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Working Party on the Information Economy

**ICT DIFFUSION TO BUSINESS: PEER REVIEW
Country Report: Austria**

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FOREWORD

In December 2005 this report was presented to the Working Party on the Information Economy as part of the peer review of ICT diffusion to business in Austria. It was recommended to be made public by the Committee for Information, Computer and Communications Policy in March 2006.

The report was prepared by Graham Vickery of the OECD Secretariat and Katharina Warta (Technopolis). The series of peer reviews of ICT diffusion to business is co-ordinated by Graham Vickery. It is published under the responsibility of the Secretary-General of the OECD.

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SUMMARY

Austria is in the middle group of countries in terms of most indicators of information and communication technology (ICT) infrastructure for business. E-readiness and Internet penetration are around average, broadband is widely available even if lagging in rural areas, business R&D growing, Internet banking and e-government applications advanced, although aggregate ICT and knowledge investments are below average. There may however be a considerable lag between availability of inputs of ICT-related services and competences and widespread ICT applications and use. E-government is well-developed and is a good example of a policy lever which has important impacts on business and citizens as well as improving government efficiency. Similarly, electronic payments and electronic signatures are well developed but e-commerce performance is only average. ICT policy has aimed to sustain relatively good economic performance and modernise the economy by tackling market distortions and market failures. This has included broad liberalisation of network services, increased direct public funding and incentives to private spending on R&D, and initiatives for ICT skills and diffusion. However, co-ordination is a complex and challenging task in a federal government structure and does not necessarily lead to a centralised approach to ICT policy and its direction and form. Policy responsibilities and programme implementation are spread across a large number of ministries and bodies; informal information exchange and programme evaluation practice may be insufficient to identify and meet emerging challenges, and recent transparent initiatives such as the White Paper on ICT-related strategy should be continued and strengthened.

Policy domain	Current policy priority	This priority should be	Recommendations
Co-ordination of initiatives	Low to medium	Increased	Within the Austrian Federal system ICT policy responsibilities and programme implementation are widely spread. The debate on an overarching strategy for ICT policies should be further enhanced by foresight exercises that include all relevant ministries and bodies along the lines of recent initiatives.
Infrastructure	Medium	Continued	The objective of comprehensive broadband coverage is welcomed; however an integrated approach of tax incentives and depreciation for infrastructure investment may be preferable to subsidies offered for a limited time period.
R&D and innovation	High	Continued	Public IR&D support has increased ICT R&D performance. Phasing out of some programmes, declining funding of innovation competence centres, and the wide spread of ministerial responsibilities may lead to a slowdown that needs addressing.
Venture capital	Low	Continued and increased over time	The venture capital market is under-developed. Further venture capital development and reduction of related administrative burdens is a general issue that needs addressing.
ICT skills	Medium to high	Continued and increased	Initiatives addressing ICT skills of young people are well-developed and should continue. ICT workplace skills should be further developed, especially for women and older workers.
Content creation	Medium	Increased	Increased attention should be placed on a coherent and liberalised market for electronic content.
Small and medium-sized firms	Medium	Increased	Some scattered initiatives explicitly address increased use of ICT in SMEs and related needs for skills and organisational capabilities. Existing initiatives should be evaluated and co-ordinated, and if necessary, increased following evaluation.
Standards, trust-security	High	Continued	Trust and security issues are addressed and co-ordinated centrally. Present efforts of information diffusion and awareness creation should continue or even increase.
Evaluation	High	Continued and increased	The evaluation culture has improved. Programme and institutional evaluations are published, and results partly integrated in policy design. However, evaluations tend to be <i>ex-post</i> or mid-term. <i>Ex-ante</i> evaluations and foresight exercises to better identify challenges and objectives should be further developed.

INTRODUCTION

The OECD Growth Study concluded that information and communication technology (ICT) is a key input to productivity and growth performance (OECD, 2001a, 2001b, 2003a). In 2001, the OECD Ministerial Council urged the OECD to strengthen its peer review of structural reforms. The 2002 Ministerial Council requested “the OECD to increase its monitoring of member countries’ implementation of the recommendations of the OECD Growth Study”.

This report is part of the peer review process of policies promoting ICT diffusion to business, designed to respond to the two Ministerial requests as part of the Growth Follow-up project. OECD peer reviews are used as a method to bring together peers from member countries to discuss policy experience and challenges in an individual country. Once a critical mass of countries has been reviewed, a cross-country comparative synthesis report will be prepared with a view to identifying common good policy practices. A summary document has been prepared and declassified covering the first seven country reviews for: Denmark, Finland, Italy, Korea, the Netherlands, Norway and Switzerland [DSTI/ICCP/IE(2005)6/FINAL]. Following a first round of reviews conducted in the Working Party on the Information Economy (WPIE) in December 2003, a second round in June 2004, and a third round in December 2004, the present report was background for the fourth review meeting in December 2005. The discussion and comments made at the meeting are reflected in this final version of the country report.

This report reviews the status of diffusion of ICT to business in Austria and describes current and previous policies aimed at ICT uptake in firms. ICT diffusion to business is one of the five parts of the ICT policy framework used in the Information Technology Outlook 2006 Policy Questionnaire, shown in Table 1. Given the complexity of the ICT diffusion process and the central role of a number of the other factors, attention is also given to the other parts of the framework (including R&D, public procurement, standards, broadband, and trust and security issues) that are important elements in the diffusion of ICT to business.

Table 1. ICT policy framework

ICT Policies				
Fostering ICT Innovation	Increasing Diffusion / Use	Maintaining a Healthy ICT Business Environment	Enhancing the Infrastructure	Promoting Trust Online
R&D programmes	<i>Diffusion to households and individuals</i>	<i>Competition in ICT markets</i>	Electronic payment / settlement	<i>Security of information systems and networks</i>
Government development	<i>Diffusion to businesses</i>	<i>Intellectual property rights</i>	Standards	<i>Privacy protection</i>
Government procurement	Professional/managerial ICT skills	<i>Trade and FDI</i>	Broadband	<i>Consumer protection</i>
Venture finance	Organisational change	International co-operation	<i>General network infrastructure</i>	
Innovation networks	<i>e-government</i>			
	Content			
	Government demonstration			

The report also presents recommendations for possible policy actions based on the strengths and weaknesses observed in the Austrian ICT-related policy. Policies to encourage ICT diffusion to business have covered traditional areas such as publicly financed awareness-raising and business services to develop ICT readiness in small businesses, and more general business environment policies such as infrastructure competition. The review does not focus directly on broader aspects of Information Society policies aiming at citizens' and households' uptake of ICTs and participation in the Information Society. Furthermore, the review should not be seen as a comprehensive evaluation of the effectiveness of all recent initiatives, but as a guiding tool for facing the challenges and setting priorities for new initiatives.

ICT diffusion to business

ICT investment and use can be a strong driver for labour productivity and multifactor productivity at firm level. The regulatory environment, the availability of appropriate skills, the capability for organisational change, as well as the strength of accompanying innovations in ICT applications all have major effects on the ability of enterprises to seize the benefits of private and public investments in ICT (OECD, 2003a).

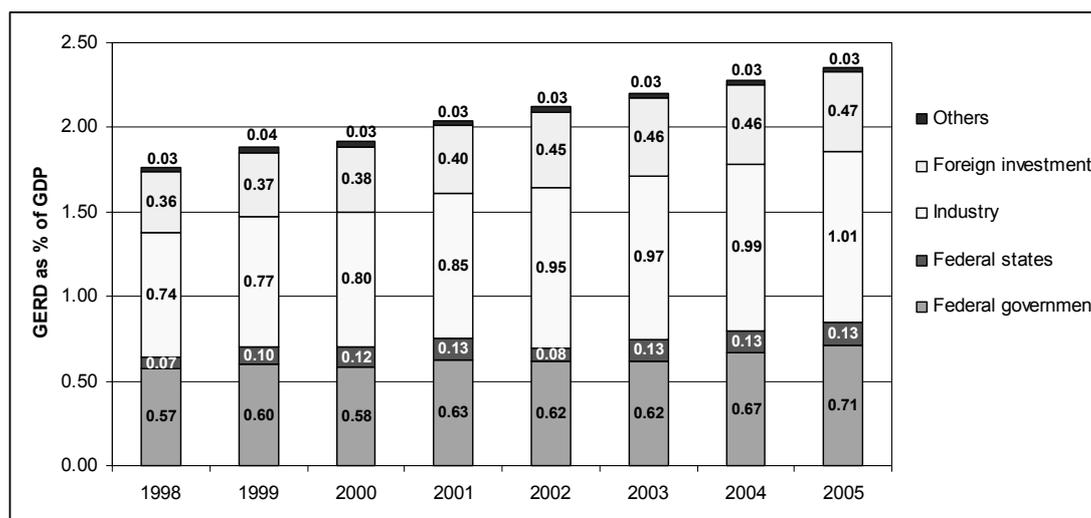
The role of ICT as an enabler of change across traditional segments of society and its institutions also introduces new challenges in terms of developing and implementing appropriate policies and implementation mechanisms. This broader understanding of success factors calls for a wider range of policies and better statistics for the full monitoring of policies and their impact. Where such indicators are not available, the report draws on related data.

GENERAL ECONOMIC SETTING AND INDUSTRY STRUCTURE

Austria's GDP per capita is over 15% higher than the OECD average and it was in sixth position among OECD countries in 2003.¹ After a period of low economic growth from 2001 the economy recovered, with GDP growth of 2% in 2004 driven by strong external demand, and a forecast for 2005 of 1.9%, which is higher than France, Switzerland, Belgium and Germany but lower than the OECD average and Sweden, Denmark, Finland and the United Kingdom.

Austria had good economic performance in the past despite structural weaknesses and relatively low knowledge-intensive inputs, but this "performance paradox" has been succeeded by a catching-up in investment in research and development (R&D) and other intangibles. R&D expenditures were 2.27% of GDP in 2004 and should rise to 2.35% in 2005 (Statistics Austria),² due to increased private and public R&D expenditures and increased foreign R&D investment. Austria is one of the few countries approaching the goal of R&D expenditures of 3% of GDP defined by the European Council Meeting in Lisbon in 2002. Its R&D intensity is above the EU15 average and close to the total OECD average, and the growth of aggregate R&D expenditure has been well above OECD and EU15 averages since 1995 (OECD, 2005c).

**Figure 1. Gross domestic expenditure on R&D in Austria
percent of GDP**



Source: Statistics Austria, 2005.

However, Austria's recent economic performance has still been weaker than that of comparable small open economies in Europe. Some of these top performers have been investing more, and more consistently, in drivers of growth such as information technology and innovation. Austria's "old growth paradigm" is still evident in capital formation biased towards physical capital. Investment in the new drivers of growth does not yet match its income per capita, even if economic activity is becoming more science-based as new

¹ GDP per capita, 2003 at current prices, in US dollars, based on current purchasing power, OECD, *National Accounts of OECD countries, Main aggregates*, Volume 1.

² BMBWK (2005), *Research and technology report*, Vienna.

opportunities in ICT and the life sciences emerge.³ Overall, investment in knowledge (R&D, software, higher education as a share of GDP) was below the OECD and EU average in 2002 with the relatively good performance in R&D not matched by expenditures on software and higher education which were below the OECD and EU averages, and R&D and to a lesser extent software being the major contributor to the growth of investments in knowledge (OECD, 2005c). Furthermore, investment in machinery and equipment (in 2002 as a share of GDP) was above the OECD and EU average, and has remained stable as a share of GDP reflecting the weight of traditional machinery-intensive industries in the economy.

The venture-capital market to finance innovation and new firms is also underdeveloped in Austria. Venture capital investments in ICT lag far behind the OECD average (0.057% of GDP in 2000-03 against 0.257% for the OECD) and the total venture capital market is very small compared with other countries (OECD, 2005c). However, according to expert views the weakness of the venture capital market is mainly due to the regulatory environment and low quality projects, rather than a shortfall in venture funds as existing funds are not completely exploited.⁴ Moreover, Austrian venture capital investments predominantly go into expansion with a significant share into start-ups, whereas buyouts dominate on average in Europe. And the share of high-technology sectors in total venture capital finance is 51% in Austria, compared with only 35% in the EU but 60% in the OECD as a whole. This suggests that despite its very low share Austrian investment is relatively favourable for entrepreneurship, innovation and growth. In terms of types of investors, banks dominate in Austria with over 40% of investments, whereas in Europe on average banks are considerably less important (21.5% in 2003), and pension funds, funds of funds and insurance companies more important (see Annex Figures A1 and A2).

Labour force participation is marked by a particularly early effective retirement age, with participation rates of only 53% of the 55-59 age group (compared with 60% in the EU15 and 64% in the OECD), and 12% of the 60-64 age group (27% in the EU15 and 39% in the OECD). A recent OECD report argues that despite recent pension reforms that encourage longer working lives starting to take effect, attitudes of employers and employees appear to be changing very slowly and existing pathways into early retirement are still used extensively.⁵ Of the employed labour force of 3.15 million people, 68.4% are employed in services, 27.9% in production and industry, and 1% in agriculture.

In terms of industry size structure, there are a relatively large number of large firms with more than 250 employees (0.4% compared with 0.2% in the EU19 average) and they have a relatively large share of employment (34.7% compared with 30.3%). Only 23.2% are employed in very small firms with less than 10 employees while the European average is 39.4%.⁶

³ Hutschenreiter, G. (2005), "Innovation Policy and Performance in Austria", Chapter 2 in *Assessing Innovation Policy and Performance – A Cross-country Comparison*, OECD, Paris.

⁴ Analysis by the Austrian Private Equity and Venture Capital Organisation (AVCO).

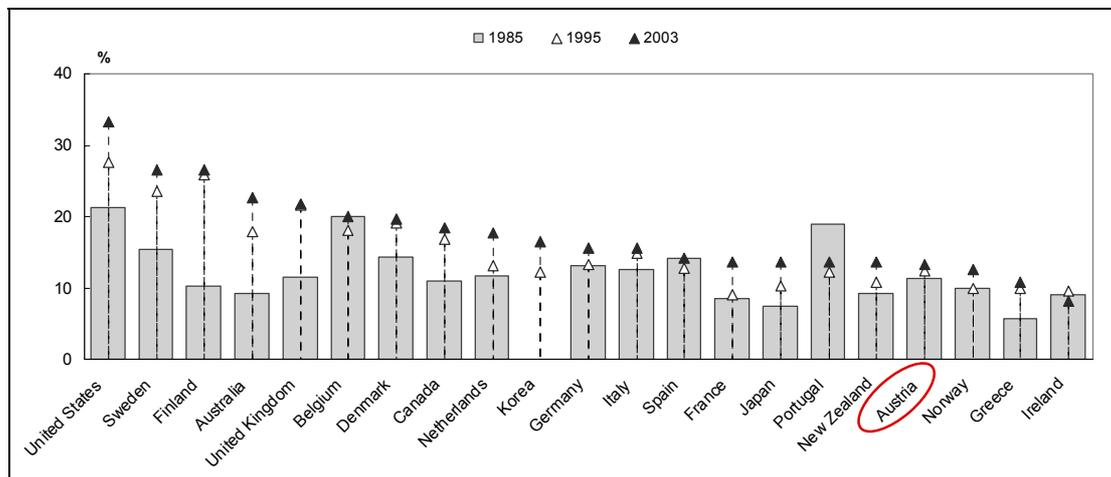
⁵ OECD (2005d), *Aging and Employment Policies Austria*, Paris.

⁶ See <http://www.kmuforschung.ac.at/>

GENERAL ICT DIFFUSION IN AUSTRIA

A high rate of ICT diffusion is necessary to benefit from the network effects associated with these technologies. Investment in ICT as a share of gross fixed capital formation has increased considerably in most European countries. However Austria is an exception with both a low share and low growth, other low growth countries including Belgium and Spain and to a lesser extent Germany, Italy and Norway (see Figure 2). By ICT assets, Austria shows relatively higher growth of software investment since 1995 and a lower investment growth in communication and IT equipment, suggesting a relative shift towards more applications-oriented investment once the basic physical infrastructure is in place.

**Figure 2. Investment in ICT, 1985-2003
percentage of gross fixed capital formation**



Source: OECD (2005), *STI Scoreboard*. ICT equipment is defined here as computer and office equipment and communication equipment; software includes both purchased and own account software. Software investment in Japan is likely underestimated, owing to methodological differences.

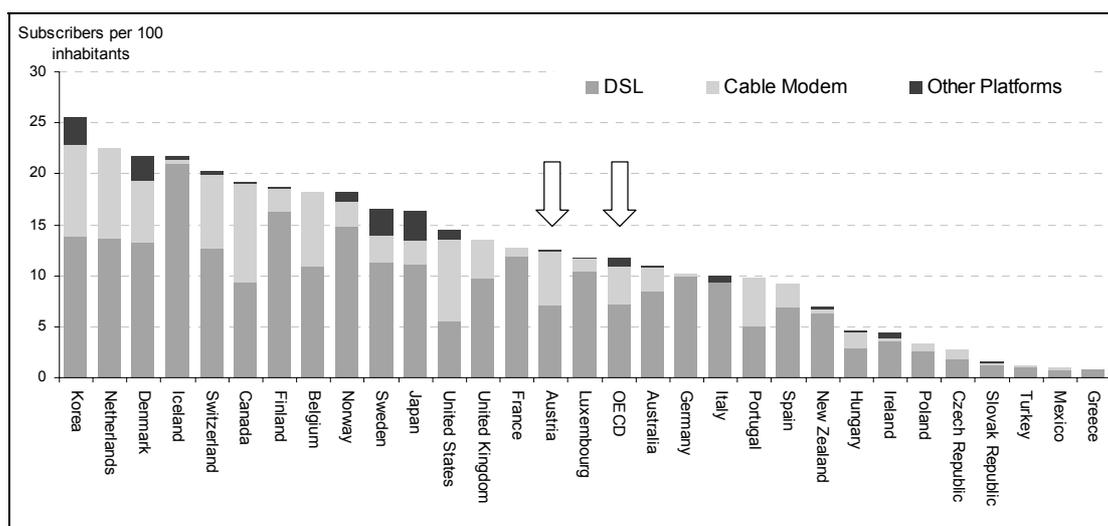
Computer penetration in Austria was below the OECD average in the mid-1990s but it has since moved towards the average. The “e-readiness rankings” published by the *Economist* since 2000 provide a composite indicator of national ability to promote and support digital business and ICT services, and a measure of its relative e-business environment. In 2005 Austria ranked 14th out of 65 countries, after: the Nordic countries; North America; Switzerland; the United Kingdom; Hong Kong, China; Australia; Singapore and Germany. In the category of connectivity it ranked 11, in business environment only 19.

For general ICT indicators, Austria is in the middle range of OECD countries. For example, 44.6% of Austrian households had Internet access in 2004, well behind the European frontrunner Denmark with 69.4% (see Table 2). In terms of broadband subscribers, Austria’s position is just above the OECD average (Figure 3), with relatively high cable penetration. Broadband penetration increased by 3.8% between June 2004 and June 2005, twice the OECD average (1.48%) but only half that of Finland, top of the list with a growth-rate of 7.7%.

**Table 2. Households with access to the Internet
percent of all households**

	2000	2001	2002	2003	2004
Turkey	6.9				7.0
Mexico		6.1	7.4		8.7
Hungary					14.2
Greece			12.2	16.3	16.5
Czech Republic				14.8	19.4
Poland					26.0
Portugal	8.0	18.0	16.0	21.7	26.2
France	11.9	18.1	23.0	31.0	33.6
Spain			17.4	27.5	33.6
Italy	18.8		33.7	32.1	34.1
New Zealand (2001)	37.4				
Ireland	20.4			35.6	39.7
Austria	19.0		33.5	37.4	44.6
Finland	30.0	39.5	44.3	47.4	50.9
Australia	32.0	42.0	46.0	53.0	
Sweden	48.2	53.3			
Canada	40.1	48.7	51.4	54.5	
United States	41.5	50.3		54.6	
Japan			48.8	53.6	55.8
United Kingdom	19.0	40.0	49.7	55.1	55.9
Luxembourg			39.9	45.4	58.6
Netherlands	41.0		58.0	58.9	
Germany	16.4	36.0	46.1	54.1	60.0
Norway				60.5	60.1
Switzerland	36.5	54.7	61.9	64.4	
Denmark	46.0	59.0	55.6	64.2	69.4
Iceland					80.6
Korea	49.8	63.2	70.2	68.8	86.0

Source: OECD, ICT database and Eurostat, Community Survey on ICT usage in households and by individuals, May 2005. Households with at least one member between 16 and 74 years old. Data from the Community Survey covers EU countries plus Iceland, Norway and Turkey, and are for the first quarter of the reference year. For the Czech Republic, data relate to the fourth quarter of the reference year.

Figure 3. Broadband subscribers per 100 inhabitants, by technology, June 2005

Source: OECD Key ICT Indicators, November 2005.

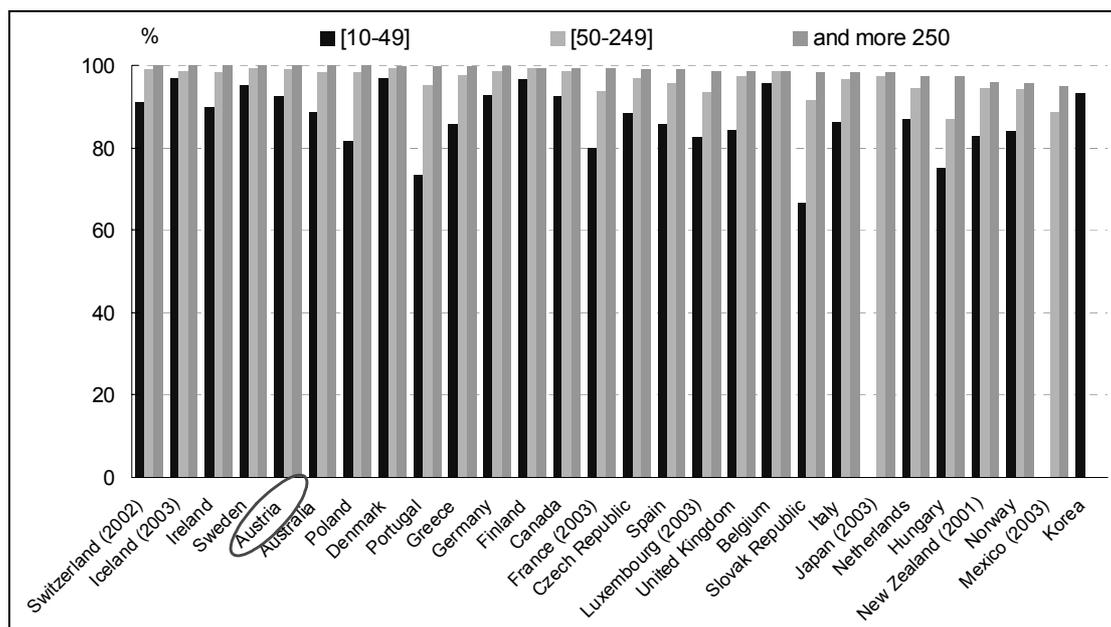
Mobile communications is the most dynamic sector within ICT. Starting from a relatively unfavourable position at the beginning of the 1990s (belated liberalisation, relatively low initial usage, high prices) Austria made considerable progress in the 1990s and leapfrogged some of the former leaders. With 87.6 mobile phone subscriptions per 100 inhabitants in 2003, Austria is above the EU average and can be compared with Nordic countries with high penetration and low services pricing.

ICT DIFFUSION IN AUSTRIAN BUSINESS

Austria has high Internet penetration but slow introduction of e-commerce

Business Internet penetration is relatively high: 100% in large firms in 2004, 99% in SMEs with 50-250 employees, and 92.5% in SMEs with 10-49 employees (Figure 4). However, the share of firms with broadband access was only 55%, placing Austria in middle ranks of OECD countries, along with the Netherlands and Germany. On the other hand a large share of firms (70%) have their own Web site.

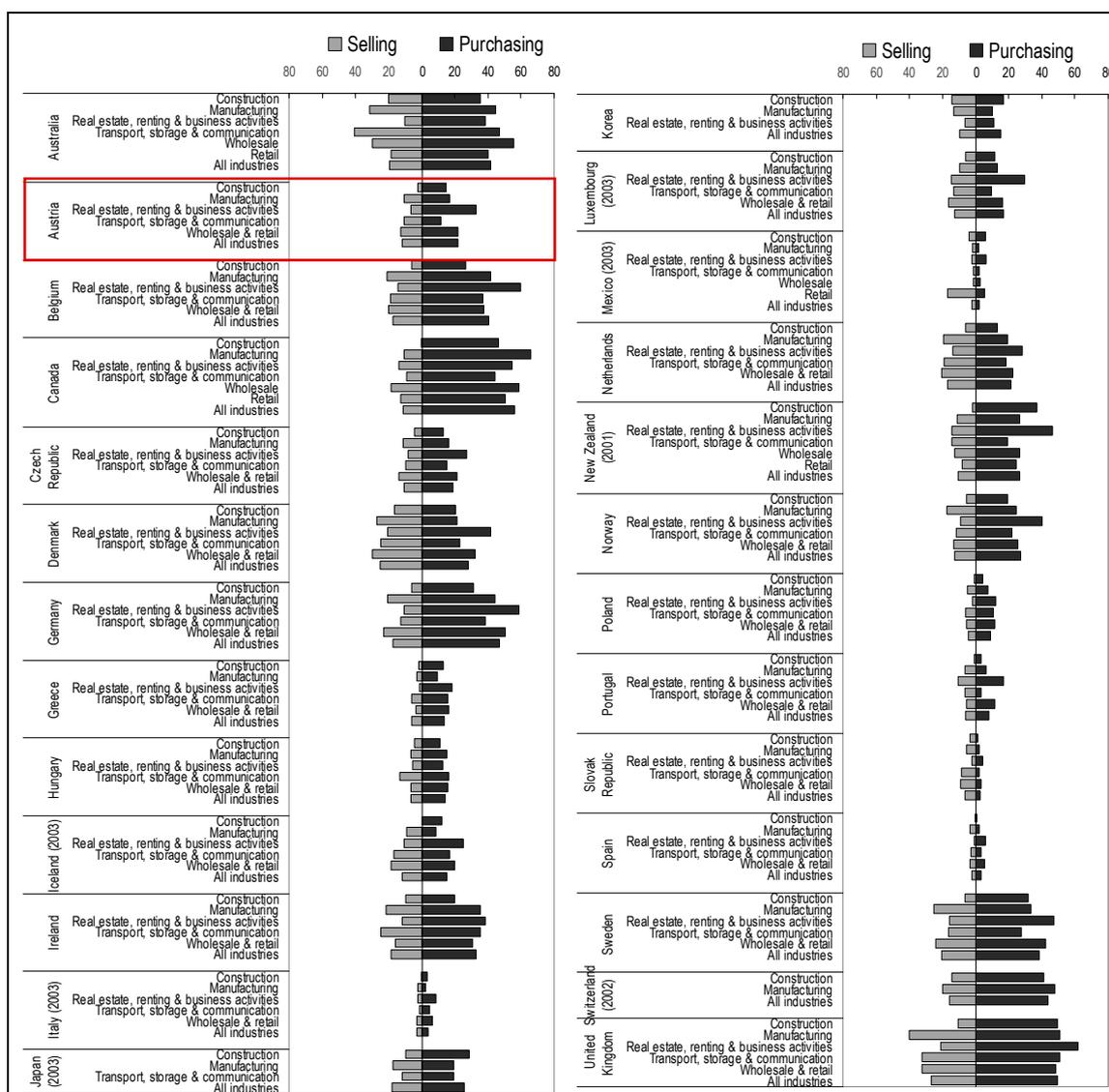
**Figure 4. Internet penetration by size class, 2004 or latest available year
percentage of businesses with ten or more employees using the Internet**



Source: OECD, 2005c.

Despite relatively high Internet penetration, e-commerce is not well-developed (see Figure 5). For both Internet selling and purchasing, Austria is in the OECD middle ranks, close to Norway and the Czech Republic. Austria is well behind Germany where the share of firms active in e-commerce transactions was twice as high, with 47% of companies with more than 10 employees purchasing over the Internet (Austria 22%), and 21% selling over the Internet (Austria 11.6%).

**Figure 5. Internet selling and purchasing by industry, 2004 or latest available year
percentage of businesses with 10 or more employees in each industry group**



Source: OECD, 2005c. The definition of Internet selling and purchasing varies between countries, with some explicitly including orders placed by conventional e-mail (e.g. Australia and Canada) and others explicitly excluding such orders (e.g. Ireland, the United Kingdom and some other European countries). Most countries use the OECD concept of Internet commerce: goods or services are ordered over the Internet but payment and/or delivery may be off line.

Internet banking

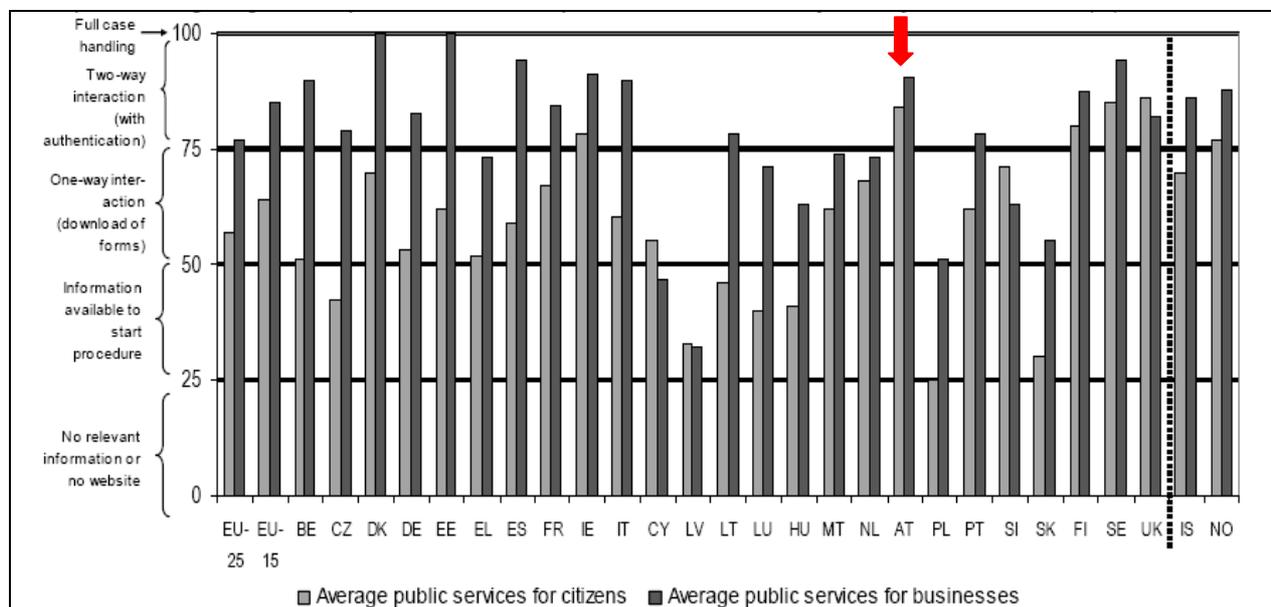
Internet banking is used extensively in Austria: 82% of businesses used the Internet for electronic banking and financial services in January 2005, up from 58% in January 2002. All sizes of businesses use Internet banking – more than 90% of businesses with 50 or more employees, and the share of small businesses (10–29 employees) is also high (80%). Statistics on household use show an increase in the share of Internet users using electronic banking services from 22% in 2002 to 31% in 2003, 35% in 2004 and

40% in 2005.⁷ In general, payment by cheque has been abandoned in Austria. This good performance can to a large extent be explained by early co-ordination between Austrian banks which use electronic banking for inter-bank transfers.

E-government

E-government is increasingly important as a driver of business ICT applications as well as improving efficiency of government services. Three quarters of Austrian businesses use e-government, 91% of these for downloading forms, and 75% for obtaining information from public Web sites (2004-05 European e-commerce survey). Austrian e-government services have high interactivity and are relatively advanced compared with other European countries (approximately fifth in terms of services to business, see Figure 6 and interview discussions). For example, income, corporate and local and municipal tax run entirely over the Internet, based on a well-coordinated approach among independent Federal and local administrations.

Figure 6. Average sophistication of basic on-line public services, by country, October 2004 (%)



Source: Reis, F. (2005), Eurostat.

A successful innovation in e-government and one of the major administrative reforms at Federal level is the electronic file (ELAK – *elektronischer Akt*) replacing the paper file in all Austrian ministries from 2005. ELAK has 7 500 users, with the objective to cover 17 000 users in the entire Federal administration. This reform has been managed by a consortium of the *Bundesrechenzentrum* (a service provider for public IT applications created in 1997) and its affiliate BIT-S GmbH, in close co-operation with all federal ministries, together with private IT and software suppliers. Other basic infrastructure such as the central residence register has also been introduced.

⁷

According to the European survey of the usage of ICT in households, conducted in Austria in February and March 2005, 55% of all 16-74 year olds living in Austrian households had used the Internet during the 3 months preceding the survey for private or professional use or for education and training, either at home or elsewhere (2004: 52%, 2003: 41%, 2002: 37%).

In March 2004 the E-Government Act (Federal Act on Provisions Facilitating Electronic Communications with Public Bodies) entered into force, setting the framework for electronic interaction between administration and citizens, notably through extended use of electronic identification conforming to the Austrian citizen card concept (e.g. bank cards, the e-card, mobile phone signature, etc.) (see below).⁸

Telecommunications market

Austria's telecommunications market has been progressively liberalised since the early-1990s and is now completely open to competition. Telekom Austria, the incumbent fixed-line and mobile operator 30%-controlled by a state holding company, retains a significant share of most Austrian markets, 73% of long distance calls in 2003, and 43% of mobile communications in 2004, approximately the European average (Eurostat). The telecommunications market has shown continuing growth in general and rapid growth in the mobile market, with close to 100% penetration and 57% of total sales in 2004, leaving the fixed voice telephony market with 33% of total sales. Broadband has shown the highest growth rates with 50% revenue growth in 2003 and 29% in 2004.

Table 3. Telecommunications revenues, 2002-2003

	Revenues (EUR million)			Change (%)		Share of sales (%)		
	2002	2003	2004	2002-03	2003-04	2002	2003	2004
Fixed-link voice telephony	1 683	1 627	1 564	-3.3	-3.9	40.7	36.8	33.2
Mobile communications	2 140	2 404	2 688	12.3	11.8	51.8	54.3	57.1
Broadband	186	279	361	50.0	29.4	4.5	6.3	7.7
Leased lines	124	117	92	-5.6	-21.4	3.0	2.6	2.0
Total	4 133	4 427	4 705	7.1	6.3	100	100	100

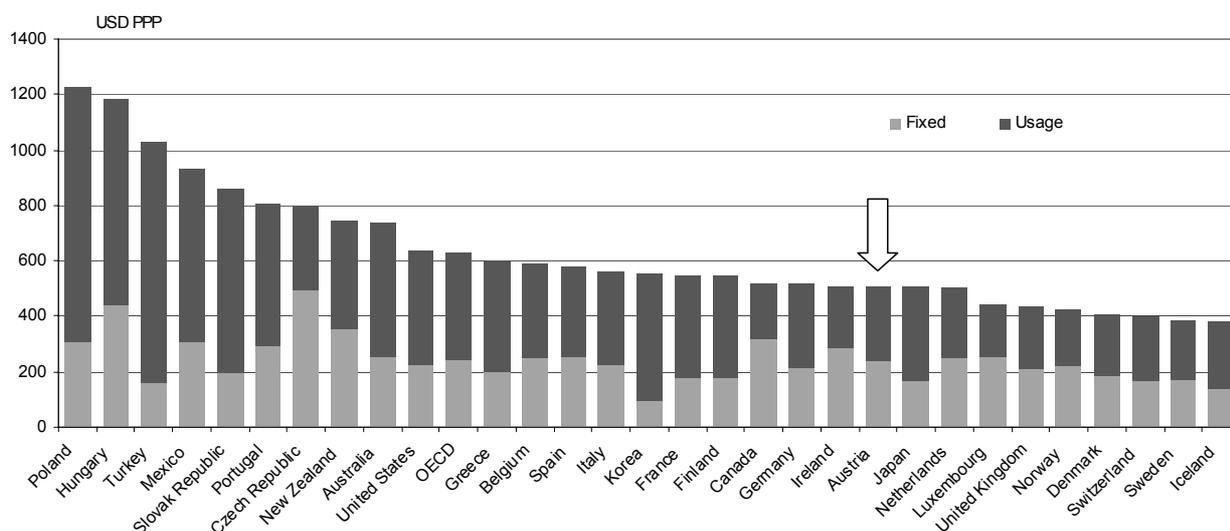
Source: Rundfunk und Telekom Regulierungs-GmbH.

Liberalisation has had a considerable impact on competition and tariffs. There are over 40 operators in the fixed voice market, 8 GSM providers and 5 UMTS providers in the mobile voice market, more than 30 operators in the leased line market and several operators, most of them in highly populated areas, in broadband. The residential Austrian market is particularly competitive, with tariffs below the OECD average (Figure 8), and business telephone charges are close to the OECD average (Figure 9). The 2003 Telecommunications Act, which brought Austria's electronic communications regulatory apparatus in line with European Union standards, is now being brought to bear on the telecommunications market.⁹

⁸ Bundesgesetz über Regelungen zur Erleichterung des elektronischen Verkehrs mit öffentlichen Stellen, *E-Government-Gesetz* – E-GovG.

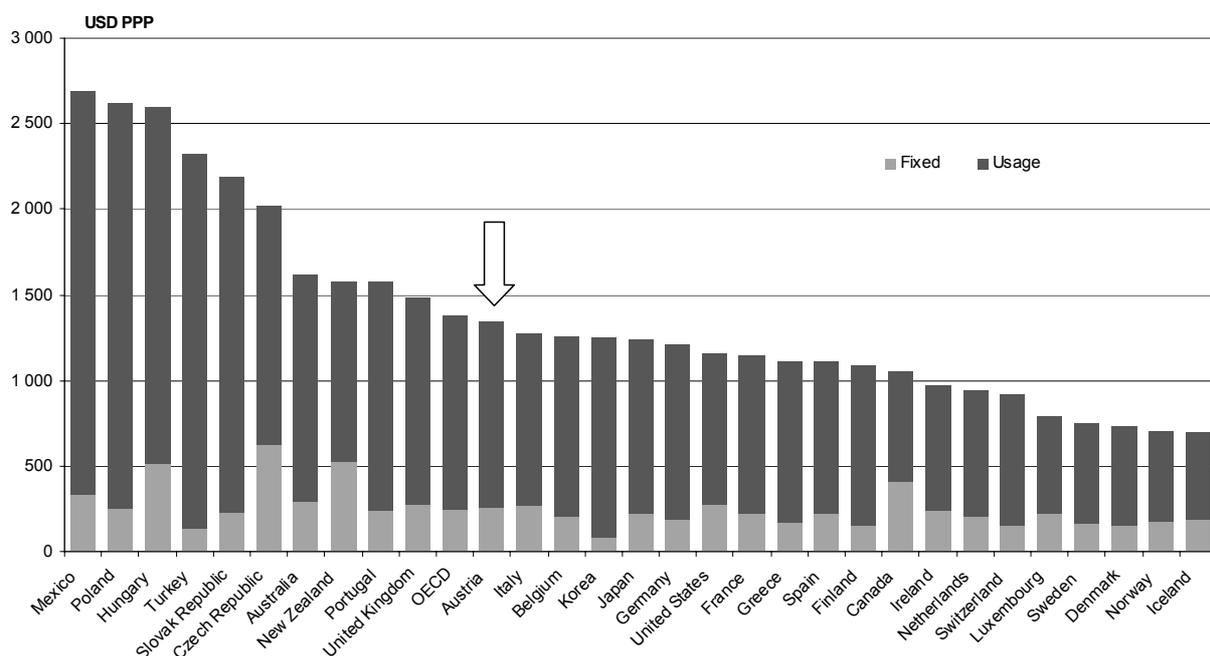
⁹ The national regulatory authorities, headed by *Rundfunk und Telekom Regulierungs-GmbH* (RTR-GmbH), is currently reviewing 18 key electronic communications markets to determine which companies have significant market power in each market. Once this review is completed and endorsed by the European Commission, the regulator will be in a better position to act in favour of new entrants.

Figure 7. OECD composite basket of residential telephone charges, August 2004



Source: OECD (2005b).

Figure 8. OECD composite basket of business telephone charges, August 2004



Source: OECD (2005b).

ICT-related business R&D

The Austrian business enterprise sector spent more than EUR 3.1 billion on intramural R&D in 2002, 66.8% of Austria's gross domestic R&D expenditure, and the share of total R&D performed in the business sector was around the OECD and EU15 averages, with the government sector also being a relatively large performer of R&D. 65% of business enterprise expenditures were financed by the business sector's own funds and 30% were from abroad (a relatively high share), mostly from within the same enterprise group. Government financing of business R&D was around 5% of the total, below the EU15 and OECD shares of around 7-8%. The manufacturing sector accounts for 73% of business R&D expenditures, 26% are in the service sector. Some 26 728 full time equivalent (FTE) employees were employed in business R&D.

Austrian ICT-related business R&D expenditures were EUR 914.3 million in 2002, equivalent to 29% of business R&D and 0.41% of GDP. This was mainly in communications equipment and to a lesser extent in software services (Table 4 gives a sector breakdown of ICT R&D). R&D data were formerly collected every four years but this has been increased to a bi-annual survey since 2002. However Austrian ICT-related R&D expenditures have not been integrated in recent OECD comparisons due to the low number of participating firms in some sectors of the NACE classification.

Table 4. R&D in ICT in Austria, 2002

NACE classification		Units with R&D	R&D expenditure (EUR 000s)	R&D employment (FTE)
30	Manufacture of office machinery and computers	10	6 678	114.0
31.3	Manufacture of insulated wire and cable	4	972	13.7
32	Manufacture of radio, television and communication equipment and apparatus	47	703 788	5 357.2
33.2+33.3	Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, except industrial process control equipment; Manufacture of industrial process control equipment	57	54 644	624.9
51.84+51.86	Wholesale of computers, computer peripheral equipment and software; Wholesale of other electronic parts and equipment	6	2 336	15.0
64.2	Telecommunications	5	41 691	281.3
71.33	Renting of office machinery and equipment, including computers	-	-	-
72	Computer and related activities	187	104 203	1 355.8
	Total	316	914 312	7 761.9

Source: Messmann, K. *et al.* (2005), Statistik Austria.

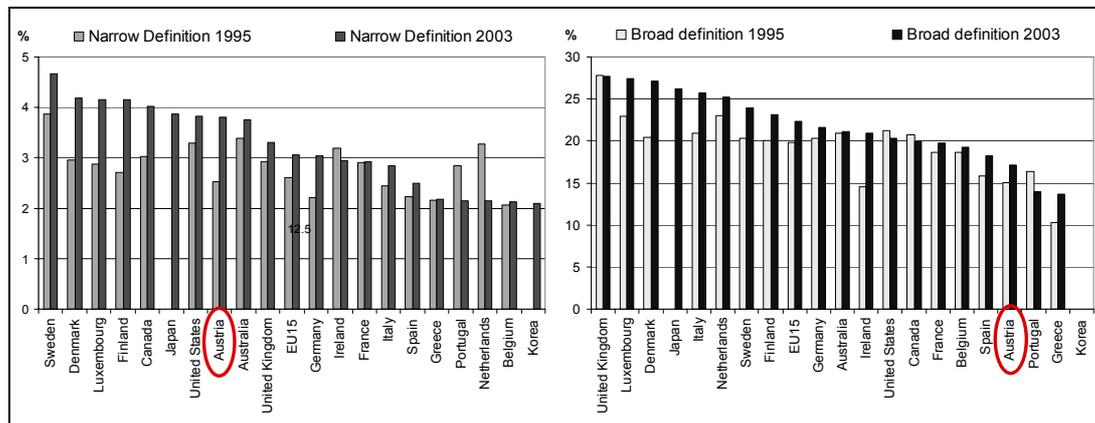
ICT-related occupations

ICT-related occupations are of two general kinds: ICT advanced and generic specialists (*e.g.* programmers, software developers but also cable layers) and a broad group of ICT users comprising ICT users in general and the advanced and generic ICT specialists. Detailed occupational data are organised on the basis of these two definitions, using the European Labour Force survey and detailed national sources for other countries (see *OECD Information Technology Outlook 2004*).¹⁰

¹⁰ See van Welsum, D. and G. Vickery (2004), *New perspectives on ICT skills and employment*, Information Economy Working Paper DSTI/ICCP/IE(2004)10/FINAL, OECD.

Figure 9 shows that in terms of the share of ICT specialists, Austria has caught up from a weak position in 1995, (see *OECD Information Technology Outlook 2004*) as did Denmark, Luxembourg, Finland and Canada. On the other hand, due to industry structure, the share of ICT users (basic users of generic ICT tools plus ICT specialists) is relatively low.

Figure 9. Share of ICT-related occupations in the total economy in selected countries, 1995 and 2003
Narrow and broad definition



Source: OECD (2005c).

Overall Austria has shown an improved performance in various measures of ICT diffusion and use following a weak start. There is high business Internet use, e-readiness indicators are in the middle range and moving up, e-banking is widespread and e-government has advanced features, and mobile penetration is very high. The overall strongly pro-competitive regulatory framework and the rapid increase in business R&D including ICT R&D provide a good basis for further growth, despite weaknesses in the structure of total knowledge investments, which still reflect the earlier equipment-intensive growth paradigm.

CO-ORDINATION OF ICT POLICY

The Austrian federal system of government has a direct impact on the number of actors involved in policy coordination in general and ICT policy co-ordination in particular. The *Länder* exercise legislative and executive powers as sub-national units, they enjoy relatively broad spending power without being restricted by the general allocation of competences, and federal legislation is executed and enforced at *Länder* level leading to a large number of actors involved at different levels. There are very few legally binding obligations for co-operation between the Federal government and *Länder* in the field of ICT policy. At federal level, because of the horizontal distribution of ICT activities and competences a large number of ministries are also involved. The allocation of competences is determined by the *Bundesministeriengesetz* (law covering federal inter-ministerial distribution of competences and co-ordination) and the leading Minister can set up advisory boards that can be important in preparing legislation or implementing projects (e.g. the Advisory Board for the Information Society below).

The Federal Chancellery co-ordinates overall horizontal information society issues in co-operation with relevant ministries. The Advisory Board for the Information Society ("*Beirat für Informationsgesellschaft*", BIG) is composed of stakeholders in information society-related fields to exchange information and experience in new ICTs among representatives of Federal ministries, chambers of commerce and labour, consumer organisations, Internet service providers, R&D funding institutions, the regulatory authorities for broadcasting and telecommunications, industry representatives, etc. This forum meets every three months and besides discussion of legal issues and emerging challenges, is important in passing on information about EU-level actions to be implemented in Austria.

Specifically for e-government and ICT in public administrations there is a Chief Information Officer consulting the federal government for strategic and technical matters, heading the "Digital Austria" platform (founded by the Federal Chancellor, and including the ICT board comprised of the CIOs of federal ministries), linking up *Länder* e-government activities, and representing e-government at European level. The ICT strategy group (IKT-Bund) of the Federal Chancellery co-ordinates legal and organisational e-government matters, the federal technical infrastructure, ICT project and programme management, and ICT budget. The e-government innovation centre (EGIZ) investigates innovative e-government solutions.

The strategic direction for ICT policy has received ongoing attention, and the co-ordination, implementation and provision of e-government services is an example of successful ICT policy delivery. But co-ordination is a complex and challenging task in a federal government structure and does not necessarily lead to a centralised approach to ICT policy and its direction or form. Even in the area of e-government the *Länder* and local governments are responsible for implementation and provision, as they are in ICT policy areas such as infrastructure, and diffusion to business and households. There are arguments in favour of an overarching ICT strategy, and arguments that such attempts have a low probability of success. Major ICT policy issues arise within local contexts or implicitly in many cases due to Austria's federal structure and the importance of the European framework for ICT policy, but rarely do they pass through a formal strategic planning process.¹¹

The European Union also plays an important role in the definition of strategic goals. Member states develop their ICT strategies but have to take into account their commitments at European level, including the strategic aims defined at the Council of Feira (2002) and Lisbon (2000), and the eEurope 2005 Action Plan (running until the end of 2005). These programmes provided the overall framework for the activities in information society policy in Austria.

In terms of the recent evolution of Austrian ICT policy, in 1994 information society issues were on the political agenda after the European "Bangeman Report" and in preparation for EU membership. End-1996, a Federal government information society report was published, drawing on working groups involving 300-400 participants. In 1998 the Federal Chancellery set up the Advisory Board for Internet and New Media. Subsequently there have been a number of initiatives but the multitude of actors at different levels of government has reduced high-level co-ordination. Co-ordination functions mainly at operational level for specific initiatives such as e-government or eFit (the ICT-oriented education and training initiative). Recent developments include:

- In 2001 major actors at political and ministerial level, including the Austrian Council for Research and Technology Development, explicitly requested inter-ministerial co-ordination. Following reflections at the highest political level, an inter-ministerial working group (the ICT board) was formally established by the Federal Government and began its work in August 2001. The board, now part of the Digital Austria platform, is responsible for co-ordinating horizontal e-

¹¹ Ohler, F, *et al.*, *Governance in Austrian Information Society Policy*, Vienna, March 2004. Report for the Austrian Council for Research and Technology Development.

government activities at federal level and is headed by the Federal Government's Chief Information Officer and comprises the CIOs of Federal Ministries.

- In May 2003 the e-government initiative was initiated by the Federal Chancellor, and the E-government platform created to set out general objectives. With close co-operation between the Federal government, *Länder*, municipalities, cities and business an e-Government Roadmap was adopted which included infrastructure expansion, in particular broadband network connections. The "Digital Austria" platform, headed by the Chief Information Officer, is now responsible for e-government strategic decision-making, monitoring communication and co-ordination.
- In 2003 the Advisory Board for the Information Society (BIG) of the Federal Chancellery succeeded that on Internet and New Media (1998), to take into account the broader ICT agenda. In May 2005 a report on the information society in Austria was published containing an overview of relevant activities. A sub-group of the BIG is developing "eAustria 2010" strategic aims and will propose an action plan for Austrian ICT-policy for the next five years. (This follows the EC "i2010" initiative).
- An industry broadband working group of the main ICT firms ("ARGE Breitband") has requested a national strategy, and has published a brochure indicating priority fields of activity.
- The national broadband strategy was published beginning 2004, to foster broadband roll-out and boost use by administrations, enterprises and citizens. A substantial component is a subsidy scheme of the Federal Ministry for Transport, Innovation and Technology (BMVIT) in co-operation with the *Länder* (see Infrastructure section below), and there is a Special Directive "Broadband Initiative 2003" to make the use of broadband technology available in areas so far not covered.
- In May 2005 the communications regulatory body (RTR, in its think-tank function) was requested by the Vice Chancellor and Federal Minister of Transport, Innovation and Technology to prepare a white paper on ICT-related strategy. The Austrian ICT- Masterplan was presented in November 2005 proposing 44 action lines. These focus mainly on infrastructure measures, but also deal with general issues including education and the electronic health-file. The next stage is to discuss implementation.

Table 5. Main policy makers in the ICT field

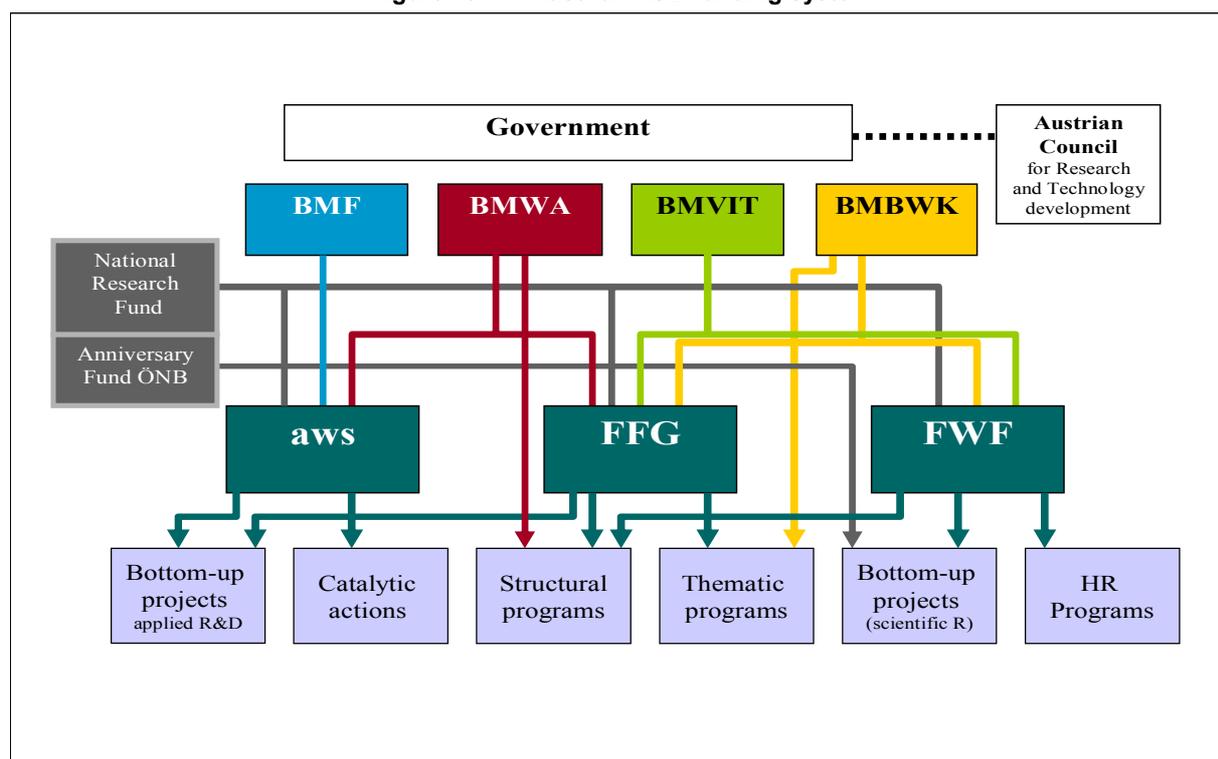
Policy actor	Field of activity
Co-ordinating and supporting institutions	
Chief Information Officer	<ul style="list-style-type: none"> strategy and co-ordination
Strategic Platform Digital Austria	<ul style="list-style-type: none"> responsible for high level co-ordination
IKT-Bund	<ul style="list-style-type: none"> responsible for e-government at operational level in Federal ministries
Kooperation-BLSG	<ul style="list-style-type: none"> responsible for e-government at operational level on <i>Länder</i> and local level
E-Government Innovation Centre (EGIZ)	<ul style="list-style-type: none"> technical specifications and innovative solutions
Ministries	
BKA: Federal Chancellery: co-ordinates overall horizontal information society issues in co-operation with relevant ministries	<ul style="list-style-type: none"> E-security e-government co-ordination of horizontal e-government activities data protection development of strategies and specifications
BMWA: Federal Ministry of Economics and Labour	<ul style="list-style-type: none"> ICT innovations e-Business e-Content
BMVIT: Federal Ministry of Transport, Innovation and Technology	<ul style="list-style-type: none"> ICT innovations ICT related R&D ICT infrastructure Broadband use
BMBWK: Federal Ministry of Education, Science and Culture	<ul style="list-style-type: none"> E-Learning IT for schools, polytechnics and universities
BMF: Federal Ministry of Finance	<ul style="list-style-type: none"> electronic documents and payment, e.g. taxes
BMJ: Federal Ministry of Justice	<ul style="list-style-type: none"> legislation concerning e-commerce, e-security
BMSG: Federal Ministry of Social Security, Generations and Consumer Protection	<ul style="list-style-type: none"> consumer protection in e-commerce development of IT-applications for relevant areas
BMGF: Federal Ministry of Health and Women	<ul style="list-style-type: none"> health telematics
Other important institutions	
Austrian Council for Research and Technology Development	Advisory council to Federal government, ministers and <i>Länder</i> in all matters related to research, technology and innovation policy
RTR: Austrian Regulatory Authority for Broadcasting and Telecommunications	Management of and support for legal procedures, preparation of formal decisions (data collection, analysis, expertises, drafting of decisions), legal authority for specific questions, think-tank
Telecom-Control Commission	Regulation of telecommunications industry; among others responsible for the development of the electronic signature
Nine federal states (<i>Länder</i>) and local governments (<i>Gemeinden</i>).	Provide IT infrastructure for local or state schools; e-government applications; promote diffusion to firms and households
Austrian Federal Economic Chamber (WKÖ), 9 regional chambers and 110 trade associations	Information platform, Telefit Roadshow, training
Main Association of Austrian Social Security Institutions (HV), Social Security Agencies	Introduction of the e-card
FWF: Austrian Fund for Scientific Research	Funds basic research
FFG: Austrian Research Promotion Agency	Funds applied research and technology development, manages science-industry co-operation programmes including competence centre programmes
aws: Austria <i>Wirtschaftsservice Gesellschaft mbH</i>	Company operating for Federal government. Business grants, loans and advice; supports technologies, innovations and start-ups
BAK: Austrian Federal Chamber of Labour	Background reporting, social partnership
AMS: Public Employment Service	Training provision
STUZZA: institute for co-operation in payment transactions (<i>Studiengesellschaft für Zusammenarbeit im Zahlungsverkehr</i>)	Since 1991, co-operation platform of Austrian banks, development of standards, cost reduction and quality assurance
Regional Development Agencies in the nine <i>Länder</i>	Promote regional/provincial economic development; foster R&D and innovation including ICT; co-ordinate cluster and networking in microelectronics, mechatronics, ICT creative industries

Table 5 lists the main actors in the ICT policy area. ICT issues are distributed to many different ministries, most of them active in fields that can impact others. In addition, the communications regulatory body, chambers of commerce and labour, the nine *Länder*, social security bodies and funding institutions for research and innovation play important roles in determining and executing ICT-related policy. ICT diffusion and use initiatives are undertaken in their field of competence by all of the ministries (see below).

Given the comparatively large number of institutional actors involved in ICT diffusion and use in a small country, a paradoxical situation has developed. While many urge an overarching national strategy, most initiatives exhibit successful co-ordination at the operational level, as can be illustrated by the e-government initiative or the introduction of the e-card (see below).

Overlapping responsibilities of different ministries and national bodies are particularly apparent in funding R&D, where, although funding agency responsibilities have been recently rationalised, the three thematic ministries, the Ministry of Finance and three funding agencies are involved either directly or via the funding agencies. Figure 10 shows the R&D funding system in simplified form, omitting funding of research organisations. It illustrates that a firm engaged in ICT-related applied R&D activities may get: *i)* “bottom-up” funding from the Austrian Research Promotion Agency (FFG); *ii)* thematic “top-down” funding from the FFG; *iii)* “structural” funding via a competence centre funded by the BMWA directly or from the BMVIT via the FFG; *iv)* start-up support from aws.

Figure 10. Austrian R&D funding system



BMF	Federal Ministry of Finance
BMWA	Federal Ministry of Economics and Labour
BMVIT	Federal Ministry of Transport, Innovation and Technology
BMBWK	Federal Ministry of Education, Science and Culture
aws	Austrian Economy Service Society
FFG	Austrian Research Promotion Agency
FWF	Austrian Fund for Scientific Research
ÖNB	Austrian National Bank

Source: Technopolis Austria.

Inter-institutional information exchange takes place formally (inter-ministerial committee), or more informally as policy makers are aware of activities in other institutions due to the small size of the country. However, there is no co-ordination mechanism that assures the identification of bottlenecks, missing links or gaps between ongoing initiatives, although with formation of the BIG in 2005 and planned initiatives this may improve. Strategy formulation was undertaken as information society issues were developing from the mid-1990s until around 2000, but subsequently faded.

SPECIFIC INITIATIVES TO ENHANCE ICT DIFFUSION

This section analyses the main initiatives which directly and indirectly affect ICT diffusion and its impacts on business performance. The main focus of initiatives is summarised in Table 8 at the end of this section.

Infrastructure

Universal infrastructure coverage is a continuing challenge because of low population density in rural areas. In highly populated areas multiple broadband platforms are available in most cases, but some rural areas are not covered. According to the Austrian Regulatory Authority (RTR) about a third of 17 245 settlement points with a total population of around 1 million were not covered for broadband in late 2003. This problem has been addressed by the Austrian broadband platform (*ARGE Breitband*), placing rural areas on top of their list of priorities.

To improve broadband coverage, a first broadband programme was launched in May 2003 in the framework of the Austrian e-government initiative, and a special directive “Broadband Initiative” in 2004 provided Federal funding of EUR 10 million for broadband infrastructure. On the initiative of the regions and with similar regional funding, this can be used to fund up to 20% of investment costs in new broadband infrastructure. Another EUR 10 million of Federal funding was provided in 2005 to extend the subsidy scheme until 2007 and coverage is expected to increase to close to total. A tax incentive scheme was introduced in 2003 to enhance individual access via new broadband Internet connections.

The Federal Chancellery has a WLAN initiative in conjunction with e-government. Together with private hot-spot providers, all e-government services with the domain name “gv.at” are offered free since March 2003.

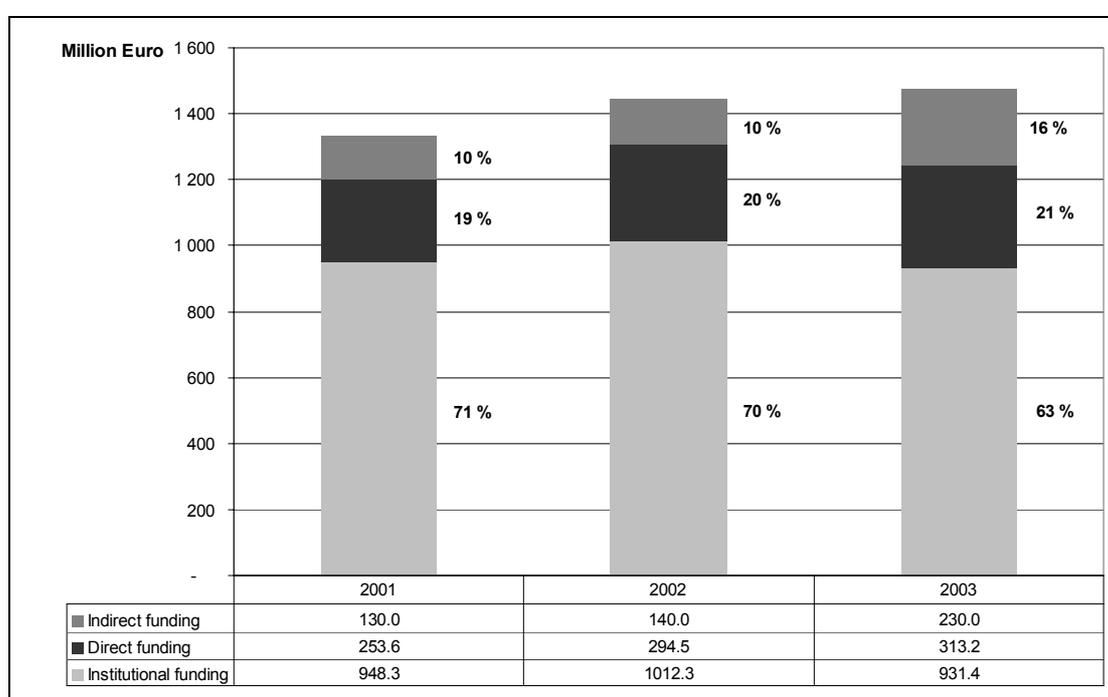
R&D support

R&D and innovation have traditionally received government support due to market failures and underinvestment in activities with large externalities, and Austria has put considerable effort into measures to support R&D. Austrian R&D support has focused on: *a) basic funding* to institutions such as research centres or universities, with the government research sector being a relatively large R&D performer in Austria and the higher education sector relatively less important, *b) direct project funding* to research institutions and firms, or *c) indirect funding* through R&D tax incentives. There have been increases in direct and indirect business funding over the last few years as support has increasingly focused on near-to-market, innovation and commercialisation while the share of public institutional funding to longer-term and more basic R&D has diminished (see Figure 11).

Data for 2003 also show the increase in indirect funding due to tax reform that increased the R&D allowance for income tax exemption from 18% to 25%, widened the definition of eligible R&D activities from the traditional view based on patent-law to international standards of the Frascati manual, and introduced a new 35% incremental allowance on increases in R&D expenditure over a 3 year moving average. Overall, Austrian R&D tax treatment is positive and relatively generous (more generous than the United States, less than Norway, Korea and Canada), although the value to business has been reduced by the recent reduction in corporate tax rates (OECD, 2005c).

Increased R&D tax allowances and the widening of the definition of eligible R&D activities has probably had a positive effect on ICT-related R&D, however sector-specific tax expenditure data are not available. Neither are there comprehensive sector-specific data for institutional funding, as funded institutions generally cover a range of different R&D areas.

Figure 11. Overview of the Austrian government R&D funding portfolio, 2001-2003

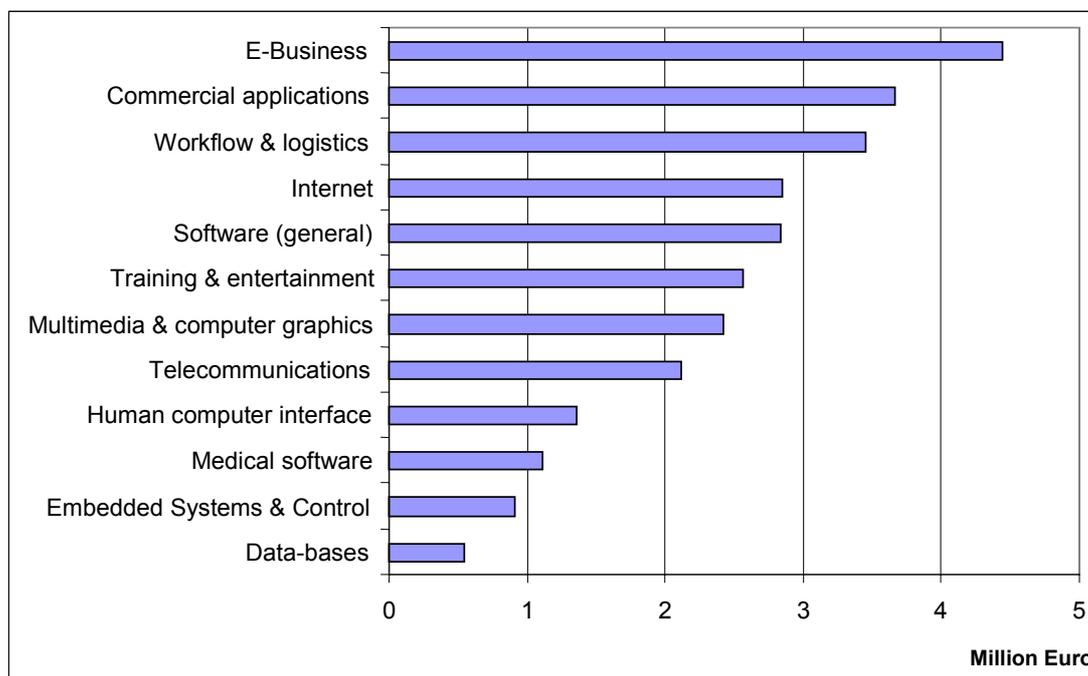


Source: Schibany, A. and L. Jörg (2005).

The following sections provide further detail on direct project funding instruments for ICT-related R&D. This support goes through three major channels: *a)* bottom-up funding, *b)* top-down ICT-focused thematic programmes, and *c)* structural programmes.

Bottom-up funding

The first and quantitatively most important instrument to promote investigator-driven industrial R&D projects is bottom-up funding of the FFG (see Figure 10 and Figure 12). This invests in innovative projects in all R&D areas, project merit being the only criterion for selection. Firms are supported via grants, soft loans, interest subsidies on bank loans, and loan guarantees. Total ICT R&D funding in 2004 was EUR 76 million, with ICT projects receiving about 31% of FFG funding. For ICT-related projects, e-business and commercial applications are the most important, followed by workflow and logistics.

Figure 12. Bottom-up funded ICT related R&D projects, 2003-2004

Source: FFG.

Bridge is a programme umbrella to tackle the perceived gap between basic research and applied research and development. It has two interdependent parts: *i*) the “Crossing Bridge Program” (“*Brückenschlagprogramm*”) under the responsibility of the FFG aimed at private industry; and *ii*) “Transnational Research” under the responsibility of FWF aimed at the public research sector. These programmes address researchers and businesses independently of thematic orientation or industry. A first call was organised in Spring 2005 and a second in September 2005. The first call received 87 project applications, with 37 funded for a total of EUR 4.97 million. According to the FFG six of these projects (with a funding volume of EUR 467 000) were in the ICT sector.

Top-down programmes

The most important technology-based top-down thematic programme is **FIT-IT** of the Federal Ministry of Transport, Innovation and Technology (BMVIT), managed by the FFG together with a private consultancy firm. FIT-IT (Research, Innovation, Technology-Information Technology) is the specific top-down programme for co-operative ICT research, aiming to promote radical innovations in specified areas. The pilot phase started in 2001 and the programme is at the interface between long-term research and shorter term industrial R&D. Three priority areas are: *i*) embedded systems, *ii*) semantic systems, and *iii*) systems on chip. In the first three calls, 14 out of 41 proposals received EUR 8.4 million funding with EUR 1.2 million on accompanying measures and PhD studies. Average project size (EUR 0.4 million) is higher than average FFG projects (EUR 146 000) or FWF projects (EUR 197 000).

An R&D funding programme for ITS and transport telematics, “**I2-Intelligent Infrastructure**”, was launched in 2002 by the BMVIT. The programme is designed for the industrial and service sectors, research institutes and universities. After calls for tender in 2003 and 2004, 61 projects have been funded.

The Austrian Federal Ministry of Economics and Labour has also launched a top-down programme under the title “**Digital Economy/ICT**” (2004-06) which follows a first initiative “Innovation using e-business” (2001-03). The overall 2004-06 budget is EUR 10 million, of which 57% are dedicated to “ICT suppliers”, 40% to “ICT users” and 3% to horizontal activities.

Protec2002+ is a technology transfer programme initiated by the Ministry of Economics and Labour running from 2002-06. One focus is to increase the integration of ICT and e-business technology into SME business processes, and improve the innovative output of firms. However, Protec2002+ is open to all sectors and all technological fields. It has three programme lines:

- Protec-TRANS to foster technology transfer between university institutes and research organisations and SMEs by enhancing the use of external resources by SMEs.
- Protec-INNO to foster the development and diffusion of new innovation management instruments and consulting techniques in SMEs.
- Protec-NETplus to establish innovation co-operations and networks between SMEs.

Structural programmes

Structural programmes are the third layer of R&D support, largely funding competence centres (for an overview of these centres see OECD, 2004c). Competence centres funded under the title “K-plus” by the BMVIT focus on cooperative research aimed at academic excellence and industrial need (the CTR and LCM centres are production oriented but with strong ICT impacts). Industrial competence centres “K-ind” and “K-net” funded by the BMWA are more business oriented although they also have both academic and industrial partners. ICT-related centres make up a large share of the total, although there was no *a priori* orientation towards ICT when the centres were being set up. Seven out of 18 K-plus centres and 6 out of 23 industrial K-ind and K-net centres are ICT-related. All K-programmes are managed by the FFG. Table 6 provides an overview.

Table 6. ICT competence centres

K_{plus}	
Advanced Computer Vision (ACV)	Vienna
Carinthian Tech Research (CTR)	Villach
<i>Forschungszentrum Telekommunikation Vienna (FTW)</i>	Vienna
Knowledge Management Center (KNOW)	Graz
Linz Center of Competence in Mechatronics (LCM)	Linz
Software Competence Center Hagenberg (SCCH)	Hagenberg
<i>Zentrum für Virtual Reality und Visualisierung (VRVis)</i>	Vienna
K_{ind}	
Salzburg New Media Lab	Salzburg
EC3 (Electronic Commerce Competence Centre)	Vienna
Evolaris	Graz
<i>Industrielles Kompetenzzentrum für Mechatronik und Automation</i>	Linz
Health Information Technologies Tyrol	Innsbruck
Austrian Network for e-Tourism	Salzburg, Innsbruck, Krems

Christian Doppler Laboratories (CD laboratories) are organised at universities as public-private partnerships between industry (private corporations) and university institutes. Researchers conduct research in areas determined by the industry partner. Currently, three out of 37 CD laboratories specialise in ICT and two further labs are engaged in areas with a significant ICT relevance.

Skills and diffusion

Education and skill formation have also traditionally received extensive government support due to potential underinvestment in activities with large social benefits. Austria has put considerable effort into raising ICT skills and spreading them more widely across the population.

Diffusion of ICT in education and research

eFit is an initiative of the Ministry of Education, Science and Culture (BMBWK) and aims at the diffusion of ICT in education and research. The initiative has four strands:

- eEducation aims at the integration of new media in the education system. An important aspect of eEducation is the ECDL (European Computer Driving License).
- eScience supports use of ICT in tertiary education
- eTraining aims at enhancing the use of ICT in lifelong learning
- eCulture supports ICT in culture and use of ICT for the preservation of Austrian cultural heritage
- eAdministration aims at facilitating the administration of education using ICT.

ICT-oriented education and training

The availability of ICT skills at various levels is a major factor for the success of ICT use. A recent study of the Austrian Council for Research and Technology Development identified a considerable number of education and training courses and categories with a focus on ICT (Table 7).¹² The relative share of students in each kind of ICT-related education and training of each type is shown in Figure 13.

Table 7. ICT education and training courses

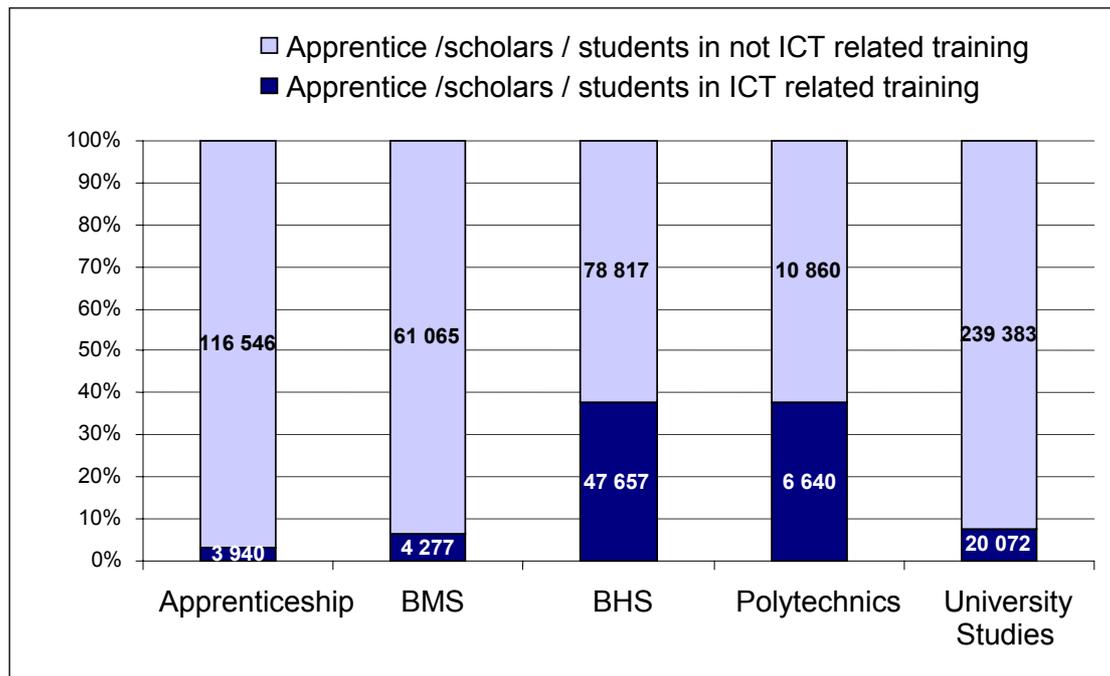
	ISCED-97 level	Cumulative duration at ISCED 5
16 university curricula (out of a total of 191)	5A	long
38 university studies (master programs etc),	5A	long
48 polytechnic curricula (out of a total of 124)	5A	medium
130 secondary technical and vocational colleges (BHS) (out of a total of 345)	3A	
47 secondary technical and vocational schools (BMS) (out of a total 718)	3B	
12 apprenticeships (out of a total of 260)	3B	

Source: Schneider, H. W. et al. (2004).

The distribution of students and trainees within particular streams of study is similar to the distribution of institutions and courses. The number of students undertaking ICT-related training is particularly high in vocational training institutions, notably secondary technical and vocational colleges (BHS, ISCED level 3A) which offer applied training, and in university courses (ISCED level 5A) which between them provide a strong basic and advanced ICT-skills base for current and future applications and productivity improvement (Figure 13).

However there appear to be no overarching reviews of the extent to which this distribution of education and training is adequate for current and future needs and how it will match the challenges from an aging population and current early retirement patterns.

¹² Schneider, H. W. *et al.* (2004). This provides the most comprehensive overview of information of this kind, even if available statistics do not always differentiate between ICT related studies and other engineering studies.

Figure 13. Number of students enrolled in 2002 in ICT-oriented education and training

Source: Schneider, H.W. et al. (2004).

IC-related skills

E-training (eFit)

E-training is part of the large-scale eFit initiative funded by the Ministry of Education, Science and Culture (see above). E-training is designed to improve information and advisory services on training and further education, to develop new teaching and learning methods, and to increase further education awarding industry certificates. E-teaching focuses on IT-training for school teachers, ensuring that their IT-qualifications conform to the European Computer Driving License ECDL.

Initiatives to promote female integration in research and technology

There are relatively few women in research and technology occupations. Analysis of the gender distribution in industrial research in Austria shows only 9% of women compared with 15% in the EU10, although in Germany the share of women researchers is also low (9.6%). The share of women researchers in business, government and higher education combined was only 19% in Austria compared with 25% in the EU10 in 1999 (see Annex Tables A1 and A2, European Commission, 2001). This led to a number of initiatives to increase female participation in technological activities:

- At general level the **fFORTE** initiative was launched by the Austrian Council for Research and Technology Development in 2002 as an inter-ministerial initiative to promote girls and women at all educational levels, and contribute to career enhancement of female scientists. It combines and co-ordinates activities of three Federal Ministries. FIT and Didact (below) are part of fFORTE.

FIT (“Frauen in die Technik” – Women into technics) works with local centres in technical universities in Vienna, Carinthia, Upper Austria, Styria, Salzburg and Tirole to facilitate access by potential female students to technical curricula.

Only 25% of IT students in Austrian universities and polytechnics are female. *Didact - Women's IT Summer Studies* organised annually by Salzburg university and Salzburg polytechnic aim to encourage women to work in IT and provide information on curricula and job opportunities.

The Labour Market Service (AMS) Vienna has various initiatives for the training of unemployed persons in training institutions. In the IT area, *"girls go technics"* is a training programme for women aged 15-21. It consists of intensive and condensed IT training and development of social and communication competences. Participants take core training in ECDL (European computer driving licence) and social skills. This is followed by a firm internship and specialisation in one of three areas (home page maintenance, PC administration, help-desk support).

Women and Occupations in engineering and handicraft (Public Employment Service, AMS) aims to foster specific technical qualifications. Total funds are about EUR 15 million, and among qualifications are ICT, mathematics, physics and some technical handicrafts. Training takes place in businesses, training centres or placement training organisations ("Stiftungen").

Business organisation

Commercial registry

From 2001 the commercial registry allows the electronic publication of balance sheets. Instructions for the correct balance sheet format are given on line and can be integrated into accounting software and a company can directly generate the balance sheet format and send it to the court by ERV.

Logistik Austria Plus

Logistik Austria Plus was a programme developed by the Ministry of Transport, Innovation and Technology running from 1999-2003 aimed at promoting R&D in Austrian logistics firms. The programme focused on four thematic areas: logistics infrastructure, green logistics, supply chain management and e-business in logistics, with "e-business in logistics" the link to transportation telematics. Seven calls for R&D projects have resulted in 70 funded projects (out of 176 applications) for EUR 9.7 million with a total of EUR 23 million in project investments.

Awareness raising/information

Awareness raising is of particular importance in a context of rapid technological change, going beyond hardware investment and covering issues of business and process organisation. The Austrian Federal Chamber of Commerce (all businesses are obligatory members) is the key actor addressing business awareness. According to a survey conducted by the Federal Chamber, security and trust and issues related to electronic signatures rank high in current business concerns, and the Chamber's current awareness and information programmes are aimed at addressing these concerns.

Telefit

Telefit is an initiative of the Austrian Federal Chamber of Commerce to raise awareness in the field of e-business, giving presentations and workshops to inform business of funding opportunities and support mechanisms for e-business applications. It is organised around road-shows. Launched in 1997/98 with a show in 52 cities, since 2000 there have been annual road-shows visiting 20-50 cities and attracting 3 500-5 500 visitors.

EC Austria

EC Austria is an information, service and event platform for e-business. It is a public-private partnership involving the Austrian Federal Chamber of Commerce and the BMWA and more than 15 industrial partners. One of the main activities of EC Austria is the diffusion of case studies of businesses which have successfully introduced e-business. In addition, EC Austria informs businesses about where they can get advice and funding for their own e-business activities.

Multimedia Business Austria

Multimedia Business Austria is an initiative of the Ministry of Economics and Labour (BMWA) to develop the Austrian market for multimedia. The initiative mainly consists of a platform for Austrian multimedia businesses, an interface for information and communication and support with networking and co-operation. One part of the initiative is the 'multimedia reader', a catalogue which provides an overview of the Austrian multimedia scene, as well as a CD-ROM and a database for registered users.

Standards, electronic signatures

Due to their public good character, it is important that standards are developed in a co-ordinated way involving the maximum number of affected participants. Co-ordination has worked well in Austria, *e.g.* with certification service providers for the use of electronic signatures for identification and authentication in e-government or e-payment where the Austrian banks co-ordinated their activities with the public sector via their co-operative platform STUZZA (see also <http://www.a-trust.at/>).

e-card

The Main Association of Austrian Social Security Institutions is entrusted with the introduction of a health insurance smart card (e-card) for an electronic administration system (ELSY) for Austrian Social Security (56th amendment of the General Law on Social Insurance, April 1999). ELSY will support administration processes among insured, employers, contractual partners (doctors, hospitals) and citizens and Social Security Institutions, so that they can be executed without paper documents (56th amendment, § 31a (1)). ELSY smart cards have to substitute for all kinds of health insurance vouchers and be submitted for any consultation of a contractual partner. Smart card roll-out is facilitated by the Austrian legal system which allows for reduced formalisation of contracts.

The e-card is the central component and is a keycard or access key to system-supplied services and data. The e-card is not a carrier of application data, but contains the necessary data and keys for holder identification and control of access authorisations. Only administrative data of the cardholder are stored on the e-card, for instance name, title, insurance number, date of birth, etc. On the reverse side is the European Health Insurance Card (EHIC). The e-card will initially substitute for the traditional paper health insurance voucher and serve as the patient's proof of claim with the physician (or dentist). In the course of 2005, 8 million insured and their dependant relatives were to be supplied with e-cards and about 12 000 physicians equipped with client software and card readers. For the cardholder, medical treatment will be accessible without administrative barriers and without paper documents.

In the start-up period the e-card will only substitute for the health insurance voucher. Further extensions are planned and partly in preparation:

- Integration of hospitals and pharmacies (electronic prescription).
- Integration of the keycard function in connection with electronic signature into the “eSV” Internet-portal of the Social Security Institutions.
- Extension of the e-card to a European-wide accepted health insurance smart card.¹³
- Integration of Social Security registration procedures.
- Application of the e-card for transmission of sensitive data in the health sector (e.g. secure transmission of diagnostic findings).

After registration, the e-card, upon, can also be used as a citizen card for electronic signature and identification for e-government without additional costs. Use for secure digital signatures requires the purchase of an additional qualified certificate. The citizen card concept is integrated at all administrative levels (national, federal and local), and Austrian banks already use the private (secure) signature option for client identification. Other applications are running in several ministries and public organisations.

Table 8. Main initiatives linked to ICT by field of intervention

Programme / initiative	Infrastructure and equipment	R&D	Software & services	Skills	Organisation, process management	Awareness and information	Technology transfer	Content	Trust & security
Austrian eCommerce Trust Mark									x
Broadband Initiative	x								
Commercial Registry					x				
Digital Economy/ICT		x				x	x		
EC Austria						x			
e-card					x				x
EContent Initiative								x	
eFit				x					
e-government initiative	x				x				x
FIT-Women into technics, DIDACT-Women's IT Summer Studies, Girls go technics, forte, Women and Occupations in engineering and handicraft				x					
Fit IT		x					x		
I2-Intelligent Infrastructure	x	x							
K-ind competence centres		x			x		x		
K-plus competence centres		x					x		
Logistik Austria Plus	x	x			x				
Multimedia Business Austria								x	
Protec2002+							x		
Telefit						x			

¹³ EHIC, substitution of the international treatment certificate E111. Preparations have already started within the Netc@rds project, in which Austria participates.

Evaluation

Some evaluations of ICT-related initiatives have been undertaken, along with strategic studies which include evaluations. These include:

- The top-down R&D programme ‘Flexible Integrated Manufacturing in Small and Medium Sized Enterprises’ (FlexCIM) that ran from 1991-1996, was evaluated in 2001 by Geyer *et al.* confirming the overall rationale and effectiveness of the FlexCIM programme. Funded firms adopted CIM technology at a significantly higher pace than companies in the control group; they were also more likely to improve their overall competitive position and had above average revenue and employment growth. The results also showed that R&D co-operation with other firms and research establishments (*e.g.* universities) positively affected the rate of CIM technology adoption both in funded and unfunded companies.
- **eFIT** has undergone an internal interim assessment with the following results:
 - In 2000, 63% of schools had Internet access via ADSL, it is now 100%.
 - Between 2001 and 2003, EUR 32.2 million were allocated to further expand the IT infrastructure in private and state-run schools, under the title “Computer Billion”.
 - By December 2004, 470 000 ECDL (European Computer Driving Licence) examinations had been taken, with 112 000 in 2004. Approximately 100 000 pupils and teachers have completed the ECDL within the framework of eFit.
 - IT job offers for women doubled in 2003-04 (3 917 participants).
 - In accordance with the goals set by European education policy, digitization projects to set up image data banks have been undertaken in museums since 2001, using the very effective TMS (The Museum System) museum data bank.
- A mid-term external evaluation of **FIT-IT** was undertaken in 2005.¹⁴ The programme’s aim of supporting long-term, radical innovation projects in selected technological fields was found to be on the right track. At the same time potential improvements were identified in the definition of these fields, the evaluation of projects and the instruments used.
- Both the **Austrian Science Fund (FWF)** and the **Austrian Industrial Research Fund (FFF)** were evaluated for the first time. National and international experts carried out a systems evaluation including impact of funding, efficiency of funding procedures and administration, the adequacy of the portfolio of programmes and instruments including their governance and role within the wider research funding system. Many of the findings were reflected in the re-organisation of the Federal research funding system in 2004.¹⁵
- The **Christian Doppler Laboratories (CDG)** were evaluated in 2005. The evaluation concluded very favourably, underlining the light administration coupled with high efficiency of the funding model of science-industry co-operation.

In addition to these evaluations, strategic studies have been undertaken on behalf of the Austrian Council for Research and Technology Development on governance in the ICT policy sector (Ohler *et al.*, 2004) and on the use of ICT in Austria (Schneider *et al.*, 2004).

¹⁴ See Zinöcker, K. *et al.* (2005).

¹⁵ See Arnold, E. *et al.* (2004).

CONCLUSIONS

Austria is a small, open economy that has undergone considerable modernisation in the ten years following accession to the European Union in 1995. Accession also coincided with the upturn of information society issues both at European and national levels and ICT related policy was explicitly addressed in the mid 1990s along with sustained liberalisation of telecommunication markets.

Austria's geopolitical position – sharing frontiers with four central-eastern European countries and with Germany as its dominant economic partner – distinguishes Austria from other small open European economies, most of which undertook modernisation earlier and are often more advanced in terms of ICT production and use.

In terms of overall policy structure, the Austrian federal system means that there are a large number of overlapping and sometimes competing ministries and bodies formulating and delivering policy. Some of these could benefit from a more comprehensive approach to foresight and planning to ensure that emerging gaps in policy coverage and implementation are recognised and addressed, as has been the case for example with e-government. On the other hand, the overall focus of policy on addressing significant market failures in R&D, innovation and education and training is the right one in terms of modernising the Austrian economy and positioning it for future growth.

Strengths

Austrian modernisation is characterised by structural change towards more technology-intensive production, although this shift is mainly from low to medium-technology intensity rather than to high-technology. With policy recognition of the importance of knowledge-intensive activities in the Austrian economy and the important role of R&D in their development, Austria has considerably increased the share of R&D expenditure in GDP, in particular increasing the share of applied and industrial development compared with public research. This will more directly contribute to innovation and economic growth and further strengthening knowledge and skill-intensity of medium-technology industries as well as moving into high-technology ones.

Market liberalisation in communications has been an important dynamic factor, leading to competitive communication services markets, with in particular very high penetration of mobile phone technology at low prices. However broadband rollout has been slow to effectively cover all areas, with some rural areas underserved. In terms of diffusion of ICT in businesses and households, Austria started from a relatively weak position and is only slowly moving above the European average, although Internet coverage is now nearly total in Austrian businesses.

There are particular strengths in some areas of ICT research, as witnessed in the high proportion of funded Competence Centres that are active in ICT development, building on and contributing to strong ICT research capabilities in the public and private sectors, including the strong foreign-financed business research component. Due to the nature of these programmes, several hundred companies are involved both in the definition as well as in the performance of the research programmes of these centres.

Public and private sector co-ordination is high for some new initiatives. The integrated approach of federal, regional, and local administrations, social security associations, and the banking sector has allowed the co-ordinated introduction of common standards and the smart card introduced in 2005 to replace social security vouchers, with options for further usage as personal identification and authentication (concept citizen card) for administrative and commercial e-services. Similarly Internet banking has been comprehensively adopted.

A further example of good practice is the integrated approach of e-government. Comparative statistics on e-government, *e.g.* on businesses which use the Internet for interaction with public authorities, show usage above the EU15 and EU25 averages (Eurostat). Furthermore Austria is in a strong position in more complex service provision, based on (back-office) electronic administration processing, with internal electronic interactive filing procedures in all ministries, increasing electronic interaction in providing citizen services, and high levels of usage for example in online tax payment.

Despite broad dispersion of responsibilities in ICT-related research to three ministries and other funding agencies evaluations of recent and current funding schemes (Flex-CIM, FIT-IT, K-plus, FFF – now FFG, FWF, CDG) in this field all conclude that there is positive design and high effectiveness of funding instruments, including coherence between different funding schemes. Although there are some overlaps, currently there is no serious gap in the provision of supporting programmes.

Weaknesses

Austria does not have to build its policy system on explicit co-ordination structures to the same extent as larger countries. Furthermore the challenges and outcomes of co-ordination in a federal system and the important role of the European ICT policy framework do not necessarily lead to centralised or purely national approaches to ICT policy. Thus, the Austrian distribution of policy competencies and programme implementation remains dispersed within the federal structure despite recent initiatives, at least in the areas information society, innovation and technology policy.

Austria's good performance in R&D policy making and its increase in industry-related public and private spending also has underlying weaknesses. Most programmes set up over the last 5-7 years are predominantly supply-oriented and financed with special funds ('Sondermittel'). The relatively good response in terms of rising aggregate R&D expenditures from both public and private research communities may weaken monitoring of emerging trends and adaptation of policy and programme structures to meet these trends. This also holds for the ICT sector in general, where no systematic monitoring exists to identify actual or potential future gaps in policy and performance.

Aggregate measures of investment in knowledge are low, there remains a sustained bias towards physical capital in overall capital formation, and the relatively slow uptake and use of many new technologies in the past suggests that Austria may face continuing challenges in terms of the modernisation of its economy. These challenges are particularly acute taking into account the potential for rapid catch-up in the surrounding Eastern European economies.

The weakness in venture capital markets has in part been attributed to poor supply of projects for venture capital financing. To the extent that this is true, then further efforts may be needed to increase the dynamism of the economy and to further encourage the translation of R&D inputs into innovation, growth and value creation. The size structure of the business sector (a relatively large proportion of employment in large established firms) may be a further sign of weaknesses in the formation and growth of new dynamic firms in knowledge-intensive sectors.

Although ICT competencies are difficult to measure a number of measures suggest that these competencies could be more broadly developed. Austria is in a relatively low position in terms of broadly defined ICT-intensive occupations despite a good performance in ICT specialist occupations, there is a very low participation rate of women in research and technical occupations, and widespread early retirement suggests low ICT-literacy in generations from 50 years onwards and poor labour market flexibility. Although each of these are currently addressed by public policy, there is no overall monitoring of ICT capacities, or over-arching strategy to address the supply and use of available skills and their integration in the economy.

Recommendations

Austria has improved its relative performance considerably over the period since European Union accession as it has restructured its economy towards newer knowledge-intensive activities. However further efforts are needed to continue this good performance as it continues to face dynamic competition from its Eastern European neighbours and broader global competition. The following recommendations are designed to help improve performance over the medium to long term.

- Despite the broad distribution of ICT-related responsibilities in many ministries and public bodies, ICT policy co-ordination works well at concrete policy and programme level as illustrated by the e-government initiative or ICT-related research funding. However, although recent steps have been taken to improve the situation, the lack of an overarching strategy may be critical especially in identifying existing gaps in policy and performance and missing links for future growth. Foresight exercises, involving major participants, would enhance monitoring and strategy building.
- Infrastructure rollout. Although the federal government has a subsidy programme for improving broadband coverage in remote and rural areas (matching the *Länders'* infrastructure policy), there has been no clear long-term national strategy for advanced infrastructure roll-out. Alternative technology-neutral but regionally targeted incentive systems based on licensing requirements and/or tax incentives for infrastructure investment should be considered.
- Public R&D support has helped to raise ICT R&D expenditures and Austria is one of the few European countries that have significantly improved R&D performance recently. However, phasing out of some programmes for institutional support may lead to declines in basic research efforts; cuts in corporate tax rates reduce the impact of R&D tax incentives to business, and if there is declining funding of innovation and technology transfer competence centres this may hinder the translation of ICT R&D into ICT innovations. The wide spread of ministerial responsibilities may not be able to address these issues comprehensively and ensure that R&D performance is further strengthened and contributes to business innovation and economic performance.
- The venture capital market is in general very under-developed, although the financing structure (relatively greater importance of banks and private individuals compared with the European average) has not hindered and has possibly aided its focus on financing firm start-ups and expansion. Further venture capital market development and reduction of related administrative burdens is a general, not ICT-specific, issue that could potentially improve the long-term innovative performance of the Austrian economy, particularly if coupled with incentives to enhance the translation of R&D inputs into innovation and new activities.
- Initiatives addressing ICT skills of young people are well-developed in the education and training system and should continue, with focused development of ICT skills successfully addressed in programmes such as eFit. However the lifelong learning component in such programmes may not be sufficient to address the macro-economic challenges of an aging population or, more

importantly, issues of labour market flexibility at the end of the career. Better monitoring of ICT skills across a wider range of workplace skills and occupations is needed to design and co-ordinate policy measures and avoid gaps, especially for older workers.

- The complexity of the Austrian Federal system may fragment development of the market for digital content, as for example, 10 laws (9 regional and 1 national) are required to implement the European public sector information (PSI) directive. Although access to much public information is provided locally, a more comprehensive policy approach could help develop the commercial potential of public sector information and content as well as expanding access to it.
- A number of scattered initiatives address use of ICT in SMEs and related needs for organisational change and skills. These initiatives should be evaluated and co-ordinated, and if there are market failures in the supply of information or demonstration projects such initiatives should be increased to the extent that such services are not adequately provided by business associations under the Federal Chamber of Commerce.
- The evaluation culture has improved, programme and institutional evaluations are published, and results partly integrated in policy design. However, *ex-ante* evaluations and foresight exercises to better identify challenges and objectives should be strengthened and linked more consistently with *ex post* evaluations.
- Finally, although ICT-related data and indicators have improved, they could be further strengthened to help track the development and diffusion of ICTs across the economy, and more particularly in the area of ICT impacts, to help improve policy monitoring and policy implementation.

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Appendix: List of people interviewed during the OECD mission

Roland Belfin, Manager, CEO's Office, Austrian Regulatory Authority for Broadcasting and Telecommunications

Karl Fröschl, Director RTD, EC3, E-Commerce Competence Center

Reinhard Goebel, Head of Unit, Federal Ministry of Transport, Innovation and Technology

Fredy Jäger, R & D Manager, Corporate Development, Siemens AG Austria

Johannes Jahn, Strategic Business & Initiatives, SAP Austria GmbH

Peter Kotauczek, President of the Austrian Software Association (VÖSI)

Gerhard Laga, Austrian Economic Chamber, Information and Consulting

Rudolf Lichtmanegger, Austrian Economic Chamber, Department of Economic Policy

Hannes Leo, Austrian Institute for Economic Research

Po-Wen Liu, Economics Division, Austrian Regulatory Authority for Broadcasting and Telecommunications

Karl Messmann, Deputy Director, Directorate Macro-economic Statistics, Science and Technology Statistics, Statistics Austria

Wolfgang Polt, Joanneum Research, Head of Vienna Office of Institute of Technology and Regional Policy (InTeReg)

Christoph Raber, Federal Ministry of Economic and Labour

Ingolf Schädler, Deputy Head of Division, Federal Ministry of Transport, Innovation and Technology

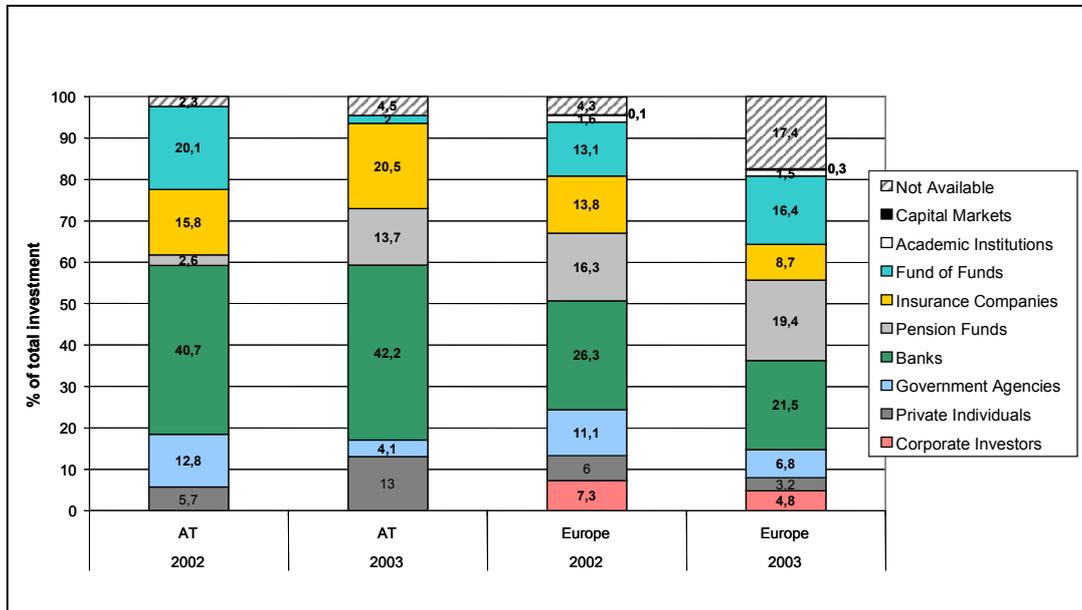
Andreas Schiefer, Directorate Macro-economic Statistics, Science and Technology Statistics, Statistics Austria

Brigitte Tiefenthaler, Austrian Council for Research and Technology Development

ANNEX

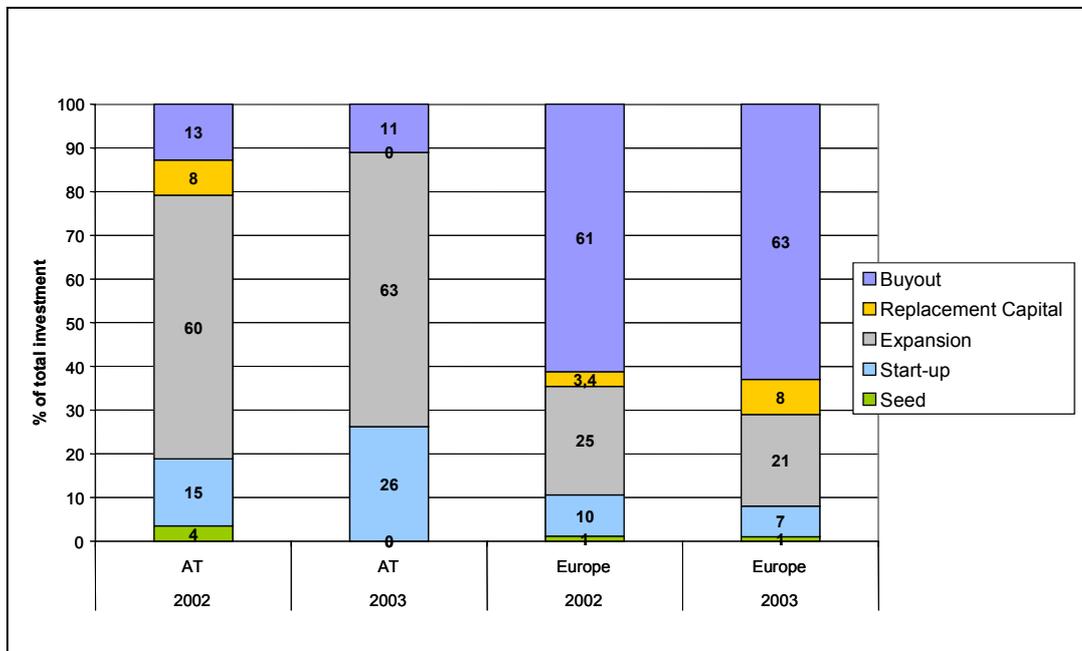
Structure of venture capital provision

Figure A1. Venture finance by type of investor, Austria and Europe



Source: EVCA, AVCO.

Figure A2. Venture finance distribution by investment phase, Austria and Europe



Source: EVCA, AVCO.

Female participation in research and technology

Table A1. Industrial researchers by gender and proportion of female researchers by institutional sector, 1999

	Industrial researchers		Proportion of female researchers (%)			
	Women	Men	Business	Government	Higher education	Total
Portugal	793	2 535	23.8	54.5	44.7	44
Netherlands	940	2 991	23.9	37.5	44.3	40.9
Spain	3 353	13 957	19.4	37.5	34.5	32.6
Ireland	536	1 364	28.2	25.2	46.2	29.8
Finland	3 999	18 516	17.8	37.5	41.8	28.6
Italy	5 490	24 216	18.5	38.1	28.4	27.2
France	17 787	68 428	20.6	28.6	31.7	26.5
Denmark	2 218	9 074	19.6	31.1	27.3	23.9
Austria	1 258	12 708	9.0	31.9	25.7	18.7
Germany	14 414	135 735	9.6	22.1	24.8	18.0
EU10	50 788	289 524	14.9	30.3	30.6	24.8

Source: DG Research, *European R&D Survey*. Government data for Germany and Ireland from European Commission, 2001. Reference year: Austria 1998. For Ireland definition of Government differs from the Frascati Manual, Government is estimated. For Germany business data in FTE, Government is estimated.

Results of a survey of female participation in 202 projects in 15 thematic technology programmes funded by the Ministry of Transport, Innovation and Technology (BMVIT) are shown below.

Table A2. Gender distribution in thematic technology programmes

Position in the project	Women	Men	Total	Share of women (%)
Project leader	30	185	215	14%
Researcher, collaborator	50	312	362	14%
Partner	81	746	827	10%
Total	161	1 243	1 404	11%

Source: Schrottenecker, I., *et al.* (2004).