, and mineral products	23	30	1.9%	41	17,392	7,984	2.78%	4,626	2.8%
Manufacture of basic metals	24	30	1.9%	36	20,827	12,554	4.36%	5,379	3.3%
Manufacture of metal products	25	58	3.7%	98	18,089	10,597	3.68%	5,186	3.2%
Manufacture of computing machines, electronic and optical products	26	132	8.5%	164	121,632	60,020	20.87%	32,394	19.7%
Manufacture of electrical equipment	27	22	1.4%	30	29,682	13,631	4.74%	7,371	4.5%
Machinery and equipment	28	130	8.4%	165	73,718	38,290	13.31%	21,212	12.9%
Manufacture of motor vehicles, trailers and semi-trailers	29	27	1.7%	29	22,979	12,446	4.33%	5,856	3.6%
Manufacture of other transport equipment	30	8	0.5%	8	15,325	8,589	2.99%	3,898	2.4%
Manufacture of furniture	31	5	0.3%	10	2,971	974	0.34%	951	0.6%
Manufacture of other products	32	32	2.1%	47	26,022	9,964	3.46%	8,442	5.1%
Repair and installation of machines and equipment	33	10	0.6%	12	6,949	3,756	1.31%	2,274	1.4%
Energy supply	35	15	1.0%	26	2,102	1,299	0.45%	1,109	0.7%
Collection, purification and distribution of water	36	3	0.2%	3	661	401	0.14%	127	0.1%
Collection, treatment and removal of waste; recycling	38	22	1.4%	30	5,498	3,298	1.15%	1,606	1.0%
Removal of environmental pollution and other waste removal	39	2	0.1%	2	1,485	773	0.27%	346	0.2%
Building construction	41	8	0.5%	17	487	324	0.11%	311	0.2%
Civil engineering	42	11	0.7%	13	2,535	1,433	0.50%	985	0.6%
Preparatory construction site work, installation engineering and other finishing trades	43	33	2.1%	58	3,096	1,551	0.54%	1,489	0.9%
Retail (without trade with motor vehicles)	47	64	4.1%	128	320	320	0.11%	320	0.2%
Provisioning of information technology services	62	192	12.3%	269	59,216	32,946	11.45%	22,618	13.7%
Information services	63	79	5.1%	153	2,103	1,455	0.51%	1,107	0.7%
Administration and management of firms and businesses; management consulting	70	77	5.0%	154	385	385	0.13%	385	0.2%
Architecture and engineering firms; technical, physical and chemical analysis	71	85	5.5%	164	2,316	1,454	0.51%	1,321	0.8%
Research and development	72	45	2.9%	54	2,161	1,277	0.44%	1,277	0.8%
35 Additional Nace codes with shares <= 0.1%		201	12.9%	398	2,333	1,868	0.65%	1,653	1.0%
Total result		**1,555**	**100.0%**	**2,431**	**547,684**	**287,642**	**100.00%**	**164,567**	**100.0%**

Table 21: FWF: Funded research personnel

	Postdocs			Doctoral candidates			Erwin-Schrödinger Scholarships			Lise-Meitner positions			Hertha-Firnberg positions			Elise Richter positions			Impulse projects			Technical employees			Other employees			Total		
	All	Women	Men	All	Women	Men	All	Women	Men	All	Women	Men	All	Women	Men	All	Women	Men	All	Women	Men	All	Women	Men	All	Women	Men	All	Women	Men
2010	976	412	564	1683	710	973	88	38	50	44	16	28	47	47	0	41	41	0	1	0	1	122	82	40	403	193	210	3405	1539	1866
2009	951	388	563	1619	671	948	86	34	52	42	19	23	41	41	0	35	35	0	1	0	1	134	95	39	405	183	222	3314	1466	1848
2008	830	320	510	1526	625	901	102	35	67	45	17	28	40	40	0	29	29	0	7	2	5	123	90	33	331	166	165	3033	1324	1709

As at 31 December 2010

Table 22: FWF: Overview of research funding: Number of subsidies

Funding programme	Applications decided 2010 Number	New approvals 2010 Number	Approval rate in % 2010 Rate
Stand-alone projects	995	310	31.2%
SFB*	50	39	36.4%
SFB extension	31	7	22.6%
NRN*	18	10	8.3%
NRN extension	7	0	0.0%
International programmes	229	92	40.2%
Doctoral college plus (DK-plus)*	6	5	29.4%
Doctoral college plus (DK-plus) extension	7	5	71.4%
Schrödinger	129	56	43.4%
Meitner	76	29	38.2%
Translational research	166	31	18.7%
Translational Brainpower	13	3	23.1%
Richter	40	15	37.5%
PEEK	48	7	14.6%
Publication funding	105	62	59.0%
START	45	6	13.3%
START extension	0	0	-
Wittgenstein	22	1	4.5%
Firnberg	50	13	26.0%
Total	2037	691	32.3%
Concept applications for SRAs	11		
Concept applications for NRNs	12		
Concept applications for doctoral college plus (DK-plus)	17		

* two-stage process; the figures shown here correspond to sub-projects of complete applications (2nd stage)
Publication funding: independent publications, translation costs, refereed publications
International programmes: international programmes, procurement of international cooperation, etc.

Table 23: FWF: Overview of funding statistics (€ million)

Funding programme	Applications decided 2010 Total	Total grants awarded 2010 Total	Approval rate in % 2010 Rate
Stand-alone projects	€ 278.95	€ 82.95	29.3%
SRA*	€ 19.62	€ 14.96	28.0%
SRA extension	€ 9.87	€ 3.78	38.3%
NRN*	€ 7.34	€ 4.26	10.6%
NRN extension	€ 2.49	€ 0.00	0.0%
International programmes	€ 48.64	€ 14.91	29.9%
doctoral college plus (DK-plus)*	€ 12.28	€ 8.18	16.6%
doctoral college plus (DK-plus) extension	€ 14.85	€ 8.91	60.0%
Schrödinger	€ 11.74	€ 5.59	45.7%
Meitner	€ 8.75	€ 3.91	39.5%
Translational research	€ 53.68	€ 8.39	15.4%
Translational Brainpower	€ 4.57	€ 1.06	23.3%
Richter	€ 11.20	€ 4.54	34.4%
PEEK	€ 12.21	€ 1.74	14.2%
Publication funding	€ 1.12	€ 0.66	58.7%
START	€ 46.61	€ 3.63	7.7%
START extension	€ 0.00	€ 0.00	-
Wittgenstein	€ 33.00	€ 1.51	4.5%
Firnberg	€ 10.06	€ 2.75	26.1%
Total	€ 586.98	€ 171.78	24.6%
Concept applications for SRAs	€ 52.86		
Concept applications for NRNs	€ 35.54		
Concept applications for doctoral college plus (DK-plus)	€ 43.66		

* Two-stage process; the figures shown here correspond to sub-projects of complete applications (2nd stage)
Publication funding: independent publications, translation costs, refereed publications
International programmes: international programmes, procurement of international cooperation, etc.

Table 24: FWF: Trend of funding of life sciences and technology (€ million)

	2008						2009						2010					
	Total	Share	Women	Share	Men	Share	Total	Share	Women	Share	Men	Share	Total	Share	Women	Share	Men	Share
Mathematics, informatics	17.7	10.1%	1.9	4.8%	15.9	11.6%	18.2	12.3%	2.8	8.2%	15.3	13.6%	20.2	11.8%	2.5	5.9%	17.7	13.7%
Physics, mechanics, astronomy	32.2	18.3%	2.3	5.9%	29.9	21.9%	19.0	12.9%	2.4	6.9%	16.6	14.7%	21.2	12.3%	4.4	10.3%	16.8	13.0%
Chemistry	10.7	6.1%	2.0	5.2%	8.7	6.4%	7.8	5.3%	1.9	5.5%	5.9	5.2%	11.1	6.4%	1.6	3.6%	9.5	7.4%
Geology, minerology	2.3	1.3%	0.1	0.2%	2.2	1.6%	1.9	1.3%	0.3	0.7%	1.7	1.5%	4.4	2.6%	0.7	1.6%	3.7	2.9%
meteorology, climatology	1.0	0.6%	0.1	0.4%	0.9	0.6%	2.3	1.6%	0.5	1.4%	1.9	1.7%	1.2	0.7%	0.1	0.3%	1.1	0.8%
Hydrology, hydrography	2.6	1.5%	0.1	0.3%	2.5	1.8%	1.2	0.8%	0.1	0.3%	1.1	1.0%	0.7	0.4%	0.0	0.0%	0.7	0.5%
Geography	0.7	0.4%	0.0	0.0%	0.7	0.5%	0.8	0.6%	0.1	0.3%	0.8	0.7%	0.9	0.5%	0.1	0.2%	0.8	0.6%
Other life sciences	3.0	1.7%	0.2	0.5%	2.8	2.0%	2.7	1.8%	1.9	5.6%	0.8	0.7%	1.9	1.1%	0.4	0.9%	1.5	1.2%
Mining, metallurgy	0.1	0.1%	0.0	0.0%	0.1	0.1%		0.0%		0.0%		0.0%	0.6	0.4%	0.1	0.2%	0.5	0.4%
Manufacture of machinery and equipment, instruments	0.5	0.3%	-0.0	-0.0%	0.5	0.4%		0.2%		0.0%		0.3%	0.2	0.1%	0.1	0.3%	0.1	0.1%
Construction engineering	0.5	0.3%	-0.0	-0.0%	0.5	0.4%		0.3%		0.2%		0.3%	0.8	0.5%	0.2	0.5%	0.6	0.5%
Architecture	0.4	0.2%	0.1	0.3%	0.2	0.2%		0.5%		1.1%		0.3%	0.6	0.4%	0.0	0.0%	0.6	0.5%
Electrical engineering/electronics	1.1	0.7%	0.0	0.0%	1.2	0.8%		1.9%		0.0%		2.5%	0.9	0.5%	0.1	0.3%	0.7	0.6%
Technical chemistry, fuel and petroleum technology	0.4	0.2%	0.1	0.3%	0.2	0.2%		0.1%		0.0%		0.1%	0.4	0.2%	0.0	0.1%	0.4	0.3%
Geodetics, surveying	0.6	0.4%	-0.0	-0.0%	0.6	0.5%		0.1%		0.2%		0.1%	0.2	0.1%	0.0	0.0%	0.2	0.1%
Traffic engineering, traffic planning	0.0	0.0%	-0.0	-0.0%	0.0	0.0%		0.0%		0.0%		0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Other engineering sciences	1.3	0.7%	0.2	0.4%	1.1	0.8%		0.5%		0.3%		0.5%	1.9	1.1%	0.3	0.7%	1.6	1.2%
Farming, plant cultivation and protection	0.9	0.5%	0.2	0.5%	0.7	0.5%		0.1%		0.3%		0.0%	0.0	0.0%	0.0	0.1%	0.0	0.0%
Horticulture, orcharding	0.1	0.1%	0.0	0.0%	0.1	0.1%		0.0%		0.0%		0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Forestry	0.6	0.3%	0.2	0.5%	0.4	0.3%		0.1%		0.0%		0.2%	0.6	0.3%	0.1	0.3%	0.5	0.4%
Livestock breeding, animal production	0.2	0.1%	0.1	0.3%	0.1	0.1%		0.3%		0.1%		0.3%	0.3	0.2%	0.0	0.0%	0.3	0.3%
Other areas of agriculture and forestry	1.6	0.9%	0.3	0.7%	1.4	1.0%		0.0%		0.0%		0.0%	0.3	0.2%	0.0	0.0%	0.3	0.2%
Total life sciences and technology	78.7	44.7%	8.0	20.2%	70.7	51.8%	60.1	40.7%	10.8	31.1%	49.3	43.7%	68.3	39.8%	10.8	25.2%	57.6	44.6%
Total grants awarded		100.0%		100.0%		100.0%		100.0%		100.0%		100.0%	171.8	100.0%	42.7	100.0%	129.1	100.0%

Table 25: FWF: Trend of funding of life sciences (€ million)

	2008						2009						2010					
	Total	Share	Women	Share	Men	Share	Total	Share	Women	Share	Men	Share	Total	Share	Women	Share	Men	Share
Anatomy, pathology	3.3	1.9%	0.5	1.2%	2.8	2.0%		1.8%		2.0%		1.8%	1.9	1.1%	0.9	2.0%	1.1	0.8%
Med. chemistry, med. physics, physiology	6.6	3.8%	1.7	4.2%	5.0	3.6%		4.5%		3.8%		4.7%	10.3	6.0%	2.2	5.1%	8.1	6.3%
Pharmacy, pharmacology, toxicology	1.6	0.9%	0.1	0.2%	1.5	1.1%		1.3%		1.5%		1.2%	6.1	3.5%	0.7	1.6%	5.4	4.2%
Hygiene, med. microbiology	3.1	1.7%	0.7	1.8%	2.4	1.7%		3.7%		5.1%		3.3%	6.0	3.5%	2.8	6.6%	3.1	2.4%
Clinical medicine	2.2	1.3%	0.5	1.3%	1.7	1.3%		1.5%		1.4%		1.6%	2.0	1.1%	1.0	2.3%	1.0	0.8%
Surgery and anaesthesiology	0.3	0.2%	0.0	0.1%	0.2	0.2%		0.0%		0.0%		0.0%	0.4	0.2%	0.0	0.0%	0.4	0.3%
Psychiatry and neurology	1.1	0.6%	0.4	1.0%	0.7	0.5%		0.4%		0.4%		0.4%	3.1	1.8%	0.5	1.3%	2.6	2.0%
Court medicine	0.0	0.0%	0.0	0.0%	0.0	0.0%		0.0%		0.0%		0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Other areas of human medicine	0.7	0.4%	0.2	0.4%	0.6	0.4%		0.6%		1.5%		0.3%	1.5	0.9%	0.4	1.0%	1.1	0.9%
Veterinary medicine	0.6	0.3%	0.3	0.6%	0.3	0.2%		0.4%		0.2%		0.5%	0.4	0.2%	0.3	0.7%	0.1	0.1%
Biology, botany, zoology	41.3	23.5%	16.8	42.6%	24.5	17.9%	34.0	23.0%	8.0	23.1%	26.0	23.0%	38.2	22.2%	14.0	32.8%	24.2	18.7%
Total life science	60.8	34.5%	21.1	53.4%	39.7	29.1%	55.2	37.4%	13.6	39.1%	41.6	36.8%	69.8	40.7%	22.8	53.4%	47.1	36.5%
Total grants awarded		100.0%		100.0%		100.0%		100.0%		100.0%		100.0%	171.8	100.0%	42.7	100.0%	129.1	100.0%

Table 26: FWF: Development of funding of humanities and social sciences (€ million)

	2008						2009						2010					
	Total	Share	Women	Share	Men	Share	Total	Share	Women	Share	Men	Share	Total	Share	Women	Share	Men	Share
Philosophy	1.3	0.8%	0.2	0.4%	1.2	0.9%		1.4%		0.5%		1.7%	2.1	1.2%	0.5	1.2%	1.6	1.2%
Theology	0.6	0.3%	0.0	0.1%	0.6	0.4%		0.8%		0.1%		1.0%	0.8	0.5%	0.4	1.0%	0.3	0.3%
Historical sciences	10.0	5.7%	3.6	9.2%	6.4	4.7%		5.6%		9.3%		4.5%	8.0	4.7%	3.5	8.3%	4.5	3.5%
Linguistics and literary studies	3.8	2.1%	0.9	2.4%	2.8	2.1%		3.5%		5.2%		3.0%	3.6	2.1%	1.1	2.6%	2.5	1.9%
Other philological and culture sciences	3.1	1.7%	0.7	1.7%	2.4	1.7%		1.5%		1.0%		1.6%	1.7	1.0%	0.5	1.3%	1.1	0.9%
Art sciences	2.7	1.5%	1.1	2.8%	1.6	1.2%		1.7%		4.0%		1.0%	3.8	2.2%	0.4	1.0%	3.4	2.6%
Other	0.7	0.4%	0.4	1.0%	0.3	0.2%		0.8%		1.9%		0.5%	0.8	0.5%	0.3	0.6%	0.5	0.4%
Political science	2.6	1.5%	0.6	1.6%	1.9	1.4%		0.4%		0.3%		0.4%	0.5	0.3%	0.3	0.8%	0.2	0.2%
Jurisprudence	1.0	0.6%	0.3	0.8%	0.7	0.5%		0.5%		0.8%		0.4%	0.9	0.5%	0.3	0.6%	0.6	0.5%
Economics	3.9	2.2%	0.4	1.1%	3.4	2.5%		2.9%		0.7%		3.6%	3.7	2.2%	0.5	1.2%	3.2	2.5%
Sociology	2.4	1.4%	0.7	1.7%	1.7	1.3%		1.0%		3.0%		0.4%	1.5	0.9%	0.7	1.6%	0.8	0.7%
Psychology	1.5	0.9%	0.8	2.0%	0.7	0.5%		0.5%		0.8%		0.3%	1.4	0.8%	0.0	0.0%	1.4	1.1%
Physical planning	0.1	0.0%	0.0	0.0%	0.1	0.0%		0.1%		0.2%		0.0%	0.1	0.1%	0.0	0.0%	0.1	0.1%
Applied statistics	0.7	0.4%	0.2	0.4%	0.6	0.4%		0.0%		0.0%		0.1%	1.8	1.1%	0.2	0.5%	1.6	1.2%
Pedagogy, educational sciences	0.4	0.2%	0.1	0.3%	0.2	0.2%		0.5%		0.2%		0.5%	0.7	0.4%	0.1	0.2%	0.6	0.4%
Other	2.0	1.1%	0.3	0.9%	1.6	1.2%		0.8%		1.6%		0.6%	2.2	1.3%	0.2	0.5%	2.0	1.5%
Total humanities and social sciences	36.6	20.8%	10.4	26.4%	26.1	19.1%	32.3	21.9%	10.3	29.8%	22.0	19.5%	33.6	19.6%	9.1	21.4%	24.5	18.9%
Total grants awarded		100.0%		100.0%		100.0%		100.0%		100.0%		100.0%	171.8	100.0%	42.7	100.0%	129.1	100.0%