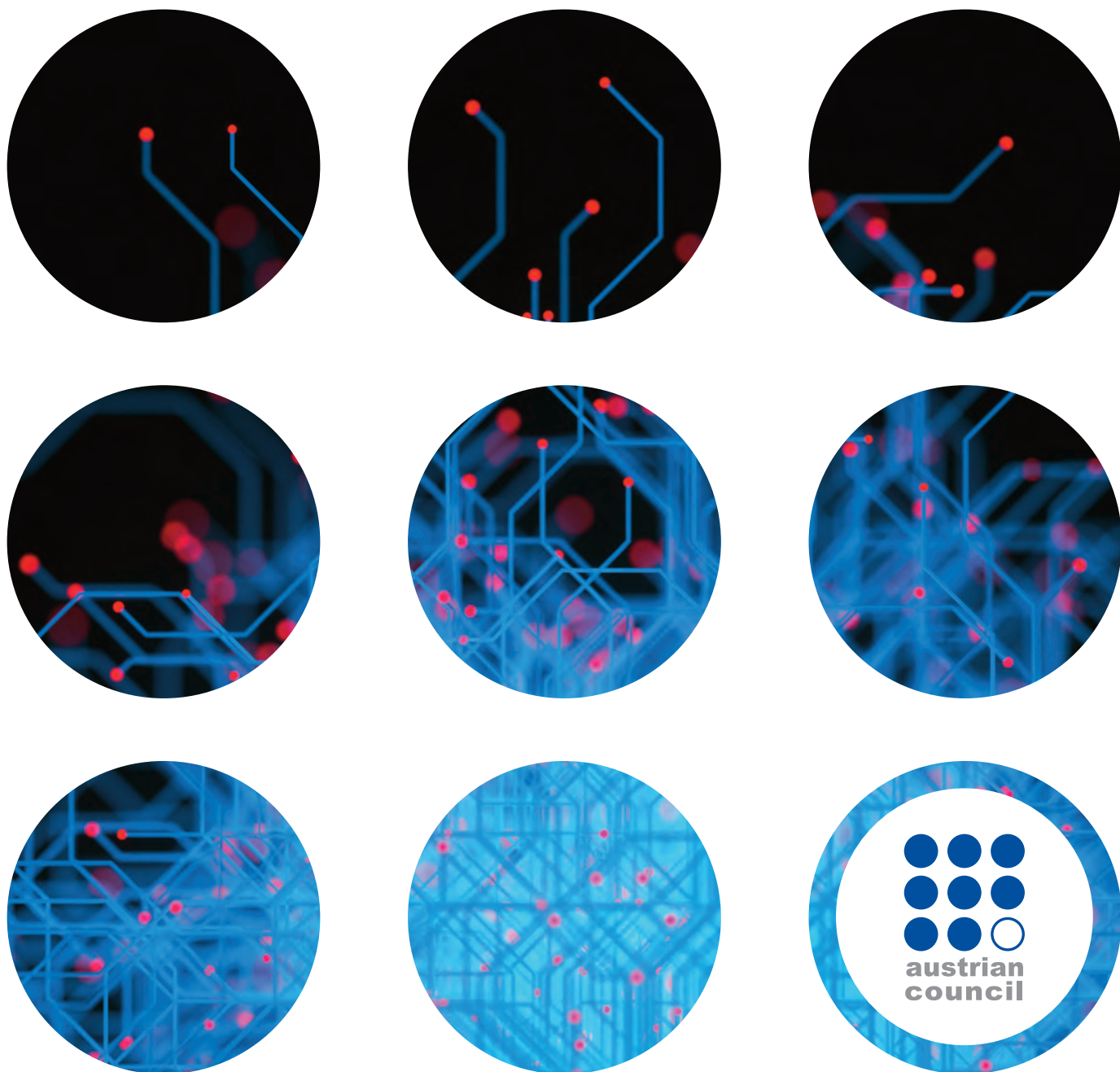




Report on Austria's Scientific
and Technological Capability
2019

contents

4 — Preamble

5 — Executive Summary

Ten years of the RTI Strategy: Austria with unchanged distance to the group of leaders	6
Final conclusion and priority recommendations: New RTI Strategy must address efficiency barriers	7
Recommendations of the Austrian Council for a future RTI Strategy for Austria	8

11 — Introduction

15 — The Austrian RTI system's performance in the international comparison and with regard to the objectives of the RTI Strategy

Priority objectives	18
Education system (without tertiary education)	23
Tertiary education system	28
Research at universities and non-university research institutions	35
Research and innovation in the corporate sector	42
RTI system governance and financing	46

55 — Summary

Overview of key results	56
Conclusion and recommendations	59

65 — **Global Innovation Monitor**

Background	66
Education	67
University research	68
Corporate research	69
Research funding	70
Economy, society and environment	71

73 — **Appendix**

Appendix 1: Indicator Set	74
Appendix 2: Indicators' Raw Data	92
Appendix 3: Methodology and Notes for Interpreting Graphics and Indicators	94
Appendix 4: Indicator set for global innovation	96
Appendix 5: Methodology and Notes for Interpreting the Figures and Indicators from the Global Innovation Monitor	98
Appendix 6: RTI Strategy Objectives	98
Appendix 7: Overview of Indicators Used In The Efficiency Analysis	102

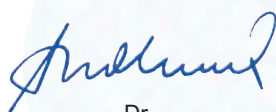
104 — **Printing Information**

preamble

With its 2017-2022 government programme the Austrian Government has set itself ambitious goals, which it fleshed out in its presentation to the Cabinet on 16 August 2018. The essential steps to achieve Austrian innovation leadership are therewith outlined. The development of a new Research, Technology and Innovation Strategy (RTI Strategy 2030), which will present the strategic guidelines for Austria's path to becoming an innovation leader, is a key starting point. This is necessary because the previous RTI Strategy has almost reached its time horizon, and the previously set objective of joining the top group has not been achieved. The current strategy was initiated in October 2009 and pursued the overarching goal of making Austria an innovation leader by 2020. The Cabinet of the day assigned the Austrian Council the task of monitoring the implementation of the RTI Strategy and summarizing its results as part of an annual report on Austria's scientific and technological capability. The Austrian Council has complied with this task since 2012. Now, on reaching the strategic time horizon and the

preliminary work for compiling a new RTI Strategy, the time has come for the Austrian Council when it will submit a final, summative evaluation of the implementation status of the applicable RTI Strategy with this report. The objective here is to derive the key lessons for the future from experiences to date and to submit proposals for the new RTI Strategy.

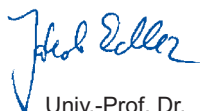
A new RTI Strategy and a more coordinated implementation process controlled at the highest political level also continue to be key elements to increase Austrian innovation performance. The Austrian Council emphatically welcomes the corresponding activities of the Austrian Government. Important now will firstly be the strategy development process, into which the diverse preliminary work, such as that of the OECD Review, must be integrated. The Austrian Council also sees this report as a building block for the future RTI Strategy. It proposes communication with the Austrian Government on the required consequences of its analyses and to continue supporting it with the pending draft of strategic guidelines and their subsequent implementation.



Dr.
Hannes Androsch
Chairman



Univ.-Prof. Dr.
Markus Hengstschläger
Deputy Chairman



Univ.-Prof. Dr.
Jakob Edler



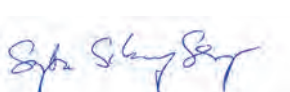
Dr.
Hermann Hauser



DI Dr.
Sabine Herlitschka, MBA



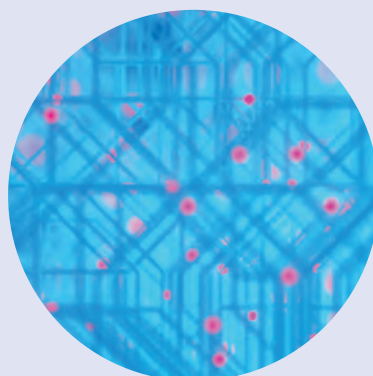
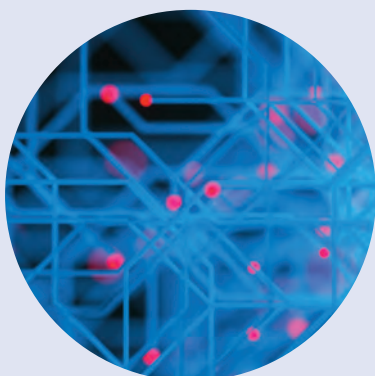
em. Univ.-Prof. Dr.
Helga Nowotny



Univ.-Prof. Dr.
Sylvia Schwaag-Serger



Dr.
Klara Sekanina





executive summary

Ten years of the RTI Strategy: Austria with unchanged distance to the group of leaders

In most international rankings on innovation performance or scientific and technological capability Austria generally occupies a position in the forward midfield. This shows how the performance of the Austrian RTI system is above the average in the international comparison.¹ The efforts of recent years to join the innovation leaders and consequently ensure economic development, prosperity, quality of life and environmental protection have therefore resulted in some effects and triggered a positive dynamic in quite a few areas. On the other hand it must also be stipulated that this dynamic has not developed sufficiently to equal that of the leading nations. Despite the improvements in individual areas, Austrian performance is therefore in particular stagnating compared to the leading European innovation nations, these being Denmark, Germany, Finland, the UK, Luxembourg, the Netherlands, Sweden and especially Switzerland. Austria therefore still ranks within the midfield of the comparison countries with the distance to the group of leaders remaining unchanged.

The goal of the Research, Technology and Innovation Strategy (RTI Strategy), adopted in 2011, was to turn Austria into an innovation leader by 2020. The 2020 time horizon specified therein is now almost upon us. In recent years the Austrian Council has systematically analysed the advances made with the implementation of the RTI Strategy within the scope of its annual Report on Austria's Scientific and Technological Capability.²

Almost ten years after the starting signal to work out the current strategy document and parallel with the start of drafting a new strategy, the Austrian Council believes it is now time to draw a final, summarising conclusion. This report performs a summative assessment of the implementation status of the RTI Strategy and shows the status of goal achievement. The developments from 2010 to today are illustrated here and the degree of goal achievement is conclusively assessed.³ On this basis, the more important improvement proposals for every area of the RTI system and recommendations for a future RTI Strategy will then be presented.

1 OECD (2018): OECD Reviews of Innovation Policy: Austria 2018. OECD Publishing, Paris, p. 3.

2 For this, see the reports on Austria's scientific and technological capability by the Austrian Council, online at <https://www.rat-fte.at/leistungsberichte.html>

3 It should be noted that quite a number of data exhibit a considerable time-lag, and an effective evaluation will therefore only be possible in 2022/23.

Final conclusion and priority recommendations: New RTI Strategy must address efficiency barriers

The detailed analyses of this report clearly show how, on the whole, the performance of the Austrian RTI system has not increased sufficiently since 2010 to move substantively towards the level of the innovation leaders. Despite above-average R&D investments and successful developments in some areas, Austria's goal distance to the leading nations measured on the basis of the set of indicators could not be reduced across the board. These findings essentially also apply to the results of the European Innovation Scoreboard (EIS), on which the overarching objective of the RTI Strategy – to move into the group of leading innovation nations – is oriented, because Austria's distance to the group of innovation leaders since 2010 has also remained unchanged in the EIS.

In summary, the Austrian Council's analyses therefore conclude that Austria will neither join the group of innovation leaders nor achieve the goals rooted in the RTI Strategy by 2020. Primarily responsible for this are the problem areas and efficiency barriers identified in the analyses, par-

tially unchanged for some years, as well as serious imbalances in the distribution of funds.⁴ The Austrian Council believes these impede any further increase in the performance of the Austrian RTI system. It has therefore not been possible to convert the above-average high R&D investments into performance that corresponds with Austria's advanced scientific and technological level of development.

The Austrian Council believes a future RTI Strategy must therefore consider the optimization proposals quoted by the OECD in the Review of Innovation Policy: Austria and specifically address the key areas under construction of the RTI system topicalized in this report, from education to the universities and innovative start-ups, right through to research funding and R&D financing. It must also be ensured that the new RTI Strategy is implemented with greater vigour than has previously been the case. The Austrian Council proposes the following priority recommendations for supporting the strategy development process.

**executive
summary**

⁴ For details see inter alia, Austrian Council (2018): Report on Austria's Scientific and Technological Capability 2018. Vienna.

Recommendations of the Austrian Council for a future RTI Strategy for Austria

The recommendations for improving the performance of the Austrian education and RTI system with regard to a future RTI Strategy that the Austrian Council believes are the most important are summarised below. For details and more specific measure proposals, please see the recommendations in the respective chapters of the report, the underlying individual recommendations and the main focus points of the reports on Austria's scientific and technological capability of previous years.

Policy prioritisation for future areas

Basically and in harmony with the key results of the OECD Review of Innovation Policy, the Austrian Council recommends – in addition to the implementation of the measures presented to the Cabinet and planned by the Government, and in particular the elaboration of the RTI Strategy – that a policy prioritisation be made for the further development of the Austrian RTI system, in order to exploit its potential accordingly to join the leading innovation nations. Political focus on the relevant future areas will contribute to affording greater weight in Austria to the topics of education, science, research, technology and innovation, and therefore injecting essential dynamism into the country's future development. The Austrian Council recommends institutionalising the RTI Summit in order to anchor regular communication for the definition and, where possible, consolidation of relevant RTI policy prioritisations at the highest political level. The Austrian Council believes the annual summit should also be used to define binding implementation plans with clear scheduling specifications, financial framework decisions and operative responsibilities. In developing the RTI Strategy the Austrian Council also recommends the known areas under construction of the Austrian RTI system in the key areas of the education system, the universities, innovative start-ups, research fund-

ing and R&D financing, which impede an increase in innovation performance, be addressed as priorities.

Priority objectives

The Austrian Council recommends, also in a future RTI Strategy, that research, technology and innovation not be understood as an end in itself, but rather as a contribution to achieving higher priority objectives on social, economic and ecological levels. An expansion of appropriate mission-orientation mechanisms is also recommended, as also suggested by the OECD. The importance of social innovations should also be considered here more than has previously been the case.

Education system

In order to increase the efficiency of the education system, within the scope of the future RTI Strategy the Austrian Council recommends the problem of education inheritance and social selectivity, which is far too high, be consistently addressed in the affected education areas. In this respect the Austrian Council recommends renewed commitment to comprehensive schools for 10- to 14-year-olds and the expansion of all-day schools. Specific measures must be targeted here to further raise the achieved performance level of 10- to 14-year-olds across the board. In this context the Austrian Council welcomes the commitment included in the government programme to quality elementary pedagogy, however it also recommends a significant increase in the number of qualified and in particular multilingual educators. Contrary to a scattergun approach the Austrian Council also recommends better financial and HR provisions (keyword: “support staff”) for those schools that are confronted with special challenges, especially with regard to the socio-economic structure of their students (or “hotspot schools”).

Tertiary education, universities and basic research

The Austrian Council recommends special focus be made in the RTI Strategy 2030 on the areas of tertiary education, universities and basic research. To increase the efficiency of the higher education area, the Austrian Council recommends the swift and consistent implementation of the measures anchored in the government programme for the structural further development of the higher education area and to improve the governance structures of the universities, study conditions and the controlling of student flows. In addition to the structural reforms planned by the Government and essentially welcomed by the Austrian Council, it also recommends an increase in the university expenditure rate to two percent of GDP, to be able to finance the required renewal measures. This would also require an increase in the private financing share. In order to remove the major efficiency barriers of the RTI system, the Austrian Council urgently recommends the further increasing of competitively awarded funds for basic research to the level of the leading nations.

Innovative start-ups

To increase innovation efficiency the Austrian Council recommends anchoring measures in the RTI Strategy, which target the removal of administrative and financial obstacles for start-ups. In this respect, firstly the adverse bureaucratic, regulatory and taxation framework conditions must be improved to make expenditure, costs and getting started time easier for innovative start-ups. Furthermore, the familiar problem of insufficient availability of private financing provided by risk capital or crowdfunding must also be addressed. In addition to funding by banks, the Austrian Council also recommends developing further funding options for innova-

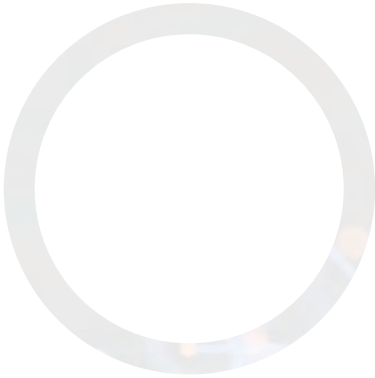
tive entrepreneurs and SMEs here. An increase in equity capital intensity from the private side would require its own special framework, such as appropriate legislative and taxation framework conditions for private equity, an improvement in the quality of the Austrian capital market and assessment stipulations of pension and insurance funds, for example.

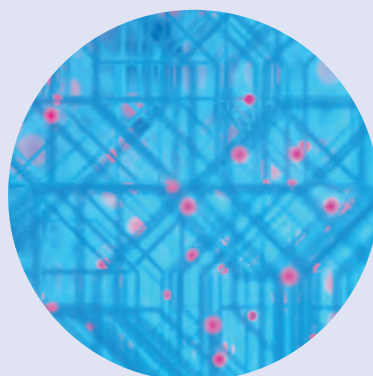
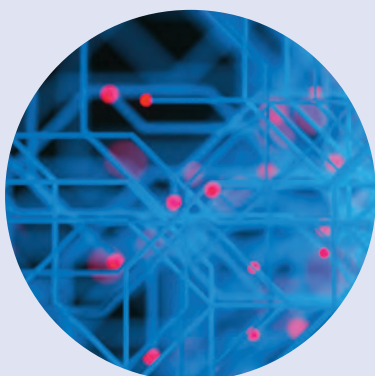
Research funding and R&D financing

The Austrian Council recommends excessive administration and fragmented and intransparent funding offers be avoided in the preparation of the new RTI Strategy, among other activities. An increase in the efficiency of research funding should be afforded greater attention in the future, whatever the case may be. Existing structures must be critically scrutinised here and incentive effects must be increased with specific funding activities.

The Austrian Council welcomes the Research Funding Act planned in the government programme and currently being prepared, which will secure the medium to long-term stability of RTI funding in Austria. In this context the Austrian Council recommends a review of the appropriate funding use in the Austrian RTI system, in order to correct existing imbalances in the distribution of funds. In the area of universities and basic research in particular the ratio between core-funded and competitively awarded public funds must be shifted in favour of the competitive share. Budgetary prioritisation should also be addressed in the international comparison with the objective of a clear, future-oriented alignment of government spending. On the whole, special focus must be made here on increasing funds awarded in competition. Appropriate objectives should be anchored within the RTI Strategy's framework.

**executive
summary**





introduction

The Austrian Government has set itself the goal of ensuring that, “Austria join the group of European innovation leaders”.⁵ The preparation of a new Research, Technology and Innovation Strategy (RTI Strategy) with a 2030 time horizon is planned to achieve this goal. An important basis for the strategy development was presented at the end of 2018 with the Review of Innovation Policy: Austria performed by the OECD.⁶ The Austrian RTI system is afforded a good testimonial herein on the basis of its solid performance. The OECD believes, among other elements, that the current RTI Strategy⁷, which is now approaching its 2020 time horizon, is a relevant basis for this.⁸ Declared goal of this current RTI Strategy: Austria to rank among the leading innovation nations by 2020.

The RTI Strategy was developed from mid-2009 together and in coordination with the Austrian Federal Chancellery (BKA), the Austrian Ministry of Finance (BMF), Federal Ministry of Education, Arts and Culture (BMUKK), the Federal Ministry of Transport, Innovation and Technology (BMVIT), the Federal Ministry of Science and Research (BMWF) and the Federal Ministry of Economics, Family and Youth (BMWFJ). It was completed in August 2010 and adopted by the Cabinet on 8 March 2011. The strategy document includes approximately 75 quantitatively measurable objectives with more than 100 measures in the ar-

reas of education, research at universities and non-university research institutions, research and innovation in the corporate sector, RTI system governance and financing. A special RTI Task Force with representatives of all ministries involved in the strategy development process was put to work for the implementation process.

The Austrian Council has monitored and evaluated the implementation of the RTI Strategy as commissioned by the Cabinet.⁹ The results of its implementation monitoring were published in a report on Austria’s scientific and technological capability published annually and presented to the National Council.¹⁰ The reports focussed from the very beginning on the achievement of the goals of the RTI Strategy and the evaluation of the measures implemented. It should be noted that the Austrian Council has repeatedly defined the Strategy as an important milestone for the future development of the Austria RTI location and positively evaluated the ambitious set of objectives. However, it has pointed out several times that the respective political intentions do not correlate sufficiently with operative implementation.¹¹

The Austrian Council employs an extensive set of indicators to measure the progress in achieving the goals of the RTI Strategy and to be able to map Austria’s performance in the international comparison. This was developed in cooperation with WIFO and widely discussed with WG 8 (RTI Rankings) of the RTI Task Force

5 Austrian Government (2018): Future initiative for research, technology and innovation Presentation to the Cabinet on 16 August 2018, p. 2.

6 OECD (2018): OECD Reviews of Innovation Policy: Austria 2018. OECD Publishing, Paris.

7 Austrian Government (2011): The Path to Becoming an Innovation Leader. Federal Government strategy for research, technology and innovation. Vienna.

8 See OECD (2018): OECD Reviews of Innovation Policy: Austria 2018. OECD Publishing, Paris, p. 38 f.

9 Austrian Government (2010): Appointment of the members of the Austrian Council. Presentation to the Cabinet on 9 September 2010, p. 1 f.

10 For this, see <https://www.rat-fte.at/leistungsberichte.html>

11 See Austrian Council (2012): Report on Austria’s Scientific and Technological Capability 2012. Vienna, see p. 26; Austrian Council (2015): Report on Austria’s Scientific and Technological Capability 2015. Vienna, p. 15.

with the inclusion of both external experts and representatives of the responsible ministries. It includes 74 indicators, which map the respective objectives of the individual chapters of the RTI Strategy and allows them to be operationalized. Special consideration was given in developing the set of indicators to Austria's specific economic structure by differentiating between structural change towards knowledge-intensive sectors (high-tech) and upgrading in all sectors (innovation-related performance improvements, in traditional sectors as well). Standardised innovation comparisons, such as the European Innovation Scoreboard (EIS), generally only measure innovation effects on the basis of the structural change component, in which Austria traditionally scores badly. Austria does, however, achieve innovation success in sectors with medium to medium-high knowledge intensity, which are often underestimated.¹² Evidently Austria must nevertheless also remain competitive in sectors with medium to medium-high knowledge and technology intensity by continuously improving existing competencies.¹³ This is illustrated by the successes of Austrian businesses in global market niches ("hidden champions"), which not least of all are achieved with continuous technological improvements and benefit from the quality of the vocational training system in Austria.

Based on this set, the Austria Council demonstrated the implementation status of the RTI Strategy in its reports and presented Austria's in-

novation performance compared to the leading nations. The strengths of the Austrian RTI system were highlighted here time and again, but attention was also paid in particular to the problem areas that impede performance improvements. A number of these system defects verified by the Austrian Council were not, however, removed and therefore continue to be a problem.

Almost ten years after the starting signal to work out the current strategy document and parallel with the start of drafting a new strategy, the Austrian Council believes it is now time to draw a final, summarising conclusion.¹⁴ The Report on Austria's Scientific and Technological Capability 2019 is considered a conclusive evaluation of the RTI Strategy's implementation, with which stock will be taken. The Austrian Council evaluates the degree of the RTI Strategy's goal achievement, as it has also done in the reports of previous years. However this year's focus is on what we can learn from the past for a future RTI Strategy. The Austrian Council broached the following issues in this respect: How is implementation of the RTI Strategy to be evaluated? What has happened with the goals set in the RTI Strategy? Which ones have been achieved? Was the distance to the innovation leaders reduced, and where is Austria today in relation to the leading nations? What are Austria's prospects of becoming an innovation leader in the future?

introduction

¹² For this, see inter alia, Janger, J. / Schubert, T. / Andries, P. / Rammer, C. / Hoskens, M. (2017): The EU 2020 innovation indicator: A step forward in measuring innovation outputs and outcomes? In: Research Policy, 46(1), pp. 30-42.

¹³ This development is illustrated by the term "Austrian Paradox": This refers to the obvious success of the Austrian economy in "old structures". See Peneder, M. (1999): The Austrian Paradox: 'Old' Structures but High Performance? In: Austrian Economic Quarterly, no. 4 (1999), pp. 239-247.

¹⁴ It should be noted that quite a number of data exhibit a considerable time-lag, and an effective evaluation will therefore only be possible in 2022/23. Due to the fact that the Austrian Government has already begun with the preparations for compiling a new RTI Strategy, this report by the Austrian Council will be the last to deal with the implementation status of the RTI Strategy.

The background of the page features a decorative design. It includes several large, overlapping circles in shades of light gray and light blue. Some of these circles contain a faint, abstract network pattern of lines and dots. The word 'introduction' is written in a bold, dark gray font inside one of the light gray circles.

introduction

This report follows the same methodology as previous reports, which serves as the basis for answering these questions. Details are provided in appendix 3 and on the Austrian Council's website under the "Performance reports" menu item.¹⁵

As well as information on the report and a range of download options, the site also offers an interactive depiction of the set of indicators, which makes it possible to retrieve detailed information about the status quo and developments in individual areas interactively.

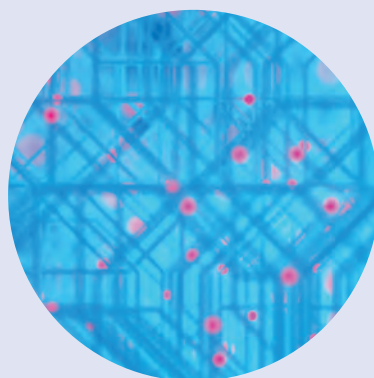
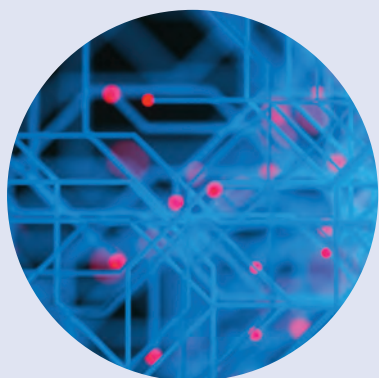
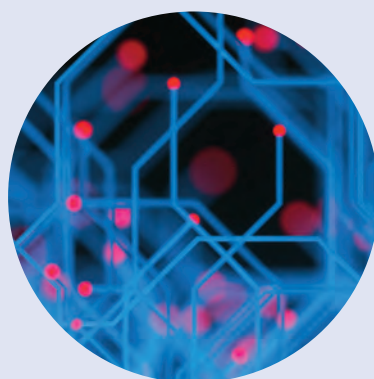
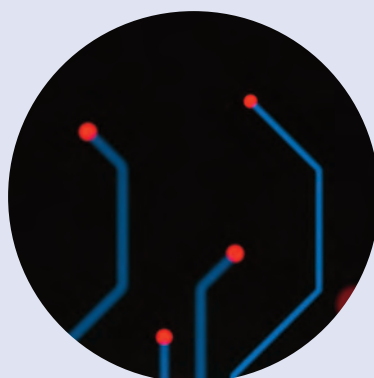
Finally it should also be mentioned that with the result of the European Innovation Scoreboard (EIS) 2018, Luxembourg has joined the group of innovation leaders, and has therefore

been added to the set of indicators, on which this report is based. This has also resulted in revisions in individual cases with some indicators, which, however, on the whole do not have any serious effects on the bigger picture. On the other hand it must be pointed out that Germany continues as an innovation leader, even though it recently exited in the EIS from the group of leaders. Arguments for this can be found, for example, with Germany's excellent scoring in quite a few other international innovation rankings¹⁶, and also in the EIS itself, because Germany's distance to the top group is minimal. In the Summary Innovation Index, Luxembourg and the UK's score is therefore 128 points, while Germany's is 127 points.¹⁷

¹⁵ <http://www.rat-fte.at/leistungsberichte.html>

¹⁶ As recently in Bloomberg for example (2019): Bloomberg Innovation Index 2019; WEF (2018): The Global Competitiveness Index 2018. WEF, Geneva.

¹⁷ For this, see European Innovation Scoreboard 2018, p. 6 and p. 54.



The Austrian RTI system's performance
in the international comparison and with
regard to the objectives of the RTI Strategy

performance
evaluation

With an R&D rate estimated by Statistik Austria at 3.19 percent for 2018, in the international comparison Austria invests an above-average high amount in its RTI

system. At the same time, however, this only generates comparatively moderate output. These findings apply to all areas of the RTI system¹⁸ and are also confirmed by the OECD.¹⁹ Table 1 up-

Table 1: Countries' ranking according to efficiency in science, technology and innovation

Science				Technology				Innovation			
Country	Rank	Value	Rank previous year	Country	Rank	Value	Rank previous year	Country	Rank	Value	Rank previous year
US	1	0.30	1	JP	1	0.36	1	MT	1	0.36	1
IE	2	0.38	2	CH	2	0.47	3	DE	2	0.73	5
HR	3	0.61	8	DE	3	0.50	2	CH	3	0.73	2
GB	4	0.61	3	US	4	0.61	5	SK	4	0.81	4
CH	5	0.71	4	NL	5	0.71	6	CZ	5	0.84	6
EE	6	0.78	6	LV	6	0.83	–	IE	6	0.86	3
SI	7	0.79	7	CY	7	1.08	4	JP	7	0.91	8
IT	8	0.94	9	IT	8	1.12	7	SI	8	0.92	7
DK	9	1.02	10	FI	9	1.18	8	HU	9	0.93	9
RO	10	1.04	5	FR	10	1.24	11	KR	10	0.96	10
NL	11	1.05	11	SE	11	1.25	9	RO	11	1.01	14
PT	12	1.06	14	DK	12	1.37	12	IT	12	1.02	12
BE	13	1.13	12	LU	13	1.44	14	FI	13	1.02	13
ES	14	1.13	15	AT	14	1.46	13	CY	14	1.03	11
SE	15	1.14	13	GB	15	1.47	16	SE	15	1.15	15
GR	16	1.14	16	BE	16	1.69	17	EE	16	1.16	16
AT	17	1.17	17	MT	17	1.71	–	AT	17	1.17	18
HU	18	1.22	23	LT	18	1.89	15	DK	18	1.17	24
FI	19	1.22	18	IE	19	2.20	18	LV	19	1.20	17
CZ	20	1.24	22	KR	20	2.20	20	FR	20	1.20	19
DE	21	1.29	20	ES	21	2.29	19	GB	21	1.24	21
FR	22	1.30	19	PL	22	2.91	21	US	22	1.24	20
PL	23	1.30	24	SI	23	2.97	24	BE	23	1.31	22
KR	24	1.31	21	EE	24	3.06	22	LT	24	1.32	23
SK	25	1.50	25	BG	25	3.27	23	NL	25	1.40	27
LT	26	1.68	26	RO	26	3.27	10	PL	26	1.41	26
JP	27	1.90	27	HR	27	3.98	25	HR	27	1.47	25
				SK	28	4.07	26	ES	28	1.48	28
				PT	29	4.34	29	PT	29	1.74	29
				HU	30	4.59	27	BG	30	1.97	30
				CZ	31	4.69	28	GR	31	3.05	31

Sources: See appendix 7. WIFO calculations. Output-oriented DEA while considering super efficiency and declining economies of scale. Interpretation of efficiency values: > 1: inefficient, = 1: efficient, < 1: super efficient.

¹⁸ For this in detail, see Austrian Council (2018): Report on Austria's Scientific and Technological Capability 2018. Vienna, pp. 18 ff.

¹⁹ OECD (2018): OECD Reviews of Innovation Policy: Austria 2018. OECD Publishing, Paris, p. 13 pp. and 52 ff.

dates the results in this respect from the Report on Austria's Scientific and Technological Capability 2018. It maps Austria's relative efficiency in science, technology and innovation in the international comparison and demonstrates how Austria is still not among the efficient countries in any area, but nor is it in the lower third in any area.²⁰

In the technology area Austria deteriorated compared to the previous year by one place, although this may also be due to the performance of the comparison countries. The value of 1.46 for Austria in the technological frontier area means that Austria could increase its technology outputs – number and quality of patents – proportionally by 46 percent, if it succeeded in using its inputs as efficiently as the countries identified as efficient, which provide the basis for calculating the technological frontier. In the scientific frontier area Austria could increase its outputs, i.e. the number and quality of scientific publications, with the same inputs by 17 percent; in the innovation frontier area in terms of dynamics and export strength of knowledge-intensive activities by 17 percent.

Austria therefore has room to manoeuvre to achieve more output in all areas with the given resources. The high monetary inputs, however,

are compensated in part by low inputs with human resources. Companies in Austria often cite the lack of qualified specialists and researchers as significant innovation or growth inhibitors.²¹

Greater attention must therefore be paid in the future to how the Austrian RTI system can better convert the high inputs into outputs than was previously the case, in line with its advanced level, and therefore increase its system efficiency. The Austrian Council has made several proposals in this respect in the past²², and in its Review of Innovation Policy the OECD also points to the existing potential to increase efficiency.²³

This report subsequently goes into the details and the individual chapters of the current RTI Strategy and demonstrates the status of goal achievement in the area of priority objectives, in the education system, at the universities, in basic research, with corporate research and innovation, and with governance and RTI funding. The developments between 2010 and today are illustrated here and the degree of goal achievement is then evaluated. The more important improvement proposals for every area of the RTI system and recommendations for a future RTI Strategy will then be presented on this basis.

performance
evaluation

20 For details on methodology, see Austrian Council (2018): Report on Austria's Scientific and Technological Capability 2018. Vienna, pp. 23 ff.

21 For this, see, inter alia, Ecker, B. / Fink, N. / Sardadvar, S. / Kaufmann, P. / Sheikh, S. / Wolf, L. / Brandl, B. / Loretz, S. / Sellner, R. (2017): Evaluierung der Forschungsprämie gem. § 108c EStG, Study commissioned by the Austrian Bundesministerium für Finanzen (Austrian Ministry of Finance; BMF). Vienna. See also Hölzl, W. / Friesenbichler, K. S. / Kügler, A. / Peneder, M. / Reinstaller, A. (2017): Österreich 2025 – Wettbewerbsfähigkeit, Standortfaktoren, Markt- und Produktstrategien österreichischer Unternehmen und die Positionierung in der internationalen Wertschöpfungskette. In: WIFO-Monatsberichte, 90 (3); pp. 219-228.

22 Austrian Council (2017): Recommendation on the way to the forefront of innovation of 30 Nov. 2017; Austrian Council (2018): Report on Austria's Scientific and Technological Capability 2018. Vienna, pp. 32 ff.

23 OECD (2018): OECD Reviews of Innovation Policy: Austria 2018. OECD Publishing, Paris, p. 17 ff.

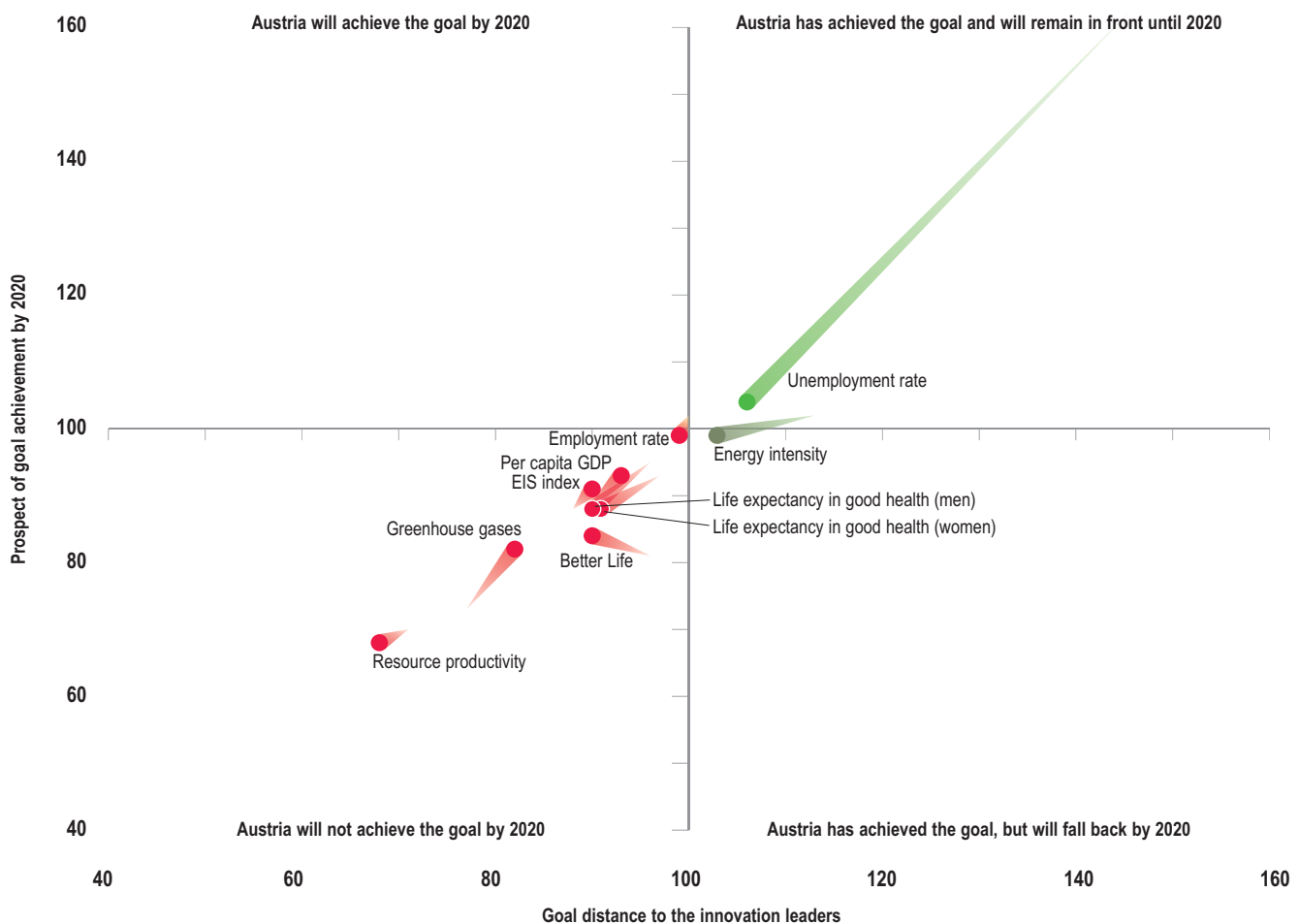
performance evaluation

Priority objectives

The success of RTI policy strategies cannot be measured on the degree of achievement of their detailed goals alone, but rather essentially on the level of achievement of their overriding objectives and therefore the effects that RTI activities can have. This section illustrates the

effect of RTI activities on the socio-economic level, which were defined in the RTI Strategy as overriding, priority objectives. These apply to areas that generally constitute the primary operational goal of policy measures and which are especially important for citizens. Included here are, economic capability ("Per capita GDP",

Figure 1: Development of goal distance and prospect of goal achievement in the area of the RTI Strategy's priority objectives from 2010 to 2019



Sources: See appendix 1. WIFO graphic. Raw data, see appendix 2. Explanation, see appendix 3.

Note: Goal distance = Austria's actual value relative to the actual value of the innovation leaders (average value most recent available year DE, DK, FI, LU, NL, SE, UK) or to the national target;

Prospect of goal achievement = value projected for Austria in 2020 relative to the national target or the value projected for the innovation leaders in 2020.

“Unemployment rate”, “Employment rate”), performance in the environment area (“Greenhouse gases”, “Energy intensity” and “Resource productivity”) and the areas of quality of life and life expectancy. Innovation performance is also addressed here on the whole as an RTI Strategy priority goal (measured on the European Innovation Index [EIS]).²⁴

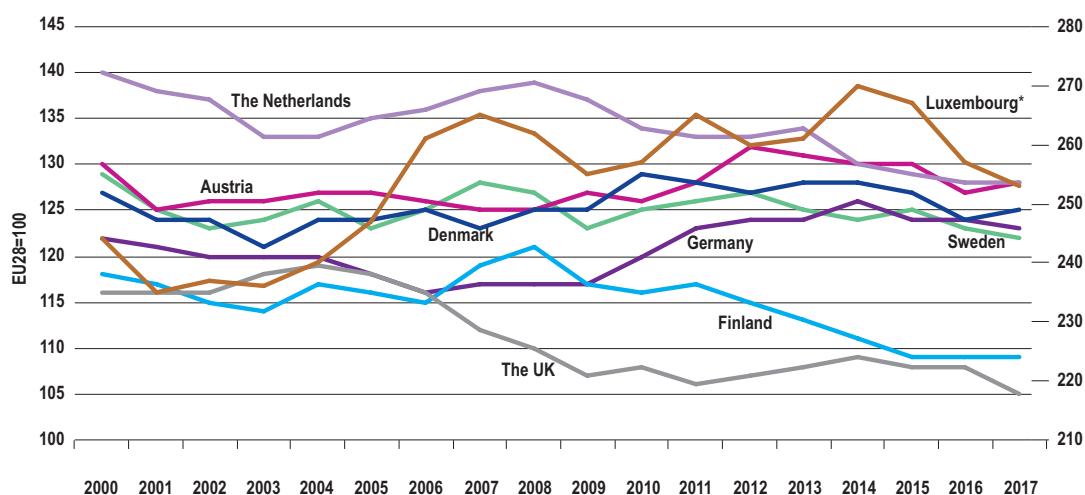
Figure 1 provides an overview of the developments in these areas from 2010 to today. The situation has only changed insignificantly during the comparison period. On the whole the level of the leading nations was only reached or surpassed with two of the ten indicators, name-

ly in the areas of “Energy intensity” and “Unemployment rate”. In the “Per capita GDP” area, where Austria scored clearly above the level of the leading innovation nations in previous years, the situation has changed so that Luxembourg with its above-average high per capita GDP has now also joined the group of innovation leaders (see figure 2). This of course changes nothing with regard to the fact that Austria continues to be among the top countries in Europe and the best performers worldwide, both with regard to real GDP growth and per capita GDP development. And

performance
evaluation

RTI Strategy priority objectives
See appendix, page 98

Figure 2: Per capita GDP development from 2007 to 2017



Source: Eurostat, * right axis.

²⁴ When interpreting the results it should be noted that Austria’s performance in the area of priority objectives is not only influenced by RTI activities, but rather by the result of many other factors as well. These include, for example, specific regulations with environment and health, which have a direct influence on the performance of the corresponding areas, or the general economic development, which also has an effect on the quality of life.

performance evaluation

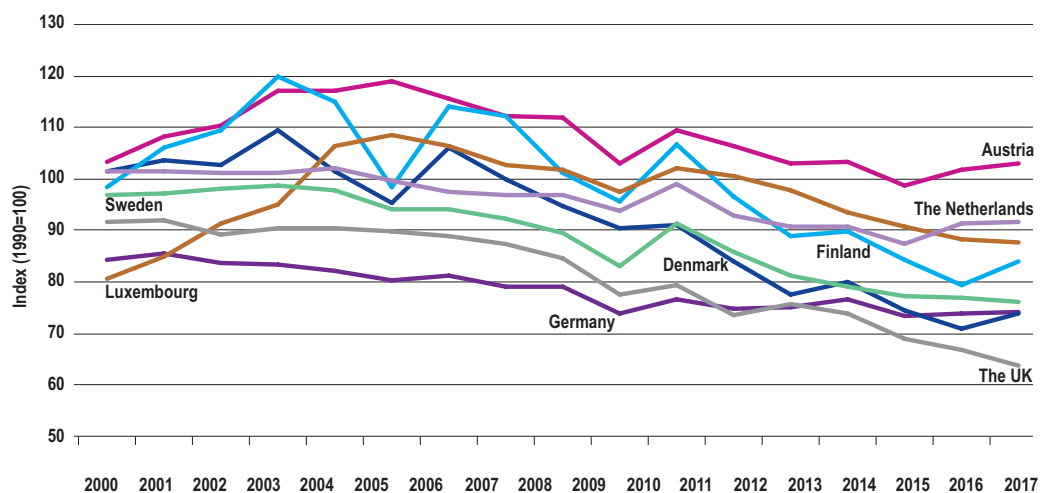
nor will anything change significantly here with the development trend remaining as it is into 2020.²⁵

Austria is traditionally among the industrial countries with a relatively low unemployment rate. Even if the distance to the innovation leaders' average has declined since 2010, the unemployment rate in Austria remains relatively low compared to the leading innovation nations. The changes

in the observation period are not expected to contribute to any change in Austria's lead position by 2020 either.

Things are different in the energy intensity area, although Austria currently ranks significantly above the average level of the innovation leaders here. According to Statistik Austria's figures, Austria has succeeded since 2005 in decoupling economic growth from energy consumption. Primary and final energy consumption were sta-

Figure 3: Greenhouse gas emissions development, 2000 to 2017



Source: Eurostat.

²⁵ Reasons for Austria's good economic performance can undoubtedly be found in the internationally competitive industrial economy and tourism sector with their countless dynamic, small and medium-sized enterprises, as well as in the well-performing agriculture and wine sector. Austria's return to Europe's dynamic centre after the fall of the Iron Curtain and its integration into the EU and the common internal market were also important for Austria's success. This also helped boost tourism, with a 35 percent share in service exports in Austria, while in the innovation leaders' average it only enjoys some 13 percent, being a key source of employment and growth in rural areas in particular (low-skill employment included). The close interconnection with Germany's successful economy also produces further benefits. The contribution of medium and high-tech products to the trade balance, which is above-average high in Austria and more or less on a par with the values of Germany and Switzerland, should also be noted. Thanks to considerable export performances, in the industrial area in particular with volume of approximately EUR 140 billion (to which are added industry-related service exports amounting to close to 60 billion), the Austrian economy has been enjoying a positive performance balance for some years now (for this, see, inter alia, Androsch, H. / Gadner, J. / Poller, B. (2017): "Zwischen Kakanien und Arkadien – Österreich in der Welt von morgen: eine bedrohte Erfolgsgeschichte?" In: Europäische Rundschau, no. 4/2017, p. 1–22, S. 11 f., and WKO (2019): Österreichische Exportwirtschaft 2019. Vienna, pp. 4 ff.).

bilised at the 2005 level, and primary energy intensity was improved by an average of 1.2 per cent per year since 2005.²⁶ As this trend can be seen in all OECD countries and the leading innovation nations also continuously make advances here, with the development dynamic remaining unchanged, Austria could fall below the level of the leading countries by 2020.

In all other areas, from today's point of view the development dynamic appears to be insufficient to join the innovation leaders by 2020. On the contrary, the overall trend since 2010 is predominantly declining or stagnating. On the whole, positive development trends can only be seen with three indicators – “Per capita GDP”, “Greenhouse gas emissions” and the “EIS Index”. However, the dynamic here is also still behind that of the leading countries.

Also to be emphasised is the fact that, in relation to the leading nations, Austria in particular scores badly with the two also technology-related environment indicators, “Greenhouse gas emissions” and “Resource productivity”. In terms of greenhouse gas emissions Austria is the only of the comparison countries analysed for this report that continues to be above the 1990 reference value (see figure 3). Although on the whole an improvement of the performance in this respect since 2010 can be verified, the development is far less dynamic than that of the leading nations. The innovation diffusion should also be increased and already existing energy-efficient technologies should be used even more than before.

Austria ranks far behind with resource productivity: Figure 1 shows how Austria has the great-

est distance to the level of the innovation leaders in this area, as well as the lowest prospect of goal achievement. This must also be considered under the aspect of resource productivity being a gauge for how much GDP can be achieved with the respectively used material; increases in resource productivity are generally seen as a result of technological progress. Austria's resource productivity actually improves in absolute terms. According to the BMNT's calculations it rose by 2.2. per cent each year between 2005 and 2016. However Austria is herewith just below the EU 28 average and at number 13 only in the European midfield.²⁷ Compared to the innovation leaders Austria has even lost ground since 2010, and the distance to the leading nations' average level has grown. This shows how Austria has not succeeded to the same degree as the leading innovation nations in utilising its technological progress to increase productivity.

The Austrian Council therefore welcomes the Austrian Government's goal of making Austria an innovation leader, and therefore further expanding the competitiveness of the domestic economy, and also proactively meeting social challenges such as climate change, resource scarcity or digitisation.²⁸ Here and with the development of the future RTI Strategy, special attention should therefore be paid to making Austria's economy and society fit to meet the global “grand challenges” and to specifically address the economic demands of the 21st century. The OECD also pointed this out in its Review of Innovation Policy: Austria.²⁹

performance
evaluation

26 For this, see Federal Ministry for Sustainability and Tourism (2018): Energy in Austria 2018. Figures, Dates, Facts. Vienna, p. 15.

27 For this, see Federal Ministry for Sustainability and Tourism (2018): Energy in Austria 2018. Figures, Dates, Facts. Vienna, p. 19.

28 Austrian Government (2017): Zusammen. Für unser Österreich. Regierungsprogramm 2017–2022. Vienna, pp. 4 ff., pp. 68 ff. and pp. 75 ff.

29 OECD (2018): OECD Reviews of Innovation Policy: Austria 2018. OECD Publishing, Paris, p. 39 ff.

performance
evaluation

Recommendations of the Austrian Council on overriding, priority objectives with regard to the future RTI Strategy

The Austrian Council recommends, also in a future RTI Strategy, that research, technology and innovation not be understood as an end in itself, but rather as a contribution to achieving higher priority objectives on social, economic and ecological levels. The efficient use of existing resources and the importance of social challenges in achieving the goal of taking Austria into the group of innovation leaders should also be considered in greater detail here than has previously been the case.

In the context of developing a new RTI Strategy, the Austrian Council also recommends, in accordance with the corresponding proposals of the OECD, a specific expansion of the mission orientation to increase the quality and speed of

progress in areas such as innovative economy and society, health, quality of life, environment and digitisation. Measures to achieve a more efficient implementation and application of research results and innovations must be focused on here to exploit the potential to meet the grand challenges, such as climate change, resource scarcity, the ageing society or digitisation, that exists in Austrian research institutions and companies on a greater level and more systematically than has previously been the case. The Austrian Council also suggests detailed strategies be developed for the innovation-oriented restructuring of the economy to support successful industries of the old economy in Austria in the development of new forward-looking business models – keyword: platform economy.

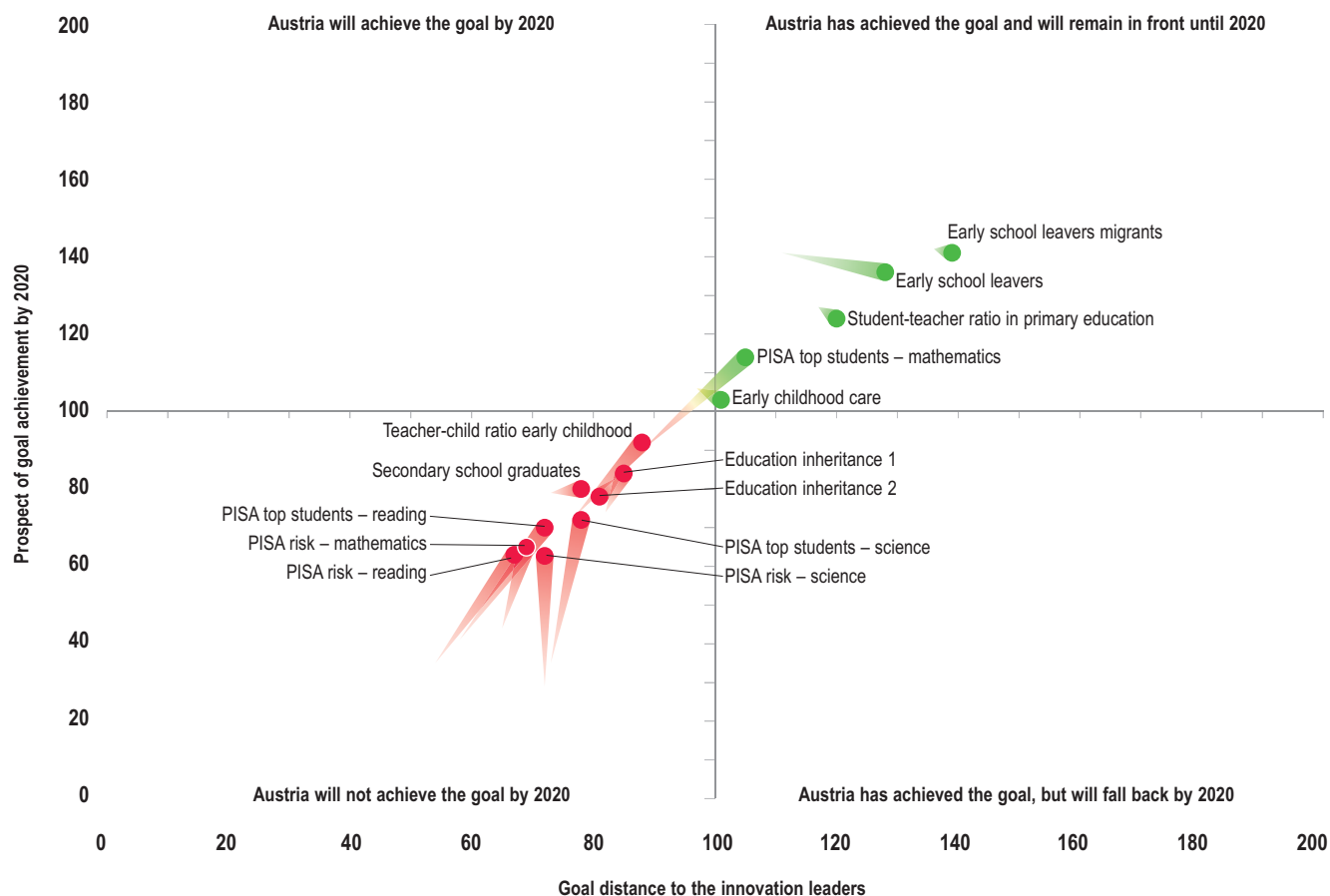
Education system (without tertiary education)

The primary and secondary education system, which provides both the basis for individual lifestyle options and the foundation of our research and innovation system, continues, despite a slightly positive development of some indicators, to show insufficient dynamic, and will not achieve the majority of the objectives of

the RTI Strategy, which can be checked with the corresponding indicators, by 2020. The situation familiar now for some years is seen here (see figure 4): The biggest weaknesses in the Austrian education system are in the risk groups surveyed by the PISA Tests in the areas of

performance
evaluation

Figure 4: Development of goal distance and prospect of goal achievement in the education system (without tertiary area) from 2010 to 2019



Sources: See appendix 1. WIFO graphic. Raw data, see appendix 2. Explanation, see appendix 3.

Note: Goal distance = Austria's actual value compared to the innovation leaders' actual value (average value most recent available year DE, DK, FI, LU, NL, SE, UK);

Prospect of goal achievement = ratio of value projected for Austria in 2020 relative to the national goal or the value projected for the innovation leaders in 2020.

performance evaluation

RTI Strategy priority objectives
See appendix, page 98

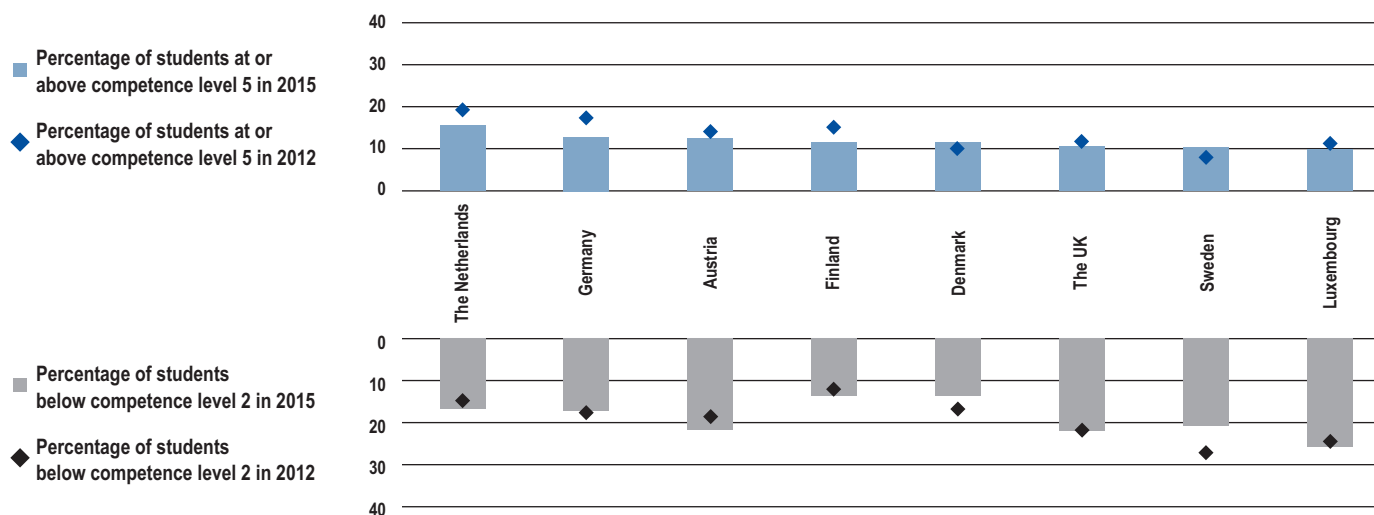
reading, mathematics and science, and in the system-inherent problem of education inheritance³⁰.

The 14 indicators for the comparison period 2010 to 2019 also show only minor changes compared to the group of innovation leaders. Although there were positive developments in relation to the leading countries with 60 percent of the indicators, the dynamic in most cases is nevertheless too weak to be able to achieve the average level of the innovation leaders in the foreseeable future, unless these deteriorate in the education area. The “Early school leavers”, “Early school leavers migrants”, “Student-teacher

ratio in primary education” and “PISA top students – mathematics” indicators, which are all in the goal area, must be positively highlighted here. The “Early childhood care” indicator will also achieve the goal by 2020.

It should be noted here that the “PISA top students – mathematics” indicator has developed positively, not because Austrian students deliver better performances, but rather because the values of the comparison countries have deteriorated. The same incidentally also applies for most other indicators with which the relational consideration exhibits an upward trend, while the absolute values do not exhibit any notable improvement in performances. This is illustrated,

Figure 5: Percentages of poorer performing and in particular better performing students in the mathematics area, 2012 comparison with 2015



Source: PISA 2015, vol. 1.

³⁰ These findings apply for the entire education system and are based on the corresponding indicators of the OECD (see appendix 1). An exception, of course with little effect on overall performance, are the vocational higher level schools (BHS), with which a correlation between the education level of the parents and the children cannot be established. See Austrian Council (2016): Report on Austria's Scientific and Technological Capability 2016. Vienna, p. 16 f. See also: Lassnigg, L. / Laimer, A. (2013): Berufsbildung in Österreich. Hintergrundbericht zum Nationalen Bildungsbericht 2012. Projektbericht des IHS, Wien, pp. 39–44.

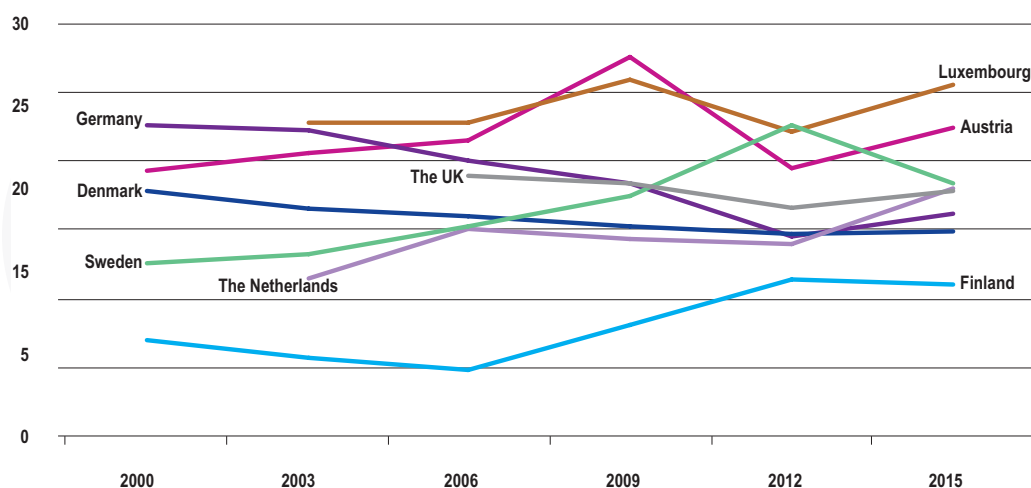
for example, by comparing the percentages of poorer performing and in particular better performing students in the mathematics area of 2015 with 2012. Over this period in Austria the group of risk students has actually grown and that of the top students has declined (see figure 5).

In view of the fact that meaningful reading and maths skills are basic requirements for the ability to positively shape our further educational path, it is especially serious that the “Pisa risk – reading” and “Pisa risk – maths” indicators do not exhibit any real improvements in the education area. Even if, as already verified in earlier reports on Austria’s scientific and technological capability, the fact that measures in the education area often require longer periods to become effective must be considered, it should nevertheless be critically noted that the PISA results have not improved significantly since they

were first surveyed in 2000. The situation with reading performances, for example, therefore shows that the percentage of students with bad reading performances rose from more than 19 percent in 2000 to more than 27 percent in 2009, and after an improvement and return to 19.5 percent, between 2012 and 2015 it deteriorated again to 22.5 percent (see figure 6). But the goal³¹ of taking the risk group below 15 percent of an age group was not achieved here either – neither with reading nor in maths nor the natural sciences.

To date Austria has not been able to reach education policy consensus on the issue of comprehensive schools for 10 to 14-year-olds, nor has it formulated specific measures to counter early education selection and therewith “education inheritance”. The Austrian education

Figure 6: PISA risk groups – reading



Source: OECD PISA. Percentage of students below competence level 2.

³¹ The member states of the European Union already agreed in 2009 in their “Conclusions on a strategic framework for European cooperation in education and training” that the level of poor performances should fall below 15 percent for under 15-year-olds by 2020. For this, see also in detail: http://www.cedefop.europa.eu/files/education_benchmarks_2020.pdf



performance evaluation

system therefore cannot leverage or promote all the existing talents and skills of its students either.

It must also be feared that the education package adopted by the Government in December 2018 will not bring about the required improvements. Furthermore, the challenges arising from increased migration and the increase in students whose native language is not German that this entails are met with concepts that the Austrian Council believes tend to complicate rather than improve the situation. In particular the reintroduction of numerical marks from second class upwards, the introduction of a “competence measurement” already in the third class or the retention of the device of “having to repeat a year” from second class upwards are in the opinion of experts not appropriate answers to the existing issues.³²

To be seen as positive here are measures for permeability in the education system, such as the A-levels equivalent, the new secondary level (NOST in Austria), to reduce repeating a year, the 2017 autonomy package, which gives schools the ability to adjust their offering to the

education region and enables more efficient control/governance, and the appointment of support staff for the IT infrastructure. Furthermore, the “training guarantee” and “training obligation”, the new competence-oriented curriculum generation, the introduction of the partially standardised school leaving and diploma examination (pivotal school leaving examinations) for standardising study maturity and the binding introduction of “pre-scientific work” (AHS) and “thesis work” (BHS) to awaken and intensify interest in science and research must also be emphasised. The actual effects of these measures remain to be seen.

On the whole once again there is the requirement for a comprehensive and in-depth structural reform of the Austrian education system, whose top priority is to tackle education inheritance, because only then can the existing potential of all children in Austria be fully exploited. An initiative for a future-oriented education system, which meets the requirements of the day and equips students with the education and necessary skills required to overcome the challenges of the future is therefore required.

³² For examples: Klemm, K. (2009): Klassenwiederholungen – teuer und unwirksam. Published by Bertelsmann-Stiftung, Gütersloh. Online at: https://www.bertelsmann-stiftung.de/fileadmin/files/BSSt/Publikationen/GrauePublikationen/GP_Klassenwiederholungen_teuer_und_unwirksam.pdf

See also, statements by education researcher Stefan Hopmann in “Die Presse” of 11 Feb. 2016 (“Schulexperte: Sitzenbleiben ist schädlich”), online at: https://diepresse.com/home/bildung/schule/4924111/Schulexperte_Sitzenbleiben-ist-schaedlich

Recommendations of the Austrian Council for the education system (without tertiary education) with regard to the future RTI Strategy

In terms of the new RTI Strategy the Austrian Council urgently recommends the problem of “education inheritance” be addressed more consistently than it has been to date and without ideological preconceptions. This is not only required for equal opportunity, but also and in particular in the interests of the Austria innovation and business location. As measures for this, among others, the second obligatory kindergarten year, the continued quality-assured expansion of language education for kindergarten children and an improvement in the qualification of educational staff must be implemented. A significant increase in the number of multilingual educators and better financial and HR provisions are required to reduce social selectivity and to develop the potential of all young people as much as possible (keyword: support staff) for those schools that are confronted with special challenges with regard to the socio-economic structure of their students (or “hotspot

schools”). The socially indexed awarding of funds was actually already planned in the 2017 Education Reform Act, however to date there have been no implementation steps that would have had the appropriate effect either.

To tackle early social selection in the education system, in addition to the ongoing expansion of day care, the Austrian Council also and in particular recommends the expansion of all-day schools with interwoven activities and the termination of early separation – which currently happens at the age of 9 or 10 and therefore far too early – by replacing it with later educational path decisions. At the same time the performance level must be raised across the board with specific support measures. With regard to a future RTI Strategy in particular, the Austrian Council also suggests a comprehensive international comparison of appropriate models and options.

**performance
evaluation**

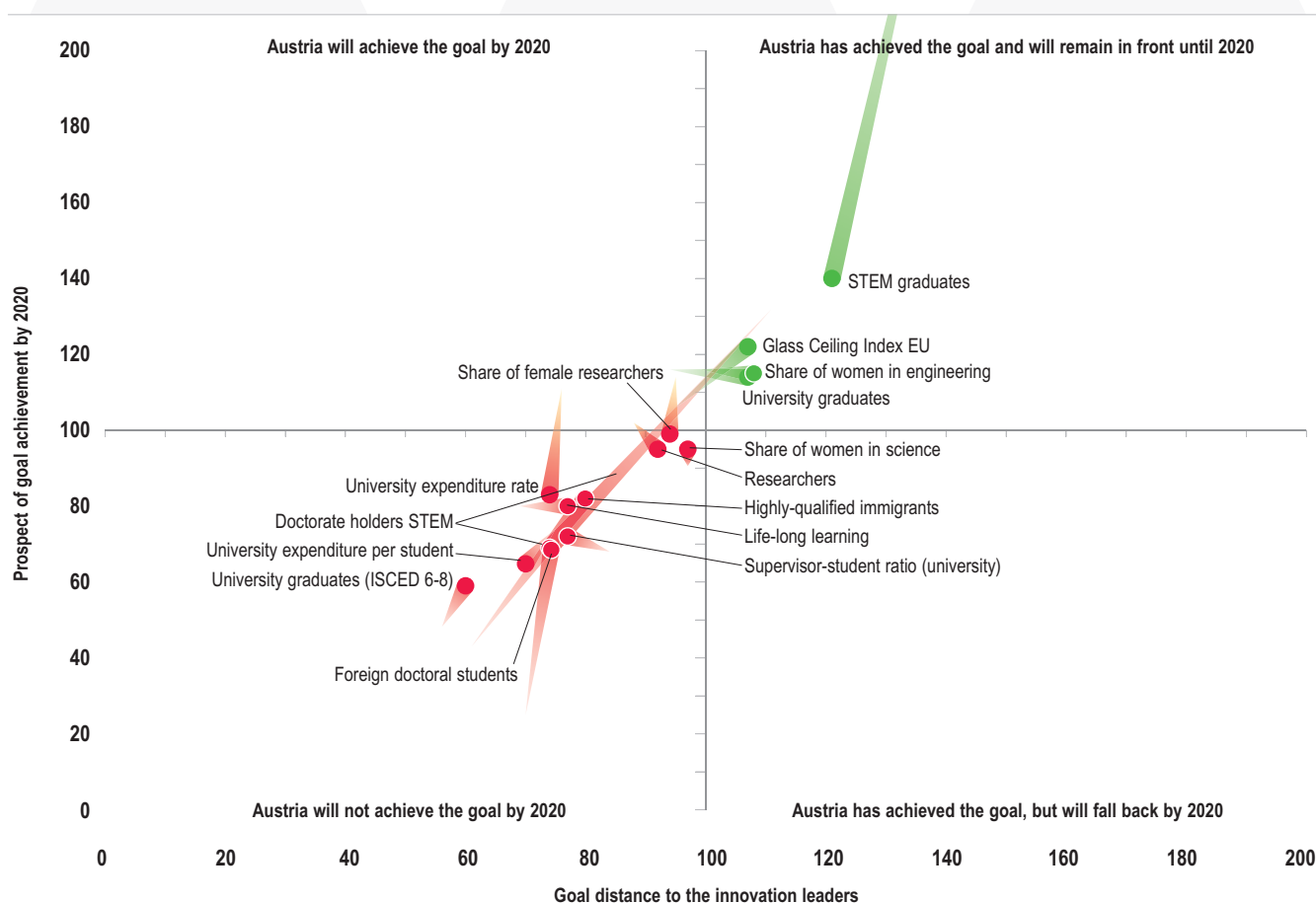
performance evaluation

Tertiary education system

A total of 15 indicators are analysed for the tertiary education sector and their changes relative to the group of innovation leaders are observed. These observations reveal the goals set were achieved with less than one third of the indicators (see figure 7). Three other indicators (“Share of female researchers”, “Share of women in science”,

“All researchers”) are just behind the innovation leaders’ average since the RTI Strategy was adopted. These positions were maintained due to an identical growth pattern in Austria and the comparison countries. The group of those indicators that show a significant deficit compared to the innovation leaders in particular includes the university development-relevant KPIs, “University

Figure 7: Development of goal distance and prospect of goal achievement in the tertiary education system from 2010 to 2019



Sources: See appendix 1. WIFO graphic. Raw data, see appendix 2. Explanation, see appendix 3.

Note: Goal distance = Austria's actual value compared to the innovation leaders' actual value (average value most recent available year DE, DK, FI, LU, NL, SE, UK);

Prospect of goal achievement = ratio of value projected for Austria in 2020 relative to the national goal or the value projected for the innovation leaders in 2020. Scaling deviates to better illustrate.

expenditure rate”, “Supervisor-student ratio at universities”, “University expenditure per student”, “University graduates (ISCED 6-8)”.

The “University graduates (ISCED 6-8)” indicator shows the greatest distance to the innovation leaders. In the 30 to 34 age group only 25.9 percent completed higher level education in Austria and therefore only about half as many as in the comparison group.³³ This is due on one hand to the familiar structural differences in the education systems and educational transitions in the individual countries³⁴. If we consider, for example, the indicator for “University graduates (all)”, then with 40.8 percent of the 30 to 34 age group with ISCED 5–8 completion (tertiary education rate), Austria has already achieved the national target of 38 percent by 2020³⁵, but persisting inefficiencies also continue at the universities. The study conditions at universities requiring improvement on multiple levels, due, for example, to an insufficient infrastructure, bad supervisor-student ratios, a study organisation that insufficiently considers the heterogeneity of students³⁶, and study grants that do not go far enough, has to date resulted in too many students with lower or insufficient examination activity³⁷, long study periods and a comparably low proportion of graduates.

With an insufficient university expenditure rate to date (currently at 1.48 percent of GDP³⁸) and a high number of students combined with too

few professors and science staff, the situation did not improve in recent years. In the 2016/17 study year more than 100,000 of the total of approximately 280,000 students registered as regular students achieved less than 16 ECTS points, and therefore are statistically identified as “examination-inactive”.³⁹ This results ceteris paribus in a very low study completion rate of an average 47.8 percent, of which only about one third of the studies are completed in the expected study period. In the 2016/17 study year only 32,250 students completed their university studies with a degree; 35,250 left their university without completing their studies.⁴⁰ With study completion rates between approximately 86 and 91 percent the medical universities in Vienna, Graz and Innsbruck scored most positively here. The University of Linz brought up the rear of the group with a completion rate of only some 37 percent.

The “Supervisor-student ratio (university)” indicator, which clearly identifies the imbalance between the number of science staff and students, must be considered in close correlation with the university budget. The increases in staffing levels at the universities were insufficient to contribute to any improvement, due to the parallel sharply rising student numbers. Between 2012 and 2017 only 213 professorship positions and 85 positions in the “Professor-equivalent” cate-

performance
evaluation

RTI Strategy priority objectives
See appendix, page 98

33 The average value of the “University graduates (ISCED 6-8)” indicator for the comparison countries is 43.45 percent. Last available data from 2017.

34 See Report on Austria’s Scientific and Technological Capability 2017. p. 45 ff.

35 The average value of the innovation leaders is 46.8 percent.

36 The “National strategy for the social dimension in third level education” (see also chapter, “RTI system governance and financing”) analyses and addresses these issues. Within the scope of the performance agreements 2019-21, projects in this respect are agreed with every university and their implementation is linked with a budget retention of 0.5 percent of the global budget of every university.

37 A bachelor, master or degree study course applies as “examination-active” when it is run with at least 16 ECTS per academic year. This restriction, however, says little about the academic success, if the annual input for an undergraduate study course is indeed 60 ECTS.

38 Goal achievement requires another 0.52 percent of GDP. This is equal to some EUR 2.2 billion.

39 Knowledge balance KPI 2.A.6; tab. 2.7 Examination-active bachelor, degree and master studies at universities.

40 Knowledge balance KPI 2.A.3 (called up on 24 Jan. 2019).



performance evaluation

gory were additionally set up.⁴¹ Measured against the innovation leaders the distance in this area even grew (see figure 7). The development of “university expenditure per student” shows a similar pattern here, which in the current data set is seen to be even stronger than before with the entry of Luxembourg into the group of innovation leaders.

With the decision to increase the budget of the universities from the performance agreement period 2019-2021 made at the end of the last legislative period, an important step was made to put management at the universities in a position to improve important framework conditions such as supervisor-student ratios in study courses with high attendance numbers or infrastructural facilities and to establish more efficient structures in the areas of research and teaching, in governance and at the operative level. Although the goal of a university expenditure rate of 2 percent⁴² will not be achieved with this budgetary increase, with the additional EUR 1.3 billion compared to the completed 2016-2018 PA period the 22 universities will receive an average budget increase of 13 percent. In total⁴³ this is just under EUR 11 billion for the 2019–2021 PA period.⁴⁴

Improvements financed herewith, in particular the expansion of science staff and better supervision ratios, should ultimately contribute to increasing examination-activity and the number of graduates and therefore optimising the performance of Austrian universities compared to

those of the leading innovation nations. In addition to the increase in competitive research funding, this is one of the more important factors to be able to compete with comparable universities of the innovation leaders. One of the challenges for the universities will be to fill the planned 360 additional professor and “equivalent” positions (career opportunities, among others) by 2020 and to appropriately meet the quality requirements for candidates here, so, depending on the staff fluctuation level for this, a total of some 300 to 400 favourable appointments will have to be made at Austria’s universities every year.

The budget distribution will be awarded impact-oriented according to certain basic and competition indicators with the “NEW university funding”. Teaching, research and AAA⁴⁵ as well as funds for infrastructure and strategic development are mapped in the “3 pillars model”⁴⁶. The basic funding for teaching is calculated in differently evaluated subject groups and on the basis of the number of actively attended study places. The basic research funding is based on the levels and expansion of the research staff in the individual subject groups. The amount awarded over the defined competition indicators is approximately 3.6 percent of the overall budget, so it is relatively low, but will motivate the universities to achieve improvements, in raising third party funds, for example, in implementing structured doctoral programmes or even in increasing the amount of graduates. EUR 50 million will also be awarded competition-oriented as project

41 University data reports based on BidokVUni; all usage categories in accordance with Z2.6 (retrieved on 24 Jan. 2019).

42 The GDP share of tertiary education spending is determined as a benchmark for financing in the international comparison. In the “Together for Austria” 2008-2013 government programme the Austrian Government committed to achieving the goal of 2% of GDP public and private spending for the tertiary education sector by 2020.

43 Conclusion of the performance agreements 2019-21 including the construction projects in the PA period, continuous clinical additional expenditure, University of Krems, retained funding for 2019-21 and Med. Faculty of the University of Linz. Acc. to UG § 141b.

44 It must, however, be critically noted that these funds are awarded via basic funding and therefore contrary to the increase in the competitively awarded share of the university budget called for several times by the Austrian Council.

45 Advancement and Appreciation of the Arts.

46 See UG § 12a. Definition of the global budget of the universities.

funding for university projects in the areas of digitisation and the social dimension of teaching. Reference is made at this point to the Austrian Council's statement on the University Funding Act⁴⁷, in which, among other things, it is recommended the share of funds awarded in competition for teaching and research be increased in the coming PA period.

The access regulations extended during the course of the capacity-oriented, student-related university funding present a further possibility for the universities to improve their access and study place management and to actively select students. Highly attended study courses can then be managed more efficiently, which in coming years should also be reflected in both graduate levels and in the context of optimising expenses.

The Austrian Council believes the planned package of measures has the potential to introduce a change process. It also calls for future-oriented management with clear roles in management committees⁴⁸ and leadership, designed to further increase efficiency and effectiveness at Austria's universities and to achieve quality improvements. The expansion of digital infrastructures and the implementation of digital technologies at universities can open up the potential here to support these processes and to fundamentally change science, teaching and learning. This also includes expanding the role of teachers at universities away from merely providers of knowledge and towards the role of learning coaches and mentors. The use of more innovative teaching and learning formats also requires trying out new ways to intensively further educate teaching staff in a didactic way, as well as the further development and differentiation of the "university teacher" job description.

There can be no doubt these measures impact across the entire university area. The higher education policy must continue to focus on the overriding goal of shaping a differentiated education system with clear training profiles for third level education providers, which meets the social requirements and needs of the economy. The growing need for highly-qualified people in knowledge-intensive professions must in particular be considered here. The recently presented technical college development and funding plan only supports this to a limited degree. The expansion of technical college study places does indeed focus on key points, which will grow in importance for the labour market in the future (IT, Industry 4.0, biosciences and health and health-care, for example), but absolutely no target values for the individual study programmes are defined in the development plan. The Austrian Council also believes the planned expansion of the number of study places by 2023 in coordination with the OECD's analyses⁴⁹ is not ambitious enough to meet future requirements.⁵⁰ From today's point of view the development dynamic will not be sufficient to achieve the medium-term goal of increasing the share of TC students to 30 percent over the next 10 to 15 years.

Making career paths attractive and transparent is a decisive factor in increasing the quality of the universities. This is necessary on one hand to motivate graduates to go into research at universities, and on the other hand to train researchers for knowledge and research-intensive companies. How successfully graduates in Austria can be motivated to study to become researchers is mapped in several indicators for this report (see figure 7).

performance
evaluation

⁴⁷ Statement of the Austrian Council on regulations for the implementation of capacity-oriented, student-relevant university financing (UniFinV). Vienna, 22 June 2018.

⁴⁸ For this see the Austrian Council's recommendation for governance and management structures at universities, Vienna, March 2015.

⁴⁹ See OECD (2018): OECD Reviews of Innovation Policy: Austria 2018. OECD Publishing, Paris, p. 135 ff.

⁵⁰ For this, see the Austrian Council's statement on drafting the technical colleges development and funding plan 2018/19–2022/23; Vienna, 21 Dec. 2018, and "Recommendation for the further development of the technical colleges sector in the Austrian education and science system"; Vienna, 30 May 2017.



performance evaluation

Enabling equal career opportunities for men and women is an important element of a successful knowledge and research landscape. The “Glass ceiling index EU” indicator shows how the glass ceiling is continuously lower for women. Despite a constant increase in the numbers of women over recent years, the share of female professors and owners of a *venia docendi* is still less than 30 percent. The share of women in these scientific/artistic leadership positions, as before, does not reflect their representation in lower career levels.

The share of women in technology in Austria thankfully is also above the average of the comparison countries, however in all comparison countries it is significantly below that of men.⁵¹ In technology studies on average only every fourth graduate is a woman.⁵² The share of women in natural sciences⁵³ in Austria is actually considerably higher, but as this share is even higher on average with the innovation leaders, Austria is just below the level of the comparison countries with this indicator. With a value of 29.5 percent the “Share of female researchers” indicator in Austria, measured against the entire scientific research staff, is at a similar level to that in the leading nations. With the “Researchers” indicator the number of researchers is mapped in relation to overall employment. With a value of 10.36 researchers per 1,000 employees Austria also occupies a place among the innovation leaders here.

Austria has an excellent position in relation to the average level of the leading nations with regard to the “STEM graduates” indicator (see figure 7). Expedient measures will, however, have to be continued for future challenges and to guaran-

tee a sufficient number of specialists in knowledge and research-intensive professions. Measured against the comparison group, the “Doctorate holders STEM” indicator in particular shows a negative trend.

Another important component for the success and quality of the universities and university research is active participation in the global “brain circulation”. An increased exodus of intellectual assets, or the feared “brain drain”, must be avoided here. In most countries, especially in those with higher science and research activity, measures are therefore taken to specifically increase the attractiveness of the science and research location. Bringing the best brains into the country and keeping them here with the right salaries, is the goal of various promotional activities and measures. Some countries participate more here in the brain circulation and are also more successful than others. The most important criteria and motives for choosing a research location are attractive research conditions and options to be able to perform independent research projects. However other factors also have an influence on researchers’ mobility behaviour. This would, for example, include the language, which is why English-language countries such as the USA, the UK, Australia or New Zealand traditionally enjoy a high level of appeal and are often the researcher’s country of choice.

However social and political stability, openness to other cultures and favourable immigration and residence provisions are also relevant factors. Some small, open and innovative countries are therefore also successful in attracting talent. The share of mobile participants in the tertiary area, for example, is 12 percent in Belgium, in Luxembourg 22, in Switzerland 20 and in Aus-

51 The leader here is Sweden with approx. 33 percent proportion of technology female graduates (28), followed by Luxembourg (25), the UK (25), Austria (24), the Netherlands (23), Finland (22) and Germany (20).

52 “Share of women in engineering” indicator.

53 “Share of women in natural sciences” indicator.

tria it is 18 percent.⁵⁴ Although Austria on the whole presents itself as a coveted destination country for third level studies, a successful “brain gain” cannot be seen in the important “Foreign doctoral students” and “Highly-qualified immigrants” indicators. In Europe it is Switzerland, the UK, Belgium, France and Sweden in particular that show a high share (>34 percent) of international doctoral/PhD students. With 28.3 percent of international participation, Austria is behind the innovation leaders in the midfield of

the OECD countries with doctoral courses. The positions of the Austrian universities in the lower areas of more standard international university rankings do not contribute either to attracting the strategically interesting group of internationally mobile students outside of Europe (Asia and the USA in particular). Universities’ reputations are also a significant factor in the study location choice for this group.⁵⁵

**performance
evaluation**

⁵⁴ See OECD, Education at a glance 2017; C4 indicator.

⁵⁵ Hazelkorn, E. (2014): The Effects of Rankings on Student Choices and Institutional Selection. In: Jongbloed, B. / Vossensteyn, H. (eds): Access and Expansion Post-Massification: Opportunities and Barriers to Further Growth in Higher Education Participation. London, Routledge.

Recommendations of the Austrian Council on the tertiary education system with regard to the future RTI Strategy

The significant increase in the budget for the universities from the 2019 to 2021 PA period and the step towards impact-oriented funding represent an opportunity for the universities to develop future-oriented procedures at the level of teaching, research and AAA, and at the governance and operative levels. The Austrian Council recommends implementing the change process this enables in third level education with the goal of establishing a student-centred third level system that enables efficient study courses. Exploiting the potential of digitisation for the strategic and structural further development of the universities will play a significant role here.

The Austrian Council also recommends promoting the same measures at all levels of university management, which contribute to a quality-related efficiency increase. An accompanying evaluation will also result in a successive increase of the competitively awarded share of the university budget.

The Austrian Council further recommends the goal of a university expenditure rate of 2 percent of GDP be further pursued with increased emphasis. This should be anchored within the framework of the future RTI Strategy to establish a high-performance third level education

sector, which can stay abreast in international competition with the best European countries and at the same time can also satisfy the rising demand for third level education, and consequently meets the growing requirement for highly qualified specialists in an innovative knowledge-based society.⁵⁶

In the interests of an expansion of the international knowledge transfer, the Austrian Council recommends anchoring a transparent arrangement of the career paths at the universities and the sustainable assurance of the expansion of additional positions in the new RTI Strategy.

In the context of an RTI Strategy 2030 the Austrian Council also believes it is necessary to accelerate measures for the structural further development of the Austrian higher education area. Tasks and functions of universities and technical colleges must also be coordinated with one another more strategically than they have been to date. In this context the Austrian Council has already called on the Austrian Government to swiftly push forward the expansion of the technical college sector oriented on social requirements, for which it recommends an annual five percent increase in the number of TC study places. The goal here should be to increase this share in the medium term to approximately 40 percent.⁵⁷

⁵⁶ Recommendation of the Austrian Council: (i) Recommendation for the further development of the technical colleges sector in the Austrian education and science system of 30 May 2017. (ii) Recommendation for policy prioritisation for the tertiary education sector, especially the universities of 14 Sept. 2017. (iii) Recommendation on the path to becoming an innovation leader, of 30 Nov. 2017.

⁵⁷ See Austrian Council (2017): Recommendation for the further development of the technical colleges sector in the Austrian education and science system of 30 May 2017.

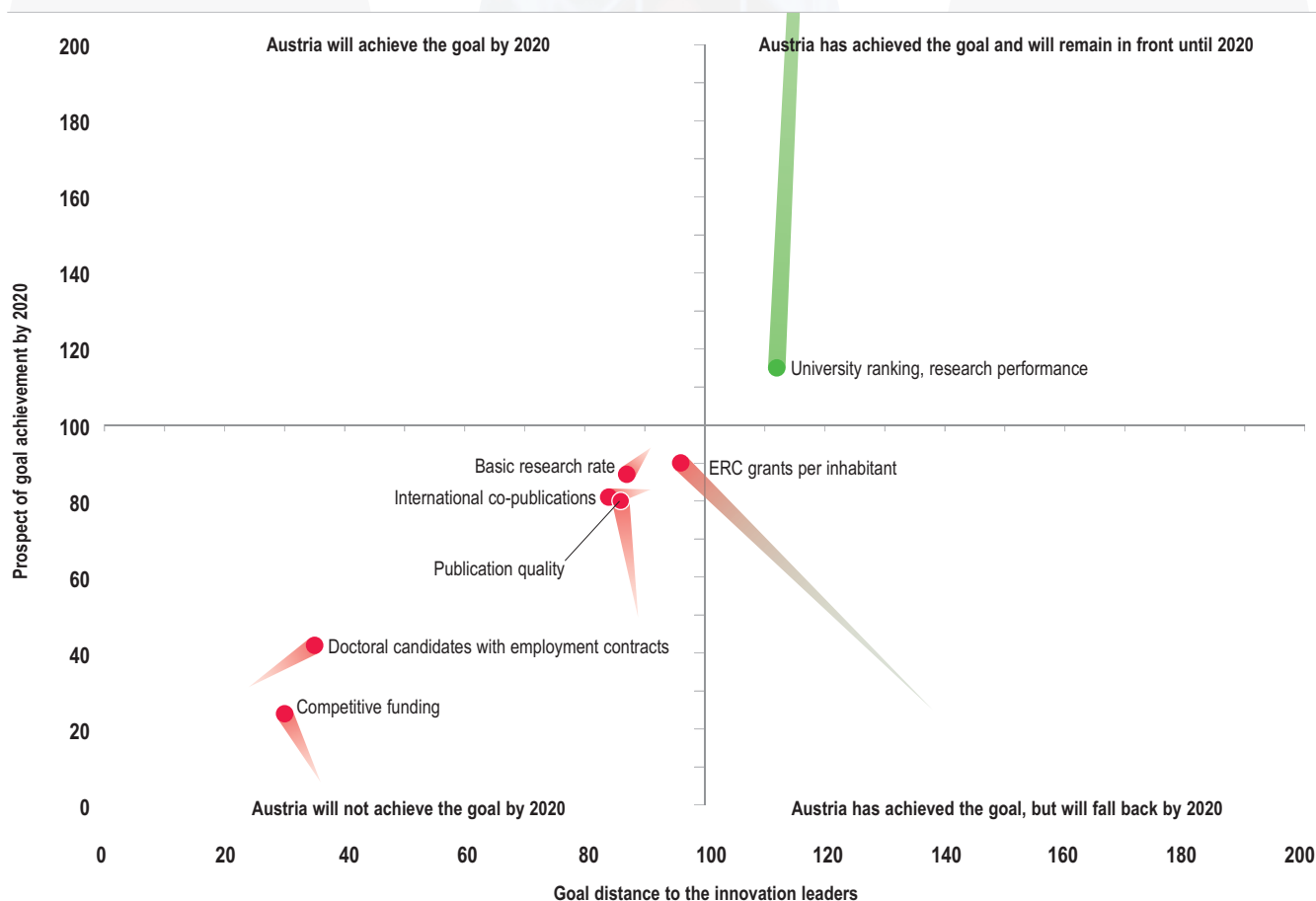
Research at universities and non-university research institutions

Figure 8 provides an overview of Austrian performance in the area of “Research at universities and non-university research institution”. The overall picture shows scarcely any improvements over the period since 2010. On the whole, only one indicator continues to rank above the average level of the leading innovation nations. The goal distance to the innovation leaders has not been reduced.

As figure 8 shows, only the “Doctoral candidates with employment contracts” indicator exhibits a positive development dynamic. The share of doctoral students in an employment relationship at a university has actually increased in the comparison period. In 2010 approximately every fourth doctoral student was in a working relationship with a university; today it is ap-

performance
evaluation

Figure 8: Development of goal distance and prospect of goal achievement in the area of research at universities and non-university research institutions from 2010 to 2019



Sources: See appendix 1. WIFO graphic. Raw data, see appendix 2. Explanation, see appendix 3.

Note: Goal distance = Austria's actual value compared to the innovation leaders' actual value (average value most recent available year DE, DK, FI, LU, NL, SE, UK);

Prospect of goal achievement = ratio of value projected for Austria in 2020 relative to the national goal or the value projected for the innovation leaders in 2020. Scaling deviates to better illustrate.

performance evaluation

proximately 35 percent. The rising number of doctoral students in structured programmes is welcome. However, the continuation and expansion of career-building measures must remain a priority goal, in order to offer an attractive research location for young talent from home and abroad.

The indicators for scientific output – “Publication quality” and “International co-publications” – have found a stable position close to the innovation leaders’ average. Publication quality maps the number of publications among the most cited 10 percent of globally published scientific publications. Relative to overall publication activity, which doubles on average every nine years⁵⁸, the share of top publications remained de facto unchanged over the observation period. This essentially applies for all coun-

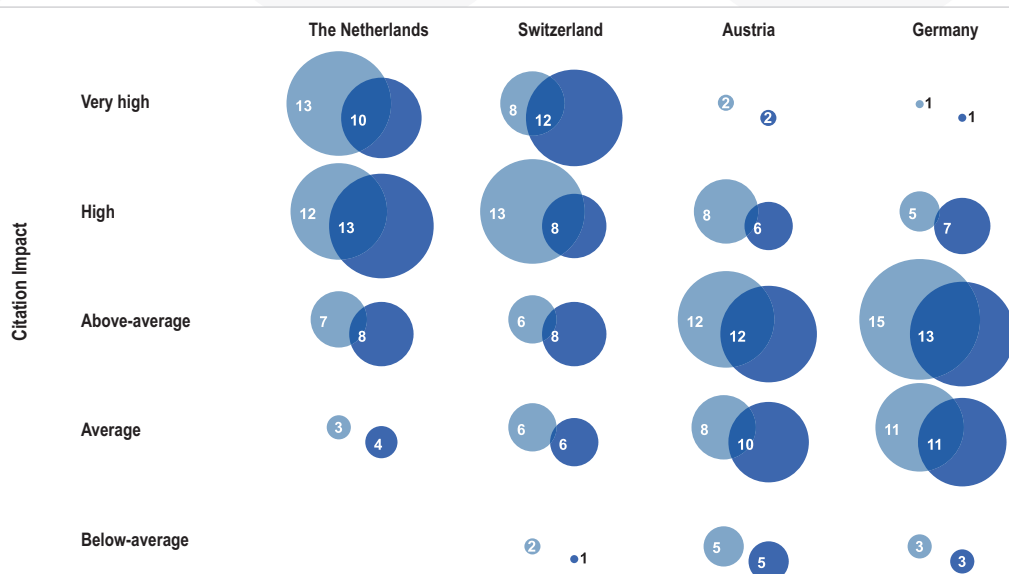
tries of the comparison group. In Austria this share is about the same as Germany and Finland, but somewhat behind the other innovation leaders. The Netherlands and the UK have the highest values here.

The “International co-publications” indicator provides information on the number of publications with at least one foreign co-author and is calculated in relation to the total population. Compared with 2010 the bibliometric database for Austria in 2017 shows 41 percent more publications in this category. In the comparison countries this increase was, however, significantly surpassed, and is even double this for Denmark. Despite the advances in Austria, the distance to the group of innovation leaders has therefore grown.

An analysis of the scientific impact and the publication quality based on the publication data of

RTI Strategy priority objectives
See appendix, page 99

Figure 9: Analysis of the scientific impact in 35 disciplines



Source: Rathenau Institut, <https://www.rathenau.nl/en/science-figures/output/performance-profile-netherlands-research-system> (download performed on August 13, 2018). As calculated and presented by the AC.

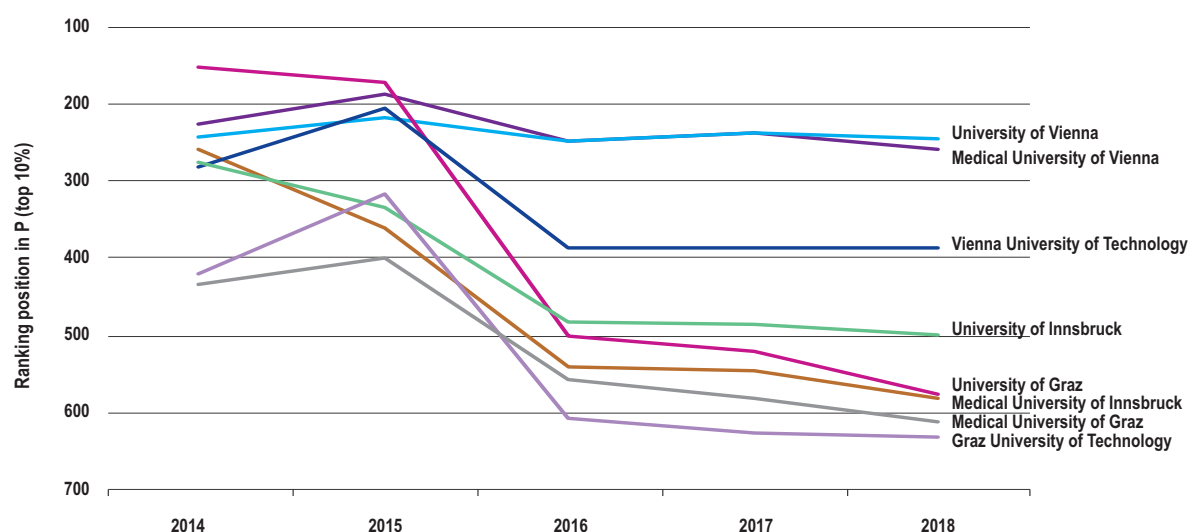
Note: On the basis of the Citation Impact the disciplines are categorised in five performance groups and presented for the time periods 2010–2013 (light blue circles) and 2012–2015 (dark blue circles). The size of the circles correlates with the number of disciplines.

⁵⁸ Bornmann, L. / Mutz, R. (2014): Growth rates of modern science: A bibliometric analysis based on the number of publications and cited references. In: Journal of the Association for Information Science and Technology, 66 (11).

18 countries in 35 scientific fields over the years 2012 to 2015 on the whole produces a similar picture.⁵⁹ In Austria a very high citation impact was achieved in 2 of the 35 knowledge fields (astronomy and astrophysics as well as multidisciplinary journals), 6 exhibit a high impact and in 12 more fields the impact is still above the average. In 15 scientific fields Austria is in the mid-field or below with this sample of countries. A comparison with the Netherlands shows a very clear lead in publication quality compared to Austria. In the Netherlands a very high impact was achieved in 10 scientific fields, with a high impact in 13 more, above-average values in 8 fields, and the citation index is below the average of the countries selected in only 4 fields. Publication quality is similarly high in Switzerland, which even improved in the highest quality sector in recent years. Practically on a par

with Germany, the publications in most scientific fields in Austria exhibit a citation impact in the mid-field (figure 9). Compared with this the research performance of Austrian universities is above the average level of the leading nations. The “University ranking research performance” indicator, which is oriented on the CWTS Leiden Ranking⁶⁰ and which maps the international positioning of Austrian universities with regard to their research performance, is stable in the goal area, despite a declining trend.⁶¹ This positioning is very good news; however, it should be assessed in the context of further analyses and discussions on the evaluation of rankings. It should also be noted that the positions of the Austrian universities in the Leiden Ranking over the last five years generally exhibit a negative trend (see figure 10). Only the Uni-

Figure 10: Austrian university positions in Leiden Ranking from 2014 to 2018



Source: CWTS Leiden Ranking 2018. Note: P (top 10 %) = number and share of publications of a university which, compared to other publications in the same specialist area and in the same years, rank in the top 10 percent with regard to their citation frequency.

⁵⁹ Source: CWTS/Web of Science, data online at: <https://www.rathenau.nl/sites/default/files/EN%20-%20Specialisation%20Index.xlsx>; calculations performed by RFTE.

⁶⁰ Centre for Science and Technology Studies – Leiden University.

⁶¹ In 2015 and more recently for this report the data from the University of Leiden was recomputed on the basis of a new methodology and data revision, which resulted in a substantial change, especially with the prospect of goal achievement.

performance evaluation

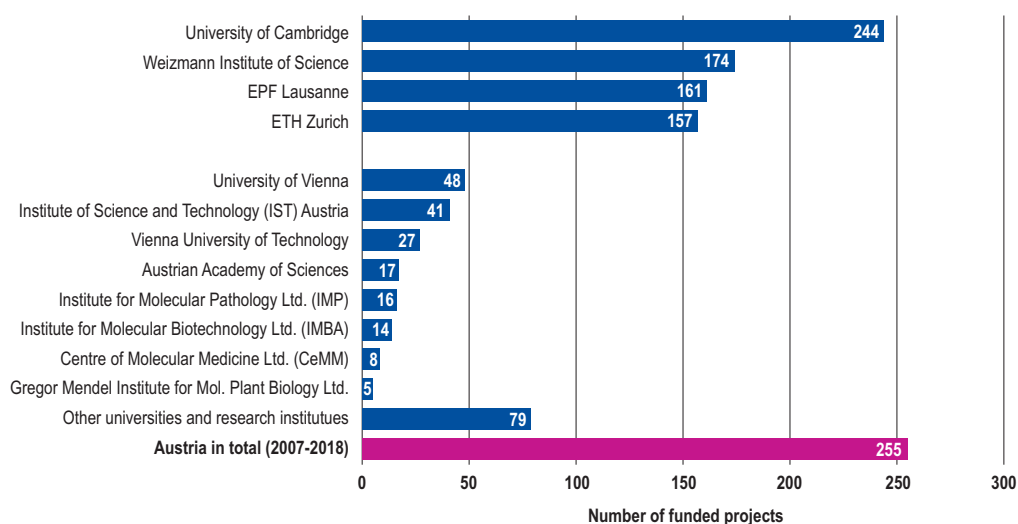
versity of Vienna and the Medical University of Vienna could maintain their positions.⁶²

One value that has developed into a notable KPI for excellence and the international success of researchers is mapped by the “ERC grants per inhabitants” indicator. Austria is actually successful in acquiring ERC grants and keeps up with the best countries, however in recent years this statistic has shown a declining success rate, illustrated by the indicator’s negative development dynamic. This could, however, change rapidly, as the distance between Austria (3.41 ERC grants per inhabitant) and the innovation leaders (3.56 ERC grants per inhabitant) is minimal. In the European average approximately 70 percent of ERC grants are acquired by researchers at universities. In Austria this value is approximately 50 percent. At national level, in previous years about as many ERC grants have been ac-

quired by non-university research institutions. This is an indication of the quality of non-university research in Austria. In recent years the Institute of Science and Technology Austria (IST Austria) in particular has been especially successful in acquiring grants. At the same time, however, this also demonstrates the improvement potential with regard to research conditions at Austrian universities. This is especially evident if we consider the success at institutional level (see figure 11). This shows that between 2007 and 2018 the University of Vienna as Austria’s most successful research institute acquired a mere one fifth of the ERC grants acquired by the University of Cambridge or a third of those acquired by ETH Zurich.

With the participations in the European framework programmes, the third level education sector could not achieve the high participation rate in FP7 in the current horizon 2020 either, while the share of approvals in the non-university sec-

Figure 11: ERC-funded projects of selected institutions from 2007 to 2018



Source: European Research Council, ERC funded projects; <https://erc.europa.eu/projects-figures/erc-funded-projects> (Download 190311). As presented by the AC.

⁶² It should be noted that changes unrelated to performance can occur due to methodological changes and the increase in the number of participating universities. For this see, CWTS Leiden Ranking, Updates and corrections. Centre for Science and Technology Studies, Leiden University, the Netherlands, online at: <http://www.leidenranking.com/information/updates>.

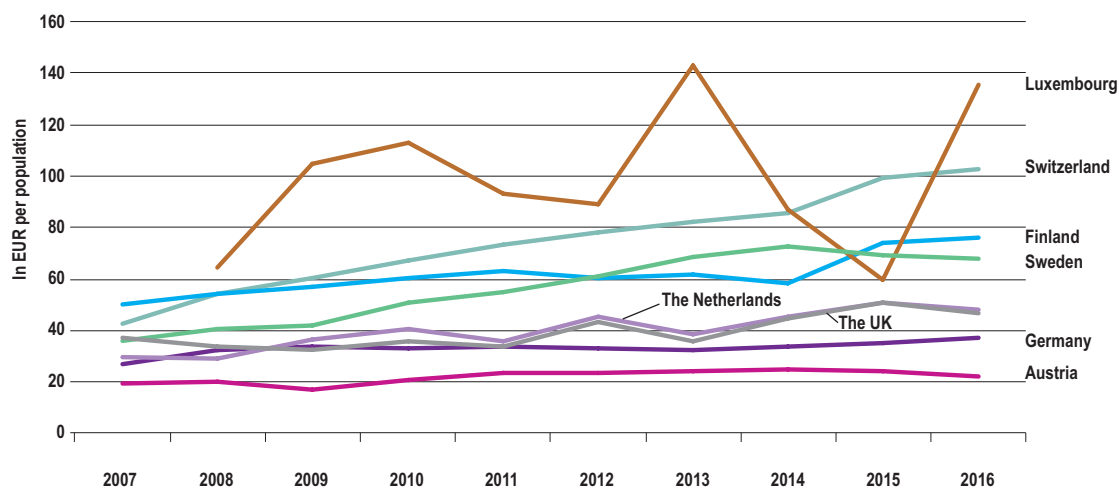
tor compared with the last framework programme remained practically constant and that in the corporate sector even rose.⁶³ As welcome as this increase is, it is also shown here that the academic area could not follow the efforts to join the European leaders (for this see also chapter, “RTI system governance and financing”).

In its previous reports on Austria’s scientific and technological capability and in various recommendations the Austrian Council has repeatedly pointed out the urgent need to improve the framework conditions for research, and basic research in particular. With the measures implemented to date it was not possible to achieve a basic research rate of 0.94 percent of GDP. With a current value of 0.54 percent Austria is in the midfield of the research-intensive countries. If we want to begin the necessary catch-up process, the Austrian Council believes a significant increase

in the competitively awarded funds for financing research in particular and a secured overhead financing⁶⁴ within the scope of the funds for the Austrian Science Fund, and long-term and sustainable financing of a modern research infrastructure⁶⁵ and the expansion of structured doctoral programmes are the most urgent areas of action.

Especially relevant here is the increase in funds for basic research awarded in competition. The corresponding “Competitive funding” indicator shows a significant deficit to the innovation leaders, which is illustrated in figure 12. In the comparison period, although various targets had been set and various things had been announced, it was not possible to significantly increase the funds for competitively awarded research funding. In relation to the population in Switzerland 5 times the

Figure 12: Development of competitive basic research funding in EUR per inhabitant from 2007 to 2016



Sources: See appendix 1.

⁶³ For this see European Commission 9/2018.

⁶⁴ Recommendation by the Austrian Council on increasing excellence in science and research. Vienna, 16 Aug. 2018.

⁶⁵ Recommendation by the Austrian Council on funding the research infrastructure and shaping of sustainable funding certainty. Vienna, 15 Nov. 2018.



performance evaluation

volume for this is available, while in Finland, Sweden, the Netherlands and the UK it is 3 to 4 times, and in Germany approximately 50 percent more funds are available. In the international competition for research funds, for the best talent and renowned researchers, Austria falls visibly further back here. In summary it must be said that the RTI Strategy's objective of increasing investments in basic research by 2020 to the level of leading research nations and of boosting basic research with structural reforms in the third level education system has not been achieved to date in any case.

It is all the more welcome then that the measures repeatedly called for by the Austrian Council have now also become a political concern. A first step will be taken with the change in university financing.⁶⁶ A next step can be taken with the excellence initiative to increase competitiveness in Austria and at international level announced in the current government programme and in the

presentation to the Cabinet on 16 August 2018. It will be essential with the funding of an excellence initiative to also introduce additional funds awarded in competition, and the improvements of the above-mentioned framework conditions will have to be vigorously followed up on, thereby enabling a potentially immense leverage effect to increase the performances of the universities and non-university research institutes, as well as companies, technical colleges and other research institutions.

The requirements of an excellence initiative and the framework conditions required for this were illustrated in detail with the recommendations of the Austrian Council⁶⁷, of the Austrian Council of Science⁶⁸ and more recently of the team of experts commissioned especially for this⁶⁹. If Austria intends to grow further in its role as a high-tech country, it will be indispensable for the body politic to accept these challenges and to further boost the existing potential in research and development.

⁶⁶ See UG § 12a Definition of the global budget of the universities.

⁶⁷ Recommendation of the Austrian Council for an excellence programme to promote science as key for more cooperation and competition in basic and top-quality research. Vienna, 22 Mar. 2018.

⁶⁸ Austrian Science Council: An excellence programme for Austria – statements and recommendations. Vienna, March 2018.

⁶⁹ Androsch, H. / Loprieno, A. / Nowotny, H. (2019, being printed): Exzellenzinitiative – Eine Zukunftsoffensive für den Forschungsstandort Österreich. Vienna.

Recommendations of the Austrian Council on the research at universities and non-university research institutions area with regard to the future RTI Strategy

The continuing deficit in the area of competitive funding of basic research compared to the innovation leaders is still too big and has an increasingly inhibiting effect on the performance and international attractiveness of Austria as a science location. The Austrian Council believes the goal of the new RTI Strategy must therefore be to create the required framework conditions to enable excellent top-level research in more research areas. In the context of compiling the RTI Strategy 2030 the Austrian Council therefore recommends the key factors of a competitive research landscape be specifically addressed. This would require a consistent increase in the funds awarded in competition to finance basic research to the level of the leading nations. An increase in the share of competitive factors in the university budget for research should also be

endeavoured. It would also require a significant expansion of structured doctoral programmes, a strategic modernisation of the research infrastructure, efficiency-oriented management structures and role-clarity of management committees as well as transparent selection processes in the area of management and scientific staff.⁷⁰

In this respect the Austrian Council recommends the programmatic conception and financial funding of an excellence initiative, which is embedded in Austria's science and research funding landscape, to enable more attractive research conditions for national and international top management and to guarantee better conditions for successful participation in international top-level research.

performance
evaluation

⁷⁰ For this, see inter alia, Austrian Council: Recommendation on the way to the forefront of innovation. Vienna, 30 Nov. 2017. Recommendation on funding the research infrastructure and shaping of sustainable funding certainty. Vienna, 15 Nov. 2018. Recommendation on increasing excellence in science and research. Vienna, 16 Aug. 2018.

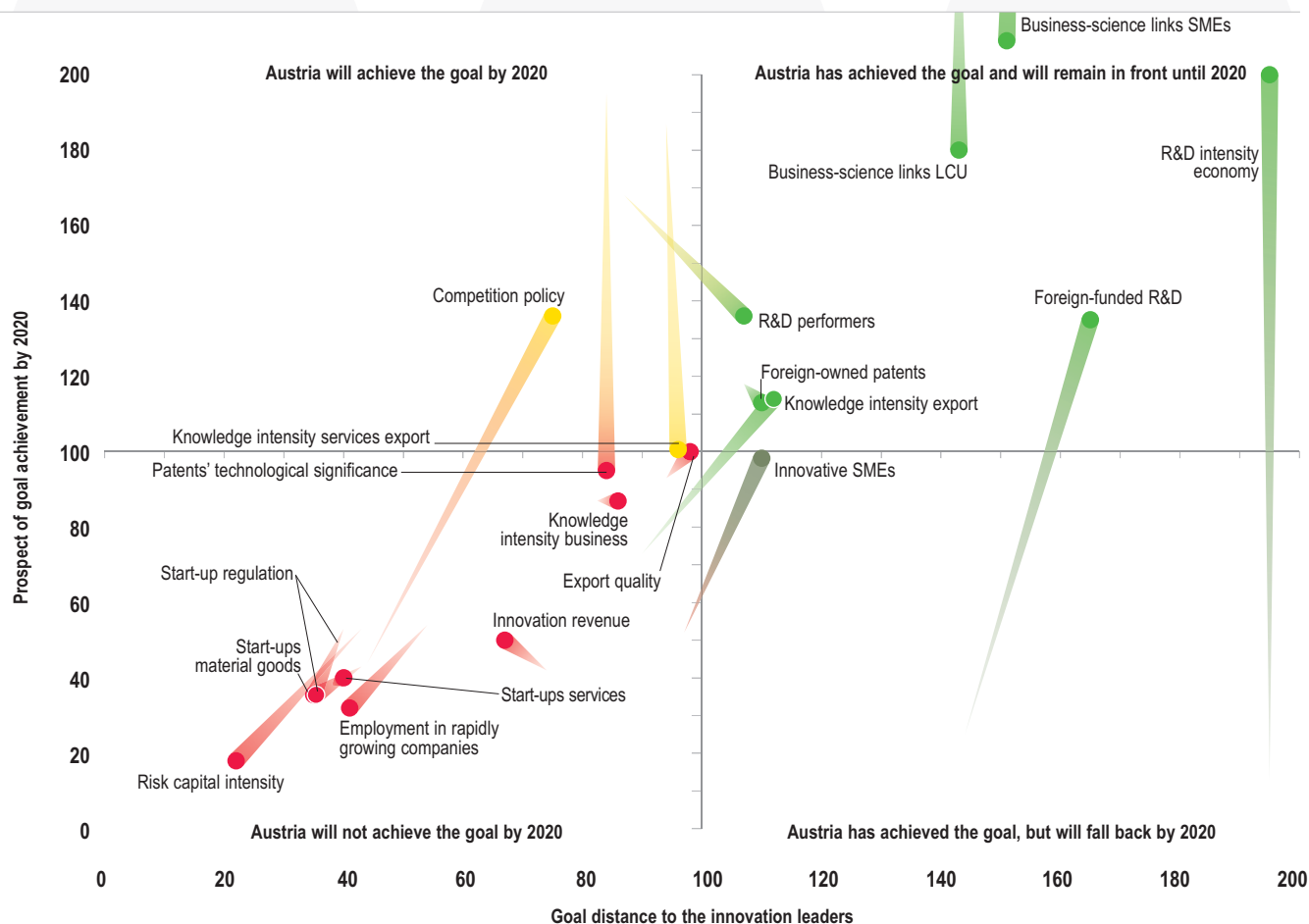
performance evaluation

Research and innovation in the corporate sector

The “Research and innovation in the corporate sector” area scores the best of all areas analysed for this report. Of the 19 indicators on the status of innovative companies in Austria, six have already achieved their goal today and continue to be stable above the level of the leading innovation nations (see figure 13). With the devel-

opment trend remaining as it is, approximately half of the objectives will be achieved in 2020. However, approximately 50 percent of the indicators remain in the left bottom quadrant, i.e. they have no realistic chance of moving into the goal area in the medium term with the current development. “Risk capital intensity” must in particular be named here, as it has developed de

Figure 13: Development of goal distance and prospect of goal achievement in the area of research and innovation in the corporate sector from 2010 to 2019



Sources: See appendix 1. WIFO graphic. Raw data, see appendix 2. Explanation, see appendix 3.

Note: Goal distance = Austria's actual value compared to the innovation leaders' actual value (average value most recent available year DE, DK, FI, LU, NL, SE, UK);

Prospect of goal achievement = ratio of value projected for Austria in 2020 relative to the national goal or the value projected for the innovation leaders in 2020.

facto negatively in relation to the leading countries since 2010. This also applies similarly for the regulation of start-up activity in Austria, the number of material goods companies set up and employment in rapidly growing companies – the corresponding indicators (“Start-up regulation”, “Start-ups material goods” and “Employment in rapidly growing companies”) all show a sharply declining trend since 2010 compared to the level of the innovation leaders. Service-based start-ups do actually show a slight upward trend, however nonetheless are clearly behind the set goals; with development dynamic remaining as it is nothing will change very much here by 2020 either.

The start-up dynamic in Austria is therefore still behind the targets of the RTI Strategy and below the level of the leading nations. As figure 13 illustrates, the reasons for this are in particular due to the insufficient availability of private funding forms, such as risk capital or crowd-funding and the adverse bureaucratic, regulatory and taxation framework conditions for start-ups in Austria. The costs and the time necessary to set up a limited liability company (GmbH), as well as its legal structure must in particular be emphasized here. The biggest hurdles here include the statutory appointment of a notary as a formal requirement, the process for entry into the commercial register and in general the inflexibility of the legal form of a limited liability company (GmbH). In this respect the Austrian Council welcomes the de-bureaucratisation regulations brought forward in the current government programme.⁷¹ These are a first step, but would have to go further.

In addition to start-up regulations, the availability of private venture capital is and will be the main weak point, and especially that of risk capital. Despite specific measures by the public sec-

tor to counter the supply problem with, for example, the start-up funds administered by the AWS, the Business Angel Funds and the Venture Capital Initiative, Austria could not improve in the international comparison, and indeed even deteriorated. As already emphasised several times, internationally competitive framework conditions in particular are lacking, although they are a requirement to enable institutional investors in Austria to engage more intensively in this area.⁷² Scarcely any advances can be seen here. And, as before, no special legal framework for private equity is planned.

Added to this is the fact that although the Austrian funding system for innovative start-ups in the international comparison is actually very extensive, it is nevertheless highly complex and intransparent (for this, see also the explanations in chapter, “RTI system governance and financing”). A restructuring would be urgently required here to make access to the system easier for potential start-up entrepreneurs. The political practice of launching new, mostly subcritically funded programmes for reasons of public perception to the detriment of existing, well-functioning mechanisms is problematic as well.

This is, however, not only about an increase in start-up numbers anchored in the RTI Strategy, but rather also and especially about their development over the course of time, if we want to benefit from the economic effects associated with them (employment, economic momentum, competitive head start, for example). Increasing the number of start-ups will bring no benefits as long as they do not have access to up-scaling (for example, demonstrator development, prototypes, etc.) and to markets. Provision of secured (private) follow-up financing is also required in this respect.

**performance
evaluation**

RTI Strategy priority objectives
See appendix, page 99

71 Austrian Government (2017): Zusammen. Für unser Österreich. Regierungsprogramm 2017–2022. Vienna, pp. 132 ff.

72 Jud, T. (2013): Functional model and framework condition of risk capital financing. In: WIFO-Monatsberichte 2013, 86(8), pp. 663–672.



performance evaluation

The body politic is urgently called upon here to create more attractive framework conditions, both to bring foreign investors to Austria and to mobilise potential private Austrian investors. Possibilities here might, for example, be appropriate legal and taxation framework conditions for private equity, an improvement in the quality of the Austrian capital market and the assessment stipulations of pension and insurance funds, as also proposed by the OECD.⁷³ In this respect the Austrian Council welcomes the initiative in the current government programme to promote alternative financing methods with the expansion of funds-of-funds models and easier tax processing of private investments in higher risk projects.⁷⁴ The previous “lighthouse” in the corporate area (the cooperation between science and leading companies) is still significantly ahead of the innovation leaders’ average. The slightly regressive development shown in figure 13 is due to improvements in the meantime with individual comparison countries. The values already available for Austria from the Community Innovation Survey suggest that Austrian performance will grow significantly again here. The excellent scoring with the “Business-science links LCU” indicator illustrates that the cooperation culture in Austria has also developed quite well due to appropriate funding mechanisms.

The good development connected with the patents in foreign ownership must also be emphasised, which in turn expresses the international interconnection of Austrian innovation activities. The corresponding “Foreign-owned patents” indicator exhibits above-average strong development dynamic since 2010. Austria more recently positioned itself clearly ahead of the innovation leaders here and will maintain this position in the foreseeable future. The same applies for innovative SMEs, which also show a positive development trend. The Austrian medium-sized sector is increasingly more innovative, as shown by the positive trend of the “Innovative SMEs” indicator, and therefore significantly contributes to increasing the national innovation performance due to the small-scale structure of the Austrian economy.

In this day and age corporate activity should no longer be oriented on unreflected profit maximisation, but rather should also serve to achieve overriding social goals. This also requires enhanced innovative thinking, on which primary economic considerations are based, right through to even stronger orientation on social valuations and effects, or “social impacts”. Research, technology and innovation can make an important contribution to further securing Austria’s economic capability while improving important social parameters such as quality of life, health or life expectancy.

73 OECD (2018): OECD Reviews of Innovation Policy: Austria 2018. OECD Publishing, Paris, p. 26 and pp. 91 ff.

See also Peneder, M. (2013): Von den “trockenen Tälern” der Risiko- und Wachstumsfinanzierung (The “dry valleys” of venture and growth funding). In: WIFO-Monatsberichte, 86(8), pp. 637–648.

74 Austrian Government (2017): Zusammen. Für unser Österreich. Regierungsprogramm 2017–2022. Vienna, p. 83.

Recommendations of the Austrian Council for the research and innovation area in the corporate sector with regard to the future RTI Strategy

In the context of the future RTI Strategy the Austrian Council recommends the funding package for start-ups be better coordinated and access for entrepreneurs be made easier. No more than a few programmes of critical financial spending should be offered. The adjustment of existing measures should take priority here over the creation of new programmes.⁷⁵

The Austrian Council also recommends the continuous improvement of bureaucratic and regulatory framework conditions for funding start-ups be anchored within the new strategy. In a first step for this, the (as a rule) legally mandatory presence of a notary as a formal requirement should be done away with, the inspection obligation of the register court should be limited and a liberalisation of the share classes with limited companies should be introduced.

The Austrian Council also recommends a tax relief and support with social security funds in wage moderation. To also ensure structural effects, this measure should be arranged as a permanent aid in the form of a basic waiver and a reduction in incidental wage costs in the first years.⁷⁶

In addition to funding by banks, the Austrian Council also recommends developing funding options for innovative entrepreneurs and SMEs. The Austrian Council welcomes the planned

drafting of a national funding creation strategy in this respect. Existing measures to improve the risk capital situation in Austria must be critically scrutinised here.

A suitable framework is required to increase equity capital intensity from the private side, such as appropriate legislative and taxation framework conditions for private equity (risk capital, Business Angel investments, crowd-funding, and similar), an improvement in the quality of the Austrian capital market and assessment stipulations of pension and insurance funds, for example, as also proposed by the OECD.

In the context of the new RTI Strategy to be compiled, the Austrian Council also recommends focusing on alternative innovation concepts, in order to create appropriate framework conditions for the funding and successful development of a recycling economy, more frugal innovation or social entrepreneurship. In addition to the setting up and continuance of appropriate funding programmes, public sector co-investments of private investments must also be named here. The new Public Procurement Law or public benefit regulations of the Federal Tax Code also offer room to manoeuvre for support measures by the public sector in this respect.

performance
evaluation

⁷⁵ See Austrian Council (2016): Report on Austria's Scientific and Technological Capability 2016. Vienna, pp. 32 ff.

⁷⁶ Austrian Council (2018): Recommendation for the improvement of the framework conditions for starting innovative companies in Austria of 22 Mar. 2018.

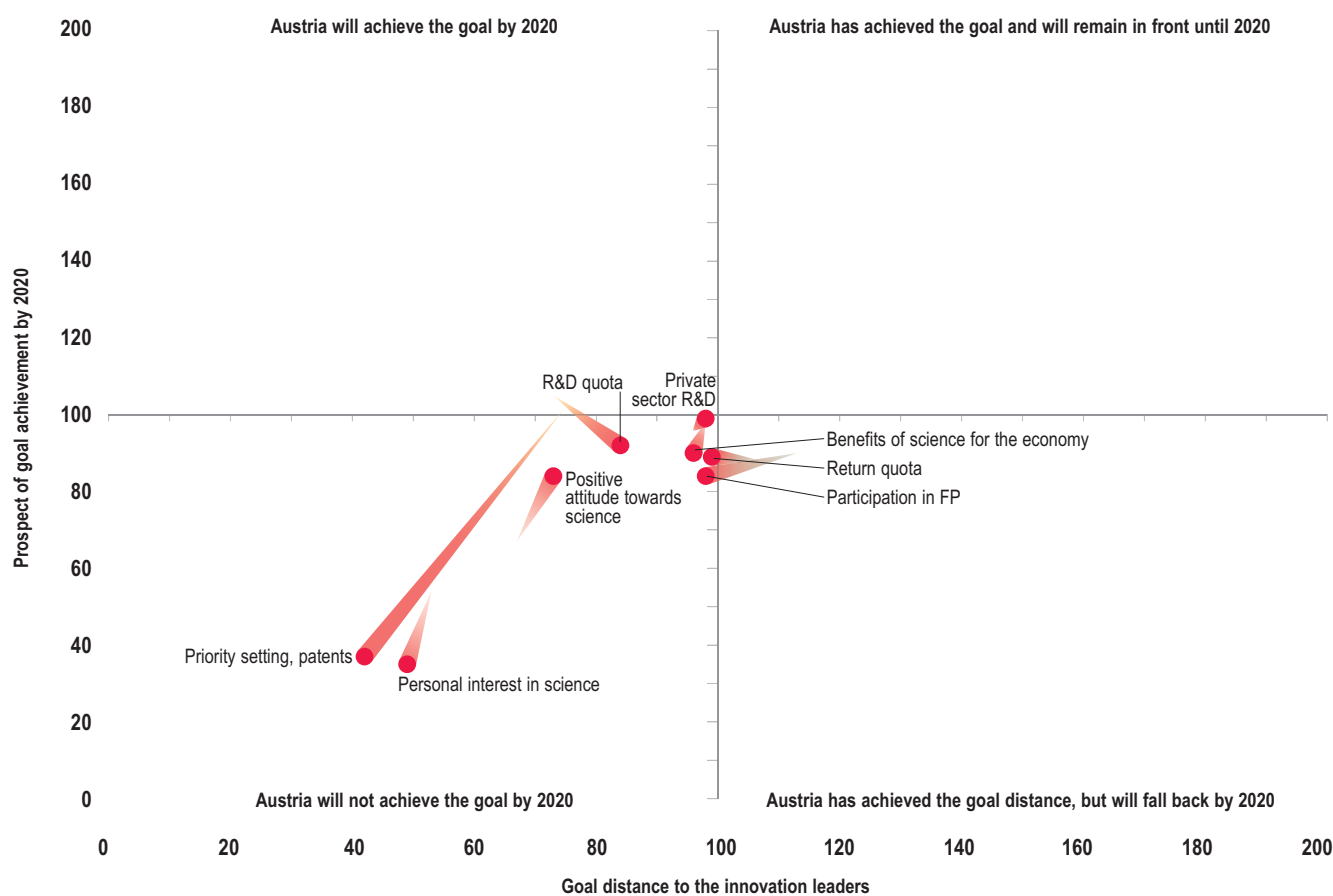
performance evaluation

RTI system governance and financing

Numerous objectives for the governance and financing area are listed in the RTI Strategy, which should both simplify and harmonise, and also produced a more transparent structure in the domestic research system. At the end of the strategy document's impact period some key points, which the Austrian Council also repeatedly referred to, are now being processed.

The overview in figure 14 nevertheless shows that the majority of the objectives trackable with indicators have not been achieved to date. Since 2010 only the area of private sector R&D funding has increased sharply and therefore has achieved the goal level. Some objectives and measures of the RTI Strategy, especially those in the international context, are also no longer applicable or relevant due to the changed glob-

Figure 14: Development of goal distance and prospect of goal achievement in the area of RTI system governance and financing from 2010 to 2019



Sources: See appendix 1. WIFO graphic. Raw data, see appendix 2. Explanation, see appendix 3.

Note: Goal distance = Austria's actual value compared to the innovation leaders' actual value (average value most recent available year DE, DK, FI, LU, NL, SE, UK);

Prospect of goal achievement = ratio of value projected for Austria in 2020 relative to the national goal or the value projected for the innovation leaders in 2020.

al political situation. Concerning a number of other targets and measures, there is no evidence that an implementation could succeed in the foreseeable future.

On a positive note, however, a more holistic and more reform-oriented approach for the RTI system is being pursued. The participation of representatives of the Austrian Government as the highest political level at the RTI Summit in spring 2019 and the objectives connected with it meet many of the strategy's requirements (the drafting of a Research Funding Act⁷⁷ or the implementation of an excellence initiative⁷⁸ must be emphasised here), as do the Austrian Council's recommendations. Particularly notable here are the institutionalisation of an RTI summit⁷⁹, already proposed in the Austrian Council's white paper in 2013, and the setting up of a research funding database, first recommended in 2011.⁸⁰

This initiative shows a clear commitment by the body politic to the importance of the RTI system, which the Austrian Council sees as an important step in underscoring the relevance of research, technology and innovation for society. This will also reinforce the efforts to incorporate the competencies and specific requirement situations of all ministries. The creation of legal framework conditions (in the Research Funding Act, among others) and an all-Austria research funding database will provide an important basis for adjusting the governance of the RTI system to current requirements and also to

performing a portfolio streamlining with the funding agencies, which has been addressed several times by both the Court of Auditors and the Austrian Council.⁸¹ In any case the Austrian Council wholeheartedly welcomes the impact direction of these measures, as the agencies can now act more independently and more flexibly, and existing redundancies can be cleaned up.

The Austrian Council sees considerable impetus with the RTI Summit adopted by the Cabinet, which must also continue to be consistently implemented with the next steps described, which however will also require regular communication to define relevant prioritisations at the highest political level. The complexity in the funding system must be reduced over the course of the restructuring and the sustainable financial provisions for research funding that this would require. In the same way that the European level also promises a simplification and harmonisation of the mechanisms and funding guidelines for more transparent administration of projects, so too must the set of rules and regulations in all areas of national and regional research funding be significantly simplified, and standardised in particular. Even if this task does present a major challenge with the multitude of players and mechanisms, it nevertheless helps significantly in improving the current unsatisfactory outputs compared to the input, and in reducing the administrative burden on re-

**performance
evaluation**

RTI Strategy priority objectives
See appendix, page 100

77 Austrian Government (2011): The Path to Becoming an Innovation Leader. Federal Government strategy for research, technology and innovation. Vienna, p. 47.

78 Austrian Government (2011): The Path to Becoming an Innovation Leader. Federal Government strategy for research, technology and innovation. Vienna, p. 21.

79 Austrian Council (2013): White paper on controlling research, technology and innovation in Austria. Vienna, p. 22.

80 Austrian Council (2011): Recommendation on setting up an all-Austria public sector research funding database of 24 Nov. 2011. See inter alia, Austrian Council (2018): Recommendation to set up a nationwide database to illustrate research inputs and outputs of 22 Mar. 2018.

81 See inter alia, Court of Auditors (2016): Report by the Court of Auditors: Research funding in Austria. Vienna 2016/4. And Austrian Council (2015): Report on Austria's Scientific and Technological Capability 2015. Vienna, p. 65 f.

searchers. This requirement, however, applies to far more than just research funding and also very much applies to the corporate area, which is confronted, from start-up to capital acquisition and market access through to product certification, with a rigid and bureaucratic system that provides little support.

The social relevance of science and research must also be improved in other areas. The establishment of dialogue between science and society has indeed shown in some successful formats that both researchers and the general public can be enthusiastic about it, however on closer examination one would have to recognise a rather strong social and regional differentiation of these activities. The tertiary sector shapes the science community and provides the basis for an innovative society. The probability that a person will begin tertiary education is 2.38 times higher with “education-oriented” homes than it is in “less education-oriented” families.⁸² Here, the interplay of social selectivity mechanisms, but also a regionally highly differentiated offering of tertiary education options, mean not only does it become more difficult for education-interested individuals to implement their ideas, but rather that a bias also emerges in the prioritisation with the scientific handling of social challenges.

The lacking integration of the general population into science opens the gap between those parts of society who are familiar with the academic world anyway through education and environment, and the entirely greater group of people who have few points of contact with science, technology and innovation and even have fears of attempting to enter into third level education institutions. Even if no current values have been established for the indicators in figure 14 used in this respect (“Personal interest in science” and “Positive attitude towards science”), numerous analyses of other surveys

nevertheless show an increasing deterioration with personal interest and attitude towards science and research.

The Austrian Council therefore underscores the appeals in the current strategy document for the social dimension in third level education, which call for a more integrative access and lower dropout rate, as well as framework conditions for social cohesion. A discrimination-free access to knowledge connected with this would also have the long-term effect that the culture of appreciation of research, technology and innovation emphasised in the strategy applies on all social levels and therefore contributes to quality of life. The RTI Strategy also addresses participation in European funding programmes. Participation in European projects has stabilised over recent years at a particularly good level (see figure 14). Even if the corresponding “Participation in FP” and “Return quota” indicators are no longer in the goal area, the distance to the average level of the innovation leaders is minimal. With a success rate of 17 percent (average: 14.7 percent) and with funds of more than EUR 1 billion acquired to date, Austria is very successful in the research framework programme.⁸³

Following many years of problem-prone use of structural funds, in recent years these have also been increasingly used with improved legal certainty and more transparent calculation models. The complementary use of funds from the framework programme and the structural funds of course still entails numerous uncertainties, on the whole significant advances have nevertheless been achieved from the perspective of the RTI system.

Figure 15 shows an interesting development with regard to the distribution structure with participation in the EU framework programme. Companies in Austria are represented significantly stronger, both compared to the other European countries and relative to the previous financing periods. In contrast to this, however,

⁸² For this see BMWFW (2017): National strategy for the social dimension in third level education. Vienna.

⁸³ With the “EU return” indicator (WFA) of the EU Commission, with 2.82 percent Austria is clearly above the goal it set itself of 2.5 percent in 2017.

the approved participations in the universities area fell sharply. In the direct comparison with other countries this is also an indication that the attractiveness of research location Austria requires improvement.

The supporting structures for international projects in Austria are essentially excellent in technical terms, however the effect of the supporting benefit is mostly lost in the fragmented structures in the institutions. This is partially also due to the fact that in many universities the scarce time, staff and financial resources mean there are only limited options to increase international networking or implement international projects. The Austrian Council also believes appropriate management processes at university management level are insufficient to consistently support the achievement of this goal. The Austrian Council has pointed out that the universities should be motivated to acquire more ERC grants, and this should also be anchored in the performance agreements.⁸⁴ Conversely, framework conditions would have

to be created at national level, which would make the RTI location more attractive – and not least of all via the provision of required infrastructures. In this respect the Austrian Council also believes full-coverage supply with digital infrastructure must also be accelerated and education (further) offers for acquiring digital skills must in particular be provided in rural areas. Furthermore, the Austrian Council considers representation on EU committees and boards an important contribution to co-shaping prioritisations at European level and to Austria's visibility in specific priority topics. The resources required here must be provided similar to networking and project initiation with scheduling and financial leeway for researchers and administration. In this context the RTI Strategy refers to the creation of appropriate institutional structures, much welcomed by the Austrian Council. This aspect was considered in detail in the previously described realignment of the portfolio of the fund-

performance
evaluation

Figure 15: Participation in the EU framework programme

Approved participations from Austria and the EU 28 acc. to types of organisations

31%	37%	22%	5%	5%	EU-28
27%	38%	23%	6%	6%	EU-28

Approved participations from Austria acc. to types of organisations in H2020 and FP7

28%	39%	22%	5%	6%	H2020 contracts
37%	32%	24%	5%	2%	FP7 contracts

■ University ■ Corporate ■ Non-uni. research ■ Pub. institution ■ Other

Source: European Commission (9/2018), values rounded off.

⁸⁴ Austrian Council (2018): Recommendation on setting up the new EU research framework programme and the national framework conditions for participation in EU mechanisms of 29 June 2018.

performance evaluation

ing agencies, so that a partially well-established system would be expanded with additional tasks.

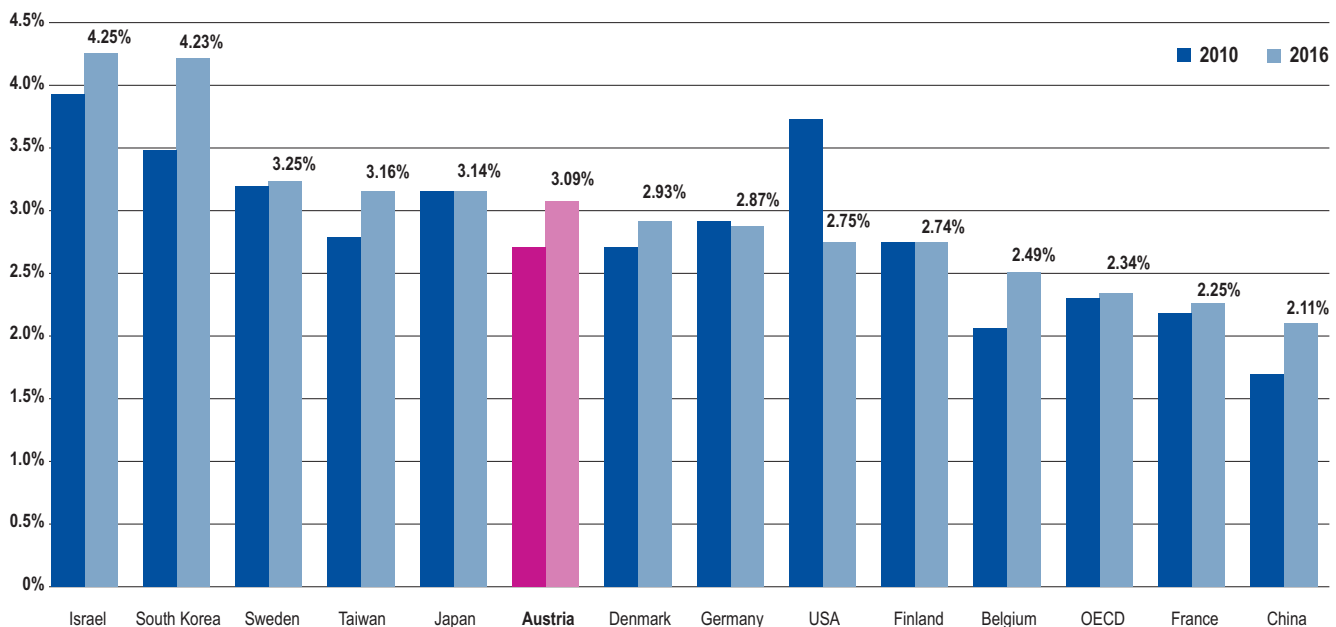
Basically research funding is an important cornerstone in achieving innovation leadership. In this respect figure 14 shows how the objective of an overall R&D rate of 3.76 percent of GDP anchored in the RTI Strategy cannot be achieved by 2020. Although the goal distance has been continuously reduced since 2010, goal achievement by 2020 is, however, ruled out. Nevertheless the rate has generally shown sharp growth over the overall period, so that Austria is now the most research-intensive country in the EU after Sweden. The Austrian rate is also already above-average high in the international comparison (see figure 16).

With a comparison of all OECD countries with regard to the R&D rates for 2016 (last year

available), Austria was therefore in the absolute top of the field, ahead even of countries such as Germany, Finland, the USA and China. Of the countries enjoying positions at the top, with a cumulative growth rate of 13 percent since 2010, after South Korea (+22 percent), Austria exhibits the highest dynamic of all other leading countries with the R&D rate.

The development in the area of the private sector R&D rate is also positive, having improved since 2010 and being now just below the goal level of 66 percent (see figure 14). The strong growth of the R&D rate in the last 20 years is driven by both the private and the public sector, whereby the public sector compensated the private sector in the aftermath of the 2008 financial crisis. In the corporate sector, however, primary industries from the non-high-tech segment were responsible for this development.⁸⁵ In 2015 the high-tech sectors in Austria were

Figure 16: R&D quotas in OECD countries (2017)



Source: OECD Main Science and Technology Indicators.

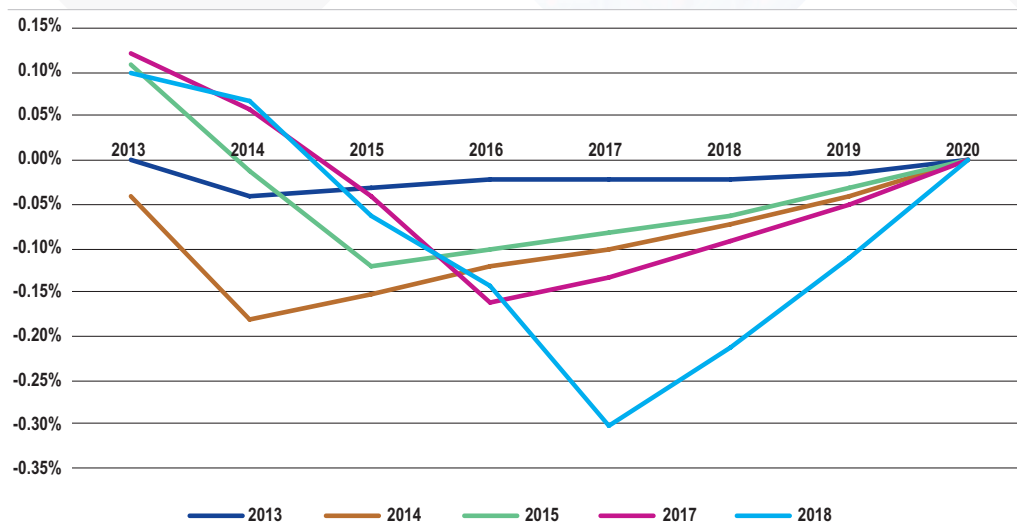
⁸⁵ For this, see Dachs, B. / Drach, A. (2019): "F&E im österreichischen Unternehmenssektor in langfristiger Perspektive: starkes Wachstum, alte Akteure?" Working Paper, AIT – Austrian Institute of Technology, Vienna.

still responsible for only 14 percent of this sector's overall spending. This is significantly lower than in countries with very high R&D intensity – in South Korea for example, more than half of the entire increase in R&D expenditures of companies between 1998 and 2015 was accounted for in high-tech sectors. This is problematic in that high-tech sectors are characterised by high R&D intensity (R&D expenditures per value created) and therefore can have greater impacts on productivity and competitiveness, when we consider the potentially higher knowledge spillover from these sectors, for example.⁸⁶ The sharp increase in funds for R&D also resulted in a massive expansion of the human resources in R&D (measured against the share of the overall R&D staff in overall em-

ployment). As a result of the increase in human resources for R&D in the corporate sectors measured on the share of R&D staff against industrial overall employment, Austria is therefore at sixth place among all OECD countries.

Figure 17 shows the development of the predictions for the R&D rate from the studies commissioned by the Austrian Council on achieving the research rate goals from 2013 to 2018.⁸⁷ The mapped lines are produced by the difference of the respectively predicted target values for achieving the rate target in 2020 relative to a deterministic trend towards the target value with the 2013 starting year. A negative figure implies the respective predicted value is below the (required) trend value. The

Figure 17: Funding paths (deviation of actual values from the trend) from 2013 to 2018 to achieve the R&D rate goal of 3.76 percent in 2020



Source: WIFO research rate targets 2020, own research.

Note: negative values = real values below reference value, positive values = real values above reference value. There are no study results for 2016.

⁸⁶ Sectors with high R&D intensity can, however, be extremely prone to disruptive developments, as the Nokia example shows.

⁸⁷ For this, see Strauss, A. / Janger, J. (2018): "Forschungsquotenziele 2020". Study commissioned by the Austrian Council. Vienna, WIFO.



performance evaluation

further the prediction values go towards 2020, the sharper the deviation, as the real values deviate significantly from the trend value. In optimistic and pessimistic scenarios with current trends continuing as they are, WIFO recently calculated the probable size of the R&D rate in 2020 (while including the usual confidence intervals and uncertainty factors): In the optimistic variant the R&D rate in 2020 achieves a value of 3.29 percent, 0.47 percentage points below the target value.

Regardless of the actual development of the rate, the new RTI Strategy should allow for a reformulation of the rate target, which is oriented on the Austrian industrial structure.⁸⁸ Some thought might even be given to completely replacing input goals with output goals, to counter the existing trends towards input-oriented control and to focus even more on the effectiveness and efficiency of R&D investments. The OECD also emphasises this increased concentration away from inputs in its Review of Innovation Policy for Austria.⁸⁹

As the OECD also states in its report, more attention will also have to be paid in the future to the ratio of direct to indirect research funding: Between 2006 and 2015 the greater part, approximately 60 percent, with business-related R&D funding came from indirect funding, that is research premiums, whereby financing through research premiums is expected to rise further due to the increase to 14 percent. Even if, because of its simplicity and R&D incentive structure, this mechanism does have benefits, it

cannot or can only indirectly support topical priorities, such as digitisation for example. As part of the new RTI Strategy the focus should therefore be on a balanced policy mix, in which the ratio of direct to indirect research funding in the future more intensively reflects the challenges that Austria faces.⁹⁰

On the whole it must be said that it has not been entirely possible to achieve the goals of this area set in the RTI Strategy. It is therefore welcome news that a number of the objectives and measures of the government programme directly address this subject area, and the Austrian Council believes they will improve the efficiency of the Austrian RTI system and innovation performance in the future.

It is also welcome news that the Austrian Government will afford the respective importance to the area of financing RTI activities. Implementation of the Research Funding Act already anchored in the RTI Strategy will ensure long-term RTI financing.⁹¹ This announcement is a true innovation in the Austrian RTI policy and is expressly welcomed by the Austrian Council, because it for the first time guarantees long-term planning security. However, as Austria's R&D quota is already above-average, possible further increases in public sector spending must be linked to structure reforms that enable a more efficient and more effective use of resources. The Austrian Council therefore also welcomes the fact that the government programme intends to give preference to awarding the additional public funding in competition, where systemically possible.

⁸⁸ The R&D quota target could be defined, for example, with an R&D quota adjusted to the industrial structure, or an adjusted quota could specify ranges for the unadjusted R&D quota. The basic principle would be an objective that would target high R&D intensity in the existing structures, that is, a high R&D intensity that, for example, supports competitiveness in the steel industry, but does not demand that the steel industry achieve the R&D intensities of the pharma industry, for example. See Janger, J. / Kügler, A. (2018): Innovationseffizienz: Österreich im internationalen Vergleich. Study commissioned by the Austrian Council. WIFO, Vienna, p. 40.

⁸⁹ OECD (2018): OECD Reviews of Innovation Policy: Austria 2018. OECD Publishing, Paris, p. 20.

⁹⁰ OECD (2018): OECD Reviews of Innovation Policy: Austria 2018. OECD Publishing, Paris, p. 19.

⁹¹ Austrian Government (2017): Zusammen. Für unser Österreich. Regierungsprogramm 2017–2022. Vienna, p. 77.

Recommendations of the Austrian Council on the areas of governance and financing with regard to the future RTI Strategy

With regard to the future RTI Strategy in particular the Austrian Council reiterates its previous recommendations to increase the efficiency of research funding and to secure the appropriate framework conditions for this. With the RTI Summit a key basis for essential pointers will be created at the highest political level. The Austrian Council believes the regular coordination of all ministries, and especially those departments that are not primarily involved in shaping the RTI landscape, is indispensable. The Austrian Council recommends an institutionalisation of the RTI Summit with the goal of anchoring regular communication to define relevant prioritisations at the highest political level.

In the context of creating legal framework conditions (especially the Research Funding Act) and a structural reorganisation of the governance structures, the Austrian Council also recommends the required financial provisions for research funding be sustainably secured and the complexity in the funding system be reduced. A new RTI Strategy must therefore also concentrate on the efficiency barriers repeatedly referred to by the Austrian Council and consistently address overlapping multi-structures, over-regulation, fragmentation, unclear responsibilities and a complicated, non-harmonised set of rules for individual mechanisms. The Austrian Council also recommends creating incentives and framework conditions in the third level education system for international networking and cooperation, which would also offer individual researchers the required scheduling and financial freedom to create international visibility.⁹²

As part of the new RTI Strategy the Austrian

Council recommends a reformulation of the quota target, which is oriented on the Austrian industrial structure and to completely replace input goals with output goals, to counter the existing trends towards input-oriented control and to focus even more on the effectiveness and efficiency of R&D investments.

The Austrian Council welcomes the drafting of the Research Funding Act anchored in the government programme, which will secure the medium to long-term stability of RTI funding in Austria. In this context it also recommends a revision of the appropriate use of funding in the Austrian RTI system. Due to the low output efficiency compared with the innovation leaders (with given above-average inputs), the Austrian Council recommends this ratio be examined in even more detail, especially with regard to how Austria can improve in innovation efficiency terms.⁹³ In this respect the Austrian Council also recommends the ratio between awarded in competition and core financed public funds be shifted in favour of the awarded in competition share. At the same time, as indicated by the OECD, the ratio between direct and indirect research funding must also be arranged more evenly and balanced. In this context the Austrian Council welcomes the setting up of an all-Austria research funding database, which would enable access to and scientific use of the available data of the ministries and funding agencies, with all confidentiality obligations complied with.

In the context of compiling an RTI Strategy 2030, the Austrian Council emphasises its previous recommendations to accelerate suitable initiatives to leverage the value of science and

performance
evaluation

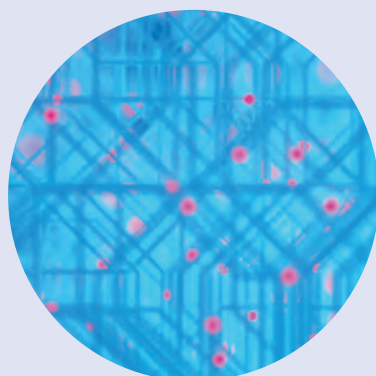
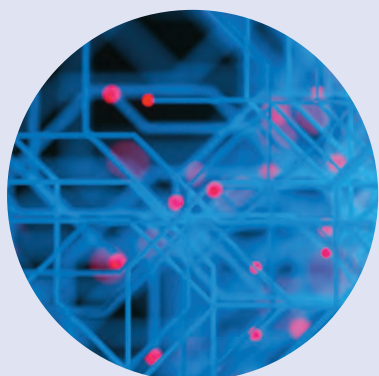
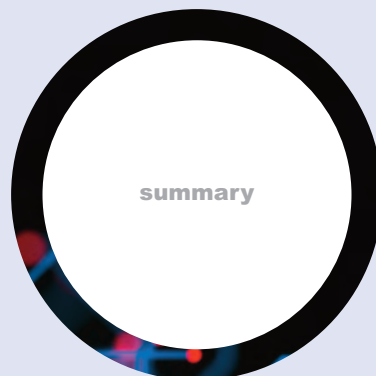
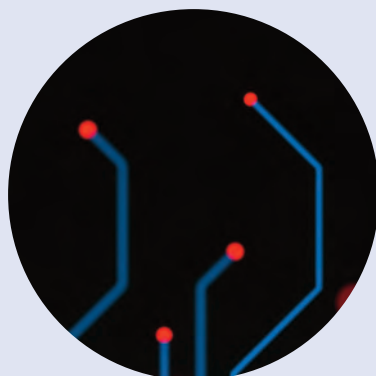
⁹² See inter alia, Austrian Council (2017): Recommendation on the way to the forefront of innovation of 30 Nov. 2017.

⁹³ See inter alia, Austrian Council (2018): Report on Austria's Scientific and Technological Capability 2018. Vienna, pp. 32 ff.

**performance
evaluation**

research among the general public. Social cohesion is an important requirement here, which must also be reflected in the access to academic education opportunities. The currently dominant education inheritance as a gauge for existing deficits with discrimination-free access to knowledge and third level education

must be countered with appropriate dialogue with all social groups. The Austrian Council also recommends checking low-threshold incentives for scientists, with which the dialogue with society is rewarded as part of scientific careers – in the form of crediting corresponding ECTS points, for example.



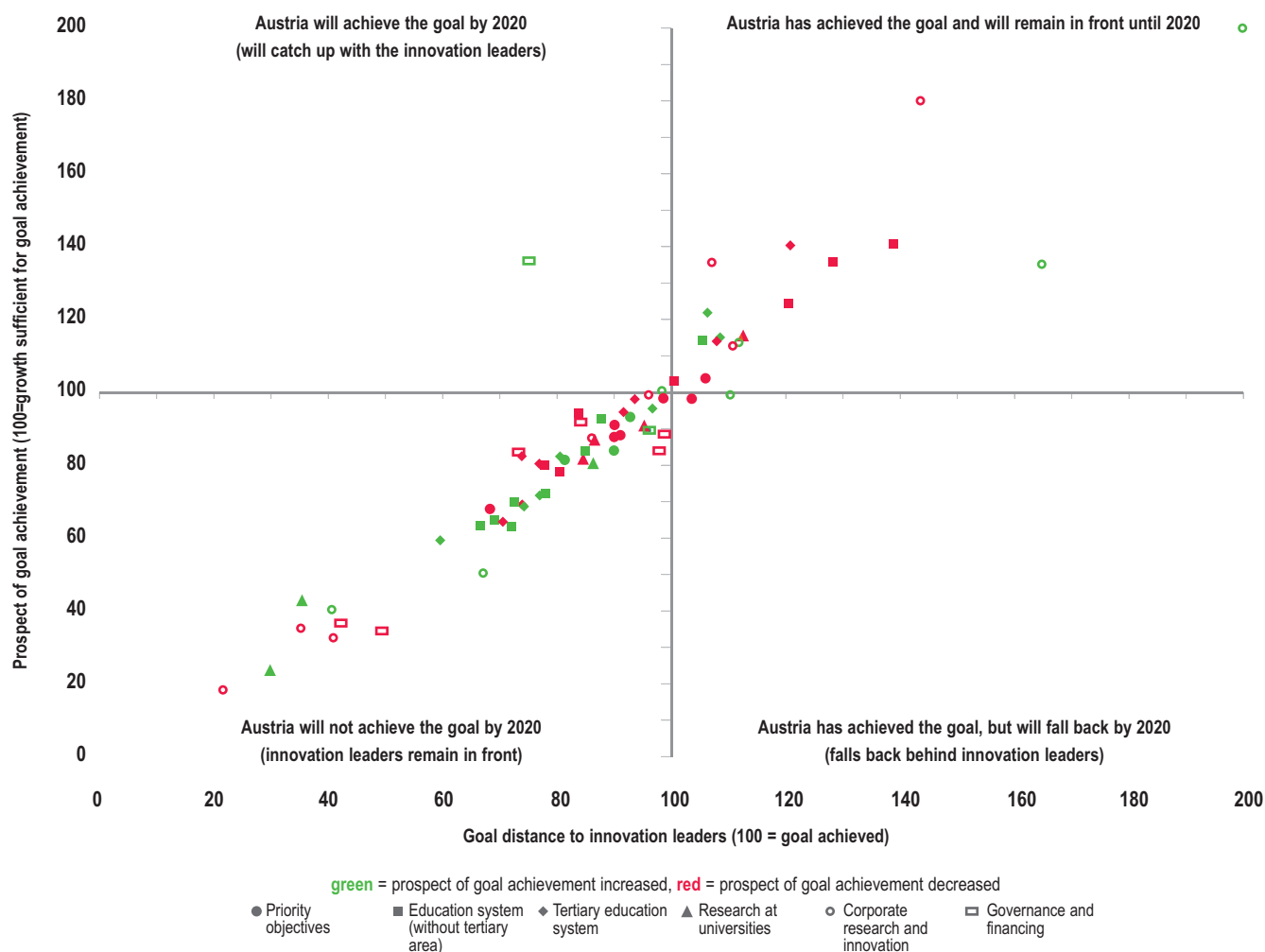
summary

Overview of key results

If we look at the performance of the Austrian RTI system in its entirety, it is clear that the catch-up dynamic is insufficient on the whole to achieve the goals of the RTI Strategy or the level of the innovation leaders. Figure 18 provides

an overview of all 74 indicators used for this report in relation to the average level of the leading innovation nations. The figure illustrates the areas in which the goals of the RTI Strategy have already been achieved and Austria's performance and development dynamic is better

Figure 18: Overview of Austria's performance in all areas of the RTI strategy and in relation to the innovation leaders



Sources: See appendix 1. WIFO graphic. Raw data, see appendix 2. Explanation, see appendix 3.

Note: Goal distance = Austria's actual value compared to the innovation leaders' actual value (average value most recent available year DE, DK, FI, LU, NL, SE, UK);

Prospect of goal achievement = ratio of value projected for Austria in 2020 relative to the national goal or the value projected for the innovation leaders in 2020.

than those of the innovation leaders – all indicators in the right top quadrant – and in which areas it is behind the leading nations, and with development trends remaining as they are, has no realistic chance of achieving the level of the leading nations by 2020 (all indicators in the left bottom quadrant).

Figure 18 shows that the greater part of the indicators are still in the left lower quadrant; this is equal to approximately two thirds of the indicators used. This overall situation has not changed much in the last ten years. This means Austria's catch-up dynamic was insufficient on the whole to achieve the goals of the RTI Strategy and the average level of the innovation leaders. Those areas with an unrealistic prospect of achieving their goals by 2020 as they currently stand, are predominantly the problem areas of the Austrian RTI system already addressed several times by the Austrian Council, from the entire education system to

the framework conditions at the universities, right through to innovative start-ups and research funding.

This complete overview is illustrated in table 2, and in figures 19 and 20. On the whole, positive trends can only be seen in just under half of the goal areas, as only 45 percent of the indicators show an improvement in the goal distance and prospect of goal achievement compared with 2010. Across and beyond all areas the average goal distance (85) to the innovation leaders (=100) compared to 2010 has grown, and Austrian performance has remained almost unchanged below the dynamic required for goal achievement. Compared to the Mid-Term Review performed by the Austrian Council in 2015 on the implementation status of the RTI Strategy, the goal distance has grown slightly, and the prospect of goal achievement has even grown significantly.⁹⁴ It is therefore quite clear

summary

Table 2: Overview of the average goal distances and prospects of goal achievement and changes compared to 2010

	Number of objectives	Average		Goal achievement (% of indicators)		Indicators		Average	
		GD	PGA	2019	2020	Increased in %	Decreased in %	GD change in perc. points	PGA change in perc. points
Total	74	85	85	27%	27%	46	49	-4	-4
Priority objectives	10	91	89	20%	10%	40	60	-6	-6
Education	15	91	91	33%	33%	60	33	7	14
Tertiary education	15	87	91	27%	27%	47	53	0	-5
Uni. research	7	76	74	14%	14%	57	43	-9	4
Corporate innovations	19	88	95	42%	47%	42	58	2	-6
Governance and financing	8	76	70	0%	0%	25	38	-19	-23

Sources: See appendix 1. WIFO graphic. Raw data, see appendix 2. Explanation, see appendix 3.

Note: Goal distance = Austria's actual value compared to the innovation leaders' actual value (average value most recent available year DE, DK, FI, LU, NL, SE, UK);

Prospect of goal achievement = ratio of value projected for Austria in 2020 relative to the national goal or the value projected for the innovation leaders in 2020.

⁹⁴ Austrian Council (2015): Report on Austria's Scientific and Technological Capability 2015. Vienna, p. 82.

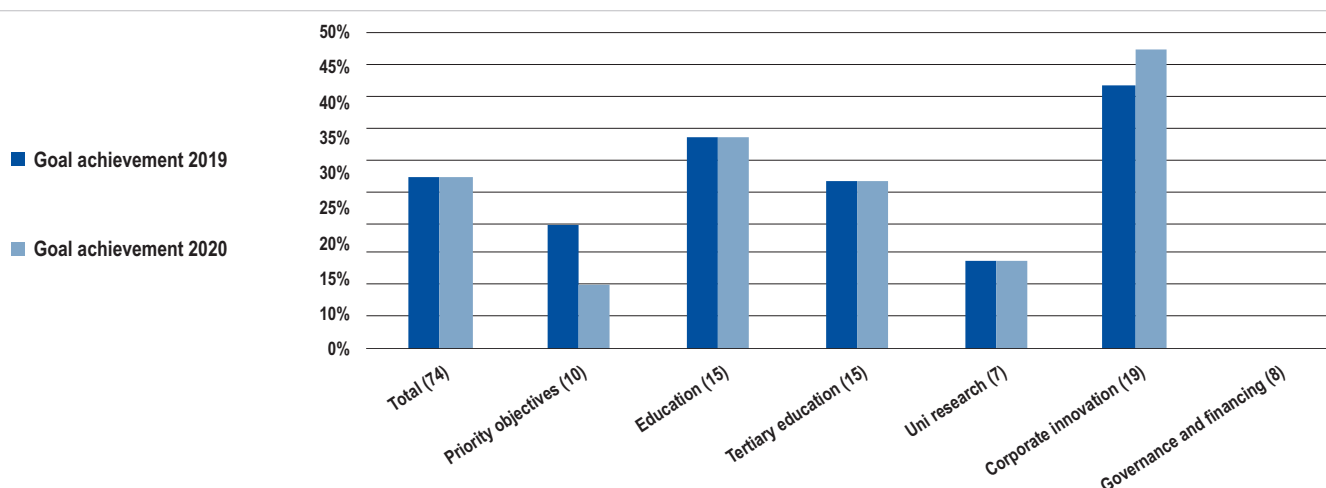
summary

that the development seen across and beyond all indicators, in particular in recent years, was not sufficiently dynamic to achieve the level of the innovation leaders, and with Austrian innovation performance there is still catch-up requirement across the board.

Figure 19 shows the current and foreseeable

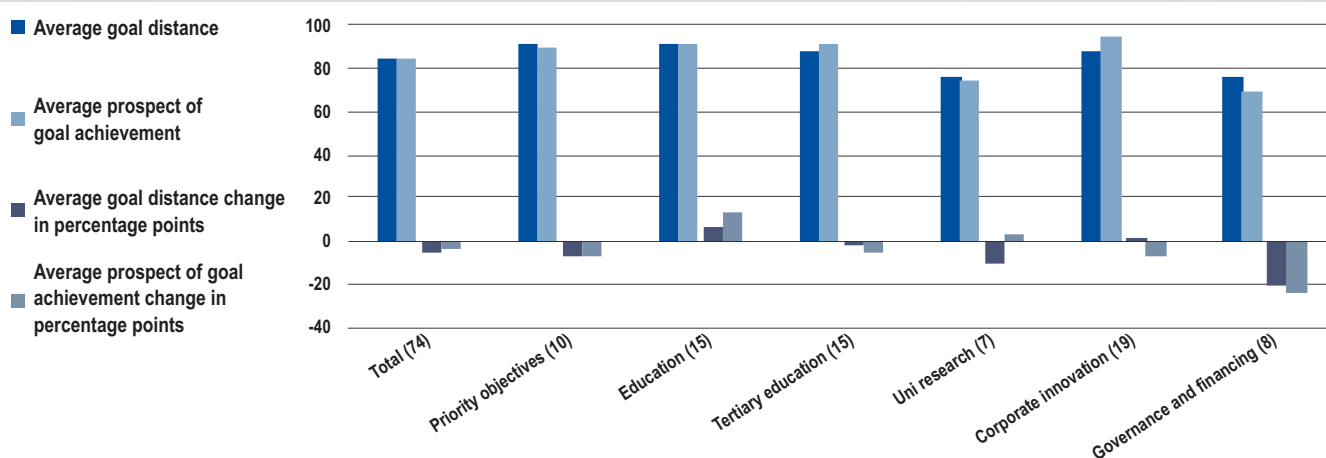
level of goal achievement in 2020. This illustrates how it appears that goal achievement is not possible for any of the indicators in the “Governance and financing” area, and in the “RTI Strategy priority objectives” area only a small portion of the goals will be achieved, with only 10 percent. From today’s point of view the “Research and innovation in the corporate

Figure 19: Current and foreseeable level of goal achievement in 2020



Sources: See appendix 1, raw data see appendix 2. Note: Values in brackets = number of objectives or indicators.

Figure 20: Average level and change in goal distance and prospect of goal achievement



Sources: See appendix 1, raw data see appendix 2. Note: Innovation leaders average = 100. Values in brackets = number of objectives or indicators.

sector” and “Education (without tertiary education)” areas, in which 47 and 33 percent of all indicators are expected to achieve the goal level, score the best.

Figure 20 shows the average goal distance and the average prospect of goal achievement for all analysed areas. If we look at Austria’s distance to the average level of the leading nations, it is clear that the “RTI Strategy priority objectives” and “Education (without tertiary education)” areas exhibit the shortest distance. On the whole, however, there is a goal distance to the leading nations in all areas of the Austrian RTI system, and the prospect of goal achievement is not high enough in any area to achieve the level of the innovation leaders by 2020. It is striking that the goal distance has been reduced in hardly any area over the last ten years. The only positive exception is the “Education (without tertiary education)” area, and in the “Research and innovation in the corporate sector” area the distance at least remained unchanged. In the other areas the goal distance to the leading innovation nations has, however, mostly increased slightly since 2010.

Positive indicator developments are found in the education area in particular. Approximately half of the indicators improved in both the “Education system (without tertiary education)” and in the “Tertiary education system” indicator. This is due, for example, to the improvements in supervision ratios, especially in

the early childhood area, to increases in graduate numbers at the universities and to successes in the area of promotion of women. In most cases, however, this is also attributed to a deterioration in performance of the compared countries. Despite these relational improvements, there is therefore still an overall distance to the leading innovation nations. The development dynamic of both areas is also insufficient to achieve the average level of the innovation leaders by 2020. In the “Research at universities” area 4 of 7 indicators (57 percent) do actually also improve with regard to their prospect of goal achievement, but this is not sufficient to join the leading nations – only 1 of 7 will probably achieve the goal by 2020.

The “RTI Strategy priority objectives” area showed the greatest decline. While at the time of the Austrian Council’s Mid-Term Review⁹⁵ with regard to both the goal distance and the prospect of goal achievement it was above the average level of the innovation leaders, it now exhibits a regressive trend with 60 percent of the indicators. On one hand this is because, with Luxembourg’s move into the group of innovation leaders, Austria’s level with per capita GDP no longer has a correspondingly positive effect. On the other hand, however, it is also due to the insufficient domestic performance compared to the leading nations, in the environment area, for example.

summary

Conclusion and recommendations

The detailed analyses make it quite clear that the performance of the Austrian RTI system on the whole has not increased sufficiently since 2010 to achieve the average level of the innovation leaders. These findings essentially also correspond with the picture painted by the European Innovation Scoreboard. It shows how

Austria’s performance actually increased moderately over the period, but on the whole this is insufficient to substantially reduce the distance to the group of leaders (see figure 21). Austria’s total points in the EIS in 2010 were 112, while the average value of the leading countries was 128. More recently the Austrian value was ap-

⁹⁵ Austrian Council (2015): Report on Austria’s Scientific and Technological Capability 2015. Vienna, p. 82.

summary

proximately 120 points, while the average for the leaders' group rose to 135. This means that the distance between Austria and the group of innovation leaders has not changed significantly since 2010.

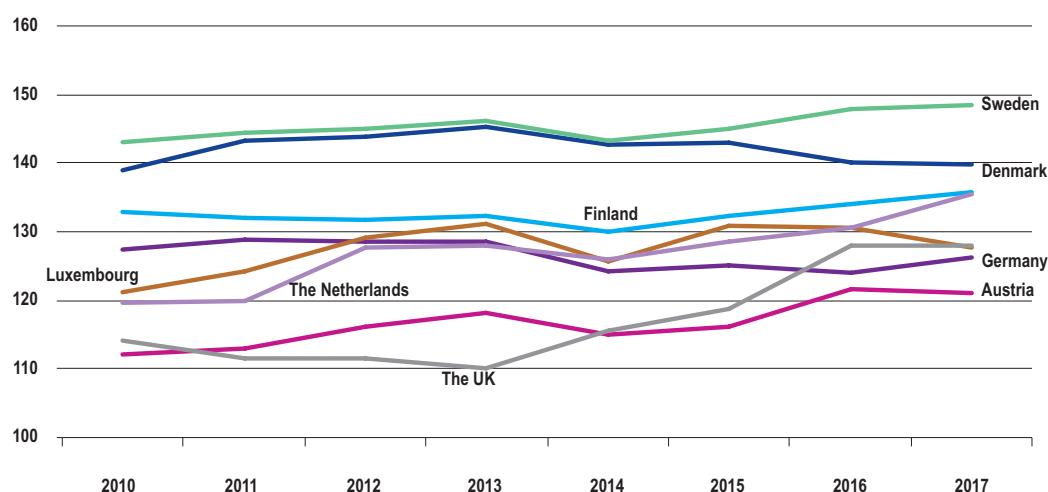
The reason in particular for Austria's insufficient development dynamic are the problem areas of the Austrian RTI system already addressed several times by the Austrian Council and the efficiency barriers identified in the Report on Austria's Scientific and Technological Capability 2018.⁹⁶

- In the **education area**, education inheritance, high social selectivity and the insufficient expansion of all-day education in particular are serious efficiency and performance barriers.
- In the **universities and basic research area**, in addition to the insufficient funding situation relative to the leading countries (with parallel expandability of the competitively acquired share to the university budget), prob-

lems in the area of governance and management at the universities and uncontrolled student flows in particular present an obstacle to increased performance.

- In the **area of innovative start-ups**, above all the adverse bureaucratic, regulatory and taxation framework conditions and the insufficient availability of private financing through risk capital or crowdfunding can be identified as key efficiency barriers.
- In the area of **research funding** high complexity and lack of clarity continue to generate high friction losses and obstruct an efficient distribution of funds.
- A further efficiency barrier can be found in the **R&D funding area**. Austria is indeed very well positioned in this respect with one of the highest research quotas in the international comparison. However imbalances continue in fund distribution, which have an inhibiting effect. Divergent development trends with regard to the funding of basic research

Figure 21: Comparison of pformance in the European Innovation Scoreboard from 2010 to 2017



Source: European Innovation Scoreboard 2011–2018.

⁹⁶ Austrian Council (2018): Report on Austria's Scientific and Technological Capability 2018. Vienna, pp. 67 ff.

and applied research, the increasing imbalance between direct and indirect research funding, and the misalignment between basic funding and competitively awarded funds, especially in the area of the universities and basic research, must be highlighted here.

These barriers are the primary obstacle to further increases in the Austrian RTI system's performance. It is consequently not been possible to convert the above-average high R&D investments into performance that corresponds with Austria's advanced scientific and technological level of development. As the detailed analysis of this report reveals, Austria's performance in the areas of education, science, research, technology and innovation is stagnant, despite the high inputs (financial in particular) compared to the leading innovation nations. Austria has the potential in almost all areas of the RTI system to further increase its efficiency and to boost its outputs with given inputs.⁹⁷ Considered in its entirety the efficiency of the Austrian RTI system is average and for the most part occupies a midfield position with the comparison countries. The Austrian Council believes, however, that this is insufficient for a country that operates close to the scientific, technological and innovation frontier.

A future RTI Strategy must therefore in particular target the optimisation of the input-output ratio, the systematic removal of existing efficiency barriers and the more effective and more efficient use of available funds than has previously been the case.⁹⁸ Only then can increased top performances be generated and the entire RTI system be developed more intensively towards excellence.

How this could work is demonstrated by the leading innovation nations, especially Switzerland and Germany, from whom Austria could learn quite a bit when it comes to innovation efficiency. The recently issued Global Competitiveness Index 2018 of the World Economic Forum awards first place to Germany for innovation, followed by the USA and Switzerland.⁹⁹ The reasons for this include the quality of scientific institutions and publications, the number of registered patents, and the successful marketing of products, among others. Austria is not among the leading countries in any of these areas. Considerable potential for improvement is found with the quality of the scientific institutions and in the market transition area in particular.

Quite a few of the measures included in the government programme and in the presentation made to the Cabinet on 16 August 2018 in particular can contribute to improving Austria's innovation performance. How intensively the Austrian Government will also actually implement these measures remains, however, to be seen. The significance the new RTI Strategy planned by the Austrian Government will afford to the increase in efficiency of the Austrian RTI system and the boosting of the effectiveness of science and research funding also remains to be seen. To be welcomed in any case is the fact that, with its presentation to the Cabinet, the Austrian Government has made a clear commitment to the required efficiency increase in Austria's RTI system.¹⁰⁰

The presentation states that with the future RTI Strategy the Austrian Government is,

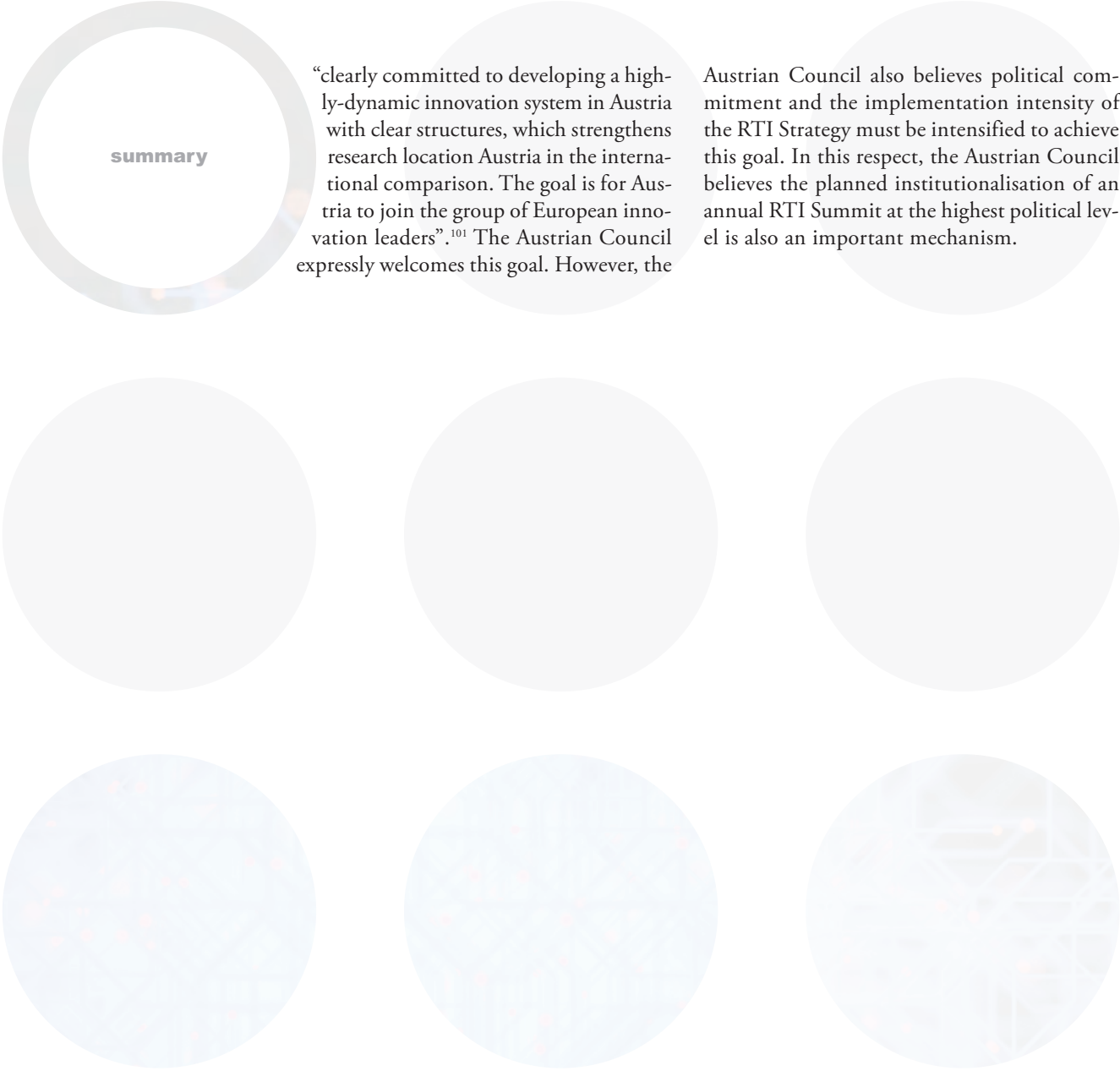
summary

97 For this in detail, see Austrian Council (2018): Report on Austria's Scientific and Technological Capability 2018. Vienna, pp. 18 ff.

98 For this in detail see, Austrian Council (2018): Report on Austria's Scientific and Technological Capability 2018. Vienna, pp. 32 ff.

99 WEF (2018): The Global Competitiveness Index 2018. WEF, Geneva.

100 Austrian Government (2018): Future initiative for research, technology and innovation Presentation to the Cabinet on 16 Aug. 2018, p. 2.



summary

“clearly committed to developing a highly-dynamic innovation system in Austria with clear structures, which strengthens research location Austria in the international comparison. The goal is for Austria to join the group of European innovation leaders”.¹⁰¹ The Austrian Council expressly welcomes this goal. However, the

Austrian Council also believes political commitment and the implementation intensity of the RTI Strategy must be intensified to achieve this goal. In this respect, the Austrian Council believes the planned institutionalisation of an annual RTI Summit at the highest political level is also an important mechanism.

¹⁰¹ Austrian Government (2018): Future initiative for research, technology and innovation Presentation to the Cabinet on 16 Aug. 2018, p. 2.

Recommendations of the Austrian Council for a future RTI Strategy for Austria

The most important recommendations for improving the performance of the Austrian education and RTI system with regard to a future RTI Strategy are summarised below. For details and more specific measure proposals, please see the recommendations in the respective chapters of the report, the underlying individual recommendations and the main focus points of the reports on Austria's scientific and technological capability of previous years.

Policy prioritisation for future areas

The Austrian Council essentially and in harmony with the key results of the OECD Review of Innovation Policy recommends, in addition to the implementation of the Cabinet measures planned by the Government and in particular the elaboration of the RTI Strategy, that a policy prioritisation be made for the further development of the Austrian RTI system, in order to exploit its potential accordingly to join the leading innovation nations. Political focus on the relevant future areas will contribute to affording greater weight in Austria to the topics of education, science, research, technology and innovation, and therefore injecting essential dynamism into the country's future development. The Austrian Council recommends an institutionalisation of the RTI Summit with the goal of establishing regular communication to define relevant prioritisations at the highest political level. The Austrian Council believes the annual summit should also be used to define binding implementation plans with clear scheduling specifications, financial framework decisions and operative responsibilities. In developing the RTI Strategy the Austrian Council also recommends the known areas under construction of the Austrian RTI system in the key areas of the education system, the universities, innovative start-ups, research funding and R&D financing, which impede an increase in innovation performance, be addressed as priorities.

Priority objectives

The Austrian Council recommends, also in a future RTI Strategy, that research, technology and

innovation not be understood as an end in itself, but rather as a contribution to achieving higher priority objectives on social, economic and ecological levels. An expansion of appropriate mission-orientation mechanisms is also recommended, as also suggested by the OECD. The importance of social innovations should also be considered here more than has previously been the case.

Education system

In the interests of an increase in the efficiency of the education system, within the scope of the future RTI Strategy the Austrian Council recommends the problem of education inheritance and social selectivity, which is far too high, be consistently addressed in the affected education areas. In this respect the Austrian Council recommends renewed commitment to comprehensive schools for 10 to 14-year-olds and the expansion of all-day schools. Specific measures must be targeted here to further raise the achieved performance level of 10- to 14-year-olds across the board. In this context the Austrian Council welcomes the commitment included in the government programme to quality elementary pedagogy, however it also recommends a significant increase in the number of qualified and in particular multilingual educators. Instead of a scattergun approach, the Austrian Council recommends better financial and human resources (keyword: support staff) for those schools that are confronted with special challenges, especially with regard to the socio-economic structure of their students (or "hotspot schools").

Tertiary education, universities and basic research

The Austrian Council recommends special focus be made in the RTI Strategy 2030 on the areas of tertiary education, universities and basic research. To increase the efficiency of the higher education area, the Austrian Council recommends the swift and consistent implementation of the measures anchored in the government programme for the structural further development of

summary

summary

the higher education area and to improve the governance structures of the universities, study conditions and the controlling of student flows. In addition to the structural reforms planned by the Government and essentially welcomed by the Austrian Council, it also recommends an increase in the university expenditure rate to two percent of GDP, to be able to finance the required renewal measures. This also requires an increase in the private sector financing share. In order to remove the major efficiency barriers of the RTI system, the Austrian Council urgently recommends the further increasing of competitively awarded funds for basic research to the level of the leading nations.

Innovative start-ups

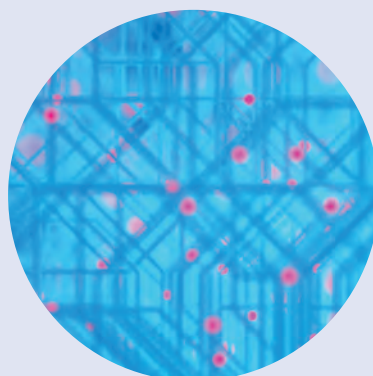
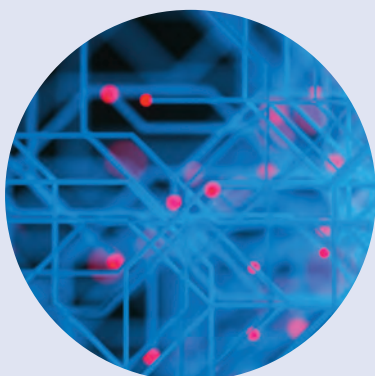
To increase innovation efficiency the Austrian Council recommends anchoring measures in the RTI Strategy, which target the removal of administrative and financial obstacles for start-ups. To do this all the adverse bureaucratic, regulatory and taxation framework conditions must primarily be improved, in particular to reduce innovative start-up input, costs and set-up time. Furthermore, the familiar problem of insufficient availability of private financing provided by risk capital or crowdfunding must also be addressed. In addition to funding by banks, the Austrian Council also recommends developing funding options for innovative entrepreneurs and SMEs. A suitable framework is required to increase equity capital intensity from the private side, such as appropriate legislative and taxation framework conditions for private equity, an improvement in

the quality of the Austrian capital market and assessment stipulations of pension and insurance funds, for example, as also proposed by the OECD.

Research funding and R&D financing

The Austrian Council recommends excessive administration and fragmented and intransparent funding offers be avoided in the preparation of the new RTI Strategy, among other activities. An increase in the efficiency of research funding should be afforded greater attention in the future, whatever the case may be. Existing structures must be critically scrutinised here and incentive effects must be increased with specific funding activities.

The Austrian Council welcomes the Research Funding Act planned in the government programme and currently being prepared, which will secure the medium to long-term stability of RTI funding in Austria. In this context the Austrian Council recommends a revision of the appropriate use of funding in the Austrian RTI system, to correct existing imbalances in funding distribution. In the area of universities and basic research in particular the ratio between core funded and competitively awarded public funds must be shifted in favour of the competitive share. Budgetary prioritisation should also be addressed in the international comparison with the objective of a clear, future-oriented alignment of government spending. Special focus should be afforded here to the competitive awarding of funds, especially for basic research. Appropriate objectives should be anchored within the RTI Strategy's framework.



Background

The Global Innovation Monitor supplements the preceding analysis by comparing selected countries (China, Israel, Canada, Switzerland, South Korea, the USA) with Austria on the basis of the indicators used in this report from the areas of education, university research, corporate research, economy, society and environment. This comparison of innovation performance in the global context will illuminate the capability of the Austrian RTI system in the light of global trends.

The comparison countries for the Global Innovation Monitor were chosen for a number of

reasons: Firstly, they were defined as the target countries for Priorities 1 and 2 in the recommendations of the working group 7a to the RTI Task Force.¹⁰² Secondly, the selected countries are – with the exception of China – deemed to be global innovation leaders that can serve as benchmarks due to their successful performance. China was included in the list because it has faster growth rates for spending on research, publications, patents etc. than any other country. Thirdly, members of the Austrian Council who took part in official visits to these countries were given deeper insights into the RTI systems there.

¹⁰² Beyond Europe: Austria's internationalization in research, technology and innovation beyond Europe. Recommendations of Work Group 7a to the Federal Government's Task Force (July 2013), p. 7.

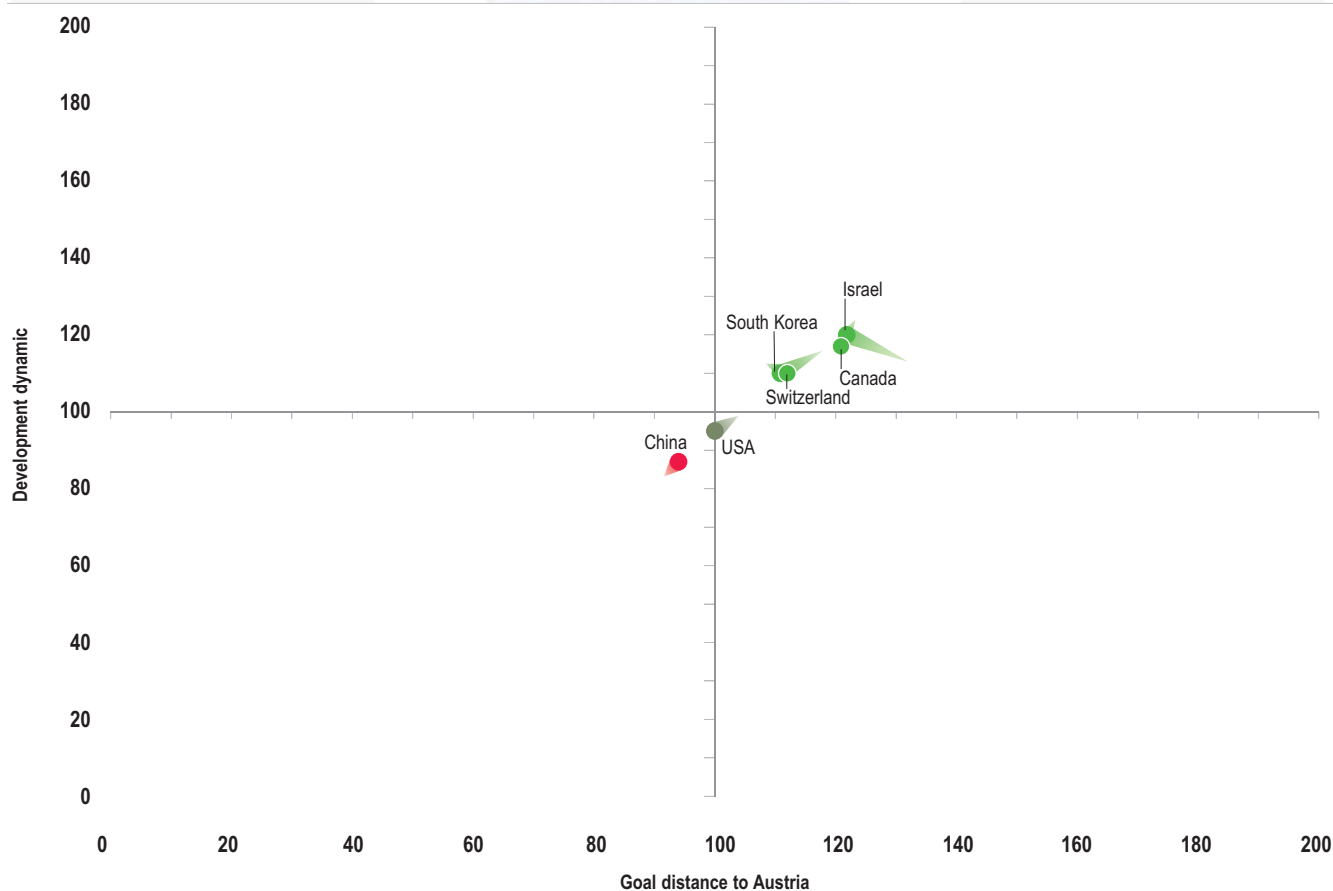
Education

The assessment of the education system presents the results of the PISA studies in aggregated form as output component and the spending in the tertiary education sector for students as input component. If we compare the current analyses, Austria's education performance is ahead of that of China, more or less on a par with the USA, but clearly behind that of the leading innovation countries, Israel, Canada, South Korea and Switzerland (see figure 22). With regard to the performance of education

systems, Switzerland, South Korea, Canada and Israel are still more or less ahead of Austria with regard to both goal distance and development dynamic. Compared with the USA, Austria is more or less the same, even though the USA has lost dynamic, which indicates a longer term fall behind Austria's position. China is significantly behind, and with the trend remaining as is, has no realistic chance of reaching the Austrian level in the foreseeable future.

global
innovation monitor

Figure 22: Education in the international comparison



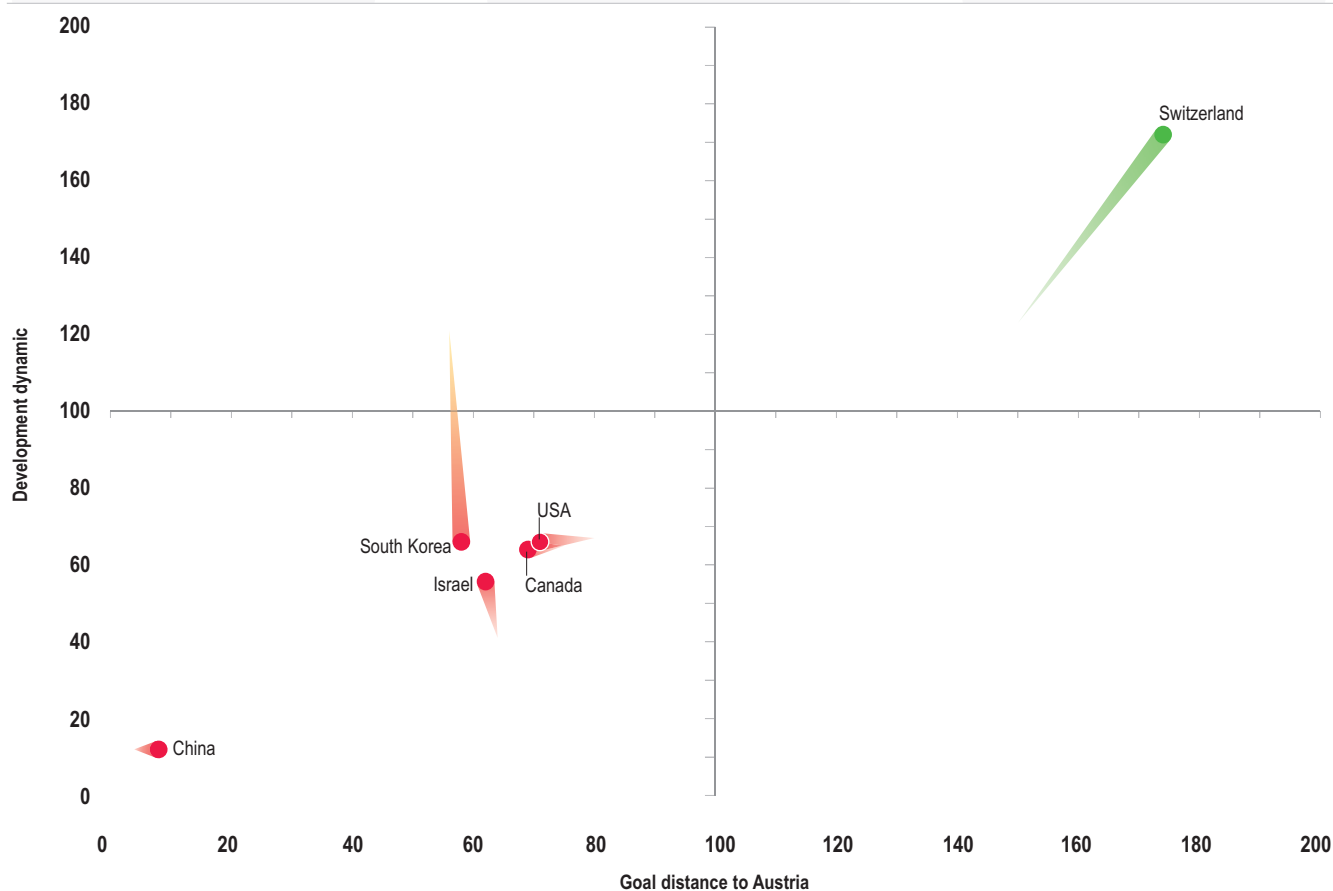
Source: See indicators list, appendix 4, WIFO presentation; Methodology and notes for interpreting the figures and indicators, see appendix 5.

University research

The trend in the area of university research appears to be somewhat better than that in the education area. On the basis of the aggregated individual indicators of “University ranking”, “Expenditure for basic research” and “Expenditure for tertiary education, research and development in relation to the general public”, Austria is far behind Switzerland, but clearly ahead of, Canada, South Korea, Israel and the USA; China ranks far behind on the whole at a lower level (see figure 23).

Switzerland is the top research nation in the most diverse international rankings. With the development trend remaining unchanged, this situation will stay as it is in the near future, and Austria will scarcely reduce its distance to Switzerland. The prospect of China catching up on Austria’s current dynamic is extremely low. But Israel, Canada, South Korea and the USA will not achieve Austria’s level by 2020 either with the trend remaining as it is.

Figure 23: University research in international comparison



Source: See indicators list, appendix 4, WIFO presentation; Methodology and notes for interpreting the figures and indicators, see appendix 5.

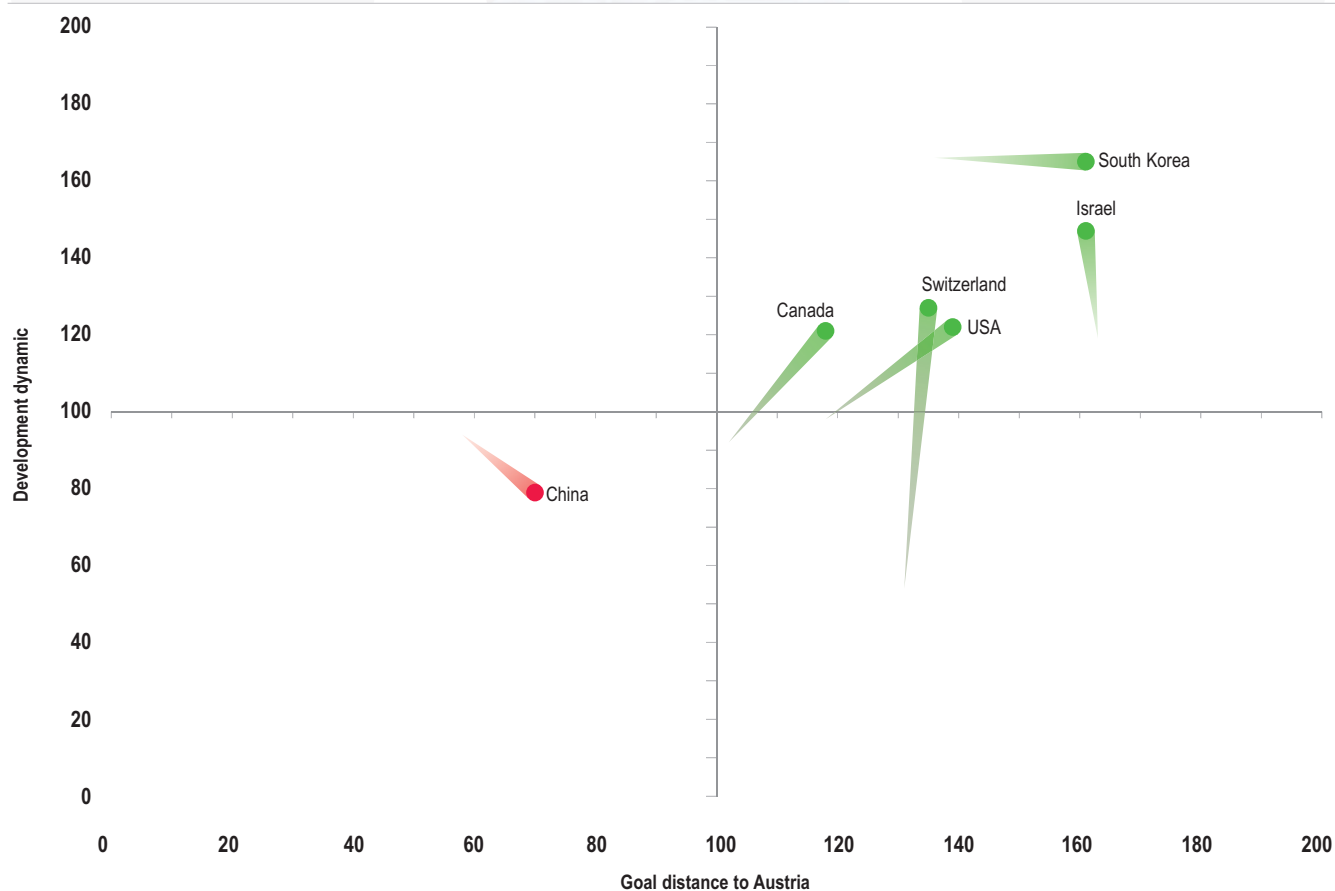
Corporate research

Figure 24 shows a catch-up requirement for Austria with regard to performance in the indicators for corporate research and innovation, which have been summarised for this illustration. Apart from China, all selected countries

are ahead of Austria. With trend patterns remaining as they are, their dynamic development means they will continue to extend their lead ahead of Austria.

global
innovation monitor

Figure 24: Corporate research in the international comparison



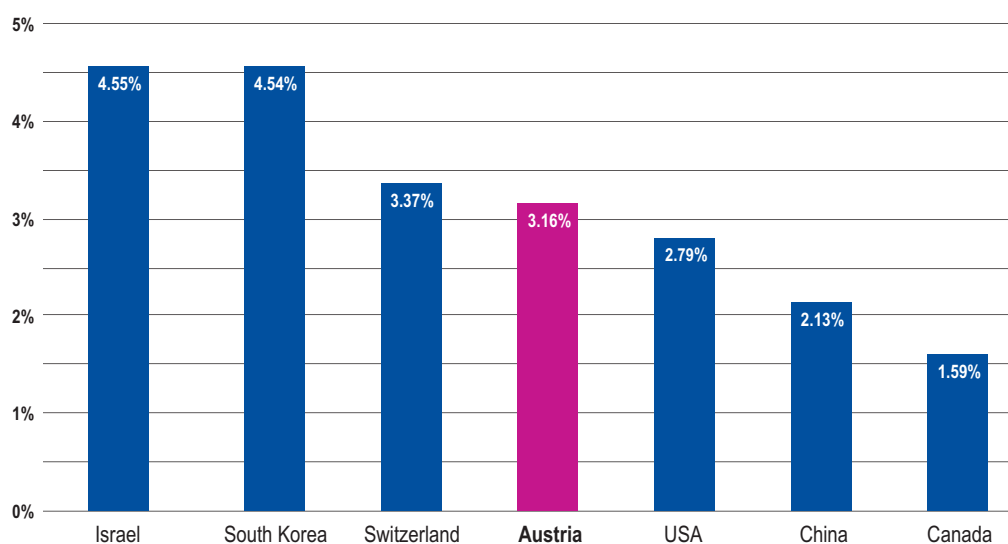
Source: See indicators list, appendix 4, WIFO presentation; Methodology and notes for interpreting the figures and indicators, see appendix 5.

Research funding

Figure 25 shows a comparison of the R&D rates for the countries selected for the Global Innovation Monitor according to the Main Science and Technology Indicators 2017 of the OECD (last available year respectively); the Austrian R&D rate still scores 3.16 percent for this reason and others.¹⁰³ Regardless of this, the fundamental ratios have also seen scarcely any change compared to previous years: In the international comparison Israel and South Korea

continue to have the by far highest research rates; Switzerland and the USA are more or less on a par with Austria. Measured on overall volume, with approx. USD 412 billion, China is already ranked number 2 behind the USA (USD 464 billion). In the comparison for this, with R&D expenditures of approx. USD 11.6 billion (at purchase power parity), in 2016 Austria ranked among the top 20 in the global list of countries. In per-capita terms it even ranks at number 5.

Figure 25: R&D rates (in % of GDP) selected countries, last available year



Source: OECD MSTI (2017)

¹⁰³ According to Statistik Austria's global estimate, Austria's R&D quota for 2018 is already 3.19 percent.

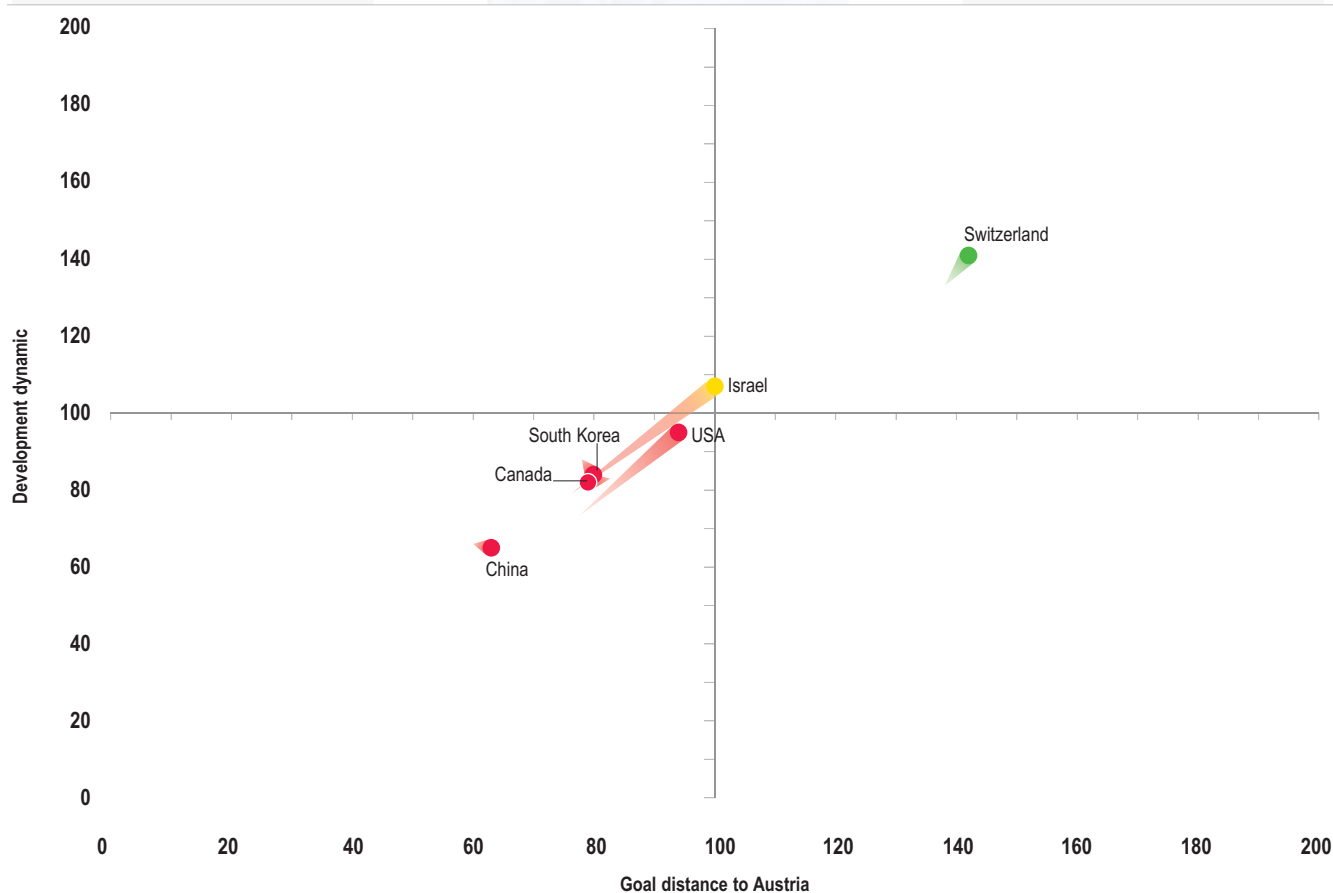
Economy, society and environment

Figure 26 shows that Austria is positioned relatively well with regard to the economic, social and environment-relevant KPIs in relation to the countries considered here. Only Switzerland currently scores considerably better than Austria with these indicators. Israel has improved considerably and is on a par with Austria.

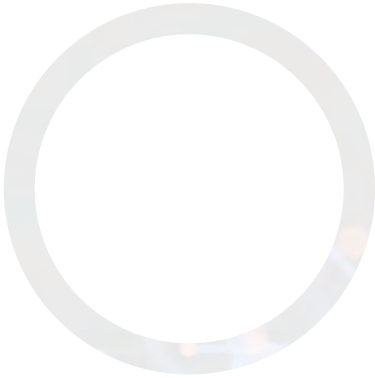
With regard to the above-average development dynamic, Israel and Switzerland are also in an area that allows us to conclude that little will change with this positioning in the foreseeable future. The performance of China, Canada, South Korea and the USA is insufficient to be able to catch up with Austria in the medium term.

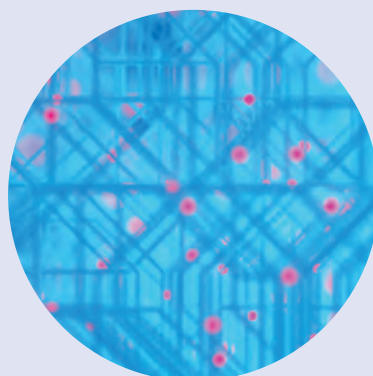
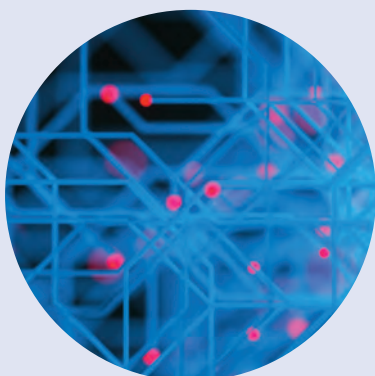
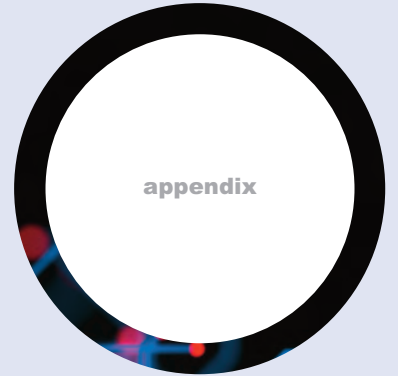
global
innovation monitor

Figure 26: Economy, society and environment in the international comparison



Source: See indicators list, appendix 4, WIFO presentation; Methodology and notes for interpreting the figures and indicators, see appendix 5.





Appendix 1: Indicator Set

Strategy Objectives	Indicator to track Goal Achievement	Abbreviation	Numerator
Priority Objectives			
Vision: In 2020 Austria is an innovation leader. Objective: We want to further develop the potentials of science, research, technology and innovation in Austria to make our country one of the most innovative in the EU ...	EIS Innovation Index (Summary Innovation Indicator)	EIS Index	Innovation index value (normalized 0–1)
... and thus strengthen the competitiveness of our economy and increase the wealth of our society ...	GDP per capita at purchasing power standards (PPS)	GDP/per capita	Gross domestic product (GDP) at purchasing power standards
	Employment-to-population ratio	Employment rate	Employed (20-64 years)
	Unemployment rate	Unemployment rate	Unemployed (15-74 years)
... and overcome the big social and economic challenges of the future.	OECD Better Life Index	Better Life	Better Life Index– value (0–10)
	Healthy life years: Number of years a person of a certain age can expect to live without illness/disability.	HLY (F)	Years without chronic illness/ activity limitation
		HLY (M)	
	Reduction of greenhouse gas emissions in %	Greenhouse gases	Emissions of greenhouse gases, base year 1990 Index (1990=100)
	Efficiency increase: energy intensity	Energy intensity	Gross Domestic Energy Consumption (kg. oil equivalents)
	Efficiency increase: productivity of resources	Resource productivity	GDP

Denominator	Brief Explanation of Indicator	Source	Calculation information	ID No.
n.a.	The EIS Innovation Index is supposed to make the innovation performance of the EU member states comparable. It is made up of 25 unweighted single indicators covering several innovation areas (such as human resources, research spendings, patents and structural change).	EIS European Innovation Scoreboard		1
Total population	Gross Domestic Product (GDP) per capita is a measure of a country's total economic output. It is defined as the value of all newly-created goods and services, minus the value of all goods and services consumed as inputs. The underlying figures are expressed in PPS, a common currency, which balances price level differences between countries and allows significant GDP volume comparisons.	Eurostat		2
Working-age population (20-64 years)	The employment rate complements GDP per capita as a measurement of a country's economic development. The working population comprises people who during the reference week worked in gainful employment for at least one hour or who did not work, but had a work place and were only temporarily absent.	Eurostat		3
Persons in Employment (15-74 years)	The unemployment rate complements GDP per capita as a measure of a country's economic development. The unemployment rate is the number of people unemployed as a percentage of the labour force. The labour force is the total number of people employed plus unemployed. The figure is seasonally adjusted.	Eurostat	Inverted	4
n.a.	The indicator measures wealth and quality of life across a wide range of factors. It covers several areas but as income, education and health overlap with other areas these are not included. The remaining areas are work-life balance, integration in social networks, participation in social/political events, personal security, environmental quality, housing and life satisfaction.	OECD Better Life Index		5
Life expectancy	This indicator reflects the challenges of ageing populations. The number of healthy life years an individual will enjoy can be influenced by medical and technological progress and by social innovations such as new preventative healthcare models at the workplace.	Eurostat		6
				7
n.a.	This indicator is one of Austria's Europe-2020 goals and reflects the fact that climate change can only be efficiently stemmed by a reduction in absolute terms of greenhouse gases. The target aims for a reduction and not an increase.	Eurostat; Austrian Federal Environment Agency	Inverted; national target	8
GDP (in 1,000 €)	This indicator shows the development of energy efficiency; i.e. energy consumption required for Austria's annual economic output.	Eurostat; Statistik Austria	Inverted	9
Domestic material consumption (kg)	This indicator measures the total amount of physical resources directly used in Austria's annual economic output.	Eurostat; Statistik Austria		10

Strategy Objectives	Indicator to track Goal Achievement	Abbreviation	Numerator
Educational System – Pre-Primary and Primary Education			
The educational system as a whole needs to be optimised, starting with the early childhood phase. Vision 2020: age-based, early childhood educational support has been established.	Participation in early childhood education	Early childhood care	Children (4–primary level) in institutional childcare facilities
	Ratio of students to teaching staff	Student-teacher ratio early childhood	Number of children (3 years and older) in institutional childcare facilities
	Ratio of students to teaching staff in primary education	Student-teacher ratio in primary education	Number of students in primary education
Educational System – Secondary Education			
The proportion of early school leavers should be reduced to 9.5% by 2020.	Percentage of early school leavers	Early school leavers	People aged 18-24 with lower secondary educational attainment or less
The proportion of pupils graduating with a secondary school-leaving certificate within an age cohort should be increased to 55% by 2020	Percentage of secondary school graduates	Secondary school graduates	Passed final school leaving examination
The number of students with a first language other than German, who complete the upper secondary level should increase from 40% at present to 60%. Better integration of immigrants	Number of students with a first language other than German who have completed the second level of secondary school	Early school leavers immigrants	Number of students with a first language other than German who have completed the upper secondary level of education (AHS, BHS, 3-year technical school, apprenticeship)
The reforms aim at mitigating social selectivity.	Influence of socio-economic background on reading competence	Inheritance of education 1	Influence of PISA Index for the socio-economic background on reading competence (increase in socio-economic gradient)

	Denominator	Brief Explanation of Indicator	Source	Calculation information	ID No.
	Population 4–5 for Austria, for other countries depending on the age at which children start school (4–6)	The percentage of the population between the age of 4 and the age at which children start school who are participating in early childhood education. This indicator is used to measure progress toward the primary goal set out in the Strategy "General and Vocational Education" of increasing the proportion of children (between the age of 4 and the age at which compulsory primary education starts) who participate in preschool education to at least 95% by 2020.	Eurostat	National target	11
	Number of qualified teachers without teaching assistants	The ratio of students to teaching staff compares the number of students (full-time equivalent) to the number of teachers (full-time equivalents and not teaching assistants) at a given level of education and in similar types of institutions.	OECD, Education at a glance	Inverted	12
	Number of teachers (full time-equivalents) at primary level	The ratio of students to teaching staff compares the number of students (full-time equivalent) to the number of teachers (full-time equivalent) at a given level of education and in similar types of institutions.	Eurostat	Inverted	13
	Total population between 18-24	This is a core target within the framework of the Europe 2020 strategy. "Early leavers from education and training" are people aged 18 to 24, who fulfill the following conditions: the highest level of education or training attained is ISCED 0,1,2 or 3c short – i.e. lower secondary level – respondents should not have received any education or training in the four weeks preceding the survey.	Eurostat	Inverted	14
	Age cohort 18-19 years	Final examination rate: students who passed final school-leaving examinations (without second or subsequent qualifications), as measured by the arithmetic mean of the population aged 18 to 19.	Statistik Austria	National target	15
	Age cohort 18-19 years with a first language other than German	The indicator shows the share of students with a first language other than German, who have attained upper secondary educational attainment level (final school leaving examination, apprenticeship, intermediate technical schools).	Statistik Austria	National target	16
	n. a.	The average difference in students' reading attainment which indicates a one unit increase in the PISA index of economic, social and cultural status is defined as an increase in the socio-economic gradient. The wider the average attainment gap, the greater the impact of students' socio-economic background on their reading skills. The socio-economic background is measured by the PISA-index of economic, social and cultural status and is based on information provided by the students on their parents' education level and occupational status and household possessions, such as a writing desk for studying and the number of books. Statistical fluctuations are taken into consideration in the assessment.	OECD PISA	Inverted	17

appendix

Strategy Objectives	Indicator to track Goal Achievement	Abbreviation	Numerator
Education System – Secondary Level			
		Inheritance of education 2	Influence of the PISA Index for the Socio-Economic Background on Reading Skills (strength of correlation–share of the declared variance)
The reforms aim at continuously increasing quality in education (secondary level).	Share of students with poor performance in basic skills (literacy, numeracy, science) Target: 15% at most	PISA risk students – reading	Students who at best achieve competence level 1 of the relevant PISA scale
		PISA risk students – mathematics	
		PISA risk students – science	
	Share of students who reach at least competence level 5 (in literacy, numeracy, science)	PISA top students – reading	Students who reach the competence level 5 or higher
		PISA top students – mathematics	
		PISA top students – science	
Optimum qualification for economic activity (...)	Share of graduates in employment (aged 20 to 34)	Skill Mismatch	Individuals between the ages of 20 and 34 who are in employment and who graduated from an educational programme of at least secondary level II and who left the general education and vocational education system no more than three years before the reference year.

	Denominator	Brief Explanation of Indicator	Source	Calculation information	ID No.
	n. a.	The strength of the relationship between reading performance and socio-economic background is measured by the percentage of the variance of students' performances, which can be explained by the differences in students' socio-economic background. The higher the share of the declared variance, the greater the influence of the socio-economic background.	OECD PISA	Inverted	18
	Total number of students participating in OECD PISA	This indicator provides information about the number of students as a percentage of the total population who on the basis of their test results at best attain proficiency level 1 on the relevant PISA scale. It can be assumed that low proficiency levels in these three basic skills results in significant disadvantages in personal and social life.	OECD PISA	Inverted; national target	19
				Inverted; national target	20
				Inverted; national target	21
	Total number of students participating in OECD PISA	This indicator shows the distribution of school performance upwards, i.e. the share of students with very good results.	OECD PISA		22
					23
					24
	All individuals between the ages of 20 and 34 who graduated from an educational programme of at least secondary level II and who left the general education and vocational education system no more than three years before the reference year	This indicator attempts to reflect the mismatch between training/education and the demands of the job market. It is an official target of the European Education and Training Strategy.	Eurostat	National target; as no time series is available, the prospect of goal achievement was calculated with the goal distance	25

Strategy Objectives	Indicator to track Goal Achievement	Abbreviation	Numerator
Educational System – Tertiary Education			
38% of 30 to 34-year-olds have a university degree in 2020	Share of 30 to 34-year-old university graduates in the 30 to 34-year age cohort.	University Graduates	Number of 30 to 34-year-olds with a graduation in the tertiary sector (ISCED 5-8)
		University Graduates (ISCED 6–8)	Number of 30 to 34-year-olds with a graduation in the tertiary sector (ISCED 6-8)
The conditions of study at universities should be fundamentally improved, which will require establishing new financing models for higher education.	Student-to-Staff ratio	Staff-Student ratio university	Number of students
Vision: universities, universities of applied sciences and non-university research institutions work within excellent framework conditions and are sufficiently financed to optimally perform their tasks in research and teaching.	Percentage of GDP spent on higher education	University expenditure rate	Expenditure for the whole tertiary sector
	University expenditure per student	University expenditure per student	Expenditure for the whole tertiary sector
This is to guarantee universities, research institutions and companies a sufficient supply of highly-qualified researchers.	Number of researchers per 1,000 employees	Researchers	Researchers according to OECD Frascati definition
	Doctors in STEM subjects per 1,000 of the population	Doctors in STEM subjects	Doctors in STEM subjects
	STEM graduates per 1,000 of the population	STEM graduates	Graduates STEM fields
The reforms are aimed at balancing the gender imbalances in research.	Women researchers as a percentage of total researchers	Percentage of female researchers	Number of female researchers (OECD Frascati definition)
	Percentage of women in Science, Technology, Engineering and Mathematics (STEM)	Share of women in science	Number of female graduates in science
		Share of women in engineering	Number of female graduates in engineering
	Glass Ceiling Index (percentage of female professors relative to the percentage of female scientific and artistic staff)	Glass Ceiling Index EU	Percentage of female professors

	Denominator	Brief Explanation of Indicator	Source	Calculation information	ID No.
	30 to 34-year-olds	This is an Austrian Europe 2020 core indicator and reflects successful participation in tertiary education. With the adjustment in the ISCED classification, the two last age groups of BHS are now included in the tertiary sector (ISCED 5, formerly ISCED 4a).	Eurostat, Statistik Austria Mikrozensus	National target	26
		This indicator uses a closer definition for university graduates, essentially from bachelor level (ISCED 6, formerly ISCED 5).			27
	Academic staff at universities	The indicator shows the staff-to-student ratio at universities. It is calculated, wherever possible, on the basis of full-time equivalents.	Eurostat	Inverted	28
	GDP	Share of expenditure on tertiary education as a percentage of GDP as a measure for funding in an international comparison. The Federal Government has set a goal of 2% in the Government programme.	OECD, Education at a Glance	National target	29
	Number of students (ISCED 2011 6-8)	The "University expenditure per student" indicator complements the GDP rate by considering different dimensions of the tertiary sector in different countries. A tertiary sector with a 50% graduation rate will ceteris paribus require considerably more funds than a sector with a 25% graduation rate.	OECD, Education at a Glance		30
	Total employment	The indicator shows the number of researchers relative to total employment, i.e. the researcher-intensity in employment.	OECD MSTI		31
	25 to 34-year-olds/1,000	Tertiary degrees ISCED 6 in the sciences and technological disciplines per 1,000 of the population aged 25 to 34	Eurostat		32
	Age cohort of 20 to 29 year-olds/1,000	Tertiary education in science and technology subjects (ISCED 5–8) per 1,000 people aged 20 to 29.	Eurostat		33
	Number of female researchers (OECD Frascati definition)	This indicator measures the number of women as a percentage of research staff	OECD MSTI		34
	STEM graduates science in total	This indicator measures the percentage of women in STEM graduates (ISCED 6-8), who are frequently involved in technological innovation processes.	Eurostat		35
	STEM graduates engineering in total	This indicator measures the percentage of women in STEM graduates (ISCED 6-8), who are frequently involved in technological innovation processes.	Eurostat		36
	Percentage of women among scientific staff	The indicator shows how likely it is that a woman makes the leap from scientific staff to a top position at university.	European Commission	Inverted	37

Strategy Objectives	Indicator to track Goal Achievement	Abbreviation	Numerator
Education System – Further Education/Skill Structure Migration			
Vision: The immigration of highly-skilled people will be encouraged and utilised.	Highly-qualified immigrants as a percentage of the foreign-born population	Highly-qualified immigrants	Foreign-born, highly-qualified workers residing in Austria
	Foreign doctoral students	Foreign doctoral students	Number of doctoral students from abroad
To do this, the entire education system must be optimised – to models of lifelong learning.	Participation in lifelong learning	Lifelong-learning	Participants in measures for further education aged 25 to 64
Research at Universities and Non-University Research Institutions – Basic Research and Universities			
Increase investments in basic research by 2020 to the level of leading research nations.	Basic research expenditure as a percentage of GDP	Basic research quota	Expenditure on basic research as defined by the OECD Frascati Manual
Strengthening of basic research through further structural reforms of the university system. Vision: Austria is a top location for research, technology and innovation, which offers optimum working conditions and career opportunities for excellent scientists. Excellent research is a matter of course in Austria.	Publication quality	Publication quality	Number of publications among the 10% most cited publications worldwide
	International co-publications	International co-publications	Number of scientific publications with at least one foreign co-author
	ERC grants per inhabitants in million	ERC grants per inhabitants	ERC grants (starting, advanced and consolidator grants)
	Positioning of Austrian universities in international research rankings.	University ranking: research performance	Number of Austrian universities in broad ranking groups (1-500) of international comparisons of research performance, weighted by ranking groups and relative to the population (currently only Leiden Ranking)

	Denominator	Brief Explanation of Indicator	Source	Calculation information	ID No.
	All foreign-born people residing in Austria	The indicator reflects the qualification structure of immigration. It comprises foreign-born people with residence permit and at least three-month duration of stay. A university degree is the qualification criterion.	Eurostat		38
	All doctoral students	Share of foreign doctoral students in all doctoral students	Eurostat, WIFO calculations (analogous to EIS, European Innovation Scoreboard)		39
	Total population 25 to 64	Participation in lifelong learning is an official target of the ET 2020 Strategy (general and vocational learning)	Eurostat		40
	GDP	The Innovation Leaders are not used for comparative purposes, as only Denmark collects data of basic research expenditure for which data. In this case, the reference countries are the five OECD countries with the highest level of basic research expenditure as a percentage of GDP for which data is available (most recent available year: 2010: Switzerland, South Korea, Denmark, France, USA)	OECD MSTI		41
	Total number of scientific publications	The indicator is a measure for the quality of scientific publications, i.e. the quality of research.	EIS European Innovation Scoreboard		42
	Total population	International scientific co-publications can be interpreted as an indication of the quality of scientific research, since international cooperation normally increases scientific productivity.	EIS European Innovation Scoreboard		43
	Total population in millions	The indicator reflects the success in obtaining ERC funds, which are awarded only for international top research following a strict evaluation process. The indicator is calculated on the basis of the data published annually by the ERC.	ERC, World Bank		44
	n. a.	The indicator shows how Austrian universities position themselves in terms of international research performance. It shows the number of Austrian universities in broad ranking groups (1-50, 51-100, 101-200, 201-300) in international university comparisons (currently only Leiden Ranking) relative to the size of the country (number of universities per 10 million inhabitants); the number of universities is weighted with the ranking groups (the better the ranking group, the higher the weighting). This indicator also shows whether a country has only a single leading institution or a broader range. Calculated on the basis of a new methodology, in 2015 the data from the University of Leiden resulted in a significant change over 2014.	Leiden Ranking		45

Strategy Objectives	Indicator to track Goal Achievement	Abbreviation	Numerator
Research at Universities and Non-University Research Institutions – Basic Research and Universities			
Reform university funding (more competitive and project-related, incl. cost coverage). The funding of university research through competitive external funding from the FWF needs to be reinforced.	Budget of funds for funding basic research per inhabitant	Competitive funding	Budget for funds to support basic research per per inhabitant
Vision: Attractive scientific careers based on international models are a common standard at Austrian universities.	Percentage of doctoral students employed at university (uni:data)	Employed doctoral candidats	Doctoral students with an employment contract at university
Research and Innovation in the Corporate Sector – Innovation and Corporate Research			
Enhance domestic value creation by encouraging research-intensive industries and knowledge-intensive services.	Share of knowledge-intensive sectors in employment	Knowledge-intensity economy	Employment in knowledge-intensive sectors (sectors in which more than 33 % of the employed labour force have completed tertiary education)
	Share of medium level and advanced technology products in total export	Knowledge-intensity exports	Export of medium level and advanced technology products
	Innovation-intensive sectors as a share of total services exports	Knowledge-intensity service export	Export innovation-intensive service sectors
The structure of the manufacturing and service sectors has to be improved by increasing the innovation and knowledge-intensity of firms.	R&D quota in the corporate sector, adjusted by industry structure	R&D intensity business	Corporate-sector R&D expenditures,adjusted by the industry-specific R&D intensities
	Export quality in technology-orientated industries	Export quality	Exports of technology-orientated industries of material goods in the highest and middle price segment

	Denominator	Brief Explanation of Indicator	Source	Calculation information	ID No.
	Total population	Funds for funding basic research generally award their resources in competition and project-related. The budget per inhabitant is therefore an indicator for the structure of university funding.	FWF, World Bank		46
	Number of doctoral students	An employment contract while studying for a doctorate is standard international practice to ensure the attractiveness of careers in science. Doctoral programmes in science can last 3 to 6 years; during this period students who have not enrolled in a doctoral programme are already working. Without employment, careers in science are therefore hardly an attractive option compared with a career in industry.	Uni:Data	National target was used	47
	Total employment	The indicator shows the weight of employment in sectors, which employ many university graduates in an international comparison and are thus regarded as particularly knowledge-intensive.	Eurostat, WIFO calculations (analogous to EIS, European Innovation Scoreboard)		48
	Total value of all exports	The indicator measures the contribution of medium and high technology products to the trade balance and can thus also be seen as a measure of the knowledge intensity of the export structure.	Comtrade, Eurostat WIFO calculations (analogous to EIS, European Innovation Scoreboard)		49
	Total exports of services without tourism	The indicator shows the export weight of service sectors with high innovation intensity and can thus also be seen as a measure of the knowledge intensity of the export structure. Due to the specific characteristics of Austria (Alps, cultural cities) tourism accounts for a far higher share of services exports in an international comparison. Thus this sector is not taken into consideration.	EBOP, WIFO calculations		50
	Value creation in the corporate sector	The R&D intensity can be interpreted as a measure of knowledge intensity. However, the average R&D intensities vary greatly depending on the sector and an adjustment of the industry structure is necessary in order to make an internationally comparable statement on the R&D intensity of the corporate sector. Adjustments in the economic classification (NACE 1.1 to NACE 2) resulted in extensive changes in 2015 over 2014.	OECD, WIFO calculations		51
	Total export of technology-orientated industries for material goods	Export quality can be interpreted as a measure to improve the product structure.	Eurostat, WIFO calculations		52

Strategy Objectives	Indicator to track Goal Achievement	Abbreviation	Numerator
Objectives “Leverage knowledge, add value” – innovation and Corporate Research			
The number of firms that systematically conduct research and development should be increased between 2010 and 2013 by a total of 10% from 2,700 and by a total of 25% by 2020.	Increase in the number of companies conducting systematic research and development	R&D Performers	Number of companies in Austria conducting systematic research and development
Mobilise SMEs in research and innovation performance	Share of innovative SMEs	Innovative SMEs	SMEs with product or process innovation
Further increase Austria's attractiveness as a location for research and technology intensive firms.	Foreign-funded R&D	Foreign-funded R&D	R&D funding from abroad
	Share of foreign owners (applicants) of EPO patents with the participation of inventors residing in Austria	Foreign-owned patents	Number of patents with purely foreign applicants and at least one domestic inventor
Sustainable increase in the level of innovation in companies by increasing the share of innovations, which are new to the market	Share of innovations, which are new to the market as measured by the revenue they generate	Innovation revenue	Revenue produced by innovations, which are new to the market
Research and Innovation in the Corporate Sector – Science and Business Cooperation			
We want to increase the co-operation intensity of Austrian firms and strengthen strategically-orientated collaboration between science and business (focus on excellence and sustainability).	Share of companies with innovation co-operation with universities/research institutions	Business-Science Links LCU	Companies with innovation co-operation with universities/research institutions
Reduce barriers to, and companies' (SMEs) fears about, co-operation with science/research	Share of SMEs with innovation co-operation with universities/research institutions	Business-ScienceLinks SMEs	SMEs with innovation co-operation universities/research institutions
More firms should expand their technology leadership and attain top positions in innovation	PCT applications relative to GDP	Technological significance of patents	Number of patents applications filed under the PCT, at international phase, designating the European Patent Office (EPO).

	Denominator	Brief Explanation of Indicator	Source	Calculation information	ID No.
	n. a.	Survey units engaged in R&D, by performance sector (co-operative research and in-house research subsumed)	Statistik Austria	National target	53
	Total number of SMEs	The indicator describes the share of SMEs with innovation activity, i.e. a measure of innovation breadth.	Eurostat, CIS (analogous to EIS)		54
	Gross domestic expenditure on R&D	A disproportionately large share of research spending in Austria is financed from abroad. While this is an indication of Austria's quality as a location for research, it also increases the fragility of research activity in Austria. Thus, there is no need for continued growth in the share of foreign funding, at the same, however, a dramatic fall is also undesirable.	OECD MSTI		55
	Number of all patents with the participation of at least one domestic inventor	This indicator shows the control of foreign entities over inventions made by inventors living in Austria. Consequently it demonstrates the share of patents with at least one domestic inventor and where all applicants live abroad as a percentage of total patents owned by national inventors.	PATSTAT (autumn 2018) WIFO calculation		56
	Companies' revenues	The indicator reflects the economic significance of innovations, which are not only new to the company, but also new to the market and are therefore particularly innovative. It is thus an impact indicator for innovation	Eurostat		57
	Total population of companies	This indicator reflects the intensity of co-operation between companies and science and research	Eurostat		58
	Total population of SMEs	This indicator reflects the co-operation intensity of SMEs with science and research	Eurostat		59
	GDP at PPS	The number of patent applications can be understood as an indicator of the number of innovations	EIS European Innovation Scoreboard		60

Strategy Objectives	Indicator to track Goal Achievement	Abbreviation	Numerator
Research and Innovation in the Corporate Sector – Venture Capital Market and Start-Up Dynamic			
Substantially increase the intensity of private equity and venture capital in the formation of technology-based, innovative firms.	Venture capital intensity (market statistics)	Venture capital intensity	Venture capital invested in Austria (also through foreign funds)
Number of knowledge- and research-intensive new start-ups should climb annually by an average of 3% until 2020.	Average annual growth in the number of knowledge and research-intensive start-ups.	Start-ups material goods	Number of knowledge and research-intensive start-ups (material goods)
		Start-ups services	Number of knowledge and research-intensive start-ups (services)
Starting a business should be made much easier and relieved of cost burdens.	Ranking with respect to start-up regulations in doing business	Start-up regulation	Ranking with respect to start-up regulations in doing business
	Employment in rapidly growing companies	Employment in rapidly growing companies	Employment in rapidly growing companies in knowledge-intensive sectors
Research and Innovation in the Corporate Sector – Innovation and Competition			
Stimulate innovation via an active competition policy. To do this, institutions that monitor competition should be strengthened.	OECD indicator Competition policy	Competition policy	OECD indicator Competition policy
Political Governance of the RTI System – Setting Priorities			
Strengthen Austria's competitiveness in a wide range of cross-cutting fields in science and technology by focusing 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 competencies and potential of Austrian firms that can help implement research results for overcoming the grand challenges.	PCT patent applications in fields of technology that are particularly important for societal challenges	Priority setting: Patents	PCT patent applications in selected technological fields (climate change mitigation and health)

	Denominator	Brief Explanation of Indicator	Source	Calculation information	ID No.
	GDP	This indicator measures venture capital intensity on the basis of the total sums invested in Austria, also by foreign funds (market statistics).	AVCO, EVCA		61
	n. a.	This indicator measures start-up activity in knowledge and research-intensive sectors of the material goods industry.	Statistik Austria	National target	62
	n. a.	This indicator measures start-up activity in knowledge and research-intensive industries within the service sector.	Statistik Austria	National target	63
	n. a.	The indicator compares the regulatory framework for founding an LLC (GmbH) in the different countries based on the following four criteria: number of necessary administrative steps, time, costs (% GDP per capita) and minimum capital (% GDP per capita).	World Bank	Inverted	64
	Employment in rapidly growing companies in the total economy	The indicator shows the dynamic of rapidly growing companies in knowledge-intensive sectors. It is not known, however, if the companies in question actually achieve their growth on the basis of innovation activities.	EIS – European Innovation Scoreboard		65
	n. a.	The indicator classifies a number of rules governing competition in terms of their propensity to facilitate competition.	OECD	Inverted, normalised; break in time series (2013)	66
	GDP in PPS	This indicator measures inventive activity in fields of technology that make an important contribution to overcoming two societal challenges (climate change and the ageing population, and health).	PATSTAT (autumn 2018), WIFO calculation		67

Strategy Objectives	Indicator to track Goal Achievement	Abbreviation	Numerator
Political Governance of the RTI System – Funding System and International Positioning			
Increased Austrian participation in European funding programmes, for example in the Research Framework Programmes or the European Structural Funds.	Returns ratio	Returns ratio	Austria's share in funding in the 7th framework programme/ Horizon 2020 (core framework programme)
	"Utilised capacity" (participation in Framework Programme based on researchers per country)	Participation in Framework Programme	Austrian participations as a share of total participations (EU 27) in the respective Framework Programme.
Political Governance of the RTI System – Research and Society			
A culture of appreciation for research, technology, and innovation, and an understanding of how this field makes an essential contribution to increasing the quality of life and societal prosperity	Attitude towards science (personal interest, economic benefits)	Personal interest in science	Share of people with a high to medium appreciation of science in different areas
		Economic benefits of science	
		Positive attitude toward science	
Financing of the RTI System			
Increase research intensity by one percentage point, from 2.76% today to 3.76% of GDP in 2020.	R&D intensity	R&D intensity	Gross domestic expenditure on research and development
Of this investment amount, at least 66%, but 70% if possible, should come from the private-sector. To this end, 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.	Share of research funding provided by the private-sector	Private-sector R&D	R&D financing from non-governmental sources

	Denominator	Brief Explanation of Indicator	Source	Calculation information	ID No.
	Austria's contribution to the EU budget.	The indicator shows Austria's success at obtaining EU funding relative to its total EU budget contribution, i.e. whether Austria obtains an above or below-average return in research. An above-average return indicates that Austria receives a high proportion of European grants.	PROVISO and EU-PM (FFG)		68
	Researchers/country as a share of total researchers EU 27	This indicator shows whether a country's involvement in the FP is above or below its theoretically available capacity (potential). The indicator is calculated over the period of the relevant Framework Programme as of the census date).	PROVISO and EU-PM (FFG)		69
	All respondents	This indicator shows the public perception of science. The questions in the Special Eurobarometer were divided into two groups. One set of questions addressed the personal benefits of, or interest in, science and technology, the other, the benefits of science and technology for the economy.	Eurobarometer		70
					71
					72
	GDP	R&D Intensity: Gross domestic expenditure as a percentage of GDP	OECD MSTI, Statistik Austria	National target	73
	Total expenditure on R&D	The share of private-sector research funding is the share of total R&D spending that is financed by business enterprises.	OECD MSTI, Statistik Austria	National target	74

Appendix 2: Indicators' Raw Data

Indicator	Current value AT	Inno. Lead.	Unit	Goal distance	Growth AT	Inno. Lead.	Productive growth	Prospect of goal achievement	Available time series	ID
EIS Index	120.97	134.49	Relative to EU (= 100)	90	1.10	0.71	4.33	91	2010–2017	1
Per capita GDP)	128.00	137.86	Volume index of real per capita spending in PPS (EU 28 = 100)	93	–0.09	–0.25	2.32	93	2000–2017	2
Employment rate	72.20	73.21	in %	99	0.31	0.31	0.78	99	2000–2017	3
Unemployment rate	4.90	5.19	in %	106	1.28	0.02	3.14	104	2000–2018	4
Better Life	6.79	7.54	Index 0–10	90	–3.07	–0.95	2.63	84	2013–2017	5
Life expectancy in good health (F)	67.90	74.69	in %	91	–0.66	0.03	2.53	88	2004–2016	6
Life expectancy in good health (M)	71.90	79.97	in %	90	–0.49	0.06	2.81	88	2004–2016	7
Greenhouse gases	103.06	84.00	in %	82	–0.01	–1.09	–4.98	82	2000–2016	8
Energy intensity	4.45	4.61	Gross domestic consumption in terajoules/GDP	103	–0.45	–1.73	–0.76	99	2000–2016	9
Resource productivity	1.79	2.62	GDP/material consumption in kg	68	1.60	1.64	15.68	68	2000–2017	10
Early childhood care	95.60	95.00	in %	101	0.72	0.26	–0.21	103	2000–2017	11
Teacher-child ratio early childhood	13.28	11.62	Number (children-support staff)	88	–2.24	–1.36	–4.14	92	2002–2016	12
Student-teacher ratio in primary education)	11.60	13.97	Number (children-teachers)	120	–1.39	–0.57	4.11	124	2001–2016	13
Early school leavers	7.40	9.50	in %	128	–1.87	–2.34	8.68	136	2000–2017	14
Secondary school graduates	42.80	n. a.	in %	78	0.94	n. a.	8.72	80	2000–2017	15
Early school leavers – Migrants	83.28	n. a.	in %	139	0.47	n. a.	–10.35	141	2011–2017	16
Education inheritance 1	45.10	38.34	Socio-economic gradients incline	85	0.12	–0.37	–3.35	84	2000–2015	17
Education inheritance 2	14.57	11.75	Share of explained variance	81	–0.88	–1.72	–5.65	78	2000–2015	18
PISA risk - reading	22.54	15.00	in %	67	1.04	0.93	–7.82	63	2000–2015	19
PISA risk - mathematics	21.75	15.00	in %	69	1.24	1.55	–7.16	65	2003–2015	20
PISA risk – science	20.83	15.00	in %	72	2.73	3.00	–6.35	63	2006–2015	21
PISA top students - reading	7.24	10.00	in %	72	–0.20	0.47	7.18	70	2000–2015	22
PISA top students - science	12.46	11.84	in %	105	–1.13	–2.67	–3.72	114	2003–2015	23
PISA risk – science	7.72	9.90	in %	78	–2.80	–0.96	3.69	72	2006–2015	24
Skill Mismatch	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	25
University graduates	40.80	38.00	in %	107	2.05	2.81	–2.34	114	2004–2017	26
University graduates (ISCED 6-8)	25.88	43.45	in %	60	1.66	1.75	21.01	59	2004–2017	27
Supervisor-student ratio (university)	16.20	12.46	Number (students-support staff)	77	1.49	–1.28	–9.16	72	2002–2017	28
University expenditure rate	1.48	2.00	in %	74	2.34	1.65	6.25	83	2000–2015	29
University expenditure rate per student	17,717.83	25,137.59	in USD	70	3.32	4.51	12.78	65	2000–2015	30
Researchers	10.36	11.31	in %	92	3.28	2.02	5.20	95	2002–2017	31
Doctoral graduates STEM	0.90	1.22	in %	74	2.57	4.77	12.50	69	2000–2016	32
STEM graduates	22.10	18.28	in %	121	7.26	3.47	–1.47	140	2000–2016	33
Share of female researchers	29.49	31.53	in %	94	2.76	1.79	3.06	99	2002–2015	34
Share of women in natural sciences	48.43	50.11	in %	97	–0.46	–0.22	0.47	95	2005–2015	35
Share of women in engineering	27.41	25.30	in %	108	1.93	0.35	–1.61	115	2005–2016	36
EU Glass Ceiling Index	1.76	1.87	Index (ratio figure)	106	–3.34	–1.88	–0.57	122	2004–2013	37

Indicator	Current value AT	Inno. Lead.	Unit	Goal distance	Growth AT	Inno. Lead.	Productive growth	Prospect of goal achievement	Available time series	ID
Highly-qualified Immigrants	28.40	35.21	in %	81	3.48	2.58	10.45	82	2004–2017	38
Foreign doctoral students	28.30	38.14	in %	74	1.08	3.43	11.04	69	2008–2016	39
Lifelong learning	15.80	20.51	in %	77	3.86	2.35	11.72	80	2000–2017	40
Basic research quota	0.54	0.62	in %	87	2.89	2.22	6.61	87	2002–2016	41
Publication quality	11.14	12.89	Top publications in % of all publications	86	–0.32	1.15	4.22	80	2008–2015	42
International co-publications	1,375.83	1,628.73	Number per million inhabitants	84	6.40	7.49	13.98	81	2010–2017	43
ERC grants per inhabitant	3.41	3.56	Number (grants/inhabitants)	96	9.25	10.95	13.07	90	2009–2017	44
University ranking research performance	29.76	26.53	Number per ranking group/population	112	0.49	–1.30	–3.00	115	2009–2016	45
Competitive financing	21.89	73.29	in EUR/population	30	1.18	6.26	45.28	24	2007–2016	46
Doctoral candidates with employment contracts	35.31	n. a.	in %	35	6.22	n. a.	41.48	42	2010–2017	47
Knowledge intensity business	15.00	17.46	in %	86	0.85	0.33	5.52	87	2008–2017	48
Knowledge intensity exports	58.04	52.56	in %	110	0.40	–0.36	–3.55	113	2005–2017	49
Knowledge intensity exports service industry	75.84	79.10	in %	96	0.44	–1.13	0.46	100	2010–2017	50
R&D intensity of the economy	0.91	0.29	in percentage points	316	9.03	–0.19	–18.28	317	2008–2016	51
Export quality	80.61	82.04	in %	98	0.10	–0.63	–0.02	100	2010–2017	52
R&D performers	3611.00	n. a.	Number	107	4.89	n. a.	–1.34	136	2002–2015	53
Innovative SMEs	40.71	36.90	in %	110	–2.00	–0.68	–1.88	99	2006–2014	54
Foreign-funded R&D	16.01	9.71	in %	165	–1.34	3.77	–8.52	135	2000–2016	55
Foreign-owned patents	29.32	26.25	in %	112	0.44	0.38	–2.11	114	2000–2015	56
Innovation revenue	8.40	12.54	in %	67	1.90	2.02	14.25	50	2004–2014	57
Business-Science Links LCU	56.80	39.63	in %	143	4.62	0.74	–5.17	180	2004–2014	58
Business-Science Links SMEs	29.90	19.76	in %	151	8.03	2.82	–4.47	209	2004–2014	59
Patents' technological significance	4.70	5.62	Number applications/GDP	84	1.03	–1.21	2.12	95	2008–2015	60
Risk capital intensity	0.11	0.51	in % of GDP	22	–10.29	–5.39	58.34	18	2007–2017	61
Start-ups material goods	–3.55	n. a.	in %	35	–2.40	n. a.	29.86	35	2010–2016	62
Start-ups service industry	–6.36	n. a.	in %	40	–4.49	n. a.	25.39	40	2010–2016	63
Start-up regulation	118.00	41.43	Rank	35	4.33	2.41	–26.41	35	2006–2017	64
Employment in rapidly growing companies	1.94	4.75	in %	41	–5.54	–1.35	18.36	32	2008–2015	65
Competition policy	0.35	0.26	Index value of a compound indicator	75	–10.00	–9.23	–5.92	136	2003–2013	66
Priority setting – patents	0.60	1.42	Applications/GDP	42	1.29	2.64	19.80	37	2000–2014	67
Returns ratio	124.60	126.16	Index value	99	–0.22	2.54	3.84	89	2012–2017	68
Participation in FP	125.99	128.82	Index value	98	–0.78	2.71	5.17	84	2012–2017	69
Personal interest in science	9.20	18.59	in %	49	–24.06	–21.80	–11.62	35	2010–2013	70
Benefits of science for the economy	63.63	66.33	in %	96	–2.16	–1.27	–0.63	90	2010–2013	71
Positive attitude towards science	44.52	60.81	in %	73	2.37	0.31	4.97	84	2010–2013	72
R&D quota	3.16	3.76	in %	84	3.08	0.08	5.99	92	2000–2017	73
Private sector R&D	64.81	66.00	in %	98	0.15	0.21	0.61	99	2000–2017	74

Goal distance = actual value AT/actual value innovation leaders or actual value AT/target AT

Prospect of goal achievement = value projected for Austria in 2020 relative to the national goal or the value projected for the innovation leaders in 2020

Appendix 3: Methodology and Notes for Interpreting Graphics and Indicators

All indicators used in this Report were proposed by the WIFO, subjected in the cooperation with WG 8 (RTI rankings) of the RTI Task Force to a wideranging discussion with experts and coordinated with the ministries responsible for implementing the RTI Strategy. They are based on explicit objectives of the RTI Strategy of the Austrian Federal Government and on internationally used classifications of the OECD, Eurostat, etc. and corresponding databases. These are accessible to the public and are regularly surveyed nationally and internationally.

For this report the indicators are illustrated in the corresponding figures according to their distance to the goal (**goal distance**) and their prospect of **goal achievement**. The **goal distance** on the horizontal axis illustrates the current Austrian value. It shows the ratio and the distance of the last available Austrian value to the national set goal according to the RTI Strategy and the Education and Training 2020 Strategy.¹⁰⁴ If there is no national goal, the goal of the last available average value of the current five innovation leaders, Denmark, Germany, Finland, the Netherlands and Sweden (“innovation leaders actual value”) is used.¹⁰⁵ This is because Austria’s move into the innovation leaders is a priority goal of the RTI Strategy.

All indicators must be interpreted in the same direction, i.e. values above 100 signal goal achievement, values below 100 a corresponding distance to the goal. The standardisation of the values is achieved as follows: The Austrian value is divided by the respective target value and multiplied

by 100. If performance improvements are accompanied by a decline in the indicator values, such as with the unemployment rate, for example, the values would be inverted (i.e. target value in the numerator, Austrian value in the denominator), in order to retain the interpretation of “greater equal to 100 = goal achievement”. Corresponding indicators are identified in the indicators list under “Calculation Information”. Values above 200 are limited in the graphics to 200. The goal distance says something about the level difference to the goal – about Austria’s current performance, but not about the changes or dynamic required for goal achievement. An indicator that is currently just below goal could therefore worsen again due to a negative dynamic. To put it another way, the exclusive comparison of the goal distances does not allow any conclusions on the probability of goal achievement.

For this reason the prospect of **goal achievement** on the vertical axis was selected as the second dimension of the indicators-based illustration. It shows whether or not the past growth of the indicator is sufficient for goal achievement. It is the ratio of the projected value for Austria in 2020 to the target value for 2020 – based on the average annual growth rate of the respective data series in the past (for this, see also the values in Appendix 2). As a target value for the growth calculation, if there is no national goal, the projected value for 2020 will be used, and not the actual value of the innovation leaders. This in turn is determined on the basis of the average growth rates of the comparison countries in the past.¹⁰⁶

¹⁰⁴ For the education system, at the suggestion of the Federal Ministry of Education, Arts and Culture at the time, target values of the European Education and Training 2020 Strategy, which is independent of the RTI Strategy, were used for some indicators.

¹⁰⁵ The term “innovation leader” refers to those EU countries in the top group in the annual European Innovation Scoreboard (EIS) of the European Commission.

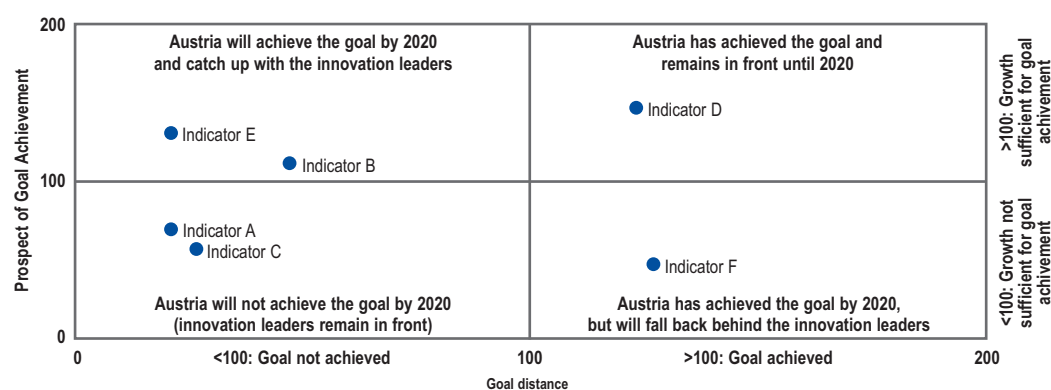
¹⁰⁶ The argument for this is that it is unlikely that the innovation leaders will remain at their current level. Austria’s placing in the European Innovation Scoreboard is therefore always made increasingly more relative to the placing of the other countries, i.e. it always considers the growth of all countries. A setting of the target value on the actual value of the innovation leaders would result in prospects of goal achievement that are too optimistic, whereby the priority setting of the measures could be distorted.

A prospect of goal achievement above 100 means that the growth in the past had been above the growth required for goal achievement. The prospect for goal achievement in 2020 should be correspondingly high. If the value is under 100, the past dynamic gives cause to fear the goal will be missed. Values above 200 on the other hand are limited to 200.

On the whole it must be emphasised that these calculations are based on the average growth rates of the past. They therefore do not represent any

prognoses based on assumptions, but rather illustrate the development under the proviso that everything continues as it was before. The results will change with the growth course of coming years and are integrated into the regular updating of the graphics. Like all calculations they must be interpreted with due caution, but they do however produce a general view of the dynamic in the individual objectives, from which priority areas of action can be concluded.

Figure 27: Sample graphic for explaining the interpretation of the indicators



Sources: See Appendix 1. Note: Goal Distance = Austria's actual value relative to the national target or the innovation leaders' actual value (value for the most recent available year for DE, DK, FI, LU, NL, SE, UK); Prospect of Goal Achievement = Value projected for Austria in 2020 relative to the target value. Values over 200 limited to 200. Raw data, see Appendix 2.

The combination of goal distance and prospect of goal achievement produces a graphic illustration of four areas with varying implication (see figure 26).

If an indicator is in one of the two areas on the left side, this means that Austria has not yet achieved the corresponding goal. For indicators in the bottom left area this will very probably also stay as it is until 2020 due to the weak growth without additional measures or measure intensification. Measures that are suitable to increase the indicator values in this area should therefore be handled as special priority. In the top left area a further continuous development could result as before in achieving the goal by 2020, as the Aus-

trian development dynamic is greater than that of the comparison countries. That is, in these areas no further measures would be required, always assuming a continuously constant development.¹⁰⁷

Indicators in the two right quadrants show that the corresponding goals have already been achieved. In all likelihood the right top area will also remain as it is due to the high growth of the specific indicator, provided the growth of the innovation leaders remains within the expected scope. In the right bottom area Austria's growth is insufficient to maintain its edge ahead of the innovation leaders in the long term. The development should be observed very closely here to also counteract in good time where required.

¹⁰⁷ Trend changes are, however, recorded rather quickly due to the annual updating of the indicator sets.

Appendix 4: Indicator set for Global Innovation Monitor

	Indicator Name	Available Time Series
		Austria
Economy, society and environment	Per capita GDP to PPS	2000–2016
	Employment rate	2000–2017
	Unemployment rate	2000–2017
	Life expectancy at birth	2000–2016
	Efficiency increase: resource productivity	2000–2016
	Efficiency increase: energy intensity	2000–2017
Education	Teacher-child ratio early childhood	2002–2016
	University expenditure per student	2000–2015
	PISA average points – reading	2000–2015
	PISA average points – maths	2003–2015
	PISA average points – science	2006–2015
	PISA education inheritance	2000–2015
	University graduates (25–34 years old)	2000–2017
	STEM graduates	2000–2016
	STEM graduates – women	2000–2016
University research	University ranking, research performance	2009–2015
	University expenditure for R&D/population	2002–2017
	Basic research rate	2002–2016
Corporate research	R&D rate	2000–2017
	Private sector research funding share	2000–2017
	Number of researchers per 1,000 employed people	2002–2017
	Number of researchers per 1,000 employed people	2000–2017
	Start-up regulation	2006–2017

Available Time Series							
	China	Israel	South Korea	Canada	USA	Switzerland	Source
	2000–2016	2000–2016	2000–2016	2000–2016	2000–2016	2000–2016	OECD
	2000–2017	2000–2017	2000–2017	2000–2017	2000–2017	2005–2017	OECD, World Bank (data for China)
	2000–2017	2000–2017	2000–2017	2000–2017	2000–2017	2000–2017	World Bank
	2000–2014	2000–2016	2000–2016	2000–2014	2000–2016	2000–2016	OECD
	2000–2016	2000–2016	2000–2016	2000–2016	2000–2016	2000–2016	IEA, Energy Balances
	2000–2015	2000–2017	2000–2017	2000–2017	2000–2017	2000–2017	IEA, Energy Balances
	2002–2016	2004–2011	2002–2016		2002–2016	2004–2013	OECD Education at a Glance
		2000–2015	2000–2015	2007–2013	2000–2010	2000–2013	OECD Education at a Glance
	2000–2015	2000–2015	2000–2015	2000–2015	2000–2015	2000–2015	OECD PISA
	2003–2015	2006–2015	2003–2015	2003–2015	2003–2015	2003–2015	OECD PISA
	2006–2015	2006–2015	2006–2015	2006–2015	2006–2015	2006–2015	OECD PISA
	2000–2015	2006–2015	2000–2015	2000–2015	2000–2015	2000–2015	OECD PISA
	2010–2017	2003–2017	2000–2017	2000–2017	2000–2017	2000–2017	OECD Education at a Glance
	2003–2005		2000–2016	2013–2016	2000–2016	2000–2016	UNESCO
	2003–2005		2000–2016	2013–2016	2000–2016	2000–2016	UNESCO
	2009–2015	2009–2015	2009–2015	2009–2015	2009–2015	2009–2015	CWTS Leiden Ranking, WIFO calculation
	2000–2017	2000–2017	2000–2017	2000–2017	2000–2017	2000–2014	OECD MSTI, World Bank
	2000–2016	2000–2016	2000–2016		2000–2016	2000–2016	OECD MSTI
	2000–2017	2000–2017	2000–2017	2000–2017	2000–2017	2000–2012	OECD MSTI
	2000–2017	2000–2015	2000–2017	2000–2017	2000–2017	2000–2012	OECD MSTI, WIFO calculation
	2000–2017		2000–2017	2000–2015	2000–2015	2000–2014	OECD MSTI
	2000–2017	2000–2017	2000–2017	2000–2017	2000–2017	2000–2017	PATSTAT, World Bank
	2006–2017	2006–2017	2006–2017	2006–2017	2006–2017	2006–2017	World Bank

Appendix 5: Methodology and Notes for Interpreting the Figures and Indicators from the Global Innovation Monitor

The graphics of the Global Innovation Monitor provide an overview of the development trends of the selected countries with regard to their performance in the areas of education, university research, business research, economy, society and environment. Austria (AT) represents the reference point here. Austria's goal distance (x-axis) and the

development dynamic (y-axis) are calculated standardised for Austria (=100). Those countries that are currently rated better than Austria appear axis right of 100 in this illustration. With a y-axis value >100 the countries shown have a higher development dynamic than Austria; by doing so, they either reduce their gap to Austria or cannot be caught up with.

Appendix 6: RTI Strategy Objectives

- To advance to the group of leading innovation nations in the EU by 2020
- To boost the Austrian economy's competitiveness
- To increase social prosperity
- To meet the major social and economic challenges of the future

RTI Strategy Objectives – Education System (without Tertiary Area)

- We want to promote the talents of people at all levels of education, awaken their passion for research and enable them to achieve the best-possible qualifications for economic activity and scientific research. Universities, research institutes and businesses will therefore be guaranteed a sufficient offering of highly qualified researchers.
- The education system must also be optimized in its entirety, beginning in the early childhood phase through to models for lifelong learning.
- The reforms focus here on the mitigation of social selectivity, improved permeability between educational programmes and paths, continuous quality improvements in the class (...), as well as improved integration of immigrants (...).
- The rate of early school leavers will be reduced by 2020 to 9.5 percent.
- The secondary school graduates quota will be raised to 55 percent of one age group by 2020.
- The percentage of students with a first language that is not German, who complete secondary school, will increase from 40 percent at the moment to 60 percent

RTI Strategy Objectives – Tertiary Education System

- Study conditions at universities will improve significantly, whereby new financing models for university teaching will also be established.
- The reforms focus on (...) a continuous quality improvement in university teaching and improved integration of immigrants (...).
- The percentage of 30 to 34 year-olds that have completed university studies or have a similar qualification will be increased to 38 percent by 2020.

RTI Strategy Objectives – Research at Universities and Non-University Research Institutes

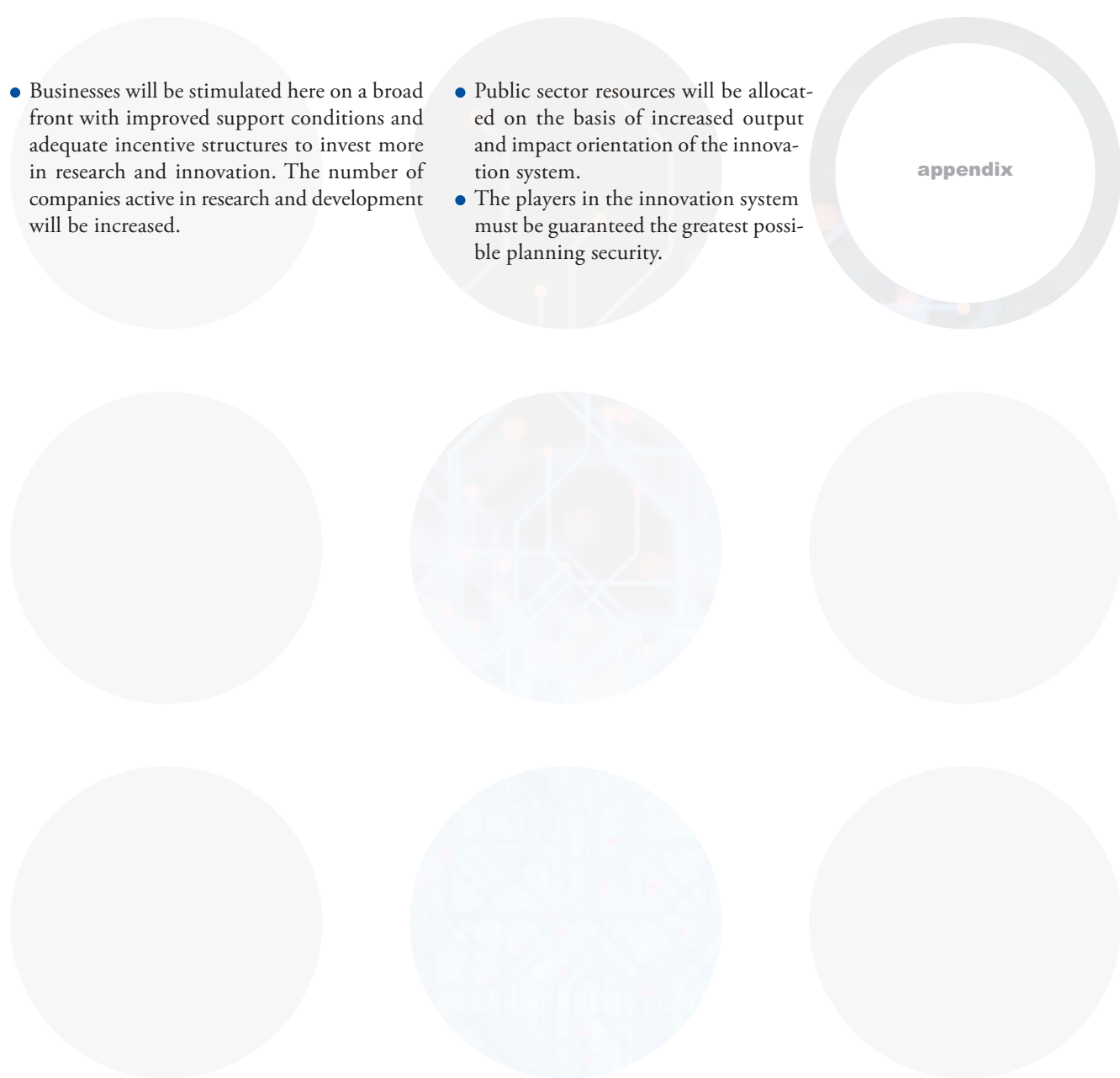
- We want to increase investments in basic research by 2020 to the level of the leading research nations.
- We want to boost basic research with further structural reforms in the university system.
- The university financing model will also be reformed. Research financing will be more competitive and project-based.
- University research financing must be boosted via third-party resources of the Austrian Science Fund (FWF) acquired competitively and organized with appropriate cost coverage.
- The universities' profiling will be supported by setting up excellence clusters.
- The orientation of teaching and research topics at universities and the cooperation with non-university research institutes will be better coordinated as part of an overall strategy.
- Development of clearer role models in line with defined performance goals for the various institutions in the non-university research sector.
- The internal structures of the research institutes will be boosted by reforms and adjusted to new requirements.
- The overall structure of the non-university research sector will be optimized for better coordination.
- We want to expand the research infrastructures in Austria as the basis for excellent research and for Austrian research's international positioning in a coordinated fashion.
- The profiling of universities and non-university research institutes as the carriers of the research infrastructures will guarantee optimum coverage of strengths and synergy effects in usage.

RTI Strategy Objectives – Research and Innovation in the Corporate Sector

- We want to increase domestic value creation by pushing forward research-intensive industry and knowledge-intensive services and implementing more demand-side mechanisms in procurement, regulation or standardisation to stimulate innovations.
- The product and services structure must be improved by increasing knowledge and innovation intensity in business.
- The number of companies active in systematic research and development will be increased from the estimated level of about 2,700 between 2010 and 2013 by about 10 percent in total and by 2020 by about 25 percent in total.
- The internationally successful leading Austrian companies will be strengthened in their leading role for the innovation system and SMEs will become more active in increasing their research and innovation performance.
- The attractiveness of location Austria as the base for research and technology-intensive companies must be improved further.
- The innovation level in companies must be sustainably raised by increasing the number of radical innovations that are new for the market.
- We want to increase the cooperation intensity of Austrian companies and strengthen the strategically oriented cooperation between science and industry – with special focus on excellence and sustainability.
- This must include the removal of barriers and start-up fears, especially for SMEs, for collaborations with science and research, and easier access for innovative businesses to external resources.
- More companies should therefore expand their technological leadership and target top innovation positions.
- We want to significantly increase equity and venture capital intensity at start-ups of technology-based and innovative companies.
- The number of knowledge and research-intensive start-ups will be increased by an average of three percent a year by 2020.
- We want to significantly increase the equity and venture capital intensity in setting up technology-based and innovative companies.
- The number of knowledge and research-intensive start-ups will be increased by an average of three percent a year by 2020.

RTI Strategy Objectives – Governance and Financing of the RTI System

- We want to clearly coordinate the competencies of the responsible ministries with one another. Efficient coordination mechanisms among the responsible departments will be set up for this.
- The allocation of assignments among departments and funding agencies will be optimized with increased operational independence for agencies with a parallel increase in strategic control by the departments.
- Duplicate assignment allocation must also be prevented at funding agency level.
- System effectiveness and system intelligence must be increased with higher goal and output control.
- We want to boost Austria's competitiveness in generic cross-disciplinary areas in science and technology by focusing on activities in internationally competitive movers and shakers. We would refer here to the key strengths of domestic science and industry. The competencies and potential of Austrian companies that can contribute to overcoming the "grand challenges" in the implementation of research results must in particular be considered here.
- Priorities must be set in research and technology development based on systematic selection and decision processes. Sufficient justification of state prioritisation must be ensured here to prevent market and system failure.
- A new priority definition for specific challenges will result here in a more concentrated coordination of the activities in a system-wide deployment of all relevant departments within the scope of the Research, Technology and Innovation Task Force.
- System-wide priorities to address major social challenges of the future (the "grand challenges") must in particular be established.
- Priorities must be defined on the basis of preliminary analyses, should have a time-limited effect and be subject to parallel reviews.
- We want to develop a coordinated foreign science and research policy by bundling existing measures to support internationalization. The appropriate institutional structures will also be set up for this.
- Austria will position itself optimally in the "European Knowledge Area" with active participation in the formulation of an all-European research, technology and innovation policy.
- Stronger Austrian participation in European funding programs will also be targeted, such as the research support programs or the European structural funds, for example, with the goal of a continuously increasing return quota.
- Selective global cooperation will also be set up and expanded with innovation frontrunners such as the USA, selected Asian countries and the competitive BRIC countries.
- The cooperation with countries in Central, Eastern and South-East Europe will also be further intensified.
- We want to establish a policy approach in the funding system that will deploy the most efficient bundle of measures in a coordinated fashion in the respective context.
- Direct research funding will be further developed here oriented on the use of an adequate range of mechanisms.
- The legal bases for research funding will be standardized.
- The principle of allocation through competition will be enhanced.
- We want to promote a culture of appreciation of research, technology and innovation and the understanding that these make a considerable contribution to increasing quality of life and social prosperity.
- A stable and infrastructural environment for diverse forms of the dialogue on science and society will also be established here in the interests of a "scientific citizenship".
- Responsibility and integrity in science matters must also be boosted with institutionalised processes.
- We want to increase the funding quota by 2020 by one percentage point from the current 2.76 to 3.76 percent of GDP.
- At least 66 percent, but if possible 70 percent must be contributed here with investments from the private sector.



- Businesses will be stimulated here on a broad front with improved support conditions and adequate incentive structures to invest more in research and innovation. The number of companies active in research and development will be increased.

- Public sector resources will be allocated on the basis of increased output and impact orientation of the innovation system.
- The players in the innovation system must be guaranteed the greatest possible planning security.

appendix

Appendix 7: Overview of Indicators Used In The Efficiency Analysis

Area Name	Long Description
Science – Input	Researchers in FTE in university and state sector per 1,000 of the population
Science – Input	R&D expenditures in state sector and universities in US dollars and PPPs
Science – Output	Aggregation of the Leiden University Ranking relative to population
Science – Output	Number of citable publications per 1,000 of population
Science – Output	Number of publications among the most cited 10% worldwide
Technology – Input	R&D expenditures in corporate sector in USD and PPPs in % of GDP
Technology – Input	Researchers in FTE in corporate sector per 1,000 of population
Technology – Output	Patent applications at EPO acc. to inventor's place of residence per 1,000 of population
Technology – Output	Patent applications at EPO, JPO and USPTO acc. to inventor's place of residence per 1,000 of population
Innovation – Input	R&D expenditures in all sectors in USD and PPPs
Innovation – Input	Researchers in FTE in all sectors per 1,000 of population
Innovation – Input	Share of 25 to 34-year-old university graduates in % of the 25-34 age cohort of the population
Innovation – Output	Share of innovative SMEs in the SME population in CIS
Innovation – Output	Share of innovation-intensive sectors in value creation in %
Innovation – Output	Employment in rapidly growing companies in innovation-intensive sectors
Innovation – Output	Share of exports in high-price segment in all exports
Innovation – Output	Complexity score of exporting products
Innovation – Output	Share of exports with medium-high to high technology intensity in overall export

Short Description	Period	Countries Sample	Source
Number of researchers (HEI & GOV) per population	2002–2016	EU-28, CH, JP, KR, US	OECD, Eurostat, WIFO calculations
R&D expenditures (HERD & GOVERD) per population	2002–2016	EU-28, CH, JP, KR, US	OECD, Eurostat, WIFO calculations
University ranking per population	2009–2016	AT, BE, CH, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IT, JP, KR, LT, NL, PL, PT, RO, SE, SI, SK, US	CWTS Leiden
Number of publications per population	2005–2017	EU-28, CH, JP, KR, US	Scimago, World Bank, WIFO calculations
Quality of publications	2008–2015	EU-28, CH, JP, KR, US	European Innovation Scoreboard
R&D expenditures (BERD) in % of GDP	2009–2016	EU-28, CH, JP, KR, US	OECD, Eurostat, WIFO calculations
Number of corporate researchers per population	2002–2016	EU-28, CH, JP, KR, US	OECD, Eurostat, WIFO calculations
Patent applications (EPO) per population	2000–2015	EU-28, CH, JP, KR, US	PATSTAT, autumn 2018, World Bank, WIFO calculations
Triadic patent applications per population	2000–2015	EU-27 (ohne GR), CH, JP, KR, US	PATSTAT, autumn 2018, World Bank, WIFO calculations
R&D expenditures (GERD) per population	2000–2016	EU-28, CH, JP, KR, US	OECD, Eurostat, WIFO calculations
Number of researchers per population	2002–2016	EU-28, CH, JP, KR, US	OECD, Eurostat, WIFO calculations
Tertiary graduation (25-34 year olds)	2004–2017	EU-28, CH, JP, KR, US	OECD
SME with innovations	2008–2015	EU-28, CH, JP, KR, US	European Innovation Scoreboard
Innovation-intensive sectors	2008–2016	EU-28, CH, JP, KR, US	OECD, Eurostat, WIFO calculations
Employment in rapidly growing start-ups	2008–2015	EU-27 (ohne GR), CH	European Innovation Scoreboard
Export quality	2000–2017	EU-27 (ohne LU), CH, JP, KR, US	BACI, WIFO calculations
Export complexity	2000–2017	EU-27 (ohne LU), CH, JP, KR, US	BACI, WIFO calculations
Knowledge intensity, export	2005–2017	EU-28, CH, JP, KR, US	Comtrade, WIFO calculations (analogous to EIS European Innovation Scoreboard)

printing
information

Publisher and Media Owner | © austrian council

Council for Research and Technology Development | 1010 Vienna | Pestalozzigasse 4

Vienna | April 2019

Members of the Council

Dr. Hannes ANDROSCH | Chairman

Univ.-Prof. Dr. Markus HENGSTSCHLÄGER | Deputy Chairman

Univ.-Prof. Dr. Jakob EDLER

Dr. Hermann HAUSER

DI Dr. Sabine HERLITSCHKA, MBA

em. Univ.-Prof. Prof. Dr. Helga NOWOTNY

Univ.-Prof. Dr. Sylvia SCHWAAG-SERGER

Dr. Klara SEKANINA

Secretariat

DI Dr. Ludovit GARZIK, MBA | Managing Director of the Secretariat

Mag. Dr. Johannes GADNER | Deputy Managing Director of the Secretariat

Dr. Constanze STOCKHAMMER | Deputy Managing Director of the Secretariat

Dr. Anton GRASCHOPF

Mag. Bettina POLLER

Priv.-Doz. Dr. Gerhard REITSCHULER

DI Walter SCHNEIDER

Project Manager and Editor | Mag. Dr. Johannes GADNER

Translation | Dr. Billaudelle & Partner | www.billaudelle-partner.com

Design and Production | Grafikatelier Heuberger | Vienna

Photo Credits | istockphoto.com | monsitj

Printed by | [gugler cross media](http://guglercrossmedia.com) | Melk

greenprint*
klimapositiv gedruckt



Gedruckt nach der Richtlinie „Druckerzeugnisse“ des Österreichischen
Umweltzeichens. [gugler cross media](http://guglercrossmedia.com), Melk; UWZ 609; www.gugler.at





www.rat-fte.at

