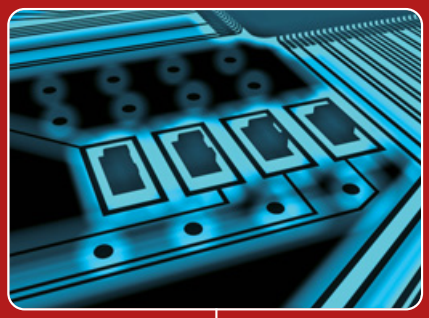
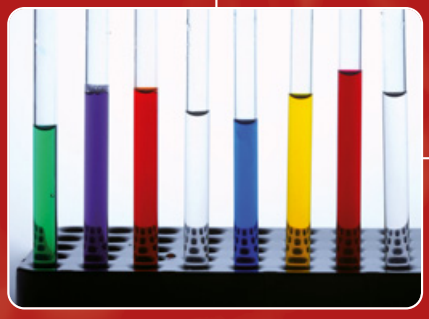
Realising potentials, increasing dynamics,
creating the future

Becoming an Innovation Leader



Strategy for research, technology and
innovation of the Austrian Federal Government



REPUBLIK ÖSTERREICH

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The RTI Strategy of the Austrian Federal Government

Preface

The era we live in is marked by ecological and demographic challenges, increasing global competition and – as a result – a continuous change in the structure of society and the economy. On top of this, we are confronted with the effects of the international financial and economic crisis on the public budget and on the medium-term growth potential of the domestic economy. Austria is faced with the question of how to get the country ready for the future and how it can improve the high standard of living for generations to come.

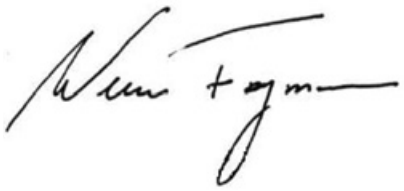
We are convinced that one decisive answer to this question must be: by reinforcing research, technological development and innovation. In doing so, we create high-quality jobs, supporting long-term employment and the sustainable growth of the economy.

Thus our objective for Austria is to push forward from the group of Innovation Followers into the group of Innovation Leaders, i.e. to be among the most innovative countries in the EU. But to achieve this goal we must have a more coordinated political approach. We need a mutual dialogue between science, business and society, along with a broad approach to innovation, which includes not only technological improvements but also societal, social and economic innovations. Despite the current financial and economic crisis the federal government is still investing considerable resources in research, technological developments and innovation. It is, however, crucial where these funds are actually invested and how we can guarantee that they are used efficiently.

With this strategic plan, “Realising potentials, increasing dynamics, creating the future: Becoming an Innovation Leader” we make a clear statement in favour of promoting research, technology and innovation. In it, we define our strategic and operative goals, set action priorities and lay down support measures that we need to implement over the next decade. They will allow us to build on our strengths, occupy new fields and niches in the future, establish transparent structures for funding and decision-making and to ensure that public money is used efficiently and sustainably.

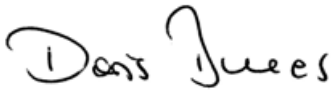
The foundation of this strategy was prepared by the Federal Chancellery, the Federal Ministry of Finance, the Federal Ministry for Transport, Innovation and Technology, the Federal Ministry of Science and Research, the Federal Ministry of Economy, Family and Youth and the Federal Ministry for Education, Arts and Culture on the basis of existing studies and involving input from the social partners and crucial stakeholders.

We would like to thank all those who, with their contributions, have helped make the RTI strategy an important basis for a forward-looking policy in and for Austria. Now the time has come for us to work together with everyone involved to consistently implement the concepts we have outlined.



Werner Faymann
Austrian Federal Chancellor

DI Josef Pröll
Vice Chancellor and Federal Minister of Finance



Doris Bures
Federal Minister for Transport,
Innovation and Technology

Dr. Beatrix Karl
Federal Minister for Science
and Research

Dr. Claudia Schmied
Federal Minister for Education,
Arts and Culture

Dr. Reinhold Mitterlehner
Federal Minister of Economy,
Family and Youth

1 Taking on challenges, finding answers

Getting ready to become an Innovation Leader

In the last two decades, Austria has managed to catch up impressively in its performance in research, technology and innovation. This undertaking was marked by a notable rise in the level of research intensity (R&D expenditures as a percentage of GDP) throughout the entire innovation system. Research intensity increased in the last decade from 1.94% of the gross domestic product to 2.76%. This places Austria among the top players in Europe in innovation intensity.

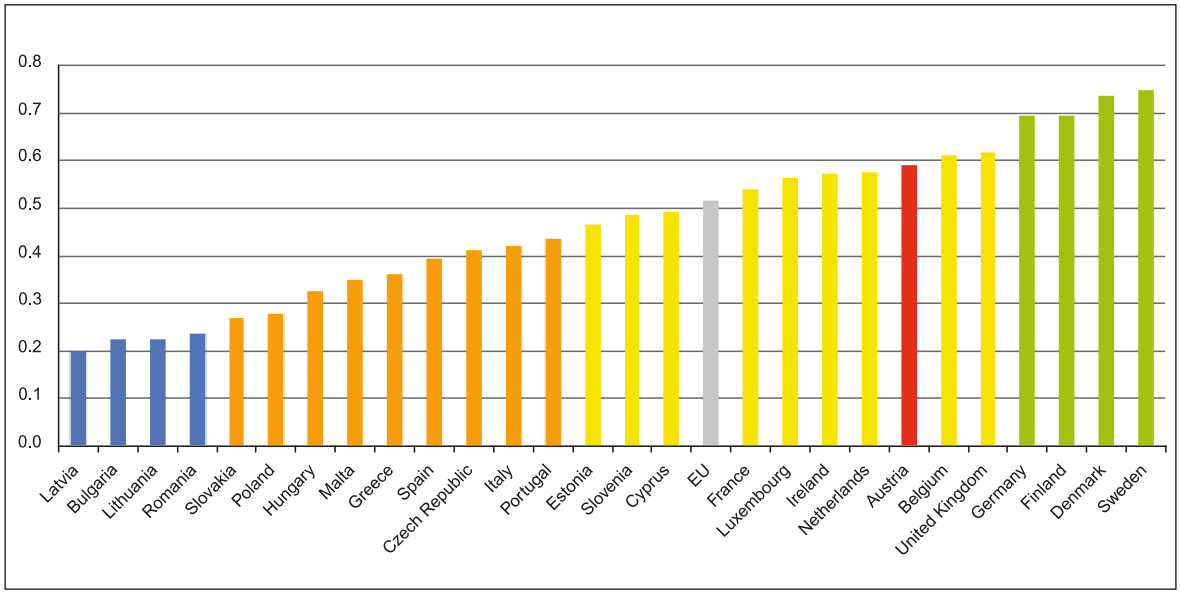
In the Innovation Union Scoreboard (called the European Innovation Scoreboard until 2009), the indicators compiled for innovation performance placed Austria in seventh place, one of the leaders among the Innovation Followers. The group of Innovation Leaders, which includes the Scandinavian countries Sweden, Denmark and Finland, as well as Germany, is now within striking distance. The catching-up process of the past decades has been successfully completed.

This development helped improve Austria's economic competitiveness in recent years, enabling the country to achieve economic growth above the EU average, higher employment rates and growing prosperity. Measured in terms of per capita income, Austria is now in fourth place in the EU and among the Top Ten worldwide[1].

New challenges, new goals

The gap in benchmark performance between input and output quantities already hints at the challenges that confront Austria's innovation system today. In the context of the catching-up process, existing structures were adequate, and an imitative technology strategy that focussed on intelligent adaptation and rapid diffusion of technological developments was extremely successful.

Today, after the completion of the catching-up process, the benefits of this strategy are tapering off. Competition from the countries in the middle technology segment that can offer significantly more favourable pricing is also increasing in globalised markets. More and more coun-



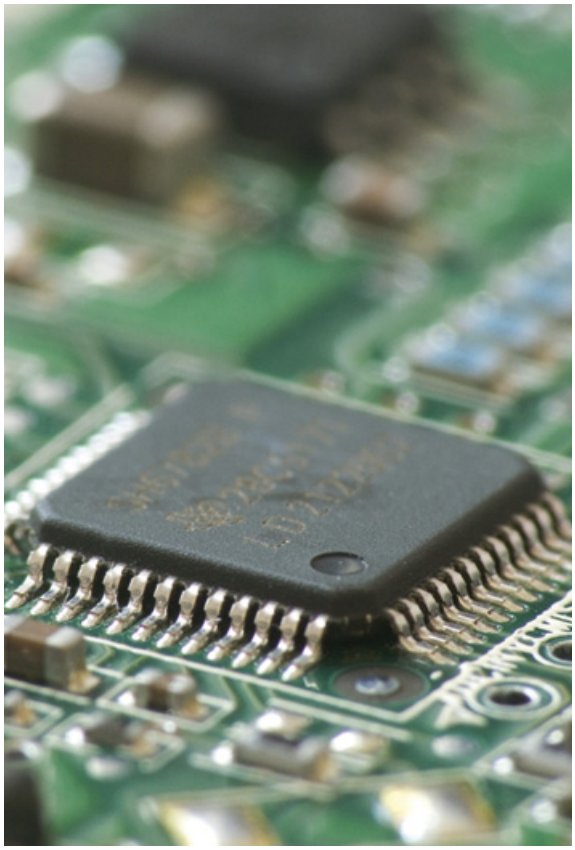
Source: Innovation Union Scoreboard 2010
Innovation Leaders are at least at 120%, Innovation Followers at 90-120%, Moderate Innovators at 50-90% and Modest Innovators are below 50% of the EU average.

[1] Source: Eurostat, figures for 2009

tries – some in our immediate neighbourhood as well – are going through a catching-up process too, moving up into positions that Austria held previously.

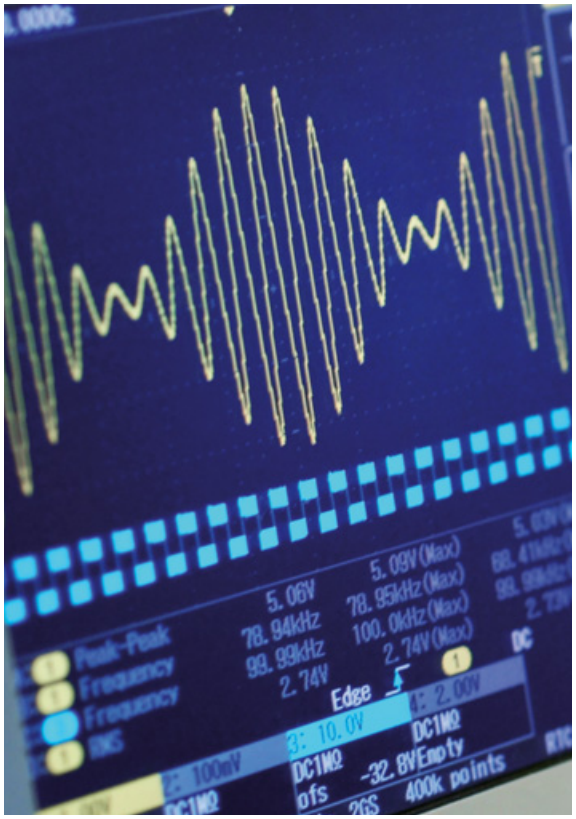
In the face of these challenges, Austria must reposition itself, and that means that we must set new goals that aim for intelligent and sustainable growth. We want to climb into the circle of Innovation Leaders and be among those countries that perform research at the frontiers of knowledge and produce at the leading edge of technology. To do this, we must utilise the full potential of our knowledge-based society and strive for excellence.

In this context, innovation performance must continually improve in terms of both quantity and quality, and it must bring in noticeably higher profits. The prerequisite is that we make fundamental reforms and efficiency improvements throughout the entire innovation system.



European framework

Austria's shift in research and innovation policy is running parallel to a new strategic orientation at the European level. The Lisbon Process has reached its target year of 2010. The process brought dynamism into innovation policy, but several expectations remain unfulfilled. With the Europe 2020 strategy, the European Union is setting new strategic initiatives oriented towards smart (development of a knowledge- and innovation-based economy), sustainable (promoting resource-efficient, greener and more competitive economy), and inclusive growth (promoting a high-employment economy marked by social and territorial cohesion). These developments will also have a significant influence on Austria's strategic goals.



The financial and economic crisis

These new strategic initiatives are being developed against the backdrop and from the expe-

rience of the deepest financial and economic crisis since World War II. As the Europe 2020 strategy plan confirms from the outset, the crisis "has obliterated years of economic and social progress, and has revealed the structural weaknesses of the European economy".

In the face of the crisis, research, technology and innovation assume a fundamental importance as focal points of government action. Worldwide consensus has emerged that the way forward proceeds via the acceleration of education, research and innovation, which are crucial for the development potential of knowledge-based economies. In a highly industrialised knowledge-based economy such as Austria's, about two-thirds of economic growth can already be attributed to qualitative changes that are based on research, technological change and innovation, training and education. The most innovative countries in the world, such as the Scandinavian countries, Switzerland, Germany and the USA, strengthened their future investments in research, technology, innovation and education right in the middle of the economic crisis.

This calls for the public sector to provide support and vision, particularly in the context of the highly cyclical swings to which private research and development expenditures are subjected in the industry sector. In Austria, where corporate commitment to research and development increased very dynamically from 2000 to 2007 with a 55% rise in expenditure, there are several signs that the crisis year 2009 resulted in a

decrease in this dynamism of investments in research and development in the corporate sector. The public sector behaved in a counter-cyclical manner in this situation: the share of federal spending on overall research financing climbed from 2007 to 2010 by seven percentage points to 35%. This allowed research intensity to reach 2.76%, despite the crisis environment.

Consolidation

The aftereffects of the crisis also mean that we, like all other European governments, must confront the difficult task of medium-term consolidation of public finances. At the federal financing level, we are on a path of budget consolidation that should bring us from a 4.5% deficit in 2010 to 2.5% in 2013. Education, research and innovation are considered priority policy fields and therefore will be the least impacted, relatively speaking, by consolidation measures. Furthermore, additional funds for proactive measures in this area have already been procured in the annual amount of € 260 million from 2011 to 2014. Nevertheless, the impressive track record of growth in recent years in public investment in research and development cannot be sustained during this phase of consolidation.

During this period it will be all the more important to activate and optimally exploit the potential of private research financing, and to implement the structural measures that can be the foundation of sustainable, innovation-based growth. An even more expansive policy in research, technology and innovation should create the prerequisites – if crisis management and consolidation allow it – for achieving optimal leverage in the private sector and a higher degree of efficiency for government expenditures.

Reforms must, however, extend far beyond a narrowly defined research and technology policy. Our most urgent tasks are a forward-looking reform of the education system, improvements in the situation for innovative firms through an active competition policy, and improved access to capital markets.

Research intensity 2020: 3.76%

We declared in the inaugural government statement that our objective was to reach a research intensity of 4% by 2020, and we continue to view this target as part of a vision on which to orient ourselves. However, we recognise that in the face of the financial and economic crisis, not only will measures be necessary to consolidate state finances and deal with the consequences of the crisis, our research intensity target also cannot be met. In the coming decade, we will seek to increase our research intensity by one percentage point, from 2.76% today to 3.76% in 2020. In the Europe 2020 strategy, which sets individual goals for research intensity in the EU member states, we have committed ourselves to pursuing this goal.

International experience has shown us that this trend will only be attainable if we activate private investment in research and development. Private share in the research intensity of 2020 should reach at least 66% or even, if possible, as international examples show, 70%. In the coming years, we want to stimulate firms and research institutions by creating a situation that encourages innovation and promotes more research. The contribution of the public sector should, after the necessary consolidation phase called for by the financial crisis and budget consolidation in the second half of the decade, hereby be stabilised on a path where it can support the research intensity with this ratio of private and public research financing.

The federal government's strategy

The developments described here constitute the frame of reference for the strategy on research, technology and innovation, which the Austrian federal government is presenting in this document. With this document, we are

making a clear statement for the promotion of conditions conducive to research, technology and innovation. The strategy plan is thus the conclusion of a multi-year process of discussions and analyses. The Austrian Research Dialogue[2] (2007-2008), was designed to be a broad, nationwide process of discourse and consultations with Austrian stakeholders for the purpose of further developing the innovation system and our knowledge-based society.

The comprehensive evaluation of the Austrian research funding system[3] ("System Evaluation" 2008-2009) provided a profound assessment of the entire system, along with recommendations for improvement by experts.

The Council for Research and Technology Development made its proposals and recommendations for further development of the Austrian research and innovation system ("Strategy 2020")[4] in the summer of 2009.

Challenges and development potential

All this preparatory work gives us a fairly widely consistent picture of the pressing challenges we are faced with and the development potential the Austrian innovation system still holds:[5]

>> **Human potential:** The transition from the education system into the innovation system is inadequate in Austria. Available human potential is not being utilised optimally. The primary obstacles in our path towards innovation leadership are a lack of interest in technological and life science subjects, low female participation rates in research, difficulties in integrating immigrants into the education and innovation system, a still strong brain-drain to other countries, and relatively low societal openness to science and technology.

>> **Basic research:** Basic research forms the essential foundation for radical innovations and makes it possible for society to develop by expanding the frontiers of scientific knowledge. Basic research is a core area of government responsibility and is therefore an indispensable component of an Innovation Leader strategy. The proportion of basic research financing as a share of GDP was 0.44% in Austria in 2007, lower than in important OECD benchmark countries.

>> **Venture capital market:** Due to its historic strongly bank-biased corporate financing structure, Austria is underdeveloped in terms of venture capital, in both early phases and expansion phases. This complicates high-risk, growth-oriented early-phase financing for young, innovative, knowledge-based firms.

>> **Competition:** The OECD considers the situation for innovation – such as competition and financing options – to be about as highly effective for increasing expenditure on research and development as are specific instruments, such as direct research fun-

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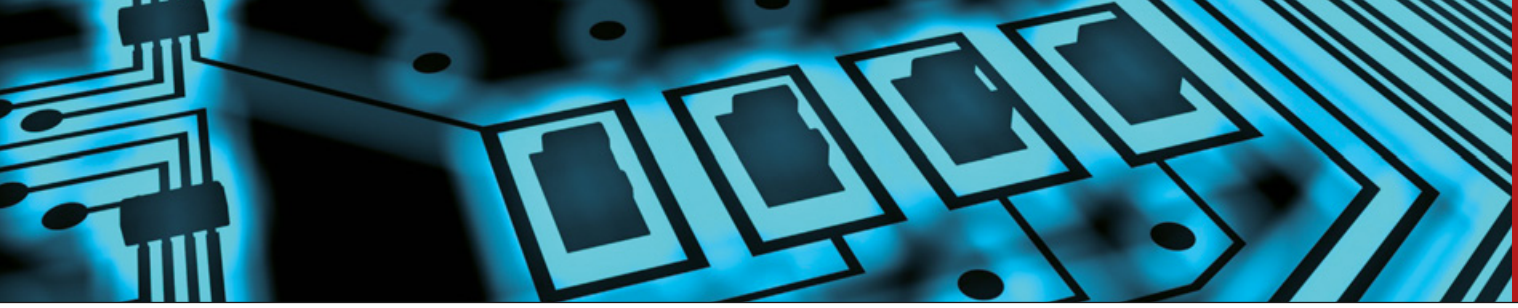
2 *http://www.bmwf.gv.at/startseite/forschung/oesterr_forschungsdialog/*

3 *http://www.bmvit.gv.at/innovation/forschungspolitik/systemevaluierung/index.html*

4 *http://www.rat-fte.at/tl_files/uploads/Strategie/090824_FINALE%20VERSION_FTI-Strategie2020.pdf*

5 *In addition to footnotes 1-3, see also: Innovation Union Scoreboard 2010 (IUS): http://www.proinno-europe.eu/inno-metrics/page/innovation-union-scoreboard-2010, & Research and Technology Reports: http://www.bmvit.gv.at/service/publikationen/innovation/forschungsberichte/index.html*



ding. This situation could be markedly improved in Austria; above all, the competitive conditions for promoting innovation in some areas, such as market entry for new providers, remain inadequate.

>> **Governance:** Analyses and evaluations indicate that there are weaknesses in governance structures which could hinder the further development of the Austrian innovation system in its attempt to realign its strategic positioning. Root causes are primarily the different pillars and compartmentalised political structures that do not collaborate enough, thereby preventing a systemic perspective and making coordination within the overall system difficult.

>> **Structural change:** In light of economic, environmental and societal challenges, structural change in industries that engage intensively in research, innovation and education is not taking place with the necessary energy.

Grand Challenges

Our innovation system, however, is also being challenged by major societal and economic problems that we must face and find answers for in the future. We must confront climate change and its threatening consequences. We must overcome global scarcities in energy and natural resources, partially by converting to new and renewable resources. We must find answers to demographic transformation and the consequences of an aging and increasingly intercultural society, thereby guaranteeing people in our country a secure, healthy and high quality life.

These trends represent major challenges of a global stature. They imply dramatic changes in the economy and in society. We need world-class science, research and technology to be able to formulate adaptive strategies and identify development options. We also need to use these technological advancements to build up capacity for solutions concerning new products, processes and services.

Objectives

Our strategy for research, technology and innovation therefore pursues two main objectives:

- We want to continue developing the potentials of science, research, technology and innovation in Austria, to make our country one of the most innovative in the EU by 2020, strengthening the competitiveness of our economy and increasing the prosperity of our society.
- We want to continue developing the potentials of science, research, technology and innovation in Austria, using them in a holistic manner to deal with the major societal and economic challenges of the future.

From these targets we can derive the following additional objectives:

>> Sustainable reform of the Austrian education system: Optimise framework conditions for research, technology and innovation; improve the connections between the education and innovation systems; increase the quality and quantity of human resources available in Austria for research, technology and innovation.

>> Strengthen basic research and its institutions: Increase funding of basic research while simultaneously increasing the share of funds that are awarded in competitive processes; continue with structural reforms of universities and coordination of those performing excellent research inside and outside the universities.

>> Strengthen the innovative power of firms: Increase direct and indirect support to improve the technological performance and innovative power of Austrian firms; intensify applied research and technology transfer,

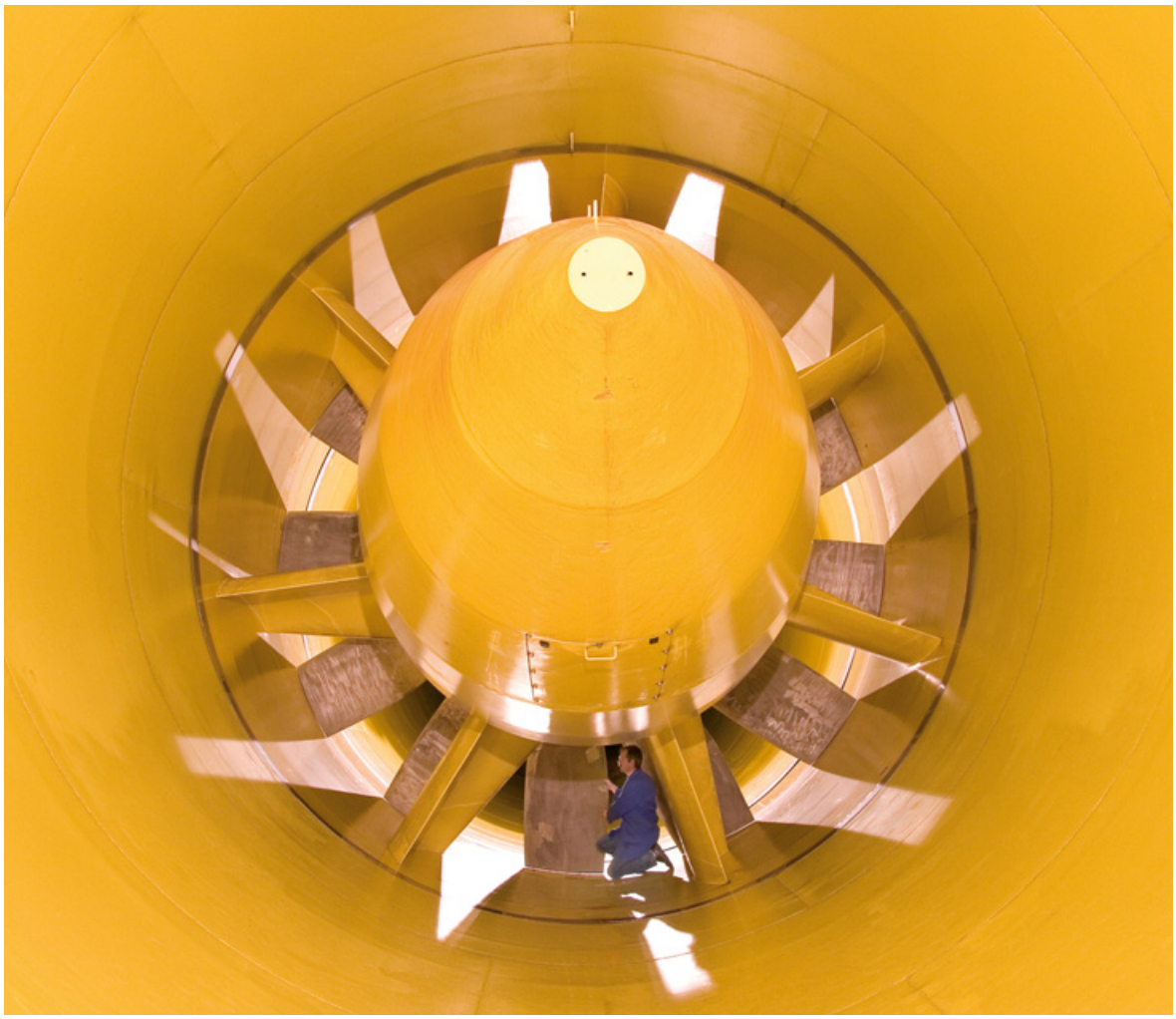
especially among small- and medium-sized enterprises (SMEs), as well as the supporting role of leading firms; strengthen the utilisation of demand-side instruments in innovation policy.

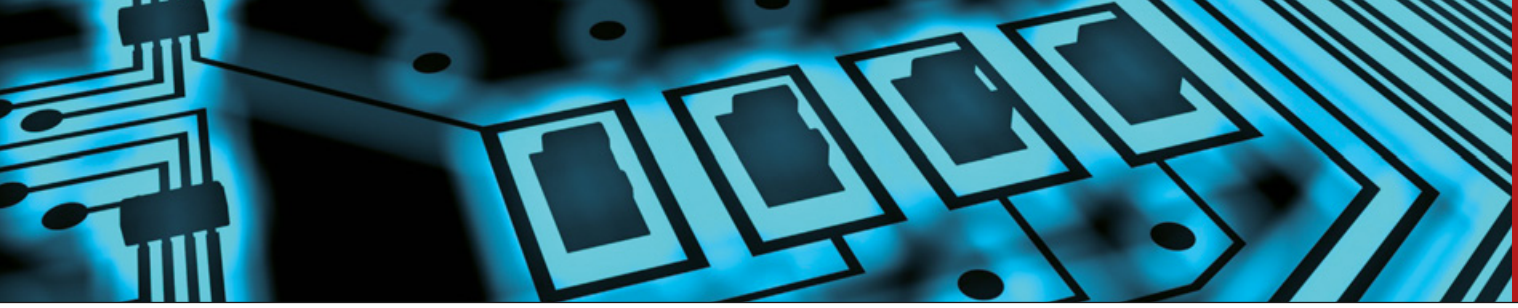
>> Increase the efficiency of political governance: Increase the efficiency and effectiveness of the innovation system by means of clear governance structures; a modern research (funding) regulatory framework with principles for results-oriented funding allocation and improvement of planning reliability for all actors.

Principles

With our strategy for research, technology and innovation, we as the federal government are establishing the guiding principles of our political activity in education, research and innovation policy for the coming years. This will also have a long-term effect on competition and funding policy.

The government administrative offices will drive these principles forward, coordinate them, and monitor the entire process to ensure the further development of the strategy.





We must keep the following principles in mind:

>> Instead of an exclusive focus on promoting science and technology, a comprehensive approach to innovation policy is being pursued that includes not just financial support measures, but also legislative and organisational measures in such areas as education, competition, regulation and procurement.

>> A systemic approach must be pursued that supplements different measures and creates synergies. Collaboration and coordination are essential maxims for action. Before setting new initiatives, we evaluate whether existing activities can be reoriented, rebundled or reformed.

>> It must be ensured that funds are efficiently and effectively used via improved regulation and constant monitoring, as well as through shared usage of research institutions and infrastructures. All measures are oriented first and foremost in terms of their impact. Initiatives and programmes that do not lead to the desired impact will be shut down or fundamentally reformed.

>> Excellence in basic research on the one hand and top-flight corporate research on the other are supported as much as possible. This requires disbursing a higher share of funds through competitions and renewing our efforts to encourage high-risk projects. Prioritisation and support in the interconnection of international research structures and excellence networks help strengthen Austria's image.

>> National innovation system actors are fully integrated in globalised developments of science and technology and can profit optimally from the relevant EU programmes.

>> There is a high leverage effect in public investments triggering the greatest possible investments from the private sector with the long-term goal of attaining a share of two-thirds to 70% of private funds in overall research and development expenditures.

VISION AUSTRIA 2020 – AN INNOVATION LEADER

• In 2020, Austria will be an Innovation Leader.

By 2020, Austria will be solidly established among the EU's most innovative countries and considered one of Europe's Innovation Leaders. Austria will be a top location for research, technology and innovation, offering excellent researchers outstanding work and career opportunities and attracting research institutions and highly innovative firms from all over the world. Excellent research and radical innovation will be normal in Austria, as will be the close collaboration between science, business and society. An overall policy perspective related to science, research and innovation will help to strengthen the three sides of the "knowledge triangle" (education, research and innovation) and to improve collaboration between them.

• Human potential and skills will be optimally developed and used.

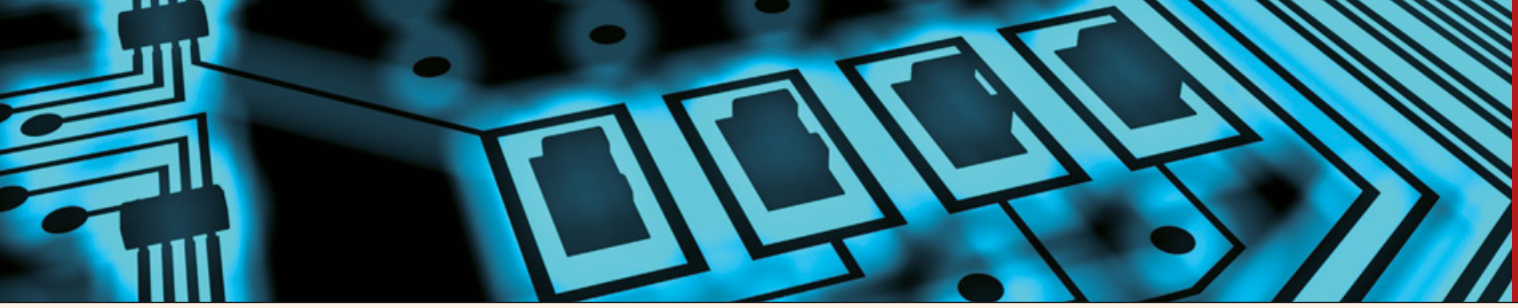
The education system will promote in particular innovative and creative thinking and action. Access to the education system, and its permeability, will have fundamentally improved in terms of performance fairness and equality of opportunity, as well as in the choice of university subjects and careers that fit individual abilities and preferences. Interest and motivation for technical and life-science-related training will be comprehensively promoted. In addition to encouraging age-appropriate, early childhood pedagogy and the best possible detection of existing potentials in all levels and within all school types, relevant educational institutions will have established a solid, improved education and training system for teachers. The immigration of highly skilled people will be encouraged and utilised.

• Excellent situation for universities, universities of applied sciences, and non-university research institutes will form the basis of the innovation system.

Universities, universities of applied sciences, and non-university research institutes will work within excellent framework conditions and be sufficiently financed to optimally perform their tasks in research and instruction. Attractive scientific careers at the international level will be the prevalent standard at Austria's universities. The universities will receive support to conduct basic research at the highest level and educate outstanding graduates. Well-established research infrastructures at universities, universities of applied sciences and non-university research institutes will promote both top performances in research and be the basis for successful cooperation between science, business and society.

• Innovative firms will ensure the prosperity of a modern knowledge-based society.

New to market innovations and increasing exports of cutting-edge technology, high-tech products and knowledge-intensive services will make Austrian firms a recognised world market leader in knowledge-intensive industries and services. The share of Austria firms that systematically conduct research and innovation will be among the highest in Europe. Optimal framework conditions will favour the constant improvement of innovation performance in the corporate sector. Modern competitive regulations will guarantee an intense competitiveness and innovation ability among



firms. Public procurement and an innovation-oriented infrastructure policy will increase the demand for innovative products and knowledge-intensive services. The start-up dynamic among technology-based and innovative businesses will be high. With a well-functioning market for private equity and venture capital, young and innovative firms will be able to grow quickly and create future-proof jobs.

- **A customised funding policy will support the performance of the innovation system.**

  A committed funding policy that is oriented towards efficiency, quality and effectiveness will address priorities and set the proper economic accents. This will guarantee longer-term security in planning and financing, providing quick support to innovation system actors and the maximum possible leverage effect with a fine-tuned mix of direct and indirect support measures. In the area of the direct funding system, clear, bundled competencies and unambiguous governance structures will be established, Indirect (tax) concessions for research activities will be significantly simplified. There will be clear priorities that are backed up with a flexible mix of instruments. This will help guarantee the increased output orientation of the entire innovation system.

2 Developing talent, awakening passion

Implementing sustainable reforms in the education system

Education is the foundation of knowledge-based economies and makes an essential contribution to the social and economic development of our society. Skills are crucial for the development potential of our community and the robustness of our democratic institutions. Yet skills also determine the ability of firms to develop and implement innovations, thereby affecting the economy's competitiveness. The quality of human potential determines the quality of research, which in turn creates new knowledge and is the prerequisite for new understanding, and for adapting and applying new technologies and research that have been developed elsewhere.

The education system is thus an essential component of the innovation system; it plays a preeminent role in the system's prospective development. This significance increases the closer we get to our ideal of being a knowledge-based economy in which knowledge is the most important factor in competition. Dealing with the potentials to and obstacles of development in the education system today must therefore be an integral component of any strategy aimed at improving research, technology and innovation.

Status and challenges

On the whole, Austria's education system still has a good reputation. International rankings show that Austria, as a place to conduct business, gets very good ratings for education, flexibility and employee motivation. In the face of challenges brought on by a knowledge-based society and the conditions of global competition, however, it is becoming increasingly clear that the education system needs fundamental reform and new approaches.

The findings of numerous studies and international benchmarking suggest that the Austrian education system is not exploiting its full potential. Only 39% of an age group in Austria acquire a university entrance certificate (through a school-leaving examination); the OECD average is 61%. With an academic ratio of 34.6% – defined as the proportion of people with tertiary or equivalent post-secondary education in the 30-34-year-old resident population – Austria is below the EU average of 38%. In Austria, only 43% of each age group enrol in a course of study at a university or university of applied sciences; the OECD average is 56%.

Findings come together in the following overall picture

The Austrian education system distinguishes very early on between vocational and academic paths; access to education is strongly influenced by social stratification. Due to a lack of permeability of educational paths, this early selection phase has a decisive influence on the educational expectations of children and adolescents, and it is almost impossible to change course later. The young age at which the choice is made has negative consequences including drop-outs and frequently a poor choice of study or career.

The available potentials and major qualifications of immigrants are not being developed to a great enough extent, nor are they being used enough in science and business. Immigrants also often have extremely poor education levels even in the second and third generation. Language barriers impede access to education.

In the life sciences and technical disciplines, the gap is widening between the economy's demand for skilled workers and youths' interest in training. The situation is aggravated by demographic developments; by 2020, we can expect a strong drop in the number of 15- to 19-year-olds in the population pyramid.

New, creative and attractive approaches in pedagogy, especially in the technical and life

science subjects, have not yet been sufficiently developed in our current education system. In addition, a clear gender imbalance in technical- and life-science-related studies on the one hand, and language- pedagogical studies on the other, is leading to a “feminisation” or “masculinisation” of entire professional fields.

The situation in university teaching, and especially the amount of time professors have per student, is particularly unfavourable in international comparison, which exerts a negative influence on the rating of Austrian universities in university rankings. The widely disparate number of students headed into the different university courses results not only in different study conditions at university, but also in disparate opportunities on the job market.

A lack of scientific career options dampens the incentive for talented students to pursue a career track that leads into research or university. Only a fraction of doctoral students who study in Austria find a position appropriate to their skills, or at least a third-party-financed position, at university. Intersectoral mobility between basic research, applied and industrial research needs major improvement, as this poses an additional career obstacle.

The proportion of women in the entire higher education sector and in non-university research institutes sinks markedly after the doctorate. Industrial research has the lowest proportion of women in Europe. Many women give up faced with the primarily masculine conditions prevailing in this sector.

Objectives: Education system

- We want to promote the talents of people in all levels of education, awaken their passion for research, and facilitate the best possible training for business dealings and scientific research. This should guarantee universities, research institutions and firms a sufficient pool of highly qualified researchers.
- To do this, the entire education system must be optimised, from the early childhood phase to models of lifelong learning.
- These reforms attempt to mitigate social selectivity, to improve permeability between education courses and tracks, to implement thorough quality improvements in school and university instruction, to better integrate immigrants, and to balance out gender discrepancies in research.
- The portion of drop-outs should be reduced to 9.5% by 2020.
- The portion of pupils graduating with a school-leaving certificate for an age cohort should be raised to 55% by 2020.
- Among the pupils whose first language is not German the share of those who do complete upper secondary school should increase from 40% to 60%.
- The conditions of study at universities should be fundamentally improved, which will require establishing new financing models for higher education.
- The proportion of 30- to 34-year-olds who have completed a university degree or have an equivalent educational certificate should be increased to 38% by 2020.

Support measures

Structural reform of the education system

>> Improve early support programmes with an obligatory and free year of kindergarten (half-days) for five-year-olds
>> Increase the number of full-day schools and expand need-based full-day child care
>> Expand the vocational diploma programme for apprentices and the vocational school-leaving examination for adults as a course of study
>> Introduce Austria-wide educational standards and partially standardised final examinations
>> Further develop the school system in terms of better individual support and an increase in permeability, especially in lower secondary school
>> Strengthen human potential in the areas of mathematics, information technology, life sciences, and technology through targeted funding in (pre-)school education and at university institutions

Improve educational transitions

>> Expand career orientation and study advising in schools (such as a study checker ("Studienchecker") or trial studying ("Studieren probieren"))
>> Establish flexible study entry phases in all diploma and bachelor's programmes

Improve quality assurance and quality enhancement of higher education institutions

>> Develop an "Austrian model" for future distribution of financing to universities based on student-related functions (teaching) and research
>> Improve supervisory relationships between students and faculty
>> Develop indicators for improving quality of teaching in higher education

Improve integration programmes

>> Increase hiring of teachers whose first language is not German, and intercultural employees
>> Offer more language teaching
>> Design flexible recognition and equivalence validation of diplomas and other degrees

Increase mobility

>> Targeted increase of mobility among students and graduates in selected countries
>> Expand exchange programmes for pupils, students and teachers at all levels with research-, technology- and innovation-intensive firms and abroad

Improve conditions for researchers at universities

>> Make awarding of permanent positions at universities transparent and performance-based
>> Improve collective agreements and the University Act concerning the tenure-track system (implement a career model with options for unlimited employment, dependent on performance evaluations)
>> Increase support for doctoral candidates and post-docs by expanding structured programme offerings

Strive for gender equality in research

>> Include gender-specific budgeting measures in all research support
>> Establish individualised support measures for women studying to become scientists
>> Support measures for improved compatibility between career and family

3 Creating knowledge, promoting excellence

The foundation of a knowledge-based society

Basic research is driven by curiosity, expands the frontiers of scientific knowledge and creates a reservoir of new knowledge that can lead to radical innovation. It represents one of the major pillars of the innovation system. Its significance as a location factor in knowledge-based economies grows the closer we approach the front lines of technological development and socio-economic innovations.

Basic research is a key area of the government's responsibility in research and innovation policy. In common with all highly developed industrialised countries, basic research in Austria is also funded overwhelmingly by the public sector. Therefore basic research plays a major role in the federal government's strategy for research, technology and innovation.

The ability of basic research to fulfil its goal in the innovation system depends considerably on the quality of the site – primarily universities – where the research is carried out. Seventy per cent of basic research is performed at tertiary education institutions. Since the Universities Act 2002 conveyed autonomy to universities, they have been involved in dynamic and complex development processes. Autonomy opens up opportunities and tasks universities with raising their profile. However, their ability to do so is defined primarily by their disposable financial resources. Universities are in constant global competition to attract the best and the brightest minds for their research. Their appeal to excel-

lent researchers from both inside and outside the country will be a crucial factor of the human potential throughout the research location Austria.

Non-university research institutes are also involved in this global competition for top talent. Whether traditional institutions, such as the Austrian Academy of Sciences, or new institutions founded in recent years, such as the Institute of Science and Technology Austria (IST-Austria), they fill in the research landscape around the universities. The strategic objective for basic research in Austria is to create a productive relationship balancing competition and cooperation among these excellent research institutions.

The promotion of collaboration between science and business since the 1990s has given rise to a broad spectrum of successful institutions alongside universities and firms. These new sites of collaborative research enrich the research landscape: the COMET programme's Competence Centers for Excellent Technologies, the Christian Doppler Research Association and its laboratories (CDG), the Ludwig Boltzmann Gesellschaft (LBG) and the institutes of Austrian Cooperative Research (ACR). The Austrian Institute of Technology (AIT), which was recently strategically repositioned, represents a cornerstone of research oriented toward the business sector. All of these organisations form an important segment in a diverse non-university research scene with different institutions.

The quality of research, however, is also determined by the quality of the available infrastructure. "State of the art" research, and along with it the dynamic development of our knowledge-based society, require researchers to have access to competitive equipment and infrastructure at their institutions. The shared use of major research infrastructures among firms, universities and non-university research institutes is an essential option.

UNIVERSITIES AND BASIC RESEARCH

Status and challenges

In international comparison, basic research in Austria – both in terms of monetary inputs and outputs (publications, quotations, etc.) – is located in middle field; however, it is lagging behind the global benchmarks, such as the USA and European reference countries. The proportion of financing for basic research as a share of gross domestic product was 0.44% (according to the last complete survey in 2007), which was lower than in important OECD countries.

In the context of the successful catching-up process that Austrian research has completed in recent decades, the public sector has significantly increased its expenditures on research and development. Financing of basic research, however, was comparatively static. From 2002 to 2007, public expenditure on corporate research grew from € 404 million to € 598 million, or by 48%, whereas expenditures for academic research – which go primarily to basic research in Austria – increased from € 1,157 million to € 1,446 million, or by 25%.[6]

Academic research in this context refers to the research conducted at universities and other institutions in the tertiary sector, including such institutions as the Austrian Academy of Sciences, IST-Austria and the AIT.

Nevertheless, Austria has built up substantial research capacity of international elite quality, such as in materials physics, quantum physics and the life sciences, as well as in the humanities, social sciences and cultural studies. This is reflected in the successful participation of many

6 *According to figures from the Austrian Institute of Economic Research (WIFO) and Joanneum Research*

Austrian-based scientists in EU Framework Programmes and the first calls for proposals from the European Research Council. We must strengthen this foundation of excellent basic research. At the same time, we must constantly work on further developing this potential into new fields with promising perspectives.

With the Austrian Academy of Sciences' newly created research agencies – the Institute for Molecular Biotechnology (IMBA), the Gregor Mendel Institute for Molecular Plant Biology (GMI), and the Research Center for Molecular Medicine (CeMM) – and the improvement of existing academy institutes, as well as the founding of IST-Austria, Austria has established several new instruments for building up excellent research. Together with the universities, these institutions could form the nucleus of excellent research done in Austria; we must work to upgrade and expand this, solid core through the promotion of networking, the construction of shared infrastructure, and fine-tuned human resources policy. We must therefore adapt the structures of the Austrian Academy of Sciences to meet these new requirements.

In this context the growing international competitive pressure on top researchers represents one of the greatest challenges. The Excellence Initiatives in Germany, which provide elite universities with significantly better funding, for instance, are creating a strong brain drain effect on top research personnel. Austria must promote the excellence segment of its own basic research to establish and expand the attractiveness of this research location for top researchers, and thereby Austria's position. On the other hand, we must improve the international visibility of basic research in the university sector through appropriate personnel, financing and infrastructure conditions.

In order to do this, we must further strengthen competition-oriented financing in university research. Third-party funding via research projects of the Austrian Science Fund (FWF) that have been evaluated in competitions, signals a stronger orientation on quality. Corresponding to the international trend, funding of overhead costs for research is taken into account. An overhead premium for research projects ac- quired through competition is a goal-oriented and unbureaucratic way to support evaluated research achievements and strengthens the position of researchers at universities and other institutions.

The autonomy of Austria's universities makes them strong, independent partners for implementing strategic goals related to research policy. This partnership is defined within the legal framework of the Universities Act and is substantiated in the multi-year performance agreements between public sector financing and autonomous universities.

For the implementation of this research strategy, it is essential that performance agreements provide clear stimuli for universities to encourage strategic orientation and strengthen cooperation among universities to ensure efficient utilisation of all available resources.

Objectives: Universities and basic research

- We want to increase investments in basic research by 2020 to the level of leading research nations.
- We want to improve basic research by implementing further structural reforms in the university system.
- The university financing model should be reformed. Research financing should become more competitive and project-based.
- University research financing, in the form of third-party funding from the Austrian Science Fund (FWF) via competitive applications, must be strengthened and given appropriate financing.
- The establishment of individual profiles of universities should be supported by creating Clusters of Excellence.
- The orientation of teaching and research topics at universities, and the collaboration with non-university research institutes, should be better aligned with an overall strategy.

Support measures

>> Develop an "Austrian model" for future distribution of financing to universities based on student-related functions (teaching) and research

>> Expand third-party financing of university research via Austrian Science Fund (FWF) projects evaluated in competition, with lump-sum coverage of 20% of overheads

>> Implement an Austrian excellence initiative, by creating up to ten Clusters of Excellence by 2020

>> Develop performance agreements into an instrument for better coordination of research topics among universities and for promoting collaboration with other research institutions

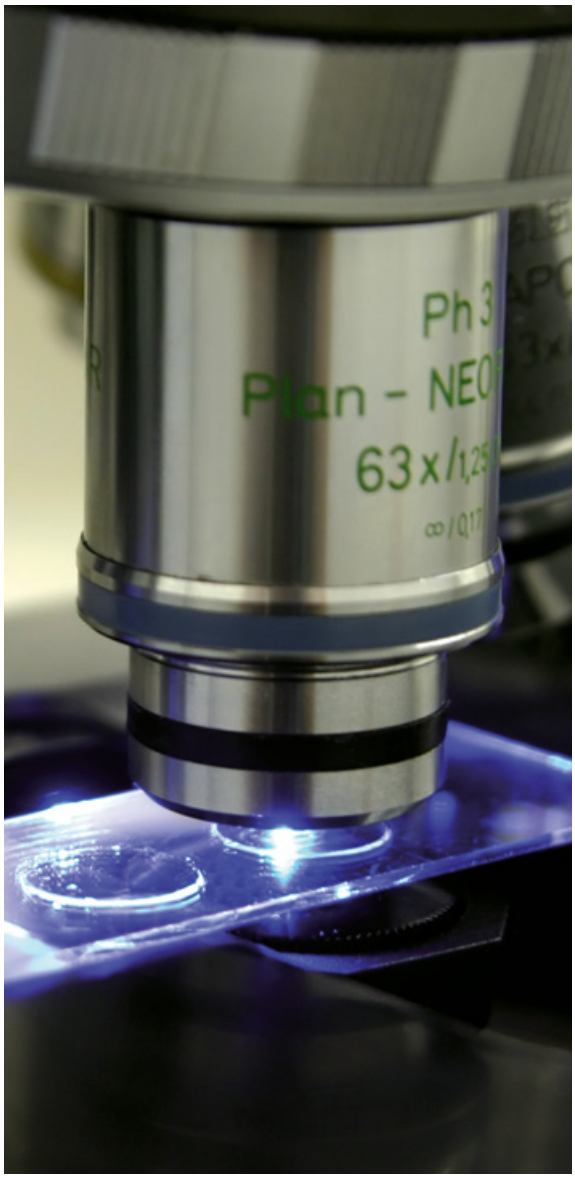
>> Refinance the infrastructure acquired before 2004, based on an inventory survey and partially finance new infrastructures for cooperation between university and non-university research institutes

>> Reform the structure of the Austrian Academy of Science by creating a development plan, concluding performance agreements, and introducing modernised financing and liquidity management

NON-UNIVERSITY RESEARCH INSTITUTES

Status and challenges

In addition to the university sector, Austria has established a diverse and differentiated landscape of non-university research institutes into which approximately one-third of public expenditure on research and development flows. These institutions are an essential pillar of Austrian research, providing important stimuli, especially in research that serves social development and innovations in the corporate sector.



Thus, a wealth of different structures – in terms of responsibility, financing forms, mission, management and degree of scientific methods – have emerged from various development contexts. So far, there have hardly been any basic empirical surveys on their role and their effect on the innovation system.

Diversity and regional distribution promises flexibility, creativity and competition, yet it also leads to a structure dominated by small units, with high fixed costs and inefficient parallel structures. Often, the means for building up long-term competence are not available. Consequently, several non-university research institutes do not have a clear picture of their role.

Efforts are underway, and should be intensified, to strengthen collaboration and share profile building between universities, universities of applied science, and firms, as well as between universities and non-university research centres in applied and basic research (cf. Chapter 4). At institutions of applied research – such as AIT, ACR and Joanneum Research – a comprehensive reform and strategy process was and is being conducted, and should be continued.

Objectives: Non-university research institutes

- Develop clear role models along defined performance goals for various institutions in the non-university research sector
- Internal research institute structures should be strengthened through reforms and adjusted to new requirements.
- The overall structure of the non-university sector should be optimised to improve coordination.

Support measures

>> Reform the structure of individual institutions and further international and strategic positioning of the Austrian Institute of Technology (AIT)
>> Finance non-university institutions with temporary performance agreements and subsidy contracts based on criteria such as publications or patents
>> Flexibly shape research structures with stimuli for the (re-)integration of non-university institutions into universities or other, larger research structures
>> Create non-university research structures primarily in the form of temporary institutions
>> Reform and standardise the regulatory framework by redrafting the Research Organisation Act (FOG)

RESEARCH INFRASTRUCTURE

Status and challenges

A competitive infrastructure at research institutions, and access to international infrastructures, is an indispensable prerequisite for a competitive research location. According to user surveys conducted for the System Evaluation, however, the availability of and access to research infrastructures represent, after human resources, the second greatest bottleneck for the development of research in Austria.

Both research institutions and firms agree on this point. Expanding Austria's infrastructure and synchronising it with international elite standards is therefore a major challenge.

Thus far, signs of a coordinated, shared procurement and use of infrastructures are only found in high-profile cases where the visibility of investments is already high enough. The efficiency and effectiveness of funding allocation requires the coordination of infrastructure procurement and use on the basis of a national overview of the research sector.

Furthermore, future participation in pan-European infrastructures is of decisive importance for Austria's competitiveness as a place to do research.

Objectives: Research infrastructure

- We want to expand research infrastructures in Austria as the foundation for excellent research and to internationally position Austrian research in a coordinated manner.
- The development of research profiles of universities and non-university research institutions as hubs of research infrastructure strives to guarantee optimal coverage, synergies as well as increase existing strengths.

Support measures

>> Develop a binding "national roadmap for research infrastructure"
>> Provide stimuli for networking infrastructures to achieve critical mass, such as financing of large infrastructures linked to concepts of coordinated usage (such as high-performance computers)
>> Expand cooperation of research institutions and firms on the basis of a shared infrastructure
>> Austrian participation in European and international infrastructures in the context of the ESFRI roadmap
>> Develop a regulatory situation for using infrastructures such as biobanks and statistical data bases

4 Utilising knowledge, increasing added value

Activating innovation potential

As a high-income country, Austria can only secure and expand its competitiveness and quality as a location to the extent to which the transformation to a knowledge-based economy takes place. The prerequisite is an on-going intensification of the transfer process from science to the economy: newly created knowledge must find a shorter path to utilisation. This means substantially increasing the scope and level of innovations that are developed and implemented in Austria. Increasing numbers of Austrian firms should develop technological or market-oriented competitive advantages through innovation so they can become market leaders in global competition, creating economic growth and jobs. To do this they will need to intensify more ambitious research and development activities in firms performed by highly skilled employees on the foundation of the latest scientific findings. This is why increasing the performance of the innovation system is one of the fundamental tasks in a strategy for research, technology and innovation, which will make Austria an Innovation Leader. We must adopt a broad approach to innovation that not only includes technological, research-driven and non-technological innovations in manufacturing and in the service sector but also ecological and social innovations as well as innovations in the public sector.

Incentives to increase efforts in innovation can be implemented at the supply side, promoting technological developments. Austria has primarily followed this approach in the catching-up phase. But essential stimuli for more innovation can also come from the demand side. The way public procurement is handled, setting norms, defining standards and regulatory frameworks for economic actors can all have a decisive influence on the demand for innovative solutions and the size of the markets for innovative products.

The competition policy framework is also a crucial criterion for an economy's innovation power. Support measures for intensifying competition – especially in sectors previously shielded from international competition – can significantly boost innovation efforts. International comparison figures suggest that Austria still has considerable potential for intensifying competition. This was also confirmed in the results of the System Evaluation. The System Evaluation also showed that there is still potential for further reducing the time and costs for starting a business.

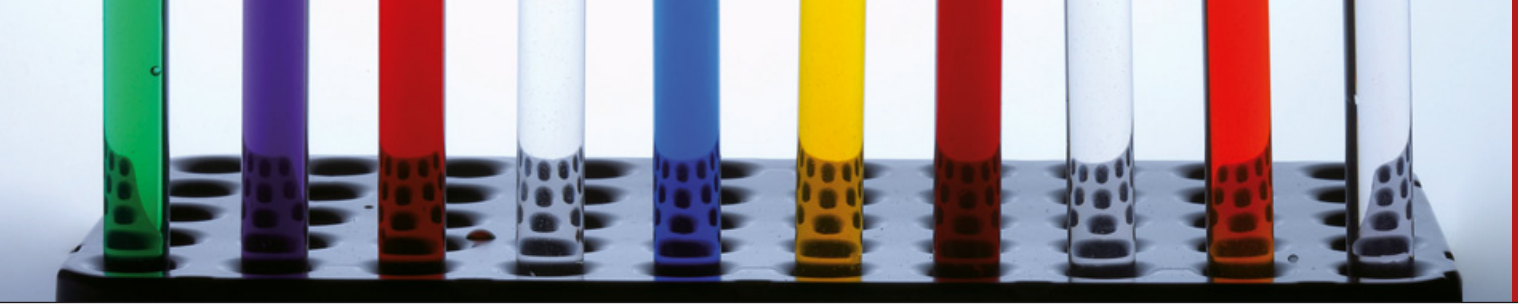
INNOVATION AND CORPORATE RESEARCH

Status and challenges

The international comparative data from the European Innovation Scoreboard (and its latest advancement: the Innovation Union Scoreboard) document an impressive catching-up process that Austria has completed over several years, improving its performance in research, technology and innovation and leading to Austria's position right behind the top nations.

This catching-up process was driven by, among other things, a significant increase in research and development expenditures from both the public and the private sector. Expenditures in the Austrian corporate sector have more than doubled in the last ten years, up to € 3.38 billion in 2010. Furthermore, financing from abroad reached € 1.17 billion in 2010, including the returns from the EU research framework programmes.

Nevertheless, the share of value added in corporate-sector industries focussed on research, technology, education and science is still developing too slowly in international comparison.



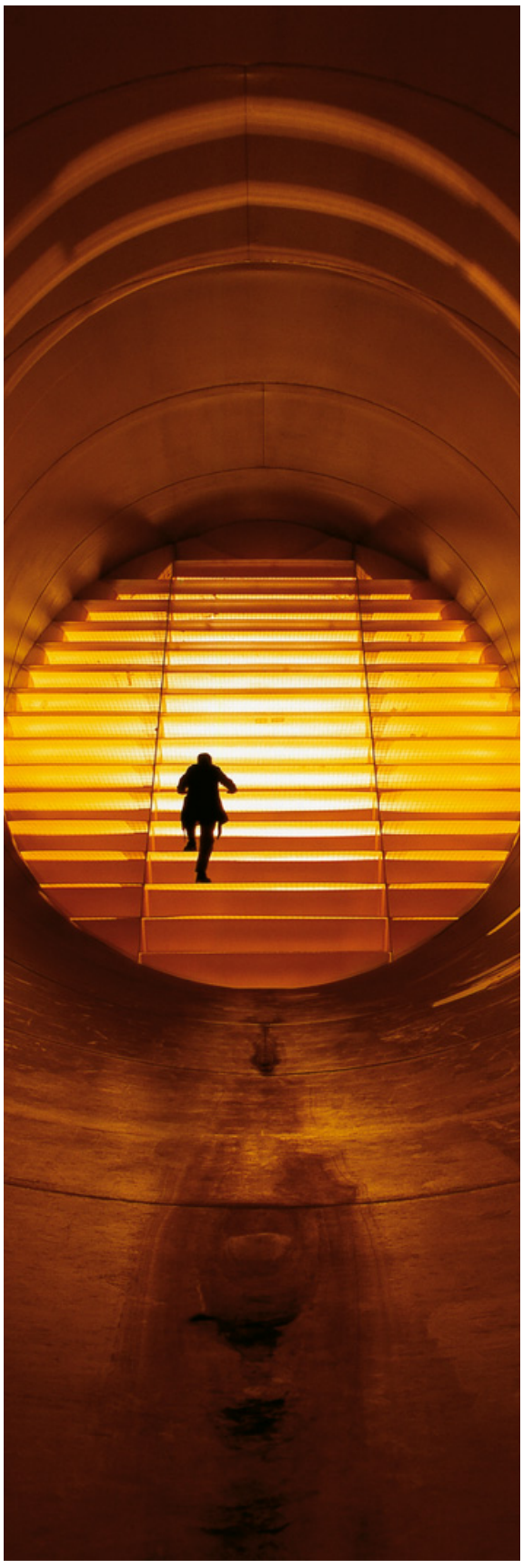
Innovation potential has not yet been fully realised, above all regarding the output targets. This can be seen in below-average performance of firms in innovations that are new to the market, in a low share of knowledge-intensive services, in a comparatively low technology content in export products and services, and below-average shares of employment in the medium- and high-tech sector of manufacturing.

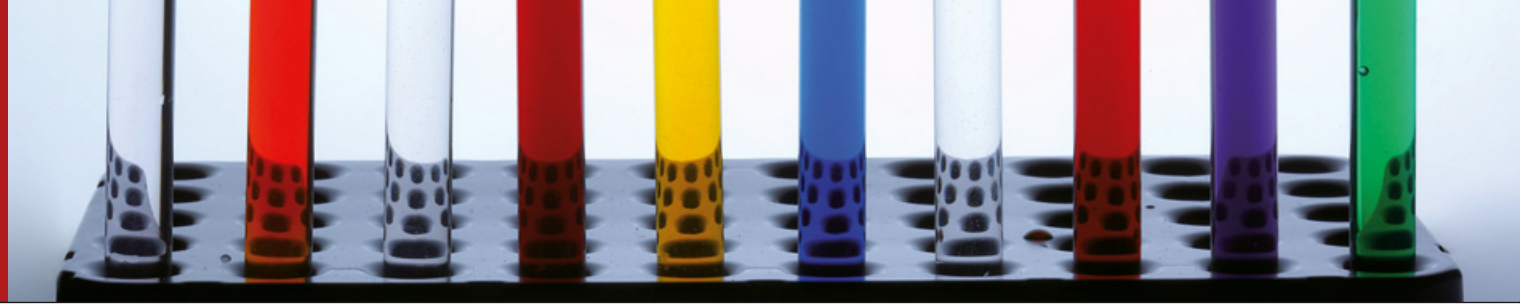
Yet there are also deficits on the input side. Despite highly dynamic developments in recent years, financing from industry still has a too small share of gross domestic expenditure on R&D. In 2010, the ratio of public to private investments in research and development was at 43 to 57 per cent, thereby deviating significantly from the targets of the Lisbon Process by one- to two-thirds. This is why we must make a special effort to further increase corporate research.

So our challenge now is to keep the innovation system on its dynamic path of development. We need to activate all of the innovation system's potentials. This requires a strategic bundle of measures that go beyond a narrowly defined technological, supply-side innovation policy: it includes demand-side measures, such as public procurement and a competition policy that stimulates innovation.

If the demand for innovative products and services in Austria – e.g. through public procurement – increases, then not only will the quality of publicly created infrastructure and services improve; rather, reference markets for Austrian technology firms will also grow, which can again encourage corporate research and development.

Austrian innovation policy, however, is still too focussed towards a narrowly defined concept of high-tech innovation that does not focus enough on non-technological aspects such as organisational innovations, service concepts and new





business models. In this context the increasing importance of users and consumers in developing innovative products and services must also be taken into account.

The focus here should expand upon the Austrian economy's strengths and on the structural improvement of the Austrian manufacturing and service sectors in the direction of higher research and knowledge intensity; the expansion of innovation activities at all firms, especially in small- and medium-size enterprises (SMEs); stronger exploitation of the potential of creative industries; substantial increases in the level of innovation; and a significant improvement in financing by mobilising private equity and venture capital.

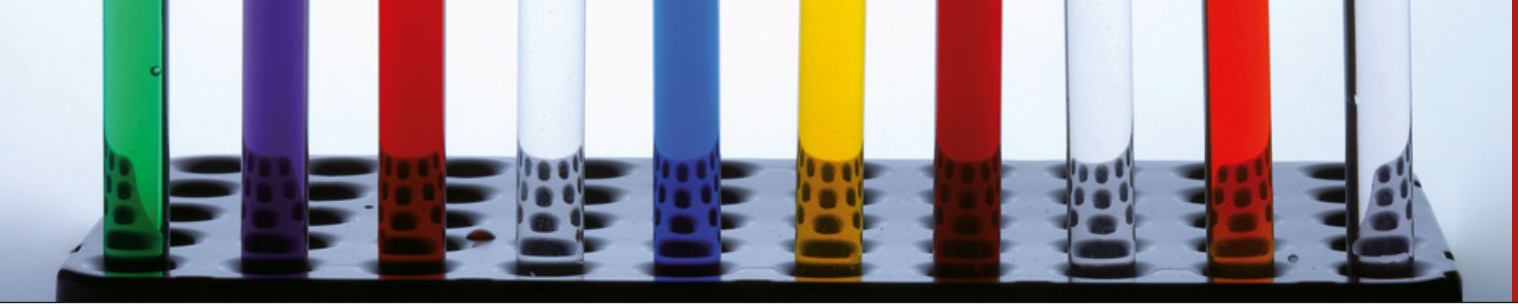
Due to Austria's strong dependence on international corporate parent companies for corporate research and development investments, locational quality plays an important role in research financing. A multinational corporation's decision as to where to locate a research centre is based upon several factors.

In addition to generally important elements such as taxation and political and legal stability, firms also place great emphasis on such factors as the availability of skilled employees the protection of intellectual property, and the local presence of universities and faculties that specialise in science and engineering.

In the area of human resources, Austria however is experiencing an increasingly critical bottleneck that must be overcome. A taxation system that keeps costs low for research development is not decisive, but it can, ceteris paribus, like the range of direct subsidies, positively influence decisions about where to locate a research facility.

Objectives: Innovation and corporate research

- We want to enhance domestic value creation by encouraging research intensive industries and knowledge intensive services. In the process, we want to stimulate innovations through a strong emphasis on demand-side instruments in public procurement, regulation and standardisation.
- The number of firms that systematically conduct research and development should be increased between 2010 and 2013 by a total of 10% from 2700 and by a total of 25% by 2020.
- The role of internationally successful Austrian leading firms as a central pillar for the innovation system should be strengthened and the research and innovation potential of small and medium enterprises should be activated.
- Austria's attractiveness as a location for research and technology intensive firms has to be increased further.
- The innovation level of firms has to be raised by expanding the share of radical innovations that are new to the market.
- The structure of the manufacturing and service sectors has to be improved by increasing the innovation and knowledge intensity of firms.



Support measures

>> Expand direct funding and its optimal coordination to include indirect funding for activating and increasing both corporate research and innovative performance among firms

>> Stimulate innovation through demand side measures, especially via increased use of innovation-friendly approaches in procurement processes (such as competitive dialogue or functional service description

>> Intensify innovation in the public sector (such as energy efficiency in public buildings, e-governance, e-health) and in public infrastructures

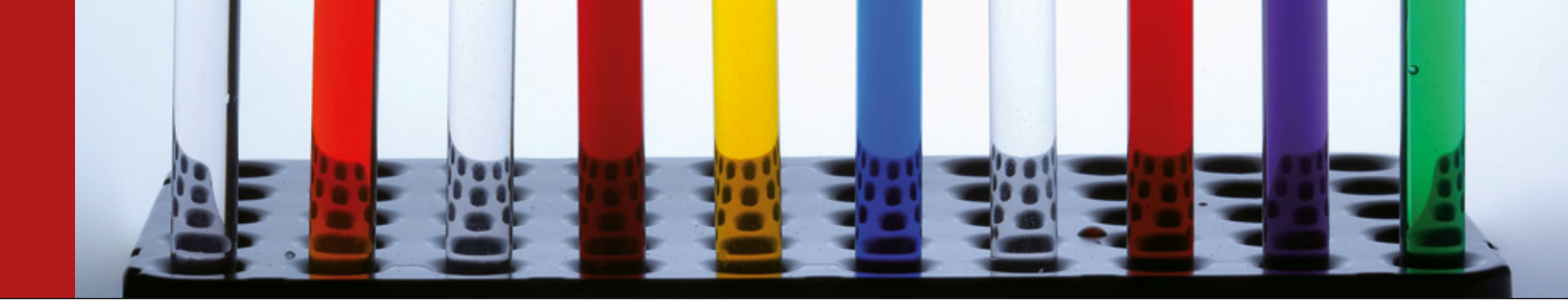
>> Improve the situation for, and intensify efforts to attract additional research-intensive firms and expand headquarter functions

>> Implement an innovation-oriented infrastructure policy, e.g. via innovation-friendly public procurement and high-tech investments in domestic infrastructure, while at the same time supporting technology firm exports

COOPERATION BETWEEN SCIENCE AND BUSINESS

Status and challenges

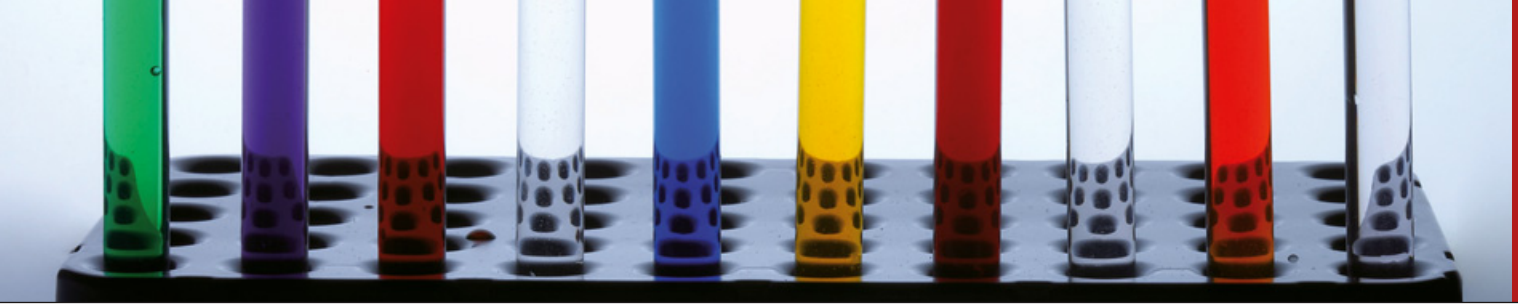
In the 1990s, the low amount of interaction between science and business was identified as one of the critical deficits in the Austrian innovation system. Since then, cooperation between universities and firms has fundamentally improved. Interventions via research and techno-



logy policy (such as the Competence Centre Programme, the Christian Doppler Research Agency, and the Bridge and COIN programmes) have made a difference, as has the Universities Act of 2002. As a result, Austria is now among the international leaders in cooperation intensity between science and business. In order to protect these gains, we must now continue to optimise support measures and adjust to shifting situations. Because the structural improvement of Austrian business in the direction of more knowledge and research intensity, and the increases in innovation can only be attained with a stronger utilisation of the (scientific) research base, easier access (also for SMEs) to sources of knowledge, and rapid utilisation of research and development results. However, knowledge transfer requires that appropriate entrepreneurial and content-based competencies in innovation and knowledge management exist, both in firms as well as in science and research institutions.

Objectives: Cooperation between science and business

- We want to increase the cooperation intensity of Austrian firms and strengthen the strategically oriented collaboration between science and business – with a special focus on excellence and sustainability.
- This means that we must reduce barriers and hindrances among firms, especially SMEs, for cooperating with science/research facilities, and make it easier for innovative firms to access external resources.
- This will allow more firms to expand their technology leadership and attain top positions in innovation.



Support measures

>> Further develop support measures for research cooperation, networks and strategic alliances with a focus on excellence and sustainability (such as COMET, Bridge, COIN) and models for thematically focussed basic research (such as CDG)
>> Strengthen the leverage and transfer functions of clusters and intermediaries
>> Identify areas of strength for bundling resources and tapping synergies, and support development in leading topics in research and development (between industry and science/research)
>> Support the "linking" of Austrian firms and scientific research institutions to EU and international programmes
>> Support firms in securing and enforcing intellectual property and its implementation
>> Expand initiatives for strengthening human resources in the area of applied research, and for improving intersectoral and international mobility

START-UPS AND VENTURE CAPITAL FINANCING

Status and challenges

Finally, research, technology and innovation policy is also measured by its contribution to accelerating structural transformation. Austria's innovation system still has clear deficits in this area.

The early-stage dynamics of technology-based and innovative firms still have high development potential. According to estimates from the Council for Research and Technology Development, only 5-10% of approximately 30,000 annual start-ups are knowledge-intensive, technology-oriented firms. The proportion of young, fast growing firms is significantly below average in international comparison.

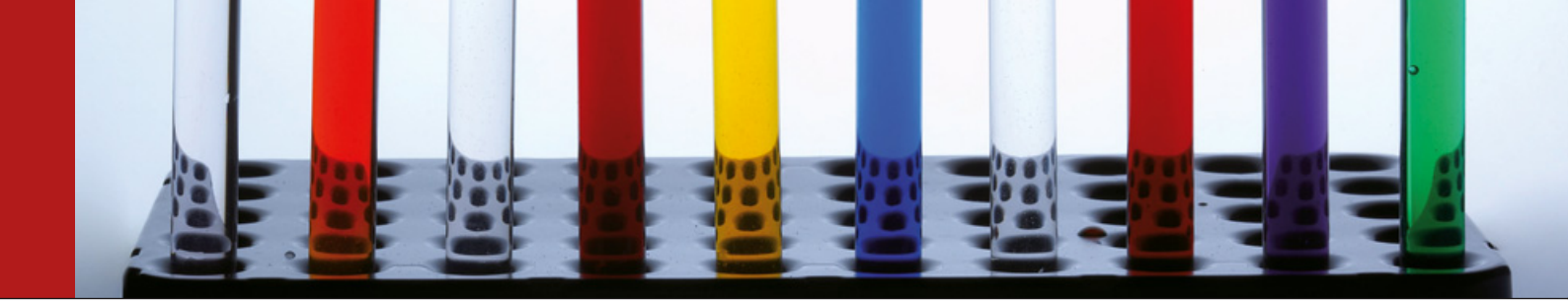
The weakly developed venture capital market in Austria (especially in early-phase investment) is causally linked with this fact. In Austria, financing structures are traditionally oriented towards loans, which tends to prevent financing high-risk innovation activities. Specific challenges must be overcome to strengthen equity capital financing of research and development investments. In international comparison with Europe's most innovative countries, Austria shows significant weaknesses in this respect.

As the Innovation Union Scoreboard shows, the share of venture capital in Austria in 2009 stood at 0.03% of GDP, far behind leaders such as the United Kingdom (0.26%), Sweden (0.23%) and Finland (0.15%).

What is needed here above all are two things: first, to guarantee legal security in the area of investment companies by creating modern, internationally competitive legal conditions; and second, to establish role-models (profitable funds as a success story for other investment companies and investors).

The public sector can play an important role as legislator and cornerstone investor. Institutions associated with the public sector assume the role of an investor in a private investment fund, thereby signalling to others trust in the management and business strategy.

Despite positive developments on the marketplace in recent years, not as many companies take advantage of going public as in top innovation countries. While Austria's stock exchange has a market capitalisation of about 18.4% of GDP, top countries like Switzerland are at 176%. Even if we consider that traditional stock exchanges, such as New York (79.4%), London (69.4%) and Tokyo (66.4%) are not representative for Austria, the gap between Austria and countries such as Finland, Sweden and Denmark (46.4%) and Israel (53.3%) is significant enough.



Due to subpar market conditions in the stock exchange, venture capital and private equity segments, Austria's firms, and especially her innovative entrepreneurs, lack crucial sources of financing for research and development investments. This must be addressed with legislative measures.

Objectives: Enterprise formation

- We want to substantially increase the intensity of private equity and venture capital in the formation of technology-based, innovative firms.
- The number of knowledge- and research-intensive new start-ups should climb annually by an average of 3% until 2020.
- The growth of innovative firms should be accelerated.

Support measures

>> Create a regulatory framework to strengthen equity capital in young firms that are oriented towards technology and growth

>> Expand venture capital initiatives to stimulate early-phase investment, taking previous developments into account

>> Optimise and complete existing support measures for forming technology-based and innovative enterprises, focussing above all on measures for the start-up phase (cf. pre-seed, seed financing, business angels, technology marketing, etc.)

>> Strengthen finance competence and entrepreneurship at universities, including the establishment of knowledge transfer centres

>> Develop new financing models with venture capital investment for realising university intellectual property rights (IPR), and establish university-related venture investment companies

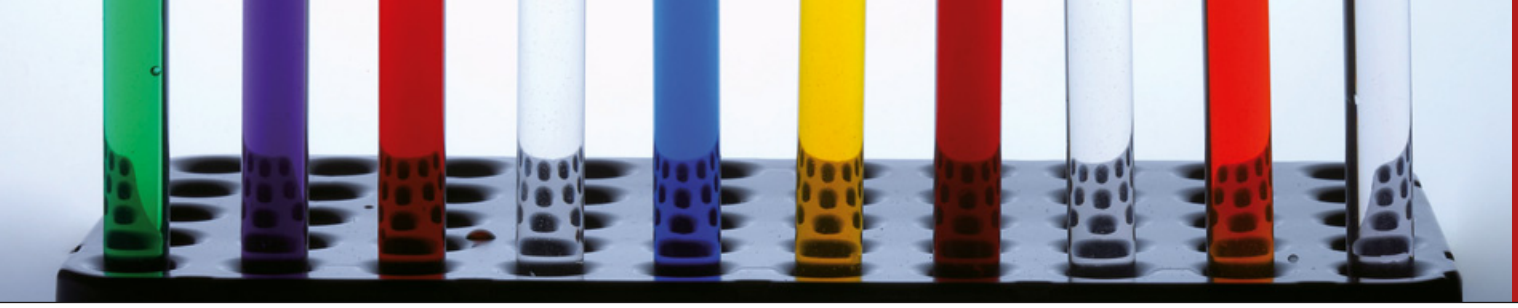
PROMOTE INNOVATION THROUGH COMPETITION

Status and challenges

The intensity of competition is assumed to have a major influence on innovation activity. The core of entrepreneurship is the firm founders' endeavour to improve their financial position by constantly seeking out innovations. This is the engine of economic growth and social transformation. The task of competition policy is to provide entrepreneurs with a challenging yet fair environment in which they can manifest their opportunities and have a successful future. The primary goals of competition policy are to intensify innovation activity and achieve efficiency gains.

The connection between competition and innovation is not linear; instead, it depends on industry-specific elements and market factors. Working out shared standards has the advantage that it ensures competition in the market between manufacturers of products who use the same norms. On the other hand, there is a danger that norms create barriers to market entry, leading to new impacts that hinder competition. This is why a applied innovation policy must resort to sector-specific support measures. When forming research clusters, we must ensure from the start that competition is not excluded.

In some industries, especially in the service sector, Austria lags in competition intensity when compared internationally. For this reason we must make it easier to form an enterprise, e.g. by lowering the administrative costs and shortening the time it takes. We must also improve market entry regulations in terms of education requirements and licensing. A high-quality system of commercial legal protections plays a decisive role in ensuring steady technological progress and innovations in our domestic economy.



Improving the system of fulfilling competitive regulations also makes a decisive contribution to ensure that competition functions in all markets. The Austrian Federal Competition Authority should be strengthened and the organisation of competition authorities should be reformed to achieve optimal synergies of all institutions active in this area.

Objectives: Promote innovation through competition

- We want to stimulate innovation via an active competition policy.
- To do this, institutions that monitor competition should be strengthened.
- Starting a business should be made much easier and relieved of cost burdens.

Support measures

>> Remove administrative hurdles in the areas of enterprise formation and service regulations
>> Reform of the Austrian Federal Competition Authority (tasks, powers, resources)
>> Conduct sector-specific analyses (for example, in the fuel and food markets)
>> Assess competition policy regulations in terms of innovation obstacles

5 Providing guidance, establishing frameworks

Efficiently organising political governance

National innovation systems are complex networks of relationships between a large number of actors that all have specific roles. The productive power of these innovation systems thus depends to a significant degree on efficient governance, that provides guidance and establishes frameworks. It should open up opportunities that allow policy and administration, innovation actors and institutions to move toward their objectives, thereby promoting the progress of the entire system.

The situation for political governance, however, is in the midst of a fundamental transformation. On one hand, the Austrian innovation system is facing new challenges. The catching-up phase is over. The Innovation Leader group is within reach. Closing this gap is a core goal of this strategy. On the other hand, today's economic and societal challenges have global dimensions, suggesting a degree of complexity that requires comprehensive, systematic and increasingly international solutions.

Political governance of the innovation system cannot be restricted purely to research, technology and innovation policy in its narrower sense. It can only be effective in mutual agreement and cooperation with other policy areas, such as educational policy, competition policy and a general policy of international openness and mobility.

The most pressing topics in policy management therefore extend across various political areas.

These include:

- >> efficiently arranging governance structures and distributing competencies and tasks;
- >> creating clear mechanisms for setting priorities;
- >> transparently structuring the subsidy system to reflect priorities;
- >> acting coherently in a multi-layered political system, from internationalisation to regional coordination;
- >> creating an adequate environment for dialogue between science and business.

GOVERNANCE STRUCTURES

Status and challenges

In the course of Austria's successful catching-up process in research, technology and innovation, political governance has created important structures in the innovation system that have supported the good overall performance. With the completion of the catching-up process and the new goal of becoming an Innovation Leader, the demands on the national innovation system are changing.

At the same time, economic and societal problems are posing increasing challenges to research, technology and innovation. Solution expertise is needed, and this requires comprehensive ideas that transcend the boundaries between fields of policy action, that apply across institutions, and that include stakeholders from all segments of the innovation system, from scientists to innovators on the market. The task of policy management will therefore become more and more complex and will require new approaches.

The findings of the Austrian Research Dialogue and the CREST Report, the System Evaluation and recommendations from the Council for Research and Technology Development on the federal government's RTI strategy, have located a few weaknesses that the Austrian governance system has in the face of these challenges.

The System Evaluation identified their causes to be primarily in the "compartmentalised and fragmented policy structures". These structures stand in the way of a systemic overview, com-

plicate the coordination of sector-specific policy approaches, and frequently drive cooperation to the informal and personal level.

The System Evaluation views the division of labour between ministries and agencies as legally clear, “however, the agencies, when it comes to agenda setting and strategic development, have far more influence than is ascribed to them on the basis of theoretical requirements. On the other hand, ministries are often also active when it comes to implementing initiatives.” Asymmetrical information distribution between ministries and agencies make effective management difficult, as does the double function of ministries as owners and clients in programme development. To improve the assignment of roles, a shared process is recommend that leads step-by-step to more strategic management by the ministries on one hand and to more operational independence for agencies on the other.

Furthermore, the political governance mechanism was enriched by additional stakeholders – above all by functional integration in the form of councils – and independent grant and financing institutions such as the National Foundation for Research, Technology and Development or the Climate Change and Energy Fund (KLI.EN), although, according to the System Evaluation, too little attention was paid to the functions that these entities fulfil in the system.

Objectives: Governance

- We want to coordinate the competencies of the responsible ministries in a clear way. To do this, efficient coordination mechanisms should be established among the responsible ministries.
- Task distribution among the ministries and funding agencies should be optimised by granting higher operational independence to the agencies and simultaneously strengthening strategic management by the ministries.
- At the funding agency level, task administration should be tidied up to remove duplicate efforts.
- The system’s effectiveness and intelligence should be increased by augmented management of objectives and outputs.

Support measures

>> Establish a Task Force for Research, Technology and Innovation at a high level, with the following responsibilities: Support, substantiate and coordinate the implementation of the new RTI strategy; the strategic and system-oriented articulation and coordination of individual ministries' activities; and deal with the recommendations of the Council for Research and Technology Development.

>> The Council for Research and Technology Development is the federal government's strategic consultancy body for questions related to RTI policy. The Council works closely together with the ministries on recommendations for the medium-to long-term orientation of this policy field. To do this, the Council for Research and Technology Development will provide an annual working agenda.

>> Strategically manage funding agencies via performance contracts based on output and impact goals

>> Increase system efficiency for the Climate Change and Energy Fund (KLI.EN) by enhanced exploitation of synergies, as well as further development and coordination of its instrument portfolio in the context of modern and flexible topic management

SETTING PRIORITIES

Status and challenges

Around the world, setting priorities in policy management is receiving more attention and weight in research, technology and innovation. The scarcity of financial resources is one reason for this, as is the identification of major societal challenges. The European Union has addressed the latter in the form of "Grand Challenges". Top-down policy prioritisation must, however, always be supported by evidence. We must find an adequate balance between top-down and bottom-up approaches to research funding.

Austria was and is required to focus its activities, especially when it comes to further development of generic knowledge and generic technologies, such as information and communication technologies, material sciences, life sciences, the humanities and social sciences. These are the drivers of new developments and enablers of economic and social progress.

Setting priorities in science and technology in Austria, however, is still not systematic enough and often reactive in character, assuming the form of ad hoc interventions. In addition, current practices yield priorities that are in essence purely ministry-specific priorities, which each ministry then uses to define its objectives. This leads to sub-critical measures and often to a reduced impact on the research and innovation system. This applies in particular to the solutions that research and innovation contribute to upcoming social problems. Therefore, in future, priorities should be defined and implemented according to the dimension of the challenge, as inter-ministry or ministry-specific priorities.

Before the priorities can be defined, there needs to be a systematic analysis (using foresight, monitoring and roadmapping) and social discourse. Priorities should be limited to a temporary timeframe, yet created for a sufficient and sustainable length of time. Moreover, they should be oriented equally towards scientific results, marketable products and social solutions as outputs. Financial planning reliability and the formulation of specific targets are essential prerequisites.

Grand Challenges

The urgent need for finding a new approach to establishing priorities becomes particularly clear when we consider the Grand Challenges, the great societal challenges of the future. They must be addressed in a way that covers the entire system. This requires new forms of collaboration between ministries, agencies and stakeholders.

Climate change, dealing with scarce resources, and ensuring quality of life in the midst of demographic change are unquestionably among the global developments that often have unforeseeable consequences and will require a major collective effort to be solved.

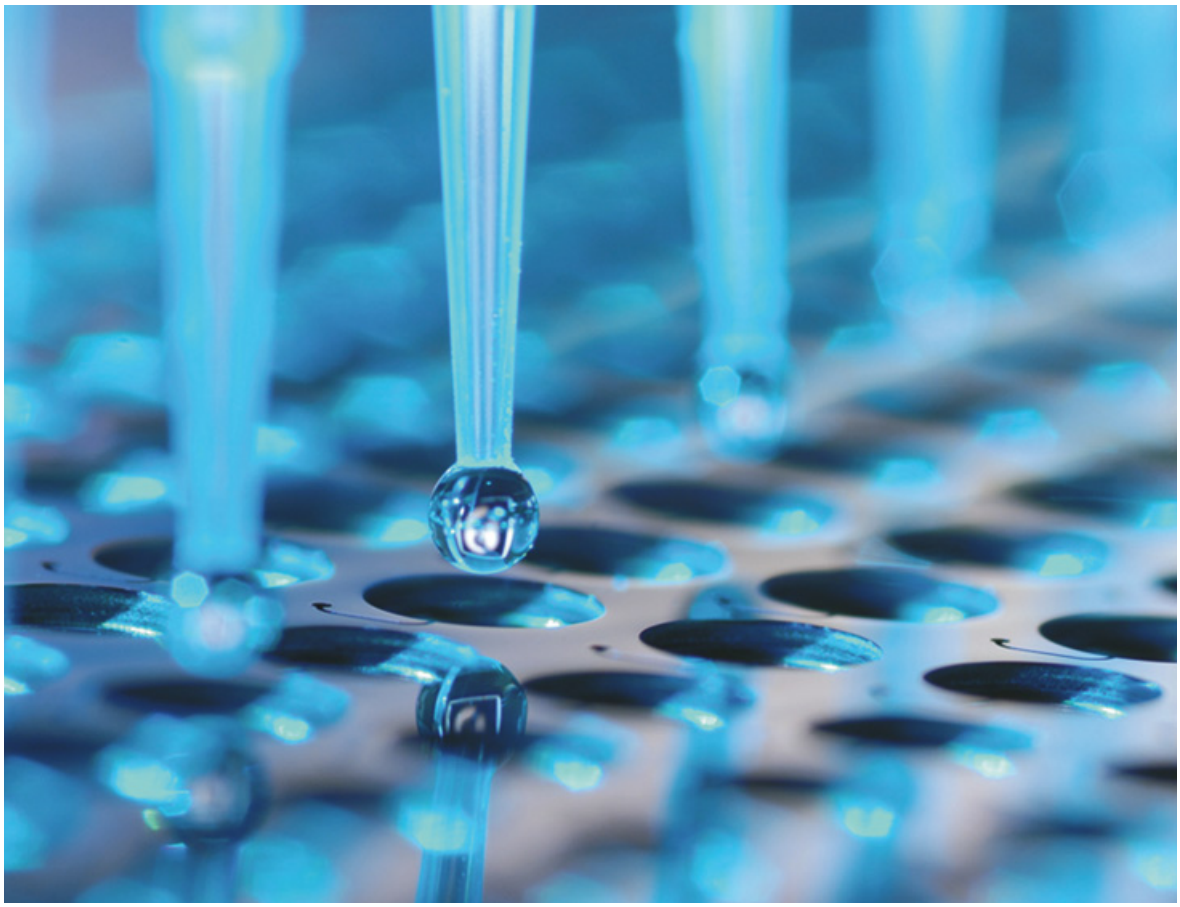
Climate change is necessitating the development and application of completely new technologies in energy use via factorial improvement of energy efficiency in construction, transportation (i.e., alternative propulsion systems, electro-mobility) and intelligent production. At the same time, adaptation strategies to climate change must be developed to address irreversible climate changes. On this issue, questions related to environmental changes are just as much in focus as those related to health care and food safety. This is a matter of technological, systematic and social research supported by analyses, impact studies, scenario and model building, space- and earth-based environmental monitoring, etc.

Global scarcities in energy, natural resources and strategic raw materials are increasing demand for renewable resources. This poses

not only a technological challenge for society, but also the necessity of adapting space and land use appropriately. Ensuring sustainable production of biogenic raw materials and fuels (for example, bio-energy, solar thermal energy, photovoltaics and geothermal energy), as well as their distribution via intelligent and secure infrastructures, requires comprehensive, regionally differentiated knowledge about ecological, environmental, economic and social conditions that must be gained through interdisciplinary, focussed basic research. Data, methods and models for continuous monitoring are indispensable for making sure that the effects of changing resource production and use can be constantly monitored.

Demographic change requires answers on how to guarantee a high quality of life that benefits both people and the environment. To do this, new and systematic research approaches must be developed that combine specific societal needs with social and product-related innovations. This last point will become increasingly important to support active lifestyles and self-sufficient modes of living.

Research, technology and innovation policy can contribute to solving these challenges by creating new knowledge, exploring innovative solutions, and providing more efficient and competitive technologies for society to use.



Objectives: Setting priorities

- We want to strengthen Austria's competitiveness in a wide range of cross-cutting fields in science and technology by focussing activities on units of internationally competitive size. To do this, fields in which domestic science and business are strong should be taken into account. Special attention must be paid to the competences and potentials of Austrian firms that can help implement research results for overcoming the Grand Challenges.
- Priorities in research and technology development should be set on the basis of systematic selection and decision-making processes. While doing so we must make sure that governmental priorities are sufficiently justified to prevent market or system failure.
- The definition of new priorities for specific challenges should lead to a concerted coordination of activities in a comprehensive system approach by all concerned ministries in the context of the Research, Technology and Innovation Task Force.
- To address the great societal challenges (Grand Challenges) of the future comprehensive system priorities must be established.
- Priorities should be defined on the basis of preliminary analyses, their effects should be limited in time, and they should be monitored.

Support measures

>> Develop national strategies for generic science and technology fields

>> Establish "inter-ministrial research, technology and innovation priorities" and "ministry priorities", as well as a definition of the mechanisms and structures for their implementation and realisation:

> Inter-ministrial research, technology and innovation priorities will be borne by several ministries and can gain political legitimacy if they are collectively presented by the Council of Ministers

> Ministry priorities address the implementation of goals and measures within one ministry's own area of responsibility and competence

>> Assess the creation of inter-ministrial research, technology and innovation priorities, particularly for the Grand Challenges of "climate change", "resources" and "quality of life and demographic change"

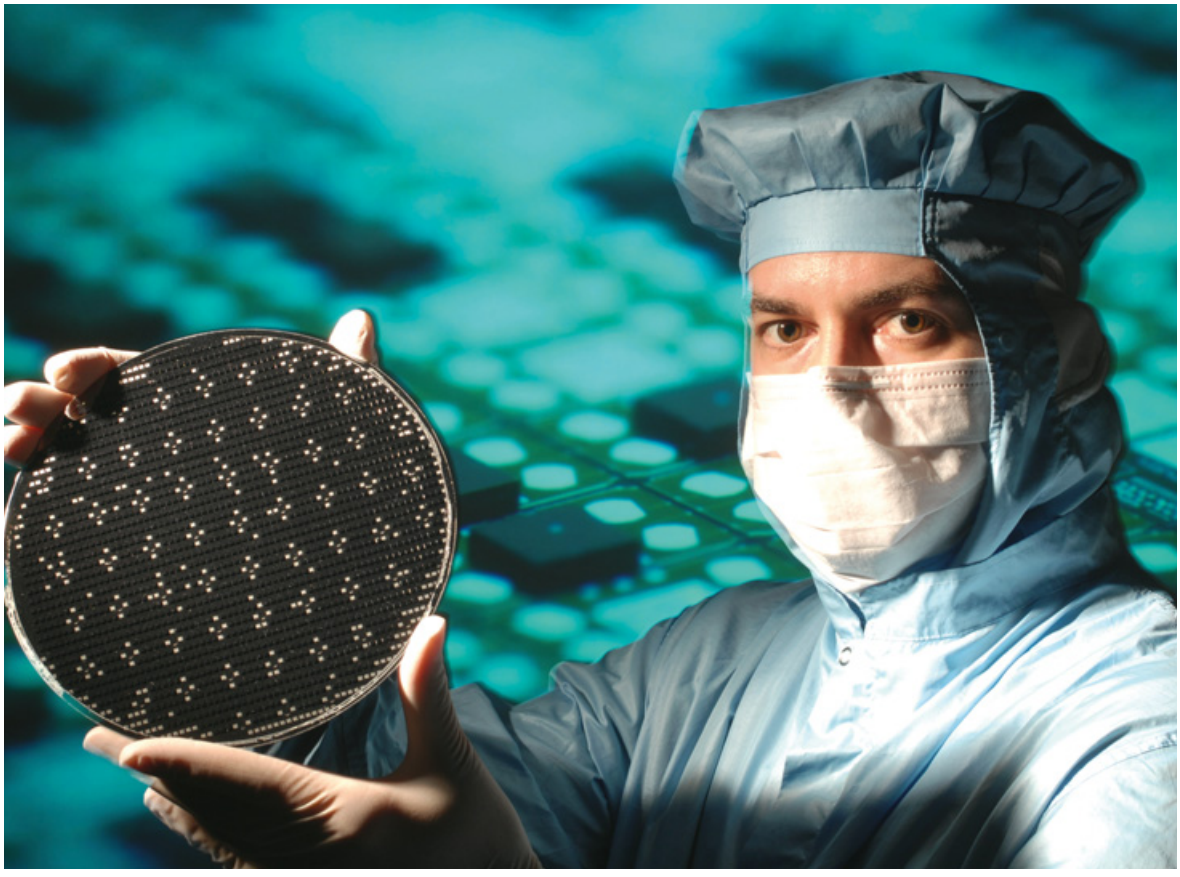
THE FUNDING SYSTEM

Status and challenges

The public sector has a wide range of options to create conditions and implement incentives that can promote research, technology and innovation in multiple segments of the innovation system. In Austria, this has led to a diversified funding system that covers everything from indirect funding via tax deductions, open-topic bottom-up funding-upon-application, to top-down programmes for defined topics.

However, the funding system focuses primarily on intervening through programmes. All available data confirm an over-reliance on "programmes", a result of the tendency to solve problems, once they have been identified, by resorting to funding programmes because they are the most readily available instruments. Yet developing a situation conducive to research and innovation, e.g. standardisation or regulations affecting taxation and the environment, would be another rich, efficient and cost-saving set of governance instruments. A strategy aimed to guarantee Austria a position as an Innovation Leader over the long term requires a comprehensive, and better coordinated, set of implementation instruments in funding policy.

The System Evaluation sees tax-related and direct research funding as complementary instruments. Tax-related measures offer incentives for establishing and intensifying private research investment. It also encourages multinational corporations to locate their research departments in Austria. The originally complex, unclear system of tax incentives for research and development was simplified (research tax allowances were eliminated while simultaneously raising tax credits from 8% to 10%).



However, decisions about location also include other factors, such as the availability of highly skilled human resources and the quality of the infrastructure.

The role of direct funding, in contrast, is directed towards supporting high-quality yet risky projects that, if successful, promise high and sustainable social benefits. Long-term funding effects, however, are realised primarily by firms that make use of both tax-related and direct funding instruments.

The new strategic goal of becoming an Innovation Leader and the economic and social challenges of the coming years speaks against a nonselective continuation of the present, historically based distribution of funds, and requires to focus funding instruments more clearly. We will need a coordinated set of different instruments to be able to address the diverse challenges and target groups in a suitable manner.

In addition to the question of specific funding instruments, there is also the question of how to allocate funding within the system. In particular, institutional funding revolves around the question of allocation through allotment (basic financing) or through competition.

Objectives: The funding system

- We want to establish an overall policy approach in the funding system that applies the most efficient bundle of measures in a coordinated way in each context.
- Direct research funding should be further developed as regards the use of an adequate mix of instruments.
- The regulatory basis for research funding should be streamlined.
- The principle of competition-based allocation should be strengthened.

Support measures

>> Eliminate research tax allowances in accordance with § 4 Para. 4 of the Austrian Income Tax Act; raise tax credits from 8% to 10% in accordance with § 108c of the same

>> Optimise direct research funding:

> Address funding goals with a coordinated mix of measures and instruments, instead of concentrating on programmes as preferred instruments of intervention

> Establish strategic theme management in the ministries (as opposed to programme management), with a coherent and coordinated utilisation of all instruments

> Revise the variety of thematic programmes and concentration of resource utilisation to focus on a few, broadly defined priorities with strategic relevance for Austria

> Simplify, harmonise and standardise instruments to reduce administrative costs for citizens and firms

> Change the regulatory principles of funding (guidelines, programme documents, etc.) while taking into consideration the specific needs of target groups

>> Establish a modern, homogenous regulatory framework for research funding as a basis for federal funding

>> Increase the proportion of competition-based funding in basic research

>> Reinforce the performance orientation of institutional funding by setting up performance- and target-based contracts for basic financing

INTERNATIONAL POSITIONING

Status and challenges

The political governance of research, technology and innovation takes place within the political system on several different levels. The emergence of the European Research Area creates a new playing field with growing influence. One essential task of policy management is Austria's integration into this political sphere, particularly to ensure that we have a voice in setting policy and agendas.

Political management in Austria, however, operates in a federal system in which the federal states have in recent years become actors with their own research and innovation policies.

Austria and the EU Research Framework Programmes

Austria is very well integrated in the European Research Area, which can be seen in the successful participation of Austrian researchers and research institutions in the European Union's Research Framework Programmes. The System Evaluation, however, identifies the need for additional measures "to guarantee the transition from a mindset oriented towards programme returns to one that exercises strategic co-determination in relevant areas."

This must be linked with appropriate organisation and personnel development in the ministries in order to build up competences and capacities for active research and innovation policy participation at the EU level. A coherent bundle of measures is needed to optimally exploit the potentials offered by the European Research Area and to promote Austrian interests with confidence.

Strategic collaboration with countries outside the EU – with innovation front runners such as the USA, as well as the rising BRIC countries (Brazil, Russia, India and China), and the countries bordering Central, Eastern and Southeastern Europe – still has significant expansion potential and calls out for a coordinated approach. The strategic significance of Asia must also be taken into account.

Path from the 4th to the 7th EU Research Framework Programme

	FP4 1994-1998	FP5 1998-2002	FP6 2002-2006	FP7[1] as at 11/2010
Successful Austrian participations	1,923	1,987	1,972	1,558
Share of successful Austrian participations in overall number of participations	2.3%	2.4%	2.6%	2.4%
Retained projects with Austrian participation	1,444	1,384	1,324	1,141
Successful Austrian coordinators	270	267	213	189
Share of Austrian coordinators in total number of coordinators	1.7%	2.8%	3.3%	3.4%
Austrian share of granted funds (RI)	1.99%	2.38%	2.56%	2.57%
Approved grants for Austrian participations (in million euros)	194	292	425	490[2]
Indicator of financial return based on Austria's contribution to the EU budget[3]	70%	104%	117%	126%

Source: PROVISO, the Austrian Monitoring Project of the EU Framework Programmes by bmwf, bmvit, bmwfj and bmlfuw

1 and 2 as at 11/2010 not all results are available; therefore the figures are indicative benchmarks

3 Source: European Commission – EU Budget 2009 Financial Report

Objectives: International positioning

- We want to develop a fine-tuned international science and research foreign policy by bundling existing measures to support internationalisation. To do this, we need to create the appropriate institutional structures.
- Austria should position itself optimally in the 'European Knowledge Area' by assuming a shaping role in the formulation of overall European policy on research, technology and innovation.
- In addition, we should strive for even more Austrian participation in European funding programmes, for example in the Research Framework Programmes or the European Structural Funds, with the goal of further increasing the return ratio.
- Selective, global collaboration should be set up and expanded with innovation front runners such as the USA, selected Asian countries, and the rising BRIC countries.
- Collaboration with Central, Eastern and Southeastern European countries should be further enhanced.

Support measures

>> Establish a permanent working group to coordinate and implement an Austrian policy for international science and technology, consisting of the relevant ministries

>> Develop an action plan for "Austria and the European Knowledge Area 2020". It should be developed by the Federal Ministry of Science and Research and the Federal Ministry of Transport, Innovation and Technology, including relevant ministries and stakeholders

>> Develop a coherent cooperation strategy for various priority areas: Central, Eastern and Southeastern Europe, North America, Asia and the BRIC countries

RESEARCH AND SOCIETY

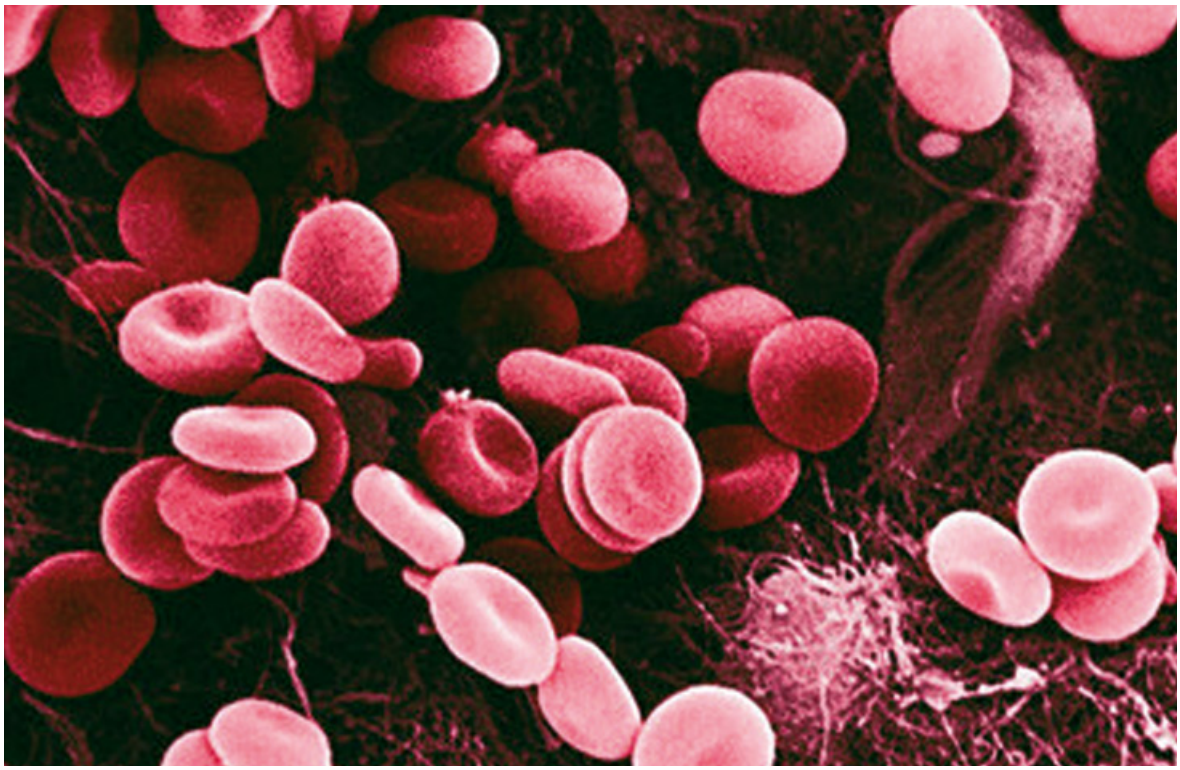
Status and challenges

If knowledge today represents society's most important resource, then the production of knowledge and its distribution becomes a crucial societal function. Science, as the institution of knowledge production, therefore faces the challenge of reporting on its activities to society. Dialogue is demanded, and participation, transparency and responsibility are expected. The relationship between science and the public has shifted fundamentally in recent decades and actively shaping this relationship has become a task for policy management. It revolves around "scientific citizens", citizens who have the right to be informed about science and technology, as well as make decisions about it. Yet these citizens are also committed to this interaction with science and bear shared responsibility.

This is a complex and dynamic field of policy that penetrates several areas of society. It affects education policy and the design of curricula, as well as dealing with museums, media policy, democratic policy and ethical questions. In Austria, this field has not been developed very much yet. There has not been a managed coordination and public funding of measures and projects for conveying the results of science since the expiry in 2006 of the "Innovative Austria" dialogue campaign, initiated by the federal government and the Council for Research and Technology. There are few private bodies for this task as other countries have, for example, in the form of foundations.

Thus the trust between citizens and science, which must be proven and legitimated again and again, remains fragile. Science lacks social acceptance, and research policy decisions lack democratic feedback.

The importance of scientific integrity and responsibility is not recognised enough by research policy. Low awareness of the problem in dealing with conflicts of interest in research



hurts not only the reputation of individual institutions, but also that of Austria as a place to do research and business as well. Research ethics must become a priority in debates about integrity.

>> Create a clear statutory regulation of research ethics commissions related to audit contracts, the legal quality of auditor's opinions, and procedural rules

Objectives: Research and society

- We want a culture of appreciation for research, technology, innovation, and to promote an understanding of how this field makes an essential contribution to increasing the quality of life and societal prosperity.
- To do this, we must establish a stable infrastructural environment for multiple forms of dialogue between science and society, along the lines of a "scientific citizenship".
- Responsibility and integrity in science should be strengthened via institutional processes.

Support measures

>> Establish a central administrative location for dialogue between science/research and society

>> Promote dialogue activities for research, technology and innovation

>> Conduct a regular national performance survey to show how research makes a social contribution that shapes the future

>> Expand independent impact assessments of technology

>> Establish high standards for scientific integrity:

> Strict guidelines for dealing with conflicts of interest in contract research

> Disclosure of value systems in research

> Make the results of publicly financed or subsidised research projects available in an appropriate manner and method to the public

> Strengthen the organisations that are intended to do this

6 Providing incentives, creating options

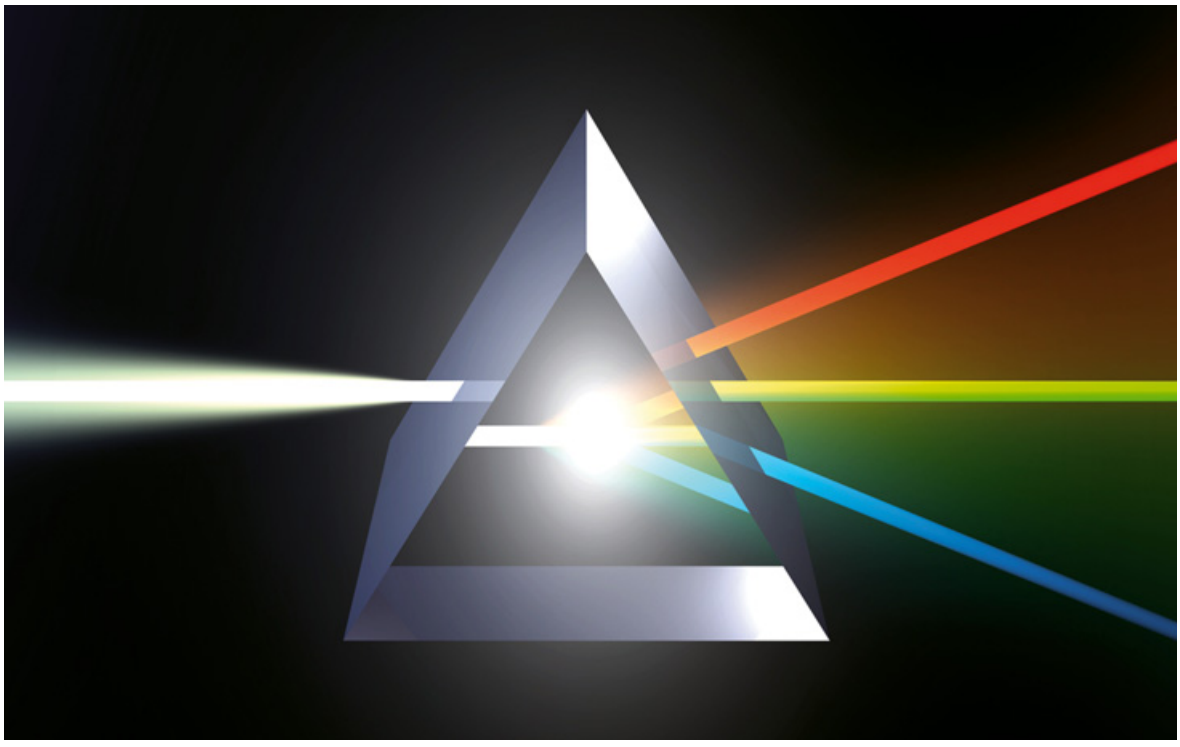
Broadening the financial base

The volume of public research funding in Austria today is well over 1% of the gross domestic product (GDP). This demonstrates the high priority that the policy agenda has placed on research, technology and innovation in recent decades. The proportion of public research funding, measured in terms of GDP, has climbed from 0.73% (1995) to 1.15% (2010). This number experienced significantly more dynamic growth than did the economy.

Austria's share of corporate sector research and development expenditure, financed by public means such as direct subsidies and tax credits, is significantly above the OECD country average. The share of publicly funded research in Austrian corporate research is 10.3%; the OECD average is 6.6%.

These public incentives have also induced over-proportional growth in private research investment in the past decade. This placed Austria as the European champion in investment dynamism for research and development, and kept its research intensity on the path towards the three per cent goal of the Lisbon Process. At the same time, the ratio of public to private research and development investments gradually approached the Lisbon target of one-to two-thirds.

This development was interrupted suddenly by the outbreak of the 2008 financial and economic crisis. Dynamism in research expenditure by firms receded, and the public authorities reacted anti-cyclically by expanding their investments. According to a global survey by the Central Austrian Bureau of Statistics, Austria's research intensity reached 2.76% in 2010, which puts us in third place in EU rankings. The ratio of public to private financing, however, has again deviated significantly from the targets. The state bore the costs of 41% of research and development in 2010. This research and development momentum, driven by the public



sector, was the right thing to do during the catching-up process of recent decades, and it also had its merits during the worst phase of the financial crisis.

If we are going to achieve our goal of reaching Innovation Leader status, however, then the innovation system's dynamism must be increased further. This will require a significant increase in private investments in research and development, because all countries that have research intensities of more than three per cent also have significantly higher financing from the private sector.

The Austrian federal government has declared that the objective is to reach a research intensity of 4% by 2020, and views this target as part of a vision that provides orientation. In the face of the financial crisis and the resulting necessity for consolidating government finances, we are seeking to increase our research intensity by one percentage point, from 2.76% today to 3.76% in 2020. We have committed to this in the framework of the Europe 2020 EU strategy process. Attaining this goal, however, requires that we continue transforming the structure of the corporate sector in the direction of research-intensive industries, while increasing the number of firms that conduct systematic research and development.

One of the great challenges of this strategy for the coming years is therefore, in addition to direct and indirect funding, to stimulate firms and research institutions by creating a situation that encourages innovation and promote more research. Private participation in the research intensity of 2020 should at least reach 66% and, if possible, 70%. The contribution of the public sector should, after the necessary phase of consolidation, be stabilised on a path where it can support the research intensity with this ratio of private and public research financing.

International comparison of R&D expenditure

2009[1]	R&D expenditure as a percentage of GDP	Growth of R&D expenditure in %[2]	Government expenditure on R&D[3]	Business enterprise expenditure on R&D[3]	R&D funding from abroad[3]
Israel	4.86	1.27	15.91	77.24	3.02
Finland	4.01	1.97	21.84	70.29	6.64
Sweden	3.75	-1.00	22.22	63.95	9.32
Japan	3.42	1.25	15.62	78.17	0.38
Korea	3.37	4.67	25.41	72.88	0.31
Switzerland	3.01	1.89	22.84	68.19	5.95
United States	2.77	0.23	27.05	67.27	n/a
Austria	2.76[4]	4.04	41.20	43.32	15.05
Denmark	2.72	1.40	25.33	61.15	9.71
Singapore	2.68	4.21	29.88	63.48	5.30
Germany	2.64	0.75	27.71	67.92	4.01
United Kingdom	1.77	-0.24	30.66	45.42	17.75

Source: OECD, own calculations

1 Data for 2009 or latest available year.

2 Annual average growth rate between 2000-2009

3 As a percentage of total R&D expenditure, the private non-profit sector accounts for the rest of the total R&D expenditure

4 Global Estimate 2010, Statistics Austria

Status and challenges

The decision by firms to invest in innovation depends significantly on the ability to supply the necessary financing. Up to two-thirds of innovation projects in firms are financed from cash flow. The more innovative a firm is, the more likely it is to use equity capital for financing, not least to manage rapid growth.

The regulatory situation for equity capital financing of research and development investments represents a bottleneck for tapping innovation potential in Austria. Austria's innovative firms lack a crucial source of financing (see the section in Chapter 4 on enterprise formation and venture capital financing).

Security and trust in a stable financial environment are essential for mobilising private research and development financing. The public sector will therefore vigorously use existing instruments to make planning secure. Federal finances offer a four-year binding preview of expenditures for important policy areas. Within these limits, each minister can enter into multi-year contractual commitments. If this option is used, it would create years of planning security for policy, administration and all actors in the innovation system.

Planning security, however, can also be ensured by creating binding priority and resource planning in all areas at the content level. In times of budget consolidation, streamlining the system offers the opportunity to free up funds for new purposes. For example, this can be done by letting some programmes expire, combining programmes, or by differentiating between research funding intensities.

The new budget law strengthens and promotes the impact and output orientation of the innovation system with medium-term financing solutions and performance targets. Binding ex ante evaluations, standards for both formulating goals and evaluating them, and systematic monitoring all contribute to efficiency gains.

These elements will be explicitly anchored in the innovation system by research funding regulations. These regulations will contain, along with principles and targets of the research agenda, specific objectives, the definition of a path for federal research and development investments, a revision of research funding regulations, planning and allocation policies, a code of conduct, and a reporting system.

Objectives: Research funding

- We want to increase research intensity by one percentage point, from 2.76% to 3.76% of GDP, by 2020.
- Of this investment amount, at least 66%, but 70% if possible, should come from the private sector.
- Firms should be stimulated on a broad front (including an improved regulatory situation and sufficient incentive structures) to perform more research and innovation. The number of firms conducting research and development should be increased.
- Allocation of public funds should follow in line with the increased output and impact orientation of the innovation system.
- Innovation system actors should be guaranteed the greatest possible planning security.

Support measures

>> Develop research funding regulations, e.g.:
  > Establish basic principles and targets of research policy
  > Define output targets
  > Long-term budgetary planning reliability
  > Code of conduct
>> Open up alternative private financing sources

Beyond designing political and regulatory frameworks for financing, however, we must orient the entire innovation system towards mobilising all potentials that can be leveraged for research, technology and innovation in business and industry. This is a primary goal of our strategy and requires concerted efforts in all policy areas. Many of the necessary contributions to our strategy have already been addressed in the chapters above: they extend from supplying highly skilled workers to the rapid availability of new knowledge in exchange with scientific institutions; from attractive access to equity capital to competitive conditions that are both guaranteed and fair; from monetary funding to efficient support and consultancy services for positioning on international markets.

With our strategy for research, technology and innovation, we want to take the path of a systemic, modern policy on research, technology and innovation. A policy that connects with educational policy and competition policy alike, taking advantage of public procurement as an influential instrument as well as reforms in the capital markets. And our strategy should demand excellence in science as well as top performances from firms working in technology development.

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