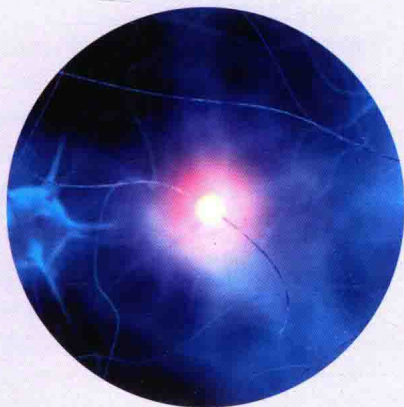
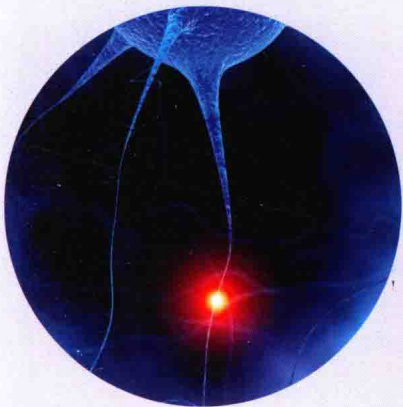
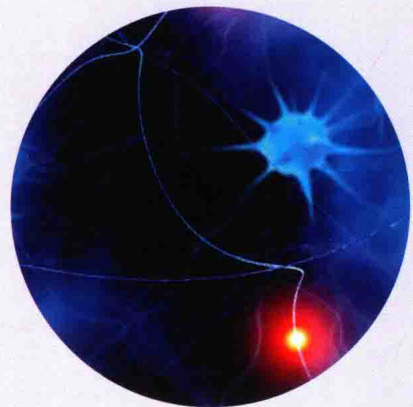
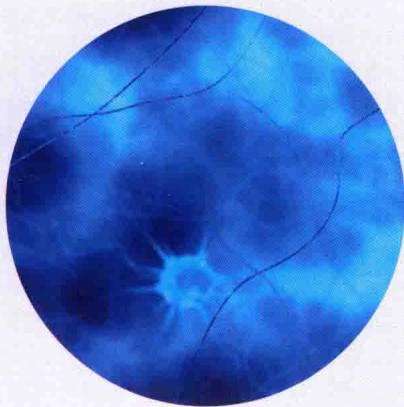
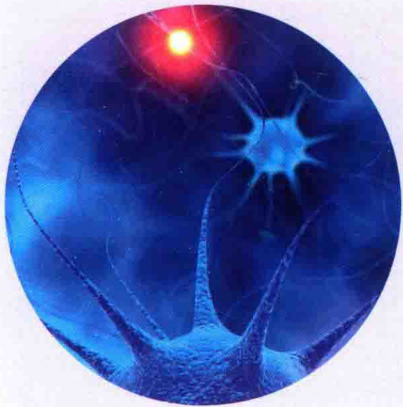
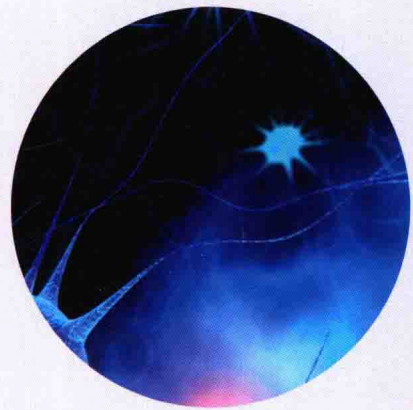
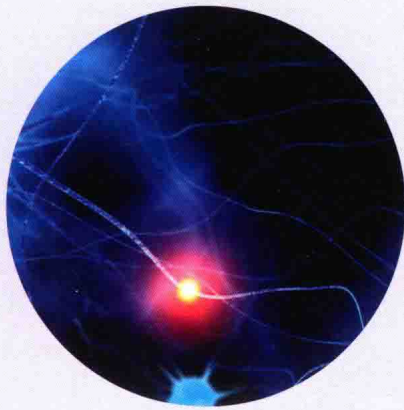
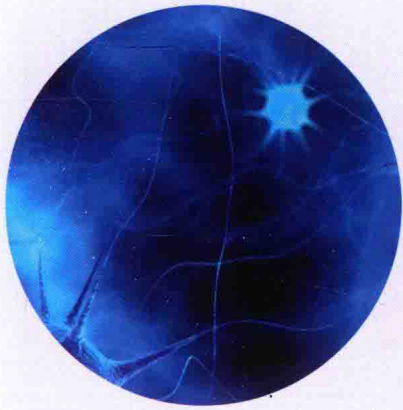


Report on Austria's Scientific
and Technological Capability
2015



Report on Austria's Scientific
and Technological Capability
2015

contents

4	Preamble	
5	Executive Summary	
	Results of the Mid-Term Review in Detail	7
	Priority Fields of Action and Recommendations	11
13	Introduction	
17	Evaluation of Austria's Performance Relative to the Goals and Measures of the RTI Strategy	
	Priority Objectives	18
	Innovation Impacts at the Economic and Societal Level	19
	Innovation Output, Effectiveness and Efficiency of Innovation	23
	Quality of Inventions: Performance of RTI Activities at the Macro-Level	27
	Summary	28
	Education System	29
	Education System (without tertiary education)	29
	Tertiary Education System and Gender Aspects in the RTI System	34
	Research at Universities and Non-University Research Institutions	39
	Universities and Basic Research	39
	Non-University Research	44
	Research Infrastructure	44
	Research and Innovation in the Corporate Sector	47
	Innovation and Corporate Research	48
	Cooperation Between Science and Business	51
	Start-ups and Venture Capital Financing	53
	Promote Innovation Through Competition	57
	Political Governance of the RTI System	60
	Governance Structures	61
	Setting Priorities	63
	International Positioning	64
	Funding System	65
	Research and Society	67
	Financing Research, Technology and Innovation	72

79___ **Summary and Priority Fields of Action**

Key Results and Conclusion of the Mid-Term Review _____	83
Priority Fields of Action and Recommendations _____	84

87___ **Global Innovation Monitor**

Economy, Society and Environment _____	89
Education _____	90
University Research _____	91
Corporate Research _____	92
R&D Financing _____	93

95___ **Appendices**

Appendix 1: Indicators _____	96
Appendix 2: Indicators' Raw Data _____	114
Appendix 3: Methodology and Notes for Interpreting the Figures and Indicators _____	116
Appendix 4: Details on the Innovation Output Indicators in Figure 6 _____	118
Appendix 5: Ranking of Indicators After Change in Goal Distance and Prospect of Goal Achievement _____	118
Appendix 6: Indicators for the Global Innovation Monitor Including Raw Data _____	120
Appendix 7: Methodology and Notes for Interpreting the Figures and Indicators from the Global Innovation Monitor _____	122
Abbreviations _____	123

124___ **Printing Information**

preamble

In October 2009, the Austrian Government launched an ambitious project when it commissioned a Strategy for Research, Technology and Innovation. This RTI strategy was drawn up with the participation of six government ministries, coordinated by the Federal Chancellery, with the explicit aim of positioning Austria among the leading innovation nations by 2020.

In its working programme for the period 2013 to 2018, the Government stated that the strategy would remain an important framework for its RTI policy. The Austrian Council also considers the strategy to be an important milestone in Austrian RTI policy, a view it has expressed several times in its statement concerning the RTI strategy as well as in past reports on Austria's scientific and technological capability.

Five years after the project was initiated, and five years before the end of the time horizon, the Austrian Council has carried out a provisional assessment in which it explored the following questions: How is the implementation of the RTI strategy progressing? Where does the Austrian RTI system stand today? Will the goals set out in the RTI strategy be achieved? Will Austria be an innovation leader in 2020? However, it is al-

so vital to answer the question as to how much energy and how many resources are needed to actually achieve this goal.

The Report on Austria's Scientific and Technological Capability 2015 seeks to provide answers to the questions posed above. It is intended as a mid-term review that evaluates the extent to which the targets of the RTI strategy have been met halfway through the time horizon. This undertaking is consistent with the task given to the Austrian Council by the cabinet of strategically monitoring the implementation of the RTI strategy and evaluating its goal orientation. In its analysis, the Austrian Council is keen to draw attention to positive developments but also just as clearly to address failures and omissions.


The Austrian Council will engage in an exchange with the Government as regards the necessary consequences from the mid-term review and will continue to support it with the implementation of the RTI strategy. The Report on Austria's Scientific and Technological Capability 2015 may offer fresh impetus to the innovation policy agenda. In the opinion of the Austrian Council, this also includes fleshing out and quantifying the goals of the RTI strategy, whereby the Austrian Council will be happy to support the Government during this process.



Dkfm. Dr.
Hannes Androsch
Chairman



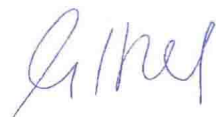
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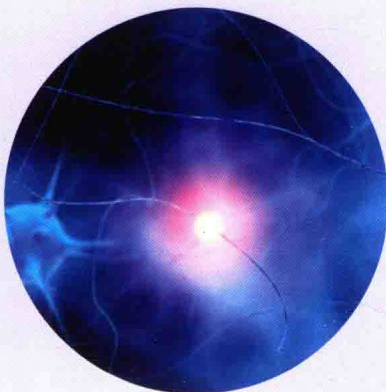
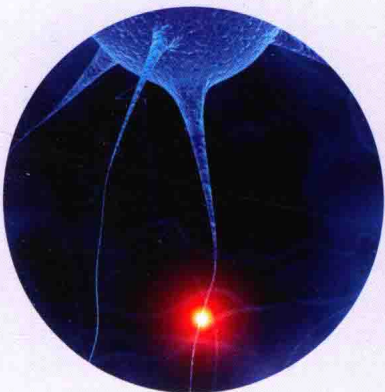
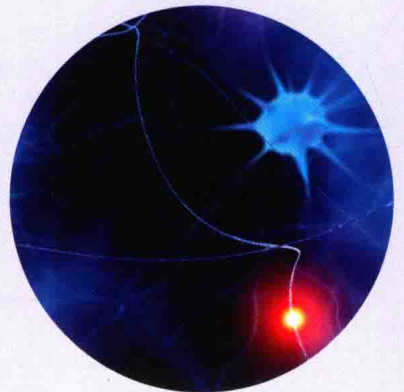
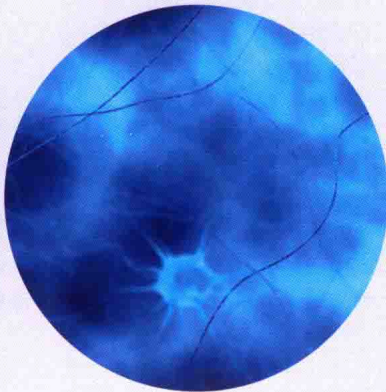
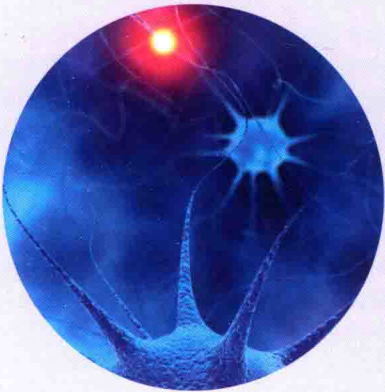
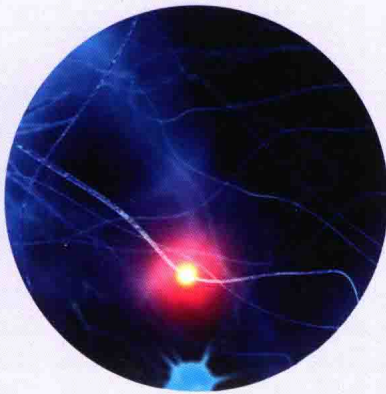
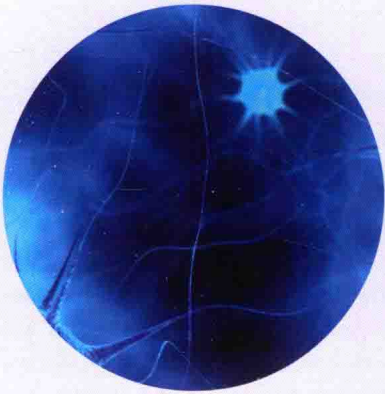
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The Federal Government's RTI strategy was completed in August 2010 and adopted by the cabinet on 8 March 2011.

Five years have passed since then, and in another five years, the end of the 2020 time horizon specified by the RTI strategy will have been reached. The Austrian Council has used this opportunity to prepare its Report on Austria's Scientific and Technological Capability 2015 in the form of a mid-term review of the RTI strategy. The intention is to clarify the key question of whether Austria will succeed in achieving the overarching goal of the RTI strategy and become an innovation leader by 2020.

The Austrian Council has again analysed the weaknesses of the Austrian RTI system, which were identified in the RTI strategy and has concluded that the key findings of the RTI strategy are still valid today. The main starting points for the strategy – on the one hand, the politically

agreed goal to become an innovation leader and on the other, the continuing crisis and the resulting budgetary constraints – remain unchanged. The majority of the RTI strategy goals have accordingly lost none of their relevance. The Austrian Council therefore continues to regard the Government's RTI strategy as an important milestone for the future development of Austria as a location for research, technology and innovation. Five years after the strategy was drafted, the goals are as relevant as ever – even though the achievement of certain goals by 2020 now looks extremely ambitious.

For its mid-term review, the Austrian Council has used data series covering the period 2010 to 2015. This five-year perspective shows stable development which acts as a reliable indicator of the impact of the strategy. This is the basis upon which the Austrian Council has formed its judgement as to whether the goals of the RTI strategy can be reached by 2020.

Detailed Results of the Mid-Term Review

Priority Objectives: Above-Average Economic Performance, Deficits in Innovation Performance

executive
summary

Austria continues to report a better-than-average economic performance, which also compares very favourably with that of the innovation leaders Denmark, Germany, Finland and Sweden. Per capita GDP in Austria has risen slightly since 2010 and this is reflected in a level of national prosperity which clearly exceeds that of the leading innovation nations. Despite some deterioration, unemployment in Austria remains comparatively low. The overall employment rate has effectively remained unchanged in the last five years, although there has been a significant increase in the female employment rate.

This contrasts with the areas of innovation, the environment, health and quality of life, where there is little realistic prospect of achieving the goals by 2020. This shows that Austria's economic success is not based solely on innovation,

and that in addition to intensifying RTI activities in general, there is still scope to boost innovation activities in the fields of the environment, health and quality of life, even if these are also influenced by a host of other factors.

In respect of innovation performance, there is still a significant amount of catching up to do. Although a differentiated analysis shows that Austria's performance is better than suggested by the Innovation Union Scoreboard (IUS), the country continues to show a performance deficit vis-à-vis the leading innovation nations. Based on the results of the mid-term review, the Austrian Council concludes that the pace of development expected in the field of innovation will not suffice to enable Austria to join the ranks of the leading nations by 2020.

Education System (Without the Tertiary Sector): Not Possible to Reach the Goals, Despite Positive Trends

Developments in the primary and secondary sectors of the education system were consistently positive in the period 2010 to 2015, although not as dynamic as those in the leading nations. This means that – although the trend is moving in the right direction – there is insufficient momentum to catch up with the innovation leaders.

The performance of the Austrian educational system is very good in a number of areas, for example the higher-than-average staff-to-student ratio in the secondary sector and the small number of early school leavers. However, in other areas, such as the quality of academic achievement or the social selectivity of the educational system, Austria's performance remains well below

that of the innovation leaders. The results of the PISA survey 2012 showed that although there had been progress, performance in many areas was still not equal to that of comparison countries.

For countries on the technological threshold, which are aiming to catch up with the leading innovation nations, it is less the quantitative and more the qualitative aspects in the educational system that are crucial. Based on the results of the mid-term review, it is questionable whether the goal of the RTI strategy to improve the performance of the educational system can be achieved by 2020 without additional efforts being made.

Tertiary Education System: Performance Clearly Inadequate

Austria's performance in the tertiary education sector is clearly inadequate. With the exception of the steadily increasing number of university graduates, which has consistently exceeded the target horizon since 2010, none of the indicators has registered a notable improvement in goal distance, let alone achieved the particular goal.

Although there are positive developments in a number of areas, such as, for example, the number of women studying STEM subjects or the immigration of highly qualified persons, these are inadequate to achieve the goals by 2020. In

fact, the majority of indicators show a declining trend, especially in areas such as the number of graduates and PhDs in STEM subjects or the level of university spending per student, where the development has consistently fallen below that of the innovation leaders since 2010. From today's perspective, only four of the 15 indicators available for the tertiary education sector are likely to have reached the target value of either the leading innovation nations or the targets defined for Austria. In the opinion of the Austrian Council, this is far too little for Austria to advance into the group of innovation leaders.

Universities and Basic Research:

Weaknesses in the Framework Conditions Threaten Above-Average Research Performance

The research output of Austrian universities and academic research institutions has risen continuously since 2010. This is demonstrated above all by the higher-than-average number of successful project applications to the European Research Council and to individual universities improving their positions in international ranking tables.

This positive trend is threatened by weaknesses in key framework conditions for research quality, such as competitive funding for basic re-

search or the transition to modern doctoral programmes. In both areas, Austria's performance is well below that of the leading countries. Given the inadequate development, this will not change by 2020, and accordingly from the present perspective it is unlikely that the goal will be achieved. If Austria's performance remains at current levels, it is doubtful whether Austria will be able to achieve its aim of joining the group of leading nations in terms of universities and basic research.

Research and Innovation in the Corporate Sector: Competitive Edge at Risk in Key Areas

The competitive edge Austria has enjoyed in corporate research and innovation is at risk in a number of key areas. In respect of one third of the indicators, the goals for 2020 have already been met and for several other indicators there is only a small goal distance to the innovation leaders. This is the case for example in relation to the corporate sector's positive ex-

port performance or the relatively intensive cooperation between science and industry. However, many of the indicators in which Austria is ahead of the leading countries, e.g. attractiveness as a location, have shown a steadily declining trend since 2010, in particular due to the improved performance of the innovation leaders.

In addition, the goals in the majority of indicators have not yet been reached and progress in a number of indicators is inadequate for the goals of the RTI strategy to be achieved by 2020, or was actually negative. This is true mainly for the weaknesses identified in recent years and even earlier in respect of start-ups, venture capital intensity, the intensity of research and development of Austrian industry

and the radicality of innovation activity. Based on the result of its mid-term review, the Austrian Council concludes that both the improvements in the area of corporate research and the development dynamics are insufficient to allow Austria to join the group of leading innovation nations by 2020.

R&D Financing: Negative Trend Compared to the Innovation Leaders

Both key indicators for R&D financing – the GERD-to-GDP ratio and the proportion of private-sector research spending – have been stagnating for years without any prospect of change. In view of the target date of 2020 for the RTI strategy, momentum is even expected to be negative in comparison with the leading nations. So far, the measures contained in the RTI strategy, which would be able counter this decline, have not been implemented with sufficient rigour, if – as in the case of the Research Financing Act – at all.

In the opinion of the Austrian Council, the momentum of this trend is certainly inadequate for a country aspiring to become an innovation leader. A comparison of current spending on R&D, with the “target” levels based on the steady increase in expenditure since 2011 with a view to achieving the target in 2020, shows that it is highly unlikely that the GERD-to-GDP target ratio of 3.76 percent will be achieved by 2020.

Summary Conclusion of the Mid-Term Review: Progress is Inadequate to Achieve the Goal of Becoming an Innovation Leader if the Trend Remains Unchanged

The Austrian Council believes that the goals set out in the RTI strategy are still valid. However, the results of the mid-term review clearly indicate that the strategy alone – no matter how correct and important its goals are – will not be enough to achieve the overall aim of advancing to join the group of innovation leaders by 2020. While it is evident that the trends for half the goals are moving in the right direction, it is equally apparent that the current measures to implement the RTI strategy are inadequate to allow Austria to keep up with the pace of development of the leading countries. This means that if the trend remains stable, the innovation leaders will forge ahead and leave Austria be-

hind. In the remaining five years, the intensity with which the strategy is implemented must be drastically increased. Otherwise Austria will not only not be an innovation leader in 2020, it will actually be at risk of falling behind other nations.

Thus to achieve the goal of becoming an innovation leader, a new phase of policy-making is needed. Instead of the previously fragmented individual measures, a package of reforms must be successively implemented, which must be adapted to suit the entire RTI system. However, this requires a stronger political commitment and a greater degree of political willpower.

executive summary

The key question posed in the Austrian Council's mid-term review, and previously in its white paper on steering research, technology and innovation in Austria, is therefore: How serious is the ambition formulated in the RTI strategy to become an innovation leader? If this ambition is to be taken seriously, policymakers must give much greater priority to education, research, technology and innovation – as key factors for Austria's future – than they have in the past.

While the Federal Government's RTI strategy is ambitious, it does not set out binding targets in respect of individual measures; it is more of an orientation paper. To press forward with implementation of the strategy more decisively, the

Austrian Council urges that an active reform process be initiated. This must receive support at the highest political level. It is the opinion of the Austrian Council that this will require an RTI reform agenda led by the Federal Chancellery and carried out in cooperation with all ministries with responsibility for RTI. This must contain binding political targets and clear mandates for the RTI Task Force. The research action plan recently adopted by the BMWFW could form one element of this stronger focus on implementation.

If there is no increased focus on the key issues education, research, technology and innovation, the Austrian Council believes that the goal of establishing Austria as a leading innovation nation by 2020 will clearly not be achieved.

Priority Areas of Action and Recommendations

On the strength of the indicator-based analysis and evaluation of the capability of the Austrian RTI system, the Austrian Council has identified five priority fields of action:

- The educational system (including the tertiary sector)
- Basic research
- Start-ups and growth of innovative early-stage companies
- Governance structures
- Private-sector R&D financing

In some cases, no progress has been made in these areas for many years. Due to their importance for the RTI system, the Austrian Council takes the view that greater efforts are needed in these areas

in particular, in order to improve the performance of the Austrian innovation system as a whole. The Austrian Council therefore recommends

- Intensifying the reform of the education system
- Increasing competitively allocated financing for basic research
- Further optimising the legal and financial framework for business start-ups and growth
- Improving governance structures for the implementation of the RTI strategy
- Promoting measures to increase the private-sector share of R&D funding

Recommendations of the Austrian Council Regarding Priority Fields of Action

Intensify Reform of the Education System

The Austrian Council recommends further reforms to modernise the structures of the education system, in particular by implementing specific measures to strengthen school autonomy and streamline the division of competences between the Federal Government and the provinces. The Austrian Council once more recommends that to overcome early-age selection in the education system, there be a commitment to, and implementation of, comprehensive all-day schooling in secondary education first stage, alongside ability differentiation and talent development.

Furthermore, the Austrian Council considers that there is an urgent need to increase early-childhood education (by means of a second year of kindergarten and the promotion of German and other first-language skills), to increase the number of multi-lingual educators (including in particular Turkish speakers) and to provide schools facing special challenges (especially in terms of the socio-economic background of the pupils) with increased financial and human resources.

The Austrian Council recommends that the goal set out in the Work Programme of the Austrian Federal Government to increase to 2 percent of GDP the amount spent on universities should be defined as a minimum target and that the additional annual expenditure, of on average 400 million euros, that is required should be made available for the tertiary sector. Furthermore, the Austrian Council recommends that when taking the necessary legal steps to implement study-place financing, emphasis should be given above all to measures to improve study conditions and in particular to increase the number of graduates in STEM subjects. Further reforms of university career models can contribute to making Austrian universities more competitive in an international context.

Increase Competitively Allocated Financing for Basic Research

The Austrian Council urgently recommends a substantial and sustainable increase in competitively allocated funds for basic research to expand the numbers of those engaged at the top of excellent research and to improve research

conditions of Austria as a location for science. Failing this, both the improved quality of research performance and Austria's attractiveness as a location for science are seriously endangered.

Further Optimisation of Legal and Financial Framework Conditions for Business Start-ups and Growth

The Austrian Council recommends implementing innovative concepts and supporting funding models with the goal of optimising framework conditions to encourage start-up activity in the knowledge- and technology-intensive sector. The Austrian Council again recommends examining whether international models of tax concessions can be applied to early-stage and small knowledge- and technology-based companies in Austria. A differentiation in the research premium with higher percentages for early-stage and small innovative companies should therefore be considered and, if and where necessary, developed and implemented in detail.

The Austrian Council also recommends developing financing opportunities for innovative young entrepreneurs and SMEs. Crowdfunding, including peer-to-peer lending and crowd investing should be encouraged by an effective and efficient legal framework and should be incorporated into a competitive overall strategy for corporate growth. In this context, the Austrian Council welcomes the BMFWF's recent crowdfunding initiatives agreed by the Government at its closed-door conference, and in particular, the Alternative Financing Act.

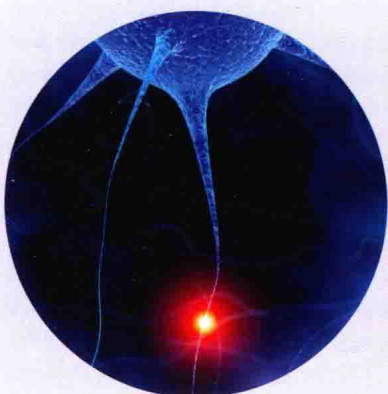
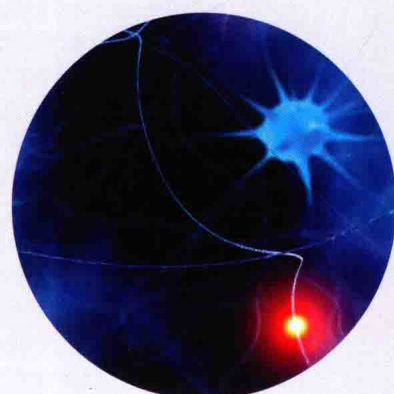
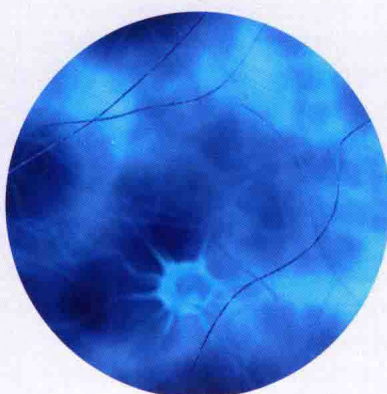
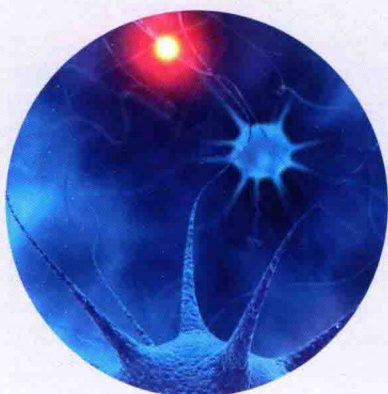
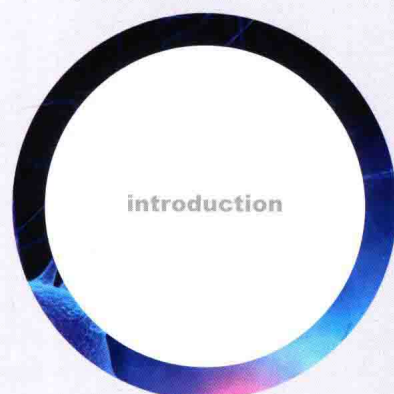
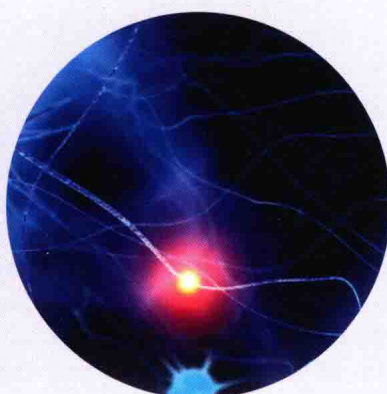
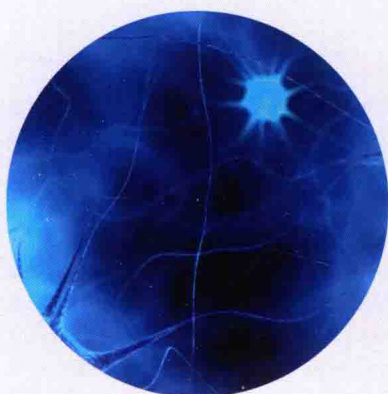
Furthermore, consideration should also be given to introducing a tax allowance for business angels to increase equity investments and to reduce ancillary wage costs for start-ups and companies engaged in research. In addition to this, the Austrian Council backs innovative funding models, which fund guarantees in conventional early-phase programmes.

Improve Governance Structures to Implement the RTI Strategy

The Austrian Council recommends initiating an active and sweeping process of RTI policy reform with a view to moving ahead with the implementation of the strategy more decisively. This must be backed at the highest political level. To this end, the Austrian Council believes that an RTI reform agenda is required that should be led by the Federal Chancellery and implemented in cooperation with all those ministries with responsibility for RTI. This agenda should be embedded in government plans and must contain politically binding, specific and quantifiable targets. These must form the basis for clear terms of reference for the RTI Task Force, which must in future play a more active role in steering the implementation of the RTI strategy.

Promote Measures to Increase the Private-Sector Share of R&D Funding

The Austrian Council recommends focusing on measures to increase the proportion of private-sector R&D funding. This can be done, for example, by improving framework conditions for philanthropic gifts and donations, for foundations and for private venture capital funding. In this context, it is essential to concentrate the use of public-sector funds in a way that strengthens their leverage effect with a view to increasing incentives for private-sector R&D spending and increasing the share of financing provided by the private sector. The Austrian Council therefore recommends the relevant initiatives adopted at the government's closed-door conference, such as the non-profit package or the crowdfunding initiative be vigorously implemented. Given the substantial increase in the volume of the research premium, the Austrian Council also recommends conducting a detailed evaluation of its impacts. This evaluation should be based on existing (micro) data and should follow a micro-econometric approach.



On 31 August 2009 the cabinet ministers agreed to set up an inter-departmental working group to formulate a Strategy for Research, Technology and Innovation (RTI) in a process that would be politically coordinated by the chancellor and vice chancellor. The goal was to define “strategic goals and measures for Austrian RTI policy for the period up to 2020, based on the results of the evaluation of the research funding system, the Research Dialogue and the RTI recommendations submitted by the Austrian Council for Research and Technology Development.”¹ The steering group commissioned to develop the strategy met for the first time on 5 October 2009. During 30 meetings held over several months, five working groups, each with its own thematic focus, developed strategic goals and a package of measures for each chapter of the strategy document. Furthermore, each of the working groups invited stakeholders to participate in developing the strategy. The RTI strategy was completed in August 2010 and adopted by the cabinet on 8 March 2011.

This is the first time that Austrian RTI policy actors had worked together in this form to jointly draw up and agree binding goals and implementation-orientated measures. The fact that the RTI strategy constitutes an agreement between six government ministries demonstrates the great importance the Federal Government attaches to education, research, technology and innovation. The setting up of an inter-ministerial task force to coordinate the implementation of the RTI strategy is also a positive signal.

The findings and analyses regarding the status quo at the time the strategy was drawn up provide a realistic and critical picture of Austria’s position as a location for RTI as it was then. Five

years later, however, political, economic and social framework conditions have in some cases changed significantly on both the global and national level.² Thus we are confronted with a sustained weakening of global economic growth, which presents Europe in particular, and to an increasing degree Austria, with huge challenges. This goes hand in hand with a crisis of the European Union, the consequences of which for Austria are not yet entirely foreseeable. At any rate, the effects of the resulting budget constraints and fiscal consolidation can already be felt in Austria.³

Of course, this has also affected the Austrian innovation system, which has to come to terms with the end of a period of dynamic growth and with steadily declining resources. One innovation policy consequence of this, which affects the responsible ministries, academic institutions, research institutions and companies with R&D activities in equal measure, is the growing need to develop and effectively implement mechanisms for alternative forms of resource allocation. Targeting resources more effectively and – as the Austrian Council has already demanded in its strategy for excellence – selecting and supporting the best projects in a much more focused way than in the past will be central in this regard.⁴ Although the RTI strategy references this by defining an increase in competitively allocated funding as a key goal, this should be made even clearer and above all implemented with an appropriate urgency.

However, it is not just the financial impacts of the economic crisis that are changing the context within which the RTI strategy has to be implemented. The increasing importance of the European Research Area, for example, is leading to much greater mobility of, and increasing

¹ Presentation to the cabinet on 3 February 2010, p. 1

² See, for example, PWC (2015): *The World in 2050: Will the shift in global economic power continue?*; Kissinger, H. (2014): *World Order*. Penguin Press, New York; Keuschnigg, C. et al. (2014): *Vision Österreich 2050 – Vorsprung durch Bildung, Forschung und Innovation*. Holzhausen Verlag – Vienna, p. 19ff.

³ Aiginger, K. (2015): *Die Wende vom Konflikt zum Brückenbau*. In: *Der Standard*, 3./4. January 2015, p. 38.

⁴ Austrian Council for Research and Technology Development (2007): *Exzellenzstrategie*.

competition between, researchers. The effect is to force universities to make themselves more attractive to their own research personnel and to improve conditions with a view to attracting foreign researchers and stemming the increasing brain drain out of Austria. At the same time, increasing competition for European funds from Horizon 2020 such as the European Research Council (ERC), is playing an increasingly large role.

The situation is exacerbated by the global grand challenges such as climate change, resource scarcity, population growth, demographic change, urbanisation, the third industrial and digital revolution, etc. all of which are having an impact on Austria's society and economy – and thus on the domestic RTI system.⁵

All these challenges and changes have contributed to a situation in which an increasing number of voices within the Austrian RTI community are questioning the relevance of the RTI strategy. The Austrian Council has therefore again analysed the main weaknesses of the Austrian RTI system which were identified in the findings of the RTI strategy. In particular, these were the performance of the educational system which is not realising its potential, a system for financing basic research with competitively allocated funds that is uncompetitive in an international comparison, inadequate start-up dynamics and poor business growth rates among start-ups together with a lack of suitable capital investment as well as a share of private-sector R&D funding that is basically too low.

The results of the relevant analyses and the Austrian Council's monitoring of Austria's innovation performance in recent years show that the RTI strategy's key findings are still relevant today. The central starting points for the strategy

– on the one hand, the politically agreed goal to position Austria as an innovation leader and on the other, the continuing crisis and the resulting budgetary constraints – remain unchanged. The majority of the RTI strategy goals have accordingly lost none of their relevance. The Austrian Council therefore continues to regard the Government's RTI strategy as an important milestone for the future development of Austria as a location for research, technology and innovation. Five years after the strategy was drafted, the goals are as relevant as ever – even though the achievement of certain goals by 2020 now looks extremely ambitious.⁶ At the half-way point before the target date for the RTI strategy is reached, the Austrian Council has raised the following questions: How is implementation of the RTI strategy progressing? Where does the Austrian RTI system stand today? Will the goals set out in the RTI strategy be achieved? Will Austria be an innovation leader in 2020? However, it is also vital to answer the question how much energy and how many resources are necessary to actually achieve this goal.

The Report on Austria's Scientific and Technological Capability 2015 is intended to be a mid-term review, which takes stock of the progress that has been made five years after the RTI strategy was commissioned and five years before the end of the time horizon is reached. As in its previous reports, the Austrian Council evaluates the extent to which the goals of the RTI strategy have been fulfilled – but now from the perspective of the halfway point to the time horizon. For the mid-term review, the Austrian Council has used data series covering the period 2010 to 2015. This five-year perspective

⁵ Cf. Androsch, H. / Gadner, J. (2013): *Austria's Future in the World of Tomorrow* (ed.): Austria 2050 – FIT for the Future. Holzhausen, Vienna. pp. 254-272

⁶ Failure to achieve the goals by 2020, however, is no reason not to implement the necessary RTI policy measures as swiftly as possible so that developments can be set in motion that will result in the achievement of the goals – even this is only after 2020.

introduction

shows stable development which acts as a reliable indicator of the actual impact of the strategy. This is the basis upon which the Austrian Council has formed its judgement as to whether the goals can be reached by 2020.

Furthermore, this year the Global Innovation Monitor, which was presented by the Austrian Council at the Alpbach Technology Forum in 2014, will form part of the report for the first time. The Global Innovation Monitor compares selected Austrian statistical parameters with those of the leading innovation nations outside the EU. Such a comparison on

both the European and global levels should help shed light on Austria's performance in the context of worldwide trends.

This report follows the same methodology as previous reports – details are provided in Appendix 3 and on the Austrian Council's website under the menu item Performance Reports (<http://www.rat-fte.at/annual-reports.html>). As well as information about the report and a range of download options, the site offers an interactive depiction of the indicator sets, which makes it possible to retrieve detailed information about the status quo and developments in individual areas interactively.