



Research and Innovation performance in Austria

Country profile

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Austria

The challenge of further enhancing the innovation base of a knowledge-intensive economy

Summary: Performance in research, innovation and competitiveness

The indicators in the table below present a synthesis of research, innovation and competitiveness in Austria. They relate knowledge investment and input to performance or economic output throughout the innovation cycle. They show thematic strengths in key technologies and also the high-tech and medium-tech contribution to the trade balance. The table includes a new index on excellence in science and technology which takes into consideration the quality of scientific production as well as technological development. The indicator on knowledge-intensity of the economy is an index on structural change that focuses on the sectoral composition and specialisation of the economy and shows the evolution of the weight of knowledge-intensive sectors and products and services.

	Investment and Input	Performance/economic output
Research	<i>R&D intensity</i> 2011: 2.75% (EU: 2.03%; US: 2.75%) 2000-2011: +3.25% (EU: +0.8%; US: +0.2%)	<i>Excellence in S&T</i> 2010: 50.46 (EU:47.86; US: 56.68) 2005-2010: +4.51% (EU: +3.09%;US: +0.53)
Innovation and Structural change	<i>Index of economic impact of innovation</i> 2010-2011: 0.556 (EU: 0.612)	<i>Knowledge-intensity of the economy</i> 2010: 42.4 (EU:48.75; US: 56.25) 2000-2010: +2.78% (EU: +0.93%; US: +0.5%)
Competitiveness	<i>Hot-spots in key technologies</i> Energy, Environment, Transport technology	<i>HT + MT contribution to the trade balance</i> 2011: 3.18% (EU: 4.2%; US: 1.93%) 2000-2011: +20.24% (EU: +4.99%; US:-10.75%)

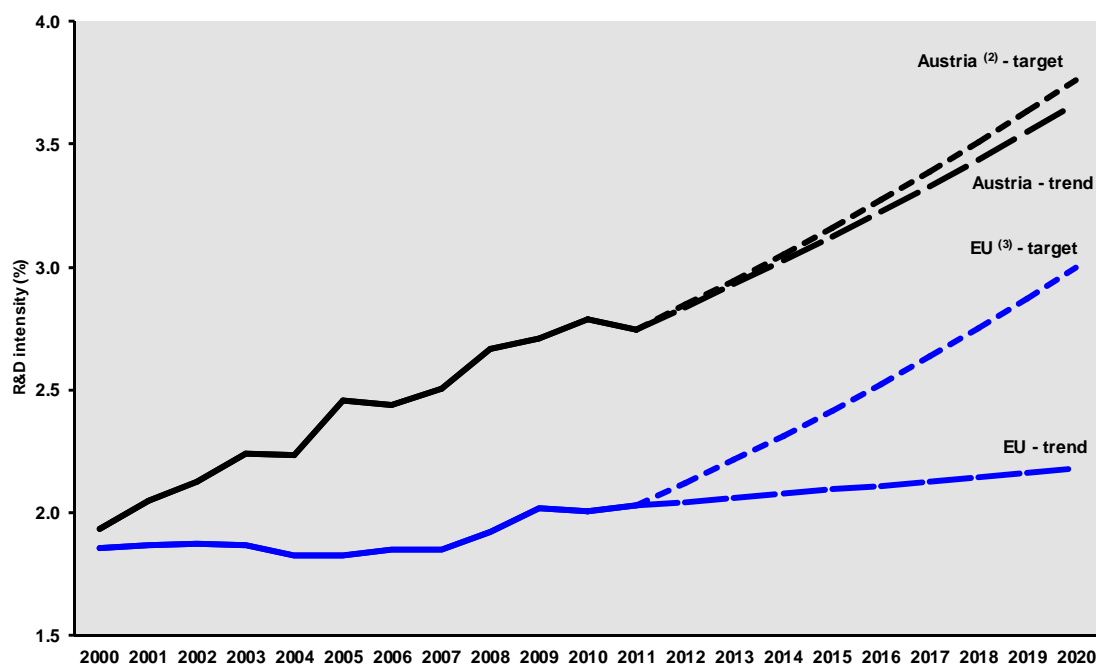
Austria has expanded its research and innovation system over the last decade with investments in research and innovation growing more quickly than the EU average. These efforts have been translated into a high and growing level of excellence in science and technology and clear strengths in key technologies for energy, environment and transport. The Austrian economy is characterised by specialised niche players, which are in constant need of innovation, in particular technological innovation, in order to remain leaders in their market segment. The level of innovation in Austrian firms is hence relatively high. Overall, according to several indicators on trade, firm innovations and patent revenues from abroad, the Austrian economy is, partly for structural reasons, less knowledge-intensive than many other EU Member States. However, the indexes on structural change and on the trade balance both point towards an upgrading of knowledge-intensity and linked to that an increase of competitiveness.

Nevertheless, the efforts to boost research need to be maintained, given the specialisation of the Austrian economy in a limited number of knowledge-intensive sectors where international competition is strong. This includes for example transport technology, biotechnology and the energy sector. The economic crisis has hit Austria less than other Member States and the unemployment rate is currently the lowest in the EU. To maintain its competitiveness and hence its favourable economic position, Austria is depending on an on-going high rate of innovation.

Austria's research and innovation policies are addressing these challenges by means of educational reform, improved governance of the R&D sector, by establishing new research centres of excellence, by setting up a more effective system of public research funding and more generally by promoting a further increase in the already high level of public and private investment in R&D.

Investing in knowledge

Austria - R&D intensity projections, 2000-2020 ⁽¹⁾



Source: DG Research and Innovation - Economic Analysis Unit

Data: DG Research and Innovation, Eurostat, Member State

Notes: (1) The R&D intensity projections based on trends are derived from the average annual growth in R&D intensity for 2000-2011.

(2) AT: This projection is based on a tentative R&D intensity target of 3.76% for 2020.

(3) EU: This projection is based on the R&D intensity target of 3.0% for 2020.

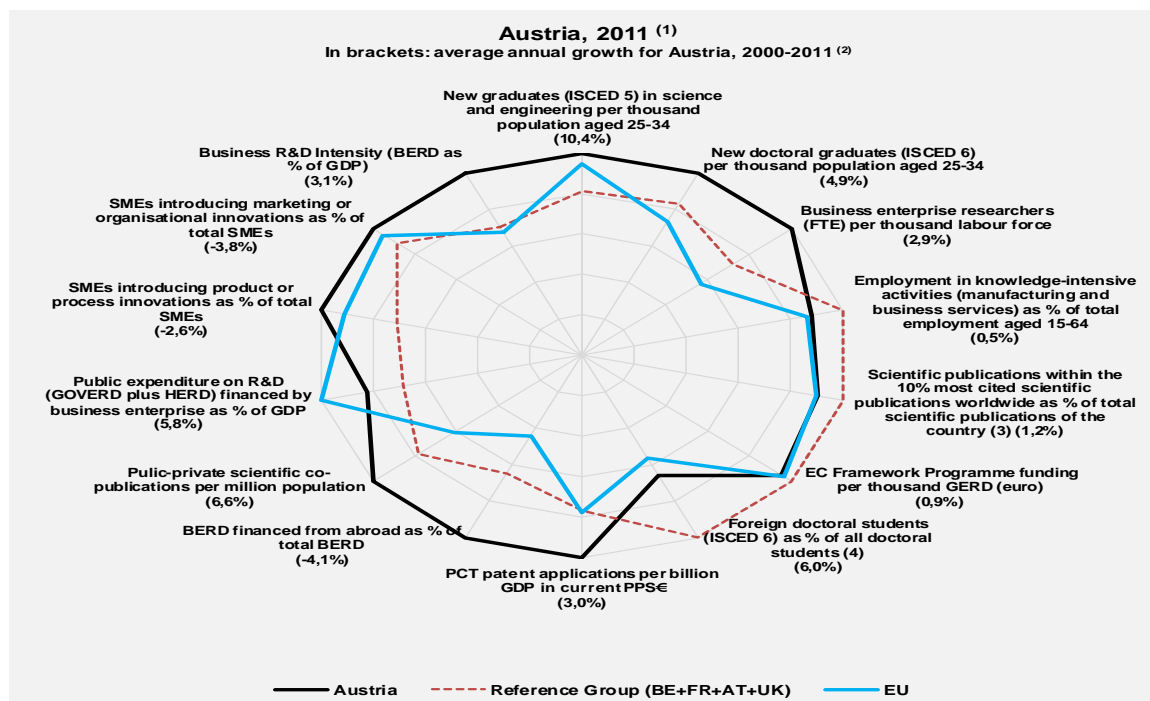
Austria has set a national R&D intensity target of 3.76%, one percentage point above the performance in 2011 and the third highest national target among EU Member States. In the past decade, R&D intensity in Austria has progressed faster than the EU average - reaching 2.75% in 2011. Overall, Austria is almost on track to achieve its national R&D intensity target, if the recent slowdown in R&D investment growth can be overcome.

Public spending on R&D as a % of GDP has shown a clear upward trend in Austria since 2002 and increased also during and after the recession of 2009, despite budgetary constraints. Also business R&D as a % of GDP has expanded strongly in the last decade and is now among the highest in Europe. However, in recent years, progress in private spending has decelerated, with a stagnation in the share of GDP and no increase in absolute spending in real terms during the recession of 2009 and only a moderate increase in 2011.

Austrian research and innovation are also benefitting from support from the EU budget, via co-funding for private and public R&D investment as well as other innovation, training and entrepreneurial activities. Main instruments are the Structural Funds and the 7th Framework Programme for Research. For the ERDF programme period 2007-2013, nearly €500 million has been allocated from the EU budget to activities related to research, innovation and entrepreneurship in Austrian regions (corresponding to over 70% of the ERDF resources allocated to Austria). Austria still has scope to increase its funding of R&D from the 7th Framework Programme. The success rate of Austrian applicants is 21.7%, slightly lower than the EU average success rate of 22%. Up to mid-2012, over 2000 Austrian participants had been partners in a FP 7 project, with a total EU financial contribution of €710 million.

An effective research and innovation system building on the European Research Area

The graph below illustrates the strengths and weaknesses of the Austrian R&I system. Reading clockwise, it provides information on human resources, scientific production, technology valorisation and innovation. Average annual growth rates from 2000 to the latest available year are given in brackets.



Source: DG Research and Innovation - Economic Analysis Unit

Data: DG Research and Innovation, Eurostat, OECD, Science Metrix/Scopus (Elsevier), Innovation Union Scoreboard

Notes: (1) The values refer to 2011 or to the latest available year.

(2) Growth rates which do not refer to 2000-2011 refer to growth between the earliest available year and the latest available year for which comparable data are available over the period 2000-2011.

(3) Fractional counting method.

(4) EU does not include DE, IE, EL, LU, NL.

The graph shows that the Austrian R&I system is balanced, with a good performance in all areas: human resources, scientific production, technology development and innovation. Progress has in general also been good. However, some warning signals come from falling innovation in SMEs and declining shares of R&D investments by foreign firms.

In the field of human resources for research and innovation, Austria performs at or above EU average and progress has been good since 2000. Tertiary attainment has been traditionally low in Austria, with many graduates classified as post-secondary, non-tertiary (ISCED 4), but a relatively high share of Austrian students study science and technology subjects and an above average proportion of them graduate at the doctoral level. Despite a strong inflow of foreign students, notably from Germany, Austria still has a lower share of foreign doctoral students than comparable countries. Highly-skilled graduates are relatively well absorbed into the Austrian economy, as evidenced by the relatively high number of business enterprise researchers and, linked to that, the good performance of Austria in the field of patent applications. Austria does not significantly outperform the EU average in high-quality scientific publications, nor in success in international competitions for EU Framework programme funds to R&D. There is a high share of Austrian universities among the good performers in major international rankings, but Austrian universities are not well represented at the very top of such rankings. Austria has improved public-private cooperation considerably in the past, both in scientific production and in contract research by business enterprises cooperating with public research organisations and now performs above the EU average in this field. Austria also performs well as regards innovation in SMEs.

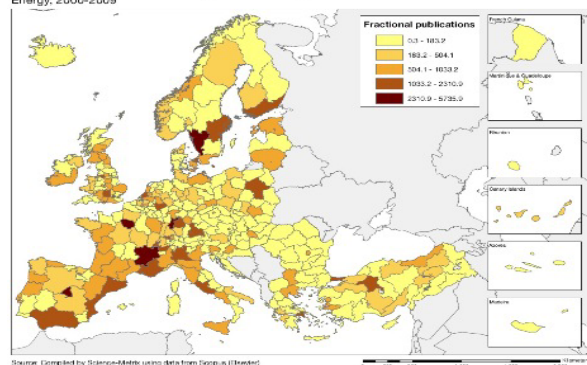
Austria's scientific and technological strengths

The maps below illustrate several key science and technology areas where Austrian regions have real strengths in a European perspective. The maps are based on the number of scientific publications and patents produced by authors and inventors based in the regions.

Strengths in science and technology at European level

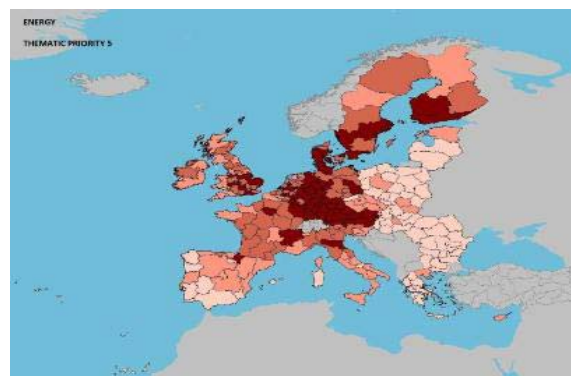
Scientific production

Number of publications by NUTS2 regions of ERA countries
Energy, 2000-2009



Energy

Technological production

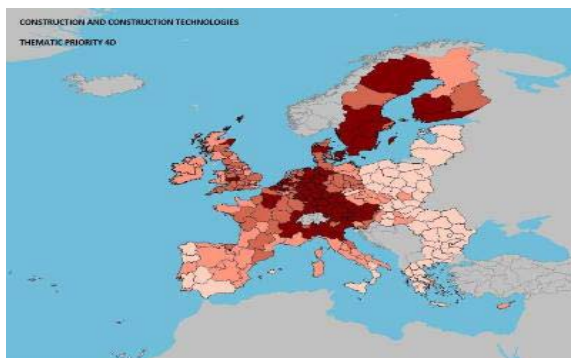
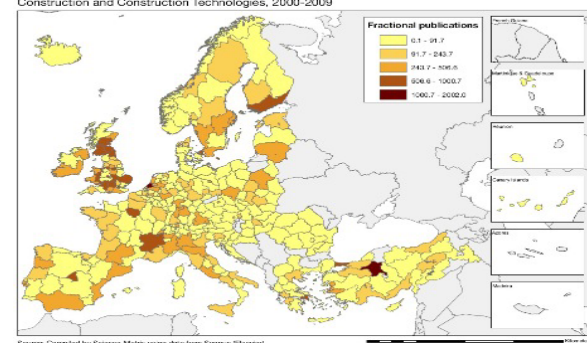


Scientific production

Construction and construction technologies

Technological production

Number of publications by NUTS2 regions of ERA countries
Construction and Construction Technologies, 2000-2009

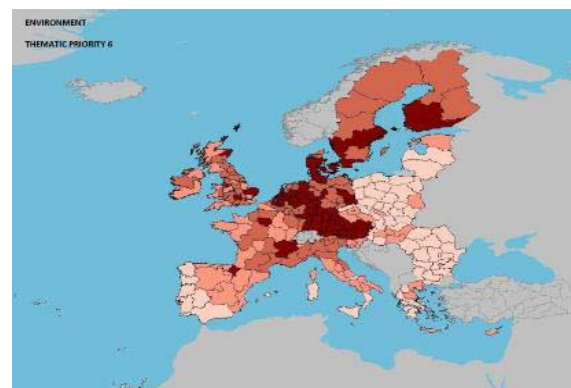
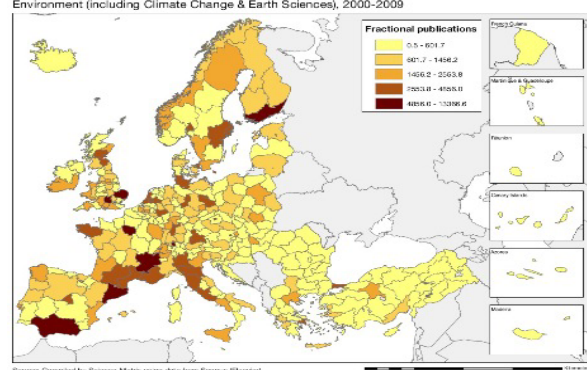


Scientific production

Environment

Technological production

Number of publications by NUTS2 regions of ERA countries
Environment (including Climate Change & Earth Sciences), 2000-2009

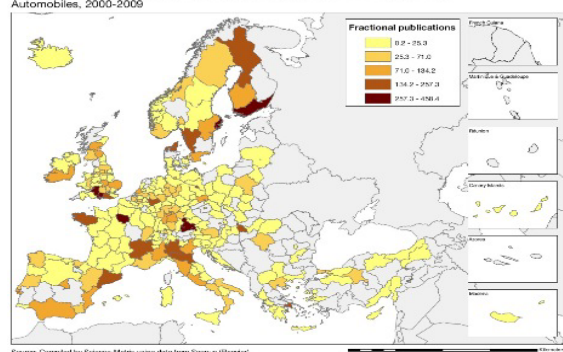


Source: DG Research and Innovation – Economic Analysis unit

Data: Science Metrix using Scopus (Elsevier), 2010; European Patent Office, patent applications, 2001-2010

Scientific production

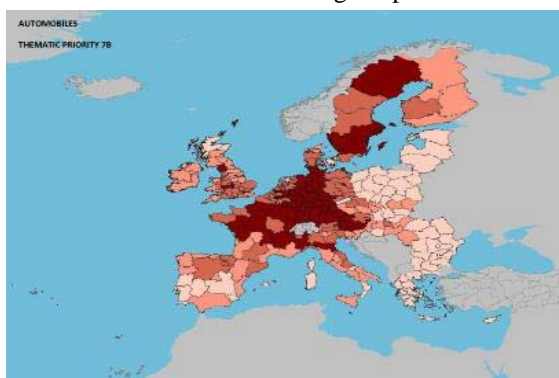
Number of publications by NUTS2 regions of ERA countries



Source: Compiled by Science-Metrix using data from Scopus (Elsevier)

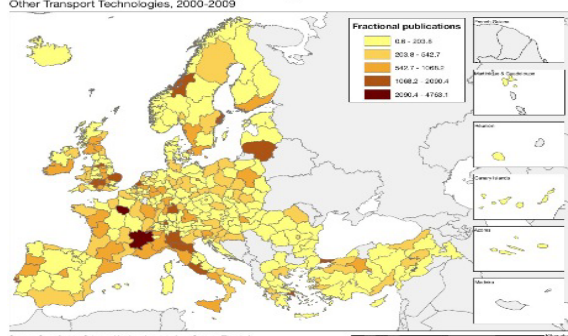
Automobiles

Technological production



Scientific production

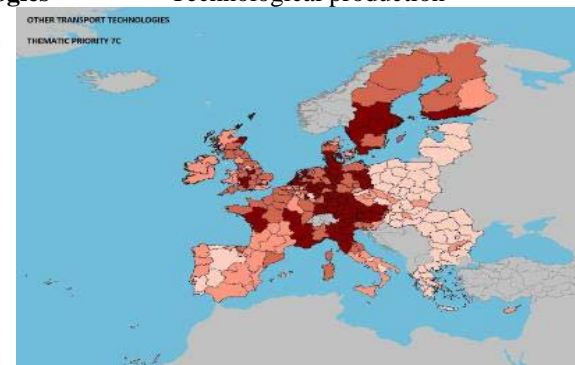
Number of publications by NUTS2 regions of ERA countries



Source: Compiled by Science-Metrix using data from Scopus (Elsevier)

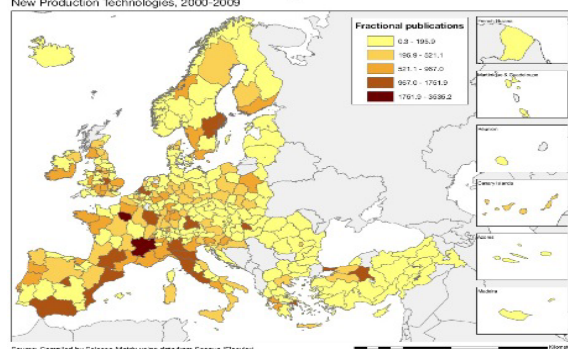
Other transport technologies

Technological production



Scientific production

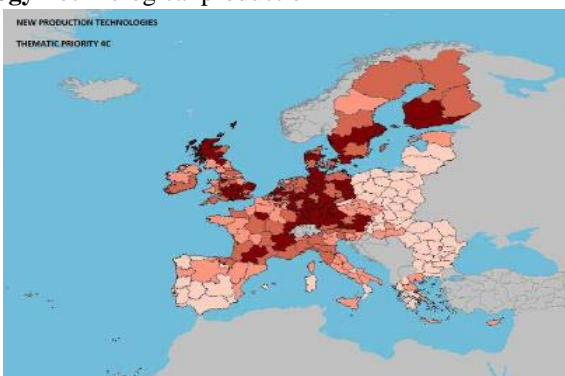
Number of publications by NUTS2 regions of ERA countries



Source: Compiled by Science-Metrix using data from Scopus (Elsevier)

New production technology

Technological production



As shown by the maps above, in terms of scientific production, only a few Austrian regions perform at high output levels and the number of high performance sectors, specifically environment, food and agriculture and information and communication technologies (the latter two not illustrated on the maps), is limited. This is partly due to the relatively small size of Austrian regions - the average population of an Austrian NUTS 2 region is less than half the EU NUTS 2 average. Leading regions (Länder) in Austria in terms of scientific production in these fields are Steiermark (Styria) and Vienna.

In terms of technology patenting, which is more closely linked to business innovation, the relative position of Austria is much better than in scientific production, with many Austrian regions among the top quarter in Europe, notably in the fields of energy, construction and construction technologies, environment, automobiles and other transport technologies and in new production technology. This reflects economic structures and the areas where Austrian enterprises are innovative and have a strong market position. The comparison between scientific output in terms of publications and patenting thus shows a certain imbalance, since the strong fields for the Austrian science base are not necessarily the same as the sectors where Austrian firms have the strongest technology development. Moreover, Austria's performance in terms of scientific output is relatively low compared to the EU average and is concentrated in specific fields and regions, whereas in relation to patenting there is good performance over many fields and regions. It will be a challenge for the future to bring scientific output in Austria to the same level as patenting, and also to ensure the long term sustainability of innovation.

Policies and reforms for research and innovation

Austria formulates R&D policies from a relatively favourable position in terms of overall R&D intensity. While research is among the priority areas in public spending, the share of private sector expenditure on R&D in total R&D expenditure has fallen from 71 % in 2007 to 68 % in 2011, thus putting at risk the achievement of the ambitious Europe 2020 R&D intensity target of 3.76 %. Among the factors explaining the recent low growth in private spending are the economic crisis and a shortage of venture capital. However, the government has taken steps to stimulate additional private sector spending on R&D. Between August and November 2011 on the initiative of the Austrian Ministry for Transport, Innovation and Technology (bmvit) 22 of the larger Austrian companies, representing more than one fifth of business enterprise research spending in Austria, have committed themselves to increase R&D spending by 20% by 2015.

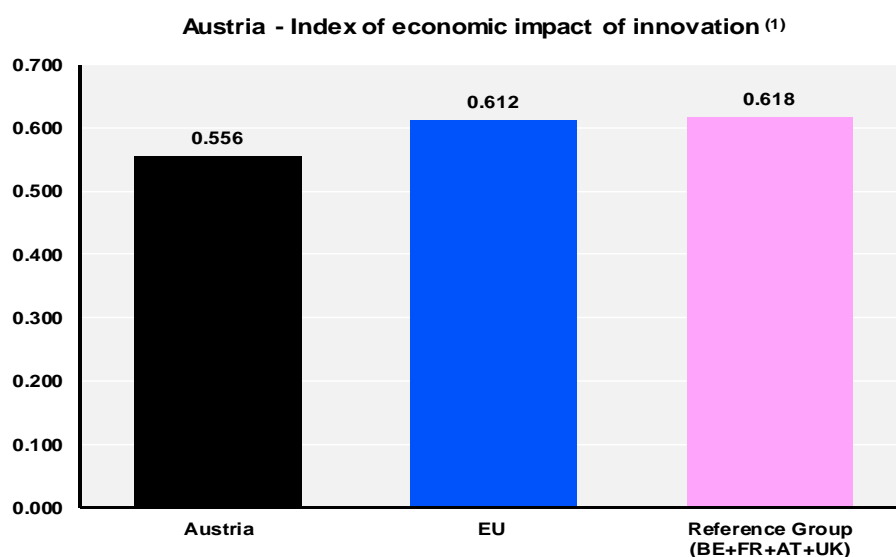
The Austrian RTDI Strategy 'Becoming an innovation leader', which was published in 2011, contains many initiatives to improve the performance of the research and innovation system. These include initiatives to strengthen the links to the education system, to increase the share of tertiary graduates, to promote high quality research infrastructure and fundamental research and to use public procurement to promote innovation.

The Austrian government has set up a Task Force for the implementation of the RTDI strategy. The initiatives of the RTDI Strategy are echoed and enhanced in the 2012 National Reform Programme and the Euro Plus Pact commitments. The most prominent measure is the simplification of the tax regime for R&D activities to a single tax credit raised from 8 % to 10 %. In addition, the cap on the amount which could be subcontracted while remaining eligible for tax credit rises from €0.1 million to €1 million. These measures are budget neutral and are expected to encourage subcontracting to research centres and universities. On the other hand, this approach favours established activities more than the breakthrough research needed for an economy like Austria's. Moreover, whereas the National Reform Programme of 2012 lists numerous initiatives in the field of research and innovation, it still lacks clear prioritisation and details of players and budgets and implementation timetables and it does not address the need for a closer integration of the Austrian R&I system within the European Research Area.

As regards sustainability of economic activities, which plays an important role in the acceptance of innovation by the public and which in itself can be a source of innovation, the National Energy Strategy from 2010 aims at increasing efficiency, energy security and the share of renewables. Funding is available for the greening of industries and an action plan was set up in October 2010 for Green Public Procurement. In 2011 a strategy paper to promote electrical mobility was prepared and in 2012 a resource efficiency action plan (REAP) was adopted.

Economic impact of innovation

The index below is a summary index of the economic impact of innovation composed of five of the Innovation Union Scoreboard's indicators¹.



Source: DG Research and Innovation - Economic Analysis Unit (2013)

Data: Innovation Union Scoreboard 2013, Eurostat

Note: (1) Based on underlying data for 2009, 2010 and 2011.

Overall, Austria's employment is slightly more oriented towards knowledge-intensive sectors than the EU average. Austria's scores on the indicators "*PCT patents application per billion GDP*" and "*Contribution of medium and high-tech products exports to trade balance*" is also above EU average, reflecting the very good innovation performance of its manufacturing sector. Austria's low score on the summary index is strongly influenced by a very low score on the indicator "*Knowledge-intensive services export as % of total services exports*", which is explained by the dominance in its services export of the tourist sector, which is classified as non-knowledge-intensive.

The recent economic crisis has been less severe on Austria than on other EU Member States with the result that the conditions for innovation have faced fewer challenges in Austria than in most other EU countries, although the availability of business financing has decreased in 2009. In 2010, according to enterprise surveys² Austria was among the middle performers in the EU as regards the ease of access to loans and the availability of venture capital. Austria currently also ranks in the middle group of EU member states in the World Bank's index *Ease of doing business*. However, Austria ranks low regarding the time needed to start a business, since the number of administrative procedures required for setting up a business is still relatively high. There are on-going efforts to reduce the administrative burden on enterprises.

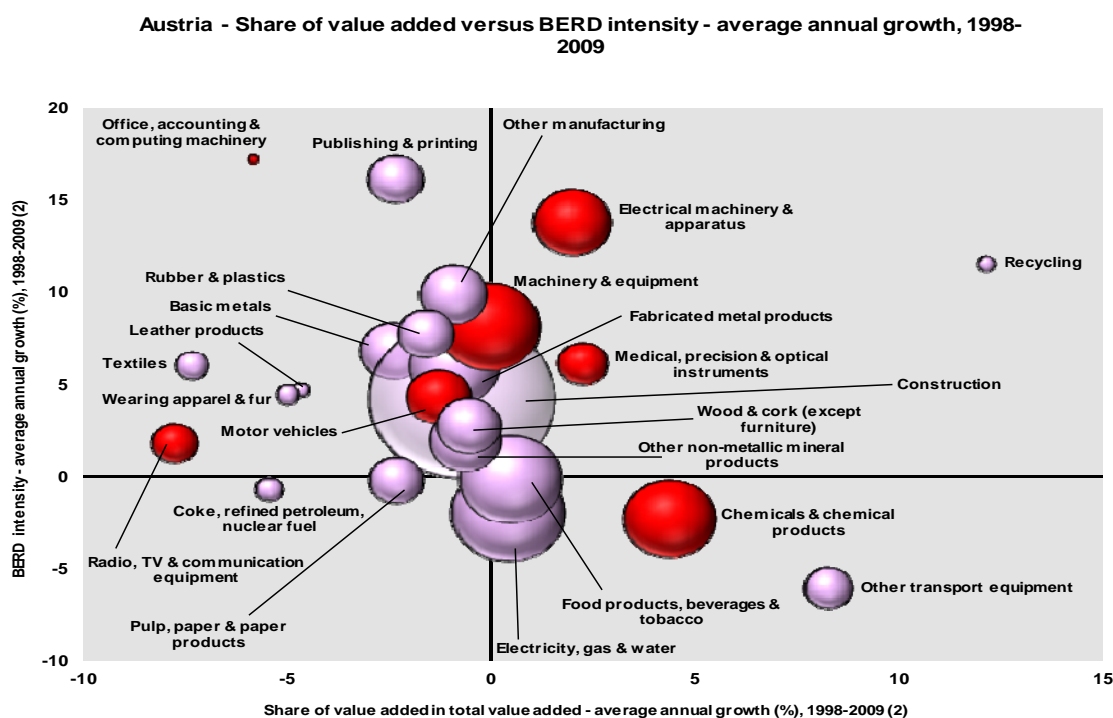
Expenditure on R&D is high by European standards, but Austria may not be sufficiently exploiting and maintaining its innovative potential. One reason for this is an underdeveloped venture capital market (venture capital represented 0.04% of GDP in Austria in 2011 compared to an EU average of 0.35%), which suffers from an unfavourable legal framework and from structural and other problems of the Austrian VC market (e.g. small size and limited differentiation, general reluctance to invest in early stages, uncertainty concerning the treatment of non-incorporated companies as VC funds etc). In addition, the education system faces the challenge of providing the skills required as a basis for innovation and competitiveness, but the low tertiary attainment rate and the general demographic development might lead to a scarcity of skilled people in the long term.

¹ See Methodological note for the composition of this index.

² World Economic Forum, The Global Competitiveness Report 2012-2013, pages 97-98 and 482

Upgrading the manufacturing sector through research and technologies

The graph below illustrates the upgrading of knowledge in different manufacturing industries. The position on the horizontal axis illustrates the changing weight of each industry sector in value added over the period. The general trend to the left-hand side reflects the decrease of manufacturing in the overall economy. The sectors above the x-axis are sectors whose research intensity has increased over time. The size of the bubble represents the share of the sector (in value added) in manufacturing (for all sectors presented in the graph). The red-coloured sectors are high-tech or medium-high-tech sectors.



Source: DG Research and Innovation - Economic Analysis unit

Data: OECD

Notes: (1) High-Tech and Medium-High-Tech sectors are shown in red. 'Other transport equipment' includes High-Tech, Medium-High-Tech and Medium-Low-Tech.

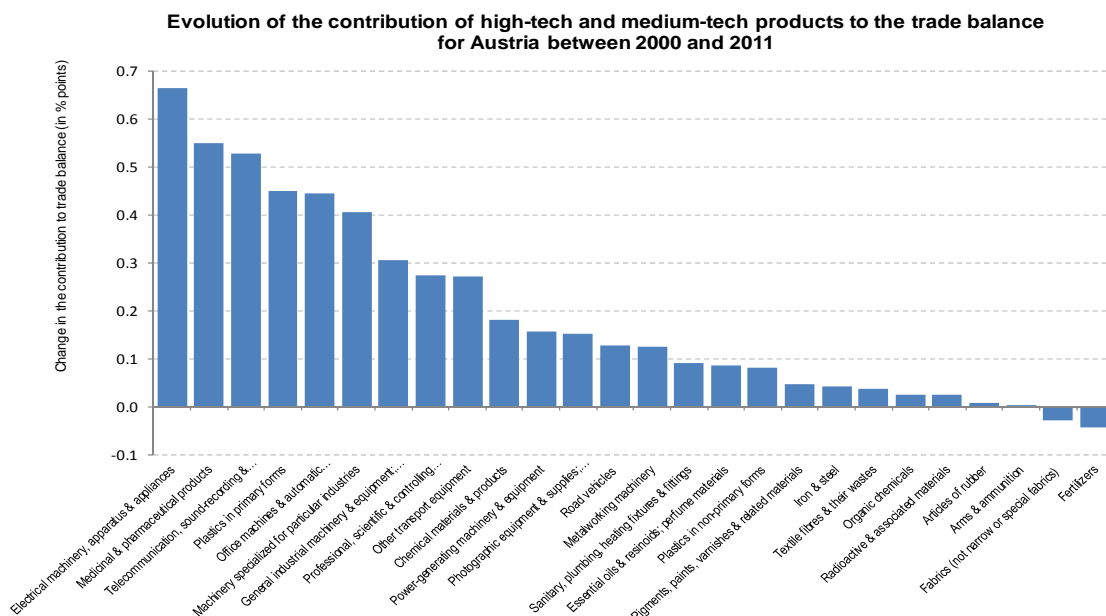
(2) 'Leather products', 'Wearing apparel & fur': 1998-2007; 'Recycling': 2003-2009.

Austria is one of the EU countries having a high contribution of manufacturing industry to total value added (around 19% compared to an EU average of 16%). In parallel, Austrian manufacturing industry has clearly increased its knowledge-intensity in high- and medium-high-tech sectors as well as in the medium-low and low-tech sectors (with the notable exception of chemicals, other transport equipment and the electricity, gas and water sector).

As in many other European countries, one of the largest sectors in the economy is the construction sector, but unlike other EU countries, the construction sector did not increase its share of the economy in the years leading up to the economic crisis, while its research intensity improved slightly. Research intensity has mostly increased in high-tech and medium-high-tech sectors, with in most cases positive results when it comes to value added. However, despite an increase in research intensity, the manufacturing of radio, TV and communication equipment has declined in importance, partly as a result of a reclassification of the activities of a large Austrian manufacturing firm, which was until 2006 attributed to this sector and probably also due to a shift of production to low wage countries. The chemicals and chemical products sector, on the other hand, has increased in economic importance despite a decline in research intensity. As regards electrical machinery and medical, precision and optical instruments an increase in research intensity has been accompanied in Austria by a growth in value added.

Competitiveness in reaping income of global demand and markets

Investment in knowledge, technology-intensive clusters, innovation and the upgrading of the manufacturing sector are determinants of a country's competitiveness in global export markets. A positive contribution of high-tech and medium-tech products to the trade balance is an indication of specialisation and competitiveness in these products.



Source: DG Research and Innovation - Economic Analysis unit

Data: COMTRADE

Notes: "Textile fibres & their wastes" refers only to the following 3-digits sub-divisions: 266 and 267.

"Organic chemicals" refers only to the following 3-digits sub-divisions: 512 and 513.

"Essential oils & resinsoids; perfume materials" refers only to the following 3-digits sub-divisions: 553 and 554. "Chemical materials & products" refers only to the following 3-digits sub-divisions: 591, 593, 597 and 598. "Iron & steel" refers only to the following 3-digits sub-divisions: 671, 672 and 679.

"Metalworking machinery" refers only to the following 3-digits sub-divisions: 731, 733 and 737.

The Austrian economy is characterised by a relatively small contribution of agriculture to GDP and a comparatively high share of manufacturing industry in total value added. The service sector, including a relatively large tourism sector, also has an above EU average share of the economy. The strongest growth in value added over time tends to occur in the service sector.

As shown by the graph above, Austria succeeded in improving its trade balance for most of its high-tech and medium-tech products over the period 2000-2011. A limited number of medium-tech products showed a stagnation or slight decline in their contribution to the trade balance. On the other hand, the trade balance improved significantly in the electrical machinery, apparatus and appliances sector – the high-tech sector, where R&D intensity has increased most over the last decade.

Overall Austria has improved its total factor productivity faster than the EU average over the last decade, a sign of innovation in line with the balanced and expanding R&I system and the upgrading of its manufacturing sector. Progress has also been made in technologies addressing societal challenges such as health and the environment and on all of the Europe 2020 targets. However, compared to other EU Member States, Austria shows a relatively low tertiary education attainment rate. Furthermore, this rate is progressing only slowly. The picture improves if post-secondary, non-tertiary education (ISCED 4), which Austria considers equivalent to tertiary education, is included. Furthermore, the high employment rate and the low rate of early leavers from education and training show that Austria makes good use of its human capital.

Table on key indicators

AUSTRIA	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average annual growth ⁽¹⁾ (%)	EU average ⁽²⁾	Rank within EU
ENABLERS																
Investment in knowledge																
New doctoral graduates (ISCED 6) per thousand population aged 25-34	1.42	1.53	1.79	1.90	2.18	2.02	1.97	1.92	2.03	2.10	2.30	:	:	4.9	1.69	6
Business enterprise expenditure on R&D (BERD) as % of GDP	:	:	1.42	:	1.52	1.72	1.72	1.77	1.85	1.84	1.90	1.87	:	3.1	1.26	5
Public expenditure on R&D (GOVERD + HERD) as % of GDP	:	:	0.69	:	0.71	0.74	0.72	0.73	0.81	0.85	0.88	0.86	:	2.4	0.74	7
Venture Capital ⁽³⁾ as % of GDP	0.07	0.06	0.06	0.04	0.05	0.05	0.04	0.13	0.08	0.05	0.04	0.04	:	-5.1	0.35 ⁽⁴⁾	16 ⁽⁴⁾
S&T excellence and cooperation																
Composite indicator of research excellence	:	:	:	:	:	40.5	:	:	:	:	50.5	:	:	4.5	47.9	8
Scientific publications within the 10% most cited scientific publications worldwide as % of total scientific publications of the country	9.9	9.6	9.5	10.4	10.4	10.5	10.7	11.4	10.9	:	:	:	:	1.2	10.9	9
International scientific co-publications per million population	401	386	402	590	688	759	784	896	967	1014	1096	1180	:	10.3	300	7
Public-private scientific co-publications per million population	:	:	:	:	:	:	:	67	70	77	84	86	:	6.6	53	6
FIRM ACTIVITIES AND IMPACT																
Innovation contributing to international competitiveness																
PCT patent applications per billion GDP in current PPSE	3.8	3.6	4.1	4.4	4.8	5.0	5.3	5.2	4.6	5.0	:	:	:	3.0	3.9	6
License and patent revenues from abroad as % of GDP	:	:	:	:	0.13	0.13	0.16	0.20	0.22	0.19	0.18	0.19	:	5.7	0.58	13
Sales of new to market and new to firm innovations as % of turnover	:	:	:	:	10.6	:	13.6	:	11.2	:	11.9	:	:	2.0	14.4	16
Knowledge-intensive services exports as % total service exports	:	:	:	:	19.3	21.8	22.7	24.0	22.8	23.1	22.2	:	:	2.4	45.1	21
Contribution of high-tech and medium-tech products to the trade balance as % of total exports plus imports of products	-1.83	-1.46	-0.91	-0.09	0.87	1.59	2.41	2.20	2.69	2.29	2.59	3.18	:	-	4.20 ⁽⁵⁾	8
Growth of total factor productivity (total economy) - 2000 = 100	100	100	101	101	102	103	106	108	108	104	105	106	106	6 ⁽⁶⁾	103	12
Factors for structural change and addressing societal challenges																
Composite indicator of structural change	32.2	:	:	:	:	37.8	:	:	:	:	42.4	:	:	2.8	48.7	16
Employment in knowledge-intensive activities (manufacturing and business services) as % of total employment aged 15-64	:	:	:	:	:	:	:	:	13.8	14.2	14.4	14.0	:	0.5	13.6	13
SMEs introducing product or process innovations as % of SMEs	:	:	:	:	49.4	:	47.8	:	39.6	:	42.2	:	:	-2.6	38.4	10
Environment-related technologies - patent applications to the EPO per billion GDP in current PPSE	0.47	0.46	0.42	0.47	0.50	0.44	0.47	0.59	0.61	:	:	:	:	3.2	0.39	4
Health-related technologies - patent applications to the EPO per billion GDP in current PPSE	0.55	0.73	0.67	0.80	0.62	0.64	0.77	0.76	0.62	:	:	:	:	1.6	0.52	6
EUROPE 2020 OBJECTIVES FOR GROWTH, JOBS AND SOCIETAL CHALLENGES																
Employment rate of the population aged 20-64 (%)	71.4	71.5	71.8	72.0	70.8	71.7	73.2	74.4	75.1	74.7	74.9	75.2	:	0.9	68.6	5
R&D Intensity (GERD as % of GDP)	1.93	2.05	2.12	2.24	2.24	2.46	2.44	2.51	2.67	2.71	2.79	2.75	:	3.3	2.03	5
Greenhouse gas emissions - 1990 = 100	103	108	110	118	117	119	115	112	111	102	108	:	:	5 ⁽⁷⁾	85	21 ⁽⁸⁾
Share of renewable energy in gross final energy consumption (%)	:	:	:	:	22.9	25.0	26.6	28.9	29.2	31.0	30.1	:	:	4.7	12.5	4
Share of population aged 30-34 who have successfully completed tertiary education (%)	:	:	:	:	21.0	20.5	21.2	21.1	22.2	23.5	23.5	23.8	:	1.8	34.6	23
Share of population at risk of poverty or social exclusion (%)	:	:	:	:	17.5	16.8	17.8	16.7	18.6	17.0	16.6	16.9	:	-0.5	24.2	5 ⁽⁸⁾

Source: DG Research and Innovation - Economic Analysis Unit

Data: Eurostat, DG JRC - ISPR, DG ECFIN, OECD, Science Metrix/ Scopus (Elsevier), Innovation Union Scoreboard

Notes: (1) Average annual growth refers to growth between the earliest available year and the latest available year for which compatible data are available over the period 2000-2012.

(2) EU average for the latest available year.

(3) Venture Capital includes early-stage, expansion and replacement for the period 2000-2006 and includes seed, start-up, later-stage, growth, replacement, rescue/turnaround and buyout for the period 2007-2011.

(4) Venture Capital: EU does not include EE, CY, LV, LT, MT, SI, SK, These Member States were not included in the EU ranking.

(5) EU is the weighted average of the values for the Member States.

(6) The value is the difference between 2012 and 2000.

(7) The value is the difference between 2010 and 2000. A negative value means lower emissions.

(8) The values for this indicator were ranked from lowest to highest.

(9) Values in italics are estimated or provisional.

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