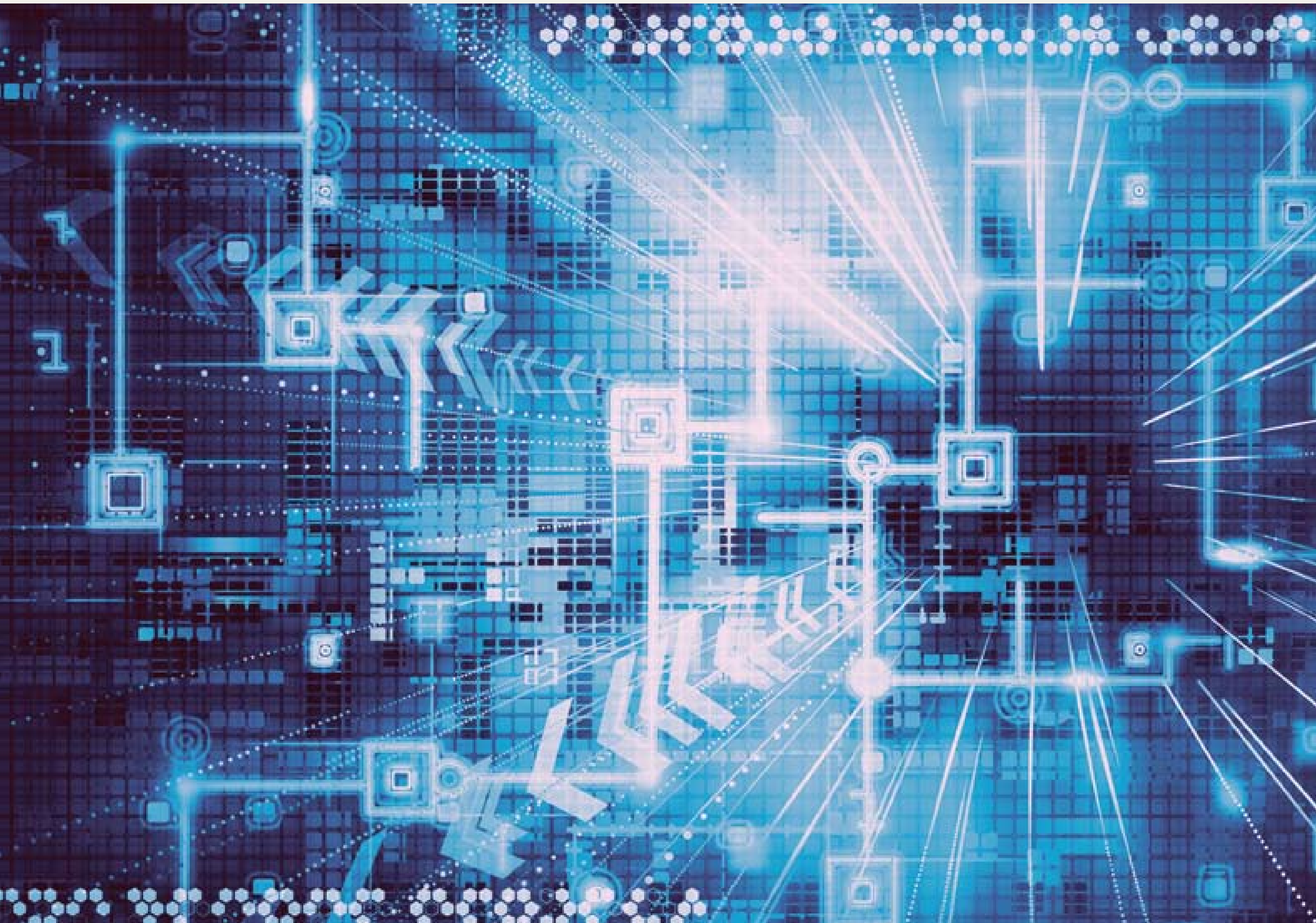
Austrian Research and Technology Report 2009

Report of the Federal Government to the Parliament (National Council) under Section 8 (2) of the Research Organisation Act, on federally subsidised research, technology and innovation in Austria



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Preface

In times of crisis and global change, science, research and development are a particularly important focus for the new federal government because investments in research and development are effective long-term and sustainable investments in the country's prosperity and future potential. Austria has completed an impressive catching-up process over the past few years that has brought us up among the leading European countries as far as expenditure on research and development is concerned. Despite the economic crisis, we are ambitiously approaching our goal of investing 3% of our GDP by 2010 in research and development – and thus in our future.

To secure the success of the past few years and to stand our ground in competition with the world's growth regions we need to hold a broad discussion about the future strategic orientation of our research and innovation policies. Building on the Austrian Research Dialogue and the evaluation report about Austrian research promotion presented by the Austrian Institute of Economic Research (WIFO), the federal government will work out a long-term strategy for research in Austria.

In order to decide what path to follow in the future, it is important to have as comprehensive a view as possible of the current situation. In this regard, we also consider the 2009 Research and Technology Report to be an important part of the strategic process ahead of us. Of course, the Research and Technology Report also offers its usual excellent and broad overview of Austrian research and innovation and will thus help to reinforce a fact-based political discussion about the importance of research and development.

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Executive Summary

The Research and Technology Report 2009 is issued by the Austrian federal government and provides an overview of the latest developments in the field of research, technology and innovation (RTI). Current data, findings and assessments are used to identify central trends in the Austrian innovation system and draw international comparisons in selected areas. This report was commissioned by the Federal Ministry of Science and Research (BMWF), the Federal Ministry of Transport, Innovation and Technology (BMVIT) and the Federal Ministry of Economy, Family and Youth (BMWFJ). All input was discussed and agreed upon in interministerial workgroups in which all the offices were represented.

Trend of R&D share of GDP

According to the current global estimate of Statistics Austria, the expenditures for research and experimental development carried out in Austria in 2009 will total more than € 7,652 billion. This global estimate sees total R&D expenditures in Austria rising 1.8% over 2008, suggesting a significant weakening in 2009 of Austria's exceptionally robust R&D growth trajectory of recent years. However, the expected decline in GDP will probably lead to a further increase in the R&D ratio from 2.66% (2008) to 2.73% (2009). The private sector, for years the driving force behind the financing of research and development in Austria with its high R&D growth rates, is now abruptly losing its momentum amid the financial and economic crisis. Financing from this source (and from abroad) is actually expected to decline. The federal government (and, at a lower absolute level, the states) is now taking over the leadership role in the trend of R&D financing in Austria. Despite – or because of – the crisis, the public sector is able to further increase its R&D financing to a quite substantial degree of about 9%. Although Austria is managing to further increase its R&D share of GDP in 2009, current figures under conditions as they now stand suggest that the 3% target will no longer be achievable in 2010.

Relationship between economic development and R&D

The abrupt deterioration of the economic situation both globally and in Austria that began in the autumn of 2008 is redefining the question of what impact the worsening recession in 2009 will have on R&D spending generally and in the corporate sector specifically. The economic situation, characterised by increasing uncertainty and investment restraint, also aggravates the overall conditions for investments in research and development. The results of an econometric panel regression across 14 countries show that research spending in general and of the corporate sector in particular run parallel to the economy (procyclically). There are indications that in bad times, R&D spending in the corporate sector actually shrinks more than the GDP. A significant decline in R&D spending in the corporate sector must therefore be expected under current economic assumptions. It is difficult to estimate the extent of this possible decline for Austria because (i) R&D expenditures are heavily concentrated on a few large corporations, and (ii) it is not possible to adequately estimate the reaction of the large foreign component in R&D financing. It is likely that this share will react disproportionately to declines in GDP. Given a GDP decline of about 2% in the EU, a drop of 3–5% in the volume of financing from abroad in Austria could certainly be expected based on the considerations presented here. The analysis of historical trends in the 14 comparison countries also shows, however, that government financing of research projects – possibly in connection with anti-cyclical measures – has increased in recessionary times. The results here (i.e., given a GDP decline of about 2%) show a growth in government expenditures by about 0.5–1.0%.

Austrian position in European Innovation Scoreboard

The current European Innovation Scoreboard (EIS), methodologically improved and based on powerful indicators, ranks Austria in sixth place in 2008. This puts Austria at the top of the group of 'Innovation Followers'. Ahead of Austria is the group of 'Innovation Leaders' – Sweden, Finland, Germany, Denmark and the United Kingdom. Austria has nearly closed the gap to the Innovation Leaders.

At the level of the individual indicators, the EIS 2008 confirms the known strengths and weaknesses in the Austrian system of innovation. The strengths lie primarily in business, with significantly above-average scores on most innovation-related indicators. Weaknesses lie in the below-average scores in human resources, especially among graduates in technical and scientific fields. The EIS 2008 also confirms a weakness in risk financing.

R&D between 2002 and 2006

Since the results of the complete R&D survey of 2006 were made available, it has been possible to draw intertemporal comparisons. The findings show that between 2002 and 2006, overall R&D spending rose 35% and the number of units performing R&D rose 17%. The corporate sector in particular shows the highest rates of increase for these two indicators (+42% for R&D spending and +24% for the number of companies doing research). These rates of increase – especially in the number of companies doing research – indicate that the research base of the Austrian economy will continue to expand in the future.

The financing structures of overall R&D spending were relatively stable in the period under review. An interpretation based on content and institutions shows that the corporate sector (domestic and foreign companies together) finances 65% of overall research expenditures in Austria. This percentage is consistent with OECD and EU averages.

With a 32% share of R&D expenditures in the corporate sector and an R&D intensity (R&D spending share of gross value added) of 22%, the high-tech sector plays the most important role in manufacturing. On the other hand, research- and technology-intensive services saw the highest growth; their R&D

share of gross value added rose from 11% to almost 17%, and 14% of all R&D spending came from this sector in 2006.

R&D expenditures in the higher education sector rose +20% in the aforementioned period. The volume of funding from the public sector – the most important source of funds for R&D in the higher education sector – rose +17%. The rise in R&D financing in the corporate sector by the public sector was significantly higher at +55%, however. Taking into account the research premium (nearly € 156 million in 2006), the public sector finances 10% of R&D expenditures in the corporate sector. The ratio of the financing of business R&D (€ 428 million) to the financing of university R&D (€ 1,355 million) by the public sector was thus about 1:3 in 2006.

Between 2002 and 2006, the number of employees in the R&D segment increased +28% to 84,000 (headcount), corresponding to 49,000 full-time equivalents. The percentage of female R&D employees did increase slightly between 2002 and 2006, but it is still relatively low at 29% (headcount). The gender-specific analysis of science personnel at the universities, however, shows that the percentage of women among younger age groups – up since 2002 – remains consistent throughout their career.

Perspectives and assessments of the Austrian system of innovation

The Austrian system of innovation was the subject of assessments, discussions and a comprehensive evaluation in 2008/09. Whereas the broad, comprehensive research dialogue attempted to address as many RTI topics as possible so as to offer the entire community a forum in which to discuss and exchange viewpoints, the CREST Policy Mix Expert Group represented the outside perspective. The 24 recommendations are guided by the idea that a common and integrated vision is lacking and that Austria would benefit from the 'formulation of integrated R&D- and innovation-oriented strategies and the resulting articulation of a coherent policy mix'.

This report includes a presentation of key results that emerged from the system evaluation. These results are based on analyses conducted as part of the system evaluation. Conclusions and recommendations still need to be discussed at the political level. The presentation focuses on the primary tools of promoting and financing research (direct subsidies and tax incentives for R&D). One finding is that the extent of tax incentives was overestimated in recent years. Contrary to the estimates of the Austrian Court of Audit and the Federal Ministry of Finance, the costs of R&D tax incentives are somewhat above € 250 million at constant prices. As for the target groups of the tax incentives, the studies conducted as part of the system evaluation show that companies with more than 100 employees represent some 40% of recipients of the old research allowance and 30% of recipients of the new research allowance. These companies availed themselves of about 90% of the total tax incentives from the old and new research allowance in 2005. Meanwhile, the introduction of the research premium led to an expansion in the use of tax incentives. Many of the newcomers are small and medium-sized enterprises (SME), who are also the main beneficiaries by volume of the research premium.

As far as the direct promotion of research goes, we see that different intervention and activity logics lead to an overlapping of supply among the target groups. The results of the analysis thus suggest that better and more flexible intercoordination of available subsidies could increase the fiscal effect of the direct promotion of research. In terms of user satisfaction, the results suggest that the oft-cited 'funding jungle' is not perceived that way by users. Instead, the studies show that users navigate the system very easily. Results suggest that users move through the system with the objective of maximising the likelihood of funding and the amount of funding commitments. The 'funding jungle' is thus revealed in a positive sense to be more akin to a 'funding supermarket'. The evaluation's studies also suggest that the programmes' objectives and mandates need to be more clearly defined. They should also be directed more strongly toward excellence and radical innovation.

The analysis of the interaction of direct subsidies and tax incentives shows that both types of funding are needed. The finding that the interaction of direct and indirect subsidies has a positive effect on the success in promoting highly dynamic companies involved in RTI is very robust and agrees largely with international findings on the interaction of direct and indirect research subsidies. Further results of the system evaluation show that the lack of highly qualified human resources at all levels creates a bottleneck and presents the major challenge to policymakers. In general, the analyses show that the entire policy of promoting and funding research needs to be combined to a greater degree with other areas of policy that affect innovation – education, financing, etc.

Research and education in the higher education sector

Approximately 0.41% of GDP is currently allocated to basic research. This puts Austria in the middle of the field in international comparison. Taking into account Austria's good position in terms of the general share of GDP spent on R&D, however, one sees a somewhat inadequate allocation of resources for basic research. At present, only 17% of all R&D expenditures is dedicated to basic research (35% for applied research and 47% for experimental development), placing Austria at the lower end of the OECD countries that have provided this data. The higher education sector accounts for 70% of basic research, giving the public sector a special responsibility in financing. It is therefore an important objective of the federal government to provide appropriate financing and to shield this financing from economic fluctuations.

Public financing is also necessary to support the research training of university graduates. University graduates have a special significance, bringing new expertise into the corporate sector and building the foundation for innovation and competitiveness. However, the indicators used in the report suggest a shortage of graduates, especially in science and engineering, that will intensify in the near future. The speed with which knowledge becomes outdated and the need for high technological expertise make it necessary to continually expand, adapt and renew a society's human capital. Missed opportunities in this field cannot be compensated over the short to medium term, since changes of course in the qualification system have a very long response time and produce results only after many years.

Qualification structure of immigrants

Austria has specific problems with regard to the qualification structure of those born abroad. Austria is the OECD country with the lowest percentage (11.3%) of university graduates among those born abroad, especially in the group of the highly qualified. International comparisons also show Austria as a country with an above-average percentage of foreign students, however. Foreign students account for 11.5%, the fourth-highest level among the 23 OECD states for which such data is available. Austria can be described as a country in which a large number of foreigners study but in which only a small percentage of highly qualified immigrants live.

The data from the employee survey shows that Austria's foreign-born population is still concentrated on the two extremes of Austria's general population, with below-average percentages of people in the mid-level qualification segment.

Efforts by immigration policymakers in recent years to attract more highly qualified employees may have contributed to a slight improvement in the educational structure among immigrants. But highly qualified persons of foreign origin have significantly higher rates of unemployment than those born in Austria and are also more likely to work below their level of qualification: About half (47%) of foreign-born university graduates work in a profession below their level of qualification. Among those born in Austria, this figure stands at 29%. This trend is especially prevalent among university graduates, immigrants from traditional guest-worker countries, those who immigrated after the age of 20 and those who immigrated from 1989 to 1993.

The opportunities for changing this situation lie first in making Austria an attractive destination for highly qualified workers and also in immigration policy interventions toward greater selection of immigrants based on educational criteria. Action is also needed to facilitate the acceptance of foreign qualifications in Austria (recognition of formal educational degrees awarded abroad). Aside from linguistic integration, several unique institutional attributes of the Austrian labour market seem to present a significant hurdle. Two target groups with special needs are women and those who immigrate between the ages of 16 and 19. With the first group, the aim is to reduce the double discrimination that highly qualified foreign-born women face on the job market. With the second group, the discontinuity in the educational path that immigration creates often leads to school dropouts. The school system should therefore integrate a comprehensive strategy to qualify those born abroad.

Growth and structural change

Overall economic growth is determined by many factors. The existing industry structure plays a special role here, and the significant influence of the shares of both technology- and human capital-intensive industries on overall economic growth was confirmed in a series of studies. Austria had a structural deficit in this area in the 1990s despite high rates of growth (structure-performance paradox). More recent and comprehensive analyses show that Austria underwent a pronounced change in favour of knowledge-intensive production branches from 1995 to 2005, lessening the deficit in innovation-intensive sectors. But other countries also saw structural changes, so that a gap remains between Austria and the EU15 countries in the group of education-intensive sectors despite the accelerated shift in industry specialisation. In addition to ongoing efforts in innovation policies, therefore, economic policymakers will have to increasingly shift their focus to the quality and efficiency of education.

Innovation in the corporate sector

Businesses innovate through diverse and open processes. An international study empirically demonstrated the positive effect of innovation on productivity. Businesses are also increasingly open to external stimuli to raise the efficiency and effectiveness of investments in R&D and innovation.

The current crisis on the financial markets and the expected recession now represent serious barriers for businesses: The reduction in business profits also makes the financing of innovations much more difficult, while falling demand hinders the introduction of new products to the market. At the same time, innovative companies can also use altered market conditions as an opportunity to generate new demand and reposition themselves among the competition through innovations – for example, by reorganising internal workflows and using the resulting gains in productivity to develop new and more efficient products. The resources made available in times of declining capacity utilisation can be used to invest in the future, opening up a special role above all for highly qualified employees. It is a company's internal expertise that further advances innovation projects in an economic downturn, allowing it to face the competition with a new product portfolio and more efficient processes when the economy rebounds. This triggers additional demand and sets new growth impulses for the entire economy.

Creative industries

The creative industries can be viewed as an important growth sector overall, and their general economic impact can no longer be underestimated. After all, one out of ten companies and one out of twenty employees falls under the creative industries, which accounts for 5% of overall value added. The creative industries can also be classified as a cross section whose products and services are used primarily in other industries and are therefore responsible for providing important incentives to the overall economy. In addition to the direct contribution their own innovations make to innovative activity, the creative industries also perform an important function in Austria's innovation system through other mechanisms. The creative industries employ human capital of above-average qualifications and exhibit an above-average mobility of personnel. Employees in the creative industries regularly change branches, thus offering their creative abilities to other industries.

Start-ups by women

The trend of professional independence and business start-ups by women has been very dynamic in recent years. The share of women in start-ups in recent years grew nearly 14 percentage points. By 2007, one of three start-ups was founded by a woman. But gender-specific differences persist in the choice of industries. The percentage of high-tech companies founded by women is just under 10% in Germany, and it is assumed to be low in Austria as well. This is an expression of the specific academic and professional choices women make but also a result of societal barriers.

Evaluation in Austria

The report of the CREST review confirms that 'Austria now has one of the most developed and integrated innovation evaluation cultures in Europe'. A developed evaluation culture represents a core component of an improving and strategically oriented RTI policy. It is also a prerequisite and consequence of good policy – efficient, transparent and fair. The diversity of programmes that exists in Austria and the resulting volume of evaluations can also lead to 'paralysis through analysis'. Evaluations only serve their purpose if their results are introduced into the formulation and practice of future policy and if appropriate mechanisms are in place to ensure this.

1 Current Trends in Research and Technology

1.1 Current Trends of R&D Expenditures in Austria

1.1.1 Results of the global estimate for 2009

According to the current global estimate by Statistics Austria, the expenditures for research and experimental development carried out in Austria in 2009 will total more than € 7.652 billion. It should be noted here (and this applies to all following sections as well) that, due to the global financial and economic crisis, this year's forecast is fraught with an exceptionally high amount of uncertainty. These uncertainties relate to both the estimation of GDP for 2009 as well as the estimations for the R&D spending of the respective performance and sources of funds (except those of the federal government which are rooted in the relevant budget act).

Compared to 2008, this result of the global estimate means that Austria's total R&D expenditures will rise by 1.8% – suggesting a significant weakening of Austria's exceptionally robust R&D growth trajectory of Austria of the last few years. However, the expected decline in GDP will probably lead to a further increase in the R&D ratio from 2.66% (2008) to 2.73% (2009) (see Figure 1).

With respect to R&D expenditures, the anticipated consequences of the global financial and economic crisis will have the most noticeable impact on the developments of the individual sources of funds. While the federal government (and the states) will continue to increase their R&D financing, financing by the private sector and from abroad (the most important factor here is the financing of R&D activities of Austrian subsidiaries by their foreign parent companies) will decline. The federal government and the states are expected to spend € 2,947 billion for R&D in 2009; of that amount the federal government will account for € 2,545 billion (+ 8.9%) and the states € 0,402 billion (+ 9.5%). This is in contrast to private sector financing of € 3,440 billion (-1.3%) and € 1,132 billion (- 6.2%) from abroad. R&D financing of € 0.133 billion (+ 9.6%) is expected in the remainder category "miscellaneous" (local governments excluding Vienna, chambers and social insurance carriers as well as the private non-profit sector).

The results of the global estimate thus show that the financial and economic crisis will impact the development of R&D financing in the following manner:

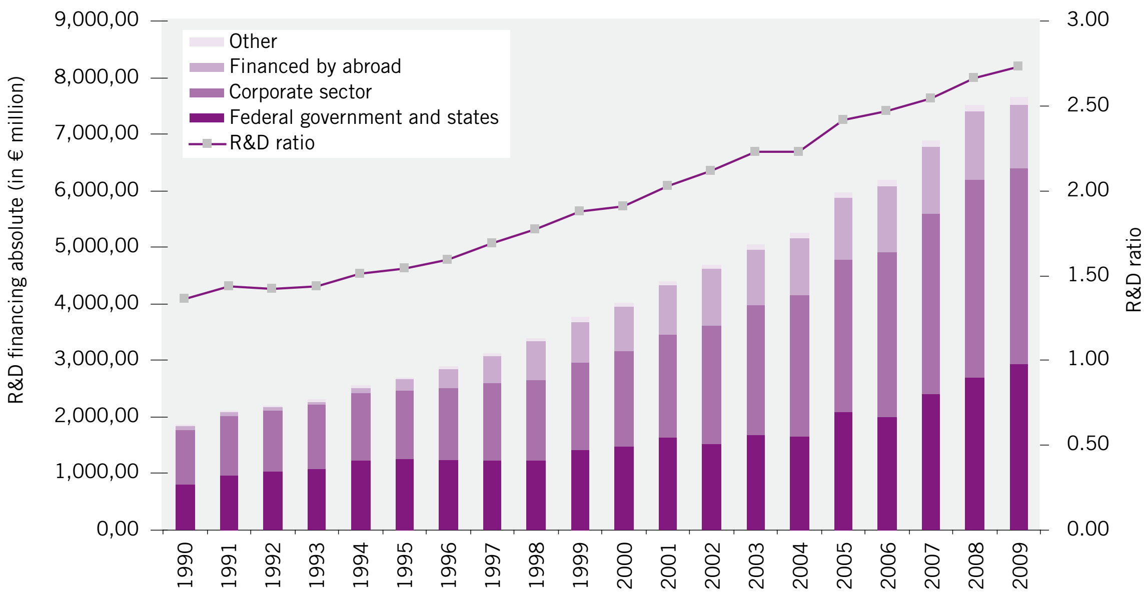
- After having been the driving force for the financing of research and development in Austria for many years with high R&D growth rates, the momentum in the private sector is now coming to an abrupt end and yet a further decline of financing from this source is to be expected.
- Foreign sources of funds consolidated at a high level in 2002; since that time the growth rates have been lower while still at a positive level. However, the portion of R&D financing from abroad for research in

Austria must also be expected to decline in 2009 as well. This decline is attributable to the reduced financing of multinational corporations to support the R&D activities of their Austrian subsidiaries.

- The federal government (and also including the states at a lower absolute level) is now taking over the leadership role as far as the development of R&D financing in Austria is considered. Despite – or because of – the crisis, the public sector is able to further increase its R&D financing to an entirely substantial degree of approximately 9%.

In combination with the falling GDP, which is used as the divisor in the calculation, Austria will in sum succeed in further increasing its R&D ratio in 2009. Due to the present figures or estimates under the conditions as they now stand, it will no longer be possible to achieve the 3% target in 2010.

Figure 1: Research and development in Austria by source of funds



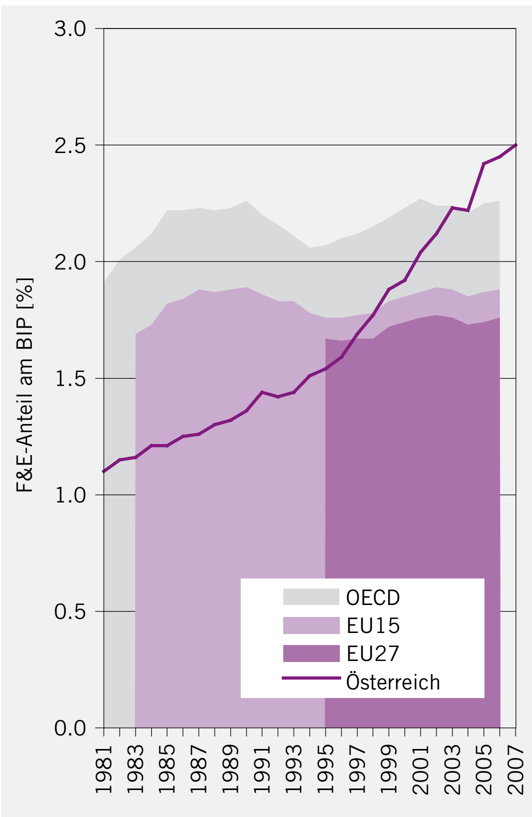
Source: Statistics Austria, Global Estimate 2009 – as of: 4. May 2009

International comparison of R&D ratios

For reasons of data availability and comparability, it was necessary to base an international comparison of the development of the R&D ratios on the period from 2000 to 2006. For Austria, the € 6.3 billion in research expenditures in 2006 meant a research ratio of 2.45% of GDP (gross domestic product), up from 2.12% in 2002 and 2.22% in 2004. Austria's progress over the last few years with regard to the objective of achieving a research ratio of 3% of GDP by 2010 has been quite impressive. Starting from a clearly below-average research ratio in the 1980s (1.1% of GDP in 1981 compared to an EU15 average of 1.64%), Austria has continuously raised the ratio – and at an especially rapid rate since

1995. It surpassed the EU15 average in 1998 (now at 1.83%). Austria has also exceeded the average of the OECD states since 2004. Of the EU (and OECD) states shown in Figure 2, Austria exhibits the greatest change at +0.53 percentage points. It is also clearly evident why the R&D ratio is stagnant on a European level. As the large member states such as France (-0.04 percentage points) and United Kingdom (-0.07 percentage points) have declined and Germany (+0.08 percentage points) and Italy (+0.04 percentage points) have only achieved marginal increases, the R&D ratio for Europe has hardly changed at all. The EU is farther than ever from achieving the ambitious target of an R&D ratio of 3% for 2010.

Figure 2: Development of R&D expenditures as a percentage of gross domestic product by country



	2000	2006	ø (2006–2000)
Belgium	1.97	1.83	- 0.14
Denmark	2.18 (1999)	2.43	+ 0.25
Germany	2.45	2.53	+ 0.08
Finland	3.34	3.45	+ 0.11
France	2.15	2.11	- 0.04
Greece	0.60 (1999)	0.57	- 0.03
United Kingdom	1.85	1.78	- 0.07
Ireland	1.12	1.32	+ 0.20
Italy	1.05	1.09 (2005)	+ 0.04
Netherlands	1.83	1.67	- 0.16
Norway	1.64 (1999)	1.52	- 0.12
Poland	0.64	0.56	- 0.08
Portugal	0.76	0.83	+ 0.07
Sweden	3.57 (1999)	3.73	+ 0.16
Slovak Republic	0.65	0.49	- 0.16
Spain	0.91	1.20	+ 0.29
Czech Republic	1.21	1.54	+ 0.33
Hungary	0.78	1.00	+ 0.22
Canada	1.92	1.94	+ 0.02
Japan	3.04	3.39	+ 0.35
Switzerland	2.53	2.90 (2003)	+ 0.37
USA	2.74	2.62	- 0.12
OECD	2.23	2.26	+ 0.03
China	0.90	1.42	+ 0.52

Source: OECD (MSTI), Calculations by Joanneum Research

1.1.2 Financing and performance of R&D in Austria

Statistics Austria performed a complete survey of the institutions that implement R&D in all sectors of the economy for 2006. This makes it possible to analyse the flows between sectors of performance and sources of funds as well as an estimate of the interdependencies of the individual sectors.

The statistics differentiate between four sectors of performance (higher education sector, state sector, private non-profit sector and corporate sector) and four sources of funds (public sector, corporate sector, private non-profit sector and abroad). It should be noted that the higher education sector is not a source of funds, and that because this is a domestic model, by definition "abroad" cannot be one of the sectors of performance. The "corporate sector" was broken down further for this analysis: firstly, the business sector (includes primarily the companies of the producing segment – producing for the market with the intention of generating income or other financial benefit – and the service segment) and secondly the cooperative sector (service institutions that do research and experimental development for companies. The majority of these do not have the intention of generating income or other financial benefit, such as the members of the Association of Cooperative Research Institutions of the Austrian Economy – ACR, the Austrian Research Centers – ARC, Joanneum Research or the competency centres).

Table 1 below outlines the breakdown of all R&D expenditures for 2006 by sectors of performance and sources of funds.

Table 1: R&D expenditures broken down by sector of performance and source of funds (2006)

Sectors of performance	in € million	Share in %	Sources of funds	in € million	Share in %
Corporate sector	4,448	70.4	Corporate sector	3,057	48.4
Cooperative sector	*428*	*6.8*	Public sector	2,071	32.8
Business sector	*4,020*	*63.6*	Private non-profit sector	27	0.4
Higher education sector	1,523	24.1	Abroad	1,163	18.4
State sector[1]	330	5.2	*excluding EU*	*1,059*	*16.8*
Private non-profit sector[2]	17	0.3	*EU*	*104*	*1.6*
Total	6,318	100.0	Total	6,318	100.0

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

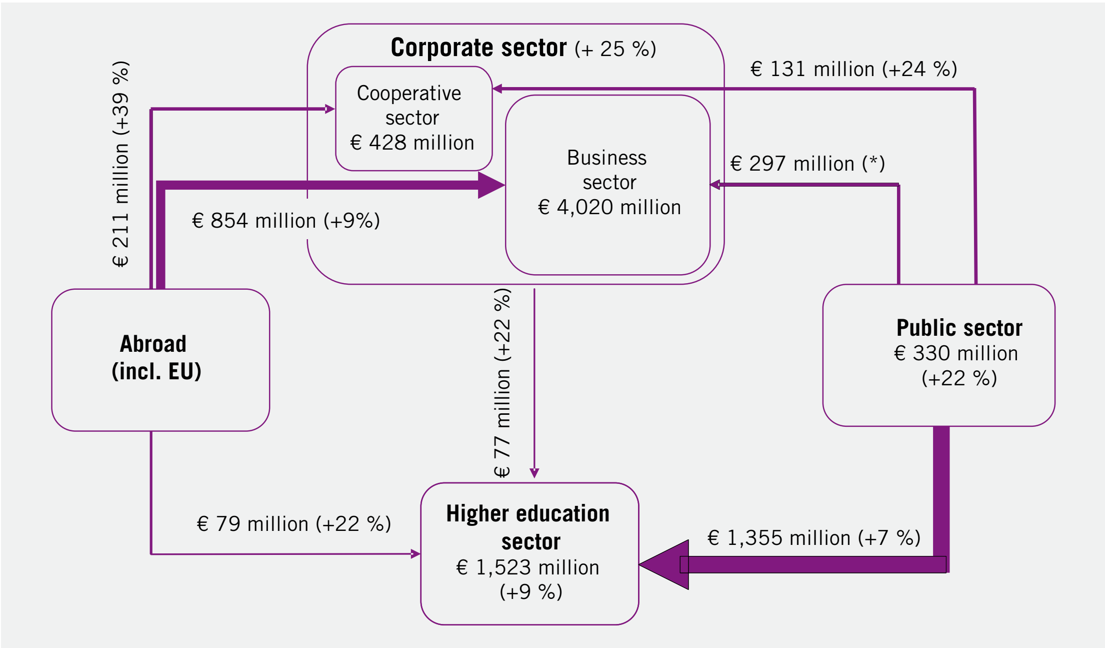
2 Private non-profit institutions whose status is predominantly private or under civil law, sectarian or other non-public.

Source: Statistics Austria, calculations by Joanneum Research

For a presentation of the interdependencies in the financing flows ("what is financed by whom"), Figure 3 shows an appropriate matrix with the following information for 2006:

- The R&D expenditures of the individual sectors of performance are shown in the box.
- The figures next to the arrows show the volume of financing.
- The percentages illustrate the change compared to 2004.[1]

Figure 3:Performing and financing of R&D in Austria for 2006 (versus 2004)[2]



* This financing flow cannot be compared with 2004. For an explanation, see the explanatory notes in the primary text. Rounded to millions.

Source: Statistics Austria; Calculations by Joanneum Research

The expenditures of the corporate sector for R&D thus totalled € 4,448 million (4,020+428) in 2006, reflecting a +25% increase compared to 2004. On the other hand, the higher education sector increased its R&D expenditures by 9% to € 1,523 million. At almost 95%, these two sectors provide the greatest share of the total national R&D expenditures (Table 1). How are these expenditures financed?

There are three significant financing flows. The first of these flows is the self-financing of the corporate sector, which finances the greatest share of its R&D activities itself (the public sector finances a total of € 428 million (297+131), and € 1,065 million (211+854) flow into the corporate sector from abroad). The corporate sector finances the remaining two thirds (€ 2,955 million) itself.

1 A comparison with the years 2004, 2002 and 1998 requires the use of earlier research and technology reports.
2 In the interest of clarity and due to its low proportion, the private non-profit sector was not considered in the breakdown.

In the case of direct public financing of business R&D, the 2006 survey recorded the research premium[3] separately for the first time and is thus – following the concept of the Frascati Manual[4] – part of the public sector financing (see in this regard Schiefer 2008). For this reason, it is only possible to a limited degree to compare the public sector financing using the previous surveys. The volume of the research premium amounted to € 156 million and thus represents the most important source of financing. After deducting the research premium, the public financing component for 2006 is € 272 million (131+297-156) which is comparable with the 2004 value (€ 229 million). This type of calculation results in an 18.8% increase of public sector financing of corporate sector R&D. However, if the research premium is legitimately included, the public sector finances almost 10% of the corporate sector R&D at a volume of € 428 million. The following table shows a detailed breakdown of the financing of the R&D expenditures in the corporate sector in 2006:

Table 2: Financing of the R&D expenditures in the corporate sector in 2006 (in thousands of euros)

			Cooperative sector	Business sector	Total
		Number of survey units performing R&D	52	2.355	2.407
Financing sources/segments		Corporate sector[1]	86,277	2,868,463	2,954,740
	Public sector	Fed.Gov.[2]	75,391	22,140	97,531
		Research premium	2,609	153,145	155,754
		States	20,779	16,798	37,577
		FFG[3]	24,309	91,401	115,710
		Other public financing[4]	7,995	13,495	21,490
	Abroad	EU	11,014	22,919	33,933
		International organisations	849	9,040	9,889
		Affiliated companies abroad	105,418	687,759	793,177
		Other companies from abroad	93,685	132,706	226,391
		Others[5]	166	2,318	2,484
		Total	428,492	4,020,184	4,448,676

1 Includes companies' own capital, funds raised in the capital market, loans from public sector development funds and funds from other domestic companies;
2 Includes the funds financed directly by the federal government (the federal offices), i.e. development funds (subsidies, allowances) as well as payments for research projects commissioned by the federal government. Examples of promotional programs of the federal government include the "stimulus programmes" of the Federal Ministry for Transport, Innovation and Technology, such as "FIT-IT" (information technology) or "Sustainable Economic Management". The management of the promotional programmes and the processing of the subsidies is frequently performed by outside institutions and not directly by the federal offices. Independent of the processing office, all development funds from support programmes are listed under "federal government".
3 Contains only subsidies (also including loan cost subsidies) awarded by the FFG to research projects of companies. These are primarily funds from the "general programmes" or from the " general funding" of the FFG or subsidies for cooperation projects under the EUREKA programme. The amounts actually paid are shown and not the "cash values". So-called "second-stage subsidies" to FFG supported R&D projects from development funds of the provinces or their outsourced funds are subsumed under "States" or "Miscellaneous". In regional development areas there is the further possibility of cofinancing of supported R&D projects from funds of the "European Fund for Regional Development" (EFRE). These funds are included in "EU". Supported loans of the FFG are contained in the "corporate sector".
4 Includes funds from local governments, chambers, social insurance carriers and other public financing;
5 Includes Private non-profit sector

Source: Statistics Austria, Schiefer (2008)

3 The research premium is an instrument of indirect research promotion. Since calendar year 2002, it has been possible for businesses (as an alternative to the research tax allowance) to apply for a research premium in the maximum amount of 8% of the R&D expenditures. As the research premium – in contrast to the two types of the research tax allowance – represents a direct transfer to a company's tax account, the Frascati Manual requires this type of financing to be subsumed under the „government sector" source of funds.
4 The Measurement of Scientific and Technological Activities. Proposed Standard Practice for Surveys on Research and Experimental Development. Frascati Manual 2002, Paragr. 393, S. 114 f., OECD, Paris 2002.

The second most important financier of research and development in Austria is the public sector – regional administrative bodies (i.e. the federal government, states, local governments, chambers and social insurance carriers). The public sector funds primarily benefit the universities and own research in the public sector. Compared to 2004, the R&D financing volume in the higher education sector rose by 7% to € 1,355 million. The ratio of the financing of business R&D (€ 428 million) to the financing of higher education R&D (€ 1,355 million) is thus 1:3.

The third most important source of funds is the foreign sector. This sector comprises both the funds of companies abroad and international organisations for R&D in Austria as well as the return flows from the EU framework programmes. To obtain a differentiated picture, € 104 million of the total volume of € 1.2 billion from the foreign sector must be attributed to the EU. At € 52 million, the higher education level sector is the primary recipient of the EU financial resources. Overall, the EU finances 1.6% of the total Austrian R&D expenditures.

The following developments should be noted in particular:

- Of all sectors of performance, the corporate sector most clearly increased its R&D expenditures at +25%. This is also reflected in the increase in public-sector financing of corporate sector R&D, which rose by +18.8% compared to 2004, and was thus significantly higher than the state financing of R&D in the higher education sector (+7%).
- In sum, the research premium finances 3.8% of R&D in the business sector.
- The cooperative sector reported an expenditure volume of € 428 million in 2006. This volume was predominantly financed by the public sector (€ 131 million) and the foreign sector (€ 211 million), which adds up to 80%. This produces a distorted picture due to the fact that in addition to the competence centres, the two largest research institutions outside of universities (Austrian Research Centers and Joanneum Research) are included in the sector. However, their financing structures are not consistent with this picture. The reason for this distortion lies in the criteria of statistical convention: Due to its extraordinary membership in Austrian Cooperative Research (ACR), AVL-List GmbH is also assigned to the "cooperative sector"[5].

1.1.3 The relationship between the business cycle and R&D expenditures

In view of the abrupt worsening of the economic situation of the global economy and the economy in Austria starting in autumn 2008, the question of what impact the further aggravation of the recession in 2009 will have on R&D expenditures in general and those of the corporate sector in particular is seen in a new light. The economic situation characterised by increasing uncertainty and investment restraint also aggravates the general framework for investments in research and development. The national and European credo of the positive impact of R&D on growth and employment must now be discussed from the other side as well, i.e. what factors influence R&D decisions and are the same time heavily de-

5 See: http://www.acr.at/61.0.html

pendent on the business cycle? A number of transfer mechanisms are currently being discussed in the literature[6], which in the estimation of the present situation and also of the goal of an increase of the research ratio to 3% of GDP (Barcelona goal) should also be taken into account (see also in this regard Schibany et al. 2006):

- The current economic situation influences the internal financing conditions of companies. In times of high and growing demand, the profitability of the companies is usually above average, and accordingly the possibilities for own financing of uncertain investments from cash flow are also high. A large number of R&D investments in companies are financed from cash flow.[7]
- Furthermore, the economic situation also influences the supply and demand situation in the capital markets. In light of the current development in the financial markets, companies (in particular SMEs) are confronted with special barriers with regard to the debt financing of R&D. Due to the high and very difficult to assess technical and commercial risks, lenders, in particular banks, are very reserved in the financing of R&D projects. R&D is frequently subject to severe credit rationing which also explains the generally low proportion of bank loans in R&D financing. The role nonetheless played by borrowing can be explained in that R&D projects are generally not defined explicitly according to financing possibilities but rather they are parts of a more comprehensive investment strategy.
- Alternative financing forms, such as risk capital, are of a particularly strong pro-cyclical nature. Private risk capital is generally easier to obtain in economic boom phases than in recessions due the strong inflow of investment capital. This is because of the expected pro-cyclical increase in enterprise values and the favourable exit options for venture capital investors via the equity markets (high price level).
- In the economic cycle, the prices for labour as a factor also change, the wages for high qualified employees being of primary importance for R&D decisions. As personnel expenses account for approximately half of R&D expenditures of the corporate sector, wage price changes also have repercussions on the decisions of companies with regard to expenditures for R&D.
- The most important influencing factor is the current development of overall demand in the companies' sales markets. Decisions concerning investments in R&D are taken in uncertainty, the future income from these investments being dependent not only on the "technological success" of the project but especially also on the future acceptance by the market and the demand for the new products resulting from the R&D project. Growing markets thus contribute to a stimulation of investment decisions while a current contraction of demand can limit the willingness to make investments in the future.
- Furthermore, these business cycle-dependent transfer mechanisms have varying impact on companies of different sizes. While SMEs have little latitude for partial adjustments due to indivisibilities of R&D activi-

6 Guellec and Ioannidis (1999), Guellec and van Pottlesberghe de la Potterie (2001), Le Bas (2001), Geroski and Walters (1995), Geroski and Machin (1993), Rammer et al. (2004).

7 On average, nearly two-thirds (64%) of total R&D expenditures in Austria are financed from cash flow (see Schibany and Jörg 2005, Schibany et al. 2004).

ties (minimum size of R&D projects), they have greater flexibility in realigning internal company resources (e.g. between R&D and innovation or other business areas such as production and sales). Due to their greater dependency on external financing sources (loans), SMEs have a different financing structure than large enterprises and are accordingly more severely affected by business cycle-related changes of the real interest rate. At the same time it must be assumed that their lower degree of internationalisation makes SMEs more strongly dependent on the domestic economy than large corporations; however, this makes little difference in a global crisis.

In the following, an attempt is made to find current references to a relationship between economic growth and R&D expenditures and – if possible – estimate them quantitatively.[8] To that end, R&D-relevant data from 14 countries[9] for the period 1981–2007 was used. The data was provided by the OECD in harmonised form.

Based on these 14 countries, an econometric panel model was estimated in which the long-term relationship between the (real) R&D expenditures and the (real) economic output (GDP) is modelled (both variables are estimated in logarithms; the estimated coefficient can therefore be interpreted directly as elasticity). As all time series exhibit definite trend characteristics, a cointegration model is estimated.[10] In doing so, the changes in R&D expenditures are modelled and estimated as a function of changes of GDP and the delayed (i.e. previous year's) deviations from this long-term relationship.

In addition, it is investigated whether evidence points to asymmetry of the R&D expenditures, i.e. whether the reaction of the research expenditures to the economic growth in recession years turns out to be different than in "normal" years. For that purpose, economic growth $\Delta\log(GDP)$ is included in the regression a second time but multiplied by a dummy variable DGDP having the value 1 if economic growth in a year was negative, and otherwise the value 0.

The model reads:

$$\Delta\log(R\&D\text{-}exp_{i,t}) = \alpha_i + \beta_1 \Delta\log(GDP_{i,t}) + \beta_2 [\Delta\log(GDP_{i,t})*DGDP_{i,t}] + \gamma [R\&D\text{-}exp_{i,t-1} - \delta_1 - \delta_2 GDP_{i,t-1}]$$

(i= country index; t= time index)

GERD, BERD, HERD and GOVERD are used for the R&D expenditures – in four different regressions.[11] If the assumption of a co-integrative relationship is true, the coefficient of the deviation variables γ must be significantly negative. β_1 measures the relationship between

8 The following comments are based on an econometric model developed by Gerhard Streicher (Joanneum Research) in connection with a research contact commissioned by the BMWF.

9 AUT, BEL, CAN, DEU, DNK, ESP, FIN, FRA, GBR, IRL, ITA, JPN, NLD, USA.

10 All time series, for both the (real) gross domestic product and also for the (real) research expenditures are strongly affected by trends; a unit root test delivers clear evidence that the time series are based on integrated stochastic processes. This is a problem if the use of integrated processes in econometric estimates can lead to spurious regressions – this can (but need not) have the result that an only apparent relationship is estimated between completely independent variables. To avoid this, it is possible to rely on instruments that were developed in the theory of "co-integrated processes". In simplified terms, a co-integrative relationship between integrated variables is estimated (and tested), which is then built into an error correction model; this error correction model is not estimated for the original variables but rather for their first differences (the difference between the value of one year and the previous year's value). This fulfils the statistical-mathematical requirements for avoiding the problem of spurious regression.

11 GERD=Gross Expenditure on R&D; GDP=Gross Domestic Product; BERD=Business Expenditure on R&D; HERD=Higher Education Expenditure on R&D; GOVERD=Government Expenditure on R&D

economic growth and research expenditures in "normal" years (i.e. those with positive economic growth); β_2 measures the difference between this relationship in normal years and recession years (the coefficient valid for recession years is therefore $\beta_1+\beta_2$).

The results are summarised in Table 3:

Table 3: Estimated results of the co-integration model

	dlog(GERD)		dlog(BERD)		dlog(HERD)		dlog(GOVERD)
α	0.02 (0.00)	***	0.02 (0.00)	***	0.04 (0.00)	***	-0.01 (0.01)
β_1	0.85 (0.11)	***	0.97 (0.16)	***	0.43 (0.15)	***	0.84 (0.15)
β_2	-0.42 (0.43)		0.71 (0.58)		-1.17 (0.63)	*	-2.37 (0.58)
γ	-0.23 (0.04)	***	-0.21 (0.04)	***	-0.37 (0.05)	***	-0.37 (0.04)
δ_2	0.98 (0.09)	***	1.33 (0.13)	***	0.69 (0.11)	***	0.44 (0.10)
R^2 / DW	0.41 / 1.31		0.37 / 1.19		0.34 / 1.42		0.33 / 1.73

Brackets contain the standard deviation of the estimator; ***, ** and * denote statistical significance on the 1.5 and 10% level

Source: OECD (MSTI), Calculations by Joanneum Research

The following conclusions can be drawn:

- In the long term, the development of BERD exceeds that of the GDP (δ_2=1.33 implies that for each 1%-increase in the GDP, BERD rises by 1.33%), GERD and GDP show practically identical growth rates over the long term (δ_2=0.98); HERD (and even more distinctly GOVERD) grow at a significantly lower rate than GDP (δ_2=0.68 and 0.44).
- In the short term, the estimated results imply that a 1% increase in real GDP leads to a 0.85% rise in GERD. An even clearer relationship with GDP can be estimated for BERD: A 1% increase in GDP is accompanied by a 0.97% increase in BERD – GDP and BERD follow a practically parallel course over the short term
- The assumption of a co-integrative relationship between economic output and research expenditures appears to be entirely justified. The coefficient of the delayed deviations from the long-term relationship is negative and statistically significant.
- With regard to asymmetry, BERD appears to contract more sharply than GDP in "bad times"; the other components of the research expenditures are less severely affected. In recession years, the elasticity between GDP and BERD is estimated to be 0.97+0.71 = 1.68 (i.e. a -1% decline in GDP is accompanied by a decline of BERD by -1*(0.97+0.71) = -1.7 %. The responsiveness of GERD declines but remains positive (0.85–0.42=0.43). HERD and GOVERD are even estimated to have negative elasticity in recession years (i.e. in the case of HERD, for example, a -1% decline in GDP is accompanied by a rise in HERD expenditures of –1*(0.43-1.17) = +0.74 %; the case of GOVERD is similar). This can suggest that the government expenditures for R&D (HERD and GOVERD are for the most part financed by the public sector) are increased in connection with anti-cyclical measures (or are budgeted in better times). However, all "asymmetric coefficients" must be interpreted with caution. They have hardly any statistical significance. Over the observed period of time, recession years are rather seldom events – it is difficult to derive statistically reliable results for these rare events.

The estimated results presented here are the result of a panel regression and represent an "average" result, averaged over 14 countries and 26 years. Over the observation period, massive recessions represent a definite exception, which complicates applicability to the current situation. The results thus do not reflect the specific Austrian situation, but rather one of a comparable group of countries. The results show that under the current economic assumptions, a definite decline of R&D expenditures of the corporate sector is to be expected. It is difficult to estimate the extent of this possible decline for Austria because R&D expenditures are (i) heavily concentrated among a few large corporations and (ii) it is not possible to adequately depict the reaction of the foreign component in the financing of R&D to recessions based on the comparison group. It can thus be assumed that the research volume financed from outside of Austria (its share in Austria is very high at almost 20%) is not only dependent on the economic development of the research country (the target country of the financing from abroad), but also on the economic development of the donor country. As foreign-financed R&D is primarily financed by companies, it can be argued that it would react similar to BERD – it can therefore be expected that these research expenditures will react at a higher rate to GDP declines in the donor countries. With the GDP decline in the EU countries of approximately 2%, based on the considerations presented here, the decline in financing volume from foreign countries in Austria could definitely be expected to be between 3 to 5%. However, the analysis of the comparison countries also shows that government financing of research projects – possibly in connection with anti-cyclical measures – has increased in recessionary times. The results in this case point to an increase of government expenditures by approximately ½ – 1%.

1.1.4 Austria's position in the European Innovation Scoreboard (EIS)

The European Innovation Scoreboard (EIS) is an instrument of the Lisbon process via which the innovation development in the EU and the EU in relation to other markets (primarily the USA and Japan) is to be depicted. This (quantifiable) performance representation is based on specific indicators that were developed over the years with the goal of obtaining a realistic picture of the innovation development.[12]

An improved database and the constant further development of the analytic methods have resulted in an increase in the comparability between the countries and accordingly the validity of the EIS over time. Despite these improvements, however, we must keep the limitations of an indicator-based depiction of an innovation system in mind, especially when the individual indicators used in the EIS are combined into a Summary Innovation Index (SII), resulting in the need for a highly cautious interpretation of this number. It is obvious that not all determinants and influencing variables can be acquired using quantifiable indicators. However, considering these limits, the 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).

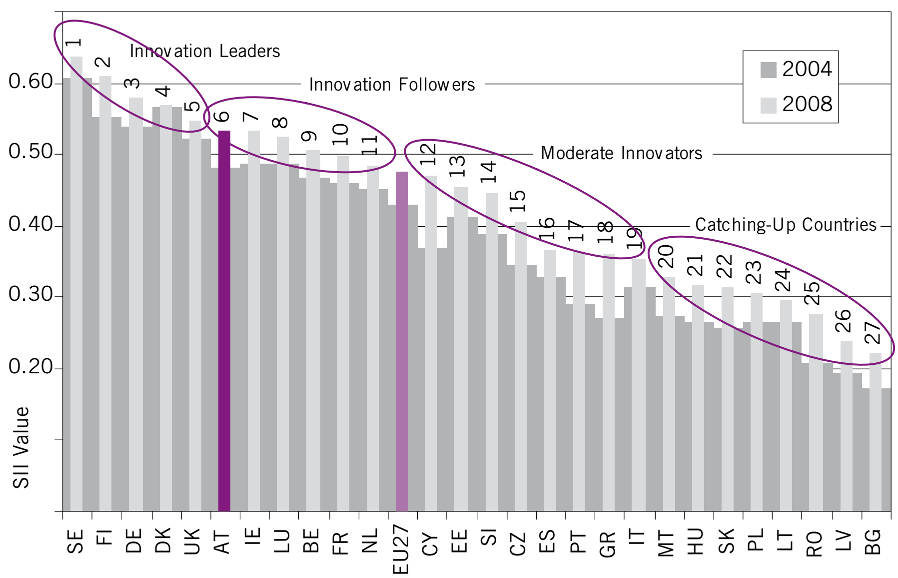
12 See the Research and Technology Report 2008 (p. 17ff.) for a comprehensive discussion of the EIS.

During 2008, a very intensive discussion took place concerning the methodological improvement of the EIS as well as improved data generation and accordingly its comparability.[13] This discussion took emerging criticism into account and the ideas discussed in a workshop[14] were included in the development of a new indicator set and new methods of analysis (see Hollanders and van Cruysen 2008). EIS 2008 is thus partially based on new indicators which increasingly take into account the non-technological aspects of innovation. Its database is now more stable, transparent and comprehensible. The trend developments in EIS 2008 also became more meaningful, as they no longer refer to the EU average but rather the 5-year averages of the absolute values are calculated.

EIS 2008 results

The results of the Summary Innovation Index (SII) now show a ranking of the EU member states that has generally remained the same since the Scoreboard was introduced. The lead group (innovation leaders) comprises 5 countries: Sweden, Finland, Germany, Denmark and the United Kingdom. The innovation followers group of Austria, Ireland, Luxembourg, Belgium, France and the Netherlands includes the 6 countries that still exceeded the average of the 27 EU member states (see Figure 4). In the overall ranking, Austria is in 6th place among the EU member states and is in the top position within the innovation followers group.

Figure 4: Comparison between countries based on EIS 2008 (including comparison with EIS 2004)



Source: InnoMetrics; calculations by Joanneum Research

13 Austria has actively participated in this discussion. Based on a study commissioned by BMWF, BMVIT and BMWFJ (Schibany, Streicher, Gassler 2007), BMWFJ sent an approved comment with regard to proposed changes to the European Innovation Scoreboard to the European Commission in April 2008.

14 „Improving the European Innovation Scoreboard"; 16 June 2008, Brussels.

The moderate innovators group comprises the countries of Cyprus, Estonia, Slovenia, Czech Republic, Spain, Portugal, Greece and Italy (positions 12–19); the catching-up countries group comprises the other "new" member states.

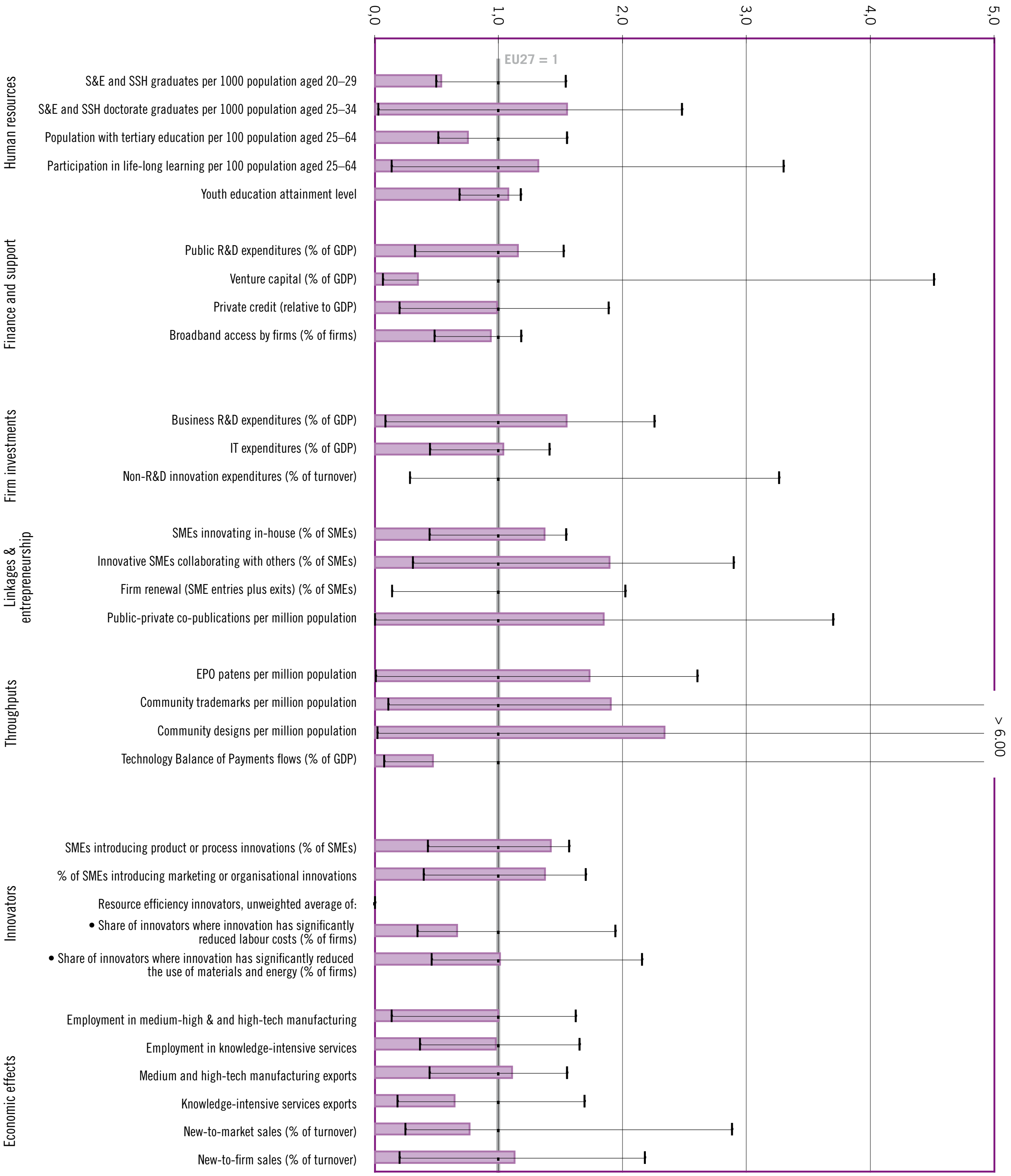
As the comparison with results of earlier EIS shows, these groups are quite stable; changes in the relative positioning primarily take place within these groups. Austria succeeded in improving its position within the innovation followers group and now is in the top position within this group.

A glance at the 29 individual indicators (in the figure below, the Austrian values are shown together with the minimums and maximums of the EU27, each referring to the EU27 average) shows that Austria is only (significantly) under the EU27 average for fewer than one-third, namely seven, of the individual indicators; two of them refer the relatively low number of academics. In particular the indicator regarding new bachelor's and master's degrees in science is very close to the minimum of the EU27; it is of interest that in contrast, the number of new doctorates is significantly higher than the EU27 average. In absolute terms, this means that Austria has one doctorate for only 12 Master's degrees – this is the best value among the EU27 where the average is one doctorate for 37 Master's degrees. Another three indicators with below-average values for Austria exhibit a high-tech relationship: the low level of funding with venture capital, the weak balance of trade in technology goods and weakness in exports of knowledge-related services.

Strengths are particularly evident in business innovation and cooperation as well as in the throughputs – patents, trademarks and design.

EIS 2008 shows that in addition to Ireland, Austria demonstrated the greatest improvement in performance in the group of innovation followers. In addition to Austria's already known strengths in innovation-related indicators, EIS 2008 also confirms the partial weaknesses in human resources and in venture capital financing.

Figure 5: Detailed results of EIS 2008; Austria vs. minimum/maximum of the EU27 (Index EU27=1)



Source: InnoMetrics, calculations by Joanneum Research

1.2 R&D in Austria 2002 – 2006

1.2.1 General

The following chapter presents some results of the global R&D surveys conducted by Statistics Austria in 2002, 2004 and 2006.[15] This intertemporal comparison is supplemented by international cross-sectional comparisons.[16]

A comparison of the survey years 2002 to 2006 shows a clear increase in both the units doing research as well as R&D expenditure:

Table 4: Units performing research and R&D expenditure in Austria, 2002–2004–2006

	Units performing R&D				Expenditures for R&D [€ millions]			
Performance sector	**2002**	**2004**	**2006**	***Change 2002 – 2006)***	**2002**	**2004**	**2006**	***Change 2002 – 2006)***
Higher education sector	969	1,038	1,162	*+20%*	1,266	1,402	1,523	*+20%*
State sector	308	226	254	*-18%*	266	270	330	*+24%*
Private non-profit sector	71	55	40	*-44%*	21	22	17	*-21%*
Corporate sector	1,942	2,123	2,407	*+24%*	3,131	3,556	4,449	*+42%*
Total	3,290	3,442	3,863	*+17%*	4,684	5,250	6,319	*+35%*

Source: Statistics Austria (R&D survey), calculations by Joanneum Research

The number of units doing research rose 17% between 2002 and 2006 (from 3,290 to 3,863 units), R&D expenditure rose by 35% (from € 4.7 billion to € 6.3 billion). The corporate sector in particular increased its spending by +42% (from € 3.1 billion to € 4.5 billion) very significantly; only the private non-profit sector recorded a decline (by one-fifth, at a quite low-level).

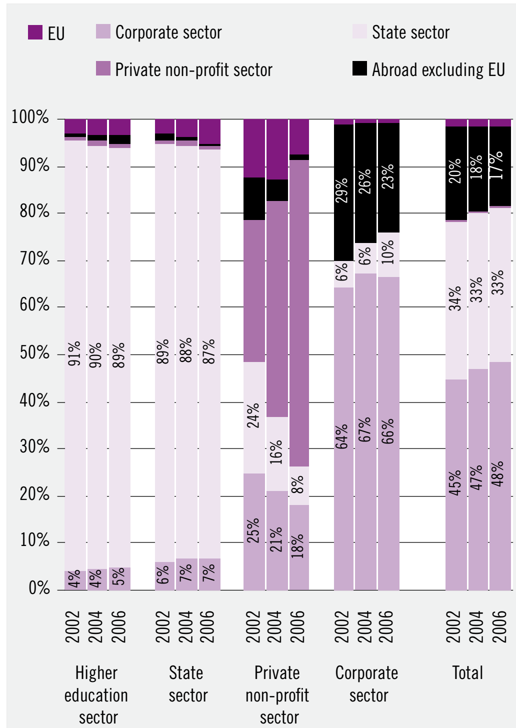
1.2.2 Financing and expenditures

The financing structure of the expenditures for research and development in Austria shows only relatively slight shifts for the period 2002 through 2006.

15 See also in this regard: http://www.statistik.at/web_de/statistiken/forschung_und_innovation/index.html
16 Based on the OECD's Main Science and Technology Indicators (MSTI)

Figure 6: R&D expenditures in € millions: 2002/04/06 broken down by sources of funds in Austria

Performance sector		Corporate sector	State sector	Private non-profit sector	Abroad excluding EU	EU	Total [€ millions]
Higher education sector	2002	51.3	1156.9	8.2	11.8	37.8	1266.1
	2004	62.6	1262.4	11.4	19.1	46.1	1401.6
	2006	76.8	1354.7	13.1	26.8	51.9	1523.2
State sector	2002	16.0	236.8	2.0	3.9	7.8	266.4
	2004	17.8	237.3	2.7	1.9	10.3	269.8
	2006	22.5	287.3	1.8	1.9	16.8	330.2
Private non-profit sector	2002	5.2	5.0	6.3	1.9	2.6	20.9
	2004	4.6	3.4	9.9	1.0	2.7	21.6
	2006	3.0	1.3	10.8	0.1	1.3	16.5
Corporate sector	2002	2018.1	175.5	1.0	906.2	30.1	3130.9
	2004	2390.6	229.2	1.2	907.6	27.9	3556.5
	2006	2954.7	428.1	1.3	1030.7	33.9	4448.7
Total	2002	2090.6	1574.2	17.5	923.7	78.3	4684.3
	2004	2475.5	1732.2	25.2	929.6	87.0	5249.5
	2006	3057.0	2071.3	26.9	1059.5	103.9	6318.6



Source: Statistics Austria (R&D survey), calculations by Joanneum Research

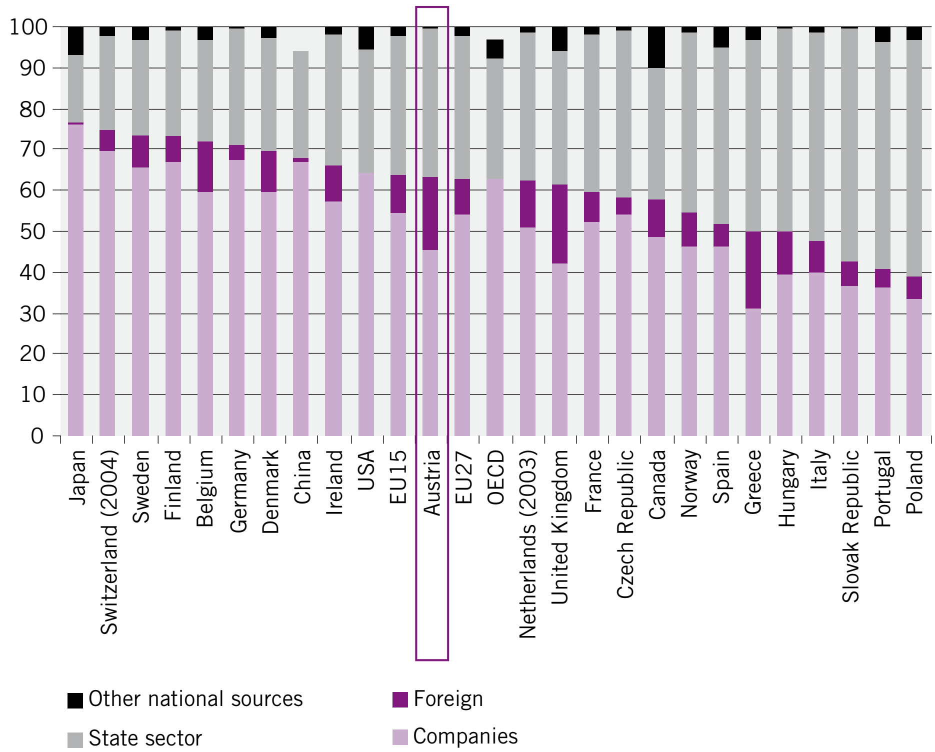
In light of these stable financing structures, however, several interesting developments are evident between 2002 and 2006. The share of the state sector in financing the research expenditures of the corporate sector rose from 6% to 10%; the share of financing from abroad dropped from 29% to 23% (however, in absolute numbers this does not signify a decline: financing from abroad rose from € 924 million to € 1060 million; this growth of +15% is however significantly less than the total growth of +35%). The self-financing share of the corporate sector remained essentially stable at 64–66%.

The higher education and state sector are predominantly financed publicly, although the state share is declining slightly; at the same time, the business and EU shares increased slightly, although they remain in a range from 3–7%. The private non-profit sector was the only one to experience significant shifts in its financing structure.

In addition to achieving a research ratio of 3% of GDP in 2010 – the pan-European level defined in Barcelona in 2002 – the "Barcelona objective" also specifically aims to increase the business share in the financing of total research expenditures to 67%. If the statistic is taken literally, this target was missed by a wide margin; however if we focus on the content of the objective, it has already been (almost) met for some time.

The nominal business share in the financing of total research expenditures came to 48% in 2006 and was thus somewhat higher than in 2002 (45%). At first glance, the 67% target for the business share has been far from met. Yet compared internationally, at 18.4% Austria has a very high share of financing from abroad; however, up to approximately 90% of this is provided by companies abroad to finance the R&D activities of their Austrian subsidiaries (the share of the EU in the R&D funds financed from abroad amounted to just under 9% in 2006). Taken together, domestic and foreign companies finance approximately 65% of the total research expenditures in Austria, meaning that the 67% goal has almost been met[17]. Applying this type of calculation, the goal has already been (almost) met on the EU15 and EU27 level.

Figure 7: Financing structure of the research expenditures for 2005 by country



Source: OECD (MSTI), Calculations by Joanneum Research

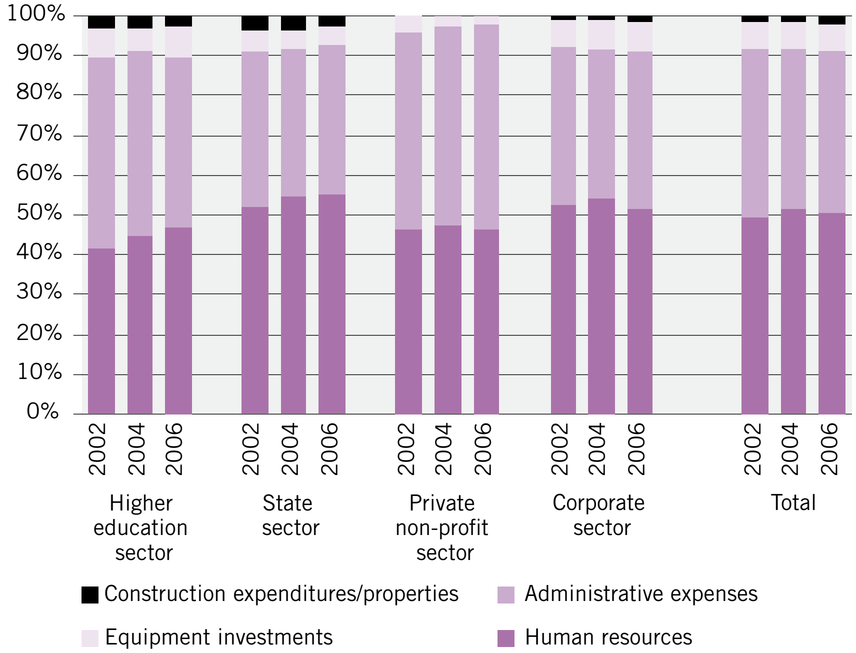
17 Of course, the high financing component by foreign companies has certain implications for the research structure in Austria: Firstly, it is basically not domestic companies that finance the research expenditures – so these have lower research expenditures (namely only the "official" share of 48%); this also means that the research expenditures of Austrian institutions (aside from the possible, but unknown financing of foreign R&D) are lower than the total ratio of about 2.50 implies. Secondly, the high foreign share suggests that Austria is very attractive as a place for research.

Japan and Switzerland have the highest business shares (or combined business and foreign shares) at almost 75% each. Austria is right at the average of the EU15 and EU27 (although with a significantly higher foreign share). The ranking of the countries also shows that the research ratio is strongly a function of the corporate sector. Countries with a high business share tend to have high research ratios.

Types of expenditure

Personnel and administrative expenses account for the greatest share of research expenditures; construction and equipment investments together are responsible for less than 10% of the expenditures.

Figure 8: R&D expenditures in 2002/04/06 by type of expenditure



Source: Statistics Austria (R&D survey), calculations by Joanneum Research

1.2.3 The corporate sector

The two most important funders of research and development, the business and the higher education sectors, will be discussed in somewhat greater detail below. The corporate sector will be broken down into economic segments and technological intensity[18], the higher education sector into scientific disciplines.

Table 5: R&D expenditures and creation of value in the corporate sector, 2002 and 2006

	2006						2002					
Sector	Number of survey units performing R&D	R&D expenditure	Gross value added	R&D as component of gross value added	Share in R&D expenditures	Share in gross value added	Number of survey units Performing R&D	R&D expenditure	Gross value added	R&D as component of gross value added	Share in R&D expenditures	Share in gross value added
		[€ million]	[€ million]	[%]	[%]	[%]		[€ million]	[€ million]	[%]	[%]	[%]
Agriculture and forestry, fisheries	3	1	3.9	0.0%	0%	2%	4	2	4.0	0.1%	0%	2%
Mining	10	7	1.2	0.6%	0%	1%	9	3	0.8	0.3%	0%	0%
Manufacturing	1324	3159	46.2	6.8%	71%	20%	1169	2273	39.5	5.7%	73%	20%
High-Tech	275	1439	6.4	22.4%	32%	3%	229	1029	5.5	18.6%	33%	3%
Medium Tech	767	1534	24.9	6.2%	34%	11%	672	1114	19.4	5.7%	36%	10%
Other material goods	282	187	14.9	1.3%	4%	6%	268	130	14.6	0.9%	4%	7%
Electricity, gas and water supply	25	9	6.0	0.2%	0%	3%	17	14	4.5	0.3%	0%	2%
Construction	82	26	17.9	0.1%	1%	8%	53	12	14.8	0.1%	0%	7%
Services	963	1246	157.3	0.8%	28%	68%	690	828	134.6	0.6%	26%	68%
Hi-tech knowledge intensive	459	605	3.6	16.8%	14%	2%	299	373	3.4	11.1%	12%	2%
Other services	504	641	153.7	0.4%	14%	66%	391	455	131.2	0.3%	15%	66%
Total	2407	4449	232.5	1.9%	100%	100%	1942	3131	198.3	1.6%	100%	100%

Note: For reasons of data availability, technology affiliation was classified at the NACE two digit level.

Source: Statistics Austria (R&D survey, National Account), calculations by Joanneum Research

As a share of gross value added, R&D expenditures were increased from 1.6% to 1.9% between 2002 and 2006 (the corresponding shares of gross domestic product amount to 1.4% and 1.7%); an increase of the R&D component can be observed in (almost) all sectors. *High-Tech-Knowledge-Intensive* services saw the highest growth; their R&D share of gross value added

18 For reasons of data availability, the definition of technology used here differs somewhat from the (customarily used) definition of the OECD: The high-tech manufacturing segment comprises the industries NACE 24, 30, 32 and 33; medium-tech manufacturing consists of industries 25–29, 31, 34, 35. The high-tech-knowledge-intensive services include NACE 72 and 73. NACE 64, which is also part of the high-tech sectors, cannot be separated out of the group NACE 60–64 (transport and communication) on the basis of the published R&D survey, and is therefore subsumed under Other services (see the annex for a list of the industries and their categorisation).

rose from 11% to almost 17%. This sector accounted for a total of 14% of all R&D expenditures in 2006. The highest R&D intensities as well as the greatest share in R&D expenditures continue to be in high-tech manufacturing. With an R&D intensity of almost 23% (up from 19% in 2002), these industries account for one-third of all R&D expenditures.

Table 6: Financing of R&D expenditures in the corporate sector, 2006

	2006											
				Public sector								
Sector	Number of survey units Performing R&D	R&D expenditure	Corporate sector	Fed.Gov.	Research premium	Fed. states	FFG	Other public financing	combined	Private non-profit sector	Foreign (excluding EU)	EU
		[€ million]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]	[%]
Agriculture and forestry, fisheries	3	1	79%	0%	1%	9%	11%	0%	21%	0%	0%	0%
Mining	10	7	57%	0%	0%	0%	1%	0%	1%	0%	42%	0%
Manufacturing	1324	3159	72%	0%	4%	0%	2%	0%	7%	0%	21%	0%
High-Tech	275	1439	56%	1%	5%	0%	2%	0%	8%	0%	35%	0%
Medium Tech	767	1534	84%	0%	3%	0%	2%	0%	6%	0%	10%	0%
Other material goods	282	187	95%	0%	2%	0%	2%	0%	5%	0%	0%	0%
Electricity, gas and water supply	25	9	93%	0%	3%	0%	1%	0%	4%	0%	0%	3%
Construction	82	26	91%	0%	3%	1%	4%	0%	8%	0%	0%	0%
Services	963	1246	52%	7%	2%	2%	4%	1%	16%	0%	30%	2%
Hi-tech knowledge intensive	459	605	54%	12%	3%	5%	5%	2%	26%	0%	17%	3%
Other services	504	641	52%	5%	2%	2%	3%	1%	13%	0%	33%	2%
Total	2407	4449	66%	2%	4%	1%	3%	0%	10%	0%	23%	1%

Note: For reasons of data availability, technology affiliation was classified at the NACE two digit level.

Source: Statistics Austria (R&D survey), calculations by Joanneum Research

A total of two-thirds of the R&D expenditures of the companies in the corporate sector were self-financed, followed by the foreign sector (somewhat under one fourth) and the public sector with 10%. The EU plays only a marginal role in the financing of business R&D and the non-profit sector plays practically none at all. Aside from the quantitatively insignificant mining sector, high-tech manufacturing exhibits an above-average foreign share at 35%, as do services at 30%. The services sector also receives a relatively high share of public funds (16%) and EU funds (2%) and a relatively small share of financing by the corporate sector (52%). A rather interesting correlation of financing structure and technology content can be observed within the manufacturing segment: the higher it is, the higher is the share of the public sector (especially the research premium) and of the foreign sector; the situation is the opposite with regard to the "degree of self-financing" (financing by the business segment).

1.2.4 The higher education sector

The financing of R&D expenditures in the higher education sector is of course dominated by the public sector. On average, the public sector finances a total of 89% of the R&D expenditures of the higher education sector.

Table 7: Financing of R&D expenditures in the higher education sector, 2006

	2006											
				Public sector								
Scientific discipline	Number of survey units Performing R&D	R&D expenditure	Corporate sector	combined	Fed.Gov.	Fed. states	Municipalities	Other public financing	Private non-profit sector	Foreign (excluding EU)	EU
		[€ million]						[%]			
1.0 to 4.0 combined	673	1,162	6%	87%	73%	2%	0%	13%	1%	2%	4%
1.0 Natural sciences	252	477	4%	89%	72%	2%	0%	15%	0%	2%	5%
2.0 Engineering	192	218	13%	79%	66%	4%	0%	8%	1%	2%	5%
3.0 Human medicine	172	397	5%	88%	74%	1%	0%	13%	1%	3%	3%
4.0 Agriculture and forestry, veterinary medicine	57	70	2%	93%	87%	1%	0%	5%	1%	2%	3%
5.0 and 6.0 combined	489	361	2%	94%	84%	2%	0%	8%	1%	0%	2%
5.0 Social sciences	274	209	4%	92%	86%	2%	0%	4%	2%	0%	2%
6.0 Humanities	215	152	1%	98%	82%	3%	0%	12%	0%	0%	1%
1.0 to 6.0 overall	1,162	1,523	5%	89%	75%	2%	0%	11%	1%	2%	3%

Source: Statistics Austria (R&D survey), calculations by Joanneum Research

At 98%, the public-sector share is the highest in the humanities; it is the lowest in engineering at 79%. The case is exactly the opposite for the corporate sector. At an average of 5%, its share lies between 1 (humanities) and 13% (engineering); a similar ranking is seen for EU funding and the foreign sector (average of 3% and 2%, respectively). "Other public-sector funding" which includes the subsidies from the Austrian Science Fund, contributes 11% to the research activities of the universities. However, these funding sources also have significantly different weightings. They contribute the smallest amount to the social sciences (4%) while their highest contribution is to the natural sciences, human medicine and humanities (15%, 13% and 12%).

1.2.5 R&D employees

Employment (as headcount) in the R&D segment increased +28% to almost 84,000 between 2002 and 2006; this expansion was supported by the business segment at +33% and the higher education segment at +30%. The state sector and the private non-profit segment exhibited declines (which were quite massive in the case of the non-profits at -35%).

Table 8: Employment in R&D, 2002–2004–2006

Performance sector	Employees – headcounts 2002	2004	2006	Change 2002 – 2006)	Employees – full-time equivalents 2002	2004	2006	Change 2002 – 2006)	Ratio FTE/headcount 2002	2004	2006
Higher education sector	25,072	29,358	32,715	+30%	9,879	11,502	12,668	+28%	39%	39%	39%
State sector	6,010	5,531	5,511	-8%	2,060	2,035	2,423	+18%	34%	37%	44%
Private non-profit sector	623	565	404	-35%	227	212	161	-29%	36%	38%	40%
Corporate sector	34,020	38,737	45,336	+33%	26,728	29,143	34,126	+28%	79%	75%	75%
Total	65,725	74,191	83,966	+28%	38,893	42,891	49,377	+27%	59%	58%	59%

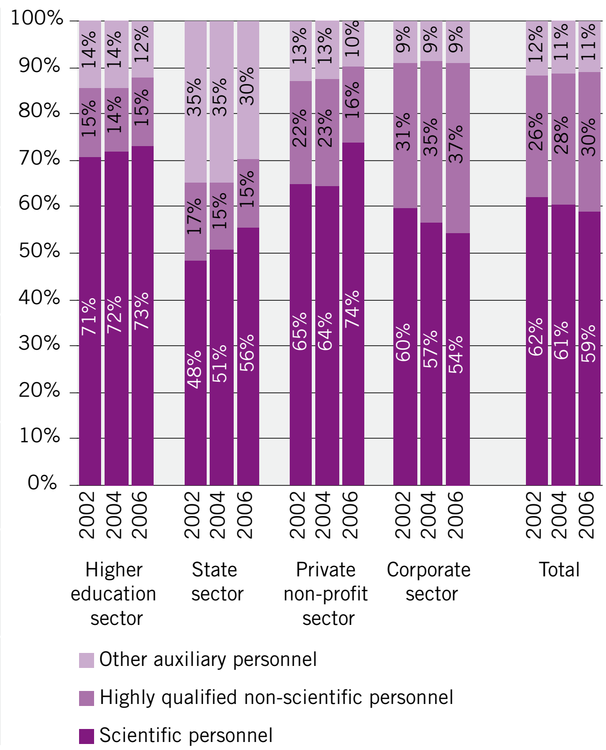
Source: Statistics Austria (R&D survey), calculations by Joanneum Research

Expressed as full-time equivalents (FTE), the increase was slightly smaller at 27% (more than 49,000). The "degree of utilisation" (the ratio of full-time equivalent to headcount) of a typical R&D employee remained constant at approximately 59%. The degree of utilisation in the corporate sector declined (however at 75%, it is still the highest). The private non-profit sector and in particular the state sector succeeded in increasing their degree of utilisation.

Employment categories and full-time equivalents are broken down as follows:

Figure 9: R&D employment structure in FTEs in Austria for 2002/04/06

Performance sector	Year	Scientific personnel	Highly qualified non-scientific personnel	Other auxiliary personnel	Total [FTE]
Higher education sector	2002	6,977	1,475	1,427	9,879
	2004	8,281	1,569	1,652	11,502
	2006	9,261	1,856	1,551	12,668
State sector	2002	999	342	719	2,060
	2004	1,030	300	706	2,035
	2006	1,349	357	718	2,423
Private non-profit sector	2002	148	50	30	227
	2004	137	49	27	212
	2006	118	26	16	161
Corporate sector	2002	16,001	8,326	2,400	26,728
	2004	16,508	10,150	2,485	29,143
	2006	18,471	12,583	3,072	34,126
Total	2002	24,124	10,194	4,575	38,893
	2004	25,955	12,067	4,869	42,891
	2006	29,199	14,822	5,357	49,377



Source: Statistics Austria (R&D survey), calculations by Joanneum Research

Driven by the corporate sector, the percentage of scientific personnel (in full-time equivalents) declined from 62% to 59% in favour of more highly qualified, non-scientific personnel (from 26% to 30%). The most highly qualified are the higher education sector (with a scientific component of 73%) and the private, non-profit sector which succeeded in significantly improving its qualification structure compared to 2002 and 2004. This also applies to the state sector.

1.2.6 Percentage of women among R&D employees

The percentage of women among R&D employees did increase slightly between 2002 and 2006; however, it is still relatively low at 29% of headcount.

Table 9: Percentage of women broken down by research sectors and employment categories, 2002 and 2006

Performance sector	Year	Total		of which					
				Scientific personnel		Highly qualified non-scientific personnel		Other auxiliary personnel	
		Head-count	FTE	Head-count	FTE	Head-count	FTE	Head-count	FTE
Total	2002	28%	22%	21%	16%	32%	26%	53%	45%
	2006	29%	24%	25%	19%	28%	24%	52%	46%
1. Higher education sector	2002	41%	38%	30%	27%	65%	65%	70%	66%
	2006	44%	41%	35%	31%	65%	65%	71%	68%
2. State sector	2002	46%	41%	35%	32%	50%	50%	55%	48%
	2006	45%	41%	39%	34%	48%	48%	53%	49%
3. Private non-profit sector	2002	50%	48%	38%	36%	63%	66%	80%	74%
	2006	57%	59%	52%	53%	65%	74%	79%	82%
4. Corporate sector	2002	15%	14%	10%	10%	18%	18%	32%	32%
	2006	17%	16%	14%	12%	17%	17%	34%	34%

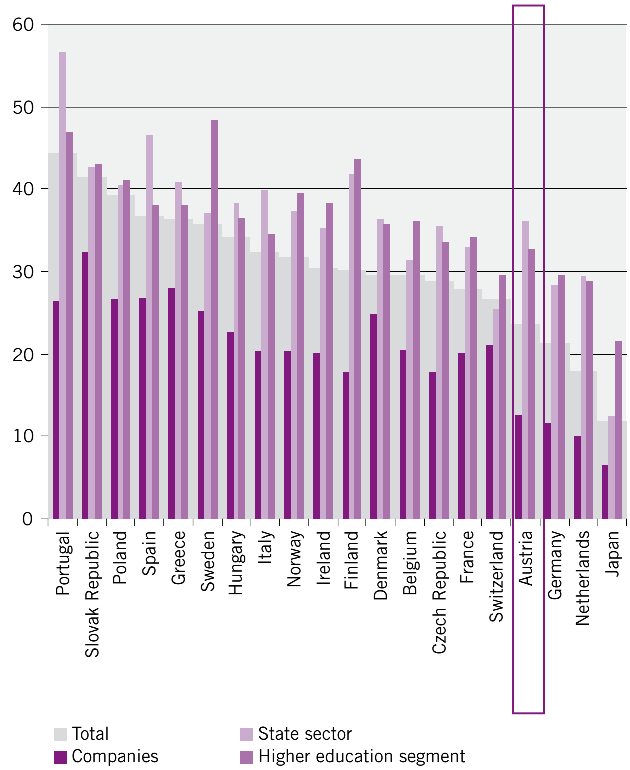
Source: Statistics Austria (R&D survey), calculations by Joanneum Research

The overall low percentage of women is primarily attributable to the corporate sector where only 17% of employees are women (or 16% of full-time equivalents). Not least, this is because of the structure of R&D in the corporate sector: where technical research is predominant. However, the percentage of women in engineering is also low in the university segment (15% of scientific staff (see Figure 12: Percentage of women in the scientific workforce of universities (FTE) broken down by age group and branch of science, 2002 and 2006) compared to 14% in the corporate sector).

Compared to other countries, Austria has a very low percentage of women in research and development (the following comparison relates to headcounts of scientific staff, i.e. persons with academic or equivalent training).

Figure 10: Percentage of women in the scientific workforce (academics and equivalent employees; headcounts) in an international comparison, 2004/05

	Total	Business	State sector	Higher education segment	Year
Portugal	44.4	26.4	56.6	46.9	(2005)
Slovak Republic	41.5	32.4	42.7	43	(2005)
Poland	39.3	26.6	40.4	41	(2005)
Spain	36.7	26.8	46.6	38	(2005)
Greece	36.4	28	40.8	38	(2005)
Sweden	35.8	25.2	37.2	48.3	(2005)
Hungary	34.2	22.6	38.2	36.6	(2005)
Italy	32.4	20.3	39.9	34.6	(2005)
Norway	31.7	20.3	37.4	39.4	(2005)
Ireland	30.3	20.2	35.4	38.2	(2005)
Finland	30.2	17.7	41.9	43.7	(2005)
Denmark	29.7	24.9	36.4	35.7	(2005)
Belgium	29.6	20.5	31.4	36.2	(2005)
Czech Republic	28.8	17.8	35.5	33.6	(2005)
France	27.8	20.1	32.9	34.2	(2005)
Switzerland	26.7	21.1	25.5	29.6	(2004)
Austria	23.6	12.6	36.2	32.8	(2004)
Germany	21.4	11.6	28.5	29.7	(2005)
Netherlands	18	10.1	29.4	28.9	(2005)
Japan	11.9	6.5	12.5	21.5	(2005)
Unweighted mean value	30.5	20.6	36.3	36.5	



Source: OECD (MSTI), Calculations by Joanneum Research

Among the 20 countries for which comparative data was available, Austria has the fourth lowest percentage of women, surpassing only Germany, the Netherlands and Japan. In the business segment, the percentage of women is lower in all countries than in the state and higher education sectors (here also this is a consequence of the technical orientation of business R&D). Austria exhibits a very low number in this area as well – again the fourth worst ahead of Germany, the Netherlands and Japan. In the state sector, Austria's percentage of women is at the average of the 20 countries and somewhat below that in the higher education segment.

Table 9 shows two additional aspects:

The percentage of women rises as the qualification level decreases. Based on all R&D employees, the percentage of women in the scientific workforce is 25%, 28% in the highly qualified non-scientific workforce and 52% of auxiliary staff; a similar pattern is also seen in the individual sectors.

Another aspect is the lower "degree of utilisation" of the female employees, defined as the ratio of full-time equivalents to headcounts. This is reflected in Table 9 by a higher percentage of women in the headcounts than in the full-time equivalents. However, the following table presents this even more clearly:

Table 10: Degree of utilisation broken down by research sectors and gender, 2002 and 2006

Performance sector	Year	Total		of which					
				Scientific personnel		Highly qualified non-scientific personnel		Other auxiliary personnel	
		male	female	male	female	male	female	male	female
Total	2002	64%	46%	65%	47%	66%	50%	56%	41%
	2006	64%	47%	63%	45%	66%	51%	57%	45%
1. Higher education sector	2002	42%	36%	42%	36%	38%	37%	44%	36%
	2006	41%	36%	41%	35%	37%	38%	41%	36%
2. State sector	2002	38%	30%	44%	39%	26%	26%	35%	27%
	2006	47%	40%	52%	42%	31%	32%	48%	42%
3. Private non-profit sector	2002	38%	35%	40%	37%	31%	35%	40%	29%
	2006	38%	41%	41%	43%	28%	41%	29%	34%
4. Corporate sector	2002	79%	75%	83%	77%	73%	75%	73%	72%
	2006	76%	70%	82%	73%	71%	70%	66%	65%

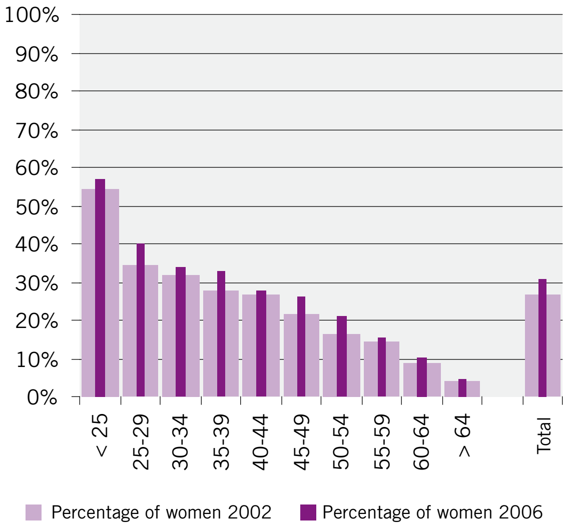
Source: Statistics Austria (R&D survey), calculations by Joanneum Research

On average, the degree of utilisation of a male employee is 64% while that of a female employee is only 47% (both practically unchanged compared to 2002). This can be explained by two effects, although it is not possible to determine their relative weight based on the present data: firstly, a higher share of part-time employment and secondly, a higher proportion of non-research activities among female employees. The pattern of lower utilisation of female employees is evident in (almost) all sectors and employment categories, the difference between male and female degrees of utilisation being the greatest in the state and higher education sectors. The corporate sector has by far the highest degree of utilisation and (except for the non-profits) the relatively lowest difference between the genders.

Overall, the trend is moving in the direction of a higher percentage of women in R&D employment, although this is taking place only gradually. However, to a certain degree this must be put in perspective. Because research careers last several decades, any "structural change" in this area must necessarily be associated with a substantial temporal component, which of course does not allow any abrupt changes in a four-year comparison (the R&D surveys of 2002 and 2006). However, changes in the gender structure can of course be observed, as is seen in Figure 11: *Percentage of women in the scientific workforce of universities (FTE) broken down by age group, 2002 and 2006*below for the scientific personnel in the university segment.[19]

19 The university segment is a subsegment of the higher education sector; no comparative analyses can be derived from the published data of the R&D surveys for the other sectors.

Figure 11: Percentage of women in the scientific workforce of universities (FTE) broken down by age group, 2002 and 2006



Source: Statistics Austria (R&D survey), calculations by Joanneum Research

The graph shows two things:

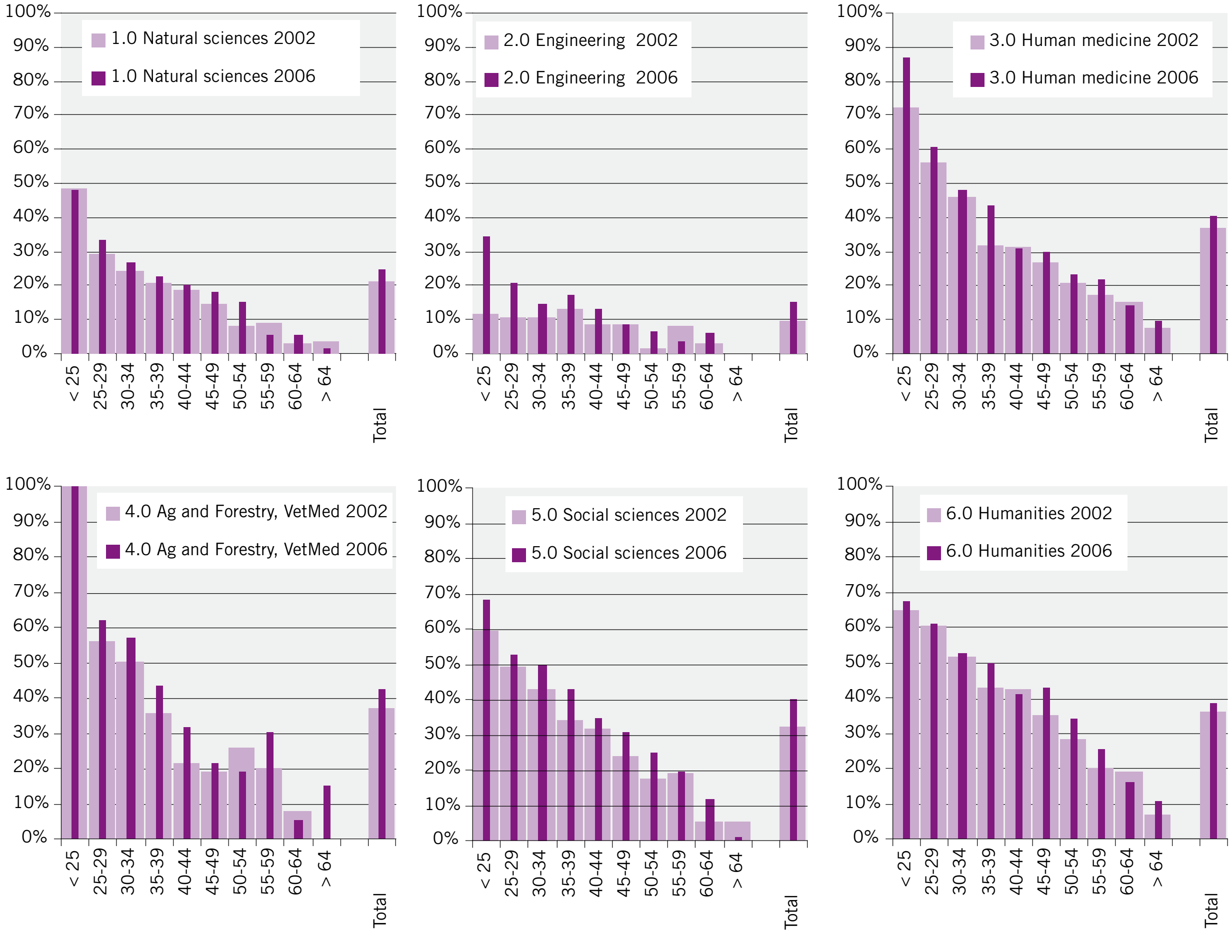
Firstly that the increase in the percentage of women includes all age groups (weakest in the over-64 age group in which the low percentage of women reflects not only the aspect of the "historical gender structure" but also the lower retirement age of women).

Secondly, and perhaps of greater significance for the future trend is that it is evident that the higher percentage of women in the younger age groups continues throughout their career; women thus do not appear to "drop out" of university careers to a higher degree than men. This is apparent in the comparison of two successive age groups in 2002 and 2006 (although the periodicity of age groups and the R&D survey is not identical – the age groups comprise five years, the interval of the survey is only four years). The percentage of women in a specific age group in 2002 correlates quite well with the percentage of women of the next older age group in 2006; this applies to all age groups with the exception of the two oldest (in which the above-mentioned lower retirement age of women results in a relative increase in the percentage of men) and the youngest age group which, however, is very small (it is rare that careers in research are begun that early). At least at the universities, it does not seem that women prematurely end their research careers significantly more than men[20]. However, the age dependency of the percentage of women continues to be very strong and because of the aforementioned structural change, it will continue to be that way for the next 20 (or more) years.

This increase of the percentage of women can basically be observed in all age categories on the level of the individual scientific disciplines as well.

20 It should be noted that the percentages are reported in full-time equivalents; it would be necessary to carry out a "career analysis" by person, preferably based on headcounts.

Figure 12: Percentage of women in the scientific workforce of universities (FTE) broken down by age group and branch of science, 2002 and 2006



Source: Statistics Austria (R&D survey), calculations by Joanneum Research

The percentage of women in the younger age groups is quite high in the disciplines of human medicine, agriculture and forestry as well as the social sciences and humanities. Among those under age 35, it is just under or even above 50%; among those under age 30, it even exceeds 60% except in the social sciences. The relatively highest increase in the percentage of women (although still quite low) can be seen in engineering. Within four years, the percentage of women increased by more than 58% from less than 10% to more than 15%. Though the increase has been greater since 2002, the percentage of women among 25–29 year olds is still relatively low at just above 20% (and by far the lowest of all scientific disciplines). In terms of development and structure, the natural sciences lie between the technical sciences and other branches of science.

Table 11 below shows the gender structure of the scientific personnel in the business segment:

Table 11: Qualification and gender structure of scientific personnel in the corporate sector, full-time equivalents (FTE), 2006

Sector	Number of survey units performing R&D	Scientists and engineers	Shares: Completed university education: Doctorate		Completed university or university of applied sciences education: Degree programme		Non-university post-secondary education or university education not completed		Master craftsman examination or foreman courses		School leaving examination, medium-level technical school, completion of vocational training		Other education		Total	
		[FTE]	Share in FTE	there of % women	Share in FTE	there of % women	Share in FTE	there of % women	Share in FTE	there of % women	Share in FTE	there of % women	Share in FTE	there of % women	Share in FTE	there of % women
Agriculture and forestry, fisheries	3	5	12%	83%	88%	23%	-	-	-	-	-	-	-	-	100%	31%
Mining	10	8	3%	-	74%	-	-	-	5%	-	8%	33%	10%	-	100%	3%
Manufacturing	1324	12480	14%	15%	39%	8%	3%	17%	3%	5%	36%	8%	4%	23%	100%	10%
High-Tech	275	6050	18%	19%	40%	10%	3%	23%	1%	21%	34%	13%	3%	27%	100%	14%
Medium Tech	767	5739	9%	6%	39%	5%	3%	8%	4%	1%	39%	4%	5%	21%	100%	5%
Low Tech	282	691	11%	19%	34%	22%	8%	29%	10%	5%	31%	14%	5%	22%	100%	18%
Electricity, gas and water supply	25	38	20%	7%	50%	12%	12%	21%	8%	-	9%	9%	-	-	100%	11%
Bauwesen	82	87	12%	1%	43%	1%	8%	-	4%	-	33%	3%	1%	20%	100%	2%
Construction	963	5853	25%	20%	49%	15%	5%	14%	1%	5%	16%	14%	4%	46%	100%	17%
Hi-Tech Knowledge Intensive	459	3256	30%	22%	51%	17%	5%	17%	0%	16%	14%	14%	1%	11%	100%	18%
Other	504	2598	18%	14%	47%	12%	5%	10%	2%	2%	20%	13%	8%	51%	100%	16%
Total	2407	18470	17%	17%	42%	11%	4%	15%	2%	5%	30%	9%	4%	30%	100%	12%

Source: Statistics Austria (R&D survey), calculations by Joanneum Research

The scientific personnel in the knowledge-intensive services sector exhibit the highest formal qualification structure. More than 80% have completed a doctorate (30%) or a master degree (51%); the percentage of persons with a secondary school education or lower is relatively low at 20%. At 43%, their percentage is relatively high in the manufacturing sector (for workshops and laboratory work). A certain correlation appears to exist between technology level and qualification level.

At 12%, the percentage of women is quite low (and also in the international comparison shown above). In relative terms, it is the highest in the highest and lowest qualification levels. At 17%, the percentage of women is slightly above average among those with doctorates and clearly above average (30%) among personnel with "other education". The percentage of women is very low in the skilled crafts (5% of those who have completed the examination for the master's certificate).

1.2.7 Summary

An intertemporal comparison of the research expenditures shows that the R&D expenditures increased by 35% and the total R&D Performance units by 17% between 2002 and 2006. The highest rates of increase for these indicators were primarily in the corporate sector (+42% for the R&D expenditures and +24% for the number of companies doing research). These rates of increase (primarily relating to the increase in the number of companies performing research) show that the research base of the Austrian economy has expanded in the last few years.

The financing structures of the total R&D expenditures were relatively stable in the period under investigation. The corporate sector (domestic companies plus R&D financing by foreign parent companies) accounted for approximately 65% of the entire research expenditures in Austria. This percentage is consistent with the OECD and the EU average.

With a 32% share in R&D expenditures in the corporate sector and an R&D ratio of 23%, the high-tech sector plays the most important role in manufacturing. On the other hand, research and technology-intensive services saw the highest growth; their R&D share of gross value added rose from 11% to almost 17% and 14% of all R&D expenditures were made in this sector in 2006.

Between 2002 and 2006, the number of employees in the R&D segment increased +28% to 84 thousand (headcount), corresponding to 49 thousand full-time equivalents. The percentage of women as R&D employees did increase slightly between 2002 and 2006; however, it is still relatively low at 29% (headcount). However, the gender-specific analysis of the scientific workforce at the universities shows that the percentage of women in the younger age groups continues throughout their career; women thus do not appear to "drop out" of university careers any more than men.

1.3 Promotion of R & D – FFG, AWS, FWF

The political significance of research, technology and innovation (RTI) has grown in Austria since the 1990s – and to an even greater degree since the EU accession. In addition to significantly increased flows of funds, the changes also had an impact on an institutional level. The recommendations already contained in the evaluation of the FFF and of the FWF (Arnold 2004) pointed in the direction of a stronger concentration of primarily the business-related research promotion and accordingly greater coordination of the activities with one another. This was intended to reduce the severe fragmentation of the federal support and design it to benefit more effectively from synergy effects. The establishment of the Austria Business Service (AWS) in 2002 and in particular the Austrian Research Promotion Agency (FFG) in 2004 created the institutional framework for a more effective and efficient promotion system. In addition to the agencies already described, this chapter will also quickly characterise and give some figures on the promotional activities of the Austrian Science Fund (FWF) as the third major promotion institution of the Austrian federal government, in order to make its role and significance in the Austrian innovation system comprehensible.[21] The following comments can by no means comprehensively describe and analyse the scope of the respective funding agencies. Their respective annual reports will serve this purpose. However, the emphasis on specific themes is intended to point to aspects of relevance to promotion policy. The following chapter thus contains, among other things, an industry classification of projects supported by the FFG and

21 See also in this regard the Research and Technology Report 2006, p. 23ff.

the discussion of AWS contains an excursus on the funding of young high-tech companies. The approval rates of the FWF will be described in greater detail below.

1.3.1 The Austrian Research Promotion Agency (FFG)

The establishment of the FFG[22] in 2004[23] combined the promotion and consulting institutions in the area of national and international application-oriented research and technology promotion. In five operating areas basic subsidies are awarded in FFG's sphere of action and responsibilities of the commissioned programme development are carried out.

Table 12: General overview of the funding commitments of the FFG (2008)

Area	Projects	Actors[1]	Participations	Total costs (€ million)	Total funding incl. commitments (€ million)	Cash value (€ million)
General funding (BP)	1421	1498	2166	541	283	159
Structural programmes (SP)	339	878	1219	424	144	144
Thematic programmes (TP)	533	905	1413	195	109	109
European and international programmes (EIP)	216	90	216	1.6	1.2	1.2
Aeronautics and Space Applications Programmes (ALR)	36	48	74	11	7	7
FFG total	2545	3419	5088	1173	544	420

1 2863 actors after adjustment

Source: FFG

In its promotional activities, the FFG moves a total project volume exceeding € 1.1 billion (total costs). This total project volume is funded at € 544 million. As in addition to traditional funding through non-repayable subsidies in the general programmes, other funding instruments such as guarantees, loan cost subsidies or loans are also used, the total subsidies of € 544 million reflect a cash value of € 420 million. Just over one-third of that amount is accounted for by the general programmes (BP).

An essential function of public-sector research promotion also consists of supporting companies in starting up research activities. The number of companies active in research and those starting R&D activities is an important indicator of the broadening of the research base and accordingly the research potential of a national economy. FFG can point to a continuous broadening of this base since it has been in existence due to the fact that it has been possible to attract new applicants every year.

Of the total number of all companies participating in FFG programmes, 38% had no experience with funded projects in the period 2003 to 2007 and were thus involved with a research project funded by FFG for the first time. The astoundingly high number of *newcomers*

22 See also in this regard: www.ffg.at
23 With the Research Grant System Structural Reform Act of 14 July 2004 BGBl No. 73/2004

in 2008 is attributable to the introduction of the Innovation Voucher which many SMEs in the services sector felt was targeted at them. In a simple manner, this funding programme awards small amounts to many small companies, resulting in a slight distortion of the sheer number of *newcomers* (Figure 13: *Subsidised companies – newcomers vs. companies with experience*).

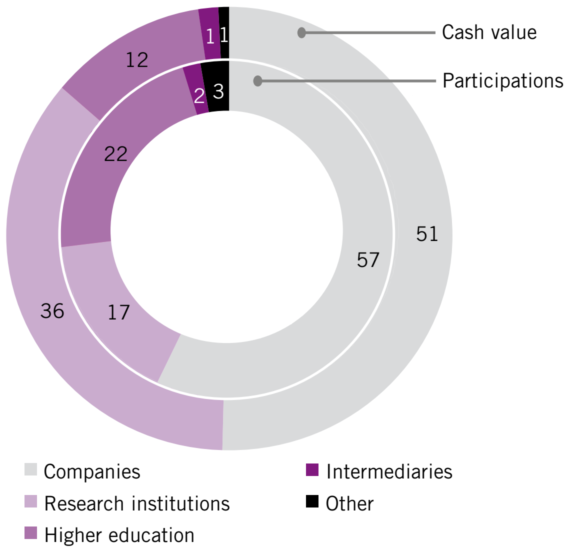
Figure 13: Subsidised companies – newcomers vs. companies with experience

Source: FFG

One of the funding focuses of the last few years, i.e. the funding of cooperative agreements between science and business, has also led to an increased diversity of the actors in FFG. The strong presence of non-business research organisations in the structural and thematic programmes has increased the percentage of research institutions and universities from 18% to 39% since the FFG was established. Concurrent with that, the business share dropped from 79% to 57%. However, a comparison of the cash values shows that the corporate sector accounts for just over one-half at 51% (see Figure 14: *Shares of the various organisation types in participations and cash values in % (2008)*).

However, if the share of SMEs is factored out of the corporate sector, SMEs account for 70% (1,250 participations) of the total 1,783 participations of the corporate sector. This reflects a 46% share of the total participation. On the cash value level, the SME share of the corporate sector drops to 53%, reflecting a 37% share of the cash value of the total funding.

Figure 14: Shares of the various organisation types in participations and cash values in % (2008)



Source: FFG

In addition to broadening the research base, public-sector, science-oriented research promotion has also contributed to a structural change. Criticism has often been voiced that Austrian technology and research promotion has done too little to accelerate the structural change in the direction of high-tech industries and knowledge-based services. This criticism first reflects a very narrow and mechanistic understanding of structural change and fails to recognise the extent of research promotion in the national economy: In 2008, gross domestic expenditures on R&D totalled € 7.5 billion. With a funding volume of € 420 million, FFG finances a 5.6% share. This is relatively low and explains why the aggregate economic structural change (which is a rather slow and gradual process) cannot be influenced very much by public-sector R&D promotion. The industry structure cannot be a suitable indicator for measuring the success of a funding agency. Nonetheless, the question regarding the industries to which the funding volume is distributed appears to be dangerous. The FFG data does not assign companies to the OECD industry classification (NACE) but rather the funded projects according to their technological orientation.

Table 13: *Funded projects by industry classification – FFG total (2008)* below classifies all projects funded by the FFG in 2008 (totalling 2545) by technology level in the manufacturing segment or knowledge intensiveness in the service industries. A 4-step scale was used as a basis for the manufacturing segment and a 6-step scale for technology intensity in the service industries. The allocation is according to the current OECD classification.

Table 13: Funded projects by industry classification – FFG total (2008)

										€ million					
	Project allocation	Projects	%	Organisations	%	Participations	%	Total costs	%	excluding commitments	%	including commitments	%	Cash value	%
Material goods segment	High tech sector	240	*9.4%*	203	*5.3%*	303	*6.0%*	182.5	*15.6%*	72.34	*14.3%*	86.7	*15.9%*	52.1	*12.4%*
	Medium-high tech sector	402	*15.8%*	452	*11.8%*	589	*11.6%*	272.7	*23.3%*	118.61	*23.5%*	139.4	*25.6%*	82.0	*19.5%*
	Medium-low tech sector	168	*6.6%*	227	*5.9%*	269	*5.3%*	65.6	*5.6%*	30.60	*6.1%*	35.6	*6.5%*	22.0	*5.2%*
	Low tech sector	100	*3.9%*	132	*3.5%*	162	*3.2%*	22.6	*1.9%*	11.74	*2.3%*	11.7	*2.2%*	7.3	*1.7%*
Services	High-tech knowledge-intensive services	501	*19.7%*	919	*24.0%*	1209	*23.8%*	366.2	*31.2%*	139.84	*27.7%*	139.8	*25.7%*	131.1	*31.1%*
	Market knowledge-intensive services	196	*7.7%*	316	*8.3%*	383	*7.5%*	3.4	*0.3%*	2.30	*0.5%*	2.3	*0.4%*	1.9	*0.5%*
	Financial knowledge-intensive services	2	*0.1%*	4	*0.1%*	4	*0.1%*	0.0	*0.0%*	0.01	*0.0%*	0.0	*0.0%*	0.0	*0.0%*
	Other knowledge intensive services	29	*1.1%*	116	*3.0%*	117	*2.3%*	28.0	*2.4%*	7.98	*1.6%*	8.0	*1.5%*	8.0	*1.9%*
	Market less knowledge-intensive services	128	*5.0%*	240	*6.3%*	303	*6.0%*	11.4	*1.0%*	6.05	*1.2%*	6.0	*1.1%*	6.0	*1.4%*
	Other less knowledge-intensive services	35	*1.4%*	40	*1.0%*	46	*0.9%*	12.1	*1.0%*	7.20	*1.4%*	7.2	*1.3%*	4.3	*1.0%*
	not classified	123	*4.8%*	257	*6.7%*	286	*5.6%*	43.9	*3.7%*	18.88	*3.7%*	18.9	*3.5%*	17.0	*4.0%*
	not allocated	621	*24.4%*	916	*24.0%*	1417	*27.8%*	164.0	*14.0%*	89.17	*17.7%*	89.2	*16.4%*	89.2	*21.2%*
	Total	**2545**	***100%***	**3822**	***100%***	**5088**	***100%***	**1172.5**	***100%***	**504.71**	***100%***	**544.8**	***100%***	**421.0**	***100%***

Source: FFG; calculations by Joanneum Research

If the topmost segments are combined, the "high-tech sector" and the "high-tech knowledge intensive services" sector make up a combined share of just under 30% of the funded projects. However, the share of these two sectors amounts to 44% on the funding volume. The medium segment is concentrated primarily in the manufacturing segment with a share of just above 22% and knowledge intensive services with a share of approximately 9% of the funded projects. If the high-tech and the medium high-tech sector as well as the technology-intensive and research-intensive services are combined, these industries account for 54% of the funded projects and 66% of the funding volume.[24]

In this connection, a number of industry-specific project statistics are also of interest (Table 14: *Project ratios by industry classification*).

24 It should also be noted that 30% of the projects and 25% of the funding volume cannot be assigned by industry.

Table 14: Project ratios by industry classification

	Project allocation	Mean project volume [1000 €]	Average funding share [%]
Material goods segment	High tech sector	760.5	29%
	Medium-high tech sector	678.4	30%
	Medium-low tech sector	390.7	34%
	Low tech sector	225.9	32%
Services	High-tech knowledge-intensive services	730.9	36%
	Market knowledge-intensive services	17.3	57%
	Financial knowledge-intensive services	5.0	100%
	Other knowledge intensive services	964.1	29%
	Market less knowledge-intensive services	89.3	53%
	Other less knowledge-intensive services	345.5	36%
	not classified	357.1	39%
	not allocated	264.1	54%
	Total	**460.7**	***36%***

Source: FFG; calculations by Joanneum Research

The main project volume is calculated as total cost/number of the projects and the average funding rate as the ratio of cash value to total cost (cash value/total cost). Calculated across all projects, the average project volume comes to € 460.7 thousand with an average funding rate of 36%.

At first glance, the project allocation of the FFG projects based on the NACE classification appears to be a reasonable allocation, as (i) the FFG's focus is project funding, (ii) the base programmes that recognise no industry-specific exclusion criteria make up the greatest share of the funding activities, and (iii) the industry membership of the company need not be identical with that of the research project.

Nonetheless, this classification must be interpreted with caution:

- As was already recommended in the FFF evaluation, in addition to a classification by project, the funded companies should also be classified by industry. This addition is currently being implemented.
- It is also questionable if a NACE industry classification provides a great deal of meaningful information concerning the technology content of research projects, i.e. if it represents an adequate classification.
- Within one class, there are great differences in the technology content of projects. Industries are by no means uniform classifications.

1.3.2 The Austria Business Service (AWS)

The AWS[25] was established in 2002 as the federal government's central development bank for handling business-related economic development.[26] Resulting from a combination of programmes funding general economic development, SME promotion, innovation promotion and regional development, the promotion spectrum of AWS is very broad and covers a large number of programme lines. Table 15: *Survey of services by funding instruments of the AWS (2008)* provides an overview services based on the funding instruments used.

25 See also in this regard: www.awsg.at
26 With the Act on Establishment of the Austria Business Service of 13 August 2002, BGBl. No. 130/2002.

Table 15: Survey of services by funding instruments of the AWS (2008)

	Projects	Funding in € million	Total project volume[1] in € million	Cash value in € million
Subsidies	3,009	167	1,695	167
Commitments	681	370	8,051	10
Loans	257	451	1,138	56
Consulting/service	1,235	–	–	–
Total	5,182	988	10,884	233

1 not including adjustment of combined promotion measures

Source: AWS

Funds totalling € 988 million were approved by AWS in 2008. As this value also includes loans, guarantees and commitments, the actual "effective" amount (cash value) at € 233 million is significantly lower. The AWS was able to fund a total of 5,182 projects in 2008, corresponding to a total project volume of € 10.8 billion.

The funding offered by the AWS is very comprehensive and simultaneously exhibits a high degree of differentiation due to the large number of lines of funding. The funding spectrum ranges from the financial support of young entrepreneurs to the subsidising of tourism and creating structural conditions for utilisation and mediation processes. This is the result of both the economic policy objectives and the legal framework conditions concerning aid schemes.

The technology promotion supported by the AWS is focused on the commercial implementation of and economic benefit from research results and they are fulfilled by two core responsibilities: on the one hand by property rights, licenses and exploitation of patents and on the other hand by the research, consulting and financial support of/in pre-establishment, establishment and growth projects. Moreover, focus programmes with industry-specific networking, consulting and financing services are offered for individual fields of the future, for example life sciences and creative industries.

This is achieved by the synergistic use of monetary instruments (in the form of subsidies, low-interest ERP loans and guarantees), intensive management and consulting activities as well a finely coordinated set of awareness-building instruments, making it possible to sustainably and efficiently support the sector of the Austrian economy dedicated to research, development and innovation in all business phases (establishment and growth).

The share of R&D-relevant instruments amounts to almost 10% of the total subsidies and results in a total project volume of € 284 million (see Table 16: *Survey of research and development services (2008)*).

Table 16: Survey of research and development services (2008)

	Projects	Funding in EUR '000	Total project volume in EUR '000
Subsidies	88	16,711	128,415
Commitments	19	14,221	44,540
Loans	23	57,561	111,273
Consulting/service	1,209	5,421	–
Total	1,339	93,914	284,228

Note: Contains all R&D-relevant promotional programmes of AWS: the programmes with a high consulting component such as tecma, uni:invent, market and technology research programmes tecnet, Business Angel Börse, consulting by the seed financing portfolio companies and LISA and also contains the awareness programmes Jugend Innovativ and Staatspreis Innovation.

Source: AWS

In addition to research and patent management, the R&D-relevant area focuses on consulting, support and mediation in the high-technology sector. Programmes such as Life Science Austria, the investment broker Business Angels or the seed financing programme for high-tech start-ups make sustained support of company start-ups possible in the high-tech sector. Companies in this sector are particularly affected by instances of market failure, and in light of the increasing risk aversion of the private sector, the public sector should become more prominent in this area.

1.3.3 Excursus: The promotion of new high-tech companies

Technology-oriented small and medium-sized companies are of great significance for technological developments and accordingly for the innovation capacity of a national economy (see in this regard Jörg and Schibany 2006). New, technology-oriented companies can

- cover market niches that are not noticed by large companies;
- respond flexibly to market changes;
- rapidly take advantage of new technical possibilities and thus strengthen the innovative strength of the national economy;
- have a stabilising effect in structural crises because of their adaptability.

Of course, the possibility of self-financing from their own cash flow is now very limited for new companies that first must establish themselves in the market. In order to implement new ideas and be able to offer marketable products or services from them, they are dependent on the willingness of outsiders to provide financing. The relation between company founders and external investors is often burdened by significant information deficits. Firstly, newly founded companies cannot point to a verifiable development of their projects in the past and it is very difficult to evaluate the information concerning the anticipated development and the prospects for the success of new companies from the outside. On the other hand, the transaction costs of an in-depth assessment and review by the investor is comparatively high for small and medium-sized companies.

These financing problems are even more pronounced for technology-oriented companies for the following reasons (see in this regard Carpenter and Petersen 2003):

- The opportunities/risks profile is characterised by particularly high uncertainty and is therefore not very attractive especially for

investors not participating in the higher profit potential.
- Usually, only experienced experts are able to provide a good assessment of the profit potential for new, technologically sophisticated products and processes. The information gap between the entrepreneurs and investors and accordingly the uncertainty regarding the quality of the projects are therefore particularly great.
- At the same time, the uncertainty with regard to the entrepreneurs' risk behaviour rises. As recipients of the residual profits, the entrepreneurs can have an incentive to enter into a greater risk after receiving the financing.
- Finally, it should be noted that to a greater degree than in other industries, the goodwill of a particularly innovation-oriented company depends on intangible assets that are not likely to be suitable as collateral for loans.

While large and established technology companies can counteract these problems through internal financing from cash flow or obtaining investment capital, new, innovation-oriented companies are most severely affected by the financing gap. The absence of an equity base, the information asymmetry between the investor and borrower concerning the actual degree of risk results in credit rationing for start-up high-tech companies.

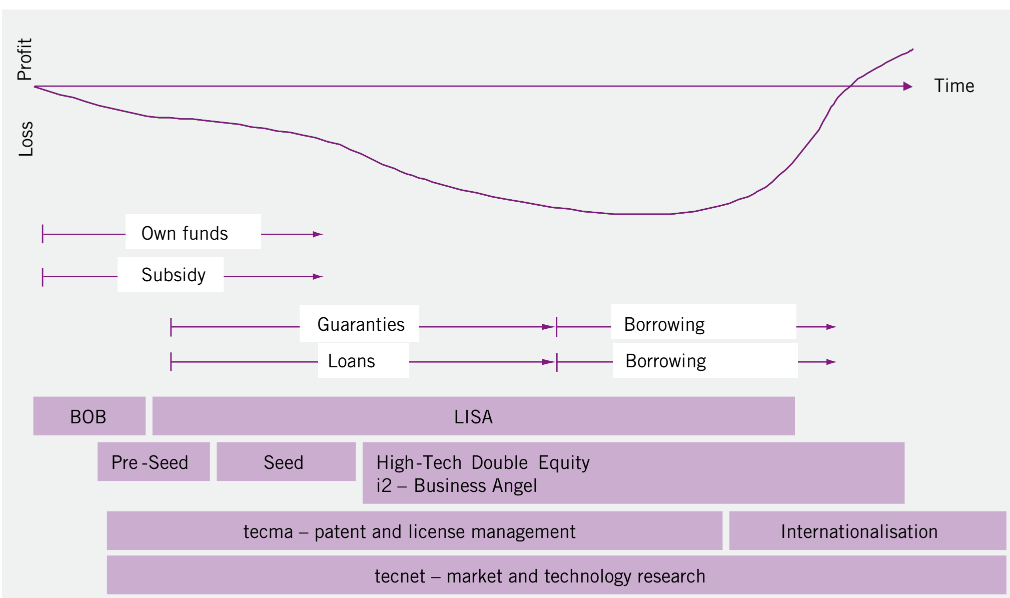
However, in order to be able to benefit from the advantages (or at least not have to accept related disadvantages) of a continuously regenerating enterprise population and a high number of flexible and highly competent small companies for the technological performance of the Austrian national economy and accordingly for its international competitiveness, a large number of support measures have come into use in the last few years. For the reasons stated, government promotion schemes support new high-tech companies in the early phase and thus close an existing financing gap. At the same time, the support measures go beyond pure financing by providing the management of the companies with supportive services tailored specifically to the area of technology and the company. Finally, this is intended to send important signals to the private venture capital and private equity market and facilitate further financing through the capital markets.

Various different measures are implemented with these objectives:
- Government investment programmes should stabilise the equity position of the corresponding companies;
- refinancing measures and assumptions of liability for private investors should reduce the default risk for private investors and increase their financing commitment;
- measures for bringing together investors and companies seeking venture capital to make the search processes more efficient and cost-effective;
- support of business angels which is expected to contribute to a greater involvement of private individuals in the financing of new companies;
- offers of consulting and awareness measures primarily with regard to spin-offs from public research institutions, e.g. in the context of thematic clusters or regional networks.

In Austria, a generous and comprehensive funding programme has been developed for the early phases of company development (Figure 15: *Financing phases and funding programmes in Austria*) to close the financing gap. Policy-makers saw a great need for action in the 1990s in particular for stimulation of business start-ups from research institutions. Academic spin-offs are an important element in the commercial utilisation of scientific results and advance the transfer of knowledge and technology. The company portfolio of the seed financing programme demonstrates the significance of the universities and research institutions in forming high-tech companies with high growth potential: Most of these companies are spin-offs from the university segment.

Figure 15: Financing phases and funding programmes in Austria

	Early Stage			Expansion
	Pre-Seed	**Seed**	**Start up**	**Expansion**
Activities	Product concept	Generation of rights and patents	Company start-up	Opening new markets
	Market analysis	Corporate structure	Development to production line status	Expansion Product portfolio
	Business plan	Business plan finalisation	Market entry	Sales expansion
	Infrastructure/location	Search for financing	Marketing concept	Growth financing
	R&D	R&D	R&D	Start of production
Support	AplusB	FFG	Founder centres	VC
	Pre-Seed	Seed	Federal states	aws/ERP
	LISA	LISA	FFG	FFG
	BOB	I2	Double Equity	Bank loans
	Federal states	Double Equity	Promotion of young entrepreneurs	Mezzanine financing



Source: Jörg and Schibany (2006)

Business start-ups by scientists and the utilisation of research results via business start-ups are affected by very specific barriers. In addition to awareness and stimulation measures that prepare the ground and awaken the interest of potential company founders, important supportive measures primarily include management consulting and qualification. In this area, the A*plus*B centres make a valuable contribution. Furthermore, potential founders face huge financing problems and encounter particular barriers with regard to debt financing. Usually there is only a product idea or at best a prototype at the time of founding. The technical risk is therefore very high. Frequently, there is not yet a market for the products to be developed which could provide guidance for pricing and the potential demand. In addition, the company has no *track record*, i.e. no experience values that outside investors could use to make a quantitative rating or that could serve as an indication of the quality of the management. The financing requirements typically contain a large share of "soft costs" (in particular personnel expenses) that cannot be secured by collateral. There is a particular risk of market failure especially for knowledge-based start-ups due to the great uncertainty about their technological and commercial success. This is what legitimises government intervention, which can be very diverse in its implementation but must be appropriate. Primarily, the government support measures provide capital and early-phase financing instruments (pre-seed, seed, double equity), consulting, qualification and research services (LISA, tecnet, tecma, uni:invent) and involve investors through access to risk capital investors (i2 – business angels).

The value of a new high-tech company thus lies primarily in its growth potential, a hopefully patentable technology and the human capital. In addition to a high level of innovative strength, external factors such as efficient distribution channels and partnerships with other companies are significant success criteria.

1.3.4 The Austrian Science Fund (FWF)

The Austrian Science Fund (FWF – Fonds zur Förderung der wissenschaftlichen Forschung) is Austria's central institution for the promotion of basic research. The FWF is committed to all sciences equally and, as scientific research in Austria takes place almost exclusively at the universities, it is the most important funding agency for university research. The mix of competitive research financing in connection with stand-alone project funding and the support of networks (Special Research Programmes (SFBs) and National Research Networks (NFNs)) can be seen as an effective method for prioritising themes and flexibly focusing on new themes. The funding criteria of the FWF are solely related to the scientific quality of the funding applications and their treatment is independent of any predetermined distribution key – all applications to the FWF are on a level playing field.

The greatest share of research funding goes to autonomous programmes, where 94% of the funding is for stand-alone projects (in addition to other programmes) for a maximum of three years. The substantially smaller "commissioned programmes" contain lines of funding such as the START programme and the Wittgenstein Award (Table 17: *Promotion of the FWF at a glance (2008)*).

Table 17: Promotion of the FWF at a glance (2008)

Funding line	Funding support (€ million)	Applications	Applications decided	Applications approved	Approval rate of the submitted funding sums
Autonomous Programmes					
Stand-alone Projects	89.9	869	833	357	39%
Special Research Programmes (SFB) [1]	11	47	48	23	33%
National Research Networks (NFN) [2]	12	32	32	12	25%
International Programmes [3]	9.7	187	160	67	28%
Doctoral Programmes-plus (DKs) [4]	16.1	7	7	3	29%
Erwin Schrödinger Grants	4.1	127	125	75	61%
Lise Meitner Programme	4.2	84	75	26	37%
Translational Brainpower [5]	1.5	12	12	5	38%
Elise Richter Programme	3	31	35	13	30%
Translational Research (TRP)	12.4	135	139	51	34%
Publication support [6]	0,5	108	106	71	60%
Total	164.4	1639	1572	703	38%
Commissioned Programmes					
START Programme	6.1	46	46	8	10%
Wittgenstein Award	1.5	13	13	1	8%
Hertha-Firnberg Programme	2.6	50	41	13	32%
Impulse Projects	0	0	0	0	-
Provision	1.54	7	26	10	24%
Total	11.74	116	126	32	12%

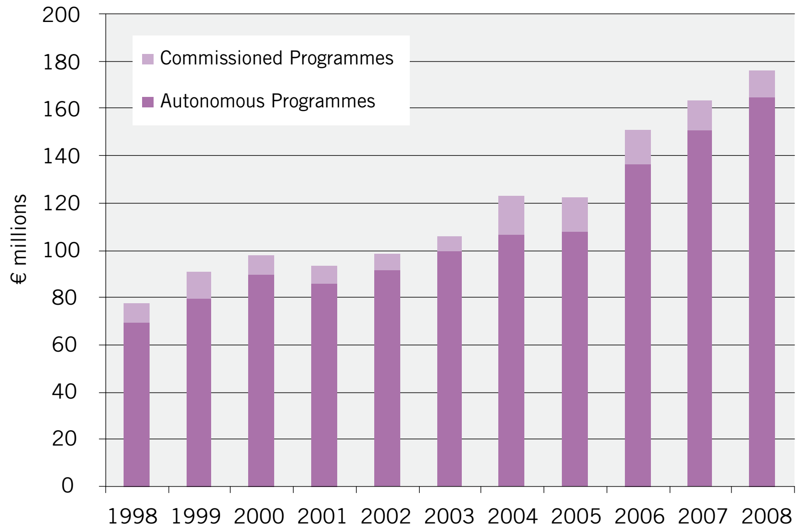
1 2-stage process; the figures shown here correspond to sub-projects of complete applications (2nd stage)
2 2-stage process; the figures shown here correspond to sub-projects of complete applications (2nd stage)
3 Initiation, international cooperative agreements, etc.
4 Is a further development implemented in 2008 of the doctoral programme (DK) established in 2004.
5 Is a programme started in 2007 for financing guest scientists in connection with TRP projects.
6 Independent publications, translation costs, journal publications

Source: Austrian Science Fund (FWF)

In 2008 a total of 1,639 applications (with an application volume of € 389 million) were submitted for the funding of autonomous scientific projects. Of these, 703 projects were funded. The average volume of an approved project amounted to approximately € 233,000.

For stand-alone projects, the approval rate was 39% of the requested funding sum. The total approval volume of the FWF was just above € 164 million for autonomous programmes (cf. Figure 16: *FWF funding of autonomous and commissioned programmes (1998–2008)*).

Figure 16: FWF funding of autonomous and commissioned programmes (1998–2008)



Source: Austrian Science Fund (FWF)

The volume of approved autonomous programmes thus rose from € 70 million in 1998 to € 164 million in 2008, reflecting a 137% rate of increase.

Research – scientific research in particular – is primarily a matter of personnel. More than 80% of the grants awarded are used to cover personnel expenses – i.e. hiring young scientists. Accordingly, FWF had more than 2,700 persons active in science so to speak on its "payroll" in 2008 (Table 18: *Research personnel funded by the FWF*).

An analysis of the distribution of funds by scientific discipline (Table 19: *Grants awarded by scientific discipline in 2008, autonomous programmes*) shows that the natural sciences are clearly in the lead. 62% of the grants awarded went to this area of science, reflecting a significant increase of almost 10 percentage points compared to the previous year. This increase was mainly at the expense of human medicine which fell back from 20% to 11% last year. The humanities and social sciences accounted for a 21% share.

Table 18: Research personnel funded by the FWF

	2006	2007	2008
Postdocs	670	860	830
Doctoral candidates	1280	1359	1526
Erwin Schrödinger Grants	93	111	102
Lise Meitner Positions	33	45	45
Hertha-Firnberg Positions	41	46	40
Elise Richter Positions	8	24	29
Charlotte-Bühler Positions	10	3	0
Impulse Projects	13	13	7
Technical Staff	102	118	123
Total	2250	2579	2702

Source: Austrian Science Fund (FWF)

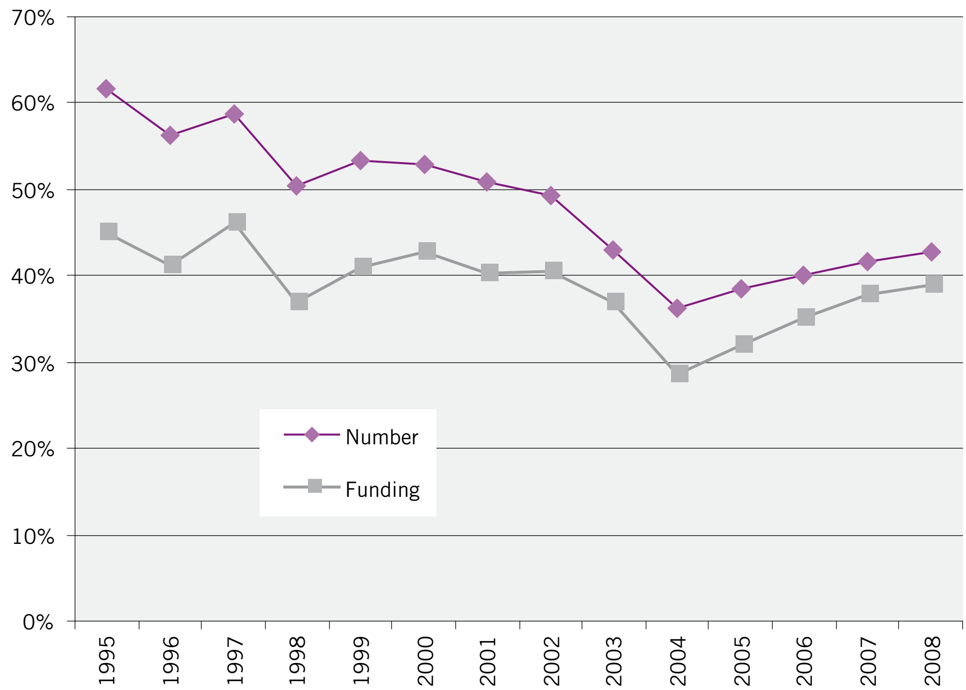
Table 19: Grants awarded by scientific discipline in 2008, autonomous programmes

	in € million	%
Natural sciences	102.2	62
Technical sciences	4.6	3
Human medicine	18.5	11
Agriculture and forestry, veterinary medicine	3.8	2
Social sciences	13.8	8
Humanities	21.5	13
Total	164.4	100

Source: Austrian Science Fund (FWF)

A much discussed characteristic of the FWF which was also recently addressed by the CREST group of experts, is the approval rate of research applications (CREST 2008).[27] According to the CREST report, it appears to be a little too high, "...and deserves closer examination." The development of the last few years shows that the approval rate of the stand-alone project applications (number) trended downwards until 2004 and dropped to 36%. By 2008, the rate had climbed back to 43%. The trend of the grants awarded shows a similar pattern and is just under 40% (see Figure 17: *Approval rate for stand-alone projects (1995–2008)*).

Figure 17: Approval rate for stand-alone projects (1995–2008)



Source: Austrian Science Fund (FWF)

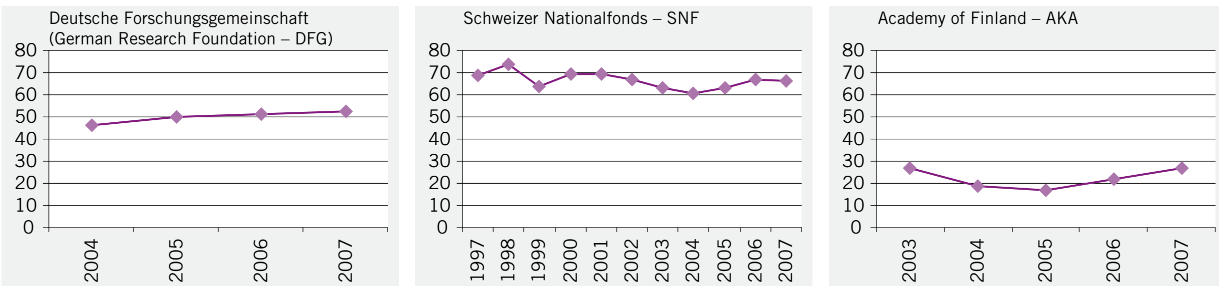
The remarks by CREST sting a bit, as the FWF does apply the internationally customary peer review method in evaluating applications, i.e. a more or less standardised quality assurance method for evaluating scientific project applications or scientific publications by professional colleagues. Peer review methods take into account that there are no other formal quality standards for research projects that would make it possible to determine the quality, innovativeness and chances of successful implementation. Furthermore, the evaluation

27 "The high success rate of project applications to the FWF compared to the success rate in other countries was taken note of with interest. Of course, this could simply have to do with the high quality of Austrian science and the Austrian research community. On the other hand, it could also mean that the quality standards are lower than elsewhere. This situation therefore deserves closer examination." (CREST 2008, p. 23).

of the FWF performed in 2004 (Arnold et al. 2004) gave the appraisal system a very positive rating.[28]

An analysis of the approval rates of other European science funds (comparable with the FWF) shows, on the other hand, that the respective rates are very diverse. The approval rates by the Deutsche Forschungsgemeinschaft (DFG; German Research Foundation) for stand-alone projects are just above 50%; those for the Schweizer Nationalfonds (SNF; Swiss National Fund) have been between 60 and 70% for years and those for the Finnish Academy of Sciences were 27% in 2007 (see Figure 18: *Approval rates of stand-alone project applications in comparison (in %)*).

Figure 18: Approval rates of stand-alone project applications in comparison (in %)



Source: DFG, SNF, AKA; calculations by Joanneum Research

It is striking that large differences exist between the individual funding agencies and that it is simply impossible to determine the optimal level of the approval quota ex cathedra. Funding agencies are a component of the innovation system and their promotion activities are affected to a large degree by contextual conditions such as additionally existing support opportunities, the financing structures of the universities, the prevailing incentive structures for scientists and other determinants. In Austria, the FWF finances approximately 11% of the R&D expenditures of the higher education sector and the federal government finances 75% with the result that only the topmost segment (approximately 20–25%) of the potentially eligible community files applications with the FWF.[29]

An entirely different situation prevails in countries like the UK, where funds for university research can in principal only be raised via the councils and accordingly the incentive to file research applications applies to a much more comprehensive group of persons. The diverse structures thus have an influence on the approval quotas.

28 "No changes in the peer review system seem to be necessary within the current regime. It is open to newcomers in term of disciplines etc, while at the same time the portfolio of funding schemes allows for some accumulation of critical resources. There are no barriers set up in the decision procedures that would give some researchers better access than others. Even individual researchers with prestigious prizes have a moderate level of projects from the council" (Arnold et al. 2004, S. 85)

29 To broaden this segment, the BMWF introduced the compensation of overhead costs of the universities for FWF projects as a part of an excellence initiative [2008, retroactive to December 2007. It is intended to put a self-reinforcing positive momentum into action in the research locations. Another important component of this initiative is an improved doctoral education (see also in this regard the University Report p. 132f.)

In general, it can also be noted that the quality of the applications has risen. To be sure, there are still no hard facts or investigations regarding this; however the following conclusions can be drawn based on the observations of the officials in the departments:

- The increased competitive pressure and the associated high rejection rates of approximately 70% and more in 2004 and 2005 have contributed to an increased quality orientation.
- Furthermore, the cumulative experience in submitting project applications primarily among younger scientists leads to an "internationalisation" of existing quality standards.
- The expert reports that have been made available in full to applicants since 2003 have in many cases led to a revision and resubmission of applications. This was often accompanied by a significant increase in quality and a higher chance of approval.
- There has been a continuous improvement of the application guidelines and the expectation since 2005 that projects be submitted on electronic data carriers as well has apparently favoured better structured and more precise applications.
- The FWF has extended its consulting activity to a new field by offering coaching workshops primarily to young scientists since September 2006. This coaching clearly improves the approval chances.

It may perhaps be wrong to attribute the high approval rate to the quality of Austrian science – as the CREST experts questioningly did. On the other hand, it appears to be all the more legitimate to attribute it to the quality of the research applications. However, if one wishes to accept the inference of attributing the approval rate to the quality of science, Austria could model itself after Switzerland. Switzerland comes off the best in an international comparison of research accomplishments (see Table 29: *Research performance in international comparison (1997–2006)*), and this despite (or perhaps even because of) the high approval rate of the Schweizer Nationalfonds.

2 The Austrian Innovation System: Appraisals and Perspectives

The Austrian Innovation System was the subject of appraisals and discussions in the years 2008/09. Initiatives were started with various objectives intended to establish the basis for a national RDI strategy through as comprehensive an overall assessment as possible.[30]

In spring 2008 the Federal Ministry of Transport, Innovation and Technology (BMVIT) and the Federal Ministry for Economics and Labour (BMWA – now the Federal Ministry of Economy, Family and Youth) commissioned a system evaluation of research promotion and financing. The evaluation's goal is to analyse the research promotion and financing with regard to the performance of the Austrian Innovation System and identify any need for action to improve it. A particular focus is on the mode of operation of the research promotion instruments. The evaluation is being carried out by a consortium of bidders consisting of the Austrian Institute of Economic Research (WIFO) as project manager, SME Research Austria, Prognos AG and the subcontractor convelop.[31]

The objectives of the Research Dialogue started in summer 2007 and presented in Alpbach 2008 were different. Here, the inclusion of the entire community created a forum in which nearly all subjects of science and research were discussed and documented. Under the lead management of the Federal Ministry of Science and Research and with the support of the entire federal government, the scope of the research dialogue was as broad as possible to offer the participants the possibility of presenting and discussing their standpoints and points of view. The discussions were compiled and made accessible in a 265 page outcome document.[32] The conclusions of the Minister of Science from the research dialogue were compiled in the so-called "future reports"[33].

To gain an outside perspective, members of the EU Scientific and Technical Research Committee (CREST)[34] were invited to prepare a country report on Austria. The policy-mix peer review country report[35] reflects the collective assessment of the Austrian research, technology and innovation environment by a review team and is the result of a consultation process with representatives of political decision-making levels, the funding agencies, the consulting bodies and national experts. The assessments of the review team were concerned with the areas of science system, industrial R&D and innovation, human resources and (of special impor-

30 See Government Action Programme for Legislative Period XXIV (2008–2013), p. 45.
31 Cf: http://www.bmvit.gv.at/innovation/forschungspolitik/systemevaluierung/index.html
32 Cf: http://www.bmwf.gv.at/forschung/oesterr_forschungsdialog/
33 http://www.bmwf.gv.at/forschung/oesterr_forschungsdialog/
34 CREST is the European Union's committee for scientific and technical research. As part of the open coordination method (cyclical activities in support of the EU's efforts to increase R&D expenditures to 3% of GDP within the EU), CREST began a series of policy-mix peer reviews during the second cycle and continued them in the third and fourth cycle.
35 http://www.bmwf.gv.at/forschung/oesterr_forschungsdialog/

tance for Austria) recommendations regarding structures and processes of formulating policy.

The most important assessments and recommendations of these three activities are summarised in the following sections; this is also intended to document that the foundations necessary for a national RDI strategy are present.

2.1 System Evaluation of Research Subsidies and Financing

2.1.1 Introduction

Austria has continuously improved its technological position in the last 15 years. In the early 1990s, most technology and innovation indicators were below or at the European Union average. In the meantime, indicators show that Austria has become a leader in this area.[36] Worthy of particular note is the positive development of the R&D ratio which improved from 1.44% in 1993 to 2.66% in 2008 (and is forecast to reach 2.73% in 2009). Austria is accordingly one of the few European countries to be on a path to reach the intended 3% ratio (nonetheless, the present conditions make it unlikely that the target will be achieved in 2010). In the same period of time, the public-sector research promotion and financing was significantly expanded and restructured. On the side of direct research promotion, the most key events were the formation of Austria Business Service (AWS) in 2002 and the Austrian Research Promotion Agency (Forschungsförderungsgesellschaft – FFG) in 2004. On the side of tax-incentivised research promotion, the way was prepared in 2002 for the research tax allowance and for the research premium based on research expenditures as defined by the OECD's Frascati Manual. The continuous increase in flows of funds and the increasing differentiation of the promotion portfolio have pointed to a need for an evaluation of the Austrian system of research promotion and financing on the policy level and the institutional level.

In autumn 2007, a system evaluation of research promotion and financing was commissioned under the lead management of the Federal Ministry for Transport, Innovation and Technology (BMVIT) and the Federal Ministry for Economics, Family and Youth (BMWFJ, at that time still bearing the name Federal Ministry for Economics and Labour (BMWA). Among several applicants, the consortium of bidders in association with the Austrian Institute of Economic Research (WIFO) comprising SME Research Austria, Prognos AG Deutschland and convelop were awarded the contract for this project in spring 2008. The contract was signed in April 2008.[37] The evaluation order contained three levels.[38]

1. Framework conditions: On the one hand, these include the general conditions that cannot be directly assigned to RDI policy but impact the function of the research system in a positive or negative manner (e.g. market regulations, tax laws, university law).[39] On the other hand, the strategic governance structures of the RDI system are analysed[40]

36 See also in this regard chapter 1.1.4 of this Research and Technology Report.
37 Aiginger et al. (2009), Final report of the system evaluation.
38 The annex contains a copy of the scope of services.
39 Janger et al. (2009), Framework Conditions – Report 1 of the System Evaluation.
40 Gerhardter et al. (2009), Strategic Governance – Report 2 of the System Evaluation.

in a narrower sense as well as the interactions between the strategic and operational level.[41]

2. Instruments: Measures of indirect, direct and (as a component thereof) institutional promotion are contained in three initially separate portfolio analyses and evaluated with respect to their design, appropriateness and mode of operation. The primary focus here is aspects of target group coverage and satisfaction as well as target group behaviour.[42]
3. Systemic Interaction: Initially the systemic requirements will be developed on a coherent and stimulus-compatible overall system of research promotion. Furthermore, this concerns the operative interaction between the institutions and actors as well as thirdly, the coherence of the instrument mix: the interaction of the direct and indirect funding instruments [43]

The first results with a focus on the instruments of tax-incentivised research promotion and their interaction will be presented in this section of the Research and Technology Report. Conclusions from these results must still be evaluated on the policy level.

2.1.2 The instruments of research promotion and financing – an overview

Direct funding is distinguished in that income is awarded to applicants as subsidies based on an assessment procedure. Direct funding thus consists of transfers from the public sector to favoured applicants. In the case of indirect or tax-incentivised instruments, the support is via tax relief mechanisms. In Austria, the tax-incentivised research and promotion instruments are based on the tax base or on the tax liability. Research tax allowances reduce the tax base; in the case of the research premium, the tax liability is reduced by a specific portion of the research expenditures.[44] If no tax liability exists due to the absence of corresponding profits, the premium (currently 8% of the applicable expenses) is credited directly to the company. Three fourths of the loss of tax revenue attributable to tax-incentivised research promotion instruments for the 2005 tax year was accounted for by the research premium. In 2007, the Austrian Court of Auditors estimated the total loss of revenue for 2005 attributable to tax concessions for research activities to be € 418 million.

In the case of tax incentives, a high degree of neutrality is generally assumed, as tax-incentivised promotion in principle does not discriminate with respect to either the type or content of the supported projects or with regard to the sectoral membership of the recipient. It funds SMEs performing research to the same degree as large enterprises performing research. Anyone meeting the criteria for funding can file a legal claim for funding without the public sector asserting the claim to intervene

41 Ruhland et al. (2009), Governance in RDI – Relation between Ministries and Agencies – Report 3 of the System Evaluation.

42 Falk (2009), Tax Incentive Schemes for R&D – Report 4 of the System Evaluation; Mayer et al. (2009), Direct Public Funding of RDI in Austria – Report 5 of the System Evaluation; Klose et al. (2009), Effects of Block Grants on Research Institutes and Universities- Report 6 of the System Evaluation; Streicher et al. (2009), Public RDI Funding in Austria – the Target Groups' Perspectives – Report 7 of the System Evaluation.

43 Falk (2009), Coherence of the Instrument Mix – Report 8 of the System Evaluation; Astor et al. (2009), Systemic Analysis of the Innovation and Intervention System – Report 9 of the System Evaluation.

44 See BMVIT und BMWF (2007) regarding the structure of tax-incentivised promotion in Austria and BMF/BMWA (2008) for somewhat greater detail.

in business decisions through taxation. Tax-incentivised promotion must thus be classified as a low-threshold, non-selective instrument with potential broad impact. Tax-incentivised promotion has at times been subject to criticism in the literature (David et al. 2000), as its structure tends to support research activities with high private benefit and not necessarily those with high social benefit due to the non-specific focussing of its content and themes. Moreover as the cash value of the funding is generally very low (at least lower compared to direct funding), from a business perspective there is little incentive to substantially increase or modify the extent and type of the research activities.

In contrast, it is inherent to the approach of direct research promotion to establish focuses that are deliberately content and subject-related and/or actor-related. It is thus possible for research projects that are considered to be important to be pushed ahead in a very precisely targeted manner, or RDI cooperation may be advanced between basic research in scientific institutions and applied research in companies via special programmes. An appropriate selection of the objects of promotion, criteria and beneficiaries makes it in principle easier to exclude spill-over effects and only subsidise activities with public funds that would otherwise not have received private financing. However, not only improved controllability and potentially higher incentive effects can grow out of the strong selectivity but just as high demands on the selection, approval and settlement process. In the case of thematic requirements, it is frequently also a problem that only inadequate information is available concerning the future potentials of individual technologies or industries, resulting in misallocations of scarce development funds. Moreover, greater selectivity in the funding offered can easily lead to growing fragmentation and confusion regarding the funding environment and its requirements. This increases the demand for information on the part of the enquirers. Similarly, funding criteria and decisions can become less transparent and the companies' planning security can drop. This is in contrast again to the high planning security of the public sector, as programmes are generally endowed with fixed levels of funding while on the other side, tax incentives undermine budget control and future income losses can only be forecast.

Table 20: Comparison of tax-incentivised and direct research promotion

	Tax incentives	Direct promotion
Access threshold for parties eligible for promotion	Low	High
Control effect	Slight	High
Administrative expense	Slight	High
Planning security		
for the company	High	Slight
for the public sector	Moderate	High
Incentive effect	Rather low	Rather high

Source: WIFO presentation

Advantages and disadvantages of the different funding approaches are in juxtaposition to one another (Table *20: Comparison of tax-incentivised and direct research promotion*). Both instruments are thus designed to complement one another with regard to conception.

2.1.3 Tax-incentivised promotion of R&D in Austria

The instruments of tax-incentivised promotion of R&D in Austria

Austrian tax law provides for tax-incentivised or indirect promotion schemes for R&D. It recognises three research tax allowances under § 4 (4) line 4 to line 4b Income Tax Act and the research premium under § 108c Income Tax Act. The assessment bases for the research tax allowances under § 4 (4) line 4 to line 4b Income Tax Act ("FFB-new") and the research premium are expenses for research and development in accordance with the OECD definition framework of the Frascati Manual. Expenses for contract research are governed in line 4b Income Tax Act. As of tax year 2004, a 25% allowance was established under the Economic Growth and Business Location Act of 2003. On the other hand, the research premium amounts to 8% of the expenses as defined by Frascati according to § 4 (4) line 4. For the research tax allowance under § 4 (4) line 4a Income Tax Act ("FFB-old"), expenses for the development or improvement of so-called economically valuable inventions are included in the assessment basis. After the Tax Reform Act of 2000, a 25% allowance rate was established as of fiscal year 2000 for expenses not deviating from the R&D expense level of the previous year. A so-called incremental allowance rate of 35% can be claimed for activities in excess of this. A requirement for use is the presence of a federal certificate in the form of a certification of the BMWFJ or a patent. Table 21 provides an overview of the funding support with regard to the assessed R&D costs of the research allowances and the research premium. Thus in 2005 the funding support through „FFB-new" was 6.25 cents per € 1 of R&D expenses of corporations.

Table 21: Tax-incentivised promotion of R&D – an overview

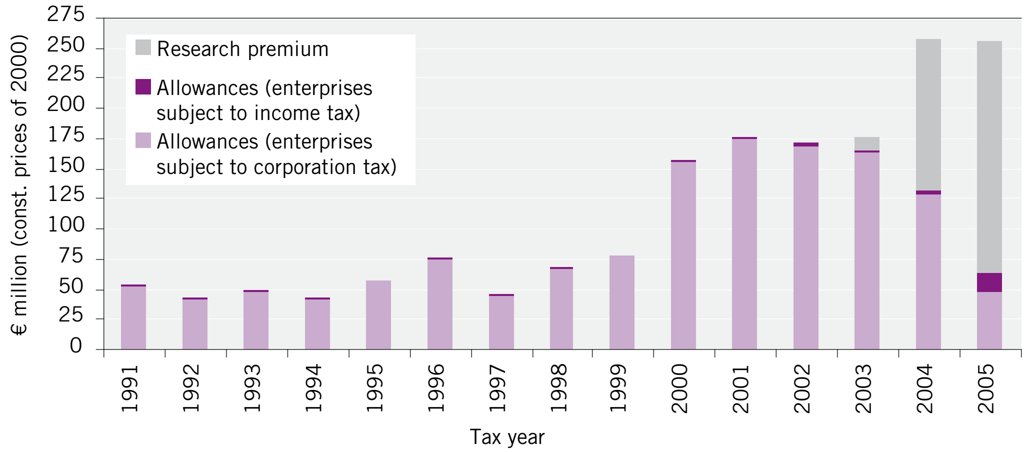
	FFB-old[1]		FFB-new[1]	FFB-new[1] for contract research	Research premium	Research premiums for contract research
	Expenses	Incremental				
2002	8.50%	11.90%	3.40%		3%	
2003	8.50%	11.90%	5.10%		5%	
2004	8.50%	11.90%	8.50%		8%	
since 2005	6.25%	8.75%	6.25%	6.25%	8%	8%

Comment: [1] The funding support of the allowances is determined by multiplying the allowance rate by the applicable corporate tax rate. For those subject to income tax, the funding support is determined by multiplying the allowance rate by the applicable marginal tax rate.

Source: Income tax statistics, WIFO calculations

The changes in the tax-incentivised promotion of R&D described above have led to an increase in the volume of support (Figure 19). In tax year 2005, the costs of the tax-incentivised R&D promotion somewhat exceeded € 250 million at constant prices. This corresponds to € 276.6 million at current prices and thus falls short of the estimates of the Court of Auditors of € 418 million.

Figure 19: Costs of tax-incentivised R&D promotion



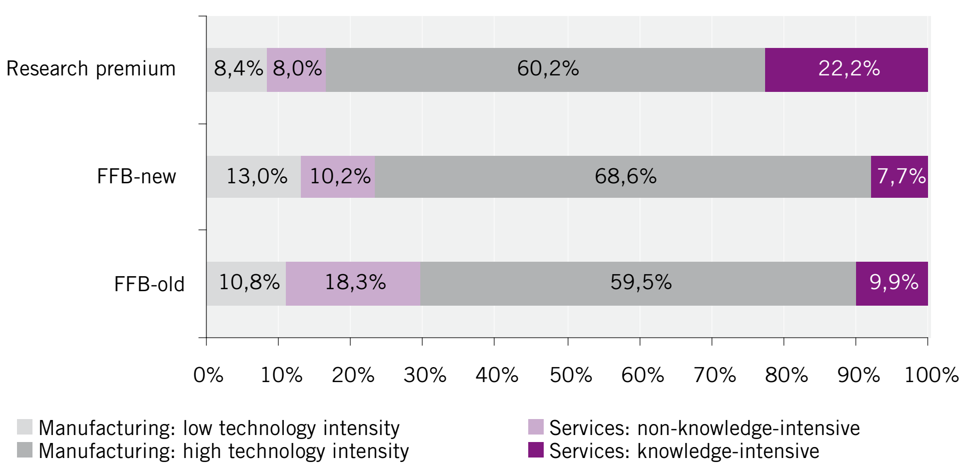
Note: On the survey date, data up to tax year 2005 was available.

Source: Corporation tax statistics, income tax statistics, notifications of the Federal Ministry of Finance, WIFO calculations

Use of the instruments of tax-incentivised promotion

Figure 20 shows the distribution of the tax-incentivised promotion in 2005 to an industry classification of companies depicting the technology or knowledge intensity. It is evident that all forms of tax-incentivised promotion are primarily used by technology-intensive companies. This applies most to FFB-new; 68.8% of the total tax-incentivised promotion claimed via FFB-new went to technology-intensive companies. Knowledge-intensive service companies primarily use the research premium (22%).

Figure 20: Distribution of tax-incentivised promotion by industry in 2005



Source: Corporation tax statistics, income tax statistics, notifications of the Federal Ministry of Finance, WIFO calculations

If the distribution of the tax-incentivised R&D promotion is considered based on the size categories of the companies, analyses show that companies with more than 100 employees represent approximately 40% of the funding recipients for FFB-old and 30% for FFB-new. In 2005 these companies used approximately 90% of the total tax-incentivised promotion from FFB-old and FFB-new. Within the companies with more than 100 employees, the large companies with more than 500 employees are among the strongest beneficiaries of tax-incentivised promotion based on allowances. Measured against the number of recipients of tax-incentivised promotion, primarily SMEs represent the greatest proportion, while measured against funding support volume; large companies receive the largest share of the support. In the case of the research premium, the number of funding recipients is similar to that of the allowances. Companies with more than 100 employees also represent approximately 30% of all funding recipients. In contrast to the allowances, however, SMEs with up to 100 employees receive more than 70% of the total funding support volume distributed via the research premium. Thus with regard to the volume of funding support, companies with more than 100 employees are the target group of the allowances and SMEs are the target group of the research premium.

With regard to the funding intensities of the tax-incentivised promotion, i.e. the ratio between funding support and the transacted research expenditures, the results of the related studies show that the funding intensities fluctuate between 4.5% and 7.7% in the size categories starting from a size of ten employees. The data available for micro-enterprises is not meaningful due to statistical under-reporting. The average funding intensity across all size categories is 6.9%. Overall, the tax-incentivised promotion is neutral with regard to company size. An industry-specific breakdown shows greater fluctuations than in the observation by size categories. In the area of manufacturing, the lowest funding intensities were observed in companies with low-to-medium technology intensity, the highest in companies with medium-to-high technology intensity. In the high-technology segment, the funding intensity is almost 5.6%. In services, a funding intensity of almost 5% was observed in industries with high knowledge intensity. The low funding intensities observed across all companies in high-technology industries and in the knowledge-intensive segment of the service industries reflect the specialisation of the Austrian economy.

Funding effects of the tax incentives

The increase of the research premium to 8% in 2004 and the lowering of the corporate tax rate from 34% to 25% in 2005 have led to increased use of the research premium at the expense of the research allowances. The introduction of the research premium has caused the number of indirectly funded companies to rise sharply. While 853 companies were still funded through "FFB-old" in 2001, the number of companies that used a tax allowance or premium rose to at least 2374 and at most 3144 in 2005. The range of variation is explained by the possibility of multiple uses of the individual instruments. The premium received the greatest share. Almost 1800 companies received favourable tax treatment through the research premium. Many of the new users are small and medium-sized enterprises (SME).

2.1.4 Direct support of research in Austria

As part of the system evaluation of research promotion and financing, the availability of direct research, technology and innovation promotion on the federal level was examined. The investigation focused on 77 different funding support measures. The programmes were allocated to the agencies as follows: Austrian Research Promotion Society (FFG) 39, Fund for Scientific Research (FWF) 19, Christian Doppler Society (CDG) 1 and Austria Business Service (AWS) 18.

The available documents about the promotion measures that are relevant to the evaluation was the starting point of the analysis. Additional information was obtained through qualitative interviews with experts from the functional departments, from the Federal Ministry of Finance, from the agencies and with experts from the target groups. Finally, a survey of the target groups was carried out and evaluated.

Availability of resources and target groups[45]

As Table 22 shows, the FFG (62.5%) and the FWF (31.8%) awarded the largest portions of the resources approved for research promotion in the period under review (2002–2007). The participation of AWS and the CDG in the entire research promotion was relatively slight. It was not determined that any sums were requested from AWS and CDG.

Table 22: Development of requested and approved subsidies (cash values) from FFG, AWS, FWF and CDG, 2002–2007, in € million

	CDG		FFG		AWS		Austrian Science Fund	
	requested	approved	requested	approved	requested	approved	requested	approved
2002	-	3.8	602.2	214.2	-	7.7	227.2	100.8
2003	-	5.5	490.8	169.8	-	11.8	324.6	105.8
2004	-	5.8	472.9	183.2	-	17.5	355.2	123.5
2005	-	6.3	535.1	257.7	-	26.6	384.6	122.1
2006	-	6.9	656.5	281.8	-	27.0	424.1	151.0
2007	-	8.4	1045.8	398.5	-	9.4	417.1	163.3
Total	-	36.8	3803.3	1505.1	-	100.0	2132.8	766.5
%-distribution	-	1.5%	-	62.5%	-	4.2%	-	31.8%

Notes: FFG (or predecessor organisations): not including Biomed (2002), SELP (2005), IEA (2003), NAWI authorisations (2007)AWS includes the following programmes: Double Equity, equity capital guarantees, i2, Product Finding, ERP technology programmes, R&D guarantees (cash values)

Source: Information from the funding agencies. Calculation and presentation by KMFA.

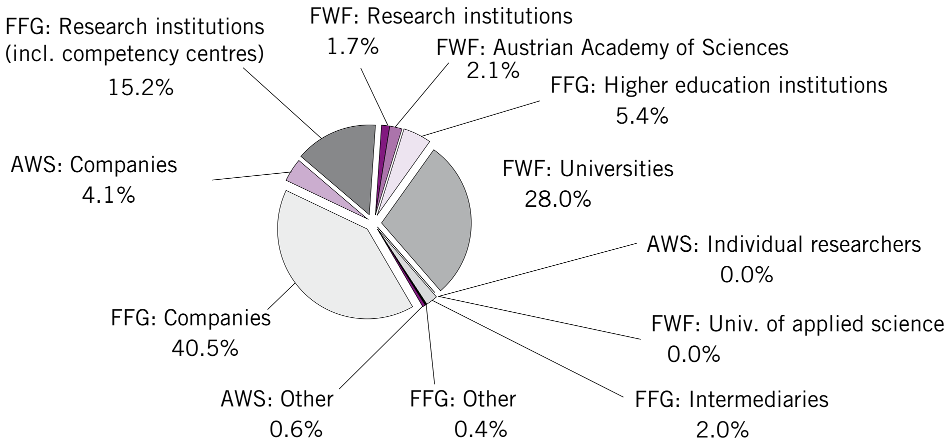
45 See also section 1.3.

The CDG shows a continuous increase of the funding sums awarded. Until 2007, AWS also had an increasing volume of funding. In 2007, a decline in the funding sums approved was observed. This was due to the expiration of several technology programmes (seed financing including LISA, protec-INNO, protec-TRANS). The subsidies awarded by FFG and its predecessor organisations declined in the 2002–2004 period and did not reach the 2002 level again until 2005. Since that time, the funding volume of FFG has increased continuously. In FFG, the greatest share of the subsidies were awarded through the base programme (see also section 1.3.1 of this report), for which most applications were also received. Both the number of applications as well as the development funds approved were increased in the structural programmes and the thematic programmes in 2007. On the one hand, this is attributable to the first COMET call for submissions and also to a number of calls for new submissions in the area of the thematic programmes. The subsidies approved by the FWF rose from € 100.8 million in 2002 to € 163.3 million in 2007. Here it should be noted that while the requested development funds rose by 83% in the period under review, the approved development funds increased by only 62%. Accordingly, the competition for development funds in the target group approached by the FWF has increased over time.

With regard to the operational implementation of the measures of the funding agencies, the analysis shows that non-repayable subsidies are the dominant instrument and their significance has even increased over time. Non-repayable subsidies were awarded in approximately 86% of the programmes examined in the system evaluation. At 9%, supported consultation is ranked in second place. Guarantees, profit-dependent repayments and loans follow at between one to five percent. Risk capital and prices for special services are ranked at 1% each at the lower end of the scale and their significance has declined over time

A target group analysis of the programme documents of the total 77 programmes of direct research promotion in Austria shows that roughly 65% of them are accessible for companies. Of these, approximately 41% are accessible without additional restriction according to the size and age of the company. 13% are limited to SMEs and approximately 5% each are focused on SMEs or on start-up financing. In a few programmes, the focus is on the technological profile of the companies. For scientists, researchers and inventors about 285 of the programmes are directly available for research subsidies. In this area, the subsidies of FWF dominate, although promotion schemes of FFG are also accessible for individual researchers. Approximately 36% of the promotional schemes are accessible for universities and other research institutions. Intermediaries are addressed as a target group in 7% of the programmes. Other institutions (e.g. museums, schools, potential users) are defined as the target group in 11% of the cases and only three programmes are directed to research institutions outside of universities. It is evident that FFG addresses companies, higher education and research institutions equally. FWF is targeted primarily to individual researchers and in a significantly lower degree to companies, universities and other research institutions. AWS focuses on companies and primarily SMEs and start-ups.

Figure 21: Distribution of the approved funding sums broken down by funding agencies and types of organisations (2002–2007)



Notes: Approved funding sums in non-repayable subsidies (Exception: general programmes including guarantees and loans: Guarantees are allocated to cash value at 3% of the assumed guarantee, loans at approximately 7%). The following programmes are included for the AWS: Double Equity, equity capital guarantees, i2, Product Finding, ERP technology programmes, R&D guarantees (cash values) FFG: intermediaries: technology transfer centres, clusters, etc.; Other: individual researchers, administrative institutions, etc. FE: research institutions.

Source: Information from the funding agencies – KMFA calculations and presentations

As seen in Figure 21, companies account for almost half of the approved funding support (primarily through FFG), universities or researchers at universities for approximately one third (primarily through FWF) and research institutions including the competency centres account for almost 20%. Continuing analyses have also shown that comparatively low funding volumes are awarded for innovation activities in the services sector. On the other hand, it is also the case that the research promotion is fully capable of bringing new actors into the system, although it is difficult to determine how many of them are companies that have no or only little experience in R&D.

Target group overlapping of the programmes and the relationship of thematically oriented programmes and non-thematic promotion to one another

The analyses show a large number of different sets of instruments are necessary to be able to address the different requirements and target groups in a suitable manner. The promotion of companies with no experience in R&D requires different instruments than is necessary for companies that continuously carry on R&D and for which the primary goal is to raise the aspiration level of their R&D activities. A very differentiated promotion system has been developed here in Austria. While gaps in promotion were still complained of in the 1990s, today's criticism is that new promotion schemes are usually the treatment of choice as soon as a need for action is identified. This has led to a multiplicity of programmes.

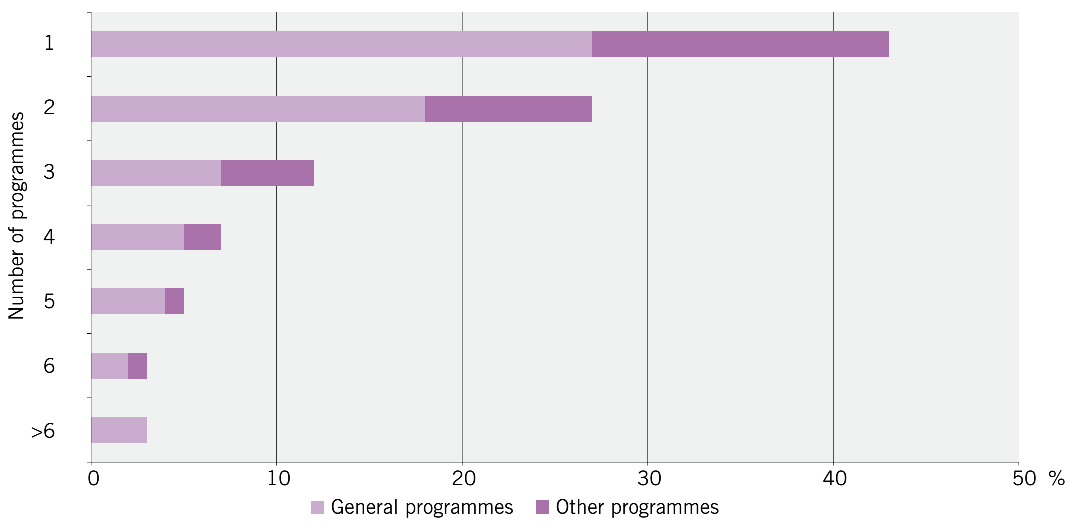
Programmes of direct research promotion can be differentiated according to whether they set thematic requirements or if the theme selection is made freely. On the other hand, programmes can have the objective of eliminating structural deficits or even adapting proven structures to new challenges. Programmes can also be differentiated according to various target groups. This results in different promotion perspectives and intervention logics. However, the analysis of the individual support measures shows that overlapping can arise between individual programmes based on these differences.

In the interaction between non-thematic promotion and thematically oriented promotion of FFG, it has been shown, for example that new applicants are attracted at the start of a new thematically oriented promotion. However, as the duration increases, a fixed clientele will develop and the number of new applicants will decrease. There are areas of technology that obtain more funding from non-thematic promotion than from the thematic programmes. In some cases, there are indications that applicants exhibit opportunistic behaviour towards programmes with higher approval and funding rates. In the course of time it is to be seen that thematically oriented calls for submissions lead to a migration of the target group from non-thematic promotion with the overall trend being approximately constant. However, this situation is not the same for all areas of technology and a differentiated consideration is necessary. However, the results of the analysis suggest that an improved and more flexible coordination of the promotions offered could increase the control effect.

System user satisfaction

Studies in the past have described the heavily differentiated system of direct research promotion in Austria as a "funding jungle". This was intended to illustrate that the high number of programmes confuses applicants and thus leads to inefficiencies for both the users and the provider side. Therefore, the system evaluation included a survey of user satisfaction.

Figure 22: Corporate survey – number of programmes in FWF, aws or FFG for which companies submitted at least one application in the period 2005–2007, in percent



Notes: n=850.

Source: WIFO/KMFA survey in connection with the system evaluation of research promotion and financing – KMFA calculations and presentation

The analyses show that both companies and research institutions systematically submit multiple applications for different programme lines and also to different agencies. Figure 22 shows that approximately 40% of the companies surveyed indicated having submitted at least one application for two or three specific programmes to FWF, aws or FFG. About one-fifth submitted applications for four or more programmes. Single applications generally relate to the general programmes by FFG; however, they are also frequently combined with other programmes.

The frequency of the submissions shows that approximately 50% of the companies surveyed submitted one to two applications to FWF, aws or FFG in the survey period. Roughly 1/3 submitted between three and six applications and approximately 12% of the companies surveyed submitted more than six applications to one of the agencies. Application frequency is clearly related to company size. 43% of the companies that submitted only one to two applications were micro-enterprises with fewer than nine employees. At the other end of the scale, roughly 33% of the companies that submitted more than six applications for funding were large companies with more than 500 employees. Similar patterns are observed in research institutions; however, the significance of third-party funds for research institutions results in a higher number of applications.

The user survey in connection with the system evaluation showed that users' satisfaction is high with regard to the clarity of the funding offered, the access to relevant information and the quality of the consulting. Complaints primarily related to the administrative expense and the lack of transparency and comprehensibility of funding decisions. In the case of companies, the decision to apply for a specific programme depends primarily on the probability that it will also be accepted and the amount of the funding. In addition to these first two aspects, research institutions also orient themselves to the thematic consistency of the programme with their application.

The survey on system user satisfaction in connection with the system evaluation thus shows that users do not feel the existing range of funding offered as a "funding jungle". It is rather the case that the users move very adeptly through the system and in part even behave in an opportunistic manner by taking advantage of the possibilities of the complex system to their own benefit. This underscores the finding that an improved and more flexible coordination of the promotions offered with one another could increase the control effect of direct research promotion.

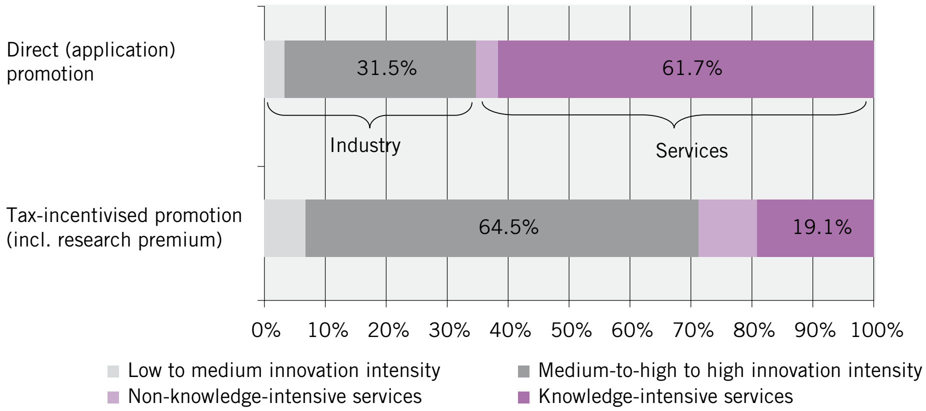
2.1.5 The interaction between tax-incentivised and direct research promotion

Conceptual differences in the design of the tax-incentivised and direct instruments are of significance to companies. Of further importance is (i) the type of company addressed via a direct funding approach and an indirect one, (ii) the extent and scope of the multiple promotion schemes (i.e. simultaneous use of both instruments) and (iii) the programmes on which the multiple promotion schemes focus. Finally, the funding effects are of significance and the question of whether an optimal division of labour between the tax-incentivised and direct research promotion exists with respect to certain RDI policy goals.

Use of the instruments

The fiscal costs of tax concessions for research activities in the form of lost tax revenues amounted to approximately € 277 million (nominal) for the most recently available tax year (2005). This is in contrast to € 272 million disbursed in 2006 via application-initiated direct promotions.[46] Approximately 46–47% of the direct public development funds paid out in 2006 flowed into the cooperative segment – which did not even account for 10% of the entire R&D expenditures. The majority of the (service) institutions combined in the cooperative segment are not profit-oriented but rather carry on research for, or in cooperation with, profit-oriented businesses.[47]

Figure 23: Distribution of the development funds by industry (2005)



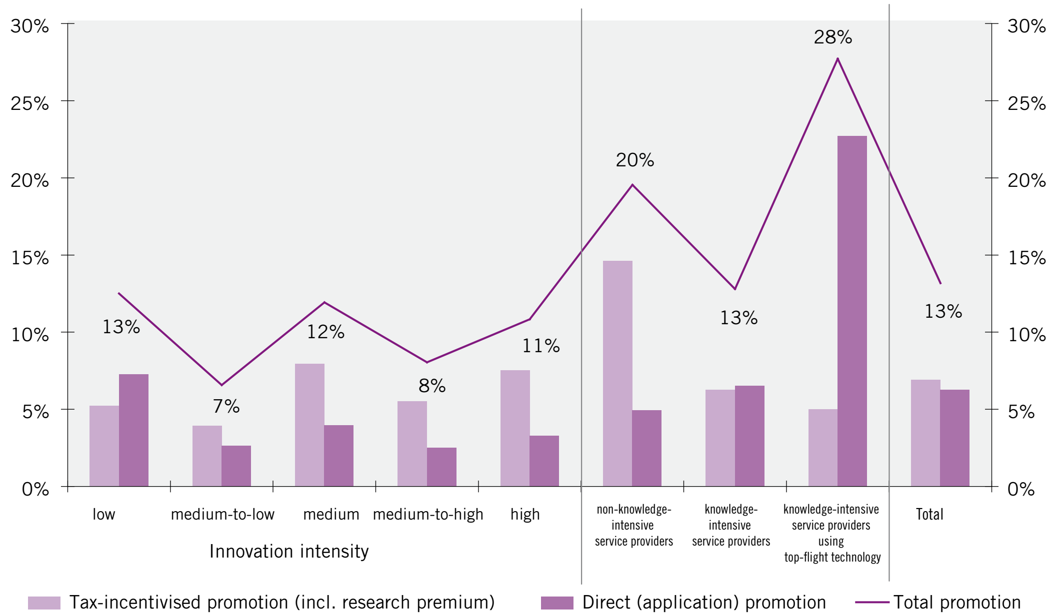
Source: R&D survey for 2004, 2006; BMF – WIFO calculations. – The data on tax-incentivised promotion is extensively documented in Falk (2009), Annex 2; the most recently available information relates to tax year 2005. Data on direct flows of funds in 2005 represents interpolated values for the years 2004 and 2006.

The distribution of the funds to different groupings of industry is extensively complementary. Figure 23 shows the share of the funds allotted to service companies and companies in manufacturing. About 2/3 of the tax-incentivised promotion benefits manufacturing; almost 2/3 of the direct promotion goes to service companies. The services sector is subdivided below into knowledge-intensive and traditional segments, electricity, gas and water supply companies, construction companies, trading companies and hotels and restaurants being included in the latter. As mentioned above, the values of the knowledge-intensive services sector are supported by the cooperative sector.

46 The public sector distributed a total of € 428 million in research funds to companies in 2006 (see R&D survey for 2006, Table 13). However, this includes € 156 million which was disbursed via the research premium; the application-initiated portion thus amounts to € 272 million.

47 In addition to research institutions outside of universities such as the ARC, the cooperative sector also includes publicly supported competency centres which work on a research programme jointly defined by companies and scientific institutions and are co-financed by corresponding promotion schemes; however they are statistically assigned to the corporate sector. The high observed R&D intensity and the high funding intensities of the knowledge-intensive service industries thus result from the design of these promotion schemes.

Figure 24: Sectoral funding intensities (2005) – tax-incentivised promotion vs. direct (application-initiated) promotion



Source: R&D survey for 2004, 2006; BMF – WIFO calculations. – The data on tax-incentivised promotion is extensively documented in Falk (2009), Annex 2; the most recently available information relates to tax year 2005. Data on direct flows of funds in 2005 represents interpolated values for the years 2004 and 2006.

In Figure 24 the economic branches in manufacturing are classified according to a new taxonomy by Peneder which replaces the OECD terminology based on the R&D intensities (which was frequently criticised as inadequate) by so-called innovation intensities.[48,49] With a 93% share, direct promotion focuses more intensely on industries with medium-to-high to high innovation intensity and on knowledge-intensive services. The comparative value for tax-incentivised promotion amounts to 84%. Both instruments thus support the frequently demanded structural change towards a stronger knowledge and technology orientation, whereby direct promotion superficially appears to have a stronger role. It should be noted here that according to the present structure of tax-incentivised promotion instruments in Austria, the only entities that can obtain a benefit from the indirect funding approach are those that are in principle subject to income tax. For the cooperative segment, this applies only on a limited basis – the cooperative segment must without exception be assigned to the knowledge-intensive services. On the other hand, companies in manufacturing are of course also beneficiaries of the cooperative institutions. These evaluations show that the indirect funding approach directly benefits research-intensive industries. Almost half of

48 Peneder (2008)
49 See in this regard BMWF and BMVIT (2007). As tax-incentivised promotion schemes are only granted for technically defined innovations (approach to Frascati R&D), the conventional OECD concept remains generally quite usable. The situation is otherwise for direct promotions that also address non-technically defined innovations.

the direct development funds flows into the cooperative sector and reaches companies performing research primarily via supported cooperation projects in competency centres and other promotion schemes directed to research cooperation.

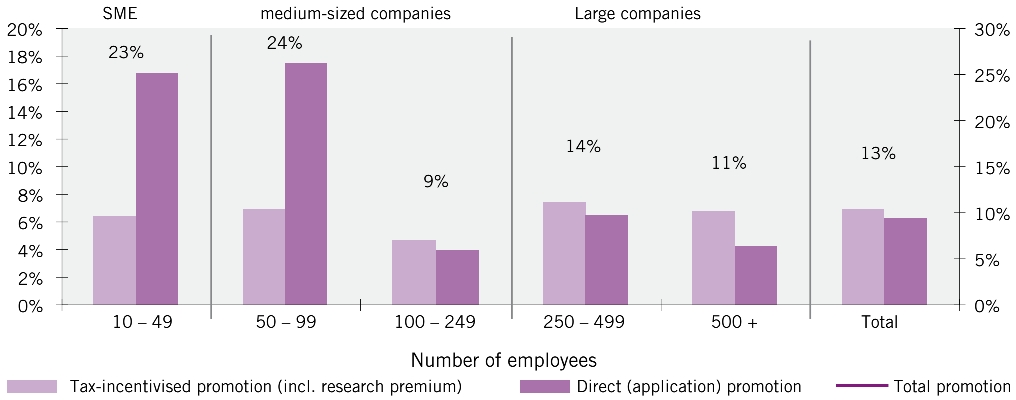
Figure 24 relates the promotions to the research tasks performed ("funding intensities"). The bars identify tax-incentivised and direct funding intensities, the sum of which is shown as a line. As roughly the same amount of funding was operative over both instruments in 2005, the funding intensities are consequently at a roughly equal level (6.9% for the tax-incentivised compared to 6.3% for the direct promotion). According to the Eurostat classification, the services sector is broken down further into knowledge-intensive segments and knowledge-intensive segments using top-flight technology, to which companies from the ÖNACE-2005 industries 72 (data processing and databases) and 73 (research and development) are assigned.[50,51] As expected, the industry comparison shows high variability. The high percentage of knowledge-intensive services in the direct promotions again arises through the cooperative sector which includes directly funded competency centres. On the other hand, the funding intensities of the non-knowledge-intensive services can be explained by statistically assigning several research-intensive companies to the trading industry. The aggregated research expenditures of the companies with low innovation intensity and the knowledge-intensive service providers using top-flight technology are (much more) strongly supported via direct application-initiated public funds. A balanced picture results for knowledge-intensive service providers. All other industries benefit much more strongly from the tax-incentivised promotion which supports Performance companies irrespective of industry than is the case with direct promotion.

Figure 25 shows that tax-incentivised promotion proves to be relatively size-neutral. In other words, the relative extent of the promotion is roughly of the same level across all size classes. Direct promotion provides benefits in a more selective manner. For enterprises with more than 100 employees, tax-incentivised promotion proves to be more attractive in the aggregate. For micro-enterprises (fewer than 9 employees), it is almost impossible to evaluate the relative significance of direct and indirect research promotion due to statistical problems in surveying the overall research expenditures in this business segment. For this reason, relevant data is not reported here. However, enterprise data shows that micro-enterprises are more strongly supported via tax-incentivised instruments to the extent they perform research.

50 Meri (2008)

51 Eurostat also classifies communication (ÖNACE–2005 64) as a knowledge-intensive service industry (WID) using top-flight technology. However, this industry is not reported separately in the R&D survey of StAt but is instead included in the group „transport and communication" (ÖNACE-2005 60–64). Consequently, a consistent funding intensity is obtained only if „transport and communication" as a whole is assigned either to the knowledge-intensive services or to the knowledge-intensive services using top-flight technology.

Figure 25: Funding intensities by company size (2005)



Source: R&D survey for 2004, 2006; BMF – WIFO calculations. – The data on tax-incentivised promotion is extensively documented in Falk (2009), Annex 2; the most recently available information relates to tax year 2005. Data on direct flows of funds in 2005 represents interpolated values for the years 2004 and 2006.

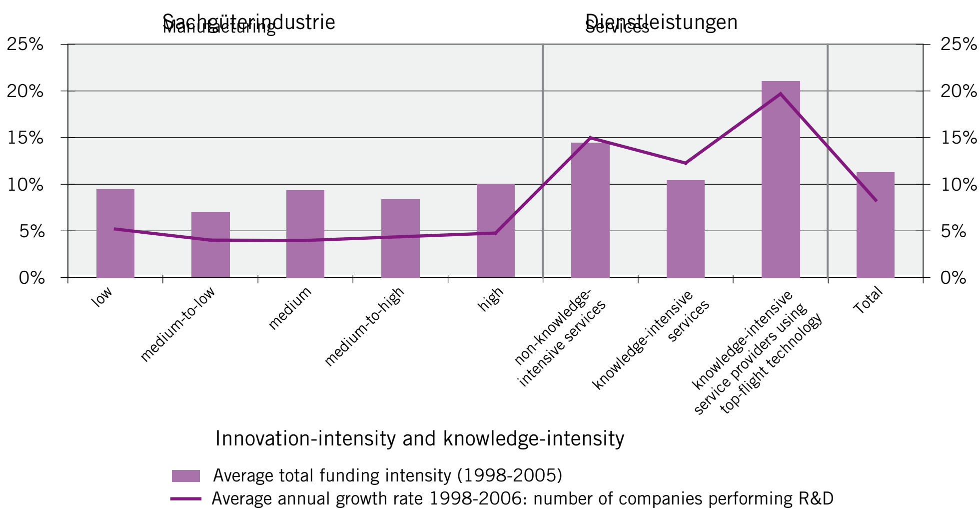
To obtain a more precise picture of how tax-incentivised promotion interacts with direct promotion on the level of the individual enterprise, a company survey was carried out in connection with the system evaluation.[52] Of the approximately 1200 RDI-active companies, 15% received no support at all – in the period 2005–2007. 13% of the companies use only tax-incentivised promotion schemes; 24% use only measures of the funding agencies. Almost every other RDI-active enterprise, namely 48%, used both tax-incentivised promotion in the period referred to and was simultaneously addressed via application-initiated promotions schemes in at least one project. Multiple promotion schemes focus on only a few programmes. In descending order, these are firstly the FFG general programmes, via which every second company receiving tax-incentivised promotion was also supported in at least one project in the 2005–2007 period. Secondly, programmes of the provinces were used to almost the same extent. Here, the usual practice of state funding where they regularly cofinancing base promotion projects comes through. Third and fourth rankings are held by EU promotion schemes and the competency centres/COMET programmes, in which 23% and 22%, respectively, of the companies receiving tax-incentivised promotion participated. An additional seven programmes were used by at least five percent of the companies receiving tax-incentivised promotion – BRIDGE, Innovation Voucher, Christian-Doppler Labore, FIT-IT, Double Equity and Energy Systems of the Future (with the programme lines "Energy/House and Factory of the Future") and the ERP programme Technology. All other programmes play a subordinate role with respect to possible multiple promotion schemes.

52 On the one hand, the sample focused on research-intensive industries – companies from the high-tech and medium-high-tech segment in manufacturing and from the research-intensive company-oriented services. From this group, companies with 10 and more employees received letters („Herold sample"). This data record was augmented to include companies that had requested research funding from funding agencies of the federal government (FFG and AWS) within the last 5 years (but were not necessarily actually funded). While this „agency sample" ensures that the data record contains a sufficient number of RDI-active micro-enterprises and service providers, which are substantially and systematically underrepresented in secondary statistical material, the „Herold sample" counteracts the distortion in the direction of directly (by application) funded enterprises.

2.1.6 Promotional effects

The last section illuminates the division of labour of the two support measures with regard to their contribution to the two basic RDI-policy goals, namely to increase the number of enterprises carrying out R&D on the one hand and also to increase the research depth of the companies that already perform research. Figure 26 shows how the research base developed in the period 1998 – 2006, initially based on sectoral data of the R&D survey. This is in contrast to the average total funding intensities (i.e. funding intensity of the respective years – in the particular industry groupings – averaged over time). Across all companies, the data shows that a higher funding intensity with higher growth rates correlates with the number of Performance companies. The special finding for the services sectors (non-knowledge-intensive services, knowledge-intensive service sectors using top-flight technology) reflects the already described peculiarities of the statistical allocation and should not be interpreted to mean that the promotion system has taken into account the tertiarisation process to a special degree.

Figure 26: Research base vs. funding intensity

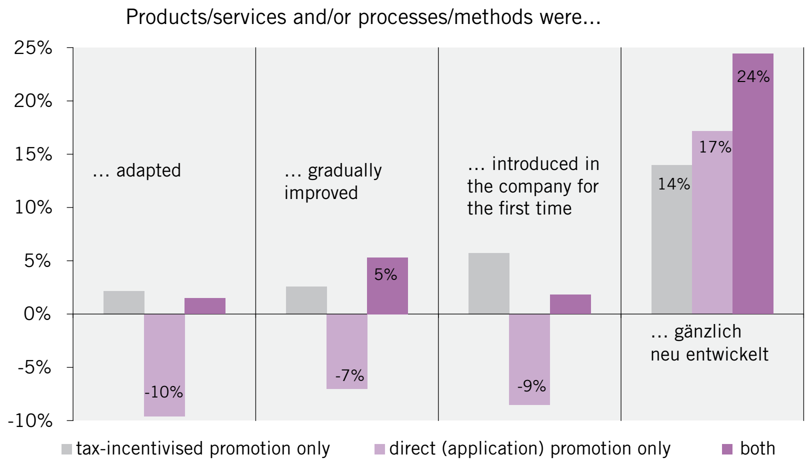


Source: R&D survey for 1998, 2002, 2004, 2006; BMF – WIFO calculations. – The data on tax-incentivised promotion is extensively documented in Falk (2009), Annex 2; the most recently available information relates to tax year 2005. Data on direct flows of funds in 2005 represents interpolated values for the years 2004 and 2006.

Based on survey data, the funding effect of the direct and indirect promotion on the innovation performance of funded enterprises in contrast to non-funded enterprises was investigated using econometric analyses. Figure 27 shows how the probabilities for the successful introduction of specific innovation types change when a company is funded in one or another manner (or both in the one and the other type). RDI-active companies that were not funded in the period 2005–2007 serve the purpose of comparison.

Figure 27 show first that the realisation of low-threshold innovations (adaptation innovations, improvements of existing products, processes or services, imitation innovations) is stimulated to a slight degree using promotion instruments. In the case of companies receiving multiple support, the probability is significantly higher that they are in this manner innovation-active across all innovation categories in relation to the comparison group of RDI-active companies not receiving support. Positive funding effects are primarily evident with respect to the successful introduction of actual new-to-market products. Companies that receive only tax-incentivised promotion exhibit a 14 percent higher probability for such "radical innovations" compared to the reference group of non-funded RDI-active companies. If a company is reached only via direct (application) promotion, the probability of success for radical innovations rises by 17 percentage points.[53] If it is supported by both tax-incentivised promotion and by programmes of direct research promotion, the probability of success rises by 24 percentage points. This would suggest that funding successes occurred only for very dynamic RDI actors in the three year perspective covered by the data.[54]

Figure 27: Probability of successful innovations in the period 2005–2007 – by degree of innovation[1)]. Changes compared to non-funded, RDI-active companies in each case[2)]



Source: WIFO/KMFA (2008): Research promotion for companies. Questionnaire for evaluating the Austrian research promotion system – WIFO calculations. – [1)] Adapting innovations: N = 1132; modifying/incremental innovations ("stepwise improvement"): N = 1136; "smart-follow" innovations (new to the company but not new to the market): N = 1103; new-to-market products/"radical" innovations: N = 1146. – [2)] statistically significant changes are marked with a size indication. The survey was designed in such a way that each of the innovation types was listed individually, each with the option of answering "yes" or "no".

53 The probabilities of success shown in Figure 27 are of a purely descriptive nature. Factors that influence the decision for funding over the long term (so-called „funding determinants") are not taken into account. These were initially identified using a simple probit model. Based on the survey data, the funding status can be observed as such, namely if a company or a specific programme (e.g. "general programme") or a specific programme group (e.g. "thematic programmes") is funded or not. The probit approach used here models the non-directly observable stochastic variable "funding probability" as a function of industry affiliation, company size, age, organisational form, RDI experience, routine and intensity. After that, the probability for "radical" innovation successes as a function of these funding determinants and the funding status was itself estimated. This econometric approach endogenises the funding decision and thus "controls" the circumstance that specific factors not only have a positive impact on the success of innovation but they simultaneously have an influence on the probability of funding. The coefficients for the decisive funding variables practically exhibit the net funding effect, i.e. innovation successes that are solely attributable to the intervention.

54 A funding success is rated as such if the innovation performance or output performance of non-funded innovation-active companies proves to be significantly lower.

This result must be interpreted with caution. The funding status still provides no information concerning the extent of the funding. A detail analysis shows that tax-incentivised companies need at least one application-initiated promotion project per year to be able to introduce new-to-market products at a significantly more frequent rate than the reference group. The funding effect of excellence-oriented programmes is higher compared to applied research programmes. Also no subsidy volumes back up these results. As promotion schemes with a claim to excellence assume an increasingly greater weighting in the total funds awarded, the result can suggest that the funding status for radical innovations plays a more significant role than for innovation successes at lower levels.

It was not possible to completely explain these aspects in connection with the evaluation based on the survey data and further surveys. The result that the interaction of direct and indirect funding has a positive impact on the funding success of very dynamic RDI-active companies is very robust and largely coincides with international findings on the interaction of direct and indirect research promotion (e.g. De Jong et al. 2007). For these companies, the tax-incentivised and direct promotion schemes have a complementary effect. Companies are only significantly more successful with respect to their R&D expenditure performance, their growth performance and in the introduction of new-to-market products when they are achieved by both promotion mechanisms.

2.1.7 Additional significant findings of the system evaluation

In addition to the aspects of direct and indirect (tax-incentivised) promotion of research focused on here, the framework conditions for research and innovation, the control of the research promotion and financing system, the effect of basic financing on research institutions as well as the strengths/weaknesses profile of the system were examined in the system evaluation. The findings with regard to system control show that the control mechanisms hardly adapt to changing framework conditions. On the one hand, this is due to the absence of a normative orientation of the system of research promotion and financing but on the other hand, it is also due to a progressive fragmentation of competencies and a close networking of the important decision makers in the system. According to the analyses, this results on the one hand in narrow, self-absorbed, hardly open communication and organisational structures that make the adaptability of the system to new long-term challenges and reflexive learning within the system more difficult. On the other hand, the observed communication and interaction structures make it possible to gradually improve the system but within the framework of a short-term perspective.

The analysis of the framework conditions shows that in addition to the absence of private investment capital for innovative enterprises, especially the lack of highly qualified human resources represents a pivotal challenge for the continued development of the innovative capacity of the Austrian economy. The strengths/weaknesses analysis of the system also shows that human resources and educational measures can have the greatest impact on the innovation system. The results of the analyses of the system evaluation therefore ascribe a much stronger mandate to an RDI policy comprehended as cross-sectional material apart from the funding agencies.

2.1.8 Summary

The results of the system evaluation show that the system of research promotion and financing consists of a large number of instruments resulting in broad target group coverage, target group attainment and target group satisfaction. The system has been successful in creating momentum for an improvement of the research and innovation activity in Austria. However, the evaluators continue to have doubts concerning the extent to which the system's organisation, prioritisation and available instruments will be capable of completing the change necessary in their point of view to a growth paradigm supported by science, technology and innovation. The analyses show that the scarcity of highly qualified human resources on all levels represents a bottleneck and accordingly a great policy challenge. In general, the analyses show that the entire research promotion and research financing policy must be more strongly linked with other policy areas having an influence on innovation, such as education, financing, etc.

On the level of the detailed findings that the system evaluation consortium has prepared based on its own investigations, it is evident that the extent of the tax-incentivised promotion has been overestimated in the last few years. Contrary to the estimations of the Court of Auditors and the Federal Ministry of Finance, the costs of the tax-incentivised R&D promotion somewhat exceed € 250 million at constant prices. With regard to the target groups of the tax-incentivised promotion, the analyses show that companies with more than 100 employees represent approximately 40% of the funding recipients for FFB-old and 30% for FFB-new. In 2005 these companies used approximately 90% of the total tax-incentivised promotion from FFB-old and FFB-new. On the other hand, the introduction of the research premium has led to a broadening of the use of tax-incentivised promotion. Many of the new users are small and medium-sized enterprises (SME) that are also the primary beneficiaries of the research premium in terms of funding volume.

With regard to the direct promotion of research, it is clear that different logical systems of intervention and action will lead to an overlapping of the offerings. The results of the analysis thus suggest that an improved and more flexible coordination of the promotions offered could increase the control effect of the direct research promotion. With regard to user satisfaction, the results suggest that the often cited "funding jungle" is not perceived as such by the users. It is rather the case that the users move very adeptly through the system and in part even behave in an opportunistic manner to take advantage of the possibilities of the complex system for their own benefit. Results in fact suggest that users move in the system with the objective of maximizing the probability of funding and the amount of the funding commitments. The "funding jungle" is thus revealed to be rather a "funding supermarket" in a positive sense. The investigations of the evaluation also suggest that the goals and responsibilities of the programmes must be defined more clearly. They should also focus more intensely on excellence and radical innovation.

The analysis of the interaction of tax-incentivised and direct promotion shows that both forms of promotion are necessary. The result that the interaction of direct and indirect funding has a positive impact on the funding success of very dynamic RDI-active companies is very robust and largely coincides with international findings on the interaction of direct and indirect research promotion.

2.2 The Austrian Research Dialogue

A process was started in Alpbach 2007 bearing the title "Austrian Research Dialogue" with the objective of gathering "ideas and inputs to position Austria as an attractive research and development location by 2020" (BMWF 2008, p. 4). By integrating as many actors and opinion leaders as possible, the plan was to lay the foundation for an RTI strategy. In its government action programme, the new federal government explicitly refers to the results of the Research Dialogue as an input towards creating a national RTI strategy.

Under the aegis of the Federal Ministry of Science and Research and with the close cooperation of the Federal Ministry of Transport, Innovation and Technology and the Federal Ministry of Economics and Labour, a dialogue was started with significant stakeholders and persons interested in politics who travelled across Austria to participate in dialogue forums and fireside chats. More than 2,200 persons participated in live events in the years 2007/08. Online dialogues and joint ventures organised by third parties gave additional support to this process.

With 21 themes of relevance to RTI policy, the discourse was deliberately set up to be very broad. This proved to be crucial for acceptance, willingness to participate and discussions. A brief description of some of the primary findings, perceptions and positions will be provided below.

In the last few years, Austria has completed an impressive catch-up and recovery process in the area of research and development. In both absolute and relative terms, the R&D expenditures have risen significantly, the qualification structure of employees in companies has been increased, and a general trend towards higher education has manifested itself. Accordingly, Austria is one of the countries that have been successful in approaching the Barcelona target of 3%. To be able to continue this transformation in the future, in addition to further development and improvement of the general conditions for the promotion of applied research, it is regarded as essential to continue to expand the promotion of basic research as well. Based on Austria's expenditures of 1,064 million euros (0.41% of GDP) for basic research, the country has been ranked as average in an international comparison for some time. One of the goals emerging from the Research Dialogue is to increase investments in basic research to the level of leading countries (such as Switzerland) by 2020, specifically to approximately 1% of GDP.

The Austrian higher education segment represents a crucial success factor. As the implementation of the 2002 University Act has called on these institutions to present themselves with a clear research profile and to position themselves in the knowledge market, excellence must be fostered in particular here. The goal is to bring about this excellence particularly through competition; existing expertise should be applied and the appointment of young scientists encouraged. Non-typical career paths and experience through mobility are to be recognised just as much as granting the option for continuous career systems. With regard to the latter, the primary objective is to establish (financial) security for early stage researchers on the doctoral candidate and postdoc level.

In this context, special attention should also be given to the support of women in science, research and technology. With only 11.3% of professorships being held by women in 2006, Austria is in last position among European universities, reflecting an urgent need for action. The goal should not only be to increase the numbers of women in leadership positions, gender dimensions should also be established and fostered in research. Career models must be developed to allow better compatibility of family and work.

"Sustainability" plays an increasingly important role in modern industrial nations. The focus is on finding solutions to problems and fulfilling specific present and anticipated social needs, prompting RTI policy to grapple increasingly with relevant social issues and accordingly a new mission orientation. This is primarily characterised by its thematic breadth and interconnection with other policy areas (such as environment, climate, energy, health, transport etc.) and for years it has found its way into various national development and environmental plans, infrastructure master plans etc. In this connection, the humanities, social sciences and cultural studies are becoming increasingly significant. Their role is to critically reflect upon the respective requirements and needs of society as well as the perception of problems. Appropriate institutional, infrastructural and monetary conditions must therefore be created in the future in order to advance not only increased quality, further internationalisation and cross-disciplinary networking, but also to communicate the results to society – with the guarantee that the knowledge has been obtained in compliance with basic rules of ethics.

Austria today has a high "culture of cooperation" which is even recognised internationally. A significant component of this culture is to be able to make use of a broad range of support measures, all of which have as their goal the promotion of industry-science linkages, ensuring the rapid exploitation of new scientific knowledge. The expansion of technology and structural programmes in particular has supported this process since the 1990s so that prominent promotion schemes such as the centres of excellence and networks, their successor COMET, the Christian Doppler Gesellschaft (CDG), FHplus, AplusB and Bridge are available to support the transfer of knowledge and technology. The most recent measures targeted at regulating and exploiting intellectual property at the universities should also be mentioned.

However, the corporate sector is not only a mainstay in the transfer of knowledge and technology; the clear and sustained increase of Austria's R&D ratio is also attributable to the expansion of R&D activities in companies. This is reflected both in the growing number companies performing research and in their research intensity. However, the percentage of companies actively involved in R&D, SMEs in particular, can be increased even further in the future. In addition to the existing companies, especially the new, innovative ones and start-ups constitute an important target group of future promotion policy. The task is to support in particular new, technology-intensive companies by providing support with regard to their principal problem, namely the financing issue. This should include firstly an adequate availability of venture capital and secondly, a functioning private equity market. In addition, increased attention should be given to academic spin-offs, which in particular contribute to transparency between science and business.

Another driving force is seen in the momentum of internationalisation which has also increasingly encompassed R&D in the last few years. It may be noted that Austrian universities are presently much more active in R&D internationally than German universities. A primary reason for this may be (from the Austrian perspective) the narrowness of the domestic market, leading to efforts to adapt products and processes to regional customers' desires. The latter is also the primary reason that companies are increasingly active in *emerging economies* such as China. The result of this is that today China is not only Austria's second most important non-European trading partner after the United States, but already approximately 1% of all Austrian exports and direct investments flow to China. Internationalisation is thus also accompanied by more intense competition for locations. In light of this, Austria's challenge is to cooperate with competent research institutions to enhance its appeal for headquarters and for companies performing R&D. In connection with this, additional R&D relationships must be built up not only with leading industrial nations but also with *emerging economies*; it will also be necessary to make use of platforms, programmes and initiatives for the development of future technologies on the European level.

Austria's path to the 3% goal appears to be successful and is thus supported by a noticeable expansion of R&D activities – both in the business segment and in the higher education sector. Furthermore, this process is advanced by promoting R&D through tax incentives and by project-related R&D promotion which, as traditional policy instruments, should in the future be accompanied by innovation-stimulating activities in public-sector procurement. All in all, however, specifically governance and occasionally the efficiency of the *policy mix* will be critical for a successful RTI policy in the next few years.

2.2.1 The report of the group of CREST policy mix experts

The Austrian Research Dialogue was also the subject of a policy mix peer review from an external perspective (CREST 2008).[55] This review took place in May 2008 and is a part of the policy mix peer review process of CREST, the European Union's Committee for scientific and technical research. Several countries had already been subject to the review.[56] The policy mix peer review team was made up of representatives from member states of the EU and one observer from the European Commission. It was led by an independent adviser. The goal was to discuss R&D policy options for Austria. Some of the recommendations and assessments (or a correction of the same) by CREST are presented below:

The review's central point is that Austria currently has neither a common, comprehensive vision nor coherent policy initiatives for stimulating the development of the entire R&D and innovation system. In the estimation of the CREST experts, the absence of an overall strategy and deficits with regard to coordination and communication mechanisms lead

55 http://www.bmwf.gv.at/euinternationales/euforschung/lissabon_prozess/crest/
56 The peer review reports can be found at: http://www.era.gv.at/space/11442/directory/11661/doc/11662.html

to inefficiencies in the Austrian governance structure which manifest themselves in specific areas as small programmes, duplicative activities, unclear divisions of responsibility with regard to the funding agencies and a "programme jungle". The CREST experts referred to countries such as Finland, Denmark and the Netherlands as exemplary. In those countries the top policy decision-makers are present to a much greater degree in strategic coordinating institutions. Accordingly, "[...] Austria would benefit from a re-evaluation of the existing structures and processes to formulate holistic R&D and innovation related strategies and the subsequent articulation of a coherent policy mix." (p. 32).

With regard to the role of the advisory committees, the CREST review refers to a recommendation already made by the OECD in its country study of Austria (OECD 2007), i.e. to establish stronger (staff) ties between the Council for Research and Technological Development (RFT) and the Science Council in order to strengthen the role, importance and weight of such a committee. This depends on the policy which confers a special significance to an advisory body with regard to the use and response to recommendations as well as on the advisory body itself. Here the peer review panel recommends a review of the role, the staffing and the *modus operandi* of the RFT to strengthen its contribution to policy decision making.

A question that has been the subject of discussions in Austria for a long time and was taken up by the CREST experts concerns the extent to which the support levels are to be maintained across an extremely broad spectrum of technology areas and industrial sectors or whether more resources should be diverted to areas of key strategic relevance to Austria. "Many countries with larger economies than Austria have recognised the danger of spreading resources too thinly ..." (p. 13). However, the CREST experts fail to recognise that (i) the key technological areas of the countries with large economies are the same for countries with smaller economies and (ii) in the event that a small country decides to favour a risky niche strategy, it is difficult to decide by whom and how an area of strategic relevance to Austria is to be defined. This depends to a very great degree on the standpoint of the person or persons who define(s) this area.

Also to be considered is the extent to which the great variety of policy instruments and especially funding instruments might lead companies to be dependent to a certain degree on public subsidies and accordingly result in a "subsidy culture" which would have an adverse impact on innovative behaviour. However, with regard to the assessments of CREST, it may be objected that the international statistics (such as the European Innovation Scoreboard) must be interpreted with caution. The "innovation voucher", for example, will increase the share of subsidised companies substantially; however, its maximum funding volume of € 5,000 per company will prevent it from replacing market-initiated innovative behaviour.

Furthermore, there is the possibility for researchers to maximise their work with international partners; problems of fragmentation and the absence of critical mass must be overcome on all levels through participation in initiatives such as ERANETs or technology platforms. A strategy in this regard should therefore also emphasise the interaction between national programmes and EU framework programmes to ensure that the possibilities for Austrian researchers to work with international partners are maximised. The further participations of research programmes in ERANETs and technology platforms should occur within the context of an overall strategy, also taking into account the initiative for the Austrian participation in joint programming activities. The goal should also be to broaden the scope of possible actions for increasing international cooperation with countries leading in the area of research.

The science sector and the industrial R&D sector were dealt with in detail in the CREST review. An early assessment was made that needs to be scrutinised. Where the review discusses a "substantial increase in the amounts of public funding for research available to universities" (p. 21) and a "small increase in public support for industrial R&D" (p. 25), this assessment is not comprehensible based on the 2002 to 2006 R&D surveys (see Figure 6). For this period, the public-sector R&D funding of the higher education sector grew by only 17%; in contrast, the funding of industrial R&D rose by 55% (not including the research premium). Taking the research premium into account, it rose by 144%.

With regard to the universities, the CREST experts see the Performance Contracts as a good instrument for making the goals more ambitious in the future. Their autonomy makes it possible for the universities to develop tailored strategies for this.

With regard to the promotion of industrial R&D, the review team was surprised by the high level of support by individual firms and the low percentage of collaborative R&D.

In the area of human resources, the CREST review points out the need for action in Austria. The theme of human resources in the area of R&D and innovation is dominated by three main topics: the number, the quality and the mobility of the qualified personnel. This is primarily a matter of providing appropriate incentives to increase the number of persons with tertiary education.

Overall, the CREST review makes 24 recommendations[57], all of which should be included in the strategic orientation of the Austrian RTI policy in addition to the knowledge obtained from the Austrian Research Dialogue and the results of the system evaluation. The CREST review sees the primary challenge in the future to be the continuation of the institutional reforms that have been started in research and promotional institutions and an attempt to optimise the governance in the RTI policy.

57 See chapter 1.3.4 for suggestions of the CREST review with regard to the approval rate of the FWF. The recommendations with regard to evaluation can be found in chapter 5.

3 Aspects of the Austrian Science System

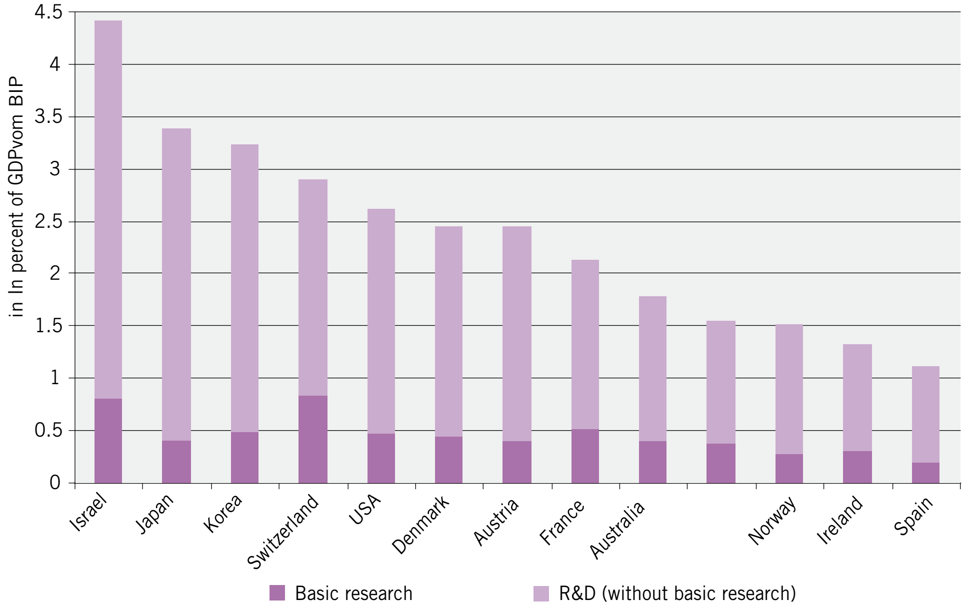
3.1 Structure and development of basic research in Austria

The topic of basic research has increasingly come into the foreground of recent research policy discussions in Austria. This development must be viewed in the context of the formidable progress Austria has made catching up; this process can be considered largely complete in the meantime. The aggregate R&D ratio places Austria above the averages for both the EU15 and the EU27, as well as the OECD. In the 1990s, the most frequently discussed deficits in the Austrian innovation system were the insufficient contribution from the corporate sector and the limited amount of interaction between business and the sciences. In recent years, however, these deficiencies have been significantly redressed, not least thanks to successful programmatic measures undertaken by the public sector. In addition, Austria is closer to realising its long-term and highly ambitious goal of achieving a 3% R&D ratio. Policy discussions have therefore shifted to the level of the individual research areas. In the context of this development in Austria's R&D landscape, the role and tasks of basic research are the focus of renewed debate. In this chapter, the quantitative weight of basic research in Austria will be assessed in relation to the GDP, to overall R&D expenditures and in international comparison. In conclusion, a few central bibliometric output indicators for basic research will be discussed.

3.1.1 Monetary expenditures for basic research in international comparison

At € 1.06 billion, basic research as a share of GDP was 0.41% in Austria in 2006. This positions Austria in the middle of the OECD countries (see Figure 28). One must also consider that some of these countries (among them Germany, Sweden, Finland and the United Kingdom) have not reported distribution by research area to the OECD for quite some time; unfortunately, this means that they could not be considered here (Guellec 2001). Countries with an especially high basic research percentage are Switzerland (0.83% in 2004) and Israel (0.76% in 2004). The USA had a basic research rate of 0.48% in 2006. At 0.40% in 2006, Japan's rate lies just beneath Austria's level.

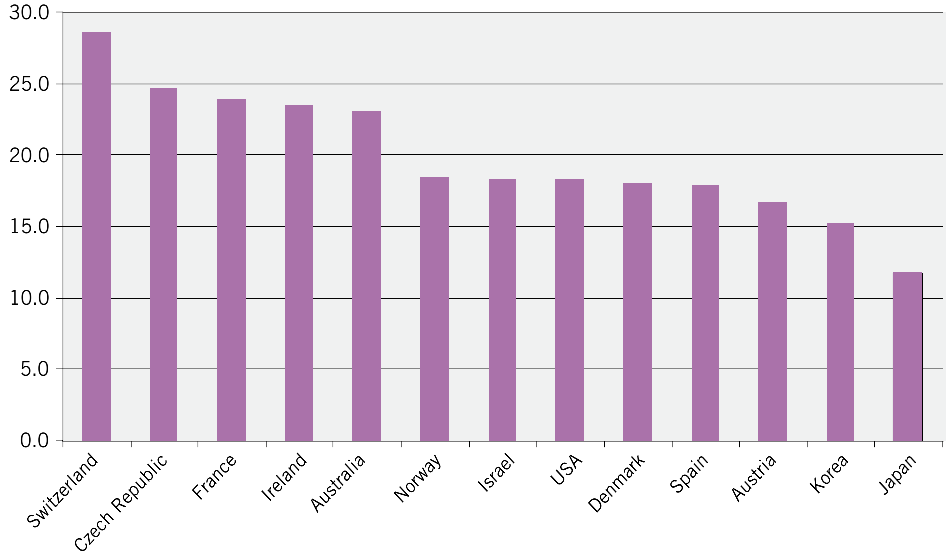
Figure 28: R&D and basic research in international comparison (in % of GDP 2006 and/or the most recent data available)



Source: OECD (MSTI 2008/1); Calculations by Joanneum Research

Figure 29 portrays the basic research orientation for R&D activities in selected OECD countries. The chart shows how high the share of basic research funding is in relation to a country's total R&D expenditures. Switzerland is once again the leader, with a 29% share of basic research. In Austria, this share is 17%, which places Austria in the lower-middle rankings of the countries assessed here. Countries with similarly high "relative" basic research orientation are Denmark, Norway, Israel, Spain and the USA. This reveals that the extent of orientation towards basic research depends on each the way the national scientific research system is structured and is not systematically dependent on general research intensity, which prevents the determination of a correlation between research rates and basic research orientation. There are countries with a high research rate and relatively low orientation towards basic research (such as Korea and Japan), and there are countries with low research rates whose research is nonetheless strongly oriented towards basic research (such as the Czech Republic and Ireland).

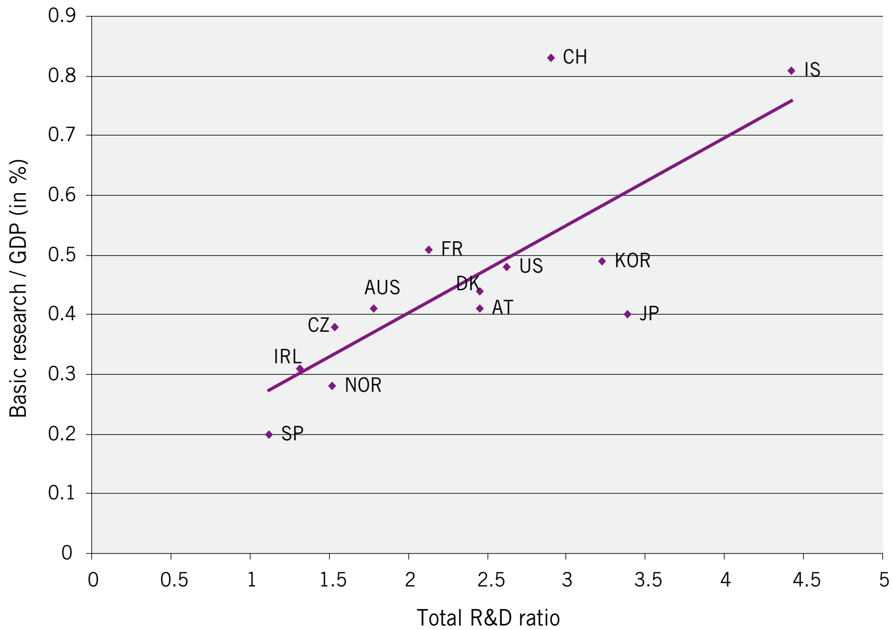
Figure 29: Share of basic research as a share of total research expenditures (2006 and/or the most recent data available)



Source: OECD (MSTI 2008/1); Calculations by Joanneum Research

Figure 30 depicts the correlation between the total R&D rate and basic research as share of GDP in international comparison. The positive correlation is, of course, at least partially tautological; since the basic research rate is a part of the total research rate, there is, ceteris paribus, a correlation. Nonetheless, the deviations from the trend line reveal some interesting details. For example, Switzerland's large deviation from the trend line reveals that the country has a special position with its specific science and research system, which is especially heavily oriented towards basic research. This also explains Switzerland's outstanding position in several bibliometric output indicators (see also the discussion at the end of this chapter). On the other hand, however, Korea and Japan's placement beneath the trend line reveals that academic research (or specifically basic research) in these countries is underrepresented in comparison to their very high research rates. Austria is also ranked underneath the trend line, even if only slightly. Nonetheless, this is an indicator that Austria is currently – according to the total research rate – allocating "too little" for basic research.

Figure 30: R&D rate and basic research rate in international comparison



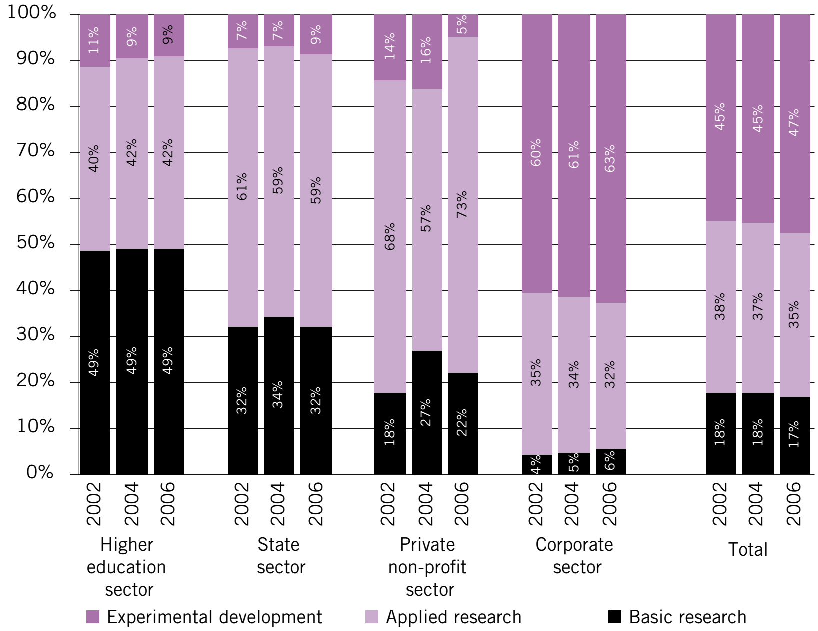
Source: OECD, Calculations by Joanneum Research

3.1.2 Basic research in Austria

In 2006, 17.2% of Austria's total R&D expenditures were allocated to basic research (35.4% to applied research, 47.4% to experimental development). These numbers have changed only slightly in comparison with 2002 and 2004 (see Figure 31). Overall, experimental development as a share of research expenditures has slightly increased from 45% to 47% while applied research share fell from 38% to 35%. Basic research remained almost constant at 17–18%.

Within the individual sectors, the orientation toward basic research (and, inversely, to both of the other research areas) was very different. The higher education sector, not surprisingly, enjoyed the highest share of basic research. Of all research expenditures in the higher education sector, just under half (49%) is assigned to basic research, 42% to applied research and 9% to experimental development. In the state sector, the share of basic research is just under one third (32.2%). In the corporate sector, basic research accounts for just over 5% of research expenditures (in private businesses, and therefore exclusively in cooperative ventures, 3.4%).

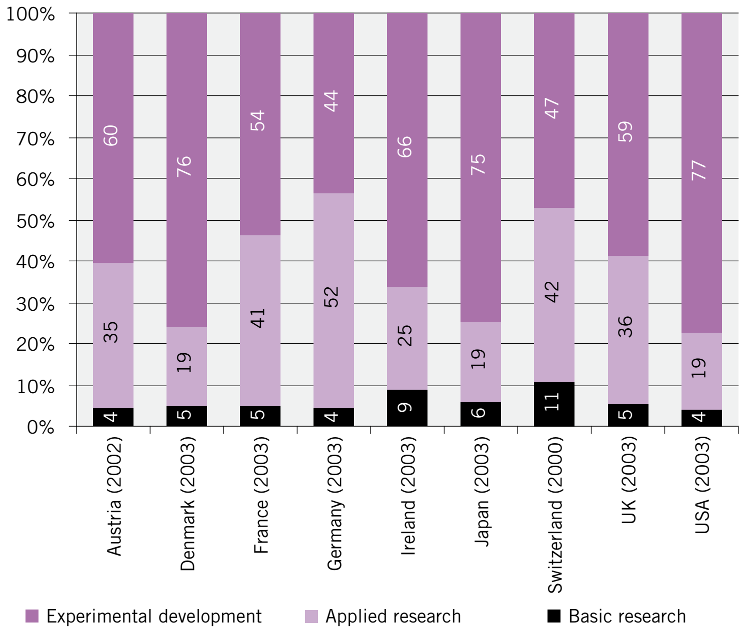
Figure 31: R&D expenditures 2002/2004/2006 by research type



Source: Statistics Austria (R&D Survey), Calculations by Joanneum Research

One question that is particularly interesting in this context is how to evaluate the relatively limited share of basic research in the corporate sector. After all, there is potential for radical innovations in basic research in the corporate sector. The existing structure of R&D activity in the corporate sector "allows gains in the catching-up process, but doesn't create a "Front Runner" position" (Aiginger et al. 2006, 131f.). An international comparison of research types in the corporate sector, however, reveals that the share of basic research has little do with either the development of new technologies or financial success (Figure 32).

Figure 32: R&D expenditures by research type in the corporate sector



Source: Statistics Austria (R&D Survey), Calculations by Joanneum Research

The share of basic research is relatively low in the corporate sector, and is lowest in the USA, a country that often serves as a model for technological breakthroughs. The financial success of technological developments occurs in the "experimental development" category. Basic research is conducted outside the corporate sector, which is also evidenced by ever-shorter product life-cycles and enormous competitive pressure.

In Austria, basic research is conducted primarily in the higher education sector (including university clinics, the arts, the academy of sciences, universities of applied sciences, private universities and Danube University at Krems), to which 70.1% of basic research funding in Austria is allocated. The corporate sector trails with 23%, although a significant portion is allocated to cooperative ventures (such as Austrian Research Centers, Kplus- and COMET centres and Joanneum Research). If one excludes cooperative ventures and focuses exclusively on actual businesses, 12.9% of basic research expenditures went to this sector in 2006. The state sector (federal institutions and states as well as municipalities) played a limited role, with only 6.5%. Austria allocates very little to the private non-profit sector (0.3%). A precise survey of respective absolute expenditures, with shares divided into three research areas, is provided in Table 23.

Table 23: R&D expenditures by research area and implementation sector

		Total expenditure	Basic research		Applied research		Experimental development	
	No. of units performing R&D	in EUR 1000	in EUR 1000	in %	in EUR 1000	in %	in EUR 1000	in %
Higher education sector	1,162	1,523,160	746,112	70.1	638,642	29.1	138,406	4.7
State sector	254	215,800	69,532	6.5	127,711	5.8	18,557	0.6
Private non-profit sector	40	16,519	3,682	0.3	12,076	0.6	761	0
Corporate sector	2,407	4,448,676	245,150	23	1,415,121	64.5	2,788,405	94.6
Of which:								
Cooperative segment	52	428,492	107,534	10.1	230,739	10.5	90,219	3.1
Business segment	2,355	4,020,184	137,616	12.9	1,184,382	54	2,698,186	91.6
Total	3,863	6,204,155	1,064,476	100	2,193,550	100	2,946,129	100

Source: Statistics Austria, Calculations by Joanneum Research

Table 24 provides an overview of research expenditures in the corporate sector categorised into technology classes. Additionally, distinctions are drawn between the business segment and the so-called cooperative venture segment (the latter deals with research institutions that are publicly administered as businesses, such as ARC, Joanneum Research or the competence centres, which are also legally managed as businesses). At the technology class level, there is a surprising result: the high-tech sector has the least orientation towards basic research (only 1% of all research expenditures are assigned to basic research, while experimental development clearly dominates with 78%). Table 24 makes it clear that experimental development and – in somewhat lower amounts – applied research dominate manufacturing. Basic research here is merely an afterthought.

The comparatively large growth in basic research in the service sector is remarkable. This can be attributed foremost to branches of the economy in the industry group "Technology and science-intensive services" (to which the economic branch "Research and development" and cooperative ventures belong), but in the business services sector, there is remarkable activity in basic research, with approximately € 49 million invested (nonetheless, this represents just under 14% of total R&D expenditures for basic research).

Table 24: R&D expenditures by research type in the corporate sector

Type of Technology	No. of units performing R&D	Total internal R&D expenditures	Basic research		Applied research		Experimental development	
			in EUR 1000	in %	in EUR 1000	in %	in EUR 1000	in %
Primary sector	13	7,966	657	8	4,031	51	3,278	41
High tech	202	1,314,044	14,187	1	270,625	21	1,029,232	78
Medium high tech	508	1,284,780	57,176	4	433,053	34	794,553	62
Medium low tech	333	373,931	20,613	6	105,899	28	247,419	66
Low tech	277	170,678	6,694	4	44,460	26	119,524	70
Other	107	34,923	1,880	5	14,402	41	18,641	53
Company-oriented services	243	350,902	48,978	14	163,445	47	138,479	39
High tech services	459	605,371	88,086	15	276,947	46	240,338	40
Other services	261	290,122	6,379	2	97,921	34	185,822	64
Total corporate sector:								
Business segment	2,355	4,020,184	137,616	3	1,184,382	30	2,698,186	67
Cooperative segment	52	428,492	107,534	25	230,739	54	90,219	21
Corporate sector total	2,407	4,448,676	245,150	6	1,415,121	32	2,788,405	63

Note: Technology class membership follows the NACE 3-position levels.

Source: Statistics Austria; Calculations by Joanneum Research

In Table 25, research in the higher education sector is divided into different scientific disciplines. With € 295.3 million, the "natural sciences" branch has the highest investment in basic research. The natural sciences are followed by human medicine (€ 160.8 million) and the humanities (€ 106.3 million). Then come the social sciences (€ 97.2 million), the technical sciences (€ 58.8 million), and agriculture, forestry and veterinary medicine (€ 27.7 million). Table 25 also provides an overview of the significance of basic research (the share of basic research as part of overall R&D expenditures) according to scientific disciplines and discipline groups. The humanities have the highest orientation towards basic research (70% of all research is basic research). The natural sciences are ranked second (62%) and the social sciences third (46%). These are followed by human medicine (41%), agriculture, forestry and veterinary medicine (40%), and technical sciences (27%).

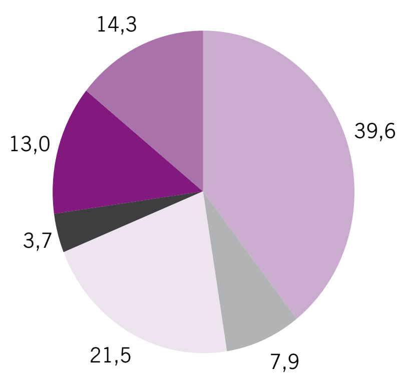
Table 25: Structure of research expenditures in the higher education sector by scientific discipline

	Total R&D expenditures	Basic research		Applied research		Experimental development	
Scientific discipline	in EUR 1000	in EUR 1000	in %	in EUR 1000	in %	in EUR 1000	in %
Natural sciences/technology/medicine	1,162,243	542,563	46.7	496,761	42.7	122,919	10.6
Natural sciences	477,341	295,271	61.9	143,332	30	38,738	8.1
Technical sciences	218,368	58,806	26.9	129,597	59.4	29,965	13.7
Human medicine	396,862	160,783	40.5	186,774	47.1	49,305	12.4
Agriculture and forestry, veterinary medicine	69,672	27,703	39.8	37,058	53.2	4,911	7
Social sciences and humanities	360,917	203,549	56.4	141,881	39.3	15,487	4.3
Social sciences	209,340	97,227	46.4	102,673	49.1	9,440	4.5
Humanities	151,577	106,322	70.1	39,208	25.9	6,047	4
Total	1,523,160	746,112	49	638,642	41.9	138,406	9.1

Source: Statistics Austria; Calculations by Joanneum Research

If one observes the weighting of the individual scientific disciplines in relation to the overall figures for basic research in the higher education sector, it is clear that the "hard" sciences (natural and engineering sciences, medicine, agriculture, forestry and veterinary medicine) perform 72.7% of basic research in the Austrian higher education sector. At the scientific discipline level, the natural sciences are first with approximately 40% share, followed by human medicine at 21.5%. Only 8% of total expenditures are allocated to basic research in the technical sciences. Conversely, the remaining 27.3% of overall funds for basic research are allocated to the social sciences and the humanities. Disbursements are roughly the same, with social sciences receiving 13% and the humanities 14.3%.

Figure 33: Scientific discipline share of total expenditures for basic research in the higher education sector



Source: Statistics Austria; Calculations by Joanneum Research

3.1.3 Output – Overview of selected bibliometric indicators

Up to now, only the monetary input amounts for basic research have been discussed. In the following, further analysis takes into account the output side by incorporating general bibliometric indicators. Despite all of the associated problems (different quality ratings for publications, disproportionate weighting of English-language publications, etc.), bibliometric indicators allow for the creation of an adequate assessment of the quantity and thematic specialisation of basic research in international context. Table 26 shows the number of scientific publications in international scholarly journals, as well as the number of corresponding citations per scientist. 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 excellence of scientific research.

Table 26: Publications and citations in international comparison (average 1997–2006)

	Publications per scientist	Citations per scientist
Switzerland	14.27	196.38
Great Britain	12.17	140.69
USA	11.19	146.04
Netherlands	10.6	130.25
Denmark	9.07	112.02
Ireland	9.02	82.58
Sweden	8.81	102.48
Italy	8.2	76.12
Belgium	7.95	83.15
EU15	6.94	73.62
Norway	5.94	58.45
Germany	5.84	68.04
France	5.68	55.54
Czech Republic	5.3	30.34
Finland	5.28	58.43
Greece	5.06	30.01
Austria	4.48	44.18
Spain	4.42	35.15
Hungary	4.41	31.53
Iceland	3.79	45.24
Japan	3.33	27.04
Portugal	2.77	17.88

Source: Reckling (2007), UNESCO database. WIFO calculations on the basis of results provided by Dosi–Llerena–Sylos-Labini (2006). The number of scientists is the total number of scientists working in full-time positions in the public sector and in private non-profit organisations.

Table 26 shows that U.S. scientists are generally more productive (11.19 vs. 6.95 publications per researcher from 1997 to 2006), and that their research is cited more often than the European average (146.04 citations vs. 73.62 for the EU15). This suggests that U.S. scientists' research is more relevant for other scientists than that of their European counterparts. Within Europe, there are significant differences, yet Switzerland is top-ranked for both indicators. The United Kingdom, followed by the Netherlands, leads the list of EU countries. These two countries (and, with a few caveats, Sweden and Denmark) are the only EU countries that come near to the benchmark level set by the United States. With its 4.48 publications per scientists and 44.18 citations per scientist, Austria is significantly behind the USA and the aforementioned EU countries in both indicators. Austria also lies beneath the EU15 average.

Table 27 compares the number of oft-cited scientists – as an indicator for the excellence of a research system – in the countries with the strongest research systems. Austria ranks among the top twenty nations for these indicators. With its twelve oft-cited scientists, however, Austria is just shy of the top position. Comparison with Switzerland is particularly unfavourable. In Switzerland, there are eight times as many oft-cited researchers. In Sweden and the Netherlands, this number is four times higher than Austria's, and twice as many oft-cited scientists work in Denmark. The gap between Austria and the leading countries reveals that when one compares the data to current population figures (for example, Austria has 1.59 oft-cited scientists per 1 million citizens, compared to 16.28 in Switzerland) or to the total number of scientists (0.68 per 1000 scientists vs. 9.69 in Switzerland).

Table 27: Proportion of oft-cited scientists by population and scientists

	No. of oft-cited scientists	Oft-cited scientists per 1 million citizens	Ranking	Oft-cited scientists per 1000 scientists	Ranking
USA	3829	16.82	1	15.67	1
Switzerland	103	16.28	2	9.69	2
Israel	47	12.49	3	k.A.	k.A.
Great Britain	439	7.79	4	6.95	3
Australia	105	7.13	5	2.06	10
Sweden	59	7.09	6	3.23	6
Canada	172	7.03	7	4.01	5
Netherlands	92	6.5	8	4.64	4
Denmark	28	5.47	9	3.05	7
New Zealand	17	5.46	10	1.73	13
Belgium	35	3.55	11	2.48	8
Finland	15	3.14	12	1.01	17
Germany	240	3.12	13	2.25	9
Norway	12	2.93	14	1.29	15
France	155	2.88	15	1.74	12
Japan	247	2.12	16	1.1	16
Ireland	7	2.06	17	1.99	11
Singapore	4	1.66	18	0.56	19
Austria	12	1.59	19	0.68	18
Italy	72	1.28	20	1.67	14

Source: Bauwens – Mion – Thisse (2008); UNESCO database. Number of full-time researchers employed in the public sector and in private non-profit organisations; WIFO calculations.

Table 28 provides a disaggregated chart of scientific profile in which the specialisation profile is represented on the basis of scientific productivity (P) and scientific efficacy (W). Values greater than one signify a comparative advantage (i.e., a country has an above-average value in this scientific area). The RCA value in this context is formally defined as follows:

$$RCAI_{i,j} = \frac{x_j / \bar{x}_j}{\bar{x}_i / \bar{x}}$$

Whereby

x_{ij} ... Average number of citations per scientific paper in country i and discipline j

$\bar{x}_i$ ... Average number of citations per scientific paper in country i in all disciplines

$\bar{x}_j$ ... Average number of citations per scientific paper in discipline j in all countries

$\bar{x}$ ... Average number of citations per scientific paper in all countries and disciplines

RCA values measure relative (!) advantages in specialisation. This means that a value greater than 1 in any one scientific discipline j signifies that the affected country has a comparative advantage in terms of overall position and/or how often the country's research is cited (measured by $\bar{x}_i / \bar{x}$) (although under some circumstances the "absolute" citation frequency in discipline j still may be under those of the top countries).

We must keep in mind that the indicator of "productivity" is distorted due to the implicit assumption that a country's scientists are equally distributed across all branches of science. By contrast, the efficacy indicator, which represents how many other scientists refer to the results of a publication, is more reliable. The efficacy analysis shows that Austria enjoys a comparative advantage in the fields of molecular biology, genetics, physics and mathematics. In the neurosciences and microbiology, Austria has a small comparative advantage. Austria's scientific research is therefore specialised in the natural and formal scientific disciplines.

Table 28: Scientific specialisation model in scientific productivity (P: publications / scientist) and scientific efficacy (W: citations / publication)

	Austria		Switzerland		Denmark		Sweden		USA	
	P	W	P	W	P	W	P	W	P	W
Agricultural sciences	0.55	0.73	0.55	0.75	0.79	**1.11**	**1.32**	0.98	0.86	0.93
Biology and biochemistry	0.98	0.96	0.71	0.92	0.88	**1.06**	**1.71**	0.72	**1.92**	**1.04**
Chemistry	0.89	0.95	0.53	0.89	**1.06**	0.87	0.89	**1.14**	0.96	**1.06**
Computer sciences	**1.05**	0.77	0.75	0.62	0.61	**1.09**	0.88	0.95	**1.51**	**1.38**
Geosciences	0.86	0.86	0.86	0.97	0.63	0.99	**1.09**	**1.06**	0.92	0.93
Human medicine	**1.37**	0.89	0.75	0.9	**1.24**	0.94	**1.09**	0.82	**1.13**	0.96
Immunology	**1.21**	0.98	**1.41**	0.94	**1.44**	0.9	0.88	0.86	**1.43**	1
Engineering sciences	0.71	0.97	**1.11**	0.93	0.97	0.8	0.75	0.95	**2.33**	**1.03**
Material sciences	0.92	0.98	**1.55**	**1.14**	0.99	0.83	0.81	0.98	0.62	0.80
Mathematics	0.98	**1.12**	0.77	0.97	0.46	0.98	0.78	0.9	0.72	0.98
Microbiology	0.90	**1.04**	0.96	0.8	0.76	**1.05**	0.62	**1.36**	0.87	0.84
Molecular biology and genetics	**1.00**	**1.25**	**1.05**	0.98	**1.41**	0.70	**1.33**	**1.08**	0.72	**1.06**
Neurosciences	**1.07**	**1.09**	0.78	0.96	**1.42**	**1.03**	0.95	0.95	**1.15**	**1.11**
Pharmacology & toxicology	0.91	0.94	0.59	0.84	0.66	0.87	**1.07**	**1.01**	**1.34**	**1.06**
Physics	**1.07**	**1.17**	**1.04**	1	**1.1**	0.84	**1.23**	0.97	**1.19**	**1.08**
Botany & zoology	0.85	0.86	**1.34**	**1.03**	**1.34**	0.96	0.73	0.85	0.89	0.89
Psychiatry / psychology	0.71	0.91	**1.26**	0.93	**1.05**	**1.02**	0.54	0.99	0.86	0.97
Aerospace engineering	0.91	0.62	0.67	0.93	**1.31**	0.99	0.98	0.84	**1.09**	0.92
Social sciences	0.55	0.69	0.98	**1.05**	0.75	0.99	0.60	0.91	0.80	**1.23**
Environmental science and ecology	0.68	0.90	**1.09**	0.84	**1.17**	0.98	**1. 4**	0.97	0.79	0.86
Economics	0.76	0.82	**1.08**	**1.07**	**1.03**	0.94	0.84	**1.05**	0.64	**1.06**

Source: Reckling (2007), OECD-MSTI, WIFO calculations. The process and methodological considerations used here are described in Lattimore and Ravesz (1996).

The statistics presented here indicate that, while Austria ranks in the (expanded) top international group, its distance from the top positions (the USA, the global benchmark, or Switzerland, the European benchmark), viewed as an aggregate, is quite sizeable. Scientific performance in individual disciplines naturally deviates from the overall indicators.

A few natural and formal scientific disciplines stand out particularly from the overall Austrian situation.

In summary, the following conclusions can be drawn regarding basic research in Austria:

- Approximately 0.41% of GDP is currently allocated to basic research. This positions Austria in the middle in international comparison. If one considers Austria's good position with regard to overall R&D ratio (in which Austria is above both the OECD and EU averages), this suggests that resource allocation for basic research is somewhat too low. At present, only 17% of all Austrian research expenditures are dedicated to basic research (35% for applied research and 47% for experimental development), which places Austria at the lower end of the OECD countries that have provided this data.
- Seventy percent of basic research occurs in the higher education sector (universities, the Academy of Science, universities of applied sciences, etc.), but only 60% of basic research funding is directed to universities.
- Approximately 13% of overall expenditures for basic research comes from the business segment, but this constitutes only 3% of overall R&D expenditures for this sector.
- Cooperative ventures, privately organised research institutions with strong public support and financing (ARC, ACR, JR, competence centres) which are counted among the corporate sector, receive approximately 10% of total basic research expenditures. Basic research comprises approximately 25% of the R&D activities in this subsector.
- In international comparison, Austria has a position in the (lower) middle field in terms of monetary input and (bibliometric) output, yet remains quite behind the corresponding global (USA) and European (Switzerland) benchmarks.

3.2 is there a "European paradox" (in Austria)?

The term "European paradox" was first coined in a 1994 European Commission publication (European Commission 1994). The concept is significant because, over the last few years, it has affected the debate over important European Commission recommendations regarding the role of universities in the Lisbon process (for example, European Commission 2003a, b; 2005; 2006). The term suggests that, although several European universities are performing world-class research, their scientific output is rarely transformed into marketable innovations because of absent or deficient transmission mechanisms. This thesis has been hotly debated ever since it was formulated (see Pavitt 2001; Dosi et al. 2005). For this reason, the following examines the extent to which the premise of the European paradox applies. On the basis of available data, the research performance of the European, and especially the Austrian, higher education sector will be compared to the USA. The second component of the paradox is discussed in the form of teaching, which is by far the most significant knowledge transmission mechanism from the higher education sector to the corporate sector. It will be determined whether the Austrian higher education institutions can produce enough graduates to meet the demands of the Austrian corporate sector. An intra-European comparison, or a comparison with the USA, is extremely limited due to the lack of comparable data.

3.2.1 Research

Scientific excellence is the pivotal point of the contradictory features of the university sector's significance for national innovation systems. In the context of the "European paradox", Europe's universities are excellent in research, but they do not transfer their knowledge and therefore do not sufficiently contribute to national innovation performance; other publications, however, emphasise excellence as a prerequisite for transfer of knowledge (see, for example, Mansfield 1995; Narin et al. 1997; Van Pottelsberghe 2007; Azoulay et al. 2006; Breschi et al. 2007).

Although scientific excellence is generally difficult to quantify, the analysis of scientific publications and citations in international journals nevertheless gives useful evidence of the extent to which scientists are involved in international scientific developments. Table 29 depicts the number of scientific publications in international journals per inhabitant for each country, as well as the breakdown of this number in publications per researcher and the relationship between the number of inhabitants and researchers. In the lower half of the table, the chart reproduces the information for scientific citations of publications published at domestic research institutes. Unlike the number of publications, the number of citations captures the relevance of a scientific project for other scientists.

Table 29: Research performance in international comparison (1997–2006)

	Total number of publications	Publications per 1000 inhabitants, 1997–2006	=	Publications per scientist*, 1997–2006	X	Scientists* per 1000 inhabitants, 1997–2006
USA	2,732,816	9.65		11.19		0.86
Japan	746,020	5.87		3.33		1.76
EU15	3,361,168	8.90		6.95		1.28
Switzerland	151,694	20.99		14.27		1.47
Denmark	83,265	15.58		9.07		1.72
Sweden	160,831	18.06		8.81		2.05
Austria	79,071	9.74		4.48		2.18
	Total number of citations	**Citations per 1000 inhabitants. Ø 1997 – 2006**	**=**	**Citations per scientist*. Ø 1997 – 2006**	**X**	**Scientists* per 1000 inhabitants. Ø 1997 – 2006**
USA	35,678,385	125.93		146.04		0.86
Japan	6,051,531	47.65		27.04		1.76
EU15	35,603,583	107.46		73.62		1.28
Switzerland	2,087,710	288.84		196.38		1.47
Denmark	1,027,981	192.32		112.02		1.72
Sweden	1,871,884	210.16		102.48		2.05
Austria	780,243	96.14		44.18		2.18

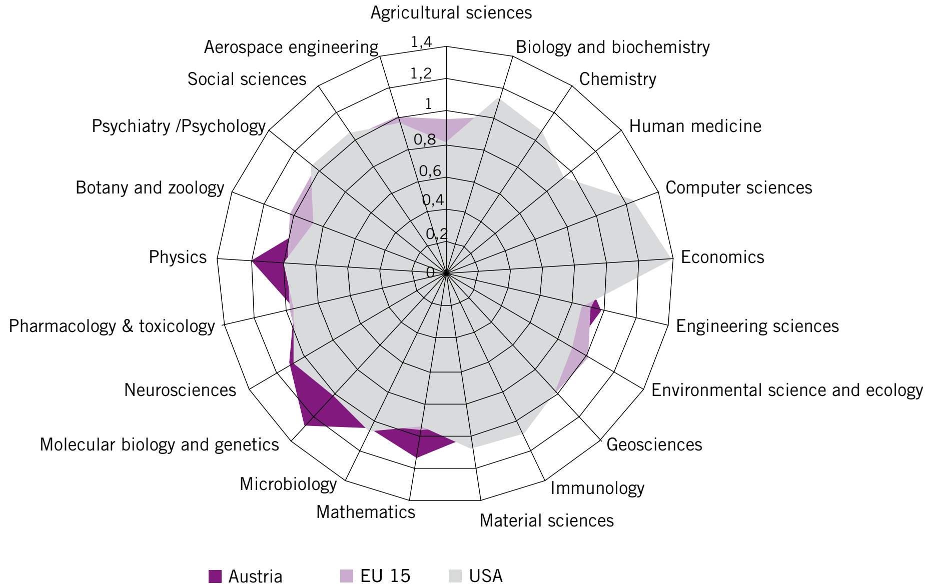
Source: Reckling (2007), UNESCO database. WIFO calculations on the basis of results provided by Dosi-Llerena-Sylos-Labini (2006).
* The number of scientists is the total number of scientists working in full-time positions in the public sector (higher education and other public institutions) and in private non-profit organisations.

The absolute numbers of publications and of publications per inhabitant (first and second columns) suggest an argument for the existence of a European paradox. More publications appear in the EU15 than in the USA. When compared with the population numbers, this first impression is slightly weakened, but overall the numbers show that the EU15 produce only a few less scientific publications per inhabitant in international scientific journals than in the USA. The number for Austria is at 9.74, slightly above the value for the USA. This would confirm the first premise of the European paradox, since these numbers suggest that the dominance of U.S. research can only be traced to the size of the USA. The relevance of publications, however, is approximated primarily by means of the number of citations that refer to these publications. This number shifts the pattern much to the advantage of the USA (lower half of Table 29). This is where the EU15 countries fall behind the USA. Individual countries such as Switzerland, Sweden or Denmark, still perform better than the USA.

More significant than the scaling of publications and citations with population figures is the scaling with the number of researchers who do not work in the corporate sector[58]. This number better reflects the productivity and quality of work in the national researcher populations. The third column in Table 26 shows that U.S. scientists are generally more productive (11.19 vs. 6.95 publications per researcher from 1997 to 2006), and that their research is cited more often than the European average (146 citations vs. 73.6 for the EU15). This suggests that U.S. scientists' research is more relevant for other scientists than that of their European counterparts. One exception here is Switzerland, which performs better in both indicators than the USA. The reason for this discrepancy between the numbers scaled to the population and to the number of researchers is that there are fewer researchers per inhabitant in the USA. This results in a slight downward distortion in the comparison of the numbers that are based on population figures. Researchers in the USA are essentially more productive and produce, according to the number of citations, more relevant work than their European colleagues. The performance of European scientists is falling behind that of their U.S. colleagues, and Austria is below the EU average.

58 In this chapter, the number of full-time employed researchers in the public sector (higher education and other public institutions) and in private non-profit organisations is used for norming. This is necessary for two reasons: 1) the overwhelming number of researchers who work in the corporate sector do not publish, or rarely publish, their work in international journals, since businesses, due to their strategic priorities, have little to no interest in sharing the work of their researchers, especially when that work results from the firm's own research activities; 2) If the number of researchers employed in the corporate sector were included, the results would be distorted to the benefit of countries that have a less technically-intensive industry structure, since fewer researchers are employed in the corporate sector.

Figure 34: Comparative advantages according to scientific disciplines – citations/publication



Source: Reckling (2007), UNESCO database; Figure and calculations by WIFO

In order to further differentiate these results, the question must be answered as to whether the dominance of U.S. scientists extends to all research disciplines, or whether the obvious advantage in the number of publications and citations can only be attributed to the scientific specialisation model in the USA. That is to say, if a country is strong in a few disciplines in which the publication of several shorter papers is the norm, and if the average number of citations are higher for these sorts of papers than in other disciplines, then the report's findings regarding U.S. scientific dominance may be distorted. In order to exclude such a structural effect, Figure 34 represents the relative advantage of a country measured in terms of its citations per publication, organised by discipline (see also the presentation of the indicator in Chapter 3.1.3). This allows for the specialisation of the countries under comparison. As Figure 34 makes clear, U.S. dominance extends to several disciplines. Therefore, it cannot be assumed that the overall results are skewed because of advantageous scientific specialisation in the USA. The USA has especially strong advantages in the areas of economics and computer sciences. For Austria, the results show a comparative advantage in mathematics, molecular biology, genetics and physics.

Table 30: The European paradox – oft-cited scientists

	No. of oft-cited scientists	Oft-cited scientists per million inhabitants	Oft-cited scientist per 1000 scientists*
USA	3829	16.82	15.67
Japan	247	2.12	1.1
EU 15	1184	3.14	2.45
Switzerland	103	16.28	9.69
Denmark	28	5.47	3.05
Sweden	59	7.09	3.23
Austria	12	1.59	0.68

* Number of full-time researchers employed in the public sector and in private non-profit organisations; WIFO calculations.

Source: Bauwens et al. (2008); UNESCO database.

The scientific dominance of the USA is further underscored when looking at the geographic distribution of oft-cited scientists. This number is also particularly important because oft-cited scientists are important agents in the transfer of knowledge between the research and corporate sectors (Zucker et al. 1998; Mathieu et al. 2008; van Looy et al. 2007). Table 30 contrasts the number of oft-cited scientists in a few countries. The USA is far above the EU average, both in absolute terms and in the number of oft-cited scientists in relation to populations and the overall population of scientists. Austria ranks among the top twenty nations worldwide for this indicator. With its twelve oft-cited scientists, however, Austria is not among the best of these. In Switzerland, there are nine times as many oft-cited scientists; in Sweden, there are five times as many. These numbers are even more significant when they are scaled with the number of scientists in a country. The new indicator expresses the density of oft-cited scientists in the overall population of scientists. The comparison with other small open economies is disadvantageous for Austria. In Switzerland, there are fourteen times as many oft-cited scientists per thousand scientists, which still lags far behind the USA. This density is almost five times higher in Sweden and Denmark than in Austria.

These numbers do not substantiate the existence of a European paradox. These indicators point out that scientific research performance in most European countries, including Austria, ranks in the top international group, but that there is still a long way to go to reach the top position globally. Scientists at U.S. colleges and universities are more productive, and their findings in every discipline more relevant, than any of their European colleagues.

3.2.2 Teaching

The second core function of universities is teaching and the education of highly qualified personnel. This is also the most important mechanism by which knowledge created at universities is dispersed to society in general and the corporate sector in particular. Special significance is therefore attached to this function for the innovation system. Peneder's study (2008) shows that the structural transformation in the Austrian economy over the last decade has accelerated innovation- and knowledge-intensive industries (see also Chapter 4.1). This implies that the need for highly qualified personnel has increased. One employment forecast (Fritz et al. 2008) shows that this trend will also continue in the near future[59] (see Table 31).

The strongest growth in employment demand is expected to take place in the highly qualified professions, that is, in positions that typically require a degree from an institution of higher education (ISCO 88[60], Code 2). Employment will grow until 2012 at 2.2% per year. According to modelling calculations, this development will be driven primarily by an increase in demand for natural scientific or technical professions (4.8% per year), in the biological and medicinal sciences (3.1% per year) and in social scientific professions (3.2% per year). Strong growth in employment is also anticipated for a few professional groups in technical and non-technical specialist fields, which are formally categorised as jobs for those with a Matura, the Austrian school leaving certificate (ISCO 88, Code 3). This applies particularly to data processing workers, a field in which employment is expected to grow by 5.1% per year until 2012.

With the available data, it is difficult to evaluate the extent to which this increase in demand for highly qualified personnel, and the knowledge they have gained at the universities, can be satisfied. There are two significant aspects here. On the one hand, there is the question of whether a sufficient number of persons in a country can become a part of this diffusion process by completing university studies, or whether a lack of graduates will inhibit the transfer of knowledge. On the other hand, another consideration is also important for the transfer of knowledge: the extent to which the distribution of completed studies for a given number of graduates leads to the best possible utilisation of these graduates in the economy and society, or whether misallocations lead to a lack of graduates in a few areas and a surplus in others.

59 Possible effects from the financial crisis of the fourth quarter of 2008 and 2009 were not considered.
60 International Standard Classification of Professions, 1988 edition.

Table 31: Forecast of employment changes in qualified professions (2006 – 2012)

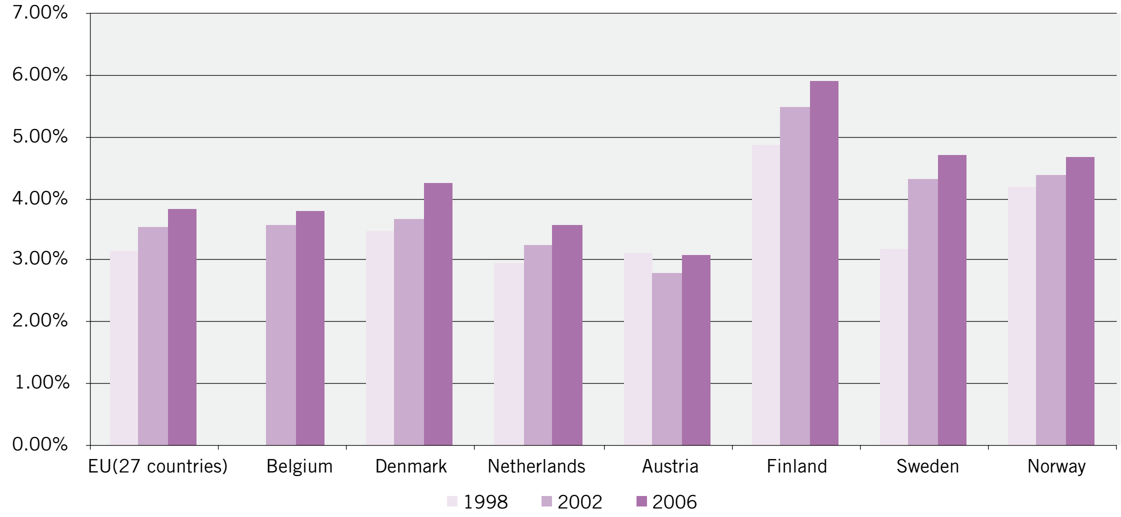
Employment development	Absolute	In % per year
ISCO 88, Code 2 – Scientists / academics	**42,100**	**2.2**
Physicists, Chemists, Mathematicians, Statisticians and computer scientists	11,600	4.8
Architects, Engineers	3,000	2.2
Life scientists, Medical scientists	6,300	3.1
Teachers at university and other institutions of higher education	1,700	1.8
Teachers in the secondary level	3,900	0.8
Science teachers at the primary and preschool level, Special school teachers	2,000	0.9
Business consulting and organisation specialists	4,100	3.1
Legal experts, Scientific administrative specialists in public service	3,300	2.4
Archival, library and information scientists, Social scientists	4,100	3.2
Writers, Artists, Clergy, Ministers	2,100	2.0
ISCO 88, Code 3 – Technical and non-technical specialists	**58,500**	**1.4**
Materials and technical engineering specialists	8,900	1.2
Data processing experts	8,700	5.1
Operators of optical / electronic equipment, Ship captains and airplane pilots, Security / Quality control	500	0.3
Medical professions (except nursing), Biotechnicians and related professions	3,900	2.1
Nursing and obstetric specialists	18,700	4.4
Non-scientific teaching staff	7,600	3.3
Finance and marketing specialists	2,400	0.2
Commercial brokers, Intermediary for commercial services	– 1,100	– 1.6
Administrative, customs and tax experts, Police commissioners, Detectives	3,100	0.4
Social work professions	5,300	4.0
Artistic careers, Entertainment and sports professions, Monks and nuns	700	0.8

Source: WIFO Industry and profession model (based on PROMETEUS and MultiREG). Rounded up to the nearest 100; differences due to rounding errors possible. Dependent, mandatory insurance employment (excluding those on maternity leave and those completing their civil service).

With regard to the first aspect, the data show that the Austrian academic quota of 18% is far below the OECD mean of 27% (OECD 2008b, p. 44). Furthermore, less Austrians go to university than the average of the EU27 countries. Figure 35 shows that the number of students has stagnated in Austria, while in other EU countries, such as Denmark, the Netherlands, Finland or Sweden – and with them the EU27 average – have climbed from 1998 to 2006. The number of university dropouts has decreased. In this indicator, Austria is near the OECD average of 30% (OECD 2008b, p. 98) and was able, in contrast to previous years, to improve this aspect of tertiary education[61]. Overall, however, these indicators suggest that too few people aspire to a tertiary education or successfully complete it to satisfy the demand for such workers.

61 In 2004, the value was between 35% and 40%, with a relatively constant OECD average.

Figure 35: Number of people who attend an institution in the regular tertiary education system (higher education institution or other tertiary institution) by country, as a percentage of the total population



Source: Eurostat, WIFO chart.

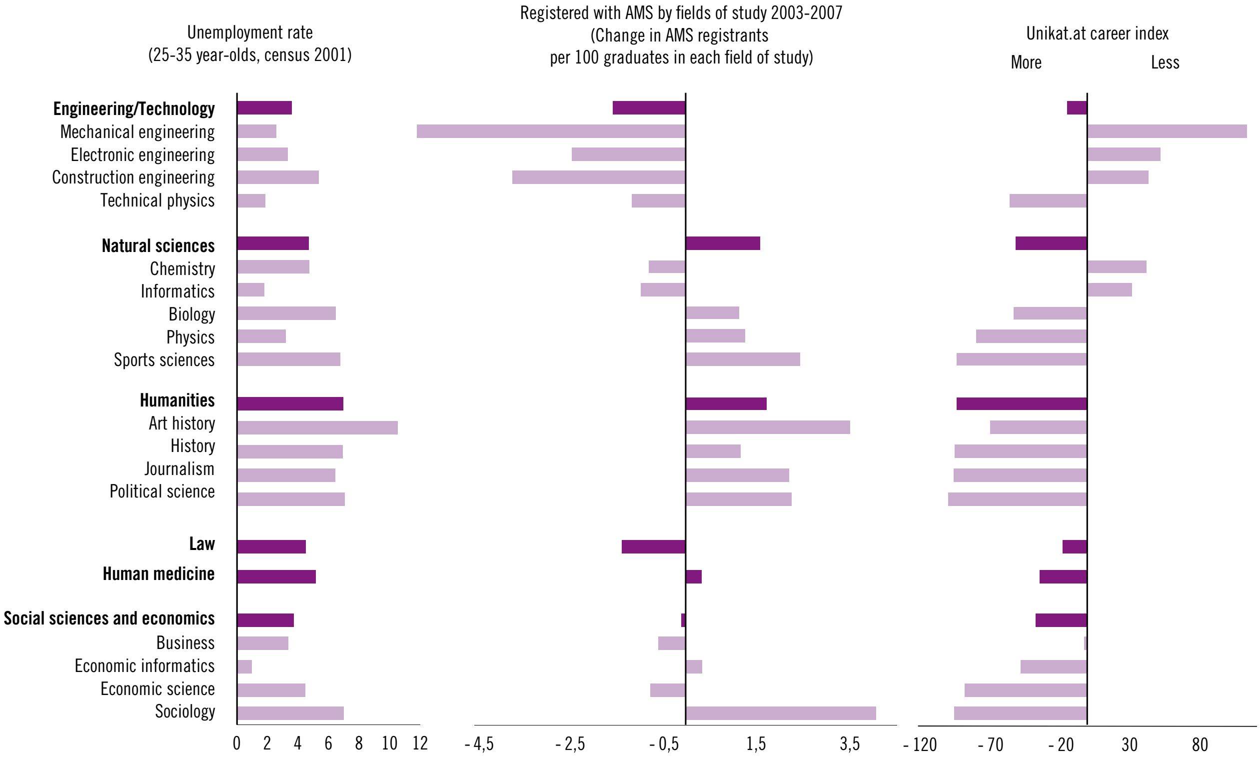
The second aspect of knowledge transfer between universities and the corporate sector is connected to the question of how successful the transfer of knowledge is in terms of a needs-based distribution of graduates. This question is best answered by an analysis of employment prospects among higher education graduates. Yet a possible imbalance between the supply of and demand for graduates is difficult to establish. Only the 2001 census data permit reliable statements with regard to employment and unemployment organised by field of study[62]. This indicator, however, cannot be projected because the registration data from the employment agencies must be included. The data only captures those people who report themselves as unemployed and only represents those open positions that businesses report to the employment agencies. Because positions with high qualification requirements are only rarely filled through the employment agencies, these kinds of jobs are underrepresented in the data. For this reason, Figure 36 presents the unemployment rate of academics[63] from 25 to 35 years of age for selected subjects and fields of study in 2001, as well as the changes in the Public Employment Service Austria (AMS) reports between 2003 and 2007.

Figure 36 shows that the unemployment rate for academics in 2001 was lowest in the engineering sciences. Unemployment was also low among graduates of certain natural, economic and social sciences. The highest unemployment rate affected graduates of the

62 The reason for this was that the capture and categorisation of Austrian labour market data according to the international standard classification (ISCO 88, COM) only permits conclusions based on customary prerequisite educational levels (primary, secondary or tertiary degree), not the actual educational level of employees. This problem is thoroughly discussed in the study by Reinstaller – Unterlass – Prean (2008).
63 The age cohort to which most university graduates belong.

humanities. The changes in the AMS reports between 2003 and 2007 for 100 graduates show that unemployment rates have decreased for the engineering subjects identified below, in a few natural, economic and social scientific fields of study, and in law. The strongest increase in AMS reports came from graduates from the humanities and sociology.

Figure 36: Unemployment rate 2001 by field of study, change in AMS reports 2003–2007, Unikat.at Career Index for 2007



Source: Statistics Austria, Census 2001, AMS Meldestatisik, UNIKAT Hochschul- Informationssysteme GmbH. WIFO chart. Unemployment rate under Livelihood I: Unemployed including those seeking their first job and those on maternity leave (if they were unemployed before; Employed: dependent employees including the marginally employed and those on maternity leave (if they were previously employed).

The third indicator in Figure 36, the Unikat.at Hochschulinformationsges.m.b.H. for 2007, is produced from the relationship between published job offers in the private sector for academics without professional experience and the estimated number of university graduates[64] who are seeking their first professional position in private industry. This also includes consideration of the competition from graduates in other subjects (university, university of applied sciences, advanced technical schools, commercial academies). At a value of 100,

64 Graduates of applied sciences universities are not included in this statistic because of classification problems. An analogue evaluation, however, would be possible in principle.

there are an equal number of graduates and advertised positions. The illustration shows the deviations from this reference value. Although this data indicates strong distortion in selection and is not representative, it nonetheless does a better job than other data of representing whether the corporate sector specifically seeks graduates with these skills[65]. This image is largely the opposite of the changes in the AMS reports. There are more positions for graduates in the technical and natural scientific subjects than can be filled by graduates. This points to a lack of graduates in these fields.

Despite all of the data-specific restrictions and the lack of comparability, these indicators suggest that, with regard to the aforementioned employment forecast and the discovery of a stronger structural transformation in knowledge-intensive industries, it is to be assumed that there will be an increasing shortage of academically educated people in the corporate sector. This will especially affect positions that require university studies in a natural or technical scientific area, and that include R&D activities among their job responsibilities. This will also limit the transfer of knowledge between higher education and the corporate sector, which can cause competitive disadvantages later on. The current data records necessitate a thorough and comprehensive investigation into the career paths of higher education graduates in the first years after they complete their studies; this would provide more precise data on which corresponding measures could be taken.

3.2.3 Summary

This analysis shows that, in Austria as well as most of the other EU member countries (and at the EU level in general), the first and decisive condition for a European paradox is not fulfilled. The data point out that scientific research performance in Austria, although it ranks in the top international group, still has a long way to go to reach the top position globally. The literature argues, however, that scientific excellence is a necessary condition for the successful transfer of knowledge between universities and businesses in two ways. First, scientific excellence requires quality teaching; second, excellence also requires cooperation between the higher education and corporate sectors. The promotion of scientific excellence is therefore an important component of a growth strategy supported primarily by scientific performance and high innovation potential in the corporate sector. Statistical analyses show that the following attributes have a positive effect on scientific performance: a high general level of education in a country, the amount of financial resources per scientist, the autonomy of universities with regard to budget, personnel and salary questions, and competition between the universities (including competition for research funding) (Aghion et al. 2007; Bauwen et al. 2008; Reinstaller et al. 2008). For Austria, the 2002 University Act set important forces in motion that now need to be further developed.

Graduates from universities and other insti-

65 The distortions result from the problems that also apply to the other indicators; for example, that graduates often go directly into a position, or that a position is offered directly to them. On the other hand, a substantial evaluation of the problem remains difficult because not all studies are prepared for specific professional profiles but nonetheless find intellectual proficiencies that can be implemented meaningfully in several academically demanding fields of activity. Therefore, we should not speak of misallocation of resources when a mathematician works as a data processing analyst, or when a political scientist works as a journalist.

tutions of higher education play a particularly important role in a growth strategy built on science and innovation, since these graduates bring new knowledge to businesses and apply it. With their contacts to their alma mater, students are also often important connections between universities and businesses. Despite the poor condition of the data, the indicators presented in this chapter suggest that there is a shortage of graduates in the natural and technical sciences, and that this shortage will become worse in the near future. In Austria, the overall number of university graduates is too low, and the distribution of students across the various disciplines is disadvantageous, given the shortage of graduates in the sciences. As the data in this chapter show, Austria needs to catch up not just in research, but also in teaching.

Universities best fulfil, their essential role in a national innovation system whenever they focus most on their traditional core responsibilities: research and teaching. World-class research, however, remains confined to a few scientific branches, which means that the major premise of the European paradox does not apply to Austria (or the EU). The transfer of knowledge – defined as the correlation between the supply and demand for university graduates – could be improved. The full potential of universities to contribute to the Austrian innovation system has not been tapped.

3.3 Qualification structure of migrants in Austria

The scale and origin of foreign labourers in the Austrian labour market are becoming increasingly complex due to a number of factors: the recruitment of guest workers in the 1960s and 1970s, the Polish crisis in the early 1980s, the armed conflicts in former Yugoslavia in the early 1990s, the fall of the Iron Curtain, Austria's admission to the EU, the eastward expansion of the EU, new policies regulating the entry of non-EU labourers into the EU labour market, the granting of residence permits to non-EU workers' families, demographic imbalances to developing countries, wage differences and the increasing globalisation of economic activities. The foreign labourers from traditional guest worker regions in southern Europe and Turkey are being joined by foreign workers from the old and new EU countries, especially Germany, as well as workers from the more distant regions of Asia and Africa, refugees and asylum seekers. As a consequence, the percentage of foreigners in the population and among the employed has increased, causing a transformation in the structure and composition of the foreign resident population in Austria in terms of origin and educational level.

At the same time, the Austrian economic structure has changed a great deal since the 1990s (see Chapter 4.1). Technological change and increasing globalisation have increasingly shifted the Austrian economy towards highly skilled professions, thereby changing the skill requirements for workers. In this context, the question arises as to whether Austria will be able, in international comparison, to retain a sufficiently skilled workforce whose qualifications can be put to use, especially as foreign worker employment in Austria has long been directed at unskilled labourers from Turkey and former Yugoslavia, Austria's two traditional guest worker regions. From a technological and political perspective, university graduates born in foreign countries and educated in Austria are of particular interest, since they could most quickly strengthen Austrian human resources in research and development.

Therefore, this chapter focuses on two major questions. First, the qualification structure of foreign-born labourers in Austria will be assessed. Second, it will be determined whether university graduates who were born abroad but work in Austria are employed in positions that correspond to their skills.

The basic data for this chapter is provided by the Austrian Labour Force Survey (LFS). This is a representative quarterly sample in which approximately 22,500 randomly selected households are asked questions about the topics of employment and living. Questions about employment focus primarily on queries about employment status, working hours, education and profession. This survey serves as the foundational data for European comparisons of the labour market. It is the only annually recorded data set that contains comprehensive information on the educational status of Austria's foreign-born population.

A disadvantage of the LFS is that it does not provide a full census count. Therefore, it is affected by survey sampling errors. Random variations cannot be fully excluded. These are to be expected whenever small groups are surveyed. In order to minimise the problem of sampling errors, this chapter analyses the average for a four-year period of time from 2004 to 2007. Although this methodological approach reduces random variations, there still remain relatively large sampling errors in a few groups (especially in agriculture and construction). We therefore adopt the conventions recommended in Statistics Austria's publications (for example, Statistics Austria 2007), in which values with a 95% confidence interval of +/- 30% or more are displayed in brackets.

3.3.1 Qualification structure of foreign-born university graduates in Austria

According to a new OECD international comparative study (OECD 2008a) on immigration and emigration of so-called "foreign-born" people among 28 OECD countries (which only goes back to 2000), Austria has the lowest number of university graduates among its foreign-born population. According to this study, Austria's percentage of university graduates as a share of the foreign-born population is, at 11.3%, trailing Poland in the last position among the OECD countries. This data confirms a series of recent international comparative studies that show that Austria lags behind most OECD countries with regard to migrant qualification structures. According to the conclusions of Belot and Hatton (2008) and Biffl (2006), Austria, among the OECD countries, has the lowest percentage of highly skilled migrants who have completed a tertiary educational level.

Table 32: Key data on qualification structures of immigration and emigration in OECD countries (in %)

	With a university degree	Students[1])	Professionals[2])
	in %		
Austria	11.3	11.5	13.3
Poland	11.9	0.5	32.7
Italy	12.2	1.2	17.5
Czech Republic	12.8	1.9	18.6
Germany	14.9	8.1	10.2
Turkey	15.2	1.3	
Slovakia	15.7		23.8
Greece	15.9		11.2
France	18.1	7.3	22.1
Finland	18.9	1.7	21.6
Netherlands	19.2		25.3
Portugal	19.3		21.3
Hungary	19.8	2.6	31.8
Spain	21.1	1.7	15.5
Luxembourg	21.7	30.5	23.3
Belgium	23	4	31.6
Switzerland	23.7	16	23.1
Denmark	23.9	6	16.9
Sweden	24.3	4.5	19
Australia	25.8	12.6	31.2
USA	26.1	3.2	
Japan	30	1.4	
Norway	30.5	3.2	20.9
New Zealand	31	3.7	33.4
Mexico	34.8		36.1
United Kingdom	34.8	10.8	34.2
Canada	38	2.8	28.8
Ireland	41.1	4.8	38.1

Source: OECD (2008a). –[1]) Percentage of total number of students. [2] Employees in ISCO professional group 1 (jobs with a managerial function) and 2 (scientists).

However, these studies also show that Austria is a country in which an above-average number of foreigners attend university. The percentage of foreign students stands at 11.5% according to OECD data (2008a), the fourth-highest percentage (after Luxembourg, Switzerland and Australia) among the 23 OECD countries for which data were available. Earlier studies also confirm these results. According to a comparative study by Tremblay (2001), Austria numbers among the countries with the highest percentage of foreign students.[66]

According to LFS data, the qualification structure of Austrian immigration has improved since 2000 (Table 33). Approximately 36% of the immigrant population that came to Austria in the late 1980s had, at most, completed compulsory schooling; only 10% of the foreign population had a university certificate or equivalent education. From 2003 to 2007, the percentage of compulsory school graduates was 31% (much higher than 21% among the domestic population), and the percentage of university graduates was 19%, higher than among the Austrian-born population (where the university graduate percentage was 10%). In comparison to the Austrian population, the foreign-born population in Austria is increasingly distributed to both extremes in education. Above-average percentages of lowly- and highly-qualified migrants stand in contrast to below-average high percentages in the middle qualification segment.

66 In international comparison, foreign students in Austria more often pursue studies in the humanities or the arts; engineering sciences are rarely studied.

Table 33: Education structure of the foreign-born and Austrian-born population of working age (between 15 and 64) by region of origin, year of immigration and age at the time of immigration (in %)

	Compulsory schooling	Apprenticeship, vocational school	School leaving exam (AHS, BHS), Master certificate	University, University of applied science
Region of origin, Native country				
Austria total	21	49	19	10
Foreign	36	32	18	14
EU 15 (without Austria)	13	35	22	29
EU 12 (new member countries)	16	37	32	16
Former Yugoslavia (without SLO)	46	39	11	4
Turkey	73	18	7	2
Other countries	30	21	22	26
Year of immigration				
1942 – 1959	20	47	20	12
1960 – 1979	47	29	13	11
1980 – 1988	35	30	19	15
1989 – 1993	36	37	17	10
1994 – 2002	35	26	21	19
2003 – 2007	31	28	22	19
Age at time of immigration				
0 to 15	43	36	15	6
16 to 19	55	25	13	7
20 to 29	33	32	21	14
30 to 39	30	31	18	22
40 and over	33	29	15	23

Source: Statistics Austria, Microcensus (pooled data records 2004–2007).

According to the results of more recent analyses (see Huber et al. 2008), the most essential determining factors on migrant educational structure are (in order of importance) the home country's structure, immigration policy and the age at which the person immigrated. The educational structure of immigrants depends heavily, then, on the home country, along with the consideration of other factors. The probability that (assuming similar personal characteristics) a person born in Turkey or former Yugoslavia has at most a compulsory school certificate is markedly higher than people from the old EU countries (former Yugoslavia: 46%, Turkey: 73%, EU15: 13%) and the probability that people from these countries have a tertiary education certificate is definitely lower. Citizens from the 12 new EU countries are only eight percentage points more likely to have only completed compulsory schooling than citizens of the old EU countries. The difference with regard to tertiary education is even smaller at two percentage points (see Table 33).

Thus overall, the best qualified labour force (including the most university graduates) among the numerically relevant groups in the Austrian labour market, are people from the 14 old EU countries, followed by citizens of the 12 new EU countries. The worst qualified labour force were born in Turkey and Yugoslavia. Additionally, the year of immigration and the age at the time of immigration have a significant influence on immigrant skills. Immigrants who came to Austria during the guest worker immigration of the 1960s and 1970s are approximately 27 percentage points more likely to have at most completed compulsory schooling than those persons who immigrated to Austria before 1960. In contrast, people who immigrated to Austria after the introduction of the 2002 Revised Immigration Law (which went into effect in 2003) are better qualified. This can be viewed as an indication that the attempts in migration policy in recent years to attract highly qualified workers has led to an improvement in the educational structure of immigration to Austria; however, as mentioned earlier, this development was insufficient to improve Austria's relatively poor international position.

Young people who immigrate to Austria when they are between 16 and 19 years old, in comparison with people who immigrate to Austria before they turn 15, are much more poorly educated. They are approximately 22 percentage points more likely than born Austrians to have completed at most compulsory schooling, and they also are less likely to complete a tertiary education. People who immigrate to Austria before they are 15 are better educated than people who immigrate to Austria after they have reached their 20th year. The group of 16- to 19-year-olds who immigrate are a special target group for education and labour policies. Educational discontinuities among this group, caused by the necessities of immigration, may lead them to drop out of school. It is therefore important to include the educational system in a comprehensive strategy to provide foreign-born students higher qualifications.

Table 34: Subject structure of the highest completed education among working university graduates (15 to 64 years of age) by country of origin

	Field of highest completed level of education			
Region of origin, Native country	**Natural and engineering sciences**	**Humanities and social sciences**	**Pedagogy and health**	**Other Field of education**
Austria total	89,095	174,856	184,194	13,945
in %	*19*	*38*	*40*	*3*
Foreign	38,589	55,384	29,562	5,935
in %	*30*	*43*	*23*	*5*
EU 15 (without Austria)	12,251	19,247	9,179	2,081
in %	*29*	*45*	*21*	*5*
EU 12 (new member countries)	8,180	11,321	6,381	(1,095)
in %	*30*	*42*	*24*	*4*
Former Yugoslavia (without SLO)	5,019	4,194	2,437	(978)
in %	*40*	*33*	*19*	*8*
Turkey	(871)	(1,265)	(1,097)	(86)
in %	*26*	*38*	*33*	*3*
Other countries	12,145	19,200	10,371	(1,677)
in %	*28*	*44*	*24*	*4*

Source: Statistics Austria, Microcensus 200 – 42007 – Basis = Persons of working age (15 to 64), Values in brackets = small sampling size.

Foreign-born university graduates in Austria are more likely to have degrees in the humanities or social sciences than Austrian-born university graduates (Table 34); this applies in particular to graduates who come from EU15 countries. However, the percentage of foreign-born university graduates with degrees in engineering and the natural sciences is higher than for Austrian-born graduates, due to the high number of Yugoslavian university graduates with these certificates. The percentage of foreign-born university graduates with certificates in pedagogy and health is lower than among Austrian-born graduates.

3.3.2 Deployment of the foreign-born labour force

Foreign-born workers are employed differently in the Austrian labour market than Austrian-born workers, even when both workers have similar education levels. The employment rate among highly skilled foreign labourers (university graduates) was on average 76% (men 85%, women 67%) from 2004 to 2007, although, at the highest levels of education, the rate was 12 percentage points lower than for Austrian-born university graduates. These differences between Austrian- and foreign-born persons are significantly larger among women (approaching 19 percentage points) than among men (approximately 5 percentage points) (Table 35). Similarly, the unemployment rate for foreign-born university graduates, at approximately 6.3% (men 5.2%, women 7.6%), is, with similar gender differences, distinctly higher than for Austrian-born university graduates. Even highly skilled foreign-born labourers in Austria are confronted with a significantly higher risk of unemployment, and lower prospects for employment, than their Austrian-born colleagues. Among highly skilled foreign-born workers, women are especially disadvantaged. As in all of the other education groups, foreign-born women suffer from double discrimination due to their gender and their origin.[67]

67 A detailed analysis of double discrimination against foreign-born women (for example, by region of origin, age or date of immigration) is unfortunately impossible given the limited sample size, which does not allow any statements based on partial aggregates.

Table 35: Employement and labour force participation rate of employees (aged 15 to 64) living in Austria, by country of origin and educational level

	Population of working age		Employment rate in %		Unemployment rate in %	
	Austrian	Immigrants	Austrian	Immigrants	Austrian	Immigrants
Total						
Max compulsory school	992,963	335,825	47	51.2	8	14.2
Apprenticeship, vocational school	2,280,679	291,123	75.4	71	3.5	8.4
School leaving exam (AHS, BHS), Master certificate	888,786	165,998	74.3	63.4	2.9	8.9
University, University of applied science	462,090	129,072	88	75.8	2.1	6.3
Total	4,624,518	922,018	70.4	63.1	3.9	10
Men						
Max compulsory school	413,933	141,823	53.1	62.7	8	14.3
Apprenticeship, vocational school	1,187,223	156,442	81	77.3	3.2	8.5
School leaving exam (AHS, BHS), Master certificate	505,255	76,414	78	70.9	2.3	8.4
University, University of applied science	228,730	63,195	90.3	84.7	1.8	5.2
Total	2,335,142	437,874	76.3	72.5	3.5	9.7
Women						
Max compulsory school	579,029	194,003	42.7	42.7	7.9	14.1
Apprenticeship, vocational school	1,093,456	134,681	69.3	63.8	3.9	8.3
School leaving exam (AHS, BHS), Master certificate	383,531	89,584	69.6	57	3.7	9.5
University, University of applied science	233,360	65,876	85.7	67.3	2.3	7.6
Total	2,289,376	484,144	64.3	54.6	4.4	10.3

Source: Statistics Austria, Microcensus 2004–2007 – Basis = Persons of working age (15 to 64), Values in brackets = small sampling size.

Foreign-born labourers in Austria are employed in professions beneath their qualifications much more frequently than their Austrian-born counterparts. They are quite often overqualified for their positions (see also Gächter 2006, Biffl et al. 2008).[68] According to the Austrian LFS, from 2004 to 2007, an average of approximately half (47%) of foreign-born university graduates work in a profession beneath their qualifications; for Austrian-born graduates, this number is 29% (Table 36). Among secondary school graduates, 67% of the foreign-born are overqualified for their jobs, but only 48% of the Austrian-born. Among graduates of apprenticeship programmes, this applies to 22% of the foreign-born and 9% of the Austrian-born.

68 In order to more thoroughly analyse professional employment of foreign-born workers in comparison with their educational level, an indicator of over- and under-qualification is established on the basis of the international literature on over- and under-qualification (see Chiswick – Miller, 2007 for an overview). The analysis was based on this approach (see Gächter (2006), Biffl et al. (2008), Lassnigg – Vogtenhuber (2007) for similar approaches in Austria): First, each professional group was assigned a qualification level based on a cross sample of the international professional group system (ISCO) educational requirements. Finally, for each person that worked in the corresponding professional group, the actual qualification level was determined. A person was ranked as overqualified if their actual qualification level was higher than what was considered "normal" for the profession. As an indicator of whether foreign-born university graduates are able to deploy their human capital in Austria, the percentage of overqualified foreign-born university graduates can be compared to that of Austrian-born university graduates.

Table 36: Under- and over-qualification of employees (aged 15 to 64) living in Austria, by country of origin and educational level

	Men		Women		Total	
	Austria	Immigrants	Austria	Immigrants	Austria	Immigrants
Max compulsory school						
Underqualified	180,405	55,271	171,572	33,613	351,976	88,883
Appropriately	30,290	30,330	68,162	47,356	98,452	77,686
Total	210,695	85,601	239,734	80,968	450,428	166,569
Teaching						
Underqualified	175,704	10,140	187,915	15,926	363,619	26,066
Appropriately qualified	629,730	86,375	472,851	42,786	1,102,581	129,161
Over-qualified	79,955	18,587	67,884	24,966	147,839	43,554
Total	885,389	115,102	728,649	83,679	1,614,039	198,781
School leaving exam (AHS, BHS)						
Underqualified	28,698	2,986	13,591	1,484	42,288	4,471
Appropriately qualified	154,532	12,629	106,969	14,310	261,501	26,939
Over-qualified	145,899	32,134	131,088	32,188	276,988	64,322
Total	329,128	47,750	251,648	47,982	580,777	95,732
University graduates						
Appropriately qualified	130,975	27,812	125,455	18,623	256,430	46,435
Over-qualified	42,247	18,546	61,863	23,379	104,109	41,925
Total	173,222	46,358	187,317	42,002	360,539	88,360
Share in %						
Max compulsory school						
Underqualified	86	65	72	42	78	53
Appropriately qualified	14	35	28	58	22	47
Total	100	100	100	100	100	100
Teaching						
Underqualified	20	9	26	19	23	13
Appropriately qualified	71	75	65	51	68	65
Over-qualified	9	16	9	30	9	22
Total	100	100	100	100	100	100
School leaving exam (AHS, BHS)						
Underqualified	9	6	5	3	7	5
Appropriately qualified	47	26	43	30	45	28
Over-qualified	44	67	52	67	48	67
Total	100	100	100	100	100	100
University graduates						
Appropriately qualified	76	60	67	44	71	53
Over-qualified	24	40	33	56	29	47
Total	100	100	100	100	100	100

Source: Statistics Austria, Microcensus 2004–2007 – Basis = Persons of working age (15 to 64).

Table 37: Overqualification of university graduates working in Austria, by country of origin, year of immigration, age at immigration and subject area of the highest completed educational certificate

	Employed person is in her position		
	Appropriately qualified	Over-qualified	Total
Region of origin, Native country			
Austria total	256,430	104,109	360,539
in %	*71*	*29*	*100*
Foreign	46,631	42,128	88,760
in %	*53*	*47*	*100*
EU 15 (without Austria)	21,803	10,204	32,007
in %	*68*	*32*	*100*
EU 12 (new member countries)	8,057	9,265	17,322
in %	*47*	*53*	*100*
Former Yugoslavia (without SLO)	3,431	5,694	9,125
in %	*38*	*62*	*100*
Turkey	(978)	(1226)	(2204)
in %	*44*	*56*	*100*
Other countries	12,166	15,535	27,701
in %	*44*	*56*	*100*
Year of immigration			
1942 – 1959	(1714)	(361)	(2075)
in %	*83*	*17*	*100*
1960 – 1979	7,529	4,006	11,535
in %	*65*	*35*	*100*
1980 – 1988	7,922	5,375	13,297
in %	*60*	*40*	*100*
1989 – 1993	9,401	11,851	21,252
in %	*44*	*56*	*100*
1994 – 2002	13,169	14,483	27,652
in %	*48*	*52*	*100*
2003 – 2007	6,699	5,848	12,548
in %	*53*	*47*	*100*
Age at time of immigration			
0 to 15	6,010	(2540)	8,550
in %	*70*	*30*	*100*
16 to 19	3,352	(1541)	4,893
in %	*69*	*31*	*100*
20 to 29	17,739	19,545	37,283
in %	*48*	*52*	*100*
30 to 39	13,996	13,741	27,737
in %	*50*	*50*	*100*
40 and over	5,323	4,559	9,882
in %	*54*	*46*	*100*
Field of highest completed education			
Social and engineering sciences	66,708	29,698	96,406
in %	*69*	*31*	*100*
Humanities and social sciences	102,262	62,700	164,962
in %	*62*	*38*	*100*
Pedagogy and health	128,389	45,896	174,285
in %	*74*	*26*	*100*
Other education fields	5,506	7,740	13,246
in %	*42*	*58*	*100*

Source: Statistics Austria, Microcensus 2004–2007 – Basis = University graduates of working age (15 to 64); Values in brackets indicate sampling errors due to low sample size.

Foreign-born women face several significant disadvantages with regard to employment opportunities, risk of unemployment and overqualification. Among female university graduates, more than half of the women work in professions for which they are overqualified. It is only among AHS/BHS graduates that there is no difference between foreign-born men and women.

Migrants can only utilise their human capital from abroad in very limited ways in the Austrian labour market. Although this analysis cannot say whether the cause of these problems lie in different educational systems, the absence of educational certificate equivalencies, the lack of foreign language fluency, the institutional conditions of the Austrian labour market, or simply discrimination against immigrants, it is clear that this observation applies to immigrants from almost every country of origin. The only exception here are people who are born in Germany or in another country that belongs to the (old) EU15. Among this group, the extent of over-qualification is not significantly higher in any of the educational segments than it is among Austrian-born workers.

Among foreign-born university graduates, people born in former Yugoslavia experience special difficulties in realising their human capital. The likelihood that a university graduate from this region will work in a position beneath their qualification level is 33 percentage points higher than for a person with comparable skills born in Austria.

In addition to these differences, the risk that university graduates will be underemployed climbs along with the migrant's age at the time of immigration. The likelihood of being underemployed is the same as for the Austrian-born among those who immigrated before they were 15 years old and therefore received a majority of their education in the Austrian school system.

Overall, these results suggest that the probability that a foreign-born university graduate will be underemployed is strongly correlated with their age at the time of immigration and their country of origin. It is striking that these problems among the foreign population in Austria are minimised most when language problems play a minor role (such as among migrants from Germany) or when the majority of a person's education is completed in Austria. Two of the most effective measures to prevent underemployment are therefore linguistic integration and increased efforts toward formal recognition of qualifications earned in foreign countries. In addition to such measures, however, a few institutional particularities of the Austrian labour market, such as the high proportion of insiders and the strong emphasis on the seniority principle, are important challenges where measures for more effective integration may be particularly effective.

However, the problems of human capital transfer still present a barrier integration. It may be assumed that these problems are of great significance in the years directly following migration. This is confirmed to some degree in the results in Table 37. According to our descriptive analysis, the likelihood of underemployment among foreign- and Austrian-born university graduates differs most for the foreign-born that immigrated after 1980. Among foreign-born university graduates who immigrated to Austria in the 1960s or 1970s, these probabilities are no longer as different for Austrian-born graduates. This seems to suggest that foreign-born graduates eventually manage to find a profession that corresponds to their qualifications.

3.3.3 Summary

This chapter offers an overview of the scale and qualification structure of foreign workers on the labour market. Austria can be described as a country where many foreigners attend university, yet a low number of highly skilled migrants live. Also, many highly skilled workers emigrate from Austria after completing their studies. Young people between 15 and 19 who immigrate to Austria have a noticeably worse educational structure than comparable immigrants who were younger or older. Migration policy efforts in recent years to attract highly qualified labourers have contributed to a slight improvement of educational structures for immigrants. Foreign-born highly skilled workers are still much more likely to be unemployed than their Austrian-born colleagues and work noticeably more often below their level of qualification. University graduates, immigrants from traditional guest worker countries, persons who immigrated when they were over 20 years old, and those who immigrated between 1989 and 1993 are especially affected.

Overall, the results show that the skills structure of foreign-born workers in Austria is marked by a few specific problems. The opportunities for changing this situation lie first in making Austria an attractive destination for highly qualified workers and also in immigration policy interventions toward greater selection of immigrants based on educational criteria. Furthermore, there need to be measures that facilitate the transfer of skills and qualifications to Austria. Aside from linguistic integration, several unique institutional attributes of the Austrian labour market seem to present a significant hurdle. Two target groups with special needs are women and those who immigrate between the ages of 16 and 19. With the first group, the aim is to reduce the double discrimination that highly qualified foreign-born women face on the job market. With the second group, the discontinuity in the educational path that immigration creates often leads to school dropouts. The school system should therefore integrate a comprehensive strategy to qualify those born abroad.

4 Innovations in the Austrian Corporate Sector

4.1 Growth and structural change in the knowledge-based economy

This section examines the hypothesis that in Austria, specialisation in traditional industry sectors, primarily those in the middle-intensity technology segment, is in contrast to the overall high standard of living and the country's positive macroeconomic development. It is therefore related to the debate over the Austrian *structure-performance paradox* (Peneder 1999; Tichy 2000; Janger 2007; Kattinger 2008), as well as the recent dispute over the significance of the high-tech versus low-tech industry sectors (Falk and Unterlass, 2006; Leo et al., 2006; Schibany et al. 2007a).

The Austrian *structure-performance paradox* refers to the contradiction between two empirical findings on the technological capability of the Austrian economy that dominate the discussion on policies related to innovation and to Austria as a location for business. Structural deficits in the manufacturing sectors had already been pointed out at the end of the 1980s (Aiginger, 1987) and confirmed in the mid-1990s (Hutschenreiter and Peneder 1997). This pessimistic view was in turn countered by the good macroeconomic trends and Austria's high standard of living. In the discussion of economic policy, there were generally two contrasting assessments. The "growth optimists" raised doubts about a causal connection between industry structure and growth and/or the precision of measurement provided by the existing classification systems, particularly the demarcation between high-tech and low-tech sectors. Countering this, the "structural pessimists" point out the exhausted historic catch-up potential and interpret the structural deficits primarily as being indicators of future risk to the standard of living that has been achieved so far.

Against this background, Peneder (1999) attempted to resolve the paradox while taking into account the empirical evidence on both sides of the debate. Put briefly, the study confirmed a growth advantage for the overall economy vis-à-vis comparable OECD countries with the same structural deficits in their industry sectors. These deficits primarily affect the share of particularly knowledge-intensive manufacturing sectors. In addition, a panel-econometric assessment model for the 1990s was used to prove a statistically significant influence of the shares of both technology-intensive as well as human capital-intensive industry sectors on overall economic growth. The positive influence of certain types of industries on growth has since been confirmed in a series of empirical studies (Peneder 2003A; Crespo-Cuaresma and Wörz, 2005; Falk 2007; Yoo 2008). *Ceteris paribus*, i.e. assuming all other factors to be equal, it follows that the existing structural deficits are putting a brake on growth in Austria.

The answer to the paradox therefore begins with the question of which factors impair the *ceteris paribus* condition. In other words, which particular advantages in terms of location and competition can (more than) compensate for the existing structural deficits? A number of characteristics peculiar to Austria could be possible explanations. The first factor is Austria's favourable location in terms of economic geography, between two high income regions (southern Germany and northern Italy) and in the immediate vicinity of the new growth regions in eastern and southeast-central Europe. Although its proximity to southern Germany and northern Italy has benefited the successful economic catch-up process, the opening to the east was a historic stroke of luck that occurred just at the period that the catch-up potential had been largely exhausted. These growth-stimulating factors were further strengthened by the process of European integration. A second possible explanatory factor is a system of macroeconomic controls that has remained surprisingly coherent over long periods of time, combined with the Austrian model of social partnership in labour relations. The key elements here are Austria's anti-cyclical fiscal policy combined with a successful control of inflation through its hard currency policy and a relatively high degree of flexibility in real wages (Tichy 1984; Guger 1998). Thirdly, the study pointed out specific entrepreneurial qualities that can be simply summarised with terms such as adaptability, flexible specialisation, and successful niche strategies (Tichy 2000; Peneder 2003B).

The Austrian "growth puzzle" therefore consists of a number of factors, and the structural findings show only one of these, albeit a real aspect that must be taken seriously. Despite good overall economic performance, the relatively traditional industry structures in manufacturing are both an indicator of unrealised growth potential in the past and a sign of risks to growth in the future, particularly if Austria is unable to transform itself from a technology consumer to a partial technology provider (Aiginger, Tichy, Walterskirchen, 2006).

This section therefore examines the question of whether the existing conflicts between traditional industry specialisation and overall economic performance will continue to exist, or whether a solution to the paradox will be found over the long term – either in the form of slower growth or a more pronounced structural transformation in the direction of knowledge-intensive industry sectors. In fact, a combination of both tendencies can be seen. On the one hand, the influence of the structure-performance paradox of the 1990s is evident in the current economic trend, while on the other hand there is a relaxation of the paradox in the sense of a convergence with European averages.

4.1.1 Current findings

The macroeconomy

If we review the structure-performance paradox in the light of the more recent data, then the first thing that becomes clear is that Austria's growth advantage, which had been constantly shrinking since the 1970s, was completely lost after 2000 (Marterbauer 2001). Compared to the growth rates in the 1970s, when Austria still held third place within the EU15 countries with an average of 3.5% per annum, its rates of 2.1% per annum in both the 1980s and 1990s put it in only eighth place (Table 38). Although Austria's growth was still slightly higher than that of the EU15 at least in the 1990s, the growth rates of 1.4%

for the years 2001 to 2007 lie exactly within the average. This mean score is strongly affected, however, by a few large countries such as Italy, France, and Germany, whereas Austria now occupies only tenth place within the EU15. The further decline in overall growth at the end of the 1990s that was expected in the course of the discussion about the paradox has therefore occurred, and the historical growth advantage achieved during the catch-up phase has now disappeared when we compare long-term mean scores.

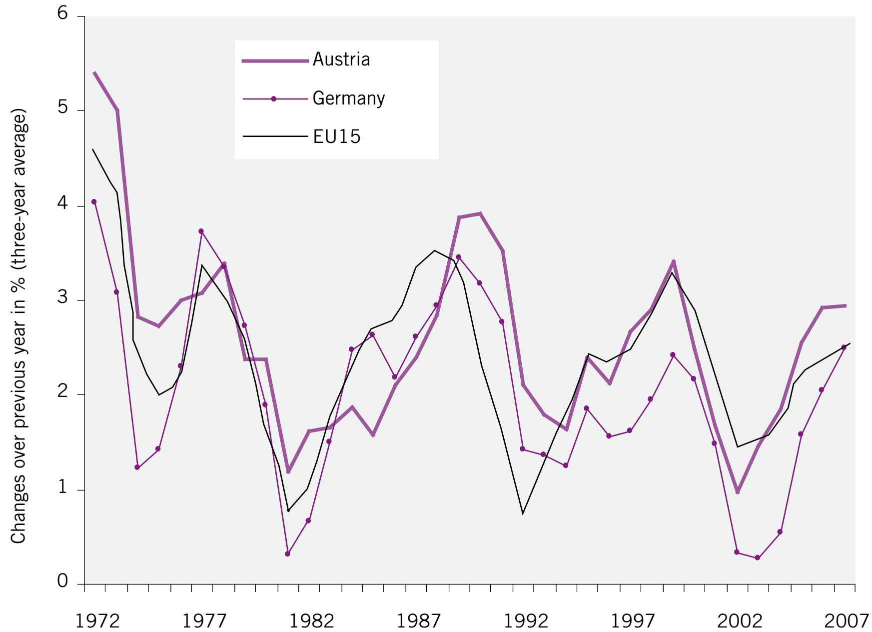
Table 38: Long-term development of per capita GDP (at 2000 prices)

1970/1980			1980/1990			1990/2000			2000/2007		
	Rank	Annual Change in %		Rank	Annual Change in %		Rank	Annual Change in %		Rank	Annual Change in %
Greece	1	3.6	Luxembourg	1	4.5	Ireland	1	6.3	Greece	1	4.0
Portugal	2	3.5	Ireland	2	3.2	Luxembourg	2	3.6	Ireland	2	3.4
Austria	3	3.5	Portugal	3	3.0	Portugal	3	2.6	Luxembourg	3	3.0
Finland	4	3.5	Finland	4	2.6	Netherlands	4	2.5	Finland	4	2.8
Italy	5	3.3	Spain	5	2.6	Spain	5	2.5	Sweden	5	2.3
Ireland	6	3.2	Great Britain	6	2.5	Denmark	6	2.2	Great Britain	6	2.1
Belgium	7	3.2	Italy	7	2.4	Great Britain	7	2.1	Spain	7	1.9
France	8	2.7	Austria	8	2.1	Austria	8	2.1	Belgium	8	1.5
Germany	9	2.6	Denmark	9	2.0	Belgium	9	1.9	Denmark	9	1.4
Spain	10	2.5	Germany	10	2.0	Germany	10	1.7	Austria	10	1.4
Netherlands	11	2.1	Belgium	11	1.9	Greece	11	1.6	Netherlands	11	1.3
Denmark	12	1.9	Sweden	12	1.9	Finland	12	1.6	Germany	12	1.2
Luxembourg	13	1.9	France	13	1.9	Sweden	13	1.6	France	13	1.1
Great Britain	14	1.8	Netherlands	14	1.7	Italy	14	1.5	Italy	14	0.5
Sweden	15	1.6	Greece	15	0.2	France	15	1.5	Portugal	15	0.5
EU 15		2.5	EU15		2.2	EU15		1.9	EU15		1.4
OECD 26		2.4	OECD26		2.3	OECD26		1.7	OECD26		1.4

Source: Eurostat, Ameco, WIFO calculations.

As a limiting factor, it must be emphasised that the poor economic performance in the years after 2003 was exacerbated by budget consolidation goals that were unusually ambitious for a downward phase of the economy, while the combination of a booming global economy and higher export orientation in 2006 and 2007 enabled Austria to return to high growth rates of 3.4% and 3.1% respectively, which were significantly higher than those of the EU15 (2.8% and 2.7%, respectively (Figure 37). With the collapse of the economy in 2008, growth rates declined generally and the outlook for 2009 is particularly poor. Nevertheless, Figure 37 shows that in times of weak economic conditions, Austria generally performs better than the EU15, which makes a positive growth advantage probable for the coming years as well.

Figure 37: Real Gross Domestic Product. Change over previous year expressed in % (three-year averages)



Source: Eurostat, Ameco.

Structural change

Most of the findings on competitiveness and specialisation consider only manufacturing. In recent times, however, this has been responsible for only approximately 20% of overall value added and 17% of total employment in Austria. In this section, therefore, we will expand the traditional structural analysis by including services. The tools for doing so are two new taxonomies for training and innovation intensity by sector, which are briefly summarised in the box below. The appendix contains a complete listing.

The two panels in Figure 38 show for the countries of the European Union as well as the USA and Japan the shared growth of per capita GDP at purchasing parity as well as a change in share of value added for the two sector types most often associated with the increasing significance of the "knowledge society." We find a significant positive increase in share of value added over time (Panel A) only in the group of the training-intensive industry sectors. While their share is constantly growing in almost all countries, the picture for the group of innovation-intensive industry sectors is not uniform. We observe a pronounced structural transformation in favour of these industry sectors in only a very few countries such as Finland, Sweden, or Hungary, but relatively minor changes in most other countries (Panel B).[69]

69 For the group of high-tech sectors as defined by the OECD, the share of value added is actually regressive in most countries of the EU, but also in the USA. These cannot be depicted very clearly in the industry sector breakdown of the EU KLEMS database, however.

Box 1: The new WIFO industry sector taxonomies (Peneder 2007, 2008a)

Industry sector taxonomies are instruments for structural analysis designed to observe growth not merely as a purely quantitative phenomenon, but also incorporating qualitative changes. It is used for the selective representation of heterogeneity, with the intention of filtering out from the otherwise impenetrable variety of individual observations those aspects and tendencies that are especially significant with regard to the subject matter being studied. Both of the new WIFO taxonomies are aimed at different dimensions of knowledge intensity in production. They include a number of improvements over the previously available classifications:

- *In both taxonomies, manufacturing and services are classified together, based upon standardised criteria. This takes into account the increasing lack of clarity in demarcation between manufacturing and services sectors, while also more clearly reflecting the existing differences in training and innovation intensity among the new categories of classifications.*
- *Both classifications are micro-founded. A taxonomy for training intensity is based upon individual data from the European Labour Force Surveys, while those for innovation intensity are based upon corporate data from the Community Innovation Survey (CIS3). In both cases, the calculation is based upon the distribution of different individual/corporate types within an industry sector (instead of simple industry averages, e.g. R&D intensity). This procedure takes into account the heterogeneity in the training level of the employees and in the innovation behaviour of individual companies, and based upon this, identifies differences in the distribution and the sector level.*[70]
- *Both classifications consider data for Austria. The classification for training intensity is also based upon comparable data for the USA, Great Britain, France, and Germany. The taxonomy for innovation intensity was identified with the help of the CIS microdata of 22 European countries (including Austria) made available in the Eurostat Data Protection room.*
- *Both of the taxonomies were determined with the help of statistical cluster methods and tested for their robustness with regard to variation between countries as part of a systematic validation. Data, methods, and results of the validation are thoroughly documented for both classifications:*

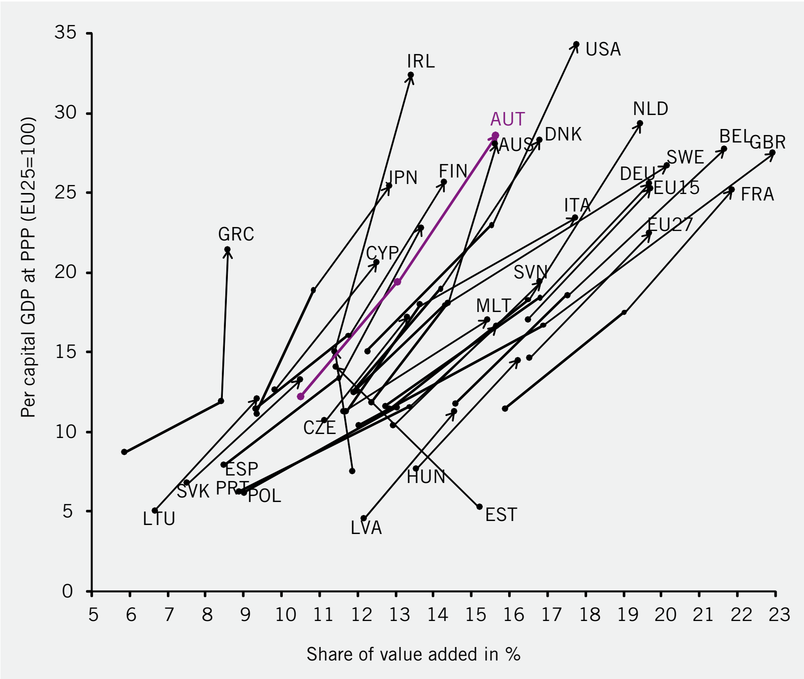
70 The observation of extremely innovative companies in sectors with low average innovation intensity, and conversely, less innovative companies in so-called high-tech sectors, is therefore not a contradiction, but rather a self-evident component of the distribution underlying the taxonomies.

In contrast to international trends, Austria shows a positive structural transformation in both dimensions in the direction of more knowledge-intensive manufacturing sectors. The share of value added in sectors with particularly high training intensity increased from 10.5% (1985) to 13.1% (1995) and 15.6% (2005); the share in the sectors with particularly high innovation intensity grew from 7.3% (1985) to 8.0% (1995) and 9.2% in 2005. Despite the large changes in the group of sectors with higher training intensity, the structural gap relative to the EU15 continued to grow from 3.6% (1985) to 4.1% (2005). By contrast, it decreased from 4% (1985) to 1.8% for the sectors with high innovation intensity.

Fig. 39 measures the structural transformation not as an absolute percentage difference in share of value added, but instead relative to the starting level (i.e. as a quotient of the share of value added in 1995), and the different sector types are sorted on this basis. This produces a surprisingly clear picture. The sectors that have profited most from the structural transformation are those with high training intensity and those with high innovation intensity. In the first group, growth in Austria was as high as that in the EU15, and in the second group, it was even higher. The structural analysis thus shows Austria to be in a catch-up process with significant changes in favour of knowledge-intensive manufacturing sectors.

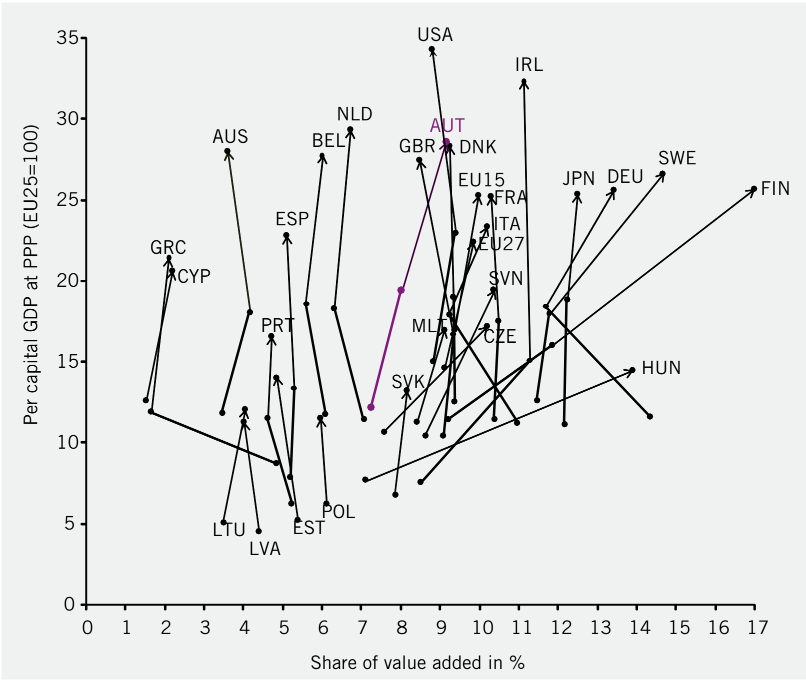
Figure 38: Growth and Structural Transformation (1985, 1995, 2005)

A. Industry sectors with high training intensity



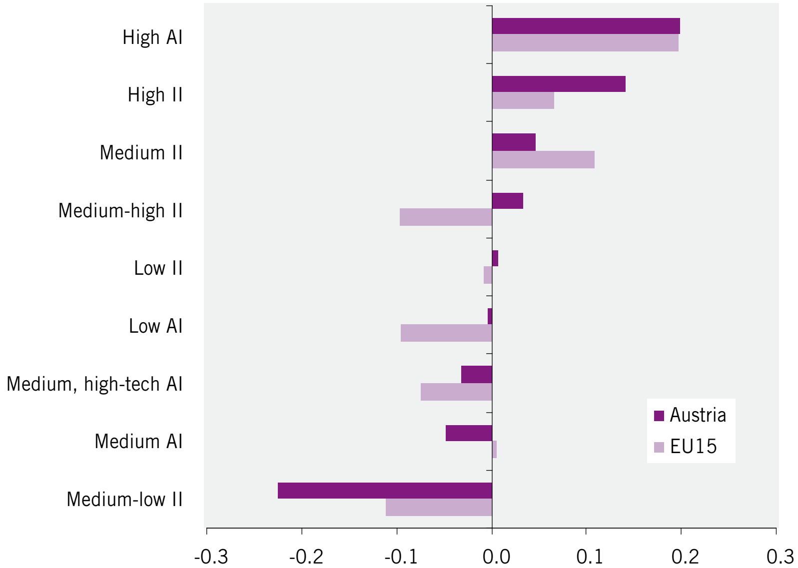
Note: All arrows begin in 1985 (1990) and end in 2005.
Source: Eurostat, Ameco; EU KLEMS; WIFO calculations.

B. Industry sectors with high innovation intensity



Note: All arrows begin in 1985 (1990) and end in 2005.
Source: Eurostat, Ameco; EU KLEMS; WIFO calculations.

Figure 39: Relative change in share of value-added 1995/2005 in %



Legend: AI: Training intensity; II: Innovation intensity.
Source: Eurostat, Ameco; EU KLEMS; WIFO calculations.

4.1.2 Summary

The Austrian *structure-performance paradox* refers to the contradiction that was particularly apparent in the 1990s between high per capita income on the one hand and the widespread tendency to remain in traditional and less technology-intensive economic sectors on the other. The current findings show that although this contradiction still exists, it is approaching a solution from both sides. In the years following 2000, the traditional growth advantage was largely lost, thus marking the final end of the economic catch-up phase, and the traditional structural gap was reduced by the accelerated transformation in industry specialisation. But this finding does not apply equally for both forms of knowledge intensity. While the deficit in the innovation-intensive sectors has declined, the group of training-intensive sectors continues to be significantly behind the EU15, despite high growth rates. In addition to the current efforts in innovation policy, future economic policy will therefore have to direct its attention more toward quality and efficiency in training.

The combination of a booming global economy and a greater export orientation in 2006 and 2007 resulted in a return to high overall economic growth rates, followed by the current economic downturn. Following the long-term pattern and strengthened by the economic stimulus packages, one can once again expect growth rates higher than the EU average in the coming years. No successful turnaround in the trend can be discerned from this as yet, however. If this trend should be confirmed throughout a complete economic cycle we will be faced with the question of whether the return of a positive growth advantage can be considered an indicator of the success of structural reforms and thus of intensified progress *along with* the cutting-edge of technology instead of the traditional catch-up movement *up to* this cutting-edge.

4.2 "Open Innovation" in Austria

Companies are faced with three primary challenges in the innovation process (Pavitt 2005, p. 88): creating new knowledge, creating functional products based upon this knowledge, and ultimately adapting the products to meet changing market needs. This process requires that internal and external knowledge bases be combined through cooperative efforts or other forms of learning from external sources. It is in this area that various studies have ascertained a weakness in the Austrian innovation system. The frequently cited finding is that Austrian companies collaborate too rarely, and above all that scientists and businesspeople fail to sufficiently learn from each other.

This article empirically investigates whether the situation has changed somewhat over the last decade. Essentially there are two indications that allow us to assume that learning from external sources actually has a higher priority in the innovation strategies of Austrian companies today:

The first is an increase in the trend towards cooperation since the middle of the 1990s, a central goal of Austrian research and technology policy (cf. Austrian Research and Technology Report 2006, p. 40 and 41). Cooperative efforts for the purpose of innovation ("innovation cooperations") are supported by a number of instruments, such as the previous centre of excellence programmes Kplus and K-ind/-net, now known as COMET, as well as AplusB, FH-plus, bridge, and many others.

Secondly, various authors argue that companies should increasingly open up their innovation processes in order to use ideas for new technologies and products from different external sources. Most recently, Henry Chesbrough (2003) coined the phrase "Open Innovation" for this strategy. This concept has since been the subject of intensive discussion in innovation research, even though several authors had also previously pointed to the significance of external sources (e.g. Rosenberg 1982, Lundvall 1988).

Putting aside the question of what is in fact fundamentally new about Open Innovation, such phrases mobilise internal company development processes and provoke debates on innovation policy. This section will examine whether there are actually indications of increased openness in innovation processes in the Austrian economy. In doing so, we will first address the underlying ideas of the Open Innovation paradigm and similar approaches. We will then assess whether Austrian companies are actually resorting more to external knowledge and information in the innovation process. This analysis is based upon data from the Community Innovation Survey (CIS) acquired through four rounds of surveys covering a period of 12 years.

4.2.1 The Concept of Open Innovation

Innovation is a process in which different, internally generated knowledge bases are combined with external knowledge: The results are new, marketable products and new or improved production processes. Chesbrough (2003) trenchantly consolidated this development trend into the concept of "Open Innovation." He defines it as follows: *"Open Innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology"* (Chesbrough 2003, xxiv). This author uses examples from several multinational companies to present the empirical findings for this development trend. Even shortly after the publication of his work, "Open Innovation," large companies around the world explicitly adopted this strategy. For example, at an OECD conference in Ferrara, Italy in fall 2005, IBM and Hitachi presented their R&D strategies based upon the Open Innovation paradigm (OECD 2005).

The idea of open, networked innovation is not new, however: Rosenberg (1982), von Hippel (1986), and Lundvall (1988) all pointed out the significance of integrating and cooperating with customers, suppliers, universities, and competitors for successful R&D and innovation activities. In his model, however, Chesbrough (2003) emphasises the interplay between a company's internal development and the internal use of external knowledge, between in-house commercialisation and alternative exploitation strategies. In the age of Open Innovation, he believes that companies are compelled to access external resources as soon as possible, and to press ahead with their R&D efforts in constant interaction with the environment. This expanded search strategy can give new life to development efforts. This is because such search activities reach beyond the relatively narrow circle of the company's own staff to access the widest possible variety of external actors, all of whom contribute their ideas and expertise.

Chesbrough contrasts the Open Innovation model with the "Closed Innovation" model. He defines the latter as the process that continues to dominate the field, namely the development of new products and processes within a relatively isolated R&D department. The Closed Innovation model follows the sequential introduction of business innovation, in which companies generate technical knowledge in their R&D departments, and then commercialise this knowledge in the form of improved production processes and new products on the market. The ability to maintain a focus on the market and to absorb information on customer needs is comparatively weak in this model. The Open Innovation paradigm is quite different: The postulate here is that companies generate profitable ideas internally or acquire them externally, and then commercialise the products built upon these ideas either themselves, in cooperative efforts with third parties, or through licensing in the marketplace.

In the Open Innovation model, the customer is an important source of ideas or cooperation partners. Von Hippel (1986), for example, introduced the concept of the "lead user," and points out the special relevance of a small group of customers who anticipate market needs and supply important impetus for innovations. Lundvall (1988) presented a comprehensive interpretation for analysing the relationship between producers and customers in the innovation process. This served as a starting point for him to develop the concept of national innovation systems. Researchers have also pointed out that new information or production technologies in particular make it possible to integrate customers into the innovation process (Rothwell 1994). With the help of interactive software tools, customers can be intensively incorporated into the innovation process or given the opportunity to create new products and product variations themselves. Thus the customers themselves increasingly become innovators, and the term "user innovation" was coined for this circumstance (von Hippel 2005).

4.2.2 Empirical findings on Open Innovation

Despite the widespread use of Open Innovation and similar concepts, there is no unanimous agreement in the literature as to the types of companies, industry sectors, and technologies for which these concepts offer special potential, and the general conditions that would enable the implementation of such strategies. Is Open Innovation a universal paradigm as postulated by Chesbrough (2003)? Or is the open, networked development and implementation of innovations restricted to certain industry sectors, types of companies, or products?

Even though several large international companies have subscribed to Open Innovation strategies and adopted Open Innovation as a slogan, the empirical literature on this topic is still rather sparse. The most thoroughly studied aspect here is interaction with customers, and a number of empirical studies have examined the different roles played by customers in the innovation process within different industries. Lüthje and Herstatt (2004) state that in the sporting goods and software segments, approximately 10 to 20% of users develop their own solutions. In some industries, the majority of new product ideas actually come from users. Examples include the medical technology sector and the development of tools in the semiconductor industry. Studies conducted in companies who produce computer-assisted planning and manufacturing tools (CAD/CAM) have likewise shown that users frequently put process innovations into practice. Nevertheless, the significance of customers as idea suppliers or innovators has also been noted in low-tech industries such as construction (Slaughter 1993). The significance of customers and users naturally depends upon certain specific characteristics of the industry sectors themselves. For example, universities are the most important source of innovation in the field of biotechnology (Zucker et al. 1998), while users dominate in the development of scientific measurement instruments (Riggs and von Hippel 1996).

The study by von Herstadt et al. (2008) examined the openness of the innovation process and the dissemination of Open Innovation strategies in Austria, Belgium, Denmark, and Norway. The authors come to the conclusion that when compared on an international basis, both the breadth (number of partners) as well as the intensity of innovation cooperations between Austrian companies are relatively low. In addition, customers are valued less as a source for innovation-relevant knowledge in Austria than in other countries. Both results are important because the authors proceed to show that Open Innovation strategies have a measurable influence on a company's success. Companies that use these strategies have a greater probability of developing products that are new to the market and achieving a higher share of revenue from their innovations. Laursen and Salter (2006) also find that using customers as a source for innovation has a positive effect on innovation output. The authors find no connection with the level of innovation, however: customers are equally significant for both radical and incremental innovations.

Moreover, in the study by Leitner (2003) on the 50 best industrial innovations between 1975 and 2000, Austria provides indications of the significance of different external sources in the innovation process. The study shows that customers, suppliers, and competitors were important suppliers of ideas, and that overall some 30% of the studied innovations with a high degree of innovation were initiated externally. Innovative pilot customers, with whom companies worked together to develop and test initial prototypes and experimental systems, played a decisive role in approximately a dozen of the success stories.

4.2.3 Open Innovation in Austria: Results of the Community Innovation Survey (CIS)

The studies described above show that Open Innovation is extremely important in certain sectors. Nevertheless, the results do not indicate whether this involves a general trend or a special situation for a few selected industry sectors. In the following, therefore, we will refer back to the results of a representative survey, the Community Innovation Survey (CIS)[71]. The CIS surveys the innovation behaviour of companies in the European Union, and is organised jointly by EUROSTAT and the national statistical offices. Results from the CIS for Austria are available for four different time periods: 1994–1996 (CIS2), 1998–2000 (CIS3), 2002–2004 (CIS4), and 2004–2006 (CIS2006). The individual surveys are based upon common definitions, and can therefore be compared with one another in principle. CIS is a random sample survey: the results for individual industry sectors and for companies with different numbers of employees are extrapolated based upon their share of the overall economy.

Firstly, the questionnaire itself underwent changes between the individual rounds. Various questions were modified or were not included in the questionnaire in individual years. Secondly, the sample changed over time. Thus, for example, CIS2 (1994/96) had a significantly stronger focus on material goods production than did later surveys, which was one reason for the strong

71 Our thanks to Andreas Schiefer (Statistics Austria) and Gerhard Schwarz (WIFO), who provided us with the data for the article.

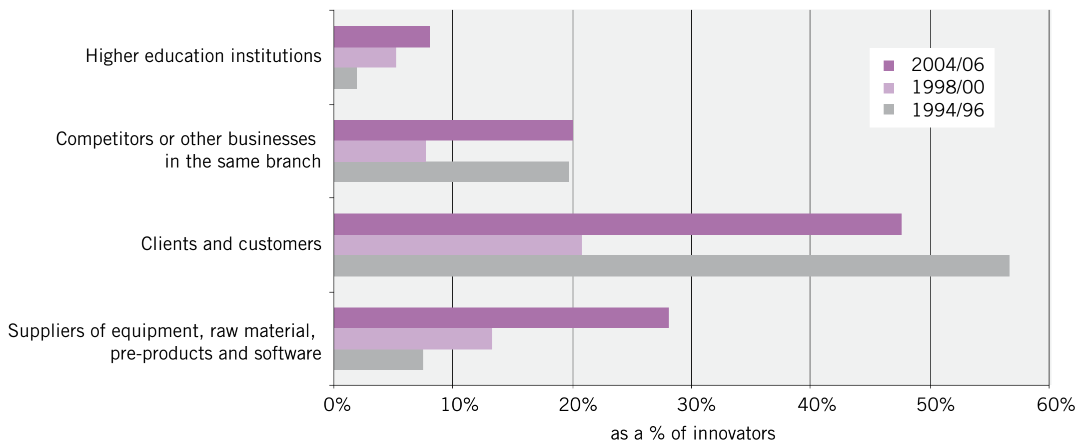
decline in the innovator ratio between CIS2 and CIS3 (1998/00) (Falk and Leo 2004, p. 12). Thirdly, when interpreting the results one must not forget that more than 10 years passed between the first and last survey. During this time, the awareness of innovation increased due to the presence of this topic in public discussion, and this could have led to a change in answer behaviour. There are also large differences between the individual surveys in terms of the economic environment: The average growth rate in real GDP was 3.5% for 1998/00, whereas the comparable value for 2002/04 is only 1.1%. Companies also change their innovation plans within an economic cycle as future prospects change.

The significance of external information sources in the innovation process

The CIS includes two questions on learning from external sources. Innovative companies are asked how they assess the significance of various internal and external information sources. These sources could include conversations with customers, observation of competitors, or published research results from universities. Such information transfers are usually informal and do not necessarily require the sender's consent

Responses to the question of external information sources are available for the time periods of 1994/96, 1998/00, and 2004/06. The question on information sources did not appear in the questionnaire for 2002/04. Another limitation that must be noted is that not all information sources were discussed in all periods. The prescribed response categories for the period 1994/06 also deviate from the questionnaire that was used in the following surveys[72]. Despite these changes, the data clearly show that the significance of external information for the innovation activities of Austrian companies has increased over time (Figure 40).

Figure 40: Percentage of innovators who categorise the significance of different information sources as "large"



Note: 1994/06: Percentage of companies who categorise a specific information source as "very important".

Source: WIFO, Statistics Austria

72 The questionnaire for the period 1994/06 contains response categories that differ from those in the questionnaires for the later periods. The categories for 1994/06 are: not used – less important – important – very important. The following surveys use the scale: no significance – minor significance – moderate significance – large significance. All of the surveys use a four-level scale, however, and thus comparison is possible. The higher education sector also includes HTLs.

The frequency with which a specific source was assessed as important increased consistently for the period 2004/06 in comparison to 1998/00 and 1994/06. In the comparison of individual sources, there is a clear ranking that is independent of industry sector or company size:

Principals or customers are the most important external information sources, and hold first place. Nevertheless, extreme fluctuations have been observed here over time (particularly from 1994/96 to 1998/00). Regardless of industry sector, customers are the most important information source both in R&D-intensive industries such as the electrical and electronics industry, as well as consumer goods producers or various service industries. The uniformity of this result is amazing when one considers that customer relationships, as well as the concentration and market power of customers, differs widely between industry sectors. Machine tool manufacturers typically have a relatively small group of customers, and the individual products they manufacture are often one-of-a-kind. Food producers, on the other hand, supply standardised products to a large number of consumers, with whom the companies communicate only indirectly via retail or market research. Various industry sectors, such as the automotive industry, can require their suppliers to comply with certain quality standards. Customers in other industries do not have this power.

The second most important information sources are the suppliers of equipment, raw materials, and primary products. As expected, suppliers above all in the capital-intensive industry sectors with lower R&D intensity, such as the food industry, textile industry, wood processing, and paper and cardboard production are valued as an important information sources. Pavitt (1984) and other authors have therefore accurately characterised innovation activities in these industry sectors as "supplier dominated industries". The significance of suppliers as information sources reaches each of the customers here. Although today even service industries such as banking or telecommunications can be described as "supplier dominated" because of their extensive investments in information and communication technologies, there are no suppliers in the service industries with a significance similar to that of suppliers in material goods production. There are no differences between large, medium-size, and small companies in their assessment of suppliers' significance as a source for innovation.

The third most important source is competitors. Functions of new products and production processes are often difficult to protect against imitation (Cohen et al. 2000). It is particularly difficult to protect innovations against imitation in the services sector. As a result, competitors often become (even involuntarily) important information sources in the innovation process. Approximately one in five innovative companies in Austria rates competitors as highly significant sources of information. In contrast to suppliers, competitors tend to be more highly rated as a source for innovation-relevant information in the medium and high-technology industries such as mechanical engineering or the electronics industry than in industry sectors with lower R&D intensity. Their rating is likewise higher in the services sector, above all in banks and retail.

Over time, universities, universities of applied science, and other non-profit research institutions are also increasingly assessed as significant. On the whole, however, the significance of these academic sources remains significantly lower than those of market-related sources. As expected, the assessment of significance is above average in medium and high-technology sectors, and below average in low-technology sectors and the services sector. The rating of universities as an information source increases as a company's size increases. The explanation for this is simple: Certain capacities in terms of research staff and permanent R&D activities are necessary for the observation, recording, and utilisation of research results produced by universities. These resources tend to be available more frequently in large companies. Overall, however, the assessment of universities and other research institutions remains significantly lower than that of customers or suppliers, even for large companies.

Innovation cooperations in the Austrian corporate sector

A second indicator for learning from external sources, in addition to the assessment of different information sources, is the extent to which companies enter into innovation cooperations. In contrast to information sources, cooperations are a significantly more formal instrument of information and knowledge exchange (Hagedoorn 2002; Caloghirou et al. 2003). They are entered into through formal agreements, and therefore have a higher level of commitment. Cooperations not only permit companies to exchange knowledge and information, they also make it possible to achieve economies of scale in the innovation process, to share development costs, and thus to reduce risk and uncertainty. Cooperation agreements also frequently regulate the utilisation of the results achieved through the collaboration. It is typically assumed that a multilateral exchange occurs in cooperations. Issuing orders to third parties without active collaboration is therefore not considered to be cooperation.

Despite enormous attention from policymakers, the trend towards cooperation has changed very little over a long period of time (cf. Table 39). The percentage of cooperating companies consistently accounts for one-fifth of innovators between 1994/96 and 2002/04. The lowest value was in the period of 2002/04; weak economic growth and uncertain expectations for the future during these years may have reduced the willingness to cooperate. Only companies with more than 250 employees showed a constant increase in innovation cooperations throughout the entire time period. In fact, it was primarily the large companies who took advantage of measures such as Kplus, which were designed to promote innovation cooperations (Hutschenreiter 2004, p. 22).

Table 39: Companies with innovation cooperations as a percentage of all innovators

	1994/96	1998/00	2002/04	2004/06
Total	18.7%	21.2%	17.4%	38.9%
Manufacturing	19.7%	18.5%	18.8%	37.9%
Services	17.2%	23.3%	15.8%	39.5%
10 – 49 employees	14.6%	17.9%	13.7%	34.4%
50 – 249 employees	25.4%	21.6%	19.7%	42.7%
250 and more employees	41.0%	38.9%	49.1%	66.6%

Source: WIFO, Statistics Austria

A significant increase in the trend towards cooperations can be observed only in the time period of 2004/06. Granted, one cannot definitively discount the possibility that this increase is due to changes in the questionnaire[73]. According to the last available figures from the 2004/06 survey, approximately 40% of Austrian innovators enter into innovation cooperations. The trend towards cooperation is approximately the same in the services sector and in the material goods production sector. It increases commensurate with company size, which reflects the relatively greater capacities of large companies for seeking partners and monitoring cooperations, as well as the higher absorptive capacities of larger companies.

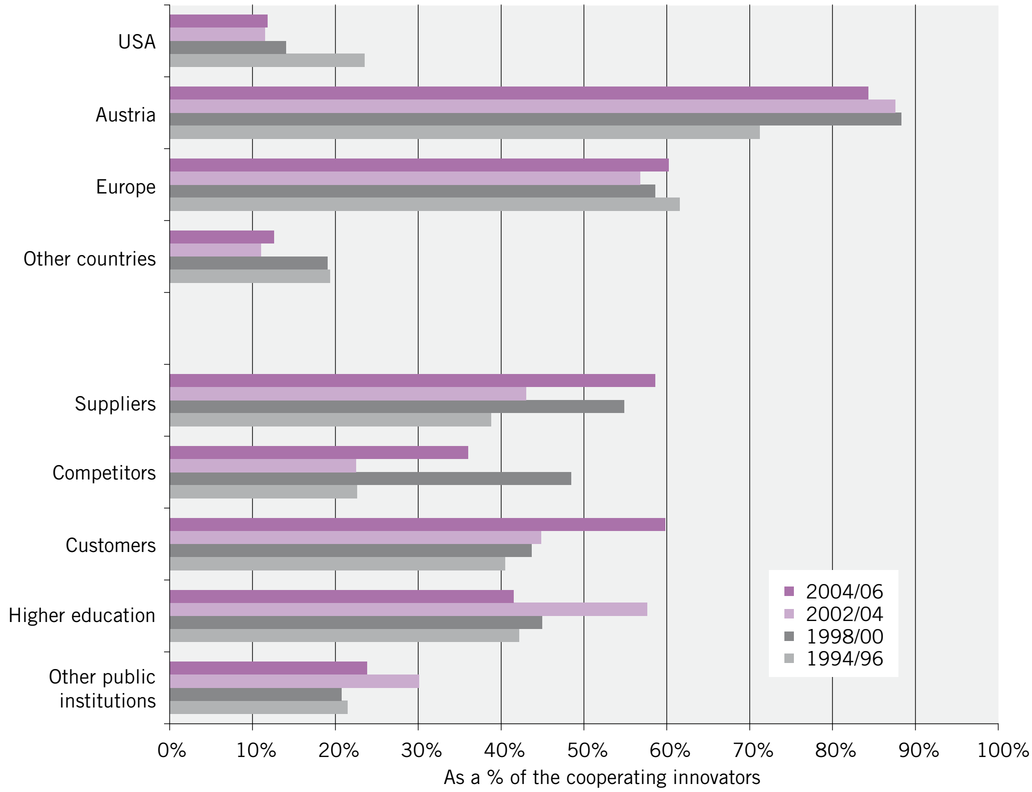
Austrian companies have become increasingly active internationally over the last 15 years. At the same time, subsidiaries of foreign companies have significantly expanded their innovation activities in Austria. Both developments should have also strengthened relationships between the Austrian corporate sector and other countries. The data show no such effect, however. The percentage of companies with cooperation partners outside of Austria has remained almost constant over time (the percentage of cooperating companies with partners in Europe increased from 58.6% (1998/00) to 60.2% (2004/06). As is the case for cooperations with European partners, the percentage of cooperating companies with partners in the USA or other countries outside of Europe has also stagnated. No significant differences can be found here between material goods production and the services sector. As expected, international cooperations increase commensurate with increases in company size.

A significant assumption in the literature on Open Innovation is the idea that companies are increasingly using different types of partners as knowledge sources in order to solve various problems. Whereas earlier cooperation was exclusively with customers, companies today enter into cooperative efforts with universities for one specific problem or collaboration with competitors for another. The spread of Open Innovation strategies in the economy should also lead to an increase in cooperations between companies and different types of partners.

The results of the CIS show that over time, Austrian companies have actually expanded their circle of cooperation partners (Figure 41). One item particularly worthy of note with regard to an open search process is the greater number of companies who cooperate with customers and suppliers. Whereas in 1998/00 only 54.8% of companies cooperated with suppliers and 43.5% cooperated with customers, as of 2004/06, 60% of all cooperating companies worked together with both of these partner groups. This shows clear parallels with the assessment of customers and suppliers as information sources in the innovation process. The rating of these two groups has likewise clearly increased over time. Vertical cooperations with customers or suppliers are the most common form of collaboration.

73 The CIS4 questionnaire defines innovation cooperation as „active participation of your company together with other companies or non-commercial institutions in joint research projects or other innovation activities," while CIF 2006 speaks of "active participation of your company together with other companies or non-commercial institutions in joint innovation activities." It is possible that respondents to the CIS4 reported only R&D cooperations.

Figure 41: Percentage of various types of cooperation partners as well as different regions of innovation cooperations in Austria



Source: WIFO, Statistics Austria

By contrast, the percentage of cooperating companies who collaborate with universities, universities of applied science, or other research institutions is stagnating. In 1994/96, 42 % of cooperating companies stated that they were collaborating with a university, and in 2004/06 the number was 41.5 %. A similar trend can be observed in cooperations with other research institutions. This is surprising when one considers that many of the pertinent subsidy programmes focus on stimulating cooperation between academia and business, and that the rating of universities as information sources has increased.

This decline should be carefully interpreted, however, taking into account the fact that this percentage relates to all companies with innovation cooperations. If the general trend towards cooperation increases, then it is possible that despite a declining percentage, the *absolute* number of companies cooperating with higher education may have increased. In this case, the decline occurs because other forms of cooperation have grown more strongly. For this reason, the findings should be reconciled with other data, e.g. joint patents or joint publications between companies and universities.

In contrast to the geographic distribution, the distribution by partner types shows substantial differences between companies involved in material goods production and those who are service providers. The latter cooperate much less frequently with higher education institutions or research organisations, but more frequently with competitors. Service innovations are less technology-based and more frequently consist of non-technical organisational or marketing innovations (cf. Miles 2005). A greater number of innovations by service companies are customer-specific developments, a fact that is not reflected in the data. This may be due to the composition of the sample, in which certain consulting services, retail, and tourism are not included and which therefore contains predominantly information- and product-centred services.

4.2.4 Summary

This article examines the question of whether the innovation strategies of Austrian companies have developed in the last decade in the direction of more external cooperation and more learning from external sources. Various approaches in the innovation literature, such as Open Innovation, presume that companies are increasingly opening up their innovation processes to external stimuli in order to increase the efficiency and effectiveness of their investments in R&D and innovation.

A comparison of results from the Community Innovation Survey over 12 years shows that Austrian companies are in fact increasingly drawing on external knowledge and external information in the innovation process. The data show an increasing appreciation of different external innovation sources, with the significance of customers, suppliers, and competitors growing in greater proportion compared to other sources, such as universities and research institutions. The percentage of cooperating innovators remained unchanged for a long time, and has been clearly increasing only since 2002/04. Within the group of cooperating companies, we were able to observe an increase primarily in cooperations with customers and principals as well as suppliers. By contrast, the percentage of cooperating companies that collaborate with universities and other research institutions is stagnating and/or declining.

Austrian companies are also increasing the breadth of their search processes: The increase in cooperations with individual partners is not impairing collaboration with other partners, and thus the companies' partner portfolios are becoming broader overall. This likewise applies for the rating of various information sources. Nevertheless, this expansion is restricted to the type of partner; the percentage of companies with foreign partners has barely changed over the entire time period.

The change in orientation towards more Open Innovation processes is a welcome development from the perspective of policy, because companies who pursue these strategies have a higher success rate in product developments, develop more new products for the market, and have a measurably positive influence on their profitability (von Hippel 2005, Laursen and Salter 2006). Open Innovation, however, also creates new policy challenges (Leitner 2009). The concept of Open Innovation challenges the role of intellectual property rights as an incentive for innovation activities. Even though the patent system has been the subject of repeated critical discussion since its inception, there is ultimately a consensus that its advantages offset the disadvantages. In more and more areas, however, intellectual property rights act as a barrier to innovation, and the open source movement is itself a reaction to the monopolies created by patents (Henkel and von Hippel 2005). The current research agenda in this area is very broad. The goal is to better understand the areas in which patents makes sense and the areas in which they have negative effects on economic welfare.

4.3 The impact of innovations on work productivity

Since the mid-1950s, technological change has been the subject of economic theory and has been incorporated in neoclassical growth models (Solow 1957; Arrow 1962; Romer 1990; Grossman and Helpman 1991). This has included the forecast of a relationship between R&D activities and productivity growth (Romer 1990). In addition to capital and labour, the R&D capital stock was included in production functions as a variable for the fund of knowledge for the empirical review. Of benefit for the analysis was the fact that a growing amount of data has been available from corporate surveys on innovation behaviour (in Europe, the Community Innovation Survey, CIS) since the end of the 1990s. Numerous studies have shown that innovation output has a significant positive influence on business success – irrespective of the indicators used to measure it. Nonetheless, significant differences are observed between indicators and between countries[74].

A recently completed project under the auspices of the OECD (see OECD 2008d, Berger 2008) has for the first time presented comparable results simultaneously for Austria and 17 additional European and non-European countries[75] using microdata from innovation surveys and based on uniform econometric models[76].

The following questions are answered:

1. What company characteristics influence the decision of a company to carry out innovation activities? And what features have an impact on the level of the innovation input (innovation expenses per employee)?
2. What correlation exists between innovation input and innovation output (measured as sales of innovative products)?
3. What relationship exists between innovation output and work productivity (measured as sales per employee)?

Influencing factors

With regard to the first question, the results are clear: In Austria, the probability of a company's being innovative rises with company size; other factors include activity in foreign markets and membership in a company group. This result was to be expected, as internationally active companies are subject to greater competitive pressure and larger companies have more resources for innovations. On the

74 See Crepon/ Duguet/ Mairesse 1998, Criscuolo/Haskel, 2002; Hagen et al. 2007, Hall/Mairesse 2006, Janz et al. 2004, Klomp/van Leeuwen 2001, Lööf/Heshmati 2002, 2006, Lööf, et al. 2003, Mohnen et al. 2006, Mohnen/ Therrien 2003, Raymond et al. 2006, van Leeuwen/Klomp 2006, Verspagen 2005

75 Australia, Austria, Belgium, Brazil, Canada, Denmark, Finland, France, Germany, Italy, South Korea, Luxembourg, Netherlands, New Zealand, Norway, Sweden, Switzerland, United Kingdom.

76 based on Crepon / Duguet / Mairess 1998

other hand, it is surprising how clearly this relationship can be detected in all countries.

Moreover, for Austria it is clear that the level of innovation expenditures is related to the fact that companies are active in foreign markets. In addition, government innovation promotion and innovation cooperation agreements play a positive role.

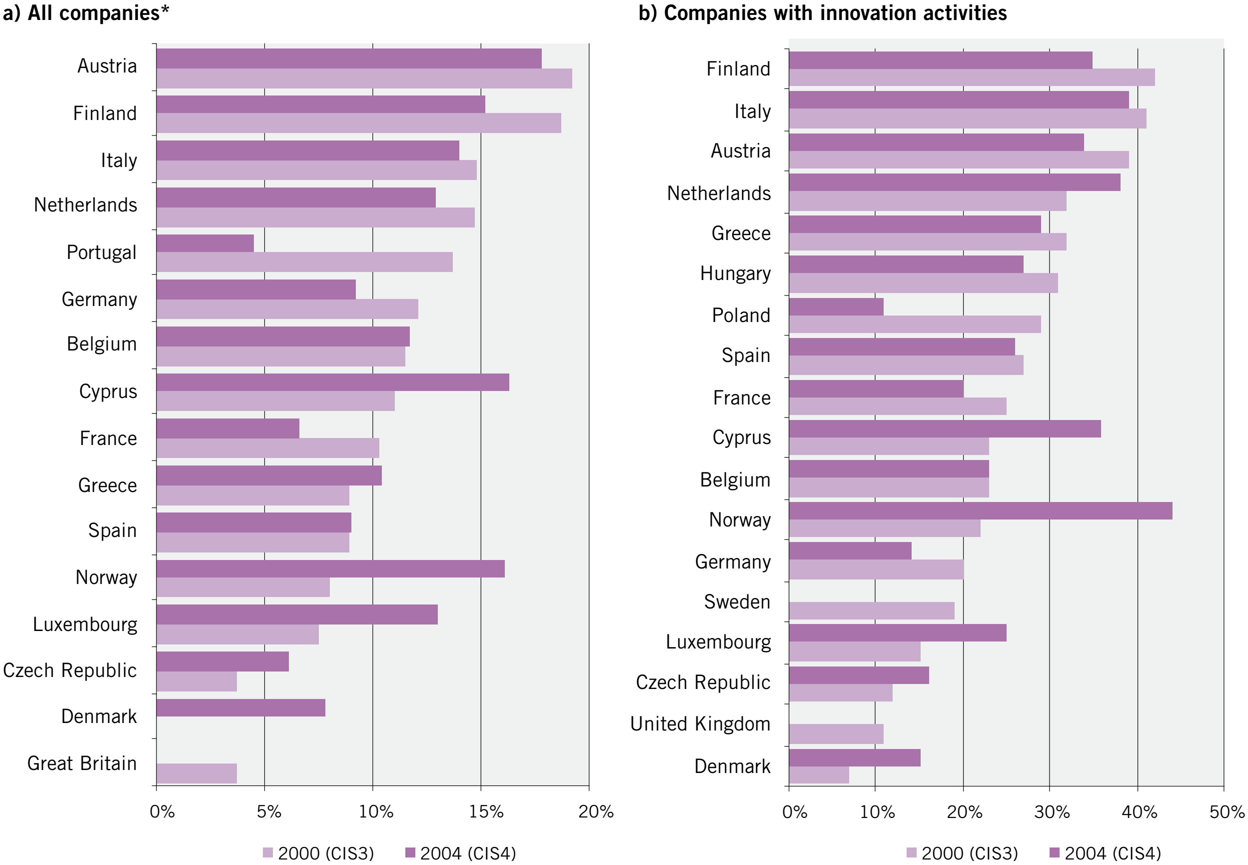
The role of public funding

In otherwise similar companies, those receiving public innovation promotion have 75% higher innovation expenditures and 41% higher participation in innovation cooperation agreements. However, it must be pointed out that the analysis only takes into account the fact of funding and not its amount; moreover, funding in Austria is often linked to the existence of cooperative agreements. These relationships can also be found in the majority of comparison countries, although in an international comparison, the high effect of public funding is particularly noticeable in Austria.

This result is extremely interesting with regard to technology policy. The innovation expenditures of a subsidised company are approximately three fourths higher than for a company which is otherwise identical but does not receive funding. The results coincide with previous studies of Austrian CIS3 data, according to which national innovation promotion leads to both increase in R&D intensity and sales of innovative products, while EU promotion has no significant impact (Mohnen and Garcia 2004). An analysis of the input additionality of corporate R&D promotion by the Austrian Research Promotion Society (FFG) points to a significant and clear additionality (Streicher 2007). However, as the present analysis contains no information concerning the amount of the funding and its use, little meaningful information can be provided concerning the additionality effect of the funding. Subsidised companies exhibit no complete spill-over effect (in that case, the innovation expenditures of such companies would not differ from those not receiving funding); however, the lack of data makes it impossible to investigate the extent to which own expenditures are substituted for by the subsidy.

The high effect in the international comparison can be partly explained by the high number of subsidised companies in Austria, which are among the highest in Europe (see *Figure 42: Proportion of subsidised companies among a) all companies and b) companies with innovation activities in selected European countries.*). However, interpretation of the international comparison should be qualified by the fact that the analysis in Austria is based on CIS3 data, while the other European countries use CIS4 data, which records indirect promotion in addition to direct promotion. This significantly limits comparability (Arundel et al. 2008).

Figure 42: Proportion of subsidised companies among a) all companies and b) companies with innovation activities in selected European countries



Source: Eurostat 2008, *own calculations

Innovation input and output

With regard to the second question, it is seen that companies with high innovation expenditures also generate higher sales of innovative products. There is also a positive correlation between the percentage of higher education graduates in the workforce and the sales share of new products. On the other hand, the size of a company, its membership in a company group, newly introduced process innovations and innovation cooperation agreements with customers or public research institutions do not have an impact on the sales of new products. Again the relationships found for Austria also apply for the most part to other countries – a very contradictory situation exists internationally only with regard to the influence of company size.

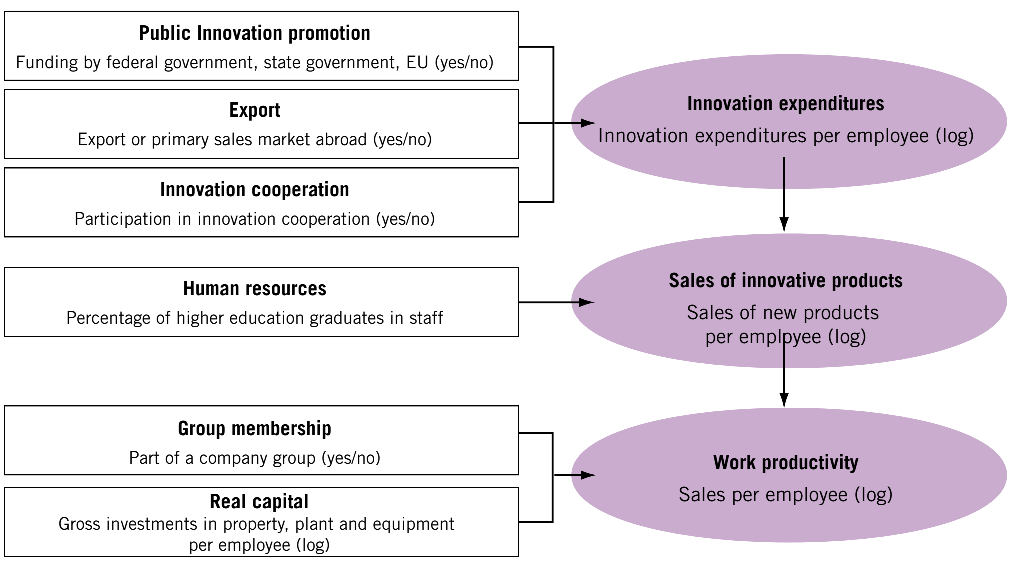
The impact on work productivity

With regard to the third and crucial question of the relationship between innovation and work productivity, it is seen that sales of innovative products are positively correlated with sales per employee. This also applies in nearly all countries in the study. Of course, however, not only product innovations have a positive impact:

membership in a company group and the capital stock (measured as gross investments in property, plant and equipment per employee) also have a statistically significant impact on productivity. On the other hand, large companies and those with process innovations astoundingly do not exhibit higher productivity – a result frequently seen in the international comparison. However, it is primarily the absence of a relationship with process innovations that does not fulfil expectations. The introduction of new or improved processes (e.g. manufacturing processes) should increase work productivity. It is difficult to explain why this effect cannot be found in the data – across all countries. Possible causes are that only a suboptimal definition of work productivity (sales per employee) is possible based on the CIS data, or that process innovations are frequently implemented in economically difficult times, i.e. those with low sales, which cannot be identified using cross-sectional data – additional analyses appear to be necessary with regard to this.

In summary, Figure 43: Relationship between innovations and work productivity illustrates the relationships found for Austria in the study. The level of innovation expenditures is positively correlated with the receipt of public innovation promotion, the existence of innovation cooperation agreements and export activities. The higher the innovation expenditures and the greater the proportion of higher education graduates in the staff[77], the higher are sales of innovative products. This also points to a positive correlation with work productivity, on which membership in a company group and investments in property, plant and equipment[78] also have an increasing impact.

Figure 43: Relationship between innovations and work productivity



Graphic: Joanneum Research

77 The base model of the OECD does not provide for consideration of the variables human capital and real capital.
78 See previous footnote.

Summary

The great merit of the OECD project is that it has for the first time analysed innovation surveys of a large number of countries with identical econometric models on a comparative basis. To be sure, the results obtained are not surprising; however, they are notably robust and clear across all model versions. Internationally active, large and affiliated companies have a greater probability of being innovative and invest more in innovation activities. Furthermore, a positive correlation is seen between public funding and the amount of the innovation input. Likewise, innovation cooperation agreements correlate positively with innovation expenditures. For their part, the expenditures exhibit a positive relationship with sales of innovative products that also have a positive impact on work productivity. Successful (product) innovations and high work productivity thus go hand-in-hand. Contrary to expectations, this does not apply to process innovations.

While the model used reflects the latest scientific standards with regard to methodology, the modelling is adversely impacted by the fact that the CIS questionnaire contains only a few variables on company characteristics, in particular for non-innovative companies. This significantly limits the design possibilities in the analysis. This problem is intensified by the international comparison to the degree that the model must be applied on the basis of the 'smallest common denominator' and several variables that are not available for all countries must be disregarded.

4.4 The role of creative industries in the Austrian innovation system

4.4.1 Definition and statistical overview of the creative industries

Creative industries are generally seen today as a sector with high growth momentum and high employment and innovation potentials. Furthermore, creative industries (CI) are also regarded as an important stimulus for innovations in other industries. There are essentially three features that constitute this special "future viability" of the creative industries.

First, the creative industries are by definition rooted in creativity as a production factor and accordingly in specific advantageous features of highly developed national economies. Compared to traditional production factors, their significance will continue to increase, so that it may be expected that the creative industries' importance to the overall economy will grow.

Second, the creative industries offer specifically the services that are gradually gaining in importance within the overall demand in national economies with high per capita incomes, namely intangible goods tailored to the individual needs and preferences of the customers. Creative industries benefit in a very special way from this (empirically observable) growing demand for high-quality services.

Third, the creative industries are a typical cross-sectional industry which can provide stimuli for a large number of other industries through their services. Such services may include the development of new products and services, their manufacture or their marketing and distribution. Cross-sectional industries usually have higher long-term growth perspectives, as they are not dependent on industry-specific development paths and/or shocks as well as individual shifts in the competitiveness between countries.

Together with the Fraunhofer Institute for System and Innovation Research (ISI) in Karlsruhe and in collaboration with the Joanneum Research Forschungsgesellschaft, the Centre for European Economic Research (ZEW) in Mannheim recently carried out a large-scale, representative survey of CI companies in Austria. The primary objective of the survey was to determine the innovation potential of the CIs and their spillover to other industries (see Georgieff et al. 2008). The results of this study were included in the Third Creative Industries Report (published by arge creativ wirtschaft austria in the Austrian Federal Economic Chamber). Some of the key facts obtained from the survey are presented below.

Due to the large number of creative services, it is necessary to have an exact definition of what is to be understood below as creative industries. Of fundamental importance for the customary definition of CIs is that the focus is on activities that on the input side are characterised by a dominance of "creativity" as a production factor and are distinguished on the output side by market offers made in the private economy. Accordingly, the CIs include all "creative" companies that offer goods in the market and are directed to generating revenues and (at least in the medium term) profits[79].

Table 40 provides an overview of selected key figures of the Austrian creative industries and their development in the last ten years. The approximately 30,000 companies (approximately 10% of all companies in Austria) of this industry group employ more than 100,000 persons (or 3.3% of all persons employed) and generate gross value added (at factor costs) of approximately € 7.7 billion.

Table 40: An overview of the Austrian creative industries

	2002	2003	2004	2005	2006
Companies	27,183	28,820	28,681	29,300	30,299
Employees	103,680	100,886	101,644	102,250	104,211
Average company size	3.8	3.4	3.5	3.5	3.4
Gross value added (€ million)	6,890	6,889	7,152	7,376	7,710
Percentage of companies	9.5	9.7	9.6	10.4	10.5
Percentage of employees	3.7	3.6	3.5	3.4	3.3
Percentage of gross value added	5.3	5.2	5.1	5.2	5.1

Source: Third Creative Industries Report, 2008

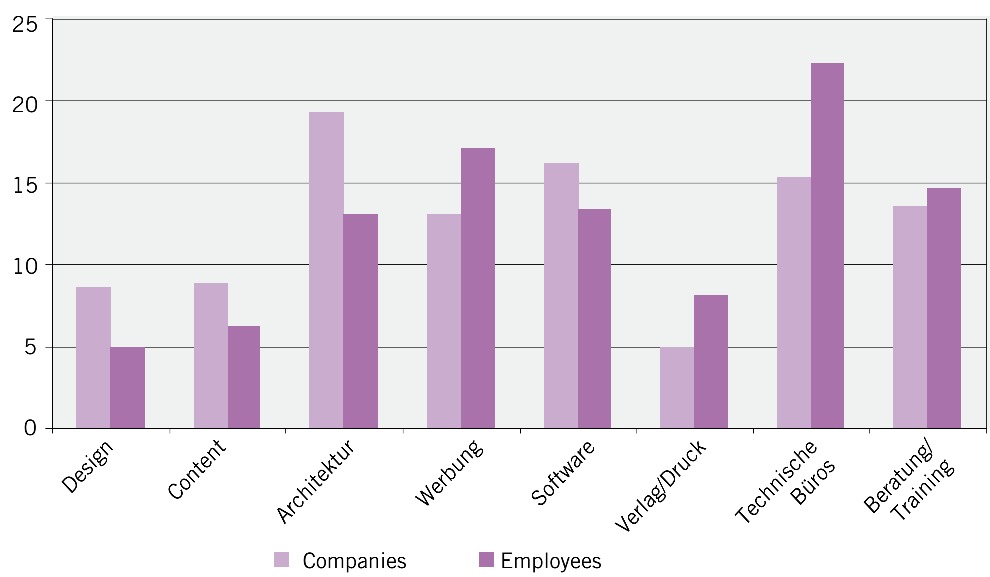
79 Charitable and public institutions that also (partly to a considerable degree) offer creative services are not considered in the context of this review.

For a more detailed presentation, it is useful to break down the very heterogeneous industry group of the creative industries into individual sub-segments. The following breakdown was chosen for this purpose (see also Figure 44).

1. Design (graphics, web design, industrial design, textile, jewellery, furniture design, etc.)
2. Content (film, literature, journalism, composition, acting, copywriting, translation)
3. Architecture (including town and country planning, project planning)
4. Advertising (including PR consulting and market research)
5. Software (programming, excluding web design, including database services, etc.)
6. Publishing/printing (including reproduction of sound, image and data carriers)
7. Engineering offices (planning for non-construction segments, including R&D services)
8. Consulting/training (management consulting, coaching, adult education)

Figure 44 shows the internal structure of the sectors with regard to companies and employment of the creative industries based on these eight sub-segments. Based on number of companies, the architectural offices are in the lead (almost 20%), followed by software (16%) and the engineering offices (15%). Consulting/training and advertising are roughly in balance with an approximately 13% share each. Design and content are at approximately 8% each. Publishing/printing is in last place, posting a 5% share of all companies of the creative industries. Due to different average company sizes, the picture with regard to staffing is in part significantly different. The engineering offices are clearly in first place with a share of almost 23% of the employees. Approximately 17% of all employees are in advertising, followed by consulting/training (15%), software (13%) and architecture (13%). With shares of 5% (design) and 6% (content) to almost 8% (publishing/printing), the quantitative significance of these segments is clearly lower.

Figure 44: Structure of the creative industries by sub-branches (percentage shares)



Source: Third Creative Industries Report, 2008

4.4.2 Creative industries in the Austrian innovation system

The creative industries are not exclusively of interest to economic policy as a dynamic growth industry with correspondingly positive impacts on employment and creation of value but also primarily due to the expected specific effects for the innovation system as a whole. Due to the following mechanisms, the creative industries are accorded a special role in the innovation system.

- First, they make a unique contribution to innovation in Austria with their own R&D efforts and corresponding innovations
- As a cross-sectional industry, the innovations of the creative industries can in turn provide important inputs for a number of other industries. The CIs thus function as an innovation driver for the entire economy.
- As a human capital-intensive segment, the creative industries contribute to knowledge transfer within the innovation system via human capital mobility (transfer of employees to other industries)
- Close linkages between the companies and scientific institutions are often found in the creative industries. This creation of networking stimulates the transfer between science and economy within an innovation system.

These mechanisms will be described for Austria below using empirical material. The results of an extensive CATI-supported survey[80] of approximately 5,000 CI companies in Austria conducted by the ZEW (Centre for European Economic Research, Mannheim) in spring 2008 will be available as a database.

R&D and innovation

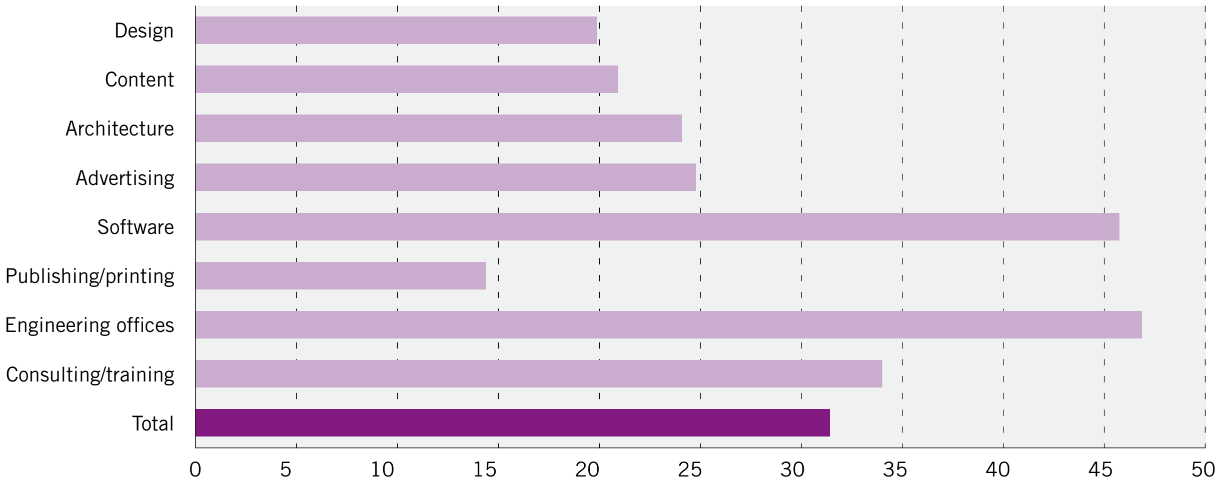
Across all companies of the creative industries, 31% perform their own research and development work. The projected total is about 6,000 companies. In interpreting these figures, it should be noted that the definition of R&D used here clearly goes beyond the narrower approach of the Frascati Manual of the OECD which is the standard for the international R&D statistics. Based on the Frascati definition, 2,356 companies perform R&D according to the most recent R&D survey (2006) of Statistics Austria. The significantly higher numbers in the CI survey result on the one hand from the fact that a three year reference period was used for it. On the other hand, R&D was defined significantly more broadly, namely as any "*systematic creative work activity aimed at expanding the knowledge present in the company*". It can be assumed that the companies subjectively classify many conceptual work activities and the creative involvement with problems as their own R&D activity. Many of the CI companies with R&D might also perform R&D on an irregular basis. Nonetheless, this broader definition is more suitable for describing the scope of systematic activities for gaining new, commercially relevant knowledge in the creative industries than the narrow definition of the official R&D statistics which is strongly geared to technical R&D work activities. Many "R&D processes" in the

80 CATI stands for Computer Aided Telephone Interview.

creative industries are not based on developments in the natural sciences and technology, but are rather of a predominantly intangible character and are targeted to converting creative ideas into products and services of interest to customers.

Differentiated according to the individual CI segments (see Figure 45), the greatest numbers of companies performing R&D are in the engineering offices (47%) and in software (46%). Also above the average is the segment consulting/training in which approximately 34% of all CI companies indicate that they carry out their own research and development work. In contrast, the three core segments of the creative industries (design, content and architecture) and advertising exhibit below average R&D activity. The share of companies performing R&D is by far the lowest in the publishing and printing trade at only 14%.

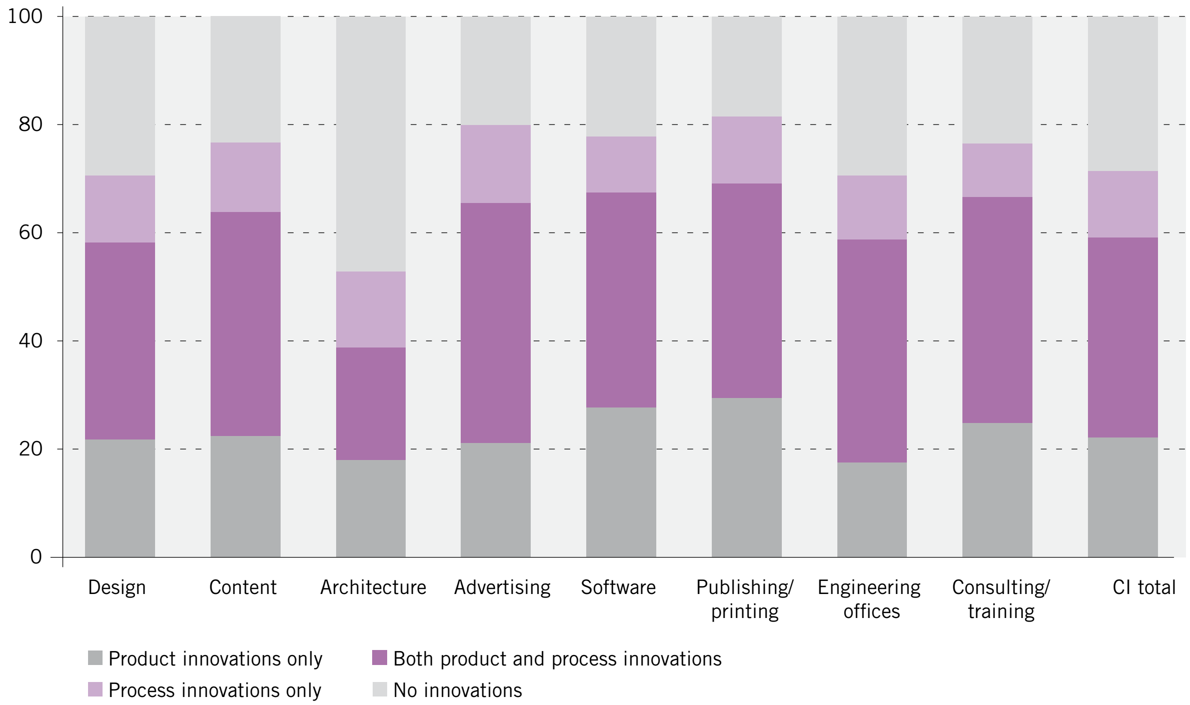
Figure 45: Companies in Austria performing R&D in the creative industries by CI segments (2005–2007) (as a percentage of all companies)



Source: ZEW: Creative Industries Austria survey 2008 – ZEW calculations. All information extrapolated to the total number of companies in the creative industries in Austria in early 2008.

Figure 46 shows the innovation activities of the creative industries. Innovations are described here as the introduction of a new ranges of services in the market by a company (product innovation) or the introduction of a new process for providing services in the company (process innovation). It should be noted that a subjective concept of innovation (as is normally the case in innovation surveys in the form of questionnaires) is assumed here. This means that an innovation must be new for the company in question; however, it may in any event have already been offered or used by other companies. Innovations are very broadly disseminated in Austria's CI companies. 71% of the companies indicate that they have introduced an innovation within a three-year period (2005–2007). Product innovations are more frequently encountered than process innovations. 59% of the CI companies introduced new product ranges, while 49% implemented new processes within the company. 37% of all CI companies have introduced both product and process innovations.

Figure 46: Proportion of companies with product and process innovations in 2005–2007 by CI segments (as a percentage of all companies)



Source: ZEW: Creative Industries Austria survey 2008 – ZEW calculations. All information extrapolated to the total number of companies in the creative industries in Austria in early 2008.

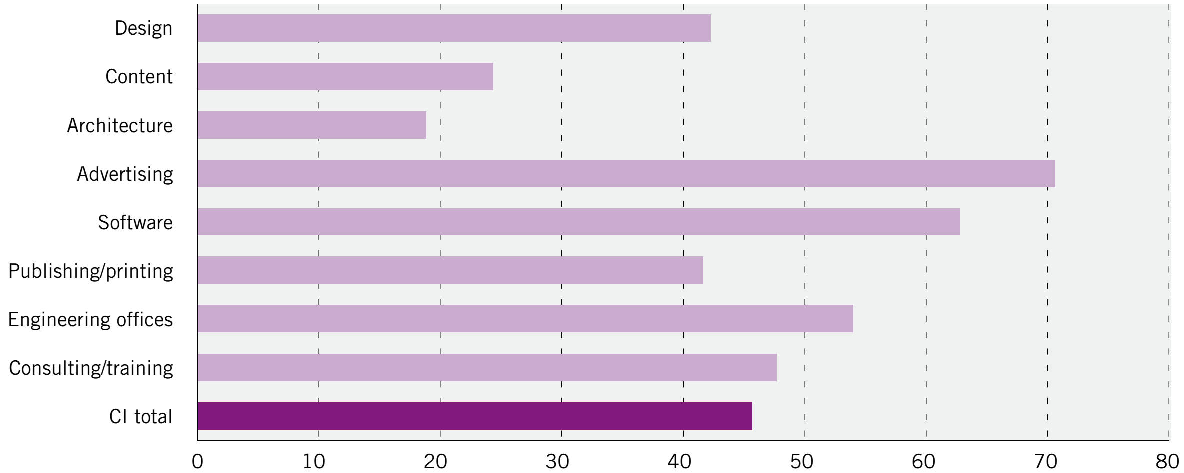
The CI segments publishing/printing, advertising, software, content and consulting/training exhibit the highest innovator ratios. More than three fourths of the companies in this area have been successful with innovations. In all these CI segments, product innovations have been significantly more broadly disseminated than process innovations and most process innovators have also brought new products to the market at the same time. The innovator ratio is on average roughly the same in the content segment and in the engineering offices. The only CI segment having a significantly lower ratio of successful innovating companies is the architecture segment where only 52% of the companies are included among the innovators and only 39% have introduced a new product range within a three-year period. This indicates that the greatest portion of the companies have specialized in a specific product range (e.g. interior design for offices, green building practices, design-planning for single-family dwellings) and they maintain this specialisation over an extended period of time. At the same time, creative services are provided within this constant product range for each individual order.

Creative industries as innovation drivers – impacts on other industries

As has already been mentioned, as a cross-sectional industry, creative industries have an important function as innovation drivers for the entire economy. First, companies of the creative industries make enquiries with other companies concerning innovative products and technologies, and as customers can thus stimulate their technology suppliers to create innovations. The function of the creative industries as innovation supporting customers results from the very considerable scope of the sector – it represents approximately 5% of the value added of the corporate sector – and primarily out of its own extremely strong innovative activity. It is especially innovative companies that expect particularly high standards for innovation and technology from their suppliers and the companies upstream in the value-added chain. Second, the creative industries offer a diverse bundle of creative services that other companies can integrate in their own innovation processes. These services that support or accompany innovations can range from ideas for new products developed by CI companies in the content or consulting segment, for example, to R&D work activities, the design of new products, the development of specific software applications for new products and processes, the development of new marketing strategies or design services for more efficient production processes, to concepts for improved utilization of the innovative potential in the company, through new consulting and training approaches and to a more communication-friendly and creativity promoting design of workstations and on to new architectural concepts.

This latter aspect, namely the support of customers in their innovation processes (in the broader sense), is empirically commented on in Figure 47. In fact, almost half of all CI companies (46%) support their business customers in introducing innovations. The advertising segment is particularly strongly dedicated to its role as an innovation supporter. 71% of the companies in the segment indicated having supported customers in introducing new products to the market or in implementing new processes. The CI segments software, engineering offices and consulting/training were also above the average. The percentage of CI companies with innovation-supporting activities is quite low in architecture (19%) and in the content segment (24%). This is due on the one hand to the comparatively low percentage of CI companies in this area whose customers also include companies (69 and 73%). On the other hand, the product range of these two segments is as such less suitable for directly supporting innovation processes in the skilled trades. While architecture is primarily geared towards the creative design of structural infrastructure and is thus at best able to intervene only indirectly in company innovation processes, companies in the content segment typically develop ideas for product content that are frequently taken up and implemented by other CI segments, for example with regard to artistic, photographic or copywriting services.

Figure 47: Proportion of CI companies that have supported corporate customers in introducing innovations, by CI segment (in %)



Source: ZEW: Creative Industries Austria survey 2008 – ZEW calculations. All information extrapolated to the total number of companies in the creative industries in Austria in early 2008.

4.4.3 Human capital mobility

An important form of knowledge transfer between companies and industries is the transfer of employees. This applies very much in particular to the creative industries. Human capital, i.e. the capabilities and skills of employees, is the most important production factor in this industry. Expertise, professional experience and creative ideas and approaches also migrate with personnel turnover. To be able to evaluate the significance of the creative industries as an innovation donor for other economic branches, it is thus necessary to investigate this form of innovation stimulus as well.

The creative industries employ a very high percentage of freelancers. In early 2008, 17% of all employees in the creative industries in Austria were freelancers. The results of the microcensus showed that freelancers accounted for only 1.6% of the workforce in the Austrian economy as a whole in 2007. However, a direct comparison is possible only to a limited degree due the fact that one person can be active as a freelancer in several companies and accordingly be counted more than once, while each freelancer was recorded only once in the microcensus. In any case, the significance of freelancers in the creative industries is higher than in the overall economy many times over.

This high number of freelancers is also associated with a high level of staff mobility in the creative industries. It should first be noted that the creative industries experienced enormously high employment growth in the period 2004–2007. Among the companies that had active operations both in 2004 and in early 2008 (i.e. excluding companies that were either newly established or closed in the years 2005 to 2007), the number of employees rose by 5% per year.[81] Significantly above-average growth is seen in the CI segments software, content

81 In comparison, the total number of persons in gainful employment (excluding self-employed) in Austria grew at a rate between 1 and 2% in the years 2005 to 2008.

and consulting/training, while employment growth rates were relatively low in publishing/printing and architecture and the design segment even exhibited stagnant employment figures (Table 41).

This net growth conceals an even much higher staff mobility, which is seen in employee turnover. Among the CI companies that had active operations in both 2004 and in early 2008, 6.6% of employees separated each year. At the same time, there were 13.1% new hires per year. This means that at year-end, only about 80% of the employees of CI companies had been employed with the same company at the beginning of the year. Staff turnover is particularly high in the segments content, advertising and software. While the high staff turnover is associated with a high number of freelancers in the segments content and advertising, the software segment has only a small percentage of freelancers. Despite the high proportion of freelancers, staff turnover is comparatively low in the segment consulting/training.

Table 41: Staff turnover in the creative industries in Austria in 2004–2007 by CI segment*

	Average annual growth in the number of employees (in %)	Rate of separations/ year (in %)	Rate of new hires/ year (in %)	Net growth of employees per company and year	Number of separations per year and company	Number of new hires per year and company
Design	0.4	7.2	7.8	0.03	0.36	0.39
Content	7.6	8.8	18.5	0.44	0.40	0.85
Architecture	1.9	6.8	9.3	0.14	0.38	0.52
Advertising	5.5	8.5	15.6	0.74	0.89	1.63
Software	7.6	7.5	17.2	0.57	0.44	1.01
Publishing/printing	3.4	5.0	9.4	0.57	0.64	1.21
Engineering offices	4.9	5.6	12.0	0.76	0.66	1.42
Consulting/tr.	7.1	5.0	14.1	0.75	0.42	1.17
CI total	5.0	6.6	13.1	0.50	0.52	1.02

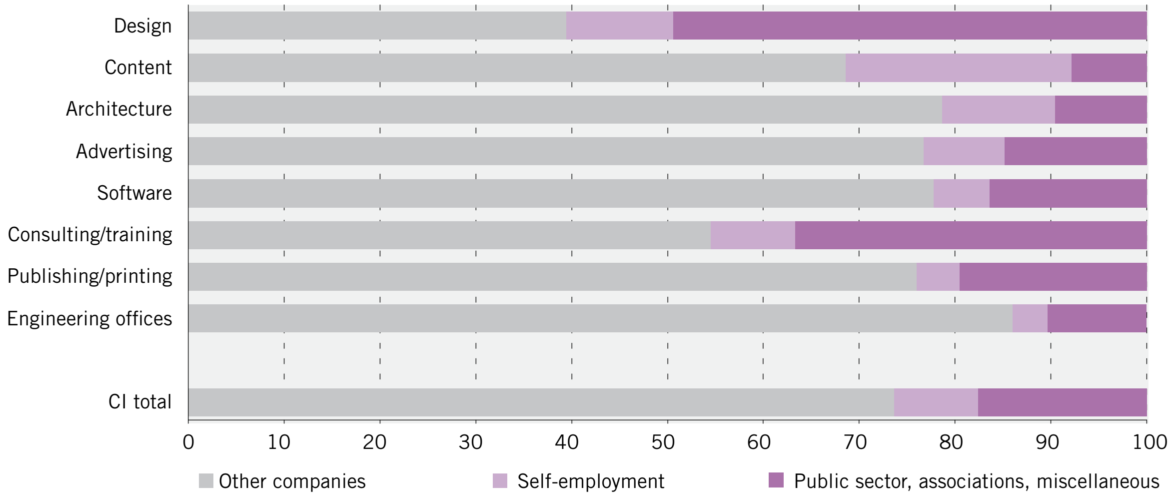
* In companies with active operations in 2004 and in early 2008 (i.e. excluding start-ups in the years 2005 to 2007).

Source: ZEW: Creative Industries Austria survey 2008 – ZEW calculations. All information extrapolated to the total number of companies in the creative industries in Austria in early 2008.

If staff mobility is converted to the number of employees who on average separate from a CI company per year or join a CI company, the values obtained are astoundingly high in view of the small size of the CI companies. Thus on average, every CI company increases its workforce by one person within a period of two years. While one person is newly hired per year and company on average, one person separates from a CI company within two years on average. The staff mobility measured in this manner is particularly high in advertising, in publishing/printing and in the engineering offices, and is in contrast particularly low in the segments design and architecture.

Between the beginning of 2005 and the end of 2007, almost 30,000 employees separated from companies of the creative industries (including employees separating from companies that were newly established during this period). The largest share of these employees moved to other companies (74%) (Figure 48). Separating employees switch particularly frequently from the CI segments engineering offices to companies, while it is relatively rare for employees in the segments design and consulting/advertising to move to other companies. 8.7% became self-employed. In absolute numbers, this amounted to more than 2,500 persons in the three calendar years under consideration.

Figure 48: Distribution of employees separating from CI companies in 2004–2007 by target sectors, differentiated by CI segments



Source: ZEW: Creative Industries Austria survey 2008 – ZEW calculations. All information extrapolated to the total number of companies in the creative industries in Austria in early 2008, rounded extrapolation.

The percentage of employees switching to self-employment from CI companies is slightly lower than the average self-employment rate in the Austrian economy (excluding agriculture and forestry), which on average amounted to 9.3% in 2004–2006 – based on information from the microcensus. The percentage of employees in the content segment switching to self-employment is particularly high (24%); the segments architecture (12%) and design (11%) also exhibit high values. In engineering offices and publishing/printing, only a few separating employees become self-employed – an indication of the high entry barriers in this segment. Public-sector and non-profit institutions make up another important target sector. 18% of all employees separating from CI companies move into this segment (which also includes the change to non-gainful employment, although the significance of this is much lower).

Furthermore, a relationship exists between the level of education of the persons employed in a company and the separation rate as well as the probability that separating employees will become self-employed (Table 42). If CI companies are classified according to whether the proportion of employees with a higher education is above or below the average of the company's CI segment, companies with an above average number of higher education graduates have a higher separation rate. However, the number of separating employees who become self-employed is more than twice as high (13% compared to 6%). This suggests that better qualified employees within the creative industries are more likely to change employers and that better qualified employees are more likely to venture becoming self-employed.

Table 42: Separations of employees from CI companies differentiated by the human capital of the employees (in %)

Percentage of employees with a higher education:	Separation rate	Percentage of separations switching to other companies	Percentage of separations entering self-employment	percentage of separations switching to public-sector/non-profit institutions, miscellaneous
Above-average	7.7	75	13	12
Below-average	6.3	73	6	21
CI total	6.8	74	9	18

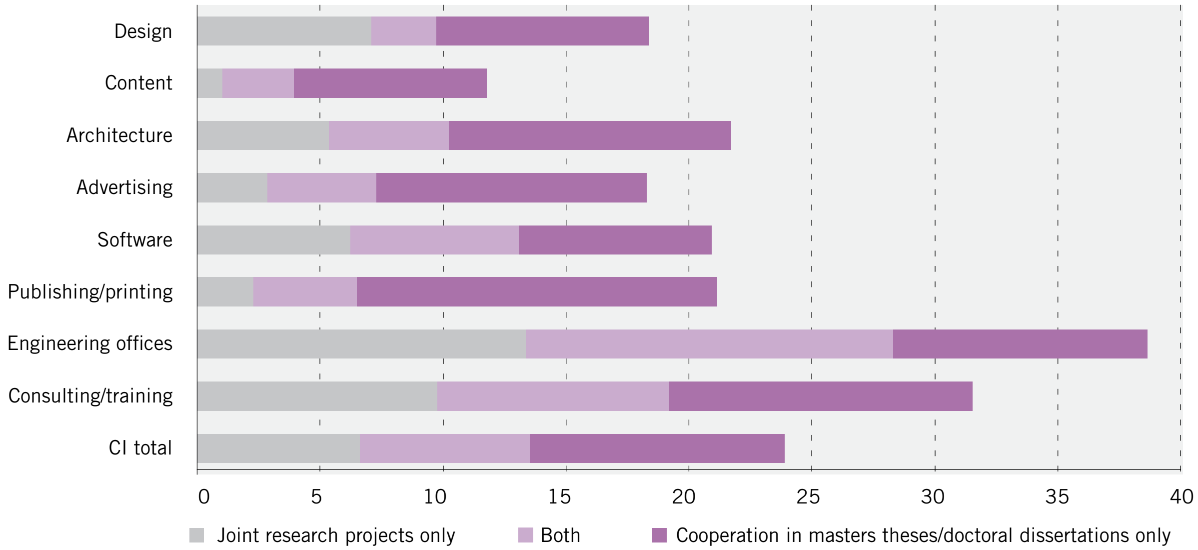
Source: ZEW: Creative Industries Austria survey 2008 – ZEW calculations. All information extrapolated to the total number of companies in the creative industries in Austria in early 2008.

4.4.4 Science cooperation and network building

The role played by companies of the creative industries in connection with knowledge transfer from science or the general network building between science and business also makes an important contribution to the innovation system. The fact that entrepreneurs as well as gainfully employed persons and freelancers in the creative industries have often received a higher education is proof of the creative industries' close involvement with scientific pursuits. 28% of employees in the creative industries have a higher education degree[82] and more than 60% of the CI companies have at least one employee who has studied at an institution of higher education. However, a transfer of new research results into marketed products does not only take place as the result of the recruitment of university graduates but also in particular through direct collaboration with science. These interactions between science and business can assume very diverse forms (see Schartinger et al., 2002). Two important forms of cooperation are joint research projects as well as collaboration in the support of masters theses or doctoral dissertations (see Figure 49).

82 In comparison, a total of 13% of gainfully employed persons in Austria are university graduates (2006).

Figure 49: Cooperation with science by CI segment (percentage share of all companies)



Source: ZEW: Creative Industries Austria survey 2008 – ZEW calculations. All information extrapolated to the total number of companies in the creative industries in Austria in early 2008.

In any case, 24% of all CI companies use at least one of these two forms of cooperation with science. 14% of all CI companies engage in joint research projects with science; 17% support master's degree candidates or doctoral candidates in connection with their theses and dissertations. In the latter form of cooperation, it can be assumed that the students are typically in cooperation with the CI company, e.g. as a freelancer. 7% of all CI companies have both joint research projects and cooperation in masters theses and doctoral dissertations. A great amount of scientific cooperation takes place primarily in engineering offices. 28% have joint research projects with scientific institutions and 24% support master's degree candidates or doctoral candidates. However, companies in the consulting-training segment also exhibit an above-average frequency of scientific cooperation. It is striking that scientific cooperation is significantly rarer in the content segment than in other CI segments. Only 12% of the content companies have arrangements for scientific cooperation in the two forms under consideration here and only 4% engage in joint research projects.

Compared with other technology and knowledge-intensive industries, it is seen that the cooperation of the CI sector with science is markedly high in an industry comparison. As the results of the 2005 innovation survey by Statistics Austria (2006) show, even the research-intensive branches of industry do not reach such a high percentage of companies collaborating with science. Based on companies active in innovation with 10 or more employees (comparison figures for other industries are only available for this group), 26% of the CI companies engage in R&D cooperation with science (excluding cooperative arrangements in the education of students). In other research-intensive and science-intensive industries, this rate is between 10 and 20%.

4.4.5 Summary

Overall, the creative industries can be seen as a significant growth sector. In the meantime, its importance for the overall economy should also not be underestimated. Every tenth company and every 20th employee is associated with the creative industries; their share in total value added comes to 5%. At the same time, the creative industries must be classified as a cross-sectional sector, the products and services of which are primarily used in other industries, and for that reason they provide significant stimuli for the overall economy. The creative industries are sui generis a highly innovative sector with considerable R&D applications and corresponding innovation efforts. In addition to this direct contribution to innovation, the creative industries also have an important function in Austria's innovation system because of additional mechanisms. The creative industries employ an above-average level of human capital and exhibit above-average staff mobility. Employees of the creative industries frequently change to another industry and in so doing make their creative skills available to other industries, The results of the survey also show that in their business relations with companies in other industries, the companies of the creative industries provide stimuli for innovation and/or are included in the innovation processes of their customers. Furthermore, companies of the creative industries often have close relationships with the science system (e.g. via joint cooperation projects or via educational partnerships with regard to masters theses/dissertations) and thus play an important role in the transfer of technology and knowledge between science and business.

The great significance of the creative industries which has been substantiated here empirically is recognized by business and technology policy and is explicitly referred to in the government action programme[83]. Corresponding initiatives and programmes for stimulating relevant activities have been started through the evolve programme.[84]

4.5 Technology diffusion in the Austrian Manufacturing industry

Innovation is not always the result of research and development. Even the application of existing technologies, such as the use of a new manufacturing process in a plant can result in increasing productivity which can ultimately also create new products. The diffusion of technology is therefore an essential source for growth, which is particularly beneficial for smaller countries, such as Austria, if they can share in the worldwide pool of technologies. Technology diffusion has contributed considerably to the growth of the Austrian economy. An analysis of the major components contributing to the economic growth, i.e. the share that the production factors of labour and capital have in changing the economic performance, indicates that changes in capital funding, such as the use of better machinery, were responsible for more than half of the growth in the added value (Peneder et al. 2006).

Technology know-how is characterised by different degrees of appropriability, different

83 See government action programme 2008–2013 for the XXIV legislative period p. 12f.
84 An overview of the activities is offered at: http://www.evolve.or.at.

applications of technological opportunities, the cumulative effect of acquiring technical know-how and tacit knowledge. Technologies develop along different trajectories based upon specific technical characteristics and the capacity of companies to absorb them. A consequence of all of these characteristics is that a different rate of technology diffusion is a fundamental and permanent characteristic feature of the industrial landscape (Silverberg et al. 1988). An insight into the extensive literature regarding technology diffusion is given by Geroski (2000) and Hollenstein and Woerter (2008), among others.

European Manufacturing Survey (EMS)

As part of the European Manufacturing Survey (EMS), ARC systems research conducted a survey of production innovations in Austrian companies in 2003 and 2006. The survey was a collaborative project together with the German Fraunhofer Institute for system technology and innovation research. A total of 280 companies participated in this survey. The analysis covered the production strategies used, the use of innovative organisational and technology concepts in production, questions regarding the deployment of human resources and their qualifications as well as questions related to outsourcing, the range of services and the way production modernisation is managed. Additional factors surveyed were performance indicators such as productivity, flexibility, and the quality achieved and last, but not least, profitability. Based upon the information provided by this survey, statements with respect to the modernity and performance of the Austrian industry and comparisons on an international scale regarding similar industries in Germany and Switzerland and in some neighbouring states in Eastern Europe, in which this survey was also conducted, can be made.
Additional information is available on the homepage of the German Fraunhofer Institute for system technology and innovation research (http://www.isi.fhg.de/pi/projekte/erhebung_pi.htm).

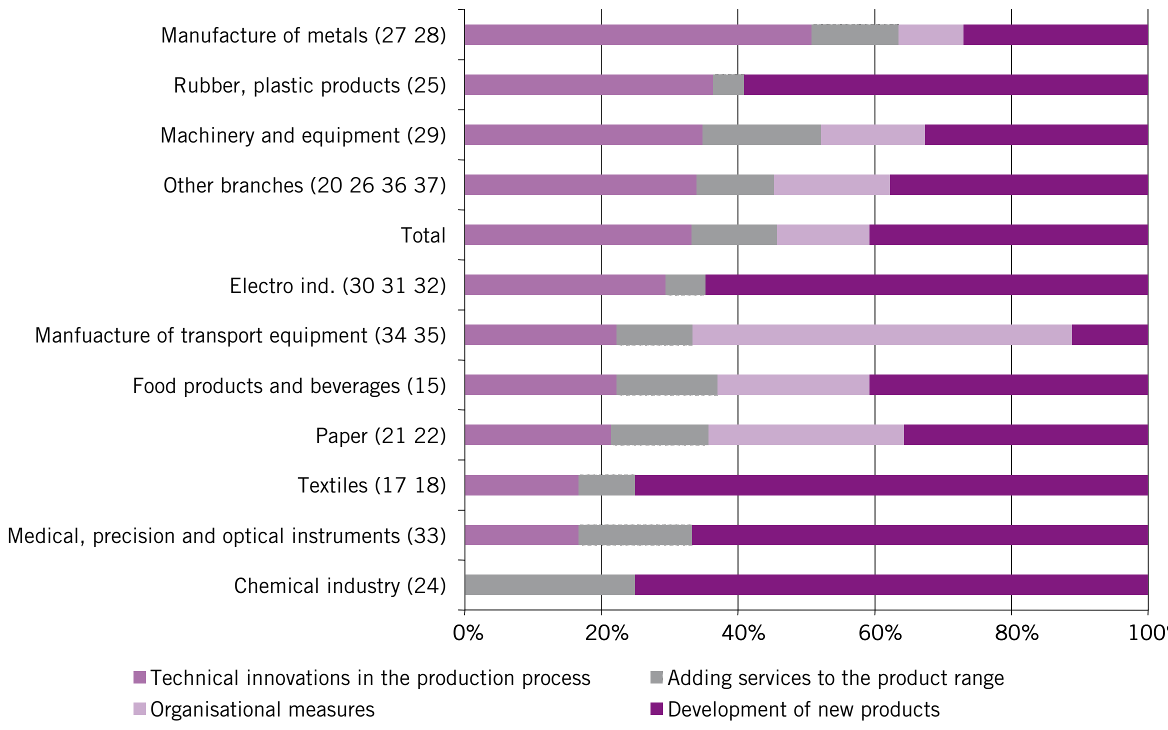
The deployment of new production technologies, however, represents merely one of several strategies for increasing productivity in the manufacturing sector. Several developments have occurred over the course of the past 40 years. Retrospectively, the change of key concepts in the modernisation of manufacturing methods can be differentiated into four phases (adapted according to Lay and Wengel 1998):

- Until the 70s, a trend towards automation dominated. Technical solutions and machinery were developed for increasingly more production applications, substituting human labour in manufacturing operations.
- Between the 70s and 80s, the focus continued to be on improving production technology and increasing automation, but then changed in favour of more flexible automation.
- Toward the end of the 80s, the domination of technological innovation was superseded as an instrument of modernisation in manufacturing operations as follows: improvements in the organisation of manufacture and the competence of human resources came increasingly to the fore.
- Since the end of the 90s, the focus has primarily been on customers. The result is that more attention is paid to adapting products to fit customer requirements, and product modernisation concentrates on offering additional services to enhance the product line.

This change in key concepts over time therefore also explains the different rates in the diffusion of new technologies: when companies' innovation strategies focus not only on finding new solutions but rather put a considerable amount of effort into the non-technical aspects of product modernisation, then it is logical that some technologies experience less diffusion.

Figure 50 illustrates the varied weighting of different strategies for modernising manufacturing operations in various industries. Although many Austrian companies consider technical innovations, i.e. the use of new machinery, a very important part of modernising manufacturing operations, they rarely place it first in the list of priorities. Overall, 41% of all companies concentrate primarily on developing new products, followed by 33% on technical innovations in the manufacturing process, 14% on organisational procedures and 13% on expanding their product line to include services. There are clear differences between how much the various economic sectors value the different measures for increasing productivity. The focus is on technical innovations in the manufacturing process, particularly in the production of metals and in the mechanical engineering sector. In most other branches of industry, technical innovations in the manufacturing process are considered the second most important measure after the development of new products. The automotive industry is an exception here, because organisational measures rate high on the list of priorities.

Figure 50: Ranking of technology in the modernisation of production methods



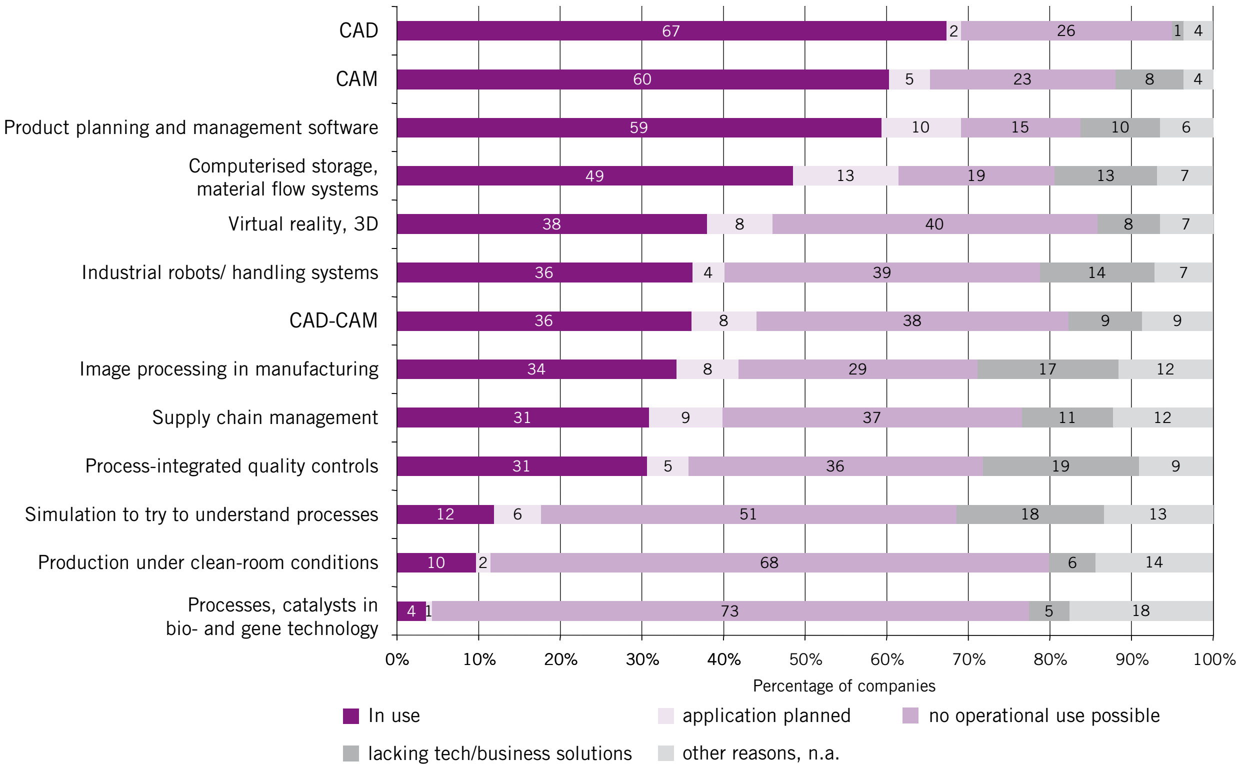
Number of companies in which the measure is top priority.
Source: ARC systems research, Survey of production innovations 2006 (EMS).

Looking at the size of the operation, there is little difference in the modernisation strategies of manufacturing processes between the individual categories, with the exception that large companies increasingly place the emphasis on the development of new products, and companies with less than 100 employees tend to expand their product line through the range of services offered.

The different significance of technical innovations in the various branches is a result of the degree in maturity of being able to use different technologies, on the one hand, and of the prospective application possibilities in a particular branch on the other. How these two factors interact is shown by the example of CAD/CAM as well as biotechnology and gene technology processes. Fig. 51 provides an overview of the rate of diffusion and the planned deployment of different technologies. In this instance, CAD and CAM are the most prevalent technologies. Approximately 80% of the companies which participated in the survey introduced these technologies already before the year 2000, and only a small percentage of the companies are still planning to introduce them. Most of the companies that have not introduced CAD and CAM by now do not envisage any potential applications for use in their operations. CAD and CAM technologies appear to have reached a saturation phase.

On the other end of the spectrum is the application of processes or catalysts in the biotechnology and gene technology sectors and production under clean-room conditions, same as is necessary for electronic components, food products, etc. More than two thirds of the companies do not envisage any application in their operations. Of the small number of companies which already introduced these technologies (4% or 10%), 80% or 74% did so already before the year 2000. Both technologies are niche applications and will probably continue to be, because companies outside of the original sectors do not have the technical expertise or consider its use uneconomical.

Figure 51: The utilisation and the planned deployment of various technologies in the manufacturing sector in Austria in 2006

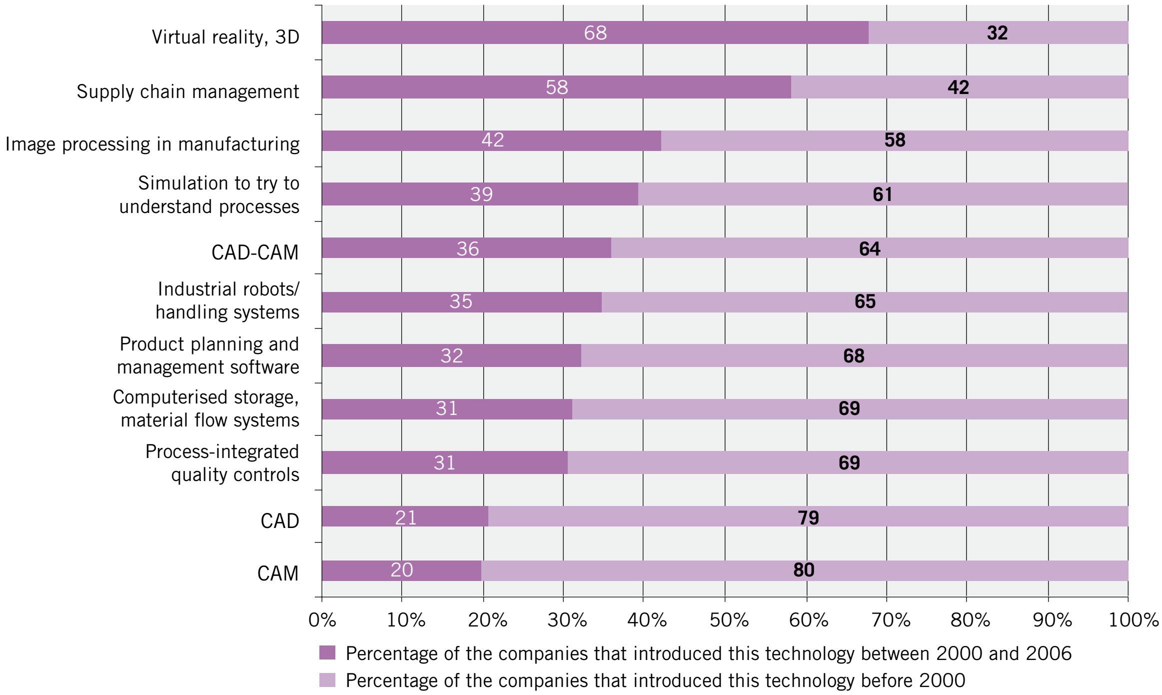


Source: ARC systems research, Survey of production innovations 2006 (EMS).

The technologies shown in figure 51 cover a wide range of diffusion dynamics. Figure 52 illustrates that such sectors as Virtual Reality (simulation for product design) and Supply Chain Management (exchange of data with other companies) have been characterised by high diffusion dynamics since 2000. These are relatively young technologies, whose application has been proved and which are currently in a growth phase. More than 50 to 66% of the companies surveyed which have introduced these technologies have done so since 2000.

On the other end of the scale are the CAD and CAM technologies, which roughly 80% of the companies surveyed introduced before the year 2000.

Figure 52: Different technologies and their diffusion dynamics

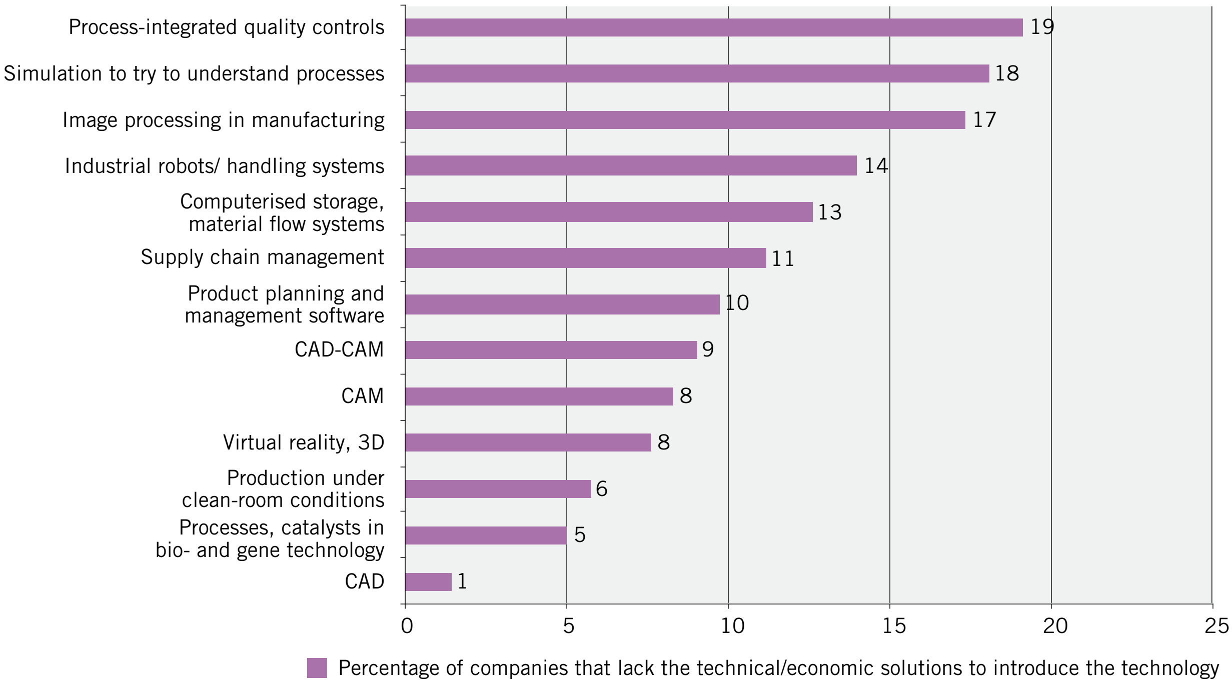


Source: ARC systems research, Survey of production innovations 2006 (EMS).

The technologies in the average range are faced with obstacles in the application (cf Figure 53). This involves technologies such as process-integrated quality control (e.g. through laser, ultrasound, sensor), simulation to try to understand processes, image processing in manufacturing operations (e.g. quality control, process management) and industrial robotics and/or handling systems for tools and work pieces. With respect to these technologies, the next years will prove whether they will prevail or fail; and failure in technological process innovations is nothing unusual (Geroski, 2000). These technologies are only being applied at a slow rate, mainly because the necessary technical or economical solutions are not yet available.

Different analyses of the obstacles for technical/organisational innovation projects indicate that it frequently is not the degree of maturity of the technology as such which prevents it from being introduced. It is rather the incompatibilities with the existing technology and path dependencies as a result of previous investments in technology that indicates the requirement of a business to adapt to new developments, such as the requirement for software development, interface problems, incompatibilities with existing machinery or with the organisational business structure. This probably where there is the greatest need for efforts in research and development in order to achieve solutions that are ready for application.

Figure 53: Technological immaturity: a range of different technologies



Source: ARC systems research, Survey of production innovations 2006 (EMS).

Process technologies have a significant impact on the productivity of a business. New technologies rank prominently in the modernisation of production methods, but Austrian industrialists increasingly also devote a substantial part of their efforts to product and organisational innovations and also into supplementing their product lines with various service programmes. Here, there are clear differences between how the various economic sectors value the different measures for increasing productivity.

On the other hand, this does not automatically mean that policy makers need to take action. Intervention is not necessary when the technologies involved have already permeated the market or are readily accepted by the companies as is. Policy should rather focus on areas with technological potential, where diffusion is at a standstill. If it turns out that the technology is not being used because there are some beginning barriers such as technological uncertainty, a lack of pilot applications or high costs during the initial phase, this would be sufficient reason to think of ways to overcome these obstacles.

4.6 The situation among women regarding self-employment and start-ups

In recent years, economic policy has increasingly focussed on how many new enterprises are being founded[85]. In the meantime, increasing the number of new businesses has become an important component of economic policy goals on a domestic as well as European level. The main emphasis is on the economic significance of start-ups in terms of competitiveness, employment, innovation and technological change: Entrepreneurship was named as an important factor for innovation, competitiveness and growth in the EU's action plan. It was also pointed out that the entrepreneurial potential has not (yet) been exhausted (European Commission 2004). Strategic political areas were specified to promote the entrepreneurial dynamics; one of their objectives is to encourage more start-ups. In addition to a clear focus on small and midsize companies, women were also explicitly named as a target group for certain measures. One starting point was the finding that women continue to be underrepresented as entrepreneurs as well as founders, yet at the same time, women increasingly consider the entrepreneurial profession to be an "important motor for employment and growth potential" (OECD 2004, p. 10). Since there is not much pertinent data or analyses about female entrepreneurship, the amount of potential among women to start up a company, or the effects of relevant (subsidy) measures, gender-specific aspects have been gaining a stronger foothold in the research about company formations and entrepreneurship in recent years.

These empirical studies have shown not only a gender gap among start-ups in Austria but also differences in the start-up behaviour of women and men: Enterprises formed by women are most frequently one-person enterprises, have a smaller size, are in traditional sectors (e.g. trade, tourism, personal services), have less start-up capital and show weaker growth. For women, founding "purely technical" businesses continues to be an exception. An analysis by the Centre for European Economic Research (ZEW) has revealed that women had an 8% share of formations in the high-tech sectors in Germany in 2007 – a number that is even two percentage points below the one from 1995 (Metzger et al. 2008). There is no corresponding systematic data for Austria. However, some conclusions can be made by observing the AplusB subsidy programme as an example. In November 2008, there were a total of nine AplusB centres in all of Austria offering support to company founders. Women constituted 7% of all the founders or co-founders.

As there is no consistent definition of company formations in entrepreneurship research, the term is used with different meanings in various research projects and statements about the number or intensity of formations by women vary. For example, depending on the recording method or definition, the share of women in Austrian start-ups varies between 25% and 40%. The type of formation (start-up, takeover, new business license), where it fits into the formation process (how long before or how long after the actual time of the formation) or a combination of both criteria are commonly used as distinguishing criteria. The Global En-

85 This section is based on Schiffbänker et al. (2007)

trepreneurship Monitor (GEM-Monitor[86]), for example, distinguishes enterprise formations according to their "lifespan" (during the first three months they are referred to as start-ups; from 3 – 42 months the entrepreneurs are referred to as new or young). The statistics on start-ups put together by the Economic Chamber summarise data from the trade authorities about the issuance of new business licenses. This categorisation is unclear from a start-up perspective, since it may also include expansions or takeovers of existing companies. On top of this, these statistics only include members of the Federal Economic Chamber. Although the majority of the Austrian start-ups are in commerce, being self-employed does not necessarily entail having a business license. There are also founders who do not need to have a trade licence, work on a contractual basis and are referred to as the "new self-employed". The ongoing deregulation of forms of occupation is thus resulting in an added heterogeneity with respect to the various possible (social) legal shapes that start-ups can take.

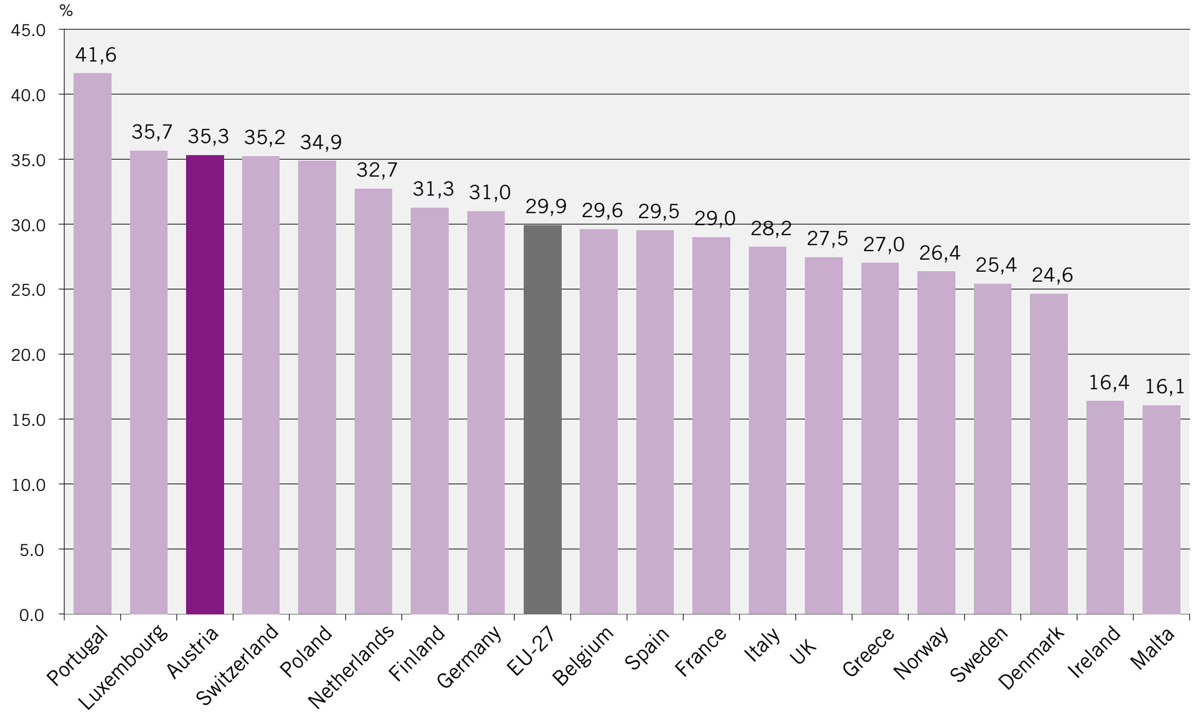
Despite these limitations, the Federal Economic Chamber's data represents the most extensive and detailed information currently available in Austria on the situation of start-ups. The following overview includes the self-employment of women as well as start-ups by women. In addition to the microcensus and labour force survey, the member statistics of the Federal Economic Chamber are used to provide the fundamental data. This is followed by a short summary of the analysis of high-tech start-ups by women (using Germany as an example) as well as the specific characteristics and situations for women in this field.

4.6.1 The self-employment of women

According to analyses based on the microcensus, there were a total of 481,500 self-employed in 2007, of which 311,500 were men (64.7%) and 170,000 women (35.3%). Compared to the previous year, this means an increase by nearly 2%, where the number of self-employed women has increased more sharply than that of the men. Compared to the EU – with a 29.9% share of self-employed women –Austria is therefore in the top range in Europe.

86 The GEM monitor examines entrepreneurial activities in 42 countries on all five continents. This results, for one, in a monitoring of the entrepreneurial activities in the scope of a representative survey of the population between 18 and 64 years old, supplemented by an assessment by selected national experts. For another, there is an analysis of the basic conditions for entrepreneurship. Austria participated for the second time in 2007.

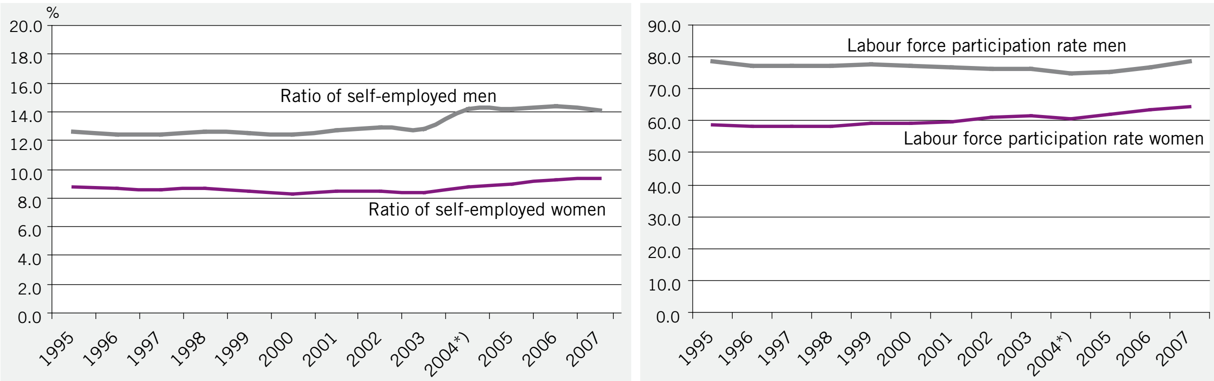
Figure 54: Share of women among the gainfully self-employed in the European Union, 2007



Source: EUROSTAT Labour Force Survey 2007

The trend over the past ten years also shows a steady increase in self-employment: a total of more than 20 percent from 1996 to 1997, somewhat more strongly for women with 23.4% than for men (18.1%). However, the ratio of employed women also increased during the same time period. The ratio of self-employed women, meaning the share of self-employed women among gainfully employed women, has therefore only moderately increased: from 8.6% in 1996 to 9.1% in 2007. In comparison, the ratio of self-employed men increased from 12.4% to 14.1% during the same time period. The total ratio of self-employed was 12% in 2007.

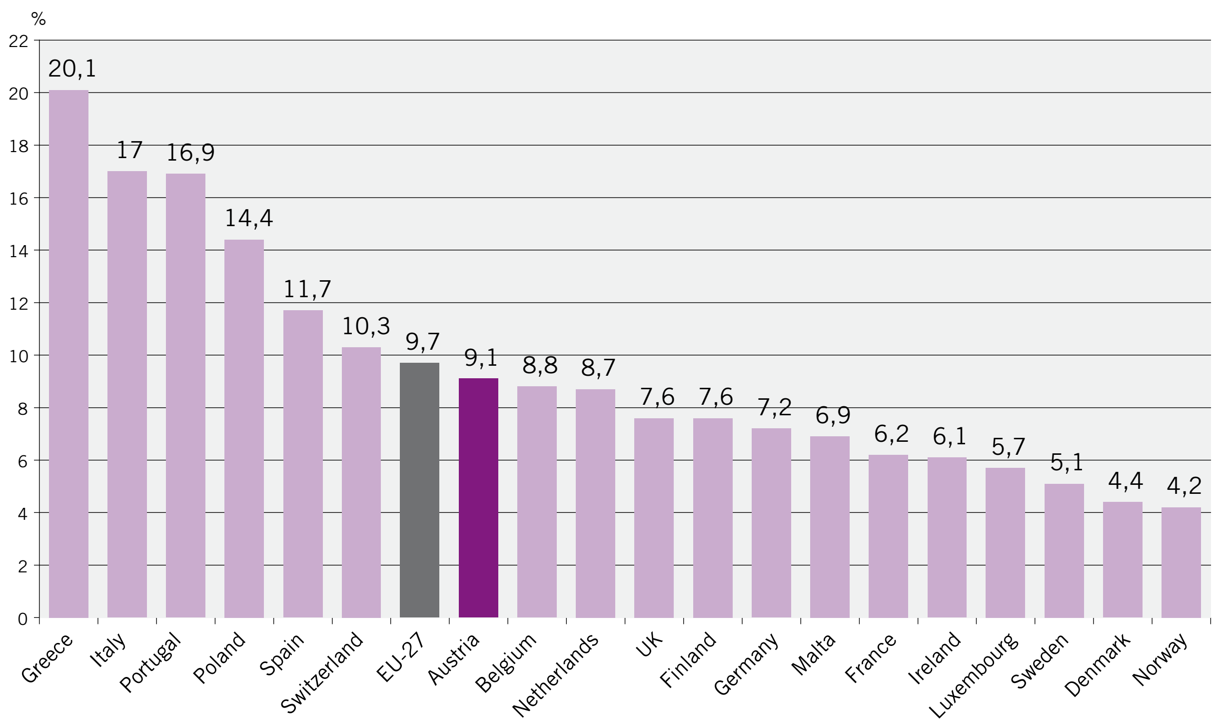
Figure 55: Ratios of the employed and self-employed 1995–2007, according to gender, in %



Source: Statistics Austria, microcensus

As far as the ratio of self-employed is concerned, Austria is in the medium range in a European comparison. At 9.7%, the average ratio of the female self-employed in the EU was barely half as much as those of the men (18.2%).

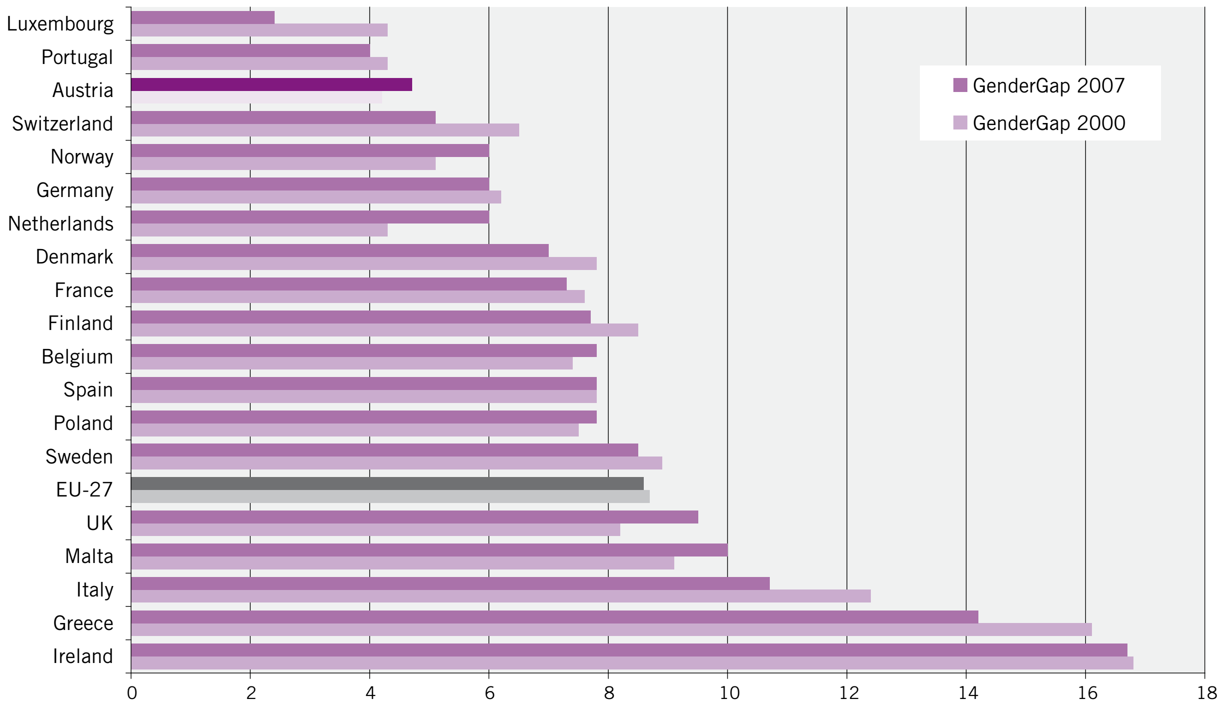
Figure 56: Ratio of self-employed women in the European Union, 2007



Source: Eurostat, http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-SF-08-099/EN/KS-SF-08-099-EN.PDF

This gender gap has barely changed during the period from 2000 to 2007 on an EU level (2000: 8.7%; 2007: 8.6%). However, there are great variations in the individual member states. With a gender gap of 4.7% in 2007, Austria is one of the countries with the lowest differences, although the gap grew by 0.5% points during this period.

Figure 57: Gender gap in the ratio of the female and male self-employed, 2000 and 2007



Source: Eurostat, http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-SF-08-099/EN/KS-SF-08-099-EN.PDF

As far as the professional position of self-employed women is concerned, there is a decrease in the share of women among the family assistants, which is very pronounced especially in the agricultural area. The share of self-employed women in commerce, trade and industry has increased, especially in midsize and larger businesses.

Table 43: Share of self-employed women according to professional position, 1990, 2000 and 2006

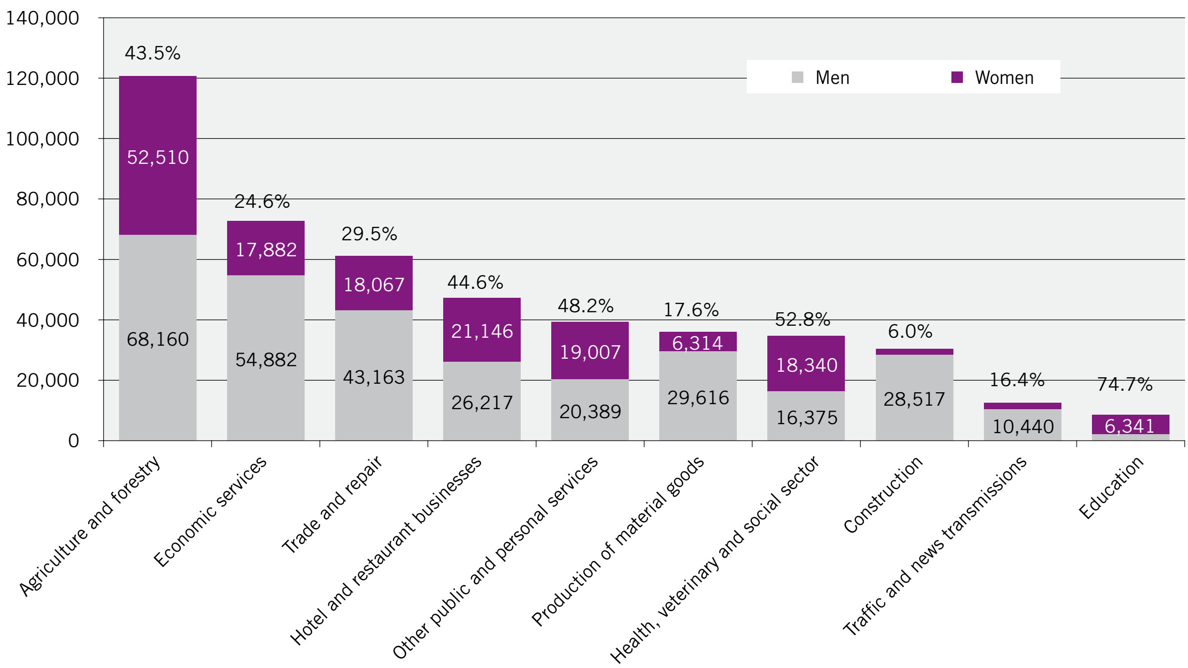
Professional position	1990	2000	2006
	Women in %*	Women in %	Women in %
Total of self-employed and family assistants	43.2	40.6	38.0
Self-employed in agriculture	36.2	42.1	44.5
Family assistants in agriculture	77.9	64.4	61.9
The share of self-employed women in commerce, trade and industry has increased, especially in midsize and larger businesses.	28.5	28.3	31.4
Small business without employees	42.0	33.1	37.6
Small business	28.1	29.8	29.9
Midsize business	18.1	20.5	24.9
Large business	10.9	13.5	14.7
Family assistants in commerce, trade and industry	69.6	68.2	66.2

* Total share of gainfully self-employed

Source: Statistics Austria, microcensus

Agriculture and forestry is traditionally the sector with the highest absolute numbers of self-employed (2007: 120,670), for women as well as men, followed by business-related services (72,764), trade and repair (61,230) as well as the hotel and restaurant business (47,363). Overall, 64% of all gainfully self-employed women and 57% of all gainfully self-employed men work in these sectors.

Figure 58: Self-employed persons according to sectors and gender, share of women in %, 2007

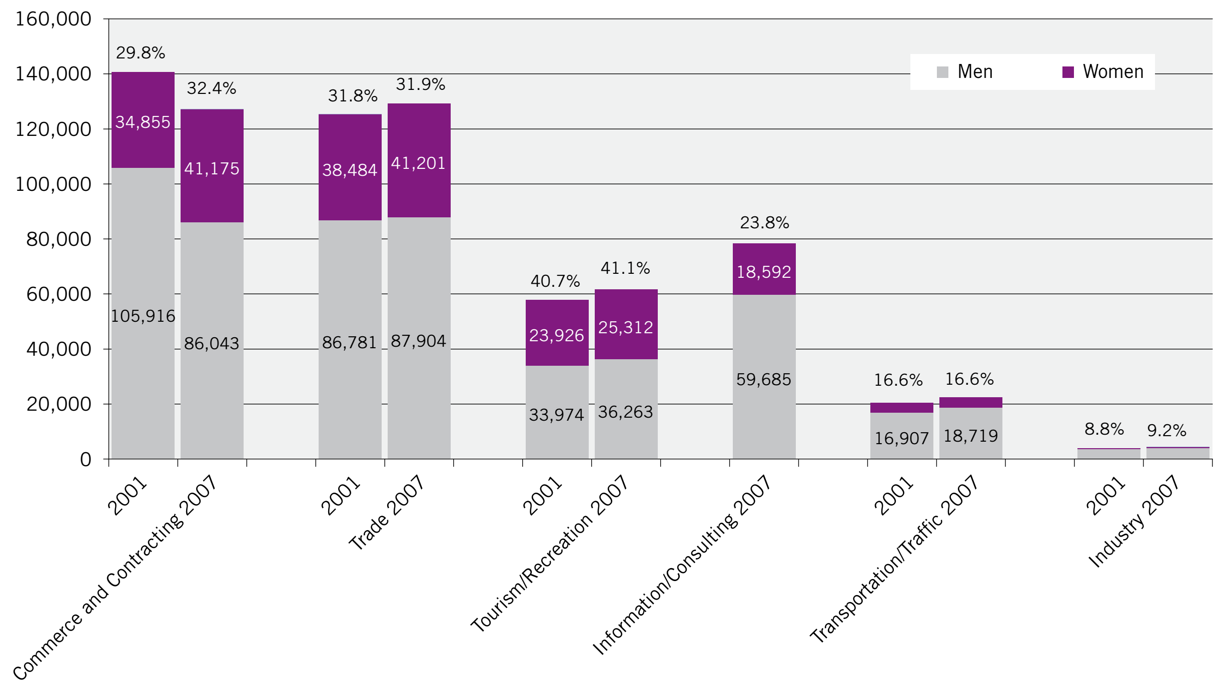


Source: Statistics Austria, microcensus

When we look at the shares of women and men within the individual industries, we see that self-employed women tend to focus their entrepreneurship more on the areas of education, health and social work, in the hospitality industry and the other services. The share of women in all of these economic areas is far above average (33.8%). In contrast, relatively few women are self-employed in the areas of production or construction. Together with the transport area and business-related services, they represent industries with an above-average share of gainfully self-employed men.

The member statistics by the Austrian Federal Economic Chamber show a similar picture. In 2007, about 130,538 or 30.8% out of 423,324 sector members (natural persons) were female. This means that almost every third Chamber member and therefore every third entrepreneur in the commercial sector is a woman. In the two largest sectors (commerce/contracting and trade) about 30% of the self-employed are also women. The highest share of women – with more than 40% – is held by the sector of tourism and leisure activities. The third-largest sector of information and consulting, however, is dominated by men by nearly 80%.

Figure 59: Sector members of the Austrian Federal Economic Chamber* according to gender, share of women in %, 2001 and 2007



* Without the banking and insurance sector, since less than 1% of all sector members operate here.

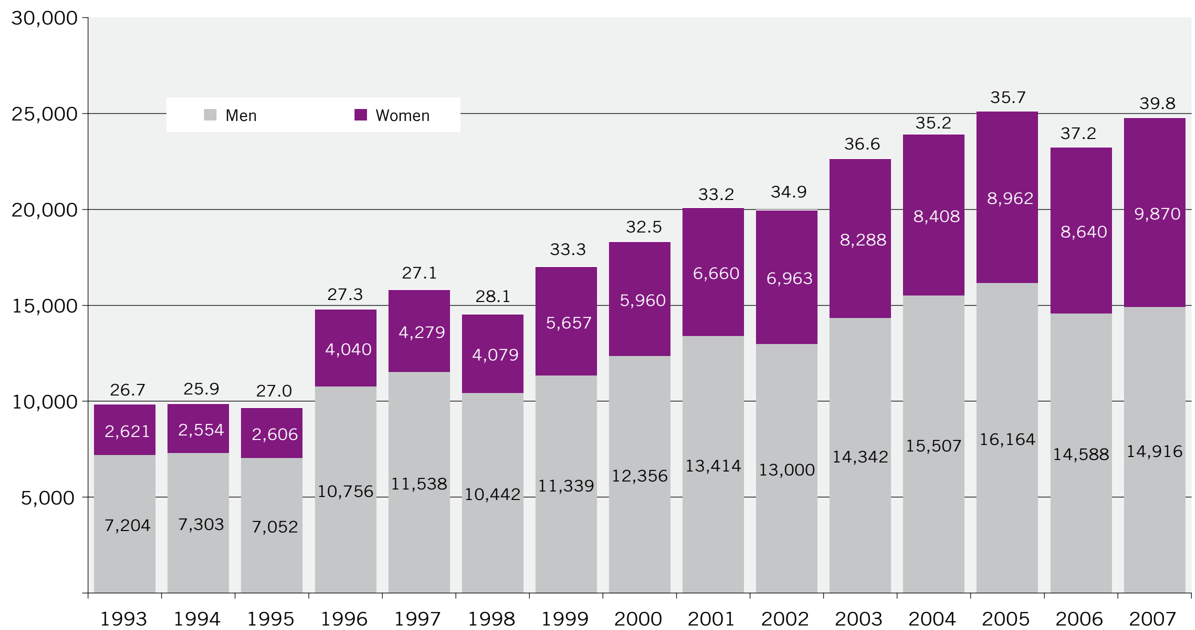
Source: Austrian Federal Economic Chamber, member statistics

This industry distribution is reflected by the professions of the self-employed. The share of women among the self-employed in contracting and technical professions is much lower than in the commercial or service-oriented professions. Reidl et al. (2006) pointed out that the self-employment ratio of women for individual technical professions in Vienna is low compared to that of men: women constitute more than 30% of the permanently employed in the IT sector and architecture but only barely more than 10% of the business owners.

4.6.2 Women are starting up

A closer look at the development of new company formations in Austria in the commercial economy over the last decade reveals positive dynamics among start-ups in general and among newly formed enterprises by women in particular. The share of start-ups by women has also noticeably grown since 1993 (+13% points between 1993 and 2007), as has the absolute number of enterprises founded (+15,000 new businesses). In 2007, the share of women among newly formed sole proprietorships was nearly 40% and is thereby higher than the percentage of women among the sector members of the Austrian Federal Economic Chamber: Nearly 10,000 entities were formed by women in 2007; the number of new formations by women has more than tripled compared to 1994. This growth is greater than the increase of new formations by members of the Austrian Federal Economic Chamber overall.

Figure 60: Development of start-ups in Austria* according to gender, 1993–2005, absolute and share of women in %



* This shows new formations of sole proprietorships, since it was only possible to receive gender-specific statements for these types of businesses. The sole proprietorships represent about 80% of all new company formations in the commercial economy.

Source: Austrian Federal Economic Chamber, start-up statistics 2007

The largest percentage of women among the founders in the commercial economy can be seen in the industries that are traditionally dominated by women. Looking at the twenty most popular industries shows the highest share of women in the area of public and private services (in the specialty groups hair stylists, foot care providers, beauticians and masseuses, 85.9%), in direct sales (66.2%) and the general trade association for this industry (54.0%). There are also many enterprises formed by women in the print business as well as in the textile and shoe industry. About one fourth of all newly formed companies by women are concentrated in these specialty groups. These distinctive gender-specific differences in the choice of industries were also identified as aggravating factors for start-ups in a recent study by Lueger et al. (2007), especially in terms of resources.

As stated in the beginning, the data provided by the Economic Chamber are the most extensive data available in Austria and they can also be used for a comparison over time. But they do not allow for an exact determination of the number of start-ups or new companies formed by women in Austria. In recent years, different empirical studies have addressed the situation of company formations in Austria as well as the share of women among the founders. In terms of the scope and type of enterprise formations, the distribution of the genders presents a very traditional picture here: The share of women in the formation cohort in 1999 examined by Schwarz and Grieshuber (2003) was around one fourth (25.1%). A longitudinal analysis of participators in the enterprise foundation programme (UGP) by AMS calculated an average share of women of 31 % for the period of 1998–2005 (Dornmayer and Lenger, 2006). A recent survey by Statistics Austria (2007) examines enterprises that were founded in 2002 and were still operating in the market in 2005. Here the share of women among the founders is 27.2%. The recent National Report by GEM (Apfelthaler et al., 2008) for 2007 even shows a percentage of women in enterprise formations of 38.1%. The fluctuation range in the shares of women (and men) is therefore barely 15% points, which makes a precise statement about the start-up intensity of women and men more difficult and also indicates a lack of reliable statistics about enterprise formations in Austria (see Schwarz et al., 2005).

There are also differences between women and men in respect to the age distribution: In the studies by Schwarz and Grieshuber (2003) and Schwarz (2006) as well as in the National Report by GEM 2007 for Austria, female founders tend to be slightly older than male founders: Women are represented most often in the age group of the 45 to 54 year-olds (38%); in the group of the 35 to 44 year-olds, the share of women (21%) is much lower compared to that of the men (32%).

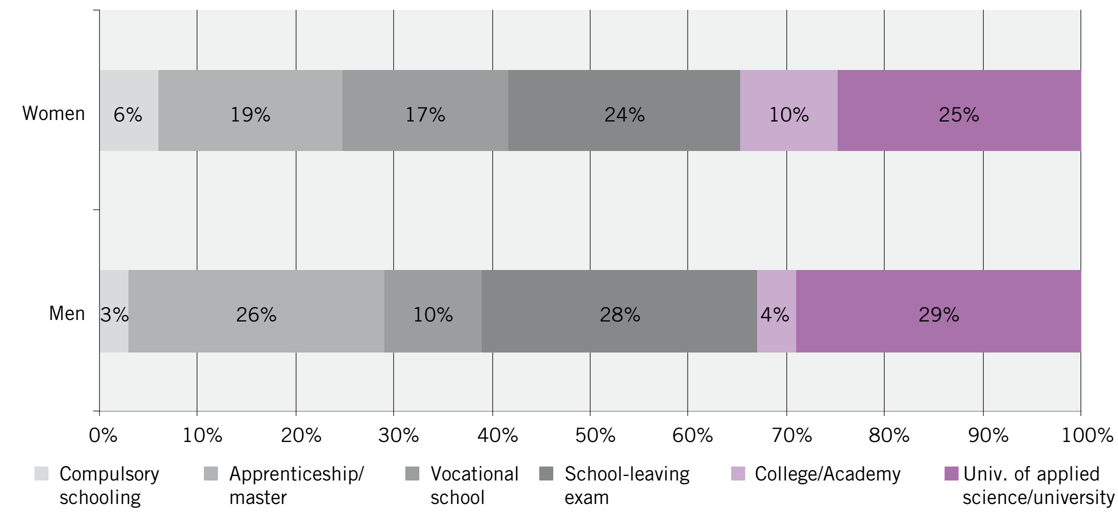
Table 44: Age distribution of enterprise founders according to gender, shares in %, 2007

	Women	Men
18 – 24 Years	16%	7%
25 – 34 Years	19%	14%
35 – 44 Years	21%	32%
45 – 54 Years	38%	33%
55 – 64 Years	6%	13%

Source: Apfelthaler G. et al. (2008), Global Entrepreneurship Monitor: Report 2007, p. 18

Schwarz (2006) points out that this age difference can primarily be attributed to women's parental and support-related absences, which somewhat delay the start-ups by women. In contrast to GEM's Country Report, Schwarz (2006) concluded from their online survey that male founders are younger than female founders: 12.2% of the male founders were under 30 years old at the time of the survey, while this share is only 7.7% in women.
The female founders not only differ from their male colleagues in terms of age but also in terms of their educational level. In general, analyses of the start-up situation in the commercial economy show a clear domination of start-ups based on skilled trades. When we look at the numbers of female to male founders in terms of the highest completed educational level, the female founders tend to have a lower educational level than the male ones (Schwarz 2006, p. 26). Women are represented slightly more frequently among the average educational range, whereas they are rarer in the areas of apprenticeships/master's certificate examinations, school leaving diplomas and university degrees.

Figure 61: The highest completed educational level of female enterprise founders* according to gender, shares in %, 2005



*Austria-wide online survey of founders in November 2005, sample size 1,276
Note: The differences in the highest educational category are significant

Source: Schwarz 2006, p. 26–27

However, compared to all gainfully employed women, founders have completed higher educational levels (see Heckl et al. 2005). Due to the increased educational level, the gender-specific differences have been reduced on the whole, but the existing differences in the trade specialisation or selection of the qualified job continue to impact the decision to form an enterprise.

On average, women form smaller companies than men and frequently start their enterprise without full-time employees as sole proprietorships with a much lower starting capital and sometimes also a lower need for financial resources than men. In combination with a choice of sectors that is segregated according to gender, this is also reflected by the different growth rates. In their study, Lueger et al. (2007) arrive at the result that the average growth of companies formed by men deviates significantly from the growth of those formed by women during the observation periods. While there is an average total growth of 2.8 employees in the enterprises founded by men, this value is only 1.2 employees for enterprises founded by women. The majority of this growth here refers to the first phase of the start-up (approximately the first three years).

4.6.3 Start-ups by women in research and technology

In recent years, an increase in the number of company formations in research and technology-intensive sectors can be observed in Austria in general, such as spinoffs in particular. So far no systematic data are available for specific start-ups by women in this sector in Austria. Therefore the corresponding indications or benchmarks can only be generated based on exemplary observations or the transfer of experience abroad.

Formations by women in the high-tech sector were examined in the scope of a study by the Centre for European Economic Research (ZEW) on high-tech formations in Germany (Metzger et al., 2008). The investigation is based on the data from the high-tech survey by ZEW in 2007. Here it was shown that the share of enterprises formed by women in the high-tech sector amounts to nearly 10% and is therefore less than half as much as the share of women in start-ups overall. The pattern of industry choices by the high-tech founders is very similar to that outside this sector: Women form more companies in the area of technology-oriented services (66%) than in high-grade technology and top technology (12%). Measured by turnover, women form smaller and slower-growing enterprises than men in the high-tech sector as well. There are also gender-specific differences in the financing: The amount of companies financed from the cash flow, meaning the company's continuous income, is lower among the companies founded by women than those founded by men. Women less frequently use their own funds but are more likely to use funds provided by relatives and friends. In respect to the formal educational level, there are few differences between the female and male founders, although the differences are great in terms of the primary knowledge level of the founding team. Technical or engineering science-related knowledge is predominant for a majority of the formations by men (59%). Formations by women focus much more frequently on commercial competency (36%) than on technical or engineering-related competency (32%).

It can be assumed that the percentage of women in high-tech formations is similarly low in Austria as it is in Germany. The reasons for this are diverse and can be traced back to personal as well as structural and societal influences. An essential reason for the low presence of women in the high-tech sector and specifically in the research-intensive industry is in the gender-specific segregated choice of education and profession: women are underrepresented in the technical and engineering fields of education and studies. As a result, this means that they less frequently work in research and technology-intensive sectors.

The share of women among scientists and engineers in the R&D area in 2006 in Austria was barely 24%. Assessments resulting from the population count in 2001 calculate a share of women in technology-oriented professions between 14% for computer technologists, data processors or engineers and 28% for mathematicians, statisticians and bioscientists. For Metzger et al. (2008), these gender-specific differences in education and professions are directly reflected in the qualification of the founders of high-tech enterprises. Formations by men and women include an equal amount of founding teams with higher education graduates with diplomas or comparable certifications. However, start-ups by men have a graduate member twice as often and can more frequently resort to a founder's experiences gained by a scientific education. Because they less frequently have a foothold in these areas, women don't have as much experience with scientific research; this experience is what often stimulates and provides the requirements to form a high-tech company.

The reasons for the weak start-up activity by women in the high-tech sector, however, can be found in more than just women's choices of professions and studies. There are many different barriers for women who consider forming a company in a research or technology-intensive sector. Gender-specific attributions in the technology field show their influences just as much as the stereotypes of start-ups. For example, women who form a company in the high-tech sector often experience a conflict between entrepreneurship and technology; in some fields the different gender structures are quite strong and influence each other strongly. For example, starting a company and working in technology-intensive sectors both traditionally have male connotations. According to Hanappi-Egger et al. (2004), women who form a company in technology-intensive sectors break through their traditionally assigned roles in two ways: For one, they are reclaiming an area that is traditionally and characteristically male, for another they have more visibility and possibly more influence as entrepreneurs. This is a difficult starting situation, and to a certain extent it is made even more difficult by the fact that women in technical jobs are often perceived more in terms of their role as women than as professionals. This interaction between structural barriers (based on the choice of education and profession) and social barriers (role images and stereotypes), complicated by individual barriers that are rooted in personal desires and concepts continues to make professional independence and start-ups by women more difficult, especially in those industries and areas in which they are underrepresented, even if the trend in recent years has been very dynamic. The percentage of women among the new formations in recent years has grown by nearly 14% points and in 2007; already every third company was formed by a woman. However, the existing, gender-specific differences in the choice of industries do not just impact the formation itself but also influence the company growth. Companies in the research and technology-intensive industries tend to have higher growth potentials than for example those in personal services, which is where an increasing number of women are forming their companies.

It is therefore important to encourage start-ups by women in this particular area by specifically targeting them and aiming offers specifically at women. This could uncover new potential, thereby promoting entrepreneurial dynamics as a whole.

An important prerequisite is the improvement of the empirical data foundations and the creation of a uniform statistic or monitoring of business start-ups in order to get a differentiated image of male and female founders in Austria (personal characteristics, structural features, etc.) and break this information down according to the various sectors (e.g. low-/medium-/high-tech, knowledge intensive, etc.).

5 Evaluation of Research and Technology Policy in Austria

Research, technology and innovation policy (RTI policy) has become increasingly important in Austria and throughout Europe in recent years. The Lisbon process and the Barcelona objectives in particular provided additional incentive to move RTI higher up on the overall political agenda. There has also been a considerable increase in media attention. In addition to their verifiable positive effects on growth and employment, RTI-specific measures also allow for a degree of latitude in policy-making that has led to increased political interest. For this reason, and also due to the increase in public spending, there is naturally also a growing demand for information, legitimatisation, learning, and control. Evaluations are used to provide information on the success and failure of measures, to assess the expediency of spending funds for specific measures, and for policy study aimed at improving these measures. This effort is certainly justified, considering that more than € 2.7 billion in public funds were spent for research and technological development in 2008. The purpose of this chapter is to provide a detailed and comprehensive overview of developments in Austria in recent years and thus to illustrate the diversity of categories involved when evaluating this field. The descriptions are based upon Zinöcker and Dinges (2009), Pichler (2009), and Polt (2009). A second section, which should become an integral part of future research and technology reports, introduces recent evaluations that appear to be relevant, along with a summary of their main findings.

5.1 Context and Reasoning

Pichler (2009, p. 46) summarises the use and the significance of evaluation as part of research and technology policy decision-making by pointing out that the financing of research and technology activities through public funding "is not a procurement process." Whereas market forces determine the success of investments in the private sector, the public sector demands an appropriate basis for decision-making as well as specific knowledge in order to legitimise the use of public funds. For this reason, the politicians as the parties providing the funds, support agencies as the parties distributing the funds, and research institutions as the parties receiving the funds all have an equal interest in creating functional evaluation structures. These interests initially coincide at the time of project decisions, when evaluations are used as the mechanism for selecting a specific project.

Nevertheless, evaluations also perform a specific function at a level that transcends projects, programmes, or institutions when decisions on new measures or assessments of new developments need to be made and implemented.

From an institutional perspective, the "evaluation culture" that has been observed over the last few years has resulted in the creation of a platform for evaluating research and technology (fteval)[87]. This laid the cornerstone for an increase in evaluation activities in Austria, evidenced by the fact that more than 60 evaluations were performed in the area of RTI policy during the period of 2003 to 2007. This is no small number for a small country such as Austria, and represents a significant increase over previous years.

The platform is an association spun off in 2006 from a joint venture founded in 1996. Its members include primarily the competent federal ministries, support organisations, and research institutions. The members have agreed to comply with the "standards of evaluation in research and technology policy" adopted by the platform. In a very general way, therefore, this should support the activities of the platform as it attempts to improve the "evaluation culture" in Austria. In particular, standards provide a framework and rules of behaviour for both the evaluator as well as the ordering institutions and the evaluated party. This creates a greater degree of commitment and security for all participants.

The evaluation platform permits an exchange between all of the parties involved in the research and technology policy-making process, and is therefore an important balancing factor in the triangulation of policy, support agencies, and research. At the same time, however, this configuration also means that no single party can assume the evaluation function as a predominant governance instrument, although it can also increase and/or ensure the acceptance of evaluations.

5.2 Legal framework for evaluation

In addition to the activities of the Court of Auditors, which performs some aspects of an evaluation function, there was for some time no statutory framework for evaluation in Austria's RTI policy. The increased significance of evaluation in the area of government subsidies as well as developments at the institutional level have also had logistical effects on the evaluation process in recent years. 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 based upon these laws[88] and for the promotion of commercial-technical research and technology development, the so-called RTD guidelines.[89] 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

87 http://www.fteval.at
88 Federal government guidelines on granting and executing subsidies pursuant to §§ 10–12 FOG, Federal Gazette No. 341/1981
89 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)

through the aforementioned laws, which can act in a largely independent manner.

For universities, an initial detailed evaluation regulation was introduced in 1997 as part of the University Organisation Act of 1993. Currently the University Act of 2002 stipulates the creation of an appropriate quality management system, and its evaluations of a university's entire spectrum of services are to be performed within this framework (§ 14 University Act of 2002).

In addition, the Council for Research and Technology Development has used a recommendation to require the Austrian federal government to consciously use evaluation as an instrument and to actively incorporate it into policy-making (Council Recommendation of 12 April 2005).

5.3 Projects, Programmes, Institutions, and the System

In the fulfilment of their function, evaluations are subject to a constant development process. Consideration of new theoretical approaches as well as the application (and/or development) of adequate methods are essential in order to appropriately monitor the effects of government subsidies and promotion efforts. New approaches in terms of content and methodology have also been developed in this area in recent years. Methods such as logic charts (Zinöcker et al. 2004), logit and probit analyses (Streicher et al. 2004), matched pairs (Pointner and Polt 2005), and focus groups were implemented for the first time. The (possible, positive) effects of evaluations are also underscored by the fact that (some) decision-makers in the agencies and ministries seriously address the results of the evaluation, and either accept the recommendations or reject them based upon reasonable objections. Examples of this include:

- The interaction between policy-making and the evaluation results (Arnold et al. 2004) in the subsidising organisations the Austrian Science Fund (FWF) and the Industrial *Research* Promotion *Fund* (FFF). This evaluation was supplemented with an audit by the Court of Auditors. There was a certain competitive relationship between the two studies, and this was also reflected in their differing results and recommendations. For example, the Court of Auditors recommended that the FWF and FFF be consolidated, while the international evaluation expressly advised against this; the politicians followed the evaluation's recommendation.
- The course taken by the FFF's successor organisation, the Research Promotion Fund (FFG), and the Austrian Science Fund (FWF) with the results of the respective institutional evaluation of 2004 (cf. Binder 2005; Novak 2005).
- The interest in evaluation on the part of ministries and agencies: For example, as of 2004 more than 140 persons (classical evaluation "users") have participated in workshops offered by the Research and Technology Evaluation platform (Zinöcker 2004).
- The organisation in 2003 and 2006 of two significant international conferences on evaluation in the area of research and technology policy: A well-used opportunity for Austrian participants to obtain information on the international state of the discussion.[90]

90 Evaluation of Government Funded Activities in R&D, May 2003. New Frontiers in Evaluation, April 2006. Documentation of these conferences is available at www.fteval.at/03conference03 and www.fteval.at/conference06.

Evaluation at the Project Level

Evaluations at the project level for the purpose of selecting project applications have experienced great advances and further development. For some years now, the Austrian Science Fund FWF has used a proven system of international peer review. Here it should be noted that although this evaluation method was in fact subjected to harsh criticism concerning possible biases and prejudices, it is largely uncontested among researchers (Arnold et al. 2004), and not only in Austria (cf. Dinges 2006). The evaluation of the fund (Streicher et al. 2004) described the professional use of the project selection method, and also showed that no inconsistencies (such as: "older applicants are preferred over younger applicants") can be substantiated.

Similar findings apply for the area of company-oriented project research: Here, the evaluation (Jörg und Falk 2004) clearly described the professionalism of the agency FFF that was processing the application[91], although it also took note of problems in risk evaluation during the project selection process.

In addition, a number of programmes are increasingly striving to create a fair and transparent process for awarding public support to projects. Forms of peer review (such as expert panels, extended peer review)[92] are often used, competitions are organised, and juries are formed. An important factor in this process is working with evaluation at the programme level. Evaluation should clearly trace and describe this form of project award process within such a programme. Various programmes (the special research areas of the FWF, the centres of excellence at the FFG, etc.) explicitly require intermediate and final evaluations of their "projects", and the FFG also evaluates the projects of its core programme at regular intervals after the fact (Sheikh 2005).

Research assignments in the ministries should be considered separately: With the increasing significance of RTI programmes since the early 1990s and the difficult budgetary conditions in the ministries, research assignments have faded into the background. Nevertheless, there were still 750 projects with a budget of approximately € 35 million created in this way in 2002 (Zinöcker and Dinges 2004).

Evaluation at the Programme Level

Evaluations are used today in almost all programmes. This can be attributed primarily to the role of the Council for Research and Technology Development, which has strongly advocated the use of these evaluations. Particularly widely discussed examples for programme evaluations include the Competence Centre Assessment (Edler et al. 2003) and the evaluation of the Technology Transfer Programme (Jörg et al. 2000), whose recommendations had clearly visible effects on the further development of these programmes.

In the area of programme evaluations, two institutional clients were early adapters in terms of seeing the necessity of evaluations: The first was the Ministry for Transport, Innovation and Technology[93], which had evaluations performed on projects that were initiated within the scope of the (no longer existing) Innovation

91 The FFF is the research promotion fund (FFF), which became part of the Austrian Research Promotion Agency FFG in 2004.
92 For the methodological differences, see Rigby 2002 and 2004.
93 In a number of forms and acronyms during the last seven legislative periods.

and Technology Fund (in addition to this ministry, the BMWA was also involved). The second central institutional client was the former Research Promotion Fund (FFF)[94], which had external evaluations performed systematically in all of the initiatives established within its institutional framework (wood research, micro-engineering, food initiatives, etc.).

Evaluation at the Institutional Level

Certainly the most extensive changes in recent years concerns how institutions are evaluated. The central institutions for the promotion of basic and applied research, namely the FWF and FFF, were evaluated in 2004 for the first time in their 40-year existence (Arnold et al. 2004). Other institutions for the promotion of research, such as the Christian Doppler Research Agency (Schibany et al. 2005) or the support structures for the Sixth EU Framework Programme (Sheikh et al. 2004), followed suit.

Another reason for this increasing significance of institutional evaluations was a new, more professional division of labour between ministries and agencies: The shifting of responsibility for programme handling away from ministries and to promotion agencies ("agencification") was a central requirement in a number of evaluations and studies, and was ultimately taken into account in political decision-making as well.

The relationship between ministries and agencies, which can also be depicted as a principal-agent problem, will have a significant influence on the control of Austrian RTI policies. All of the control mechanisms used here will be topics of future evaluations.

In the area of evaluating research institutions, there is also a clear connection to the universities, who were made autonomous with the University Act of 2002 and are now associated with the Ministry of Science by means of performance agreements. The University Act of 2002 required universities to create appropriate quality management systems sufficient to ensure quality and performance in all areas. This includes internal university evaluations, external evaluations by order of the university president's office, the university councils, the Federal Ministry of Science and Research, as well as performance evaluations for individuals. In the service agreements with the Federal Ministry of Science and Research, the universities agreed to perform quality assurance and evaluation, and these activities are therefore essential components of the performance agreements. As also mentioned in the University Report of 2008[95], work on creating quality management systems in the universities continues to advance, activities and tools for quality assurance and evaluation are being increasingly systematised, and they are well anchored in the process.

Relevant information on Austrian universities, including information on quality assurance and evaluation, is systematically recorded in the form of "knowledge balance sheets" (Leitner 2007) and performance reports.

The Austrian Quality Assurance Agency (AQA) is an independent institution created for quality assurance, evaluation, and certification. It is available to all institutions of higher education, and is supported by the main participants (University Conference, Universities of Applied Science Conference, Students' Un-

94 The FFF has been incorporated into the Austrian Research Promotion Agency (FFG), Base Programmes Department.
95 cf. University Report 2008, Chapter 1.4 „Evaluation and Quality Assurance"

ion, Federal Ministry of Science and Research). The AQA has developed various procedures for quality assurance, and it offers the Quality Audit, an independent assessment and certification of quality management systems at universities, universities of applied science, private universities, and pedagogical universities. As part of the AQA pilot project for the support and development of quality management systems, two universities are being supported in the area of research as they create their QM systems.[96]

On behalf of the Federal Ministry of Science and Research, a study is currently being prepared to evaluate research in universities. This study explores the question of how well the evaluation of research functions in Austrian universities, and what role it plays in quality management at universities. The universities thoroughly understand evaluation of research as part of a quality management system, and use it primarily as a tool for reflection and to support the development of quality management. The latter is accomplished by relying upon the evaluation results for planning and decision-making. In recent years, many universities have already set up structures and processes for research evaluation, while others are just beginning to do so. In any case, the institutional learning associated with this process will take several years yet.

The most important institutional representatives of research outside of universities in Austria, namely the Austrian Research Centres and Joanneum Research, which play a significant role in Austria's RTI policy, have not yet been externally evaluated as institutions. This is justified to a certain extent by the fact that these research institutions receive only partial basic subsidies from the state, and in any case must compete for their financing. On the other hand, however, evaluators have not yet been asked whether the (minimal) share of basic subsidies has been properly employed.

Evaluation at the Political and Systemic Level

This area of evaluation is still extremely underdeveloped internationally, although important progress has been made here in Austria in recent years. The most prominent example is certainly the systemic evaluation of research subsidies and financing (see Chapter 2.1) commissioned by the Federal Ministry of Transport, Innovation and Technology (BMVIT) and the Federal Ministry of Economics and Labour (BMWA, now the BMWFJ – the Federal Ministry for Economics, Family and Youth). The purpose of this evaluation is to analyse research subsidies and financing with regard to the performance capabilities of the Austrian innovation system, and to identify any actions needed to bring about improvements. At the same time, other activities in this regard took place at the system level. The research dialogue sponsored by the federal government (Federal Ministry of Science and Research, BMWF 2008; see Chapter 2.2) created a forum for a wide-ranging process of consultation and discussion. Finally, a Policy Mix Peer Review Team also studied the Austrian RTI system as part of the CREST (Comité de la Recherche Scientifique et Technique; EU Committee for Scientific and Technical Research), and developed specific policy recommendations (CREST 2008; see Chapter 2.2.1).

96 cf. University Report 2008, p. 92f. and Summary 1.4-1

At the same time, there is a flowing border to other reports and studies at the political and systemic level: A large number of activities that would be assigned to this area under certain circumstances are not designated as "evaluations", and also have no explicit evaluation function, even though they do contain elements of formative or summative evaluations. These include the research and technology reports that provide an annual picture of the status of RTI policy, as well as the white book produced by the Institute of Economic Research WIFO, which contains clear recommendations for the further development of RTI policy in Austria. The study "Instruments of technology policy and their mix" by Schibany et al. (2005) has in turn contributed to a sustained discussion on the relationship between the individual instruments of RTI policy and how to optimise their use.

Summary

External opinions also confirm that "Austria now possesses one of the most developed and embedded innovation evaluation cultures in Europe" (CREST 2008, p. 19). A highly developed evaluation culture is a central element for a learning and strategically focused RTI policy. A good evaluation culture is likewise a prerequisite and result of good, i.e. efficient, transparent, and fair policies. Nevertheless, as explicitly pointed out by the CREST Peer Review Team, the variety of programmes and the resulting quantity of evaluations can also lead to "paralysis by analysis." Evaluations fulfil their purpose only when their results flow into future policymaking and execution, and appropriate mechanisms are in place to ensure this.

The overview of RTI policy and its evaluation in Austria provide evidence of a vibrant field in which, despite current efforts, there is no lack of challenges for the future. Some of these challenges include:

Data and data access: Austria may well be envious to observe how other countries (e.g. the UK) have succeeded in making the public disclosure of balance sheet data by companies and data on subsidies by politicians relatively easy. A certain taboo in this area still reigns in Austria, even though the keepers of official statistics could set a good example and make access to RTI-relevant data easier. Article 1 of the Federal Statistics Act 2000 (BStatG) declares the goal of providing data "to the federal offices and agencies responsible for planning, decision preparation, and monitoring of activities, as well as to academia, business, and the public."

Generation of data: The quality of the evaluations is directly related to the quality of information (data) collected over the course of the programme. A great deal of caution must be exercised here, however: "Collect all data that is needed and need all data that is collected" is a good principle that will need to be considered, particularly given the possible overburdening of the evaluated parties (see next point).

Evaluation fatigue versus "under-evaluation": It is all too easy to become counterproductive and to create "evaluation fatigue" through too many requests for interviews, too many (and overly extensive) questionnaires, etc. The number of evaluations at the institutional and programme level has increased massively in recent years. That said, it is not sufficient to evaluate central subsidy-granting institutions, such as the FFF and FWF in Austria, only once in 40 years. A reasonable rhythm must be found here to establish the intervals at which long-term initiatives should be evaluated.

Realistic expectations: All too frequently, virtually homeopathic budgets are designated in RTI programmes to achieve goals such as "economic growth," "increased living standards," or "a change in the Austrian mindset." Now is the time to create more realistic expectations and to avoid burdening programmes with an excessive number of goals. Ex post evaluations of past programmes and the targeted use of ex ante evaluations as part of programme design could make an important contribution here.

Open discussion: Evaluations also serve to increase the visibility of programmes, activities, and policy areas, which can easily lead to evaluation becoming simply a tool that is used automatically, but without any real meaning. Thus an "evaluation culture" is not the result of simply the sheer quantity of evaluations already performed, but instead depends upon the willingness and interest on the part of the evaluated parties to respond to critical recommendations and assessments, and to discuss them freely.

5.4 Results of selected evaluations

The evaluations presented here were conducted over the past year and are relevant primarily for federal policy. The selection presented here is also limited to evaluations that are already complete and that are published and accessible on the homepage of the Research and Technology Evaluation platform (http://www.fteval.at). The presentation follows no uniform model, as the evaluations are very specific and differ in their orientation, content and ultimately in their significance.

5.4.1 Interim evaluation – AplusB Academia plus Business spin-off start-ups

The aim of this interim evaluation[97] was to look back on the progress of the A*plus*B programme so far and, on this basis, develop conclusions and recommendations for the further development of the programme in the overall context of the Austrian funding system. Among what are now numerous industry-science linkage programmes, the objective of the A*plus*B programme – initiated in 2001 by the Federal Ministry of Transport, Innovation and Technology (BMVIT) – is to sustainably increase both the prevalence and success of research start-ups. The A*plus*B programme strives to 'create centres that give scientists from universities and research institutions the opportunity to find help and guidance through stimulation, qualification and support on the often difficult path from a good idea to a company. The idea here is not only to provide concrete support in the start-up process but also to more firmly establish entrepreneurism as an option in academic thinking and action.' (Special Guideline, June 2001, page 4)

A*plus*B centres may only be sponsored by limited liability companies, and it is essential that the shareholders include at least one academic institution and one institution with demonstrated expertise. Another requirement is that at least 50% of the company shares be held by institutions entrusted with looking after public interests. This leaves the centres a great degree of freedom in choosing shareholders, so they can take regional circumstances into consideration.

The total budget for A*plus*B is some € 77 mil-

97 Heydebreck, P., K. Petersen (2008): Zwischenevaluierung – AplusB Academia Business Spin-off Gründerprogramm; inno, commissioned by BMVIT, Karlsruhe.

lion. It should be noted that the term of funding is limited to ten years. Each call should include an initial request for the first five years. A decision on the future of the centre is made at the time of the interim evaluation in the fifth year. The result of this 'stop or go' decision has so far been positive in the first five subsidised centres.

Table 45: Total budget of the AplusB programme

	1st funding period		2nd funding period		Total amount	
Approved budget	**in €**	**%**	**in €**	**%**	**in €**	**%**
Total budget	44,506,333	100	32,535,981	100	77,042,314	100
Federal funding	18,506,010	42	10,384,806	32	28,890,816	37
State funding	15,391,020	35	9,789,713	30	25,180,733	33
Equity	10,609,304	24	12,361,462	38	22,970,766	30
start-up projects	316		195		511	

Source: Heydebreck and Petersen (2008)

As Table 45 shows, the overall budget derives from various sources. The A*plus*B special guideline, for example, requires that federal funding be supplemented by financial support at the state level and from private equity:

The federal share in the centres' first funding period may not exceed 45% of the total subsidisable costs with state support of at least 35% and an equity share of at least 20%.

In the sixth to tenth year, the federal share falls to an average of up to 35% with an equity share that is typically 30% (but must be at least 25%).

The centres plan on supporting a total of 511 start-up projects with these funds. As of mid April 2008, the nine A*plus*B centres initiated 236 technology projects; 171 have already produced new technology companies, and 144 start-up projects are now active on the open market following support in the A*plus*B centres.

Table 46: Start-up projects by centre (updated: 15 April 2008)

Centers	State	Start-up projects	Completed	In center	Established
BUILD!	Carinthia	29	21	8	26
CAST	Tyrol	28	19	9	22
INiTS	Vienna	64	44	20	50
SPG	Styria	34	24	10	21
tech2b	Upper Austria	40	24	16	26
ZAT	Styria	17	10	7	13
accent	Lower Austria	8	0	8	5
BCCS	Salzburg	10	2	8	3
v-start	Vorarlberg	6	0	6	5
Total		236	144	92	171

Source: FFG, Heydebreck and Petersen (2008)

Recommendations of evaluation

Good practices include the concept of the A*plus*B programme: The programme as set up was successful overall in terms of structure, content, measures, objectives, resources and target groups. This includes the programme management by the Austrian Research Society (FFG), which adequately and professionally performs and fulfils the project support functions. The same applies to the reporting system specified for the centres – status reports, annual reports, start-up monitoring – and the interim evaluations of the centres.

Potential improvements are seen and appropriate action recommended in the following aspects: The target group of scientists from higher education and research institutions should be opened up along with the group of those with an academic background and several years of professional experience. The period that founders may remain in the centre should be handled more flexibly. The A*plus*B platform should definitely be intensified to improve cooperation at the national level and expand the exchange of opinions at the international level. The marketing of A*plus*B should be pushed toward the establishment of a parent brand.

The recommendation regarding A*plus*B 10+ can and must be: The A*plus*B centres should be allowed to continue their work unhindered to further expand the initial successes with the objective of increasing the entrepreneurial dynamics in Austria. This programme should remain under federal direction – the Federal Ministry of Transport, Innovation and Technology (BMVIT) – to ensure the necessary continuity.

5.4.2 Intellectual property rights at higher education institutions: evaluation of the programme uni:invent (2004–2006)

The aim of the evaluation, commissioned by the Federal Ministry of Science and Research (BMWF) and Federal Ministry of Economics and Labour (BMWA)[98], is to provide an overview of output and an assessment of the programme development to date. On the legal basis of the 2002 University Act (UG 2002), which gave universities new options to use and exploit the fruits of their research (§ 106), uni:invent applies targeted measures to facilitate a cultural shift at universities. The creation of adequate structures ('IPR Management') is intended to facilitate commercial exploitation of research results and provide economic incentives. In addition to the establishment of invention consultants at the institutions of higher education, the Austria Business Service (AWS) also plays a key supportive role in this programme.

The evaluation emphasises that laws provide a necessary but insufficient foundation to increase the economic implementation of research results. There is also a need for flanking measures and corresponding start-up financing to sustainably establish the subject of intellectual property rights at the universities. The uni:invent programme is therefore an important and necessary programme that reflects lawmakers' intentions at the right time and with corresponding funding.

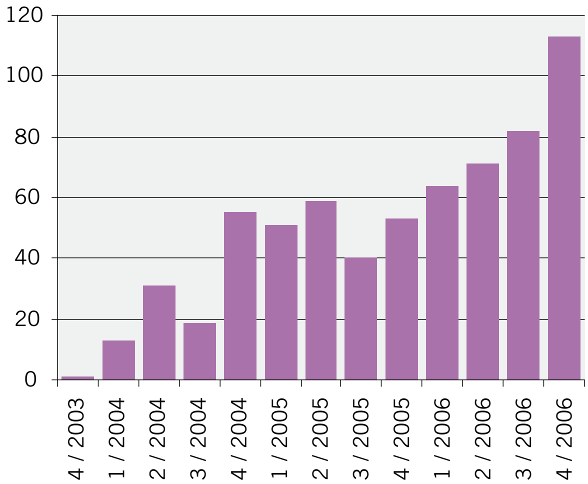
The measurable output for the period examined can be summarised as follows:

- From 2004 to 2006, applications for 652 inventions from 405 inventors were submitted, with medical and technical universities

98 Schibany, A., G. Streicher, B. Nones (2008), Geistige Eigentumsrechte an Hochschulen: Evaluierung des Programms uni:invent; InTeReg Research Report no. 74–2008, Joanneum Research, Vienna.

holding the highest share at over 60% of registered inventions.

Figure 62: Number of registered inventions

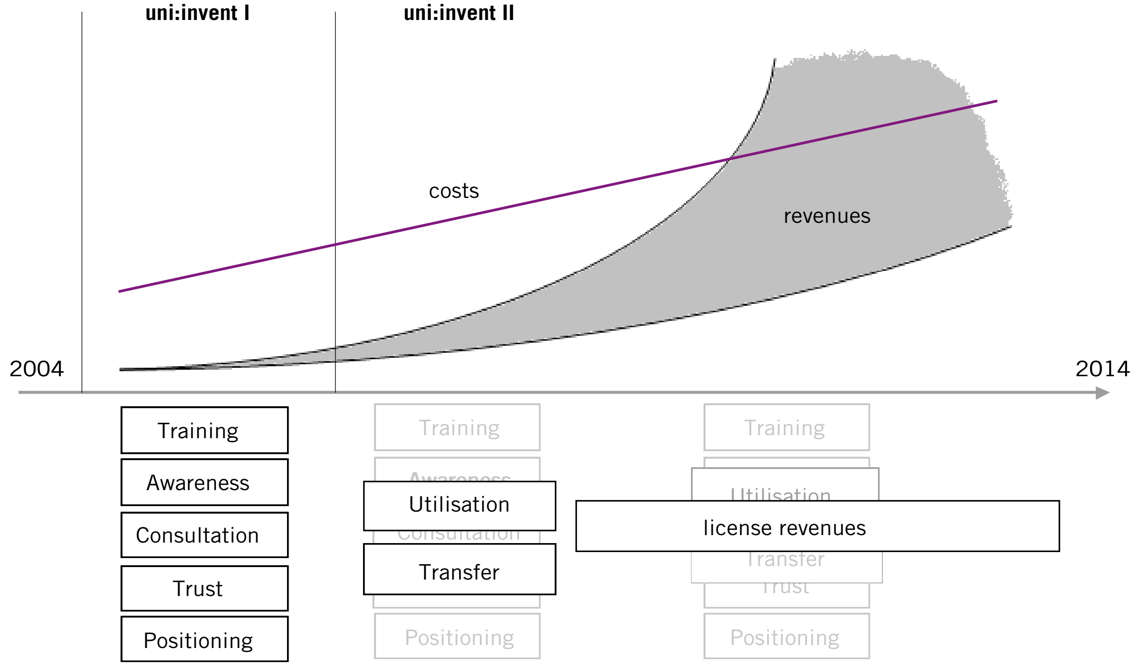


Source: Schibany et al. (2008)

- Biotechnology is by far the most important technology field with nearly a third of all applications. This is followed at some distance by chemical process technology and physics (16% and 13%).
- From the totality of all employee inventions, 281 were picked up by the universities.
- 195 of these employee inventions were registered as patents.
- The revenues already realised from this can be assessed in various ways: from strict license revenues that can be interpreted economically as 'collecting annuities' to research collaborations induced through existing ownership law. Accordingly, the revenues to date range from € 300,000 to € 1 million.

To measure the success of the programme solely on the monetary revenues realised to date would be inadequate and underestimate the measures taken in establishing a 'culture of utilisation' at Austrian institutions of higher education. Besides comprehensive awareness and consulting measures – part of the 'core business' of uni:invent to be maintained in varying intensity and focus – it is above all sector-specific characteristics that determine the trend of the revenue curve. The time factor plays an essential role in the field of life science, for example, as the development phase until the finished product is ready can last an average of ten years or longer. And no revenues flow before a product is ready to be sold. The following illustration attempts to exemplify this fact.

Figure 63: Key points of programme and revenue curve



Source: Schibany et al. (2008)

The evaluation emphasises in its summary that a series of funding programmes has already established the subject of knowledge and technology transfer at the universities. The programmes in their various manifestations target existing potential at the institutions of higher education and pursue various exploitation options. The aim, however, is to create functioning interfaces that must be adapted to the specific requirements of the university. Here, the universities are still in various stages of development.

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Annex

1. Definition of economic sectors

NACE	Industry	Department	Technology definition
01	Agriculture, hunting	Agriculture, hunting and forestry, fishing	-
02	Forestry	Agriculture, hunting and forestry, fishing	-
05	Fishing and fish farming	Agriculture, hunting and forestry, fishing	-
10	Mining of coal, extraction of peat	Mining and quarrying	-
11+13	Extraction of crude petroleum and natural gas; mining of metal ores	Mining and quarrying	-
14	Other mining and quarrying	Mining and quarrying	-
15	Manufacture of food products and beverages	Manufacturing	Other manufacturing
16	Manufacture of tobacco products	Manufacturing	Other manufacturing
17	Manufacture of textiles	Manufacturing	Other manufacturing
18	Manufacture of wearing apparel	Manufacturing	Other manufacturing
19	Manufacture of leather and leather products	Manufacturing	Other manufacturing
20	Manufacture of wood and wood products	Manufacturing	Other manufacturing
21	Manufacture of pulp, paper and paper products	Manufacturing	Other manufacturing
22	Publishing, printing and reproduction of recorded media	Manufacturing	Other manufacturing
23	Manufacture of coke, refined petroleum products	Manufacturing	Other manufacturing
24	Manufacture of chemicals, chemical products	Manufacturing	High-tech
25	Manufacture of rubber and plastic products	Manufacturing	Medium tech
26	Manufacture of other non-metallic mineral products	Manufacturing	Medium tech
27	Manufacture of basic metals and fabricated metal products	Manufacturing	Medium tech
28	Manufacture of fabricated metal products	Manufacturing	Medium tech
29	Manufacture of machinery and equipment n.e.c.	Manufacturing	Medium tech
30	Manufacture of office machinery and computers	Manufacturing	High-tech
31	Manufacture of electrical machinery and apparatus n.e.c	Manufacturing	Medium tech
32	Manufacture or radio, television and communication equipment and apparatus	Manufacturing	High-tech
33	Manufacture of medical, precision and optical instruments	Manufacturing	High-tech
34	Manufacture of transport equipment	Manufacturing	Medium tech
35	Manufacture of other transport equipment	Manufacturing	Medium tech
36	Manufacture of furniture; manufacturing n.e.c.	Manufacturing	Other manufacturing
37	Recycling	Manufacturing	Other manufacturing
40	Electricity, gas, steam and hot water supply	Electricity, gas and water supply	-
41	Collection, purification and distribution of water	Electricity, gas and water supply	-
45	Construction	Construction	-
50	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	Services	Other services
51	Wholesale trade and commission trade, except of motor vehicles and motorcycles	Services	Other services
52	Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods	Services	Other services
55	Hotels and restaurants	Services	Other services
60	Land transport; transport via pipelines	Services	Other services

61	Water transport	Services	Other services
62	Air transport	Services	Other services
63	Supporting and auxiliary transport activities; activities of travel agencies	Services	Other services
64	Post and telecommunications	Services	Other services
65	Financial intermediation, except insurance and pension funding	Services	Other services
66	Insurance and pension funding, except compulsory social security	Services	Other services
67	Activities auxiliary to insurance and pension funding	Services	Other services
70	Real estate activities	Services	Other services
71	Renting of machinery and equipment without operator and of personal and household goods	Services	Other services
72	Computer and related activities	Services	High-tech knowledge intensive
73	Research and development	Services	High-tech knowledge intensive
74	Other business activities	Services	Other services
75	Public administration and defence; compulsory social security	Services	Other services
80	Education	Services	Other services
85	Health and social work	Services	Other services
90	Sewage and refuse disposal, sanitation and similar activities	Services	Other services
91	Activities of membership organisations n.e.c.	Services	Other services
92	Recreational, cultural and sporting activities	Services	Other services
93	Other service activities	Services	Other services
95	Activities of households	Services	Other services

Source: Statistics Austria; own technology classification (based on OECD)

2. System Evaluation of Research Subsidies and Financing: Scope of services

The evaluators are requested to elaborate on the following issues:
- Analysis of system health: Is the Austrian RDTI funding system overall healthy?
- Does the system fit to current and future requirements?

The evaluation should touch upon the framework of governmental intervention (reflecting also the interplay with European and regional levels), the individual instruments and RTDI institutions and their systemic interaction as discussed below. The associated questions are not intended to be comprehensive nor compulsory set of questions. Rather are they intended to illustrate areas of interest of the clients and hence represent a guideline for the evaluator.

Framework

Framework Conditions

The field of RTDI is characterized by its diversity and by its linkages to other policy areas and systems like education or the economy.

Question 1: Assessment of the role of the frameworks conditions, human resources, tax and fiscal regimes in the innovation system.

Governance

In the last few years, the Austrian system experienced a set of administrative and organizational reforms which led to a professional system of division of labour between several ministries and agencies ('Agencyfication').

Question 2: Is there a strategic approach towards governmental intervention in the Austrian system?
- Federal Government ('Bund'), Regional Governments ('Länder') and the European level: How coherent are federal, and regional policies? How do they correspond to European policies?

Question 3: Are the mechanisms used to manage the relation between the ministries and the agencies effective and efficient?
- Is there a need for more coordination?
- Are the institutional structures and the division of labour in devising and implementing RTDI interventions effective?

Instruments & Interventions

The Austrian system has developed a rich system of public funding. The instruments can be classified as:
- Indirect measures, such as the public sector forsaking tax income from the private sector in exchange for approved RTDI investment behaviour. Indirect measures also comprise catalytic Financial RTDI measures.
- Direct measures, such as the direct transfer of financial support for RTDI via grants, conditional loans, warranties and block grants to RTDI institutions.

Indirect Measures

Instruments of indirect fiscal research advancement (Tax Credits and Tax Allowances) are crucial and (financially) very important in Austria;
Question 4**:** What evidence can be given about the structure, the usage, the acceptance and the effects of these instruments?

Direct Measures

Direct measures are the most elaborate ones of these measures: 'Elaborate' in terms of quantity of instruments used. The clients are interested in the assessment of direct measures which can be classified bottom up, top down, (including mission oriented, functional approaches) etc.

***Question 5*:** Are the rationale, strategies, approaches and the thematic focus of these measures still relevant and realistic? Is the choice of bottom-up and top-down programmes appropriate?

***Question 6*:** Are the resource endowment and the size the instruments sufficient to reach the goals of the intervention?
RTDI institutions: As mentioned above, the goal of this evaluation is NOT an assessment of the quality of RTDI institutions such as universities, Austrian Research Centers, competence centers, or the Austrian Academy of Sciences. However, the funding of RTDI institutions (e.g. via the General University Funds, GUF) (in terms of the size of the outlays) feeds back to functionality of the remaining set of direct measures in the Austrian RTDI system: a good reason to pose questions to the evaluator.

***Question 7*:** What are the effects of block grants on the behaviour of beneficiaries?

Question 8: What are the effects of block grants such as GUF on the remaining set of direct measures used?

Systems Perspective

The assessment of the Austrian RTDI intervention landscape from a systems perspective is the core of this evaluation endeavour. The evaluators are encouraged to use any available information to get a concise picture of the systemic interaction of individual instruments and institutions. Some of the available information sources are collected in the appendix to this document.

Systemic Fit of the Intervention Logic

Governments do not fund RTDI for its own sake. The most prominent rationale for government intervention is market failure (both in allocation and distribution) and system failures.

Question 9: Are these failures addressed in a sufficient and comprehensive way on the system level?
– Do needs / problem areas and the number of instruments correspond?
– Is there an overlap, or are there white spots concerning problem areas / target groups?
– Is there over / under representation of problem areas / target groups?

Question 10: Is governmental intervention in Austria (taking into account also intervention at the European and regional levels) capable of reducing these failures?

Systemic Interplay of Interventions

The underlying hypothesis of this evaluation is that the overall systemic effects of governmental intervention cannot be assessed by the simple aggregation of the effects of individual intervention. The effects on the system level accrue through the interplay – particularly between tax incentives and bottom-up funding – of individual interventions, their complementarities, their contradictions. The evaluator supplies an assessment of the joint effects of the interventions on the system level.

***Question 11*:** Can contradictions, substitution effects and complementarities be identified?

Question 12: Does the system of governmental interventions structure and support the connectivity of actors and institutions within the innovation system?

Question 13: How coherent is the set of the instruments used? Are the incentive mechanisms compatible if several interventions target the same actors or groups of actors?

Target

The following aspects are of particular interest to the clients and therefore, should be adressed in the evaluation accordingly: In the business sector: large companies (also MNEs), SMEs, start-ups and RTDI novices; in the science and research sector; university sector and the non-university sector ("Ausseruniversitäre Forschung"),: researchers, young researchers, and gender aspects are of particular interest to the clients. These should be addressed in the evaluation accordingly.

***Question 14*:** How does the system of governmental intervention cover the target groups (users)?
- Is there evidence for double founding?
- Is there competition between instruments concerning the attraction of users?

Question 15: What is the users' perspective and their assessment of the system of governmental intervention in Austria?

***Question 16*:** What is the users' behaviour in the system of governmental intervention?
- Is there evidence for strategic / opportunistic behaviour?

Recommendations & Scenarios

The recommendations made in this evaluation should lead to continuous improvement in the Austrian innovation system within the European context: through the analysis the clients want to learn a hierarchy of improvement steps ranging from incremental improvement, which can be implemented within a short time horizon to (if necessary) radical changes, which can be considered in a medium to long term perspective. The recommendations should reflect likely or potential changes in the international and national context. The evaluator should link up to national and international strategic discussions about research priorities. The evaluator will structure these developments and develop scenarios in an appropriate way. The recommendation will be linked to these scenarios.

Source: BMVIT and BMWA (2007)

3. An overview of the new industry taxonomies

Nace	Industry	Training intensity	Innovation intensity
		AI	II
10	Mining of coal, extraction of peat	Medium	Medium-to-low
11	Extraction of crude petroleum and natural gas	Medium	Medium-to-low
14	Other mining and quarrying	Medium	Low
15	Food products, beverages and tobacco	Low	Medium-to-low
16	Tobacco processing	Low	Medium-to-low
17	Textiles	Low	medium-to-high
18	Wearing apparel	Low	Low
19	Leather and leather products	Low	Low
20	Treatment and processing of wood	Low	Medium
21	Paper and pulp	Medium	Medium
22	Publishing and printing	Medium	Medium-to-low
23	Coke, refined petroleum products	Medium	medium-to-high
24	Chemicals	Medium	medium-to-high
25	Rubber and plastic products	Medium	medium-to-high
26	Glass	Low	medium-to-high
27	Manufacture of basic metals and fabricated metal products	Low	medium-to-high
28	Metal products	Low	Medium
29	Manufacture of machinery and equipment	Medium	High
30	Office machinery and computers	High	High
31	Electrical machinery	Medium	High
32	Radio, television and communication equipment	Medium	High
33	Medical, precision and optical instruments	Medium	High
34	Motor vehicles, trailers and semi-trailers	Medium	medium-to-high
35	Other transport equipment	Medium	medium-to-high
36	Furniture, jewellery, musical instruments, sports equipment etc.	Medium	Medium
37	Recycling	Medium	Low
40	Electricity, gas, team and hot water supply	Medium	Medium-to-low
41	Collection, purification and distribution of water	Medium	Medium-to-low
45	Construction	Low	-
50	Sale, maintenance & repair of motor vehicles & motorcycles	Low	-
51	Wholesale	Medium	Low
52	Retail	Medium	-
55	Hotels and restaurants	Low	-
60	Land transport; transport via pipelines	Medium	Low
61	Water transport	Medium	Low
62	Aeronautics	Medium	Medium
63	Supporting and auxiliary transport activities; activities of travel agencies	Medium	Low
64	Post and telecommunications	Medium	medium-to-high
65	Financial intermediation	Medium	Medium
66	Insurance and pensions funding	Medium	Medium-to-low
67	Activities auxiliary to insurance and pension funding	Medium	Low
70	Real estate activities	Medium	-
72	Computer and related activities	High	High
73	Research and development	High	High
74	Other business activities	High	Medium

Note: The training and innovation intensity is determined to be high, medium or low based on a multilevel and multivariate statistical cluster method. For example, the educational level completed by the employees, the R&D expenses of the businesses, the question as to whether innovations are new for the market or only for the company, registration of patents and other protective rights, and the relative importance of external and internal knowledge sources were all taken into consideration as variables. The information is based on individual and company data. The theoretical reasoning, data, methods and validation of the results have been documented in detail in Peneder (2007, 2008).
Source: Peneder (2007, 2008).

Statistical Annex

1 Financing of gross domestic expenditure on R&D and research rate 2009 (Tables 1 and *1a*)[1]

The Austrian gross domestic expenditures for research and experimental development (R&D) – i.e., the total sum of expenditures for R&D carried out in Austria – will reach 2.73% of the gross domestic product in 2009, an increase of 1.8% over 2008. Accordingly, the latest estimate of Statistics Austria shows that expenditures for R&D in Austria for the current year are expected to total € 7.652 billion. The significantly lower research expenditures than in previous years – the average annual increase was 9.4% in the period 2004 to 2008 – can be attributed to the current prediction of an economic downturn for Austria.

At 45.0% (approximately € 3.44 billion), business will finance the largest share of total research expenditures in 2009. The public sector will contribute 39.9% (approximately € 3.1 billion). Of that amount, the federal government will contribute approximately € 2.55 billion, the states approximately € 402 million, other public institutions such as local governments, chambers, social insurance carriers approximately € 104 million. Foreign entities will finance 14.8% and the private non-profit sector will finance 0.4% (approximately € 29 million). The greatest share of financing from abroad (approximately € 1.13 billion) originates from European companies affiliated with domestic companies that have chosen Austria as a research site and includes the return flows from the EU framework programmes for research, technological development and demonstration.

For comparison, the gross domestic expenditures for R&D are expressed as a percentage of gross domestic product (research rate). For Austria, this indicator has risen from 1.10% in 1981 to 2.73% in 2009 and has clearly exceeded the EU average in recent years. The most current pan-European comparison data are available for 2006, showing an average for the European Union (EU27) of 1.84% and 2.46% for Austria.

The current global estimate of the Austrian gross domestic expenditures for R&D included the final results of Statistics Austria's survey concerning research and experimental development for the 2006 reporting year and the first partial results of the R&D survey of businesses for 2007. These results show lower growth of R&D financing by the corporate sector compared to the previous years with a continuation of this trend in 2008. In 2009 the currently projected economic downturn for Austria will bring with it a decline in self-financing of R&D by companies. At € 3.44 billion, financing by business will be 1.3% lower than the 2008 figure.

As the greatest share of R&D financing from abroad originates from European companies affiliated with domestic companies, the economic forecasts make a far more severe decline likely. Based on information currently available, R&D funds can be expected to drop by 6.2%. At € 1.13 billion, research funds from abroad will be lower in 2009 than the result of the 2006 survey (€ 1.16 billion) after slight increases in 2007 and 2008.

Based on information available to Statistics Austria concerning the development of R&D-relevant budget components and additional R&D subsidies – in particular refunds by the federal government to companies in connection with the research premium, the financing of research by the federal government in 2009 at € 2.55 billion will exceed the 2008 figure

1 On the basis of the results of the R&D statistical surveys and other currently available documents and information, in particular the R&D related estimates and yearend closing data of the national government and the states, Statistics 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).

by 8.9% and make a significant contribution towards stabilising Austrian research expenditures.

2. Federal R&D spending in 2009

2.1. The federal expenditure shown in *Table 1* for R&D carried out in Austria in 2009 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 Schedule T (in the draft version of the federal budget for 2009). The estimate also includes the funds from the National Foundation for Research, Technology, and Development available for 2009 as well as the estimates of the payout for research premiums expected for 2009 which are based on the information available in mid-April 2009 (Source: Federal Minister of Finance).

2.2. In addition to its expenditures for R&D in Austria, in 2009 the federal government will pay contributions to international organisations aimed at research and the promotion of research amounting to € 71.1 million. They are shown in Schedule 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's expenditures for research, as summarised in Schedule **T**[2] **(Part a and Part b)**, which include the expenditures for contributions to international organisations (see above Pt. 2.2), are traditionally included under the title "Expenditures of the federal government for research and promotion of research."
These correspond to what is called the "GBAORD" concept[3], that is used by the OECD and EU on the basis of the Frascati Manual, referring primarily to the budgets of the central government and the states. In contrast to the domestic model these budgets include research-relevant contributions to international organisations and form the basis for the classification of R&D budget data and the basis for the classification of R&D budget data according to socio-economic goals for the reporting to EU and OECD.

In 2009 the following socio-economic goals get the largest portions of the expenditures of the state for research and research promotion:

- General knowledge advancement: 29.7%
- Promotion of trade. Commerce and industry: 25.7%
- Promotion of health care: 20.6%
- Promotion of social and socio-economic development: 5.3%
- Promotion of research on the earth, the seas, the atmosphere, and space 4.5%
- Promotion of environmental protection: 4.0%
- Promotion of agriculture and forestry: 3.1%

3. R&D expenditures by the Austrian states

The research financing by the Austrian government as collated in *Table 1* is listed from the state budget-based estimates reported by the offices of the state governments. The R&D expenditures of the state institutions are estimated annually by Statistics Austria by a methodology agreed on with the state governments.

4. An international comparison of 2006 R&D expenditure (Table 10)

The overview table shows Austria's position compared to the other Member States of the European Union and the OECD in terms of the most important R&D related indices (Source: OECD, MSTI 2008-2).

2 2009: Schedule T in accordance with the draft version of the federal budget

3 GBAORD: Government Budget Appropriations or Outlays for R&D = (official EU translation).

List of Tables

1: Global estimate for 2009: Gross domestic expenditure on R&D
Financing of research and experimental development carried out in Austria in 1989 – 2009

Financing sources	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1. Gross domestic expenditure on R&D (in € million)	**1,669.07**	**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**	**6,971.49**	**7,516.58**	**7,652.27**
of which financed by:																		
Federal government [1)]	617.84	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	2,031.25	2,337.04	2,545.50
State governments [2)]	89.38	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	359.48	367.00	401.86
Corporate sector [3)]	885.35	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	3,280.07	3,483.73	3,439.83
Abroad [4)]	53.87	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	1,190.04	1,207.70	1,132.37
Others [5)]	22.63	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	110.65	121.11	132.71
2. Nominal GDP [6)] (in € billion)	**126.84**	**159.16**	**167.01**	**174.61**	**180.15**	**183.48**	**190.85**	**197.98**	**207.53**	**212.50**	**218.85**	**223.30**	**232.78**	**244.45**	**257.29**	**270.84**	**282.20**	**280.11**
3. Gross domestic expenditure on R&D as a % of GDP	**1.32**	**1.45**	**1.53**	**1.55**	**1.60**	**1.70**	**1.78**	**1.90**	**1.94**	**2.07**	**2.14**	**2.26**	**2.26**	**2.47**	**2.46**	**2.57**	**2.66**	**2.73**

Status: 04 May 2009

Source: Statistics Austria (Bundesanstalt Statistik Österreich)

1 1989, 1993, 1998, 2002, 2004 and 2006: Survey results (federal government including the Austrian Science Fund, the two research promotion funds and in 1989, 1993 and 2002 also including ITF) 1994–1997, 1999-2001, 2003 and 2005: Schedule T/Part b of the Auxiliary Document for the Federal Finances Act (actual).
2005: Also included (not part of Schedule T) were: € 84.4 million for the National Foundation for Research, Technology and Development and € 121.3 million in research premiums paid our under Federal Law Gazette II No. 506/2002.
2007: Preliminary draft of Schedule T/Part b based on preliminary result 2007 (Federal Minister of Finance, as per April 2009). Also included (not part of Schedule T) were: € 85.5 million National Foundation for Research, Technology and Development and € 242.3 million research premiums paid out.
2008: Preliminary draft of Schedule T/Part b based on preliminary result 2008 (Federal Minister of Finance, as per April 2009). Also included (not part of Schedule T) were: € 91.0 million National Foundation for Research, Technology and Development and € 340.6 million research premiums paid out.
2009: Preliminary draft of Schedule T/Part b (Federal Minister of Finance, as per the draft of the federal budget). Also included (not part of Schedule T) were: € 35.0 million National Foundation for Research, Technology and Development, as well as € 380.0 million for research premiums expected to be paid out based on information currently available (source: Federal Minister of Finance).

2 1989, 1993, 1998, 2002, 2004 and 2006: survey results. 1994–1997, 1999-2001, 2003, 2005 and 2007-2009: based on the estimates of R&D expenditure reported by the state government offices.

3 Financing by business. 1989, 1993, 1998, 2002, 2004 and 2006: survey results. 1994–1997, 1999-2001, 2003, 2005 and 2007-2009: Estimate based on the results of R&D surveys made by Statistics Austria in all economic sectors and the R&D survey carried out by the Austrian Economic Chamber in the industrial sector up to 1993, taking into consideration the preliminary partial results of the 2007 R&D survey in the business sector.

4 1989, 1993, 1998, 2002, 2004 and 2006: survey results. 1994–1997, 1999-2001, 2003, 2005 and 2007-2009: estimates made by Statistics Austria. From 1995 including returns from the EU Framework Programmes for Research, Technological Development and Demonstration.

5 Financing by local governments (excluding Vienna), chambers, social insurance institutions and other public financing and from the private non-profit sector. 1989, 1993, 1998, 2002, 2004 and 2006: survey results. 1994–1997, 1999-2001, 2003, 2005 and 2007-2009: estimates made by Statistics Austria.

6 1989-2008: Statistics Austria. 2009: Austrian Institute of Economic Research (WIFO), economic forecast March 2009.

Table 2: Global estimate for 2009: Gross domestic expenditure on R&D
Financing of research and experimental development carried out in Austria in 1989-2009 (as a percent of GDP)

Financing sources	1989	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1. Gross domestic expenditure on R&D (as a % of GDP)	*1.32*	*1.45*	*1.53*	*1.55*	*1.60*	*1.70*	*1.78*	*1.90*	*1.94*	*2.07*	*2.14*	*2.26*	*2.26*	*2.47*	*2.46*	*2.57*	*2.66*	*2.73*
of which financed by:																		
Federal government [1)]	0.49	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	0.75	0.83	0.91
State governments [2)]	0.07	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	0.13	0.13	0.14
Corporate sector [3)]	0.70	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	1.21	1.23	1.23
Abroad [4)]	0.04	0.04	0.06	0.11	0.19	0.26	0.36	0.37	0.39	0.41	0.46	0.45	0.44	0.44	0.45	0.44	0.43	0.40
Other [5)]	0.02	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	0.05
2. Nominal GDP 6) (in € billion)	**126.84**	**159.16**	**167.01**	**174.61**	**180.15**	**183.48**	**190.85**	**197.98**	**207.53**	**212.50**	**218.85**	**223.30**	**232.78**	**244.45**	**257.29**	**270.84**	**282.20**	**280.11**

Status: 04 May 2009

Source: Statistics Austria (Bundesanstalt Statistik Österreich)

Footnotes cf. Table 1.

Table 3: Federal expenditure on R&D, 2006 to 2009
Breakdown of Schedule T of the Auxiliary Document for the Federal Finances Act 2008 and preliminary draft of Schedule T according to the draft budget for 2009 (Part a and Part b, respectively)

Ministries 1)	Actual				Budget			
	2006 2)		2007 3)		2008 3)		2009 3)	
	€ million	%	€ million	%	€ million	%	€ million	%
Federal Chancellery (BKA)4)	1.575	*0.1*	1.576	*0.1*	1.665	*0.1*	2.027	*0.1*
Federal Ministry of the Interior (BMI)	0.543	*0.0*	0.576	*0.0*	0.573	*0.0*	0.683	*0.0*
Federal Ministry for Education, Science and Culture	1,221.138	*71.9*	.	.	.	.	.	.
Federal Ministry for Education, Art and Culture (BMUKK)	.	.	39.947	*2.3*	41.820	*2.2*	66.534	*3.0*
Federal Ministry for Science and Research (BMWF)	.	.	1,239.995	*70.3*	1,279.235	*66.3*	1,554.282	*70.7*
Federal Ministry for Social Security, Generations and Consumer Protection (BMSG)	1.697	*0.1*	.	.	.	.	.	.
Federal Ministry for Social Affairs and Consumer Protection (BMSK)	.	.	1.563	*0.1*	1.816	*0.1*	.	.
Federal Ministry for Labour, Social Affairs and Consumer Protection	.	.	.	.	.	.	2.264	*0.1*
Federal Ministry for Health and Women	6.214	*0.4*	.	.	.	.	.	.
Federal Ministry for Health, Family and Youth (BMGFJ)	.	.	5.261	*0.3*	5.583	*0.3*	.	.
Federal Ministry for Health	.	.	.	.	.	.	4.675	*0.2*
Federal Ministry for Foreign Affairs	1.850	*0.1*	.	.	.	.	.	.
Federal Ministry for European and International Affairs (BMEIA)	.	.	1.727	*0.1*	1.789	*0.1*	1.905	*0.1*
Federal Ministry of Justice (BMJ)	0.117	*0.0*	0.098	*0.0*	0.111	*0.0*	0.130	*0.0*
Federal Ministry of Defence (BML)	1.602	*0.1*	1.674	*0.1*	2.082	*0.1*	.	.
Federal Ministry of Defence and Sports	.	.	.	.	.	.	2.308	*0.1*
Federal Ministry of Finance (BMF)5)	33.607	*2.0*	33.162	*1.9*	132.931	*6.9*	33.098	*1.5*
Federal Ministry for Agriculture, Forestry, Environment and Water Management (BMLFUW)	45.659	*2.7*	51.365	*2.9*	46.850	*2.4*	74.838	*3.4*
Federal Ministry for Economics and Labour (BMWA)	51.835	*3.1*	60.273	*3.4*	64.046	*3.3*	.	.
Federal Ministry of Economy, Family and Youth	.	.	.	.	.	.	83.617	*3.8*
Federal Ministry of Transport, Innovation and Technology (BMVIT)	331.713	*19.5*	326.800	*18.5*	350.621	*18.2*	375.239	*17.0*
Total	**1,697.550**	***100.0***	**1,764.017**	***100.0***	**1,929.122**	***100.0***	**2,201.600**	***100.0***

Status: April 2009

Source: Statistics Austria (Bundesanstalt Statistik Österreich)

1 In accordance with the applicable version of the Federal Ministries' Act of 1986 (2006: Federal Law Gazette I No. 17/2003; 2007, 2008: Federal Law Gazette I No. 6/2007); 2009: Federal Law Gazette I No. 3/2009).
2 Auxiliary Document for the Federal Finances Act 2008. Revised data.
3 Preliminary draft of Schedule T (as per the draft of the federal budget).
4 2009: including the highest executive bodies.
5 Including, in the cash management section, (University Act: 51) the funds provided for under the "Proactive Research Programme" (2008: € 100 million).

Table 4: Federal expenditure from 1993 to 2009 on research and research promotion by socio-economic objectives
Breakdown of Schedule 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
1993 1)	in 1000 €	1,063,049	48,743	48,585	153,961	18,381	27,194	14,308	262,368	69,792	51,015	6,080	20	9,353	353,250
	in %	*100.0*	*4.6*	*4.6*	*14.5*	*1.7*	*2.6*	*1.3*	*24.7*	*6.6*	*4.8*	*0.6*	*0.0*	*0.9*	*33.1*
1994 2)	in 1000 €	1,151,932	50,916	49,590	177,759	21,797	36,287	14,997	273,868	78,242	52,342	5,747	137	10,767	379,484
	in %	*100.0*	*4.4*	*4.3*	*15.4*	*1.9*	*3.2*	*1.3*	*23.8*	*6.8*	*4.5*	*0.5*	*0.0*	*0.9*	*33.0*
1995 3)	in 1000 €	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 4)	in 1000 €	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 5)	in 1000 €	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 6)	in 1000 €	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 7)	in 1000 €	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 8)	in 1000 €	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 9)	in 1000 €	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 10)	in 1000 €	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 11)	in 1000 €	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 12)	in 1000 €	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 13)	in 1000 €	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 14)	in 1000 €	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 15)	in 1000 €	1,764,017	80,962	64,925	435,644	28,001	38,412	19,990	373,431	90,652	56,075	9,673	27	894	565,331
	in %	*100.0*	*4.6*	*3.7*	*24.7*	*1.6*	*2.2*	*1.1*	*21.2*	*5.1*	*3.2*	*0.5*	*0.0*	*0.1*	*32.0*
2008 16)	in 1000 €	1,929,122	88,321	61,668	510,366	24,781	47,161	21,086	402,733	95,295	60,274	10,132	148	978	606,179
	in %	*100.0*	*4.6*	*3.2*	*26.5*	*1.3*	*2.4*	*1.1*	*20.9*	*4.9*	*3.1*	*0.5*	*0.0*	*0.1*	*31.4*
2009 16)	in 1000 €	2,201,600	99,161	69,234	565,766	53,112	48,478	41,227	452,894	115,651	87,633	11,404	166	1,367	655,507
	in %	*100.0*	*4.5*	*3.1*	*25.7*	*2.4*	*2.2*	*1.9*	*20.6*	*5.3*	*4.0*	*0.5*	*0.0*	*0.1*	*29.7*

Status: April 2009

Source: Statistics Austria (Bundesanstalt Statistik Österreich)

1) Schedule T of the Auxiliary Document for the Federal Finances Act 1995, actual figures. Revised data. – 2) Schedule T of the Auxiliary Document for the Federal Finances Act 1996, actual figures. – 3) Schedule T of the Auxiliary Document for the Federal Finances Act 1997, actual figures. – 4) Schedule T of the Auxiliary Document for the Federal Finances Act 1998, actual figures. – 5) Schedule T of the Auxiliary Document for the Federal Finances Act 1999, actual figures. – 6) Schedule T of the Auxiliary Document for the Federal Finances Act 2000, actual figures. Revised data. – 7) Schedule T of the Auxiliary Document for the Federal Finances Act 2001, actual figures. Revised data. – 8) Schedule T of the Auxiliary Document for the Federal Finances Act 2002, actual figures. – 9) Schedule T of the Auxiliary Document for the Federal Finances Act 2003, actual figures. – 10) Schedule T of the Auxiliary Document for the Federal Finances Act 2004, actual figures. – 11) Schedule T of the Auxiliary Document for the Federal Finances Act 2005, actual figures. – 12) Schedule T of the Auxiliary Document for the Federal Finances Act 2006, actual figures. Revised data. – 13) Schedule T of the Auxiliary Document for the Federal Finances Act 2007, actual figures. – 14) Schedule T of the Auxiliary Document for the Federal Finances Act 2008, actual figures. Revised data. – 15) Preliminary draft of Schedule T (Parts a and b) based on the preliminary 2007 actual figures. – 16) Schedule T (Part a and Part b); as per the draft of the federal budget for 2009.
Rounding differences.

Table 5: Federal expenditure in 2007[1)] for research and research promotion by socioeconomic objectives and ministries

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	in 1000 €	1,576	-	-	-	41	-	-	-	1,199	-	259	-	-	77
	in %	*100.0*	-	-	-	*2.6*	-	-	-	*76.1*	-	*16.4*	-	-	*4.9*
BMI	in 1000 €	576	-	-	-	-	-	-	-	576	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-	-
BMUKK	in 1000 €	39,947	2,181	-	327	-	-	1,156	-	7,425	-	-	-	-	28,858
	in %	*100.0*	*5.5*	-	*0.8*	-	-	*2.9*	-	*18.6*	-	-	-	-	*72.2*
BMWF	in 1000 €	1,239,995	57,754	26,724	218,626	9,425	20,678	17,513	322,540	65,733	26,873	8,761	-	54	465,314
	in %	*100.0*	*4.7*	*2.2*	*17.6*	*0.8*	*1.7*	*1.4*	*26.0*	*5.3*	*2.2*	*0.7*	-	*0.0*	*37.4*
BMSK	in 1000 €	1 563	-	-	-	-	-	-	175	1,388	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	*11.2*	*88.8*	-	-	-	-	-
BMGFJ	in 1000 €	5,261	-	59	-	-	-	-	4 177	245	-	-	-	-	780
	in %	*100.0*	-	*1.1*	-	-	-	-	*79.4*	*4.7*	-	-	-	-	*14.8*
BMEIA	in 1000 €	1,727	-	-	-	956	-	-	-	751	-	-	-	-	20
	in %	*100.0*	-	-	-	*55.3*	-	-	-	*43.5*	-	-	-	-	*1.2*
BMJ	in 1000 €	98	-	-	-	-	-	-	-	98	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-	-
BML	in 1000 €	1,674	-	-	-	-	-	-	-	-	-	-	27	-	1,647
	in %	*100.0*	-	-	-	-	-	-	-	-	-	-	*1.6*	-	*98.4*
BMF	in 1000 €	33,162	1,559	929	5,666	300	630	450	7,674	4,534	749	240	-	-	10,431
	in %	*100.0*	*4.7*	*2.8*	*17.1*	*0.9*	*1.9*	*1.4*	*23.1*	*13.7*	*2.3*	*0.7*	-	-	*31.4*
BMLFUW	in 1000 €	51,365	1,014	34,893	-	-	-	-	-	1,363	13,797	-	-	-	298
	in %	*100.0*	*2.0*	*67.8*	-	-	-	-	-	*2.7*	*26.9*	-	-	-	*0.6*
BMWA	in 1000 €	60,273	-	-	58,889	1202	-	-	-	173	-	-	-	-	9
	in %	*100.0*	-	-	*97.7*	*2.0*	-	-	-	*0.3*	-	-	-	-	*0.0*
BMVIT	in 1000 €	326,800	18,454	2,320	152,136	16,077	17,104	871	38,865	7,167	14,656	413	-	840	57,897
	in %	*100.0*	*5.6*	*0.7*	*46.6*	*4.9*	*5.2*	*0.3*	*11.9*	*2.2*	*4.5*	*0.1*	-	*0.3*	*17.7*
Total	in 1000 €	1,764,017	80,962	64,925	435,644	28,001	38,412	19,990	373,431	90,652	56,075	9,673	27	894	565,331
	in %	*100.0*	*4.6*	*3.7*	*24.7*	*1.6*	*2.2*	*1.1*	*21.2*	*5.1*	*3.2*	*0.5*	*0.0*	*0.1*	*32.0*

Status: April 2009

Source: Statistics Austria (Bundesanstalt Statistik Österreich)

1 Preliminary draft of Schedule T (Part a and Part b) based on the preliminary actual figures for 2007.

Table 6: Federal expenditure in 2008 [1] on research and research promotion broken down by socioeconomic objectives and ministries

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	in 1000 €	1,665	-	-	-	44	-	-	-	1,214	-	327	-	-	80
	in %	*100.0*	-	-	-	*2.6*	-	-	-	*73.0*	-	*19.6*	-	-	*4.8*
BMI	in 1000 €	573	-	-	-	-	-	-	-	573	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-	-
BMUKK	in 1000 €	41,820	2,679	-	327	-	-	1,175	-	7,027	-	-	-	-	30,612
	in %	*100.0*	*6.4*	-	*0.8*	-	-	*2.8*	-	*16.8*	-	-	-	-	*73.2*
BMWF	in 1000 €	1,279,235	56,928	27,306	222,958	9,730	21,108	17,953	334,732	66,613	27,352	8,856	88	49	485,562
	in %	*100.0*	*4.5*	*2.1*	*17.4*	*0.8*	*1.7*	*1.4*	*26.2*	*5.2*	*2.1*	*0.7*	*0.0*	*0.0*	*37.9*
BMSK	in 1000 €	1,816	-	-	-	-	-	-	181	1,635	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	*10.0*	*90.0*	-	-	-	-	-
BMGFJ	in 1000 €	5,583	-	59	-	-	-	-	4,654	518	-	-	-	-	352
	in %	*100.0*	-	*1.1*	-	-	-	-	*83.3*	*9.3*	-	-	-	-	*6.3*
BMEIA	in 1000 €	1,789	-	-	-	980	-	-	-	788	-	-	-	-	21
	in %	*100.0*	-	-	-	*54.8*	-	-	-	*44.0*	-	-	-	-	*1.2*
BMJ	in 1000 €	111	-	-	-	-	-	-	-	111	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-	-
BML	in 1000 €	2,082	-	-	-	-	-	-	-	-	-	-	60	-	2,022
	in %	*100.0*	-	-	-	-	-	-	-	-	-	-	*2.9*	-	*97.1*
BMF [2]	in 1000 €	132,931	5,814	2,027	52,081	1,984	3,814	1,091	22,695	7,634	3,317	545	-	80	31,849
	in %	*100.0*	*4.4*	*1.5*	*39.1*	*1.5*	*2.9*	*0.8*	*17.1*	*5.7*	*2.5*	*0.4*	-	*0.1*	*24.0*
BMLFUW	in 1000 €	46,850	837	29,893	-	-	-	-	-	1,380	14,494	-	-	-	246
	in %	*100.0*	*1.8*	*63.9*	-	-	-	-	-	*2.9*	*30.9*	-	-	-	*0.5*
BMWA	in 1000 €	64,046	-	-	63,790	1	-	-	-	246	-	-	-	-	9
	in %	*100.0*	-	-	*99.6*	*0.0*	-	-	-	*0.4*	-	-	-	-	*0.0*
BMVIT	in 1000 €	350,621	22,063	2,383	171,210	12,042	22,239	867	40,471	7,556	15,111	404	-	849	55,426
	in %	*100.0*	*6.3*	*0.7*	*49.0*	*3.4*	*6.3*	*0.2*	*11.5*	*2.2*	*4.3*	*0.1*	-	*0.2*	*15.8*
Total	in 1000 €	1,929,122	88,321	61,668	510,366	24,781	47,161	21,086	402,733	95,295	60,274	10,132	148	978	606,179
	in %	*100.0*	*4.6*	*3.2*	*26.5*	*1.3*	*2.4*	*1.1*	*20.9*	*4.9*	*3.1*	*0.5*	*0.0*	*0.1*	*31.4*

Status: April 2009

Source: Statistics Austria (Bundesanstalt Statistik Österreich)

1 Federal budget. Schedule T (Part a and Part b); (as per the draft of the federal budget 2009).
2 Including, in the cash management section, (University Act: 51) the funds provided for 2008 for the "Proactive Research Programme" (€ 100 million).

Table 7: Federal expenditure in 2009[1] on research and research promotion broken down by socioeconomic objectives and ministries.

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 1000 €	2,027	-	-	-	46	-	-	-	1,299	-	323	-	-	359
	in %	*100.0*	-	-	-	*2.3*	-	-	-	*64.1*	-	*15.9*	-	-	*17.7*
BMI	in 1000 €	683	-	-	-	-	-	-	-	683	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-	-
BMUKK	in 1000 €	66,534	2,884	-	319	-	-	19,188	-	9,407	-	-	-	-	34,736
	in %	*100.0*	*4.3*	-	*0.5*	-	-	*28.8*	-	*14.1*	-	-	-	-	*52.3*
BMWF	in 1000 €	1,554,282	79,554	32,886	258,905	11,712	26,436	21,101	407,279	91,562	31,804	10,412	98	1,256	581,277
	in %	*100.0*	*5.1*	*2.1*	*16.7*	*0.8*	*1.7*	*1.4*	*26.2*	*5.9*	*2.0*	*0.7*	*0.0*	*0.1*	*37.3*
BMASK	in 1000 €	2,264	-	-	-	-	-	-	184	2,080	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	*8.1*	*91.9*	-	-	-	-	-
BMG	in 1000 €	4,675	-	59	-	-	-	-	4,337	33	-	-	-	-	246
	in %	*100.0*	-	*1.3*	-	-	-	-	*92.7*	*0.7*	-	-	-	-	*5.3*
BMEIA	in 1000 €	1,905	-	-	-	1,050	-	-	-	842	-	-	-	-	13
	in %	*100.0*	-	-	-	*55.1*	-	-	-	*44.2*	-	-	-	-	*0.7*
BMJ	in 1000 €	130	-	-	-	-	-	-	-	130	-	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-	-
BMLVS	in 1000 €	2,308	-	-	-	-	-	-	-	-	-	-	68	-	2,240
	in %	*100.0*	-	-	-	-	-	-	-	-	-	-	*2.9*	-	*97.1*
BMF	in 1000 €	33,098	1,546	922	5,620	297	624	446	7,612	4,701	743	238	-	-	10,349
	in %	*100.0*	*4.7*	*2.8*	*17.0*	*0.9*	*1.9*	*1.3*	*23.0*	*14.2*	*2.2*	*0.7*	-	-	*31.3*
BMLFUW	in 1000 €	74,838	853	33,536	-	-	-	-	-	1,550	38,648	-	-	-	251
	in %	*100.0*	*1.1*	*44.8*	-	-	-	-	-	*2.1*	*51.7*	-	-	-	*0.3*
BMWFJ	in 1000 €	83,617	-	-	83,160	-	-	-	-	448	-	-	-	-	9
	in %	*100.0*	-	-	*99.5*	-	-	-	-	*0.5*	-	-	-	-	*0.0*
BMVIT	in 1000 €	375,239	14,324	1,831	217,762	40,007	21,418	492	33,482	2,916	16,438	431	-	111	26,027
	in %	*100.0*	*3.8*	*0.5*	*58.1*	*10.7*	*5.7*	*0.1*	*8.9*	*0.8*	*4.4*	*0.1*	-	*0.0*	*6.9*
Total	in 1000 €	2,201,600	99,161	69,234	565,766	53,112	48,478	41,227	452,894	115,651	87,633	11,404	166	1,367	655,507
	in %	*100.0*	*4.5*	*3.1*	*25.7*	*2.4*	*2.2*	*1.9*	*20.6*	*5.3*	*4.0*	*0.5*	*0.0*	*0.1*	*29.7*

Status: April 2009

Source: Statistics Austria (Bundesanstalt Statistik Österreich)

1 Federal budget. Preliminary draft of Schedule T (Part a and Part b); (as per the draft of the federal budget).
2 including the highest executive bodies.

Table 8: Expenditure on research and experimental development 1993 to 2006[1)] broken down by sector of performance and source of funds

sector	1993		1998		2002		2004		2006	
	1,000 EUR	%	1,000 EUR	%	1,000 EUR	%	1,000 EUR	%	1,000 EUR	%
Implementation sectors										
Total	**2,303,311 [1)]**	***100.0***	**3,399,835**	***100.0***	**4,684,313**	***100.0***	**5,249,546**	***100.0***	**6,318,587**	***100.0***
Higher education sector [2)]	805,315 [1)]	*35.0*	1,009,721	*29.7*	1,266,104	*27.0*	1,401,649	*26.7*	1,523,160	*24.1*
State sector[3)]	204,575 [1)]	*8.9*	218,951	*6.4*	266,428	*5.7*	269,832	*5.1*	330,232	*5.2*
Private non-profit sector[4)]	6,029	*0.3*	10,486	*0.3*	20,897	*0.4*	21,586	*0.4*	16,519	*0.3*
Corporate sector	1,287,391 [1)]	*55.8*	2,160,678	*63.6*	3,130,884	*66.9*	3,556,479	*67.8*	4,448,676	*70.4*
of which:										
Cooperative segment [5)]	107,379	*4.7*	187,179	*5.5*	261,682	*5.6*	347,703	*6.6*	428,492	*6.8*
Business segment	1,180,012 [1)]	*51.1*	1,973,499	*58.1*	2,869,202	*61.3*	3,208,776	*61.2*	4,020,184	*63.6*
Sources of funds										
Total	**2,303,311 [1)]**	***100.0***	**3,399,835**	***100.0***	**4,684,313**	***100.0***	**5,249,546**	***100.0***	**6,318,587**	***100.0***
Public sector	1,105,355 [1)]	*48.0*	1,284,576	*37.8*	1,574,231	*33.6*	1,732,185	*33.0*	2,071,310	*32.8*
Corporate sector	1,128,399	*49.0*	1,418,432	*41.7*	2,090,626	*44.6*	2,475,549	*47.1*	3,056,999	*48.4*
Private non-profit sector	9,864	*0.4*	12,200	*0.4*	17,491	*0.4*	25,201	*0.5*	26,928	*0.4*
Abroad	59,693	*2.6*	684,628	*20.1*	1,001,965	*21.4*	1,016,611	*19.4*	1,163,350	*18.4*
of which EU	,	.	44,308	*1.3*	78,281	*1.7*	86,974	*1.7*	103,862	*1.6*

Source: Statistics Austria, Surveys by Statistics Austria. – Rounding differences. – 1) 1993 including other R&D expenditures not included in the survey that were financed by the public sector. – 2) Universities including hospitals, art universities, the Austrian Academy of Sciences, testing institutes at technical federal colleges as well as (since 2002) universities of applied science, private universities and the Danube University at Krems. – 3) Federal institutions (not including those combined in the higher education sector), state, local government and chamber institutions, R&D institutions of the social insurance carriers, public sector-financed and/or controlled private non-profit institutions as well as R&D institutions of the Ludwig Boltzmann-Gesellschaft; including state hospitals. The state hospitals were not surveyed by questionnaire, but instead Statistics Austria prepared an estimate of their R&D expenditures based on the reports of the offices of the provincial governments. – 4) Private non-profit institutions whose status is predominantly private or under civil law, sectarian or other non-public. – 5) Including ARC Seibersdorf Research GmbH Including centres of excellence (since 2002). 1993 including the civil engineers segment and the segment of power plant companies; since the 1998 R&D survey the power plant companies have been included in the business subsector; from 2002 the segment of civil engineers has also been included in the business subsector.

Table 9: General research-related university expenditure by the federal government in 1999 – 2009[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	2,314,658	1,083,258
2008	2,352,334	1,113,728
2009	2,637,851	1,255,162

Source: Statistics Austria (Bundesanstalt Statistik Österreich) as per April 2009

1 Based on Schedule T of the Auxiliary Document for the Federal Finances Act
2007: Preliminary draft of Schedule T based on the preliminary actual figures for 2007.
2008, 2009: Budgeted figures. Status: Federal budget draft 2009.

Table 10: An international comparison of research and experimental development (R&D) in 2006

Country	Gross domestic expenditure for 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	Higher education sector	State sector	Private non-profit sector
		%			as a % of gross domestic expenditure on R&D			
Belgium	1.88 p)	24.7 3)	59.7 3)	55,204 p)	69.2 p)	22.2 p)	7.9 p)	0.7 p)
Denmark	2.46	27.6 3)	59.5 3)	44,878	66.9	25.9	6.6	0.6
Germany	2.54	27.8	68.1	487,260	69.9	16.3	13.9 o)	. n)
Finland	3.45	25.1	66.6	58,257	71.3	18.7	9.4	0.6
France	2.10 p)	38.4 p)	52.4 p)	363,867	63.1 p)	19.2 p)	16.5 p)	1.2 p)
Greece	0.57 c)	46.8 3)	31.1 3)	35,140 c)	30.0 c)	47.8 c)	20.8 c)	1.3 c)
Ireland p)	1.32	30.1	59.3	17,660	67.5	26.0	6.5	.
Italy	1.14	48.3	40.4	192,002	48.8	30.3	17.2	3.7
Luxembourg	1.66	16.6 3)	79.7 3)	4,377	86.1	2.1	11.8	.
Netherlands	1.73 p)	36.2 1)	51.1 1)	96,861 p)	59.2 p)	27.2 c)p)	13.6 o)p)	. n)
Austria	2.46 4)	32.8 4)	48.4 4)	49,377 4)	70.4 4)	24.1 4)	5.2 4)	0.3 4)
Portugal	1.00 c)	55.2 3)	36.3 3)	30,160 c)	46.5 c)	32.0 c)	11.3 c)	10.3 c)
Sweden	3.74	23.2 a)3)	65.7 a)3)	78,715	74.7	20.6 p)	4.5	0.2
Spain	1.20	42.5	47.1	188,978	55.5	27.6	16.7	0.2
United Kingdom	1.78	31.9	45.2	334,686 b)	61.7	26.1	10.0	2.2
EU 15 b)	**1.89**	**33.4**	**55.6**	**2,037,422**	**63.9**	**22.3**	**12.7**	**1.2**
Poland	0.56	57.5	33.1	73,554	31.5	31.0	37.0	0.4
Slovak Republic	0.49	55.6	35.0	15,028	43.1	24.1	32.8 d)	0.1
Slovenia	1.59	34.4	59.3	9,793	60.2	15.1	24.5	0.2
Czech Republic	1.55	39.0	56.9	47,729	66.2	15.9	17.6	0.4
Hungary	1.00	44.8	43.3	25,971	48.3 v)	24.4 v)	25.4 v)	.
EU 25 b)	**1.80**	**34.0**	**55.1**	**2,234,173**	**63.2**	**22.4**	**13.2**	**1.2**
Australia	2.01	38.4	57.2	125,770	57.3	25.7	14.1	2.9
Iceland 3)	2.77	40.5	48.0	3,226	51.5	22.0	23.5	3.0
Japan	3.39	16.2 e)	77.1	935,182	77.2	12.7	8.3	1.9
Canada p)	1.94	32.7 c)	48.0	213,930 c)3)	54.7	35.5	9.3	0.4
Korea g)	3.22	23.1	75.5	237,599	77.3	10.0	11.6	1.2
Mexico 3)	0.46	45.3	46.5	89,398	49.5	27.4	22.1	1.0
New Zealand 3)	1.16	43.0	41.3	23,178	41.8	32.5	25.7	.
Norway	1.52	44.0 3)	46.4 3)	31,745	54.2	30.2	15.7	.
Switzerland 2)	2.90	22.7	69.7	52,250	73.7	22.9	1.1 h)	2.3
Turkey	0.58	48.6	46.1	54,444	37.0	51.3	11.7	.
United States j)	2.66	29.1	65.2 o)	,	71.0	13.5	11.3 h)	4.2
OECD total b)	**2.26**	**28.5**	**63.9**	**,**	**69.1**	**17.2**	**11.4**	**2.6**

Source: OECD (MSTI 2008-2), Statistics Austria (Bundesanstalt Statistik Österreich)

a) Break in the time series. – b) Estimate by the OECD Secretariat (based on national sources). – c) National estimate, where necessary the OECD Secretariat has adjusted them to meet the OECD standards. – d) R&D expenditure on national defence not included. – e) National survey results, where necessary the OECD Secretariat has adjusted them to meet the OECD standards. – g) Only science/engineering research. – 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) 2003. – 2) 2004. – 3) 2005. – 4) Statistics Austria; Results of the 2006 survey on research and experimental development.

Full time equivalent = person year.

Table 11: Employees in research and experimental development (R&D) by headcount and full-time equivalents in 2006. Table shows the performance area and employment categories

Sectors, areas	No. of units performing R&D	Total	of which		
			Scientific personnel	Highly qualified non-scientific personnel	Other auxiliary personnel
			Headcount		
Total	**3,863**	**83,966**	**49,597**	**23,884**	**10,485**
1. Higher education sector	**1,162**	**32,715**	**23,609**	**4,954**	**4,152**
of which:					
1.1 Universities (without hospitals)	928	23,799	17,174	3,477	3,148
1.2 University hospitals	89	5,454	3,706	905	843
1.3 Art universities	44	827	721	61	45
1.4 Academy of Sciences	61	1,167	908	238	21
1.5 Universities of applied science	17	961	726	193	42
1.6 Other higher education sector[1)]	23	507	374	80	53
2. State sector[2)]	**254**	**5,511**	**2,789**	**1,129**	**1,593**
of which:					
2.1 Without the state hospitals	254	5,511	2,789	1,129	1,593
2.2 State hospitals	.	.	.	.	.
3. Private non-profit sector[3)]	**40**	**404**	**284**	**72**	**48**
4. Corporate sector	**2,407**	**45,336**	**22,915**	**17,729**	**4,692**
of which:					
4.1 Cooperative segment [4)]	52	4,928	2,820	1,084	1,024
4.2 Business segment	2,355	40,408	20,095	16,645	3,668
			Full-time equivalents		
Total	**3,863**	**49,377.1**	**29,198.7**	**14,821.7**	**5,356.8**
1. Higher education sector	**1,162**	**12,668.2**	**9,261.3**	**1,855.6**	**1,551.3**
of which:					
1.1 Universities (without hospitals)	928	9,986.2	7,339.6	1,321.8	1,324.9
1.2 University hospitals	89	1,333.0	815.8	342.3	174.9
1.3 Art universities	44	179.5	158.4	12.5	8.6
1.4 Academy of Sciences	61	627.9	542.7	74.9	10.3
1.5 Universities of applied science	17	384.2	288.8	76.8	18.6
1.6 Other higher education sector[1)]	23	157.4	116.0	27.3	14.1
2. State sector[2)]	**254**	**2,422.6**	**1,348.5**	**356.5**	**717.6**
of which:					
2.1 Excluding state hospitals	254	2,422.6	1,348.5	356.5	717.6
2.2 State hospitals	.	.	,	.	.
3. Private non-profit sector[3)]	**40**	**160.5**	**118.4**	**26.3**	**15.9**
4. Corporate sector	**2,407**	**34,125.8**	**18,470.5**	**12,583.3**	**3,072.0**
of which:					
4.1 Cooperative segment [4)]	52	3,342.3	2,095.1	530.6	716.6
4.2 Business segment	2,355	30,783.5	16,375.4	12,052.7	2,355.4

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 08.08.2008. -

1) Private universities and the Danube University at Krems (reported together to keep data confidential). – 2) Federal institutions (not including those combined in the higher educationsector), state, local government and chamber institutions, R&D institutions of the social insurance carriers, public sector-financed and/or controlled private non-profit institutions as well as R&D institutions of the Ludwig Boltzmann-Gesellschaft; without state hospitals. The state hospitals were not surveyed by questionnaire; instead Statistics Austria prepared an estimate of the R&D expenditures based on the reports of the offices of the state governments. For this reason there is no data about employees in R&D. – 3) Private non-profit institutions whose status is predominantly private or under civil law, sectarian or other non-public. – 4) Including ARC Seibersdorf research GmbH and centres of excellence. – Rounding differences.

Table 12: Employees in research and experimental development (R&D), headcounts and full-time equivalents in 2006, by performance area, employee category and gender

Sectors, areas	No. of units performing R&D	Total		of which					
				Scientific personnel		Highly qualified non-scientific personnel		Other auxiliary personnel	
		male	female	male	female	male	female	male	female
				Headcounts					
Total	**3,863**	**59,236**	**24,730**	**37,056**	**12,541**	**17,105**	**6,779**	**5,075**	**5,410**
1. Higher education sector	**1,162**	**18,367**	**14,348**	**15,419**	**8,190**	**1,731**	**3,223**	**1,217**	**2,935**
of which:									
1.1 Universities (without hospitals)	928	13,733	10,066	11,403	5,771	1,279	2,198	1,051	2,097
1.2 University hospitals	89	2,633	2,821	2,306	1,400	197	708	130	713
1.3 Art universities	44	447	380	417	304	15	46	15	30
1.4 Academy of Sciences	61	636	531	532	376	102	136	2	19
1.5 Universities of applied science	17	636	325	515	211	110	83	11	31
1.6 Other higher education sector[1)]	23	282	225	246	128	28	52	8	45
2. State sector[2)]	**254**	**3,037**	**2,474**	**1,694**	**1,095**	**592**	**537**	**751**	**842**
of which:									
2.1 Without the state hospitals	254	3,037	2,474	1,694	1,095	592	537	751	842
2.2 State hospitals	,	,	,	,	,	,	,	,	,
3. Private non-profit sector[3)]	**40**	**172**	**232**	**137**	**147**	**25**	**47**	**10**	**38**
4. Corporate sector	**2,407**	**37,660**	**7,676**	**19,806**	**3,109**	**14,757**	**2,972**	**3,097**	**1,595**
of which:									
4.1 Cooperative segment [4)]	52	3,584	1,344	2,270	550	767	317	547	477
4.2 Business segment	2,355	34,076	6,332	17,536	2,559	13,990	2,655	2,550	1,118
				Full-time equivalents					
Total	**3,863**	**37,771.0**	**11,606.1**	**23,529.9**	**5,668.8**	**11,335.7**	**3,486.0**	**2,905.4**	**2,451.5**
1. Higher education sector	**1,162**	**7,523.9**	**5,144.3**	**6,383.5**	**2,877.8**	**642.9**	**1,212.7**	**497.6**	**1,053.8**
of which:									
1.1 Universities (without hospitals)	928	6,085.0	3,901.2	5,141.8	2,197.8	485.0	836.7	458.2	866.7
1.2 University hospitals	89	606.9	726.1	503.5	312.3	75.1	267.3	28.3	146.6
1.3 Art universities	44	100.6	78.9	95.6	62.9	2.8	9.7	2.2	6.4
1.4 Academy of Sciences	61	378.0	249.8	350.9	191.8	25.3	49.6	1.8	8.4
1.5 Universities of applied science	17	264.5	119.8	214.9	73.9	44.3	32.6	5.3	13.3
1.6 Other higher education sector[1)]	23	88.9	68.5	76.8	39.3	10.4	16.8	1.7	12.4
2. State sector[2)]	**254**	**1,430.2**	**992.4**	**883.9**	**464.6**	**183.7**	**172.8**	**362.5**	**355.0**
of which:									
2.1 Without the state hospitals	254	1,430.2	992.4	883.9	464.6	183.7	172.8	362.5	355.0
2.2 State hospitals	,	,	,	,	,	,	,	,	,
3. Private non-profit sector[3)]	**40**	**65.4**	**95.1**	**55.6**	**62.8**	**6.9**	**19.4**	**2.9**	**13.0**
4. Corporate sector	**2,407**	**28,751.5**	**5,374.3**	**16,206.9**	**2,263.6**	**10,502.2**	**2,081.1**	**2,042.4**	**1,029.7**
of which:									
4.1 Cooperative segment [4)]	52	2,547.4	794.9	1,751.5	343.6	382.4	148.2	413.5	303.2
4.2 Business segment	2,355	26,204.1	4,579.4	14,455.4	1,920.0	10,119.8	1,932.9	1,628.9	726.5

Source: Statistics Austria, Survey of research and experimental development 2006. Compiled on: 08.08.2008. – 1) Private universities and the Danube University at Krems (reported together to keep data confidential). – 2) Federal institutions (not including those combined in the higher education sector), state, local government and chamber institutions, R&D institutions of the social insurance carriers, public sector-financed and/or controlled private non-profit institutions as well as R&D institutions of the Ludwig Boltzmann-Gesellschaft; without state hospitals. The state hospitals were not surveyed by questionnaire; instead Statistics Austria prepared an estimate of the R&D expenditures based on the reports of the offices of the state governments. For this reason there is no data about employees in R&D. – 3) Private non-profit institutions whose status is predominantly private or under civil law, sectarian or other non-public. – 4) Including ARC Seibersdorf research GmbH and centres of excellence. – Rounding differences.

Table 13: Employees in research and experimental development (in full-time equivalents) in all of the areas surveyed [1)] 2006 broken down by state[2)] and employment category

State	No. of units performing R&D	Full-time equivalents in R&D			
		Total	of which		
			Scientific personnel	Highly qualified non-scientific personnel	Other auxiliary personnel
Austria	**3.863**	**49.377,0**	**29.198,7**	**14.821,6**	**5.356,8**
Burgenland	53	335.7	166.4	108.4	60.9
Carinthia	185	2,326.6	1,728.5	493.1	105.0
Lower Austria	414	3,998.5	1,948.9	1,531.9	517.6
Upper Austria	682	7,203.0	3,715.5	2,754.4	733.0
Salzburg	224	1,834.6	1,101.3	600.6	132.7
Styria	683	9,291.7	5,447.0	2,330.1	1,514.6
Tirol	339	3,751.3	2,332.6	1,042.3	376.5
Vorarlberg	143	1,429.1	668.1	699.7	61.4
Vienna	1,140	19,206.6	12,090.3	5,261.2	1,855.1

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 08.08.2008 – 1) The state hospitals were not surveyed by questionnaire, but instead Statistics Austria prepared an estimate of the R&D expenditures based on the reports of the offices of the state governments. For this reason there is no data about employees in R&D. – 2) Standard evaluation by location of company headquarters. – Rounding differences.

Table 14: Expenditure for research and experimental development (R&D) 2006 by performance area and type of expenditure

Sectors, areas	No. of units performing R&D	Total	of which			
			Personnel expenses	Material costs	Expenditure for plant and equipment	Construction expenditures and expendi-tures for property acqui-sition
		in 1000 €				
Total	**3,863** [3]	**6,318,587**	**3,198,343**	**2,544,643**	**454,461**	**121,140**
1. Higher education sector	**1,162**	**1,523,160**	**710,514**	**655,102**	**117,422**	**40,122**
of which:						
1.1 Universities (without hospitals)	928	1,165,630	555,670	514,266	93,922	1,772
1.2 University hospitals	89	193,936	80,584	71,895	5,931	35,526
1.3 Art universities	44	21,616	12,071	8,441	1,104	-
1.4 Academy of Sciences	61	79,629	32,358	34,649	11,573	1,049
1.5 Universities of applied science	17	43,493	20,429	18,409	4,368	287
1.6 Other higher education sector[1]	23	18,856	9,402	7,442	524	1,488
2. State sector[2]	**254** [3]	**330,232**	**182,296**	**123,416**	**16,234**	**8,286**
of which:						
2.1 Without the state hospitals	254	215,800	121,261	78,254	12,157	4,128
2.2 State hospitals	,	114,432	61,035	45,162	4,077	4,158
3. Private non-profit sector[4]	**40**	**16,519**	**7,630**	**8,538**	**348**	**3**
4. Corporate sector	**2,407**	**4,448,676**	**2,297,903**	**1,757,587**	**320,457**	**72,729**
of which:						
4.1 Cooperative segment [5]	52	428,492	229,416	172,220	24,067	2,789
4.2 Business segment	2,355	4,020,184	2,068,487	1,585,367	296,390	69,940

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 19.08.2008. – 1) Private universities and the Danube University at Krems (reported together to keep data confidential). – 2) Federal institutions (not including those combined in the higher education sector), state, local government and chamber institutions, R&D institutions of the social insurance carriers, public sector-financed and/or controlled private non-profit institutions as well as R&D institutions of the Ludwig Boltzmann-Gesellschaft; including state hospitals. The state hospitals were not surveyed by questionnaire; instead Statistics Austria prepared an estimate of the R&D expenditures based on the reports of the offices of the state governments. – 3) Number of survey units not including state hospitals. – 4) Private non-profit institutions whose status is predominantly private or under civil law, sectarian or other non-public. – 5) Including ARC Seibersdorf research GmbH and centres of excellence.

Table 15: Expenditure on research and experimental development (R&D) in all survey areas [1] in 2006, by state[2] and type of expenditure

State	R&D units performing R&D [3]	Total	of which			
			Personnel expenses	Material costs	Expenditure for plant and equipment	Construction expenditures and expenditures for property acquisition
		in 1000 €				
Austria	**3,863**	**6,318,587**	**3,198,343**	**2,544,643**	**454,461**	**121,140**
Burgenland	53	34,383	18,360	10,997	4,804	222
Carinthia	185	393,752	170,180	168,824	51,455	3,293
Lower Austria	414	461,530	253,813	162,870	36,118	8,729
Upper Austria	682	964,932	434,488	446,951	64,583	18,910
Salzburg	224	200,919	111,175	62,562	23,056	4,126
Styria	683	1,121,674	575,445	458,407	72,433	15,389
Tirol	339	556,675	226,203	248,455	51,502	30,515
Vorarlberg	143	154,619	93,962	47,476	8,368	4,813
Vienna	1,140	2,430,103	1,314,717	938,101	142,142	35,143

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 25.08.2008. – 1) Including R&D expenditure estimate for state hospitals. – 2) Standard evaluation by location of company headquarters. – 3) Number of survey units not including state hospitals.

Table 16: Expenditure for research and experimental development (R&D) 2006 by performance area and type of research

Sectors, areas	No. of units performing R&D	Total expenditure on R&D	of which					
			Basic research		Applied research		Experimental development	
		in 1000 €	in 1000 €	*in %*	in 1000 €	*in %*	in 1000 €	*in %*
Total	**3,863**	**6,204,155**	**1,064,476**	***17.2***	**2,193,550**	***35.4***	**2,946,129**	***47.4***
1. Higher education sector	**1,162**	**1,523,160**	**746,112**	***49.0***	**638,642**	***41.9***	**138,406**	***9.1***
of which:								
1.1 Universities (without hospitals)	928	1,165,630	613,773	*52.6*	468,344	*40.2*	83,513	*7.2*
1.2 University hospitals	89	193,936	52,216	*26.9*	110,220	*56.9*	31,500	*16.2*
1.3 Art universities	44	21,616	6,628	*30.7*	9,757	*45.1*	5,231	*24.2*
1.4 Academy of Sciences	61	79,629	64,178	*80.6*	9,922	*12.5*	5,529	*6.9*
1.5 Universities of applied science	17	43,493	1,938	*4.5*	29,970	*68.9*	11,585	*26.6*
1.6 Other higher education sector[1)]	23	18,856	7,379	*39.1*	10,429	*55.3*	1,048	*5.6*
2. State sector[2)]	**254**	**215,800**	**69,532**	***32.2***	**127,711**	***59.2***	**18,557**	***8.6***
of which:								
2.1 Without the state hospitals	254	215,800	69,532	*32.2*	127,711	*59.2*	18,557	*8.6*
2.2 State hospitals	.	.	.		.		.	
3. Private non-profit sector[3)]	**40**	**16,519**	**3,682**	***22.3***	**12,076**	***73.1***	**761**	***4.6***
4. Corporate sector	**2,407**	**4,448,676**	**245,150**	***5.5***	**1,415,121**	***31.8***	**2,788,405**	***62.7***
of which:								
4.1 Cooperative segment [4)]	52	428,492	107,534	*25.1*	230,739	*53.8*	90,219	*21.1*
4.2 Business segment	2,355	4,020,184	137,616	*3.4*	1,184,382	*29.5*	2,698,186	*67.1*

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 25.08.2008. – 1) Private universities and the Danube University at Krems (reported together to keep data confidential). 2 Federal institutions (not including those combined in the higher education sector), state, local government and chamber institutions, R&D institutions of the social insurance carriers, public sector-financed and/or controlled private non-profit institutions as well as R&D institutions of the Ludwig Boltzmann-Gesellschaft; without state hospitals. The state hospitals were not surveyed by questionnaire; instead Statistics Austria prepared an estimate of the R&D expenditures based on the reports of the offices of the state governments. There is no breakdown of R&D expenses by type of research. – 3) Private non-profit institutions whose status is predominantly private or under civil law, sectarian or other non-public. – 4) Including ARC Seibersdorf research GmbH and centres of excellence.

Table 17: Expenditure on research and experimental development (R&D) in all survey areas [1] in 2006, by state[2] and type of research

State	No. of units performing R&D	Total expenditure for R&D[1]	of which					
			Basic research		Applied research		Experimental development	
		in 1000 €	in 1000 €	in %	in 1000 €	in %	in 1000 €	in %
Austria	**3,863**	**6,204,155**	**1,064,476**	**17.2**	**2,193,550**	**35.4**	**2,946,129**	**47.4**
Burgenland	53	33,211	2,006	6.0	12,646	38.1	18,559	55.9
Carinthia	185	386,440	19,976	5.2	68,472	17.7	297,992	77.1
Lower Austria	414	445,444	40,473	9.1	178,005	40.0	226,966	50.9
Upper Austria	682	957,176	82,135	8.6	358,948	37.5	516,093	53.9
Salzburg	224	197,003	46,159	23.4	60,816	30.9	90,028	45.7
Styria	683	1,100,380	245,662	22.3	420,659	38.2	434,059	39.5
Tirol	339	543,806	144,242	26.5	219,191	40.3	180,373	33.2
Vorarlberg	143	151,797	6,623	4.4	59,800	39.4	85,374	56.2
Vienna	1,140	2,388,898	477,200	20.0	815,013	34.1	1,096,685	45.9

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 25.08.2008. – 1) Not including R&D expenditure estimate for state hospitals. The state hospitals were not surveyed by questionnaire; instead Statistics Austria prepared an estimate of the R&D expenditures based on the reports of the offices of the state governments. There is no breakdown of R&D expenses by type of research. – 2) Standard evaluation by location of company headquarters.

Table 18: Expenditure on research and experimental development (R&D) in all survey areas in 2006 by state (according to the location of the headquarters/ according to the R&D location)

State	According to the location of the headquarters of the surveyed unit/of the company[1]		According to the company's R&D location(s)[2]	
	in 1000 €	*in %*	in 1000 €	*in %*
Austria	**6,318,587**	***100.0***	**6,318,587**	***100.0***
Burgenland	34,383	*0.5*	30,520	*0.5*
Carinthia	393,752	*6.2*	377,668	*6.0*
Lower Austria	461,530	*7.3*	514,874	*8.1*
Upper Austria	964,932	*15.3*	996,913	*15.8*
Salzburg	200,919	*3.2*	230,737	*3.7*
Styria	1,121,674	*17.8*	1,265,426	*20.0*
Tirol	556,675	*8.8*	554,722	*8.8*
Vorarlberg	154,619	*2.4*	153,947	*2.4*
Vienna	2,430,103	*38.5*	2,193,780	*34.7*

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 04.09.2008 – 1) The regional classification of the units surveyed and of the business segment was done strictly according to the state in which the headquarters is located (standard evaluation). – 2) In this more detailed regional evaluation, for businesses that perform R&D in more than one state the R&D expenditure is allocated to the states in which the R&D locations are located. For the units surveyed in the other areas the question "R&D locations also located in other states" was not relevant.

Table 19: Financing of expenditure for research and experimental development (R&D) 2006 by performance area and source of funds

R&D performed in the sectors, areas	No. of units performing R&D	Total	Source of funds								
			Business sector	Public sector					Private non-profit sector	Foreign incl. international organisations (without the EU)	EU
				Combined	Federal government 1)	State 2)	Local governments 2)	Others 1)			
		in 1000 €									
Total	**3,863 5)**	**6,318,587**	**3,056,999**	**2,071,310**	**1,516,850**	**219,984**	**8,576**	**325,900**	**26,928**	**1,059,488**	**103,862**
1. higher education sector	**1,162**	**1,523,160**	**76,791**	**1,354,658**	**1,147,358**	**31,608**	**2,542**	**173,150**	**13,059**	**26,784**	**51,868**
of which:											
1.1 Universities (without hospitals)	928	1,165,630	58,774	1,043,476	886,816	14,773	1,170	140,717	4,865	17,478	41,037
1.2 University hospitals	89	193,936	9,335	174,257	155,632	1,364	-	17,261	1,018	5,366	3,960
1.3 Art universities	44	21,616	295	20,957	19,800	496	54	607	169	18	177
1.4 Academy of Sciences	61	79,629	1,100	73,868	62,913	1,304	26	9,625	226	346	4,089
1.5 Universities of applied science	17	43,493	4,596	34,513	20,901	7,915	1,185	4,512	2,160	116	2,108
1.6 Other higher education sector 3)	23	18,856	2,691	7,587	1,296	5,756	107	428	4,621	3,460	497
2. State sector 4)	**254 5)**	**330,232**	**22,462**	**287,250**	**115,727**	**150,528**	**3,948**	**17,047**	**1,835**	**1,887**	**16,798**
of which:											
2.1 Without the state hospitals	254	215,800	22,462	172,818	115,727	36,096	3,948	17,047	1,835	1,887	16,798
2.2 State hospitals	-	114,432	-	114,432	-	114,432	-	-	-	-	-
3. Private non-profit Sector 6)	**40**	**16,519**	**3,006**	**1,340**	**480**	**271**	**9**	**580**	**10,763**	**147**	**1,263**
4. Corporate sector	**2,407**	**4,448,676**	**2,954,740**	**428,062**	**253,285**	**37,577**	**2,077**	**135,123**	**1,271**	**1,030,670**	**33,933**
of which:											
4.1 Cooperative segment 7)	52	428,492	86,277	131,083	78,000	20,779	1,262	31,042	142	199,976	11,014
4.2 Business segment	2,355	4,020,184	2,868,463	296,979	175,285	16,798	815	104,081	1,129	830,694	22,919

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 26.08.2008. – 1) The funds from the research promotion funds and the R&D financing by the higher education sector are included under "Other". – 2) States including Vienna. Local governments without Vienna. – 3) Private universities and the Danube University at Krems (reported together to keep data confidential). – 4) Federal institutions (not including those combined in the higher education sector), state, local government and chamber institutions, R&D institutions of the social insurance carriers, public sector-financed and/or controlled private non-profit institutions as well as R&D institutions of the Ludwig Boltzmann-Gesellschaft; including state hospitals. The state hospitals were not surveyed by questionnaire; instead Statistics Austria prepared an estimate of the R&D expenditures based on the reports of the offices of the state governments. – 5) Number of survey units not including state hospitals. – 6) Private non-profit institutions whose status is predominantly private or under civil law, sectarian or other non-public. – 7) Including ARC Seibersdorf research GmbH and centres of excellence.

Table 20: Financing of expenditure on research and experimental development (R&D) in all survey areas [1] in 2006, by state[2] and source of fundss

State	Survey units performing R&D [3]	Total	Source of funds								
			Business sector	Public sector					Private non-profit sector	Foreign incl. international organisations (without the EU)	EU
				Combined	Federal government [4]	State[5]	Local governments[5]	Others [4]			
		in 1000 €									
Austria	**3,863**	**6,318.587**	**3,056.999**	**2,071.310**	**1,516.850**	**219.984**	**8.576**	**325.900**	**26.928**	**1,059.488**	**103.862**
Burgenland	53	34.383	26.287	6.664	3.146	2.013	73	1.432	25	1.066	341
Carinthia	185	393.752	112.738	76.066	44.732	12.773	1.594	16.967	401	201.426	3.121
Lower Austria	414	461.530	329.998	110.889	71.309	24.736	884	13.960	3.510	12.307	4.826
Upper Austria	682	964.932	776.613	151.516	85.538	20.909	1.720	43.349	1.597	26.867	8.339
Salzburg	224	200.919	116.022	76.442	56.457	8.739	860	10.386	615	5.254	2.586
Styria	683	1,121.674	418.108	417.863	290.596	53.505	1.961	71.801	1.610	261.912	22.181
Tirol	339	556.675	270.443	238.694	188.698	19.910	378	29.708	3.904	32.945	10.689
Vorarlberg	143	154.619	123.024	18.395	6.527	8.309	295	3.264	102	12.333	765
Vienna	1,140	2,430.103	883.766	974.781	769.847	69.090	811	135.033	15.164	505.378	51.014

Source: Statistics Austria, Survey of research and experimental development 2006. Compiled on: 25.08.2008. – 1) Including R&D expenditure estimate for state hospitals. – 2) Standard evaluation by location of company headquarters. – 3) Number of survey units not including state hospitals. – 4) The funds from the research promotion funds and the R&D financing by the university sector are included under "Other". – 5) States including Vienna. Local governments without Vienna.

Table 21: Gross regional product (GRP), gross domestic expenditure on R&D and regional research ratios for 2006

Regions, states (NUTS 1, NUTS 2)	Gross regional product ("regional GDP")[1]	Gross domestic expenditure on R&D [2]	
	in € million	in € million	in % of GRP
Austria	**257.294**	**6,318.59**	**2.46**
Eastern Austria	**114.640**	**2,739.17**	**2.39**
Burgenland	5.739	30.52	0.53
Lower Austria	40.158	514.87	1.28
Vienna	68.743	2,193.78	3.19
Southern Austria	**47.193**	**1,643.09**	**3.48**
Carinthia	14.838	377.67	2.55
Styria	32.355	1,265.43	3.91
Western Austria	**95.460**	**1,936.32**	**2.03**
Upper Austria	42.560	996.91	2.34
Salzburg	18.427	230.74	1.25
Tirol	22.683	554.72	2.45
Vorarlberg	11.790	153.95	1.31

Source: Statistics Austria. Compiled on: 12.01.2009. – 1) As per 22.12.2008. – 2) Business segmemt: Regional allocation according to the company's R&D location(s) - Rounding differences.

Table 22: Higher education sector[1]: Employees in research and experimental development (R&D) in 2006, broken down by scientific discipline and employment category

Scientific discipline	No. of units performing R&D	Total	of which		
			Scientific personnel	Highly qualified non-scientific personnel	Other auxiliary personnel
			Headcount		
1.0 to 6.0 Total	**1,162**	**32,715**	**23,609**	**4,954**	**4,152**
1.0 to 4.0 Together	673	23,429	16,148	4,062	3,219
1.0 Natural sciences	252	8,551	6,371	1,416	764
2.0 Engineering	192	4,578	3,369	547	662
3.0 Human medicine	172	9,128	5,731	1,894	1,503
4.0 Agriculture and forestry, veterinary medicine	57	1,172	677	205	290
5.0 and 6.0 Together	489	9,286	7,461	892	933
5.0 Social sciences	274	5,429	4,363	532	534
6.0 Humanities	215	3,857	3,098	360	399
			Full-time equivalents		
1.0 to 6.0 Total	**1,162**	**12,668.2**	**9,261.3**	**1,855.6**	**1,551.3**
1.0 to 4.0 Together	673	9,570.5	6,747.2	1,583.6	1,239.7
1.0 Natural sciences	252	4,092.9	3,178.2	547.3	367.4
2.0 Engineering	192	2,012.6	1,502.7	215.1	294.8
3.0 Human medicine	172	2,934.6	1,744.7	733.2	456.7
4.0 Agriculture and forestry, veterinary medicine	57	530.4	321.5	88.0	120.8
5.0 and 6.0 Together	489	3,097.7	2,514.2	272.0	311.6
5.0 Social sciences	274	1,847.1	1,476.2	176.1	194.7
6.0 Humanities	215	1,250.7	1,037.9	95.9	116.9

Source: Statistics Austria, Survey of research and experimental development 2006. Compiled on: 08.08.2008. – 1) Universities including hospitals, art universities, the Academy of Sciences, universities of applied science, private universities and the Danube University at Krems. – Rounding differences.

Table 23: Higher education sector[1]: Expenditure on research and experimental development (R&D) in 2006 broken down by scientific discipline and type of expenditure

Scientific discipline	No. of units performing R&D	Total	of which			
			Personnel expenses	Material costs	Expenditure for plant and equipment	Construction expenditures and expenditures for property acquisition
		in 1000 €				
1.0 to 6.0 Total	**1,162**	**1,523,160**	**710,514**	**655,102**	**117,422**	**40,122**
1.0 to 4.0 Together	673	1,162,243	523,163	501,304	98,214	39,562
1.0 Natural sciences	252	477,341	221,736	200,462	53,571	1,572
2.0 Engineering	192	218,368	107,122	86,642	24,110	494
3.0 Human medicine	172	396,862	167,455	174,971	17,107	37,329
4.0 Agriculture and forestry, veterinary medicine	57	69,672	26,850	39,229	3,426	167
5.0 and 6.0 Together	489	360,917	187,351	153,798	19,208	560
5.0 Social sciences	274	209,340	108,633	87,399	12,976	332
6.0 Humanities	215	151,577	78,718	66,399	6,232	228

Source: Statistics Austria, Survey of research and experimental development 2006. Compiled on: 29.08.08. – 1) Universities including hospitals, art universities, the Academy of Sciences, universities of applied science, private universities and the Danube University at Krems.

Table 24: Higher education sector[1]: Expenditure on research and experimental development (R&D) in 2006 broken down by scientific discipline and type of research

Scientific discipline	No. of units performing R&D	Total spending on R&D	of which					
			Basic research		Applied research		Experimental development	
		in 1000 €	in 1000 €	in %	in 1000 €	in %	in 1000 €	in %
1.0 to 6.0 Total	**1,162**	**1,523,160**	**746,112**	**49.0**	**638,642**	**41.9**	**138,406**	**9.1**
1.0 to 4.0 Together	673	1,162,243	542,563	46.7	496,761	42.7	122,919	10.6
1.0 Natural sciences	252	477,341	295,271	61.9	143,332	30.0	38,738	8.1
2.0 Engineering	192	218,368	58,806	26.9	129,597	59.4	29,965	13.7
3.0 Human medicine	172	396,862	160,783	40.5	186,774	47.1	49,305	12.4
4.0 Agriculture and forestry, veterinary medicine	57	69,672	27,703	39.8	37,058	53.2	4,911	7.0
5.0 and 6.0 Together	489	360,917	203,549	56.4	141,881	39.3	15,487	4.3
5.0 Social sciences	274	209,340	97,227	46.4	102,673	49.1	9,440	4.5
6.0 Humanities	215	151,577	106,322	70.1	39,208	25.9	6,047	4.0

Source: Statistics Austria, Survey of research and experimental development 2006. Compiled on: 04.09.2008- 1) Universities including hospitals, art universities, the Academy of Sciences, universities of applied science, private universities and the Danube University at Krems.

Table 25: Higher education sector[1]: Financing of expenditure for research and experimental development (R&D) in 2006 broken down by scientific discipline and financing source

Scientific discipline	No. of units performing R&D	Financing source									
		Total	Business sector	Public sector					Private non-profit sector	Foreign incl. international organisations (excl. the EU)	EU
				Combined	Federal government 2)	State3)	Local governments3)	Others 2)			
		in 1000 €									
1.0 to 6.0 Total	**1,162**	**1,523,160**	**76,791**	**1,354,658**	**1,147,358**	**31,608**	**2,542**	**173,150**	**13,059**	**26,784**	**51,868**
1.0 to 4.0 Together	673	1,162,243	68,294	1,014,164	843,271	23,514	1,422	145,957	8,470	25,256	46,059
1.0 Natural sciences	252	477,341	17,665	426,884	344,414	9,986	276	72,208	1,791	8,191	22,810
2.0 Engineering	192	218,368	28,436	171,992	144,073	8,712	1,039	18,168	2,125	4,338	11,477
3.0 Human medicine	172	396,862	20,939	350,660	294,407	4,236	106	51,911	3,702	11,581	9,980
4.0 Agriculture and forestry, veterinary medicine	57	69,672	1,254	64,628	60,377	580	1	3,670	852	1,146	1,792
5.0 and 6.0 Together	489	360,917	8,497	340,494	304,087	8,094	1,120	27,193	4,589	1,528	5,809
5.0 Social sciences	274	209,340	7,364	192,358	179,340	4,156	419	8,443	3,874	851	4,893
6.0 Humanities	215	151,577	1,133	148,136	124,747	3,938	701	18,750	715	677	916

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 26.08.2008. – 1) Universities including hospitals, art universities, the Academy of Sciences, universities of applied science, private universities and the Danube University at Krems. – 2) The funds from the research promotion funds and the R&D financing by the higher education sector are included under "Other". – 3) States including Vienna. Local governments excluding Vienna.

Table 26: Universities[1]: Employees in research and experimental development (R&D) in full-time equivalents in 2006 broken down by scientific discipline and employment category

Scientific discipline	No. of units performing R&D	Full-time equivalents for R&D								
		Total	Scientific personnel						Highly qualified non-scientific personnel	Other non-scientific personnel
			Combined	Professors, male/ female	University lecturers, male and female	Junior lecturers, male/female	Assistants, male/female demonstrators, male/female	Other scientific personnel		
1.0 to 6.0 Total										
excluding hospitals	**928**	**9,986.2**	**7,339.6**	**790.2**	**1,106.3**	**1,790.1**	**55.8**	**3,597.2**	**1,321.8**	**1,324.9**
including hospitals	**1,017**	**11,319.2**	**8,155.4**	**836.1**	**1,346.6**	**2,078.9**	**55.8**	**3,838.1**	**1,664.1**	**1,499.8**
1.0 to 4.0 Together										
excluding hospitals	539	7,442.8	5,287.1	417.8	745.9	1,070.9	17.8	3,034.6	1,112.7	1,043.0
including hospitals	628	8,775.8	6,102.9	463.6	986.3	1,359.7	17.8	3,275.5	1,455.0	1,217.9
1.0 Natural sciences	229	3,624.2	2,787.6	225.0	417.0	461.3	7.2	1,677.2	478.0	358.5
2.0 Engineering	178	1,812.9	1,339.8	105.7	97.3	327.3	10.3	799.2	184.3	288.9
3.0 Human medicine										
excluding hospitals	75	1,475.3	838.2	61.5	184.3	187.8	0.2	404.5	362.4	274.7
hospitals	89	1,333.0	815.8	45.9	240.3	288.8	-	240.9	342.3	174.9
including hospitals	164	2,808.4	1,654.0	107.4	424.6	476.5	0.2	645.3	704.8	449.6
4.0 Agriculture and forestry, veterinary medicine	57	530.4	321.5	25.6	47.4	94.5	0.2	153.8	88.0	120.8
5.0 and 6.0 Together	389	2,543.4	2,052.5	372.4	360.3	719.2	38.0	562.6	209.0	281.9
5.0 Social sciences	245	1,610.7	1,301.3	217.6	197.1	523.7	30.4	332.6	133.0	176.3
6.0 Humanities	144	932.7	751.2	154.8	163.2	195.4	7.6	230.0	76.0	105.6

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 08.08.2008. – 1) Not including art universities. – Rounding differences.

Table 27: Universities[1]: Employees (scientific and non-scientific personnel) in 2006 broken down by scientific discipline and employment category. Distribution of working hours with proportionate administrative share, in percent

Scientific discipline	No. of units performing R&D	Total			Scientific personnel																		Highly qualified non-scientific personnel			Other non-scientific personnel		
					Combined			Professors			University lecturers			Junior lecturers			Assistants and demonstrators			Other scientific personnel								
		Teaching	Research and experimental development (R&D)	Other work	Teaching	Research and experimental development (R&D)	Other work	Teaching	Research and experimental development (R&D)	Other work	Teaching	Research and experimental development (R&D)	Other work	Teaching	Research and experimental development (R&D)	Other work	Teaching	Research and experimental development (R&D)	Other work	Teaching	Research and experimental development (R&D)	Other work	Teaching	Research and experimental development (R&D)	Other work	Teaching	Research and experimental development (R&D)	Other work
		Working hours (with proportionate administrative share) in %																										
1.0 to 6.0 Total																												
excluding hospitals	**928**	**28.8**	**60.8**	**10.4**	**30.5**	**62.2**	**7.3**	**41.5**	**50.2**	**8.3**	**41.2**	**51.2**	**7.6**	**36.9**	**54.0**	**9.1**	**62.4**	**24.5**	**13.1**	**13.8**	**81.0**	**5.2**	**19.7**	**55.2**	**25.1**	**28.7**	**59.4**	**11.9**
including hospitals	**1,017**	**26.0**	**54.6**	**19.4**	**27.5**	**55.0**	**17.5**	**40.0**	**48.5**	**11.5**	**35.1**	**44.0**	**20.9**	**29.5**	**42.3**	**28.2**	**62.4**	**24.5**	**13.1**	**13.2**	**80.5**	**6.3**	**17.2**	**55.2**	**27.6**	**27.1**	**51.6**	**21.3**
1.0 to 4.0 Together																												
excluding hospitals	539	23.2	65.4	11.4	24.5	68.2	7.3	39.6	51.9	8.5	39.1	52.6	8.3	33.9	56.0	10.1	72.5	15.4	12.1	7.1	88.1	4.8	16.1	56.9	27.0	25.1	61.6	13.3
including hospitals	628	21.1	55.8	23.1	22.0	56.6	21.4	37.1	48.5	14.4	31.8	42.5	25.7	25.0	38.5	36.5	72.5	15.4	12.1	6.8	86.9	6.3	14.1	56.4	29.5	24.2	51.3	24.5
1.0 Natural sciences	229	24.2	68.8	7.0	24.8	70.3	4.9	40.1	52.5	7.4	41.3	52.3	6.4	35.9	58.0	6.1	79.5	14.4	6.1	6.7	90.2	3.1	19.5	61.5	19.0	26.7	67.7	5.6
2.0 Engineering	178	25.2	65.3	9.5	26.0	67.4	6.6	42.0	50.4	7.6	41.6	51.1	7.3	38.7	54.6	6.7	59.3	23.4	17.3	8.6	85.8	5.6	18.2	52.5	29.3	26.8	64.9	8.3
3.0 Human medicine																												
excluding hospitals	75	19.6	59.8	20.6	22.6	64.4	13.0	34.3	51.4	14.3	33.6	53.0	13.4	25.9	56.2	17.9	98.7	1.2	0.1	6.0	84.9	9.1	11.6	53.5	34.9	22.3	55.6	22.1
hospitals	89	15.5	30.5	54.0	15.6	26.9	57.5	23.1	29.9	47.0	20.2	26.4	53.4	14.4	18.0	67.6	100.0	-	-	4.6	72.9	22.5	7.7	54.9	37.4	22.1	25.7	52.2
including hospitals	164	17.0	41.0	42.0	17.7	38.1	44.2	28.0	39.4	32.6	23.9	33.7	42.4	16.3	24.5	59.2	98.8	1.1	0.1	5.4	80.0	14.6	9.7	54.2	36.1	22.2	38.3	39.5
4.0 Agriculture and forestry, veterinary medicine	57	20.6	61.1	18.3	20.9	65.0	14.1	37.5	53.4	9.1	33.3	59.0	7.7	24.0	51.3	24.7	45.6	2.5	51.9	5.6	88.4	6.0	14.3	58.7	27.0	24.0	53.8	22.2
5.0 and 6.0 Together	389	41.0	50.8	8.2	41.7	50.9	7.4	43.4	48.6	8.0	45.2	48.4	6.4	40.9	51.3	7.8	52.0	33.8	14.2	37.1	56.4	6.5	35.5	47.7	16.8	40.0	52.7	7.3
5.0 Social sciences	245	39.7	51.9	8.4	40.2	52.2	7.6	43.1	48.4	8.5	45.6	48.2	6.2	40.8	51.6	7.6	53.7	35.0	11.3	29.2	63.4	7.4	35.0	47.4	17.6	40.0	52.7	7.3
6.0 Humanities	144	43.0	49.2	7.8	44.0	48.9	7.1	43.9	48.7	7.4	44.6	48.8	6.6	41.0	50.8	8.2	46.4	29.7	23.9	46.1	48.4	5.5	36.5	47.9	15.6	40.1	52.8	7.1

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 08.08.2008. – 1) Not including art universities.

Table 28: Universities[1]: Scientific personnel in research and experimental development in 2006 (headcounts and full-time equivalents) broken down by scientific discipline, gender and age group

Scientific discipline, gender	Head-count	Full-time equivalents (FTE) for R&D										
		Total	of which for employees aged									
			25 and under	25 to 29 years	30 to 34 years	35 to 39 years	40 to 44 years	45 to 49 years	50 to 54 years	55 to 59 years	60 to 64 years	65 years and over
1.0 to 6.0 Total	**20,880**	**8,155.4**	**180.8**	**2,011.5**	**1,698.8**	**1,124.1**	**898.8**	**691.1**	**534.6**	**423.2**	**420.6**	**171.7**
male	**13,709**	**5,645.3**	**77.8**	**1,209.1**	**1,122.2**	**754.5**	**648.6**	**510.9**	**423.4**	**357.6**	**377.4**	**163.9**
female	**7,171**	**2,510.0**	**103.0**	**802.5**	**576.7**	**369.7**	**250.2**	**180.3**	**111.2**	**65.6**	**43.2**	**7.8**
1.0 Natural sciences, total	5,732	2,787.6	82.5	845.3	612.8	363.2	240.8	182.3	161.9	121.1	135.9	41.8
male	4,285	2,098.9	43.0	563.4	448.1	281.1	192.2	149.5	137.6	114.6	128.3	41.1
female	1,447	688.8	39.5	282.0	164.7	82.1	48.6	32.8	24.3	6.5	7.6	0.7
2.0 Engineering, total	2,932	1,339.8	23.7	404.7	370.8	184.1	103.3	73.5	65.2	44.0	46.5	24.0
male	2,432	1,135.3	15.6	322.0	317.4	152.4	89.6	67.3	61.0	42.4	43.6	24.0
female	500	204.5	8.1	82.8	53.4	31.7	13.7	6.2	4.2	1.6	2.9	-
3.0 Human medicine, total	5,520	1,654.0	20.3	322.5	327.9	254.3	258.9	172.9	118.9	85.5	72.9	20.1
male	3,337	982.6	2.6	126.8	170.0	143.8	179.2	121.4	91.0	67.0	62.6	18.2
female	2,183	671.4	17.6	195.7	157.9	110.5	79.6	51.4	27.9	18.5	10.3	1.9
4.0 Agriculture and forestry, veterinary medicine, total	677	321.5	2.0	54.1	80.1	56.5	49.3	38.5	13.3	11.3	13.2	3.3
male	342	184.4	-	20.5	34.3	31.8	33.6	30.2	10.8	7.9	12.5	2.9
female	335	137.1	2.0	33.6	45.8	24.6	15.6	8.3	2.5	3.4	0.7	0.5
5.0 Social sciences, total	3,858	1,301.3	47.0	324.5	227.7	166.8	134.7	120.8	83.2	88.6	65.3	42.8
male	2,163	783.1	14.9	152.9	114.8	95.3	88.0	83.7	62.4	71.2	57.6	42.4
female	1,695	518.2	32.0	171.6	112.9	71.5	46.6	37.1	20.8	17.4	7.7	0.5
6.0 Humanities, total	2,161	751.2	5.5	60.3	79.6	99.3	111.9	103.2	92.1	72.8	86.8	39.7
male	1,150	461.0	1.7	23.5	37.6	50.1	66.0	58.7	60.7	54.6	72.8	35.5
female	1,011	290.1	3.7	36.8	42.0	49.2	45.9	44.4	31.5	18.3	14.0	4.3

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on 25.08.2008. – 1) Not including universities of the arts. – Rounding differences.

Table 29: Universities[1)]: Expenditure on research and experimental development in 2006 broken down by scientific discipline and type of expenditure

Scientific discipline	No. of units performing R&D	Total	of which: Personnel expenses	of which: Material costs	of which: Expenditure for plant and equipment	of which: Construction expenditures and expenditures for property acquisition
		in 1000 €				
1.0 to 6.0 Total						
excluding hospitals	**928**	**1,165,630**	**555,670**	**514,266**	**93,922**	**1,772**
including hospitals	**1,017**	**1,359,566**	**636,254**	**586,161**	**99,853**	**37,298**
1.0 to 4.0 Together						
excluding hospitals	539	864,096	400,346	385,042	77,212	1,496
including hospitals	628	1,058,032	480,930	456,937	83,143	37,022
1.0 Natural sciences	229	415,499	198,129	174,559	42,310	501
2.0 Engineering	178	191,340	95,247	74,536	21,171	386
3.0 Human medicine						
excluding hospitals	75	187,585	80,120	96,718	10,305	442
hospitals	89	193,936	80,584	71,895	5,931	35,526
including hospitals	164	381,521	160,704	168,613	16,236	35,968
4.0 Agriculture and forestry, veterinary medicine	57	69,672	26,850	39,229	3,426	167
5.0 and 6.0 Together	389	301,534	155,324	129,224	16,710	276
5.0 Social sciences	245	182,189	95,670	74,897	11,461	161
6.0 Humanities	144	119,345	59,654	54,327	5,249	115

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on 28/08/2008. – 1) Not including universities of the arts.

Table 30: Universities[1)]: Expenditure on research and experimental development in 2006 broken down by scientific discipline and type of research

Scientific discipline	No. of units performing R&D	Total expenditure on R&D	of which: Basic research		of which: Applied research		of which: Experimental development	
		in 1000 €	in 1000 €	*in %*	in 1000 €	*in %*	in 1000 €	*in %*
1.0 to 6.0 Total								
excluding hospitals	**928**	**1,165,630**	**613,773**	***52,6***	**468,344**	***40,2***	**83,513**	***7,2***
including hospitals	**1,017**	**1,359,566**	**665,989**	***48,9***	**578,564**	***42,6***	**115,013**	***8,5***
1.0 to 4.0 Together								
excluding hospitals	539	864,096	433,277	*50,2*	355,550	*41,1*	75,269	*8,7*
including hospitals	628	1,058,032	485,493	*45,9*	465,770	*44,0*	106,769	*10,1*
1.0 Natural sciences	229	415,499	249,109	*60,0*	135,572	*32,6*	30,818	*7,4*
2.0 Engineering	178	191,340	56,643	*29,6*	112,611	*58,9*	22,086	*11,5*
3.0 Human medicine								
excluding hospitals	75	187,585	99,822	*53,2*	70,309	*37,5*	17,454	*9,3*
hospitals	89	193,936	52,216	*26,9*	110,220	*56,9*	31,500	*16,2*
including hospitals	164	381,521	152,038	*39,9*	180,529	*47,3*	48,954	*12,8*
4.0 Agriculture and forestry, veterinary medicine	57	69,672	27,703	*39,8*	37,058	*53,2*	4,911	*7,0*
5.0 and 6.0 Together	389	301,534	180,496	*59,9*	112,794	*37,4*	8,244	*2,7*
5.0 Social sciences	245	182,189	90,492	*49,6*	84,496	*46,4*	7,201	*4,0*
6.0 Humanities	144	119,345	90,004	*75,4*	28,298	*23,7*	1,043	*0,9*

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 29.08.08. – 1) Not including art universities.

Table 31: Universities[1]: Financing of expenditure for research and experimental development (R&D) in 2006 broken down by scientific discipline and financing source

Scientific discipline	No. of units performing R&D	Financing source									
		Total	Business sector	Public sector					Private non-profit sector	Foreign incl. international organisations (excl. the EU)	EU
				Combined	Federal government [2]	State[3]	Local governments[3]	Others [2]			
		in 1000 €									
1.0 to 6.0 Total											
excluding hospitals	**928**	**1,165,630**	**58,774**	**1,043,476**	**886,816**	**14,773**	**1,170**	**140,717**	**4,865**	**17,478**	**41,037**
including hospitals	**1,017**	**1,359,566**	**68,109**	**1,217,733**	**1,042,448**	**16,137**	**1,170**	**157,978**	**5,883**	**22,844**	**44,997**
1.0 to 4.0 Together											
excluding hospitals	539	864,096	52,733	754,549	624,057	12,405	460	117,627	3,909	16,026	36,879
including hospitals	628	1,058,032	62,068	928,806	779,689	13,769	460	134,888	4,927	21,392	40,839
1.0 Natural sciences	229	415,499	15,232	371,266	297,528	7,592	274	65,872	1,706	7,775	19,520
2.0 Engineering	178	191,340	25,715	150,395	131,456	2,839	185	15,915	653	4,229	10,348
3.0 Human medicine											
excluding hospitals	75	187,585	10,532	168,260	134,696	1,394	-	32,170	698	2,876	5,219
hospitals	89	193,936	9,335	174,257	155,632	1,364	-	17,261	1,018	5,366	3,960
including hospitals	164	381,521	19,867	342,517	290,328	2,758	-	49,431	1,716	8,242	9,179
4.0 Agriculture and forestry, veterinary medicine	57	69,672	1,254	64,628	60,377	580	1	3,670	852	1,146	1,792
5.0 and 6.0 Together	389	301,534	6,041	288,927	262,759	2,368	710	23,090	956	1,452	4,158
5.0 Social sciences	245	182,189	5,109	172,244	163,406	1,605	81	7,152	685	783	3,368
6.0 Humanities	144	119,345	932	116,683	99,353	763	629	15,938	271	669	790

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 29/08/2008 – 1) Not including art universities. – 2) The funds from the research promotion funds and the R&D financing by the higher education sector are included under "Other". – 3) States including Vienna. Local governments without Vienna.

Table 32: State sector[1]: Employees in research and experimental development (R&D) in 2006, broken down by scientific discipline and employment category

Scientific discipline	No. of units performing R&D	Total	of which		
			Scientific personnel	Highly qualified non-scientific personnel	Other auxiliary personnel
			Headcounts		
1.0 to 6.0 Total	**254**	**5,511**	**2,789**	**1,129**	**1,593**
1.0 to 4.0 Together	97	2,831	1,325	633	873
1.0 Natural sciences	34	928	481	215	232
2.0 Engineering	12	579	328	129	122
3.0 Human medicine	32	266	166	71	29
4.0 Agriculture and forestry, veterinary medicine	19	1,058	350	218	490
5.0 and 6.0 Together	157	2,680	1,464	496	720
5.0 Social sciences	85	1,093	752	205	136
6.0 Humanities	72	1,587	712	291	584
			Full-time equivalents		
1.0 to 6.0 Total	**254**	**2,422.6**	**1,348.5**	**356.5**	**717.6**
1.0 to 4.0 Together	97	1,329.1	679.4	205.8	443.9
1.0 Natural sciences	34	363.9	245.6	39.9	78.4
2.0 Engineering	12	266.3	183.8	40.8	41.6
3.0 Human medicine	32	100.1	69.3	19.8	11.0
4.0 Agriculture and forestry, veterinary medicine	19	598.8	180.7	105.3	312.8
5.0 and 6.0 Together	157	1,093.5	669.1	150.7	273.7
5.0 Social sciences	85	479.6	357.8	76.2	45.6
6.0 Humanities	72	613.9	311.3	74.6	228.1

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 08.08.2008. – 1) Federal institutions (not including those combined in the higher education sector), state, local government and chamber institutions, R&D institutions of the social insurance carriers, public sector-financed and/or controlled private non-profit institutions as well as R&D institutions of the Ludwig Boltzmann-Gesellschaft; without state hospitals. The state hospitals were not surveyed by questionnaire; instead Statistics Austria prepared an estimate of the R&D expenditures based on the reports of the offices of the state governments. For this reason there is no data about employees in R&D. – Rounding differences.

Table 33: State sector[1]: Employees in research and experimental development (R&D) in 2006, broken down by legal entity and employment category

Legal entity	No. of units performing R&D	Total	of which		
			Scientific personnel	Highly qualified non-scientific personnel	Other auxiliary personnel
			Headcounts		
Total	**254**	**5,511**	**2,789**	**1,129**	**1,593**
Fed.Gov.	55	2,649	1,129	557	963
States (including Vienna)	39	740	269	120	351
Local governments (without Vienna)	8	155	76	30	49
Chambers	3	29	17	-	12
Social insurance institutions	-	-	-	-	-
Private non-profit institutions [2]	108	1,563	1,026	338	199
Ludwig Boltzmann Gesellschaft	41	375	272	84	19
			Full-time equivalents		
Total	**254**	**2,422.6**	**1,348.5**	**356.5**	**717.6**
Fed.Gov.	55	1,190.2	507.8	181.0	501.4
States (including Vienna)	39	204.6	94.1	16.4	94.2
Local governments (without Vienna)	8	61.5	36.7	8.3	16.5
Chambers	3	9.6	7.1	-	2.6
Social insurance institutions	-	-	-	-	-
Private non-profit institutions [2]	108	789.3	574.0	122.4	92.9
Ludwig Boltzmann Gesellschaft	41	167.3	128.8	28.4	10.0

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 08.08.2008. – 1) Federal institutions (not including those combined in the higher education sector), state, local government and chamber institutions, R&D institutions of the social insurance carriers, public sector-financed and/or controlled private non-profit institutions as well as R&D institutions of the Ludwig Boltzmann-Gesellschaft; without state hospitals. The state hospitals were not surveyed by questionnaire; instead Statistics Austria prepared an estimate of the R&D expenditures based on the reports of the offices of the state governments. For this reason there is no data about employees in R&D. – 2) Private non-profit institutions primarily financed/supervised by the public sector. – Rounding differences.

Table 34: State sector[1]: Expenditure on research and experimental development in 2006 broken down by scientific discipline and type of expenditure

Scientific discipline	No. of units performing R&D	Total	of which			
			Personnel expenses	Material costs	Expenditure for plant and equipment	Construction expenditures and expenditures for property acquisition
		in 1000 €				
1.0 to 6.0 Total	**254 [2]**	**330,232**	**182,296**	**123,416**	**16,234**	**8,286**
1.0 to 4.0 Together	97 [2]	218,420	122,972	77,649	11,394	6,405
1.0 Natural sciences	34	38,390	17,244	16,273	3,910	963
2.0 Engineering	12	22,029	14,545	6,155	1,296	33
3.0 Human medicine	32 [2]	121,429	65,453	47,189	4,629	4,158
4.0 Agriculture and forestry, veterinary medicine	19	36,572	25,730	8,032	1,559	1,251
5.0 and 6.0 Together	157	111,812	59,324	45,767	4,840	1,881
5.0 Social sciences	85	44,692	29,319	14,601	675	97
6.0 Humanities	72	67,120	30,005	31,166	4,165	1,784

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 29.08.08. – 1) Federal institutions (not including those combined in the higher education sector), state, local government and chamber institutions, R&D institutions of the social insurance carriers, public sector-financed and/or controlled private non-profit institutions as well as R&D institutions of the Ludwig Boltzmann-Gesellschaft; with state hospitals. The state hospitals were not surveyed by questionnaire; instead Statistics Austria prepared an estimate of the R&D expenditures based on the reports of the offices of the state governments. – 2) Number of survey units not including state hospitals.

Table 35: State sector[1]: Expenditure on research and experimental development (R&D) in 2006 broken down by legal entity and type of expenditure

Legal entity	No. of units performing R&D	Total	of which			
			Personnel expenses	Material costs	Expenditure for plant and equipment	Construction expenditures and expenditures for property acquisition
		in 1000 €				
Total	**254 [2]**	**330,232**	**182,296**	**123,416**	**16,234**	**8,286**
Fed.Gov.	55	100,070	56,469	32,650	8,586	2,365
States (including Vienna)	39 [2]	145,165	70,922	63,498	4,934	5,811
Local governments (without Vienna)	8	4,995	2,444	2,303	248	-
Chambers	3	4,402	654	3,748	-	-
Social insurance institutions	-	-	-	-	-	-
Private non-profit institutions [3]	108	64,328	44,707	17,818	1,693	110
Ludwig Boltzmann Gesellschaft	41	11,272	7,100	3,399	773	-

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 04 September 2008 – 1) Federal institutions (not including those combined in the higher education sector), state, local government and chamber institutions, R&D institutions of the social insurance carriers, public sector-financed and/or controlled private non-profit institutions as well as R&D institutions of the Ludwig Boltzmann-Gesellschaft; including state hospitals. The state hospitals were not surveyed by questionnaire; instead Statistics Austria prepared an estimate of the R&D expenditures based on the reports of the offices of the state governments. – 2) Number of survey units not including state hospitals. – 3) Private non-profit institutions primarily financed/supervised by the public sector.

Table 36: State sector[1)]: Expenditure on research and experimental development (R&D) in 2006 broken down by scientific discipline and type of research

Scientific discipline	No. of units performing R&D	Total expenditure on R&D	of which					
			Basic research		Applied research		Experimental development	
		in 1000 €	in 1000 €	*in %*	in 1000 €	*in %*	in 1000 €	*in %*
1.0 to 6.0 Total	**254**	**215,800**	**69,532**	***32.2***	**127,711**	***59.2***	**18,557**	***8.6***
1.0 to 4.0 Together	97	103,988	19,175	*18.4*	68,919	*66.3*	15,894	*15.3*
1.0 Natural sciences	34	38,390	14,142	*36.8*	21,698	*56.6*	2,550	*6.6*
2.0 Engineering	12	22,029	1,355	*6.2*	14,677	*66.6*	5,997	*27.2*
3.0 Human medicine	32	6,997	1,089	*15.6*	2,642	*37.8*	3,266	*46.6*
4.0 Agriculture and forestry, veterinary medicine	19	36,572	2,589	*7.1*	29,902	*81.7*	4,081	*11.2*
5.0 and 6.0 Together	157	111,812	50,357	*45.0*	58,792	*52.6*	2,663	*2.4*
5.0 Social sciences	85	44,692	9,982	*22.3*	33,193	*74.3*	1,517	*3.4*
6.0 Humanities	72	67,120	40,375	*60.2*	25,599	*38.1*	1,146	*1.7*

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 04 September 2008- 1) Federal institutions (not including those combined in the higher education sector), state, local government and chamber institutions, R&D institutions of the social insurance carriers, public sector-financed and/or controlled private non-profit institutions as well as R&D institutions of the Ludwig Boltzmann-Gesellschaft; without state hospitals. The state hospitals were not surveyed by questionnaire; instead Statistics Austria prepared an estimate of the R&D expenditures based on the reports of the offices of the state governments. There is no breakdown of R&D expenses by type of research.

Table 37: State sector[1)]: Expenditure on research and experimental development (R&D) in 2006 broken down by legal entity and type of research

Legal entity	No. of units performing R&D	Total expenditure on R&D	of which					
			Basic research		Applied research		Experimental development	
		in 1000 €	in 1000 €	*in %*	in 1000 €	*in %*	in 1000 €	*in %*
Total	**254**	**215,800**	**69,532**	***32.2***	**127,711**	***59.2***	**18,557**	***8.6***
Fed.Gov.	55	100,070	33,983	*34.0*	59,708	*59.6*	6,379	*6.4*
States (including Vienna)	39	30,733	14,627	*47.6*	15,499	*50.4*	607	*2.0*
Local governments (without Vienna)	8	4,995	1,916	*38.4*	2,127	*42.5*	952	*19.1*
Chambers	3	4,402	1,006	*22.9*	3,384	*76.8*	12	*0.3*
Social insurance institutions	-	-	-	-	-	-	-	-
Private non-profit institutions [2)]	108	64,328	13,942	*21.7*	42,843	*66.6*	7,543	*11.7*
Ludwig Boltzmann Gesellschaft	41	11,272	4,058	*36.0*	4,150	*36.8*	3,064	*27.2*

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 04 September 2008 – 1) Federal institutions (not including those combined in the higher education sector), state, local government and chamber institutions, R&D institutions of the social insurance carriers, public sector-financed and/or controlled private non-profit institutions as well as R&D institutions of the Ludwig Boltzmann-Gesellschaft; without state hospitals. The state hospitals were not surveyed by questionnaire; instead Statistics Austria prepared an estimate of the R&D expenditures based on the reports of the offices of the state governments. There is no breakdown of R&D expenses by type of research. – 2) Private non-profit institutions primarily financed/supervised by the public sector.

Table 38: State sector[1)] Financing of expenditure for research and experimental development (R&D) in 2006 broken down by scientific discipline and financing source

Scientific discipline	No. of units performing R&D	Financing source									
		Total	Business sector	Public sector					Private non-profit sector	Foreign incl. international organisations (excl. the EU)	EU
				Combined	Federal government [2)]	State[3)]	Local governments[3)]	Others [2)]			
		in 1000 €									
1.0 to 6.0 Total	**254[4)]**	**330,232**	**22,462**	**287,250**	**115,727**	**150,528**	**3,948**	**17,047**	**1,835**	**1,887**	**16,798**
1.0 to 4.0 Together	97[4)]	218,420	7,456	201,007	62,622	129,749	1,788	6,848	607	1,080	8,270
1.0 Natural sciences	34	38,390	1,090	35,131	19,690	12,285	1,711	1,445	338	131	1,700
2.0 Engineering	12	22,029	5,784	12,318	8,486	1,058	74	2,700	20	531	3,376
3.0 Human medicine	32[4)]	121,429	336	120,139	2,832	114,680	3	2,624	136	408	410
4.0 Agriculture and forestry, veterinary medicine	19	36,572	246	33,419	31,614	1,726	-	79	113	10	2,784
5.0 and 6.0 Together	157	111,812	15,006	86,243	53,105	20,779	2,160	10,199	1,228	807	8,528
5.0 Social sciences	85	44,692	6,670	30,410	17,699	3,944	182	8,585	810	341	6,461
6.0 Humanities	72	67,120	8,336	55,833	35,406	16,835	1,978	1,614	418	466	2,067

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 29.08.08. – 1) Federal institutions (not including those combined in the hgiher education sector), state, local government and chamber institutions, R&D institutions of the social insurance carriers, public sector-financed and/or controlled private non-profit institutions as well as R&D institutions of the Ludwig Boltzmann-Gesellschaft; including state hospitals. The state hospitals were not surveyed by questionnaire; instead Statistics Austria prepared an estimate of the R&D expenditures based on the reports of the offices of the state governments. – 2) The funds from the research promotion funds and the R&D financing by the higher education sector are included under "Other". – 3) States including Vienna. Local governments without Vienna. – 4) Number of survey units not including state hospitals.

Table 39: State sector[1]: Financing of expenditure on research and experimental development (R&D) in 2006 broken down by legal entitiy and financing source

Legal entity	No. of units performing R&D	Financing source									
		Total	Business sector	Public sector					Private non-profit sector	Foreign incl. international organisations (excl. the EU)	EU
				Combined	Federal government [2]	State[3]	Local governments[3]	Others [2]			
		in 1000 €									
Total	**254[4]**	**330,232**	**22,462**	**287,250**	**115,727**	**150,528**	**3,948**	**17,047**	**1,835**	**1,887**	**16,798**
Fed.Gov.	55	100,070	6,077	90,422	89,795	265	14	348	193	240	3,138
States (including Vienna)	39[4]	145,165	886	144,109	179	143,176	703	51	112	-	58
Local governments (without Vienna)	8	4,995	1,098	3,839	272	642	2,860	65	11	-	47
Chambers	3	4,402	-	4,402	-	-	-	4,402	-	-	-
Social insurance institutions	-	-	-	-	-	-	-	-	-	-	-
Private non-profit institutions [5]	108	64,328	13,584	36,072	20,064	6,213	336	9,459	1,323	1,006	12,343
Ludwig Boltzmann Gesellschaft	41	11,272	817	8,406	5,417	232	35	2,722	196	641	1,212

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 29.08.08. – 1) Federal institutions (not including those combined in the hgiher education sector), state, local government and chamber institutions, R&D institutions of the social insurance carriers, public sector-financed and/or controlled private non-profit institutions as well as R&D institutions of the Ludwig Boltzmann-Gesellschaft; including state hospitals. The state hospitals were not surveyed by questionnaire; instead Statistics Austria prepared an estimate of the R&D expenditures based on the reports of the offices of the state governments. – 2) The funds from the research promotion funds and the R&D financing by the higher education sector are included under "Other". – 3) States including Vienna. Local governments without Vienna. – 4) Number of survey units not including state hospitals. – 5) Private non-profit institutions primarily financed/supervised by the public sector.

Table 40: Private non-profit sector[1]: Employees in research and experimental development (R&D) in 2006, broken down by scientific discipline and employment category

Scientific discipline	No. of units performing R&D	Total	of which		
			Scientific personnel	Highly qualified non-scientific personnel	Other auxiliary personnel
			Headcounts		
1.0 to 6.0 Total	**40**	**404**	**284**	**72**	**48**
1.0 to 4.0 Together	15	217	136	51	30
1.0 Natural sciences	7 [2]	115 [2]	75 [2]	26 [2]	14 [2]
2.0 Engineering	8	102	61	25	16
3.0 Human medicine	. [2]	. [2]	. [2]	. [2]	. [2]
4.0 Agriculture and forestry, veterinary medicine	. [2]	. [2]	. [2]	. [2]	. [2]
5.0 and 6.0 Together	25	187	148	21	18
5.0 Social sciences	19	163	129	17	17
6.0 Humanities	6	24	19	4	1
			Full-time equivalents		
1.0 to 6.0 Total	**40**	**160.5**	**118.4**	**26.3**	**15.9**
1.0 to 4.0 Together	15	107.1	73.9	22.8	10.4
1.0 Natural sciences	7 [2]	63.9 [2]	41.0 [2]	17.5 [2]	5.3 [2]
2.0 Engineering	8	43.2	32.8	5.3	5.0
3.0 Human medicine	. [2]	. [2]	. [2]	. [2]	. [2]
4.0 Agriculture and forestry, veterinary medicine	. [2]	. [2]	. [2]	. [2]	. [2]
5.0 and 6.0 Together	25	53.4	44.5	3.5	5.5
5.0 Social sciences	19	49.5	40.8	3.3	5.4
6.0 Humanities	6	3.9	3.7	0.2	0.1

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 08.08.2008. – 1) Private non-profit institutions whose status is predominantly private or under civil law, sectarian or other non-public. – 2) In order to keep the data confidential these figures can only be reported together. – Rounding differences.

Table 41: Private non-profit sector[1]: Expenditure on research and experimental development (R&D) in 2006 broken down by scientific discipline and type of expenditure

Scientific discipline	No. of units performing R&D	Total	of which			
			Personnel expenses	Material costs	Expenditure for plant and equipment	Construction expenditures and expenditures for property acquisition
		in 1000 €				
1.0 to 6.0 Total	**40**	**16,519**	**7,630**	**8,538**	**348**	**3**
1.0 to 4.0 Together	15	12,472	5,123	7,068	278	3
1.0 Natural sciences	4	804	427	335	39	3
2.0 Engineering	8	6,921	2,058	4,660	203	-
3.0 Human medicine	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]
4.0 Agriculture and forestry, veterinary medicine	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]
5.0 and 6.0 Together	25	4,047	2,507	1,470	70	-
5.0 Social sciences	19	3,859	2,444	1,353	62	-
6.0 Humanities	6	188	63	117	8	-

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 29.08.08. – 1) Private non-profit institutions whose status is predominantly private or under civil law, sectarian or other non-public. – 2) In order to keep the data confidential these figures cannot be reported separately, but they are included in the subtotals and totals.

Table 42: Private non-profit sector[1]: Expenditure on research and experimental development (R&D) in 2006 broken down by scientific discipline and type of research

Scientific discipline	No. of units performing R&D	Total expendi-ture on R&D	of which					
			Basic research		Applied research		Experimental development	
		in 1000 €	in 1000 €	*in %*	in 1000 €	*in %*	in 1000 €	*in %*
1.0 to 6.0 Total	**40**	**16,519**	**3,682**	***22.3***	**12,076**	***73.1***	**761**	***4.6***
1.0 to 4.0 Together	15	12,472	2,790	*22.4*	9,019	*72.3*	663	*5.3*
1.0 Natural sciences	4	804	742	*92.3*	62	*7.7*	-	-
2.0 Engineering	8	6,921	2,036	*29.4*	4,326	*62.5*	559	*8.1*
3.0 Human medicine	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]
4.0 Agriculture and forestry, veterinary medicine	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]
5.0 and 6.0 Together	25	4,047	892	*22.0*	3,057	*75.6*	98	*2.4*
5.0 Social sciences	19	3,859	833	*21.6*	2,970	*76.9*	56	*1.5*
6.0 Humanities	6	188	59	*31.4*	87	*46.3*	42	*22.3*

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 04.09.2008 – 1) Private non-profit institutions whose status is predominantly private or under civil law, sectarian or other non-public. – 2) In order to keep the data confidential these figures cannot be reported separately, but they are included in the subtotals and totals.

Table 43: Private non-profit sector[1]: Financing of expenditure for research and experimental development (R&D) in 2006 broken down by scientific discipline and financing source

Scientific discipline	No. of units performing R&D	Financing source									
		Total	Business sector	Public sector					Private non-profit sector	Foreign incl. international organisations (excl. the EU)	EU
				Combined	Federal government [2]	State[3]	Local governments[3]	Others [2]			
		in 1000 €									
1.0 to 6.0 Total	**40**	**16,519**	**3,006**	**1,340**	**480**	**271**	**9**	**580**	**10,763**	**147**	**1,263**
1.0 to 4.0 Together	15	12,472	1,528	525	177	111	5	232	9,793	54	572
1.0 Natural sciences	4	804	33	77	19	54	4	-	691	3	-
2.0 Engineering	8	6,921	1,373	91	5	23	1	62	5,234	51	172
3.0 Human medicine	.[4]	.[4]	.[4]	.[4]	.[4]	.[4]	-	.[4]	.[4]	.[4]	.[4]
4.0 Agriculture and forestry, veterinary medicine	.[4]	.[4]	.[4]	.[4]	.[4]	.[4]	-	.[4]	.[4]	.[4]	.[4]
5.0 and 6.0 Together	25	4,047	1,478	815	303	160	4	348	970	93	691
5.0 Social sciences	19	3,859	1,372	785	291	148	4	342	943	93	666
6.0 Humanities	6	188	106	30	12	12	-	6	27	-	25

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 29.08.2008. – 1) Private non-profit institutions whose status is predominantly private or under civil law, sectarian or other non-public. – 2) The funds from the research promotion funds and the R&D financing by the higher education sector are included under "Other". – 3) States including Vienna. Local governments without Vienna. – 4) In order to keep the data confidential these figures cannot be reported separately, but they are included in the subtotals and totals.

Table 44: Corporate sector[1)]: Employees in research and experimental development (R&D) in 2006, classified by industry, number of employees and employment category

Industry, number of employees		No. of units performing R&D	Headcounts in R&D total	Full-time equivalents in R&D			
				Total	Scientists and engineers, [2)]	Highly qualified non-scientific personnel [3)]	Other auxiliary personnel
Total		**2,407**	**45,336**	**34,125.8**	**18,470.5**	**12,583.3**	**3,072.0**
Industry							
01+02+05	Agriculture and forestry, fisheries	3	46	13.5	4.9	8.6	-
10–14	Mining and excavation of rocks and soils	10	117	50.5	7.7	41.9	0.9
15–37	Manufacturing	1,324	29,360	23,779.8	12,480.1	9,368.9	1,930.8
15	Foods and luxury foods, drinks	87	573	281.6	151.6	107.6	22.4
16	Tobacco processing	.[4)]	.[4)]	.[4)]	.[4)]	.[4)]	.[4)]
17	Textiles and textile goods (without apparel)	28	307	229.7	70.0	140.4	19.3
18+19	Clothing, leather, shoes	14	96	57.9	19.5	27.9	10.5
20	Wood (without furniture production)	52	278	136.9	60.4	50.9	25.6
21	Paper and pulp	27	189	136.9	55.8	79.8	1.3
22	Publishing, printing and reproduction of recorded media	13	144	114.0	39.2	64.8	10.0
23	Coke, refined petroleum products, nuclear fuel	.[4)]	.[4)]	.[4)]	.[4)]	.[4)]	.[4)]
24 without 24.4	Chemicals and chemical products (except pharmaceuticals)	73	1,383	1,143.5	469.4	587.6	86.5
24.4	Pharmaceuticals, medicinal chemicals and botanical products	25	1,514	1,323.9	751.1	451.2	121.6
25	Rubber and plastic products	76	1,081	836.3	301.0	353.1	182.2
26	Other non-metallic mineral products	64	826	666.1	483.1	144.5	38.5
27.1-27.3 and 27.51/52	Basic iron, steel, ferro-alloys, tubes, iron and steel casting	29	774	416.9	222.3	134.0	60.6
27.4+27.53/54	Non-ferrous metals, light and heavy metal casting	26	414	275.1	130.0	105.5	39.6
28	Metal products	138	1,522	905.2	413.2	424.3	67.7
29	Machinery and equipment	298	5,308	4,159.4	1,751.7	2,064.8	342.9
30	Office machinery and computers	12	229	183.1	80.4	97.5	5.2
31	Electrical machinery and apparatus n.e.c.	82	2,194	1,827.1	957.2	739.7	130.2
32 without 32.1	Radio, television and communication equipment and apparatus	28	4,070	3,928.1	2,461.3	1,400.8	66.0
32.1	Electronic components	31	1,818	1,701.8	1,481.5	111.4	108.9
33 without 33.1	Precision and optical instruments	75	1,169	827.1	430.1	382.9	14.1
33.1	Medical instruments	31	606	534.0	376.5	112.0	45.5
34	Motor vehicles, trailers and semi-trailers	38	2,678	2,522.4	1,209.2	924.5	388.7
35	Manufacture of other transport equipment	16	1,138	877.4	271.1	512.1	94.2
36 without 36.1	Jewellery, musical instruments, sports good, games and toys, other manufacturing n.e.c.	30	694	455.3	201.1	236.2	18.0
36.1	Furniture	26	238	148.2	42.5	78.3	27.4
37	Recycling	.[4)]	.[4)]	.[4)]	.[4)]	.[4)]	.[4)]
40+41	Electricity, gas and water supply	25	220	62.8	37.8	23.8	1.2
45	Construction	82	407	188.1	86.6	76.2	25.3
50–93	Services	963	15,186	10,031.1	5,853.4	3,063.9	1,113.8
50–52	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal household goods	205	1,866	1,373.1	668.3	611.7	93.1
55	Hotels and restaurants	-	-	-	-	-	-
60–64	Transport, storage and communication	25	508	397.6	336.7	43.8	17.1
65–67	Financial intermediation	7	451	289.8	181.3	87.2	21.3
70+71+74	Real estate, renting and business activities	243	3,433	2,338.7	1,369.0	528.7	441.1
72 without 72.2	Computer and related activities (without software consultancy and supply)	56	491	265.6	133.2	107.6	24.8
72.2	Software consultancy and supply	210	3,326	1,904.7	964.1	884.2	56.4
73	Research and development	193	4,898	3,378.7	2,158.4	779.9	440.4
75–93	Public administration, education, health and other community, social and personal service activities	24	213	82.8	42.4	20.8	19.6
Number of employees							
1 – 49 employees		1,278	7,773	4,406.9	2,746.3	1,363.7	296.9
50 – 249 employees		721	10,770	7,098.9	3,505.7	3,057.5	535.7
250 and more employees		408	26,793	22,620.0	12,218.5	8,162.1	2,239.5

Source: Statistics Austria, Survey of research and experimental development in 2006. Compiled on: 08.08.2008. – 1) Includes the cooperative segment and the business sector. – 2) University graduates and equivalent employees. – 3) Graduates of academic secondary schools, technicians, laboratory assistants. – 4) In order to keep the data confidential these figures cannot be reported separately, but they are included in the subtotals and totals. – Rounding differences.

Table 45: Corporate sector[1]: Scientists, engineers in research and experimental development (R&D) in 2006 broken down by industry, education level and gender

Industry		Number of survey units implementing R&D	Full-time equivalents in R&D													
			Total		of which											
					Level of university education completed: Doctorate		Level of university or university of applied sciences education completed: postgraduate (masters)		non-university post secondary school education or university degree non completed		Master craftsman examination or foreman courses		School leaving examination, medium-level technical school, vocational training completed		Other education	
			male	female	male	female	male	female	male	female	male	female	male	female	male	female
Total		**2,407**	**16,206.8**	**2,263.6**	**2,608.2**	**532.7**	**6,976.7**	**841.2**	**616.1**	**111.9**	**431.0**	**24.1**	**5,012.1**	**511.1**	**562.7**	**242.7**
01+02+05	Agriculture and forestry, fisheries	3	3.4	1.5	0.1	0.5	3.3	1.0	-	-	-	-	-	-	-	-
10–14	Mining and excavation of rocks and soils	10	7.5	0.2	0.2	-	5.7	-	-	-	0.4	-	0.4	0.2	0.8	-
15–37	Manufacturing	1,324	11,230.7	1,249.3	1,435.6	250.3	4,484.5	399.3	349.9	69.9	374.6	21.6	4,159.7	379.8	426.4	128.4
15	Foods and luxury foods, drinks	87	108.2	43.4	15.0	4.0	34.7	23.1	8.6	2.9	24.6	3.0	19.1	5.1	6.2	5.3
16	Tobacco processing	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]
17	Textiles and textile goods (without apparel)	28	56.4	13.6	4.5	0.7	11.9	5.0	-	3.9	6.8	0.3	28.0	3.0	5.2	0.7
18+19	Clothing, leather, shoes	14	16.5	3.0	2.0	-	1.3	1.5	-	-	6.2	-	2.0	1.5	5.0	-
20	Wood (without furniture production)	52	58.7	1.7	3.6	1.0	28.5	0.7	3.4	-	6.5	-	13.9	-	2.8	-
21	Paper and pulp	27	45.3	10.5	13.1	2.3	12.3	2.9	2.5	2.0	9.3	-	8.1	2.3	-	1.0
22	Publishing, printing and reproduction of recorded media	13	34.2	5.0	5.0	2.0	19.2	3.0	3.1	-	-	-	5.9	-	1.0	-
23	Manufacture of coke, refined petroleum products, nuclear fuel	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]
24 without 24.4	Chemicals and chemical products (without pharmaceuticals, medicinal chemicals and botanical products)	73	363.8	105.6	170.6	43.1	72.4	33.7	17.8	5.0	9.7	1.0	86.1	19.3	7.2	3.5
24.4	Pharmaceuticals, medicinal chemicals and botanical products	25	395.3	355.8	217.2	115.2	21.0	37.1	18.2	27.3	14.0	14.0	55.8	122.4	69.1	39.8
25	Rubber and plastic products	76	272.6	28.4	24.0	1.1	111.1	9.2	9.1	4.5	21.6	-	102.6	11.9	4.2	1.7
26	Other non-metallic mineral products	64	400.0	83.1	28.5	6.2	77.6	11.8	4.1	-	4.5	-	109.5	8.8	175.8	56.3
27.1-27.3 and 27.51/52	Basic iron, steel, ferro-alloys, tubes, iron and steel casting	29	204.7	17.6	51.8	3.0	83.6	8.8	1.7	2.0	3.0	-	62.9	2.8	1.7	1.0
27.4+27.53/54	Non-ferrous metals, light and heavy metal casting	26	120.6	9.4	23.3	1.3	39.3	2.0	2.2	-	5.7	-	48.6	6.1	1.5	-
28	Metal products	138	391.6	21.6	28.7	4.6	99.0	5.3	9.2	0.2	23.2	-	228.6	10.5	2.9	1.0
29	Machinery and equipment	298	1,697.4	54.3	135.4	4.8	749.5	25.0	52.9	5.0	93.4	-	629.3	18.0	36.9	1.5
30	Office machinery and computers	12	75.0	5.4	2.4	2.7	34.3	2.7	13.0	-	-	-	22.3	-	3.0	-
31	Electrical machinery and apparatus n.e.c.	82	926.1	31.1	38.8	2.8	357.3	13.8	26.8	3.0	12.2	-	471.0	9.1	20.0	2.4
32 without 32.1	Radio, television and communication equipment and apparatus (without electronic components)	28	2,301.6	159.7	174.5	13.9	997.5	80.4	44.8	5.0	-	-	1,073.8	58.4	11.0	2.0
32.1	Electronic components	31	1,342.1	139.4	219.8	20.7	731.0	65.3	3.9	-	7.4	-	369.4	51.4	10.6	2.0
33 without 33.1	Precision and optical instruments	75	404.9	25.2	61.5	6.0	181.1	14.9	22.0	1.8	9.6	1.0	123.7	1.5	7.0	-
33.1	Medical instruments	31	338.1	38.4	45.5	5.9	143.0	13.1	13.1	-	19.2	-	76.9	11.6	40.4	7.8
34	Motor vehicles, trailers and semi-trailers	38	1,170.6	38.6	119.5	4.0	520.4	22.5	60.5	-	48.5	-	420.7	12.1	1.0	-
35	Manufacture of other transport equipment	16	259.1	12.0	32.7	1.0	83.3	3.0	11.0	-	34.1	2.0	93.0	5.0	5.0	1.0
36 without 36.1	Jewellery, musical instruments, sports good, games and toys, other manufacturing n.e.c.	30	179.0	22.1	7.0	1.0	57.6	11.2	19.7	2.1	6.7	0.3	84.4	7.5	3.6	-
36.1	Furniture	26	39.1	3.4	1.1	-	9.6	1.1	2.0	-	8.4	-	12.7	0.9	5.3	1.4
37	Recycling	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]
40+41	Electricity, gas and water supply	25	33.7	4.1	7.1	0.5	16.7	2.3	3.7	1.0	3.0	-	3.2	0.3	-	-
45	Construction	82	85.3	1.3	10.0	0.1	37.0	0.2	6.9	-	3.1	-	27.9	0.9	0.4	0.1
50–93	Services	963	4,846.2	1,007.2	1,155.1	281.3	2,429.5	438.4	255.6	41.0	49.9	2.5	821.0	129.9	135.1	114.2
50–52	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal household goods	205	523.5	144.8	136.3	44.5	159.2	51.5	52.6	1.6	29.4	1.0	112.5	30.6	33.5	15.6
55	Hotels and restaurants	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60–64	Transport, storage and communication	25	293.5	43.2	17.1	1.0	84.7	8.8	7.3	-	1.3	-	170.8	25.4	12.3	8.0
65–67	Financial intermediation	7	86.7	94.6	15.9	5.5	20.4	3.6	0.6	-	-	-	1.8	-	48.0	85.5
70+71+74	Real estate, renting and business activities	243	1,248.1	120.8	228.3	14.9	789.7	83.1	61.4	10.8	11.1	-	148.7	10.4	8.9	1.6
72 without 72.2	Computer and related activities (without software consultancy and supply)	56	122.1	11.1	15.8	3.5	45.6	4.3	1.8	-	2.5	0.5	45.8	2.4	10.6	0.4
72.2	Software consultancy and supply	210	870.3	93.8	103.7	11.1	408.0	43.6	72.1	4.7	3.3	1.0	270.1	31.4	13.1	2.0
73	Research and development	193	1,666.7	491.7	630.9	200.3	908.0	239.5	58.1	22.8	2.3	-	63.3	28.1	4.0	1.0
75–93	Public administration, education, health and other community, social and personal service activities	24	35.3	7.1	7.2	0.5	13.8	4.0	1.7	1.0	-	-	7.9	1.5	4.7	0.1

Source: Statistics Austria, Survey of research and experimental development (R&D) in 2006. Compiled on 01.09.2008. – 1) Includes the business segment and the cooperative segment. – 2) In order to keep the data confidential these figures cannot be reported separately, but they are included in the subtotals and totals. – Rounding differences.

Table 46: Corporate sector[1)]: Employees in research and experimental development (R&D) and expenditure on R&D in 2006 by state[2)]

State	Employees in R&D				R&D expenditure			
	according to the location of the company's headquarters		according to the company's R&D location(s)		according to the location of the company's headquarters		according to the company's R&D location(s) 3)	
	Headcount	*in %*	Headcount	*in %*	in 1000 €	*in %*	in 1000 €	*in %*
Austria	**45,336**	***100.0***	**45,336**	***100.0***	**4,448,676**	***100.0***	**4,448,676**	***100.0***
Burgenland	396	*0.9*	358	*0.8*	30,094	*0.7*	26,231	*0.6*
Carinthia	2,519	*5.6*	2,510	*5.5*	352,765	*7.9*	336,681	*7.6*
Lower Austria	4,957	*10.9*	5,310	*11.7*	419,846	*9.4*	473,190	*10.6*
Upper Austria	8,872	*19.6*	9,182	*20.3*	873,162	*19.6*	905,143	*20.3*
Salzburg	1,641	*3.6*	1,922	*4.2*	123,870	*2.8*	153,688	*3.5*
Styria	8,475	*18.7*	9,607	*21.2*	759,020	*17.1*	902,772	*20.3*
Tirol	2,664	*5.9*	2,624	*5.8*	311,086	*7.0*	309,133	*6.9*
Vorarlberg	1,897	*4.2*	1,881	*4.1*	143,916	*3.2*	143,244	*3.2*
Vienna	13,915	*30.6*	11,942	*26.4*	1,434,917	*32.3*	1,198,594	*27.0*

Source: Statistics Austria, Survey of research and experimental development (R&D) in 2006. Compiled on: 29.08.08. – 1) Includes the business segment and the cooperative segment. – 2) The regional classification of the units in the cooperative area is done strictly according to the state in which the company has its headquarters. For the companies in the business segment, there is a classification by the state in which the headquarters is located as well as an alternative classification by the state(s) in which the R&D location(s) can be found. – 3) R&D expenditure according to R&D location(s) was calculated based on the distribution of employees in R&D at the R&D locations.

Table 47: Corporate sector[1]: Expenditure on research and experimental development (R&D) in 2006 broken down by industry, number of employees and type of expenditure

Industry/ number of employees		No. of units performing R&D	Total	Personnel expenses	Material costs	Expenditure on plants and machinery and equipment	Expenditure on buildings and property
			in 1000 €				
Total		**2,407**	**4,448,676**	**2,297,903**	**1,757,587**	**320,457**	**72,729**
Industry							
01+02+05	Agriculture and forestry, fisheries	3	820	495	315	10	-
10–14	Mining and excavation of rocks and soils	10	7,146	3,417	2,693	1,036	-
15–37	Manufacturing	1,324	3,159,392	1,646,093	1,234,121	225,916	53,262
15	Foods and luxury foods, drinks	87	23,540	15,493	5,112	2,251	684
16	Tobacco processing	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]
17	Textiles and textile goods (without apparel)	28	26,465	13,541	9,217	3,679	28
18+19	Clothing, leather, shoes	14	5,345	2,637	1,976	322	410
20	Wood (without furniture production)	52	20,162	7,154	3,750	7,562	1,696
21	Paper and pulp	27	17,075	8,152	4,555	3,688	680
22	Publishing, printing and reproduction of recorded media	13	21,057	9,838	9,801	1,418	-
23	Coke, refined petroleum products, nuclear fuel	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]
24 without 24.4	Chemicals and chemical products (except pharmaceuticals)	73	124,462	67,575	43,057	11,147	2,683
24.4	Pharmaceuticals, medicinal chemicals and botanical products	25	277,195	89,251	154,698	25,098	8,148
25	Rubber and plastic products	76	88,010	45,646	25,158	15,827	1,379
26	Other non-metallic mineral products	64	61,635	36,338	16,525	7,629	1,143
27.1-27.3 and 27.51/52	Basic iron, steel, ferro-alloys, tubes, iron and steel casting	29	91,820	28,988	49,770	8,411	4,651
27.4+27.53/54	Non-ferrous metals, light and heavy metal casting	26	32,775	16,652	11,734	4,365	24
28	Metal products	138	99,691	57,660	35,267	6,163	601
29	Machinery and equipment	298	483,072	269,722	163,523	45,865	3,962
30	Office machinery and computers	12	17,536	11,844	4,625	817	250
31	Electrical machinery and apparatus n.e.c.	82	195,106	113,322	67,511	10,781	3,492
32 without 32.1	Radio, television and communication equipment and apparatus	28	542,261	383,137	140,951	10,413	7,760
32.1	Electronic components	31	338,014	128,945	181,091	27,917	61
33 without 33.1	Precision and optical instruments	75	82,051	47,702	25,993	5,974	2,382
33.1	Medical instruments	31	56,987	31,406	20,380	4,483	718
34	Motor vehicles, trailers and semi-trailers	38	366,364	168,830	172,985	12,474	12,075
35	Manufacture of other transport equipment	16	115,775	50,231	62,569	2,560	415
36 without 36.1	Jewellery, musical instruments, sports good, games and toys, other manufacturing n.e.c.	30	44,950	26,680	13,148	5,102	20
36.1	Furniture	26	12,084	7,435	3,497	1,152	-
37	Recycling	.[2]	.[2]	.[2]	.[2]	.[2]	.[2]
40+41	Electricity, gas and water supply	25	9,223	3,899	2,328	2,090	906
45	Construction	82	25,700	8,960	15,595	1,068	77
50–93	Services	963	1,246,395	635,039	502,535	90,337	18,484
50–52	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal household goods	205	206,227	86,126	95,246	14,597	10,258
55	Hotels and restaurants	-	-	-	-	-	-
60–64	Transport, storage and communication	25	46,468	25,873	7,808	12,787	-
65–67	Financial intermediation	7	30,211	22,418	6,358	1,435	-
70+71+74	Real estate, renting and business activities	243	350,902	165,677	161,826	19,809	3,590
72 without 72.2	Computer and related activities (without software consultancy and supply)	56	25,280	14,757	7,816	2,697	10
72.2	Software consultancy and supply	210	173,035	115,123	51,134	6,032	746
73	Research and development	193	407,056	201,244	170,353	31,579	3,880
75–93	Public administration, education, health and other community, social and personal service activities	24	7,216	3,821	1,994	1,401	-
Number of employees							
1 – 49 employees		1,278	413,807	225,890	135,466	41,474	10,977
50 – 249 employees		721	840,900	433,716	326,347	67,482	13,355
250 and more employees		408	3,193,969	1,638,297	1,295,774	211,501	48,397

Source: Statistics Austria, Survey of research and experimental development (R&D) in 2006. Compiled on: 29.08.08. – 1) Includes the business segment and the cooperative segment. – 2) In order to keep the data confidential these figures cannot be reported separately, but they are included in the subtotals and totals.

Table 48: Corporate sector[1)]: Expenditure on research and experimental development (R&D) in 2006 broken down by industry and type of research

Industry		No. of units performing R&D	Internal R&D expenditure total	of which					
				Basic research		Applied research		Experimental development	
			in 1000 €	in 1000 €	*in %*	in 1000 €	*in %*	in 1000 €	*in %*
Total		**2,407**	**4,448,676**	**245,150**	***5.5***	**1,415,121**	***31.8***	**2,788,405**	***62.7***
01+02+05	Agriculture and forestry, fisheries	3	820	-	-	719	*87.7*	101	*12.3*
10–14	Mining and excavation of rocks and soils	10	7,146	657	*9.2*	3,312	*46.3*	3,177	*44.5*
15–37	Manufacturing	1,324	3,159,392	99,170	*3.1*	858,375	*27.2*	2,201,847	*69.7*
15	Foods and luxury foods, drinks	87	23,540	300	*1.3*	6,229	*26.5*	17,011	*72.3*
16	Tobacco processing	.[2)]	.[2)]	.[2)]	.[2)]	.[2)]	.[2)]	.[2)]	.[2)]
17	Textiles and textile goods (without apparel)	28	26,465	1,493	*5.6*	6,279	*23.7*	18,693	*70.6*
18+19	Clothing, leather, shoes	14	5,345	303	*5.7*	1,304	*24.4*	3,738	*69.9*
20	Wood (without furniture production)	52	20,162	787	*3.9*	4,191	*20.8*	15,184	*75.3*
21	Paper and pulp	27	17,075	301	*1.8*	4,627	*27.1*	12,147	*71.1*
22	Publishing, printing and reproduction of recorded media	13	21,057	294	*1.4*	2,457	*11.7*	18,306	*86.9*
23	Coke, refined petroleum products, nuclear fuel	.[2)]	.[2)]	.[2)]	.[2)]	.[2)]	.[2)]	.[2)]	.[2)]
24 without 24.4	Chemicals and chemical products (except pharmaceuticals)	73	124,462	4,304	*3.5*	51,618	*41.5*	68,540	*55.1*
24.4	Pharmaceuticals, medicinal chemicals and botanical products	25	277,195	269	*0.1*	101,299	*36.5*	175,627	*63.4*
25	Rubber and plastic products	76	88,010	3,758	*4.3*	29,761	*33.8*	54,491	*61.9*
26	Other non-metallic mineral products	64	61,635	5,620	*9.1*	13,443	*21.8*	42,572	*69.1*
27.1-27.3 and 27.51/52	Basic iron, steel, ferro-alloys, tubes, iron and steel casting	29	91,820	6,548	*7.1*	24,130	*26.3*	61,142	*66.6*
27.4+27.53/54	Non-ferrous metals, light and heavy metal casting	26	32,775	1,267	*3.9*	10,823	*33.0*	20,685	*63.1*
28	Metal products	138	99,691	3,420	*3.4*	27,742	*27.8*	68,529	*68.7*
29	Machinery and equipment	298	483,072	20,734	*4.3*	174,536	*36.1*	287,802	*59.6*
30	Office machinery and computers	12	17,536	760	*4.3*	4,929	*28.1*	11,847	*67.6*
31	Electrical machinery and apparatus n.e.c.	82	195,106	4,266	*2.2*	100,406	*51.5*	90,434	*46.4*
32 without 32.1	Radio, television and communication equipment and apparatus (without electronic components)	28	542,261	1,633	*0.3*	68,348	*12.6*	472,280	*87.1*
32.1	Electronic components	31	338,014	6,920	*2.0*	56,836	*16.8*	274,258	*81.1*
33 without 33.1	Precision and optical instruments	75	82,051	2,211	*2.7*	28,654	*34.9*	51,186	*62.4*
33.1	Medical instruments	31	56,987	2,394	*4.2*	10,559	*18.5*	44,034	*77.3*
34	Motor vehicles, trailers and semi-trailers	38	366,364	14,722	*4.0*	84,144	*23.0*	267,498	*73.0*
35	Manufacture of other transport equipment	16	115,775	13,149	*11.4*	22,348	*19.3*	80,278	*69.3*
36 without 36.1	Jewellery, musical instruments, sports good, games and toys, other manufacturing n.e.c.	30	44,950	2,647	*5.9*	14,313	*31.8*	27,990	*62.3*
36.1	Furniture	26	12,084	569	*4.7*	5,060	*41.9*	6,455	*53.4*
37	Recycling	.[2)]	.[2)]	.[2)]	.[2)]	.[2)]	.[2)]	.[2)]	.[2)]
40+41	Electricity, gas and water supply	25	9,223	39	*0.4*	7,489	*81.2*	1,695	*18.4*
45	Construction	82	25,700	1,841	*7.2*	6,913	*26.9*	16,946	*65.9*
50–93	Services	963	1,246,395	143,443	*11.5*	538,313	*43.2*	564,639	*45.3*
50–52	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal household goods	205	206,227	5,498	*2.7*	76,924	*37.3*	123,805	*60.0*
55	Hotels and restaurants	-	-	-	-	-	-	-	-
60–64	Transport, storage and communication	25	46,468	392	*0.8*	9,216	*19.8*	36,860	*79.3*
65–67	Financial intermediation	7	30,211	-	-	8,830	*29.2*	21,381	*70.8*
70+71+74	Real estate, renting and business activities	243	350,902	48,978	*14.0*	163,445	*46.6*	138,479	*39.5*
72 without 72.2	Computer and related activities (without software consultancy and supply)	56	25,280	462	*1.8*	7,733	*30.6*	17,085	*67.6*
72.2	Software consultancy and supply	210	173,035	6,478	*3.7*	64,063	*37.0*	102,494	*59.2*
73	Research and development	193	407,056	81,146	*19.9*	205,151	*50.4*	120,759	*29.7*
75–93	Public administration, education, health and other community, social and personal service activities	24	7,216	489	*6.8*	2,951	*40.9*	3,776	*52.3*

Source: Statistics Austria, Survey of research and experimental development (R&D) in 2006. Compiled on: 29.08.08. – 1) Includes the business segment and the cooperative segment. – 2) In order to keep the data confidential these figures cannot be reported separately, but they are included in the subtotals and totals.

Table 49: Corporate sector: Financing of R&D expenditures in 2006 broken down by industry and source of funds

Code	Industry	Number of units performing R&D	Total	Business sector[2]	Fed.Gov.	Research premium	State[3]	FFG[4]	Other public financing[5]	Combined	Private non-profit sector	Foreign (excluding EU)[6]	EU
				Source of fundss/segments									
					Public sector								
			in 1000 €										
Total		**2,407**	**4,448,676**	**2,954,740**	**97,531**	**155,754**	**37,577**	**115,710**	**21,490**	**428,062**	**1,271**	**1,030,670**	**33,933**
01+02+05	Agriculture and forestry, fisheries	3	820	648	-	8	73	88	-	169	-	-	3
10–14	Mining and excavation of rocks and soils	10	7,146	4,087	-	-	9	44	-	53	-	3,006	-
15–37	Manufacturing	1,324	3,159,392	2,271,893	12,173	124,675	6,938	66,300	9,802	219,888	215	656,198	11,198
15	Foods and luxury foods, drinks	87	23,540	22,336	1	366	214	610	13	1,204	-	-	-
16	Tobacco processing	.[7]	.[7]	.[7]	.[7]	.[7]	.[7]	.[7]	.[7]	.[7]	.[7]	.[7]	.[7]
17	Textiles and textile goods (without apparel)	28	26,465	25,076	26	534	71	754	-	1,385	-	-	4
18+19	Clothing, leather, shoes	14	5,345	5,229	-	75	23	13	5	116	-	-	-
20	Wood (without furniture production)	52	20,162	17,626	238	266	256	1,625	-	2,385	-	-	151
21	Paper and pulp	27	17,075	15,622	9	511	-	517	86	1,123	-	330	-
22	Publishing, printing and reproduction of recorded media	13	21,057	20,801	-	15	-	170	26	211	-	-	45
23	Coke, refined petroleum products, nuclear fuel	.[7]	.[7]	.[7]	.[7]	.[7]	.[7]	.[7]	.[7]	.[7]	.[7]	.[7]	.[7]
24 without 24.4	Chemicals and chemical products (except pharmaceuticals)	73	124,462	107,758	13	3,173	133	5,263	2,189	10,771	-	5,641	292
24.4	Pharmaceuticals, medicinal chemicals and botanical products	25	277,195	228,921	-	18,077	55	3,447	80	21,659	79	26,536	-
25	Rubber and plastic products	76	88,010	74,308	26	1,863	131	4,137	61	6,218	-	7,327	157
26	Other non-metallic mineral products	64	61,635	58,106	10	747	92	1,182	153	2,184	-	1,298	47
27.1–27.3 and 27.51/52	Basic iron, steel, ferro-alloys, tubes, iron and steel casting	29	91,820	82,528	120	4,904	128	2,464	29	7,645	-	101	1,546
27.4+27.53/54	Non-ferrous metals, light and heavy metal casting	26	32,775	28,889	110	936	306	879	24	2,255	15	1,451	165
28	Metal products	138	99,691	89,432	78	3,392	463	3,181	351	7,465	-	2,623	171
29	Machinery and equipment	298	483,072	405,069	1,491	11,167	1,692	11,865	1,179	27,394	76	48,986	1,547
30	Office machinery and computers	12	17,536	14,352	-	198	72	224	200	694	-	2,490	-
31	Electrical machinery and apparatus n.e.c.	82	195,106	160,453	450	7,569	190	8,040	313	16,562	45	17,136	910
32 without 32.1	Radio, television and communication equipment and apparatus	28	542,261	243,587	2,264	21,166	338	4,103	331	28,202	-	270,109	363
32.1	Electronic components	31	338,014	107,356	5,253	19,136	1,484	6,870	2,773	35,516	-	191,824	3,318
33 without 33.1	Precision and optical instruments	75	82,051	71,228	274	2,886	401	3,985	164	7,710	-	2,156	957
33.1	Medical instruments	31	56,987	39,292	1,183	3,652	353	2,898	-	8,086	-	9,133	476
34	Motor vehicles, trailers and semi-trailers	38	366,364	279,721	312	16,597	268	1,548	1,751	20,476	-	65,171	996
35	Manufacture of other transport equipment	16	115,775	104,090	315	5,489	237	1,735	23	7,799	-	3,886	-
36 without 36.1	Jewellery, musical instruments, sports good, games and toys, other manufacturing n.e.c.	30	44,950	42,504	-	1,591	14	790	51	2,446	-	-	-
36.1	Furniture	26	12,084	11,958	-	109	17	-	-	126	-	-	-
37	Recycling	.[7]	.[7]	.[7]	.[7]	.[7]	.[7]	.[7]	.[7]	.[7]	.[7]	.[7]	.[7]
40+41	Electricity, gas and water supply	25	9,223	8,574	16	233	-	78	-	327	-	-	322
45	Construction	82	25,700	23,455	67	718	221	988	21	2,015	-	111	119
50–93	Services	963	1,246,395	646,083	85,275	30,120	30,336	48,212	11,667	205,610	1,056	371,355	22,291
50–52	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal household goods	205	206,227	106,029	831	3,946	1,061	6,265	240	12,343	25	87,480	350
55	Hotels and restaurants	-	-	-	-	-	-	-	-	-	-	-	-
60–64	Transport, storage and communication	25	46,468	41,478	74	3,359	162	659	-	4,254	-	24	712
65–67	Financial intermediation	7	30,211	29,633	-	-	-	578	-	578	-	-	-
70+71+74	Real estate, renting and business activities	243	350,902	136,272	11,424	5,946	1,325	8,750	1,253	28,698	172	181,552	4,208
72 without 72.2	Computer and related activities (without software consultancy and supply)	56	25,280	22,382	391	342	301	650	-	1,684	584	195	435
72.2	Software consultancy and supply	210	173,035	139,240	1,676	6,968	1,565	5,182	723	16,114	-	16,135	1,546
73	Research and development	193	407,056	166,504	70,389	9,361	25,594	25,971	8,814	140,129	275	85,969	14,179
75–93	Public administration, education, health and other community, social and personal service activities	24	7,216	4,545	490	198	328	157	637	1,810	-	-	861

Source: Statistics Austria, Survey of research and experimental development (R&D) in 2006. Compiled on 01.09.2008. – 1) Includes the business segment and the cooperative segment. – 2) Includes companies' own capital, funds raised in the capital market, loans from public sector development funds and funds from other domestic companies. – 3) States including Vienna. Local governments without Vienna. - 4) Österreichische Forschungsförderungsgesellschaft: Subsidies only; loans are included under "corporate sector". – 5) Includes funds from local governments, chambers, social insurance carriers and other public financing. – 6) Includes funds of foreign companies, other foreign funding and funds of international organisations. – 7) In order to keep the data confidential these figures cannot be reported separately, but they are included in the subtotals and totals.

Table 50: The path from the 4th to the 7th EU Framework Programme

	FP4	FP5	FP6.[1]	FP7[2]
	1994 – 1998	1998 – 2002	2002 – 2006	Data as per 11/2008
Number of approved projects in which Austrians are participating	1,444	1,384	1,314	529
Number of approved Austrian participants	1,923	1,987	1,946	758
Number of approved projects coordinated by Austrian organisations	270	267	211	98
Amount of subsidies that approved Austrian participants receive (in € million)	194	292	425	-
Percentage of approved Austrian participants among all approved participants	2.3%	2.4%	2.6%	2.6%
Percentage of approved Austrian coordinators among all approved coordinators[3]	1.7%	2.8%	3.3%	3.8%
Percentage of subsidies received by Austrian participants among all of the subsidies that were paid out (indicator of return flow)	1.99%	2.38%	2.57%	-[4]
Subsidies received by approved Austrian participants measured against the contribution Austria makes to the EU household (return flow ratio)	70%	104%	117%	-

Data:EC; **Processing and Calculations**: PROVISO, a project by the Federal Ministry of Science and Research (BMWF), the Federal Ministry of Transport, Innovation and Technology (BMVIT), the Federal Ministry of Economy, Family and Youth (BMWFJ) and the Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW)

1 According to the data as of October 2007, contracts have been signed for 85% of the approved projects, with the results of the negotiations announced to PROVISO by the European Commission (EC). The EC has not yet announced the results of the negotiations of the remaining 15%; the data for these projects is based on projections; the average reductions that take place as part of the contract negotiations have been taken into consideration.

2 According to the data of November 2008, PROVISO only had a 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.

3 includes all projects implemented as a consortium (so it does not include for ex.the individual grants under FP6 for mobility; projects of the idea pillar under FP7 or individual grants and prizes/awards of the people pillar)

4 The share of subsidies applied for by approved Austrian participations of the total of subsidies applied for among all approved projects in FP7 using data as of 11/2008 was 2.5%

Source: PROVISO – M. Ehardt-Schmiederer, B. Wimmer, V. Postl, C. Kobel, T. Coja, J. Brücker, M. Schoder-Kienbeck, L. Schleicher: 7. EU Framework Programme for research, technological development and demonstration (2007–2013) PROVISO overview report autumn 2008, Vienna 2008

Table 51: Austrian results in FP6

		6th. EU Framework Programme [1]										
	Total	AT										
		AT Total	B	C	LA	UA	S	ST	T	VB	V	N/A
Projects	**9,832**	**1,314**	**9**	**30**	**146**	**131**	**46**	**260**	**132**	**23**	**781**	**49**
Subsidy volume[2]	**16,336**	**424.5**	**2.6**	**8.3**	**37.5**	**35.5**	**13.6**	**85.9**	**35.7**	**3.2**	**201.4**	**0.7**
Participants[3])	**75,614**	**1,946**	**14**	**33**	**169**	**175**	**53**	**312**	**144**	**23**	**972**	**8**
Universities, Higher education	*35%*	*708*	*0*	*15*	*15*	*41*	*26*	*136*	*89*	*4*	*382*	*0*
Non-university research groups	*27%*	*411*	*2*	*4*	*83*	*34*	*10*	*71*	*2*	*0*	*201*	*4*
Small and medium-sized enterprises (up to 249 employees)	*14%*	*307*	*7*	*5*	*38*	*48*	*3*	*50*	*31*	*14*	*109*	*2*
Large companies (over 250 employees)	*10%*	*151*	*4*	*7*	*9*	*27*	*5*	*34*	*14*	*2*	*49*	*0*
Other categories	*14%*	*326*	*1*	*2*	*24*	*25*	*9*	*21*	*8*	*3*	*231*	*2*
Coordinators[5, 6]	**6,350**	**211**	**0**	**2**	**23**	**16**	**2**	**29**	**8**	**1**	**130**	**0**
Universities	*33%*	*75*	*0*	*0*	*3*	*1*	*0*	*9*	*7*	*1*	*54*	*0*
Non-university research groups	*33%*	*76*	*0*	*2*	*16*	*11*	*2*	*14*	*0*	*0*	*31*	*0*
SMEs	*11%*	*23*	*0*	*0*	*3*	*1*	*0*	*1*	*0*	*0*	*18*	*0*
Large companies	*10%*	*12*	*0*	*0*	*0*	*2*	*0*	*5*	*0*	*0*	*5*	*0*
Other categories	*13%*	*25*	*0*	*0*	*1*	*1*	*0*	*0*	*1*	*0*	*22*	*0*

Data:EC; **Processing and Calculations**: PROVISO, a project by the Federal Ministry of Science and Research (BMWF), the Federal Ministry of Transport, Innovation and Technology (BMVIT), the Federal Ministry of Economy, Family and Youth (BMWFJ) and the Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW)

1 According to the data as of October 2007, contracts have been signed for 85% of the approved projects, with the results of the negotiations announced to PROVISO by the European Commission (EC). The EC has not yet announced the results of the negotiations of the remaining 15%;
2 Total funding volume is 98.4% of the budget reserved for RTD activities in FP6; gazette of the European Community (2002) decision of the Council dated 30 September 2002 (2002/84/EC)
3 Individual researchers (beneficiaries) of the individual stipends of the Mobility Programme cannot be taken into consideration in the distribution by state
4, 5 Overall distribution by organisational category based on information from the EC according to project application
6 Includes all projects performed as a consortium (therefore does not include the individual stipends of the Mobility Programme)

Source: PROVISO – M. Ehardt-Schmiederer, B. Wimmer, M. Ramadori, V. Postl, T. Coja, J. Brücker, F. Boulmé: PROVISO-Report: 6. FP – Results 2002–2006, Status of Autumn 2007 (FOpro1424eha281107), Vienna 2007

Table 52: Austrian results in FP7

	7th. EU Framework Programme [1]											
	Total	AT										
		AT Total	B	C	LA	UA	S	ST	T	VB	V	N/A
Projects	**4,281**	**529**	**3**	**21**	**71**	**47**	**18**	**101**	**45**	**12**	**309**	**16**
Participants[2])	**28,623**	**758**	**3**	**27**	**79**	**56**	**21**	**112**	**51**	**13**	**380**	**16**
Universities, Higher education	*N/A*	*273*	*0*	*7*	*4*	*28*	*12*	*49*	*37*	*3*	*133*	*0*
Non-university research groups	*N/A*	*170*	*0*	*1*	*30*	*5*	*5*	*27*	*0*	*0*	*101*	*1*
Small and medium-sized enterprises (up to 249 employees)	*N/A*	*136*	*3*	*12*	*21*	*12*	*2*	*16*	*11*	*5*	*54*	*0*
Large companies (over 250 employees)	*N/A*	*65*	*0*	*6*	*8*	*7*	*0*	*17*	*1*	*4*	*22*	*0*
Other categories	*N/A*	*100*	*0*	*1*	*16*	*4*	*2*	*3*	*2*	*1*	*70*	*1*
Coordinators [3]	**2,583**	**98**	**0**	**7**	**10**	**7**	**4**	**13**	**6**	**0**	**51**	**0**
Universities	*N/A*	*33*	*0*	*0*	*0*	*3*	*2*	*9*	*6*	*0*	*13*	*0*
Non-university research groups	*N/A*	*31*	*0*	*0*	*7*	*1*	*2*	*1*	*0*	*0*	*20*	*0*
SMEs	*N/A*	*19*	*0*	*7*	*1*	*2*	*0*	*0*	*0*	*0*	*9*	*0*
Large companies	*N/A*	*3*	*0*	*0*	*0*	*0*	*0*	*3*	*0*	*0*	*0*	*0*
Other categories	*N/A*	*12*	*0*	*0*	*2*	*1*	*0*	*0*	*0*	*0*	*9*	*0*

Data:EC; **Processing and Calculations**: PROVISO, a project by the Federal Ministry of Science and Research (BMWF), the Federal Ministry of Transport, Innovation and Technology (BMVIT), the Federal Ministry of Economy, Family and Youth (BMWFJ) and the Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW)

1 According to the data as of November 2008, PROVISO only had part of the information about the results of the individual 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 project, the "requested" subsidy amounts are reduced), this information must be seen as a reference only.

2 The distribution by state does not account for researchers of the people pillar (researchers, stipend recipients/award-winners of the people pillar) or the idea pillar (principal investigators)

3 does not include projects of the idea pillar or individual stipends and awards of the people pillar

Source: PROVISO – M. Ehardt-Schmiederer, B. Wimmer, V. Postl, C. Kobel, T. Coja, J. Brücker, M. Schoder-Kienbeck, L. Schleicher: 7. EU Framework Programme for research, technological development and demonstration (2007–2013) PROVISO overview report autumn 2008, Vienna 2008

Table 53: FFG: Subsidy statistics 2008 – General overview

Area	Programme	Programme line	Projects	Actors	Participants	Total costs	Total funding		Cash value	Commissions
ALR	ASAP		36	48	74	10,816		7,072	7,072	318
			36	48	74	10,816		7,072	7,072	318
BP	BASIS	General funding	709	575	738	424,458	Subsidy	91,445	109,887	
							Loan	94,247		
							KKZ	2,866		
							discounts	540		
							state subsidy	2,074		
							Liability	40,127		
		Headquarters	30	28	31	65,727	Subsidy	20,020	20,020	
		High-tech start-up	25	25	25	11,433	Subsidy	4,856	5,560	
							Loan	3,121		
			764	610	794	501,617		259,296	135,466	
	BRIDGE		96	216	255	30,218		17,767	17,767	
	EUROSTARS		8	11	11	6,309		3,378	3,378	
	Innovation voucher		553	769	1,106	2,760		2,760	2,760	
			1,421	1,498	2,166	540,905		283,201	159,371	
EIP	Procurement financing for science	BMVIT share	11	7	11	100		75	75	
		BMWF share	205	83	205	1,516		1,141	1,141	
			216	90	216	1,616		1,216	1,216	
			216	90	216	1,616		1,216	1,216	
SP	AplusB									65
	brainpower austria									262
	CIR-CE		4	42	42	1,902		862	862	
	COIN	Development	13	36	43	7,523		4,330	4,330	
		Cooperation and networks	13	69	73	5,208		3,125	3,125	
			26	103	116	12,731		7,455	7,455	
	COMET	K projects	7	68	73	27,153		8,728	8,728	25
		K1	11	387	413	187,747		57,241	57,241	
		K2	3	230	241	173,531		57,844	57,844	
		Phasing Out	4	35	35	4,025		1,367	1,367	
			25	645	762	392,456		125,180	125,180	25
	EraSME		6	6	6	2,946		1,429	1,429	
	FEMtech		11	11	11	584		324	324	57
	Forschung macht Schule		254	139	254	893		548	548	
	Josef Ressel Zentren		1	6	6	825		288	288	
	PUST	(FsA, Long Night)								298
	Research Studios Austria		12	16	22	11,615		8,000	8,000	
	wfFORTE	wfFORTE/Laura Bassi Centre								617
			339	878	1,219	423,951		144,085	144,085	1,323
TP	AT:net		54	85	85	21,785		5,143	5,143	100
	ENERGIE DER ZUKUNFT		126	259	397	49,281		29,295	29,295	
	FIT-IT	ES	15	31	39	8,534		5,209	5,209	
		FIT-IT Initiatives	11	19	20	3,429		2,096	2,096	
		SemSys	13	26	35	3,889		2,923	2,923	
		SoC	7	14	23	10,988		5,943	5,943	
		Trust	7	13	16	4,672		2,948	2,948	
		Visual	12	22	27	3,735		2,623	2,623	
			65	114	160	35,248		21,743	21,743	
	GEN-AU	ELSA	3	6	6	1,100		1,100	1,100	
		Pilots	5	5	5	503		435	435	
			8	11	11	1,603		1,535	1,535	
	IEA		24	10	25	1,822		1,822	1,822	81
	IV2S	A3	1	9	9	950		496	496	
		ISB	3	15	15	516		364	364	
		I2	3	7	7	879		430	430	
			7	31	31	2,346		1,290	1,290	
	IV2Splus	A3plus	18	50	66	11,010		5,388	5,388	165
		I2V	23	64	95	9,746		5,163	5,163	
		ways2go	32	67	105	5,892		4,528	4,528	
			73	166	266	26,648		15,079	15,079	165
	KIRAS	PL1 – Networking	2	11	11	357		262	262	85
		PL2 – Coop. R&D projects	3	12	12	2,085		892	892	
		PL4	7	17	18	1,191		1,111	1,111	
			12	37	41	3,632		2,265	2,265	85
	NANO	Steps for further training and education								345
		NANO – Cluster	25	46	74	11,058		8,689	8,689	
		NANO Net	6	10	11	313		229	229	87
		Programme support measures	7	13	13	60		60	60	224
			38	66	98	11,431		8,978	8,978	657
	NAWI	EdZ	10	24	26	1,862		1,105	1,105	194
		FdZ	32	78	88	7,564		4,710	4,710	
		HdZ	21	19	23	2,409		1,430	1,430	
			63	116	137	11,836		7,245	7,245	194
	Neue Energien 2020		31	80	84	12,782		5,713	5,713	
	TAKE OFF		32	64	78	16,793		9,161	9,161	65
			533	905	1,413	195,207		109,267	109,267	1,347
FFG			2,545	2,863	5,088	1,172,495		544,841	421,012	2,989

Table 54: FFG: Subsidised projects in 2008 according to classification of ECONOMIC ACTIVITIES (NACE)

Name	NACE(2003)	PROJECTS	% Projects	Organisations	PARTICI-PANTS	TOTAL COSTS	without liability	incl. liability	% (incl. liability)	CASH VALUE	% Cash value
not classified		621	24.4%	916	1417	164,015,244	89,174,380	89,174,380	16.4%	89,174,380	21.2%
Agriculture, hunting	01	24	0.9%	26	31	4,203,405	2,438,950	2,438,950	0.4%	2,371,368	0.6%
Forestry	02	12	0.5%	14	20	679,240	469,600	469,600	0.1%	469,600	0.1%
Fishing, operation of fish hatcheries and fish farms	05	1	0.0%	2	2	5,000	5,000	5,000	0.0%	5,000	0.0%
Mining of coal, extraction of peat	10	2	0.1%	4	4	10,000	10,000	10,000	0.0%	10,000	0.0%
Extraction of crude petroleum and natural gas, related services	11	1	0.0%	2	2	5,000	5,000	5,000	0.0%	5,000	0.0%
Mining of metal ores	13	1	0.0%	2	2	5,000	5,000	5,000	0.0%	5,000	0.0%
Mining and quarrying	14	2	0.1%	4	4	461,200	291,600	291,600	0.1%	291,600	0.1%
Manufacture of food products and beverages	15	37	1.5%	51	66	8,592,590	4,374,519	4,374,519	0.8%	2,769,086	0.7%
Tobacco processing	16	1	0.0%	2	2	5,000	5,000	5,000	0.0%	5,000	0.0%
Manufacture of textiles (without apparel)	17	7	0.3%	7	7	3,564,300	1,875,800	1,875,800	0.3%	889,549	0.2%
Manufacture of wearing apparel	18	2	0.1%	1	2	1,998,000	998,000	998,000	0.2%	433,919	0.1%
Tanning and leather processing	19	1	0.0%	1	1	424,600	297,100	297,100	0.1%	156,906	0.0%
Manufacture of wood and of products of wood, except furniture	20	27	1.1%	34	45	5,933,000	2,987,500	2,987,500	0.5%	2,256,374	0.5%
Manufacture of paper and paper products	21	8	0.3%	7	9	952,160	510,200	510,200	0.1%	360,186	0.1%
Publishing, printing and reproduction of recorded media	22	4	0.2%	7	7	212,000	113,000	113,000	0.0%	67,841	0.0%
Manufacture of coke, refined petroleum products and nuclear fuel	23	4	0.2%	6	7	1,710,600	856,500	856,500	0.2%	522,290	0.1%
Manufacture of chemicals and chemical products	24	116	4.6%	146	183	103,092,937	44,504,826	51,365,826	9.4%	31,341,324	7.4%
Manufacture of rubber and plastic products	25	50	2.0%	91	99	12,788,264	6,591,207	6,924,207	1.3%	4,523,752	1.1%
Manufacture of glass and other non-metallic mineral products	26	35	1.4%	31	47	20,105,100	8,392,400	9,691,400	1.8%	6,009,320	1.4%
Manufacture of basic metals	27	40	1.6%	52	64	19,983,293	8,963,391	12,302,391	2.3%	7,526,562	1.8%
Manufacture of metal products	28	39	1.5%	47	52	11,057,800	5,794,400	5,794,400	1.1%	3,429,791	0.8%
Manufacture of machinery and equipment	29	141	5.5%	174	202	81,415,787	37,957,654	40,735,554	7.5%	24,047,226	5.7%
Manufacture of office, accounting and computing machinery	30	8	0.3%	11	11	5,150,345	2,247,614	3,077,614	0.6%	1,756,009	0.4%
Manufacture of electrical machinery and apparatus	31	33	1.3%	40	46	21,495,478	8,915,903	11,195,903	2.1%	5,774,000	1.4%
Radio, television and communication equipment and apparatus	32	99	3.9%	66	129	114,278,509	43,651,716	49,812,716	9.1%	31,227,848	7.4%
Medical, precision and optical instruments, watches and clocks	33	133	5.2%	126	163	63,087,444	26,439,352	33,777,352	6.2%	19,159,468	4.6%
Manufacture of motor vehicles, trailers and semi-trailers	34	48	1.9%	32	56	32,070,400	14,108,000	17,269,000	3.2%	7,883,672	1.9%
Other transport equipment	35	64	2.5%	60	102	34,662,077	13,120,730	18,867,730	3.5%	12,979,532	3.1%
Manufacture of furniture; jewellery, musical instruments, athletic equipment, toys etc.	36	12	0.5%	18	19	715,200	464,820	464,820	0.1%	220,351	0.1%
Recycling	37	1	0.0%	4	4	196,770	118,062	118,062	0.0%	118,062	0.0%
Electricity, gas, team and hot water supply	40	17	0.7%	87	90	17,607,021	6,804,436	6,804,436	1.2%	6,294,300	1.5%
Collection, purification and distribution of water	41	5	0.2%	9	9	1,074,930	705,700	705,700	0.1%	386,619	0.1%
Construction	45	58	2.3%	107	122	19,869,755	8,146,279	8,146,279	1.5%	7,151,074	1.7%
Sale, maintenance & repair of motor vehicles & motorcycles; retail sale of autom. fuel	50	2	0.1%	4	4	10,000	10,000	10,000	0.0%	10,000	0.0%
Wholesale trade and commission trade, except of motor vehicles and motorcycles	51	51	2.0%	84	102	255,000	255,000	255,000	0.0%	255,000	0.1%
Retail sales, except sales of motor vehicles and petrol sta-tions, repair	52	29	1.1%	51	57	142,000	141,000	141,000	0.0%	141,000	0.0%
Hotels and restaurants	55	4	0.2%	7	8	20,000	20,000	20,000	0.0%	20,000	0.0%
Land transport; transport via pipelines	60	35	1.4%	82	119	10,968,060	5,592,093	5,592,093	1.0%	5,592,093	1.3%
Aeronautics	62	4	0.2%	7	7	130,700	82,200	82,200	0.0%	82,200	0.0%
Supporting and auxiliary transport activities; activities of travel agencies	63	7	0.3%	12	13	32,000	31,000	31,000	0.0%	31,000	0.0%
Post and telecommunications	64	2	0.1%	7	7	2,478,000	661,733	661,733	0.1%	661,733	0.2%
Financial intermediation	65	1	0.0%	2	2	5,000	5,000	5,000	0.0%	5,000	0.0%
Insurance and pensions funding	66	1	0.0%	2	2	5,000	5,000	5,000	0.0%	5,000	0.0%
Real estate activities	70	10	0.4%	20	20	50,000	50,000	50,000	0.0%	50,000	0.0%
Renting and business activities	71	9	0.4%	17	18	45,000	45,000	45,000	0.0%	45,000	0.0%
Software	72	209	8.2%	281	339	52,604,082	31,461,038	31,461,038	5.8%	22,768,884	5.4%
Research and development	73	290	11.4%	631	863	311,109,846	107,715,372	107,715,372	19.8%	107,679,996	25.6%
Other business activities	74	173	6.8%	272	338	3,162,245	2,120,347	2,120,347	0.4%	1,770,325	0.4%
Education	80	5	0.2%	9	9	41,196	25,299	25,299	0.0%	25,299	0.0%
Health and social work	85	16	0.6%	83	84	26,046,688	7,367,956	7,367,956	1.4%	7,367,956	1.8%
Sewage and refuse disposal, sanitation and similar activities	90	22	0.9%	21	26	10,759,350	6,361,100	6,361,100	1.2%	3,457,393	0.8%
Activities of membership organisations	91	1	0.0%	2	2	5,000	5,000	5,000	0.0%	5,000	0.0%
Recreational, cultural and sporting activities	92	8	0.3%	24	24	1,870,340	585,602	585,602	0.1%	585,602	0.1%
Other service activities	93	10	0.4%	13	14	573,873	382,000	382,000	0.1%	382,000	0.1%
Activities of households	95	1	0.0%	3	3	723,683	434,210	434,210	0.1%	434,210	0.1%
Extra-territorial organisations and bodies	99	1	0.0%	1	1	30,000	15,000	15,000	0.0%	15,000	0.0%
Total		2,545	100.0%	3,822	5,088	1,172,494,512	504,714,589	544,841,489	100.0%	421,011,700	100.0%

Table 55: FFG: Subsidy statistics 2008 by state

	Project participants	Total promotion (subsidies, loans and liabilities)	Cash value of funding	Share *in %*
Burgenland	95	6,599,309	5,616,012	*1.3*
Carinthia	229	32,007,899	26,267,839	*6.2*
Lower Austria	426	32,948,663	26,762,807	*6.4*
Upper Austria	903	136,619,229	94,942,232	*22.6*
Salzburg	190	10,600,774	7,466,630	*1.8*
Styria	1,069	165,526,605	133,432,918	*31.7*
Tirol	249	25,864,476	20,236,642	*4.8*
Vorarlberg	110	14,476,537	8,955,067	*2.1*
Vienna	1,548	118,792,522	95,926,078	*22.8*
Foreign	269	1,405,475	1,405,475	*0.3*
FFG TOTAL	5,088	544,841,489	421,011,700	*100*

Table 56: FWF: Subsidies approved by research location (€ million) 2008 – autonomous programmes

a) University research locations:	Individual projects	SFB*	NFN*	Intern. programmes	DK-plus*	International Mobility	Translational Brain power	Richter	TRP	Publications-funding	Total	%	Total 2007	2007%
University of Vienna	€ 20.59	€ 1.72	€ 2.55	€ 2.45	€ 2.94	€ 2.17	€ 0.00	€ 1.21	€ 1.30	€ 0.17	€ 35.10	*21.4%*	€ 32.42	21.5%
University of Graz	€ 8.66	€ 0.09	€ 0.44	€ 0.34	€ 2.68	€ 0.63	€ 0.00	€ 0.28	€ 0.18	€ 0.08	€ 13.37	*8.1%*	€ 8.26	5.5%
University of Innsbruck	€ 6.77	€ 3.99	€ 2.44	€ 1.70	€ 0.24	€ 0.53	€ 0.53	€ 0.01	€ 0.79	€ 0.00	€ 16.99	*10.3%*	€ 11.28	7.5%
Vienna University of Medicine	€ 5.54	€ 0.16	€ 0.02	€ 0.57	€ 1.69	€ 0.78	€ 0.30	€ 0.16	€ 2.08	€ 0.00	€ 11.31	*6.9%*	€ 16.06	10.7%
Graz University of Medicine	€ 0.96	€ 0.05	€ 0.00	€ 0.00	€ 0.00	€ 0.10	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 1.11	*0.7%*	€ 2.10	1.4%
Innsbruck University of Medicine	€ 1.65	€ 0.03	€ 0.02	€ 0.24	€ 2.13	€ 0.36	€ 0.00	€ 0.08	€ 0.57	€ 0.00	€ 5.08	*3.1%*	€ 9.27	6.2%
University of Salzburg	€ 5.66	€ 0.01	€ 0.13	€ 0.74	€ 0.02	€ 0.08	€ 0.00	€ 0.43	€ 0.41	€ 0.02	€ 7.49	*4.6%*	€ 6.53	4.3%
Vienna University of Technology	€ 8.27	€ 0.49	€ 1.19	€ 0.98	€ 2.21	€ 1.10	€ 0.37	€ 0.21	€ 1.37	€ 0.00	€ 16.18	*9.8%*	€ 11.10	7.4%
Graz University of Technology	€ 3.40	€ 0.04	€ 1.88	€ 0.35	€ 1.87	€ 0.24	€ 0.31	€ 0.00	€ 0.29	€ 0.00	€ 8.38	*5.1%*	€ 5.53	3.7%
University of Mining Leoben	€ 0.45	€ 0.00	€ 1.09	€ 0.00	€ 0.00	€ 0.01	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 1.56	*0.9%*	€ 0.28	0.2%
University of Natural Resources and Applied Life Sciences, Vienna	€ 4.47	€ 2.98	€ 0.02	€ 0.17	€ 0.00	€ 0.61	€ 0.00	€ 0.34	€ 1.07	€ 0.00	€ 9.66	*5.9%*	€ 7.97	5.3%
University of Veterinary Medicine Vienna	€ 1.36	€ 0.01	€ 0.00	€ 0.00	€ 0.00	€ 0.01	€ 0.00	€ 0.00	€ 0.20	€ 0.00	€ 1.59	*1.0%*	€ 2.70	1.8%
Vienna University of Economics and Business Administration	€ 0.26	€ 0.03	€ 0.00	€ 0.00	€ 1.62	€ 0.14	€ 0.00	€ 0.00	€ 0.01	€ 0.00	€ 2.06	*1.3%*	€ 2.46	1.6%
University of Linz	€ 4.56	€ 0.04	€ 1.51	€ 0.01	€ 0.07	€ 0.17	€ 0.00	€ 0.01	€ 0.38	€ 0.00	€ 6.76	*4.1%*	€ 9.04	6.0%
University of Klagenfurt	€ 1.69	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.03	€ 0.00	€ 0.00	€ 0.01	€ 0.00	€ 1.73	*1.1%*	€ 0.78	0.5%
Academy of Fine Arts Vienna	€ 0.18	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.02	€ 0.20	*0.1%*	€ 0.00	0.0%
University for Applied Arts Vienna	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.30	€ 0.00	€ 0.31	*0.2%*	€ 0.11	0.1%
University of Music and Dramatic Arts Graz	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.09	€ 0.00	€ 0.09	*0.1%*	€ 0.23	0.2%
University of Music and Dramatic Arts Vienna	€ 0.44	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.02	€ 0.45	*0.3%*	€ 0.26	0.2%
b) Non-university rand other esearch locations:														
Austrian Academy of Sciences	€ 7.62	€ 0.86	€ 0.05	€ 0.88	€ 0.18	€ 0.39	€ 0.00	€ 0.00	€ 0.62	€ 0.04	€ 10.63	*6.5%*	€ 10.21	6.8%
Other research locations*	**€ 7.36**	**€ 0.48**	**€ 0.69**	**€ 1.27**	**€ 0.48**	**€ 0.88**	**€ 0.00**	**€ 0.23**	**€ 2.70**	**€ 0.21**	**€ 14.30**	***8.7%***	**€ 13.87**	**9.2%**
Total	**€ 89.88**	**€ 10.98**	**€ 12.03**	**€ 9.70**	**€ 16.13**	**€ 8.26**	**€ 1.51**	**€ 2.95**	**€ 12.38**	**€ 0.54**	**€ 164.35**	***100.0%***	**€ 150.46**	**100.0%**

* also includes universities abroad

SFB = Special research areas
NFN= National research areas
DK-plus = doctoral college plus
TRP=Translational Research Programme

Table 57: FWF: Subsidies approved by scientific discipline in 2008, autonomous programmes

Scientific discipline	2006						2007						2008					
	€ million						€ million						€ million					
	Total	Percent	Total women	Percent women	Total men	Percent men	Total	Percent	Total women	Percent women	Total men	Percent men	Total	Percent	Total women	Percent women	Total men	Percent men
Natural sciences	78.91	57.8%	14.88	53.5%	64.03	58.9%	80.86	53.7%	11.78	40.4%	69.08	56.9%	102.18	62.2%	19.47	56.4%	82.71	63.7%
Technical sciences	5.71	4.2%	0.05	0.2%	5.66	5.2%	6.01	4.0%	0.42	1.4%	5.59	4.6%	4.56	2.8%	0.28	0.8%	4.28	3.3%
Human medicine	24.24	17.8%	5.52	19.8%	18.72	17.2%	30.40	20.2%	7.65	26.2%	22.75	18.8%	18.54	11.3%	3.70	10.7%	14.83	11.4%
Agriculture and forestry, veterinary medicine	1.57	1.1%	0.56	2.0%	1.01	0.9%	1.87	1.2%	0.49	1.7%	1.38	1.1%	3.77	2.3%	1.02	3.0%	2.74	2.1%
Social sciences	7.06	5.2%	1.17	4.2%	5.89	5.4%	12.92	8.6%	3.04	10.4%	9.88	8.1%	13.85	8.4%	3.30	9.6%	10.54	8.1%
Humanities	19.05	14.0%	5.63	20.3%	13.42	12.3%	18.40	12.2%	5.77	19.8%	12.63	10.4%	21.46	13.1%	6.74	19.5%	14.72	11.3%
Total	136.54	100.0%	27.81	100.0%	108.73	100.0%	150.46	100.0%	29.15	100.0%	121.31	100.0%	164.35	100.0%	34.52	100.0%	129.83	100.0%

Table 58: FWF: ERA-NET participants

ERA-NET	Field	Start	Duration	Role of Austrian Science Fund
ERA-Chemistry	Chemistry	2004	5 years	Work Package Leader
PathoGenoMics	Pathogenomics	2004	5 years	Partner
NanoSci-ERA	Nano sciences	2005	3 years	Work Package Leader
EUROPOLAR	Polar research	2005	4 years	Task Leader
HERA	Humanities	2005	4 years	Partner
BioDivERsA	Biodiversity	2005	4 years	Partner
NEURON	Neurosciences	2007	4 years	Work Package Leader
ASTRONET	Astronomy	2005	4 years	Associate Partner (since 2007)
NORFACE	Social sciences	2004	5 years	Associate Partner (since 2007)
Plant Genomics	Plant genomics	2006	4 years	Call participation (2008)
E-Rare	Rare diseases	2006	4 years	Call participation (2008)

Table 59: AWS: Overview of performance in consultation and service portfolio 2008

	Projects [Number]				Consulting and Service portfolio [EUR '000]	Additional measures [EUR '000]	Total Services [EUR '000]	
	2008	%	2007	%	2008	2008	2008	%
High-technology consultation, mentoring and mediation	621.00	*50.30*	553.00	*48.80*	2,748.00	1,058.00	3,806.00	*52.70*
Know-how, research and patent management	593.00	*48.00*	555.00	*49.00*	1,525.00	355.00	1,880.00	*26.00*
Bundesconsulting (government consulting)	10.00	*0.80*	10.00	*0.90*	638.00	-	638.00	*8.80*
Processing, consulting: EU structure fund	11.00	*0.90*	15.00	*1.30*	901.00	0.00	901.00	*12.50*
Total	1,235.00	*100.00*	1,133.00	*100.00*	5,812.00	1,413.00	7,225.00	*100.00*

Table 60: AWS: High technology: Consultation, support and mediation (2008)

	Projects [Number]				Consulting and services [EUR '000]	Additional support measures [EUR '000]	Total Support [EUR '000]	
	2008	%	2007	%	2008	2008	2008	%
Jugend Innovativ	296	*47.7*	288	*52.1*	537	-	537	*14.1*
Government Innovation Prize	30	*4.8*			263	-	263	*6.9*
Life Science Austria	114	*18.4*	122	*22.1*	1,021	300	1,321	*34.7*
Nano Networks	-	-	3	*0.5*	-	-	-	-
Business Angels investment broker	54	*8.6*	55	*9.9*	286	-	286	*7.5*
Seed financing for high-tech start-ups[1]	126	*20.3*	85	*15.4*	641	141	782	*20.5*
ImpulsProgramm creativwirtschaft	1	*0.2*	n,a,	*n,a,*	-	617	617	*16.3*
Total	**621**	***100.0***	**553**	***100.0***	**2,748**	**1,058**	**3,806**	***100.0***

1 Seed financing for high-tech start-ups: 36 New applications that are being coming under on-going mentoring, 90 current portfolio projects currently being mentored