



Report on Austria's Scientific  
and Technological Capability  
**2017**



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preamble

The Austrian Council for Research and Technology Development has supervised the implementation of the Austrian Government's Research, Technology and Innovation Strategy since it was adopted in 2011. In accordance with the assignment commissioned to it by the Cabinet to implement strategic monitoring of the implementation activities and to illustrate Austria's performance compared with the leading innovation nations, the Council has presented its Report on Austria's Scientific and Technological Capability to the Austrian National Council every year since 2012. The Austrian Council is concerned here with both pointing out positive developments and addressing difficulties with equal clarity.

The positive signals provided in recent months by the Government give cause for cautious optimism. In January 2017, the Austrian Government presented a Work Programme for 2017 and 2018, which provides a series of important and appropriate pointers. The goal of these pointers is to make Austria one of the global frontrunners in future-oriented industries. The Cabinet had adopted an ambitious "Research Package" in November 2016 to achieve the goal defined by the Research, Technology and Innovation Strategy

(RTI Strategy) to become one of Europe's most innovative countries by 2020.

The strategic objective of pushing forward into the leading innovation nations therefore also continues to be a significant determinant of the political will. In addition to structural reform proposals, the Work Programme and Research Package also include specific budgetary measures. If they are consistently implemented, the Austrian Council believes they will contribute to putting Austria back in the fast lane.

It still remains to be seen whether the Government will actually implement the announced plans and can therefore boost the innovation policy agenda with new energy. The Austrian Council believes the order of the day is to give new impetus to the innovation dynamic, which appears to have stalled. If focused education, scientific, research, technology and innovation policy efforts are not implemented, achievement of the goals of the RTI Strategy by 2020 will be doomed to failure.

The pioneering spirit at the beginning of 2017 should in any case be utilized to once again give new momentum to the implementation intensity of the measures of the RTI Strategy. In every eventuality, the Austrian Council declares itself ready to continue accompanying the Austrian Government in its endeavours.



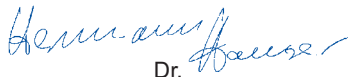
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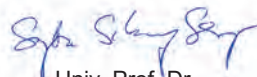
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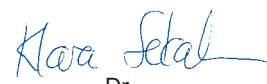
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**executive  
summary**

The 2017 Report on Austria's Scientific and Technological Capability focuses on the priority objectives of the Austrian Government's Research, Technology and Innovation Strategy (RTI Strategy). In this context an impact analysis of the innovation efforts will be performed to examine the effects of RTI activities on economic, social and ecological develop-

ments. The Report therefore differs from last year's, which predominantly focused in the Council's Mid-Term-Review 2015 on the five areas of action identified as especially relevant – education, basic research, start-ups, governance and financing. The developments in these areas and the other chapters of the RTI Strategy are only briefly illustrated in this Report and as an overview.

## RTI Strategy Priority Objectives

In addition to approximately 70 detailed goals, the Austrian Government's Research, Technology and Innovation Strategy also pursues the following priority 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

The priority objectives therefore address areas which generally represent the overriding goal of political measures and which are especially important for a country's citizens. These in particular include economic capability, performance in the areas of quality of life, health, life expectancy and environmental aspects. Innovation performance is also addressed here on the whole as an RTI Strategy priority goal. The

Austrian Council uses 10 indicators in the following four categories to evaluate Austrian performance in the area of the priority objectives:<sup>1</sup>

1. **Economic performance** – Measured on the basis of the indicators, GDP per capita, unemployment rate and employment rate.
2. **Performance in the social ambit** – Measured on the basis of the indicators, Better Life Index, life expectancy in good health for men and women.
3. **Ecological performance** – Measured on the basis of the indicators, greenhouse emissions, energy intensity and resource productivity.
4. **Innovation performance and efficiency** – Measured using the European Innovation Scoreboard (EIS) and alternative calculation methods for the effect of innovation efforts and for the ratio of input to output.

## Key Results

When interpreting the results, it should be noted that Austria's performance in the area of priority objectives is not exclusively influenced by RTI activities, but rather by the result of many other factors as well. These include, for example, specific regulations in the context of 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. In summary, the development of Austrian performance in the area of the priority objectives of the RTI Strategy cannot be evaluated as very positive. Two thirds of the 10 indicators used for this area are currently significantly below the level of the leading nations of Denmark, Ger-

many, Finland, the Netherlands and Sweden. On the basis of the development dynamic, it cannot be assumed that this situation will change substantially by 2020. Performance compared with the leading nations also diminished with 60 percent of the indicators since 2010.

With above-average high GDP per capita, continuously falling energy intensity and a comparably low unemployment rate, only three of the indicators show performance above the level of the leading nations. The other indicators also show a declining development dynamic, with the exception of the greenhouse gas emissions indicator. This means that Austria's distance to the innovation leaders has increased in most ar-

<sup>1</sup> These and all indicators listed in Appendix 1 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.

eas, contrary to the intentions of the RTI-strategy.<sup>2</sup> The key results of the analysis of Austria's performance in the four categories of the priority objectives are outlined briefly in the following.

### **Economic performance above-average**

Compared with the innovation leaders, Denmark, Germany, Finland, Sweden and the Netherlands as a recent addition, Austria's economic performance is very high. Per capita gross domestic product in Austria has increased slightly since 2010 and is reflected in social prosperity that is clearly ahead of the leading innovation nations. Both with regard to growth in real GDP and with respect to the development of GDP per capita, Austria is constantly among the best performers worldwide. With regard to the unemployment rate as well, Austria is traditionally among the industrial nations that show a relatively low unemployment rate. Despite the fact that unemployment recently rose sharply and that it is unusually high in Austrian terms, compared with the leading innovation nations it remains relatively low. Only the proportion of those in work relative to the total population has actually stagnated since 2010, but the employment rate of women has risen significantly.

### **Downward trends in the social ambit**

The indicators used to map social developments in the areas of quality of life, health and life expectancy show a sharply downward trend relative to the innovation leaders' average. Seen in absolute terms, life expectancy in Austria does actually rank among the highest in the world. Compared with the innovation leaders, however, the proportion of life expectancy in good health versus total life expectancy has for some years now only been in the average area. Austria is also significantly behind the leading nations with regard to quality of life. The Scandinavian

countries in particular score above average well by international comparison. Their figures in almost all subject areas are even far above the average in some cases. Austria, by contrast, is continuously in the midfield in the OECD comparison. In relation to Austria, Sweden, Denmark, Finland and the Netherlands show distinctly higher scores in the categories of education, health, life satisfaction and work-life balance in particular. The RTI Strategy places much emphasis on the education area in particular, where consistent implementation would also have positive effects on social developments. The strategic objective of increasing innovation success would also have a positive effect on, for example, economic competitiveness, employment and unemployment, which are all important determinants of quality of life.

### **Performance in parts of the environmental area significantly below average**

In the area of the environmental indicators, Austria's position in relation to the innovation leaders has scarcely changed since 2010. In the area of energy intensity, Austria is actually ahead of the leading nations, but with resource productivity and greenhouse gas emissions it is quite far behind. On the whole, the modest performance in the area of climate and environmental protection compared with the leading innovation nations results in Austria scoring rather badly in various international rankings. In the 2017 Climate Protection Index, for example, which was presented in November 2016 at the UN Conference on Climate Change in Marrakesh, Austria is ranked second last among the EU member states. And in the Living Planet Report 2016 by the WWF, which measures the use of resources of all countries and their ecological footprint, ranked at number 14, Austria is not only way ahead in the global ranking list of the countries with the highest resource consumption, it also ranks among the inglorious lead group across Europe. In addition to

<sup>2</sup> These findings also apply for the European Innovation Scoreboard (EIS), in which Austria's distance to the average of the group of innovation leaders has increased by 0.02 points, despite the most recent improvement by one place.

clearly insufficient area-specific regulations in Austria, the relatively low proportion of energy and environment-relevant R&D budgets of the entire public sector R&D budget in this respect must be evaluated unfavourably.

**Innovation performance to achieve the “Innovation Leader” goal is insufficient**

Austria’s innovation performance has not improved on the whole since 2010 in relation to the innovation leaders. It has clearly not been able to successfully utilise the comparably favourable starting position in 2010, which was indicated by the RTI Strategy. The main problem here is clearly the lost development dynamic, which results in Austria not being in a position to sufficiently gain lost ground. The effects of the innovation activities shown later on with the help of the impact analysis can, on the other hand, be evaluated to show that Austria is actually in a better position than that measured in the European Innovation Scoreboard (EIS), but it continues to have a significant performance deficit compared with the leading innovation nations. This has indeed been reduced in places since 2010, but the development dynamic does not allow us to conclude that Austria’s performance is sufficient enough to close the distance to the leading nations. From today’s point of view, the goal of the RTI Strategy to advance to the group of innovation leaders by 2020 is therefore not achievable.

**Conclusion**

On the whole, it is evident that Austria’s efforts to join the leading innovation nations and consequently ensure prosperity, quality of life and environmental protection have certainly triggered a positive dynamic in some areas. In others, however, a very clear decline could also be seen. Austria has therefore not yet achieved the goal defined by the Austrian Government

of advancing to the group of innovation leaders. Education, science, research and innovation therefore merit even greater attention than ever. In accordance with the corresponding recommendations of the Austrian Council and the recent announcements of the Austrian Government in its 2017/2018 Work Programme and the “Research Package”, these future areas should indeed become political priorities. Whether or not the initiatives can generate sufficient momentum to boost the innovation dynamic with new stimuli and indeed to come closer to the goal of Austrian innovation leadership in Europe by 2020 cannot be conclusively assessed from today’s point of view. The Austrian Council sees the signals being received as thoroughly positive, the actual implementation and secured financing in particular, however, have yet to take place.

To successfully navigate the course foreseen by the RTI Strategy to innovation leader by 2020, the Austrian Council in any case believes that the priority areas of action in the education system, in basic research, with start-ups and with the (private) financing of R&D defined in the Mid-Term Review and analysed in detail in the 2016 Performance Report must continue to be addressed.<sup>3</sup>

The Council believes that a long-term improvement in Austria’s performance with regard to the priority objectives of the RTI Strategy will therefore succeed, because the quality and speed of Austria’s progress in areas such as economy, health, quality of life and environment also depend very much on how capable universities, research institutes and businesses show themselves to be in the area of research activities.

The Austrian Council believes multiple positive effects can be generated by achieving the strategic goal of increasing innovation success. In addition to realizing the claim of being an innovation leader, beneficial effects on economic

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3 Austrian Council for Research and Technology Development (2015): Report on Austria’s Scientific and Technological Capability 2015, pp. 80 ff.; Austrian Council for Research and Technology Development (2016): Report on Austria’s Scientific and Technological Capability 2016.

competitiveness, employment and unemployment can also be expected. These are important determinants for quality of life – just as a high level of education. The implementation of the RTI Strategy's measures for the education system is therefore not just essential for the required increase in innovation success, but rather also equally decisive in strengthening Austria's positions in the social ambit. Research and innovation as well as their diffusion in the health sector can also make a crucial contribution to further improving Austria's performance with regard to life expectancy in good health or quality of life. Increased investments in energy and environmental research can ultimately con-

tribute to optimizing Austria's performance in the environmental sector as a whole, whereby positive effects would in turn be connected with health and quality of life.

In any case the analysis shows that the RTI activities related to the priority objectives of the RTI Strategy in Austria can be extended still further. The Austrian Council therefore not only considers the following recommendations to be a substantive conclusion of its report, but rather also and especially a contribution to achieving the priority objectives of the RTI Strategy and the realisation of the Federal Government's goal of making Austria an innovation leader and a "global frontrunner in the industries of the future".<sup>4</sup>

## The Austrian Council's Recommendations on Priority Areas of Action

### Modernisation of education system structures

In view of the educational screening that continues to exist in Austria, following on from the education reform package, further measures for early childhood development and a significant increase in the number of qualified and in particular multilingual educators are required in the early childhood area. The measures adopted in the Federal Government's Work Programme for the further development of kindergartens from care facilities into education facilities are therefore expressly welcome.

Better financial and staffing provisions (keyword: support staff) are also urgently required for those schools that are confronted with special challenges, especially with regard to the socioeconomic structure of the students. The Austrian Council also recommends further steps to modernise the structures of the education system,

in particular the revision of competencies between federal and regional authorities.

To tackle early social selection in the education system, the Austrian Council recommends a commitment to comprehensive, wholeday schools in the area of secondary level I with parallel performance differentiation and talent development and the corresponding implementation with suitable measures.

The Austrian Council also recommends the swift implementation of the study place financing announced in the Federal Government's Work Programme, on the basis of capacity-oriented study place management and sufficient budgetary resources. An appropriate adjustment of the universities' autonomy to the existing framework conditions with regard to capacity-oriented study access and to improve study conditions should be defined in the respective legislation.

<sup>4</sup> The Federal Government's RTI Strategy: The Path to Becoming an Innovation Leader. Vienna 2011, pp. 4 ff.; for Austria: Work Programme of the Austrian Federal Government 2017/2018. Vienna 2017, p. 1.

### **Increasing competitively allocated financing for basic research**

In order to broaden the spearhead of superb research in Austria and to improve the research conditions of Austria as a science location, in addition to the increase in the competitively awarded funds for basic research defined in the Federal Government's "Research Package", the Austrian Council also urgently and emphatically recommends this be targeted at the level of the leading nations. In this context, the continuance of the excellence initiative in basic research (special research areas – SRAs, among others) should also be guaranteed with the provision of sufficient budgetary resources.

### **Further optimisation of the legal and financial framework conditions for business start-ups**

The Austrian Council recommends the funding package for start-ups be better coordinated and access for entrepreneurs be made easier. Furthermore, a central and highly visible contact point for innovative entrepreneurs for each region should also be set up (with the appropriate adjustment of the existing AplusB centres or adjustment of the services of the Economic Chamber's start-up service). The bureaucratic and regulatory framework conditions for funding start-ups must also be continuously improved.

The Austrian Council supports measures to further reduce debt relief after insolvency and liquidation times for honest entrepreneurs, so that failed start-ups get a second chance quicker than they used to.<sup>5</sup> For this reason, the current move

towards the amendment of personal bankruptcy (as laid down in the "Insolvenzordnung") in the Federal Government's Work Programme is also very welcome. The Austrian Council recommends a tax relief and support with social security funds in wage moderation. For this reason, it welcomes the current proposal in the Federal Government's Work Programme.<sup>6</sup> This is, however, limited to three years and intended for all businesses. To also contribute structural effects, these measures should be arranged for the start-up area as a permanent facilitation.

In addition to funding by banks, the Austrian Council also recommends developing funding options for innovative entrepreneurs and SMEs. A rethinking of mechanisms such as tax breaks for investments in young companies, accompanied by corresponding legal framework conditions is required to increase equity capital intensity from the private side.

For implementation, we would refer to the Austrian Council's individual recommendations in this respect.<sup>7</sup>

### **Implementation of measures to achieve research quota targets and to increase the private sector share of R&D funding**

The Austrian Council urgently recommends the immediate implementation of the measures for achieving both quota targets (2 per cent for the tertiary area and an R&D quota of 3.76 per cent by 2020), as defined in the Federal Government's Work Programme and in the "Research Package". For **implementation** we would

5 For this, see European Commission (2014): Trade and Industry, SBA data sheet 2014, AUSTRIA.

6 For Austria: Work Programme of the Austrian Federal Government 2017/2018. Vienna 2017, pp. 3 f.

7 Recommendation of the Austrian Council for Research and Technology Development on the amendment to the Alternative Investment Fund Manager Act (AIFMG) of 6 March 2014; Recommendation of the Austrian Council for Research and Technology Development to optimize RTI-related start-ups of 19 November 2012; Recommendations of the Austrian Council for Research and Technology Development for the efficient implementation of research results in innovations, to create suitable framework conditions for private equity, and to introduce a tax exempt participation amount (all of 24 November 2011).



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refer to the **Austrian Council's individual recommendations** in this respect.<sup>8</sup> For the performance agreement period 2019–2021 the **basic funding for universities** to improve teaching and research conditions must also be increased by at least **EUR 1.4 billion**.<sup>9</sup>

The Austrian Council recently recommended, as also intended with the Federal Government's "Research Package", concentration of the use of public sector resources and mecha-

nisms on increasing the leverage effect to raise the incentive effect on private R&D expenditure and for raising the private financing share. The Austrian Council also recommends allocating the Nationalstiftung ("National Foundation") more funds longterm in line with the original financial allocation. The National Foundation should also be amalgamated with the Österreich-Fonds ("Austria Fund") to utilise funding and administration-related synergies.

8 The Austrian Council for Research and Technology Development's recommendation on funding research and development in Austria of 30 May 2016; The Austrian Council for Research and Technology Development's recommendation on funding for education, research and innovation in Austria of 5 September 2016; The Austrian Council for Research and Technology Development's recommendation on budgetary priority setting in Austria of 19 December 2016.

9 The Austrian Council for Research and Technology Development's recommendation on funding universities and public sector research and development in Austria in the federal funding framework 2017 to 2020, chapter "Science and Research" of 5 February 2016.



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In January 2017, the Federal Government adopted a work programme for 2017 and 2018, with the objective of increasing prosperity, growth and employment, to guarantee a more competitive and sustainable Austria, positioned among the global frontrunners in future-oriented industries.<sup>10</sup> The objectives and measures of this Work Programme specify and supplement the measures package for research, technology and start-ups adopted on 8 November 2016 (“Research Package”), with the explicit intention of achieving the goal defined by the Research, Technology and Innovation Strategy (RTI Strategy) of joining the most innovative nations in Europe by 2020.<sup>11</sup>

With the “Research Package” the Federal Government intends to get a “research billion” up and running. Specific research funding (the Federal Government intends to invest a total of approximately EUR 700 million by 2021) will create a leverage effect, which will stimulate an additional approximately EUR 500 million in private R&D investment.

The Austrian Council for Research and Technology Development essentially welcomes both the Federal Government’s Work Programme and the “Research Package”. The Council believes the objectives presented herein are an expression of the Federal Government’s intention to afford greater importance to the topics of research, innovation and technology as future-related factors for Austria than it has previously done. This is highly significant in that the key result of the Council’s Mid-Term Review was

rather sobering with regard to the implementation of the RTI Strategy in 2015.<sup>12</sup> In summary, the overriding goal of the Federal Government to join the leading innovation nations by 2020 was assessed as not achievable. The reason for this estimation was the insufficient implementation intensity of recent years, the slowdown the innovation dynamic accompanied by it, of parallel increasing dynamic in other EU countries, and Austria’s resulting backslide in all international rankings.<sup>13</sup>

The Austrian Council now believes the political initiatives of the Federal Government to intensify RTI activities are correspondingly positive. In summary the Council considers the planned measures of the Federal Government to be beneficial and important. They will ensure the required specification of implementation steps to achieve the innovation leadership targeted by the RTI Strategy. It still remains to be seen, however, whether or not the budgetary coverage required for this will be provided. This being because, on closer examination the packages of measures have to date proven to be “dreams of the future”, as the majority of the announced resources will only be fixed with the next financial framework. Only 16.4 of the EUR 700 million from the research package are earmarked for 2017. And the Federal Government’s Work Programme intends to continue the current federal financial framework (BFRG) until September/October 2017. This means that the financial cover for the planned measures is still not secured, and depends on the specific implementation of the BFRG 2018–2021.

10 For Austria: Work Programme of the Austrian Federal Government 2017/2018. Vienna 2017.

11 Federal Ministry of Transport, Innovation and Technology / Federal Ministry of Science, Research and Economic Affairs: Presentation to the Cabinet on 8 November 2016 regarding a package of measures developed by Work Group 5: Research, Technology, Start-ups.

12 Austrian Council for Research and Technology Development (2015): Report on Austria’s Scientific and Technological Capability 2015; for this, see also the “RTI Strategy Mid-Term Report” of the Austrian Research and Technology Report 2016, p. 42–92.

13 For this, see Austrian Federal Economic Chamber (2016): Monitoring Report 2016 – Austria in International Rankings. Vienna, p. 14.

It will take some time to fully understand the effects of the adopted packages of measures and the intended intensification of the implementation activities of the RTI Strategy in the set of indicators also used by the Council for its performance reports. On one hand the financing of the measures must be defined within the scope of the BFRG 2018–2021; on the other hand the set measures must first reveal their measurable effect.<sup>14</sup>

The 2017 Report on Austria's Scientific and Technological Capability will therefore not concentrate on all areas of the RTI Strategy, as in recent years up until the major Mid-Term Review in 2015, but rather – as already done in Performance Report 2016 – focus on priorities. While previous performance reports up until the Mid-Term Review have focused on all measures areas of the RTI Strategy, last year's report was primarily dedicated to the five areas of action identified in the Mid-Term Review as especially relevant: (1) education, (2) basic research, (3) start-ups, (4) governance and (5) financing. With this sixth report, the Austrian Council now focuses on the priority objectives of the RTI Strategy, as well as an impact analysis of the innovation efforts. The developments in the other chapters of the RTI Strategy are only briefly illustrated and as an overview.

The main focus in the current report are therefore the top priority objectives of the RTI Strategy and an analysis of the effects of the RTI activities on economic, social and ecological developments. This is highly consistent with the Federal Government's approach not to consider research, technology and innovation as an end in itself, but rather as a vehicle to achieve higher priority objectives. The increase in science, research, technology and innovation and the further development of the potential they

promise are not defined in the RTI Strategy alone as an important basis “to meet the major social and economic challenges of the future”.<sup>15</sup> The Federal Government's Work Programme also argues in the same direction: The goal is – as a global frontrunner in future-oriented industries – to increase Austria's competitiveness, to boost growth and employment, to increase prosperity and to guarantee ecological sustainability.<sup>16</sup>

Ultimately, in both documents it is primarily about making Austria fit for the future, in order to secure competitiveness, growth, prosperity and sustainability. For Austria's scientific and technological capability in 2017 the report therefore analyses Austria's performance in these areas and compares them with the performance of the leading innovation nations in this respect. The following four categories are examined in detail here:

1. Economic capability
2. Performance in the social ambit
3. Ecological capability
4. Innovation performance and efficiency

It should be noted that with the European Innovation Scoreboard 2016, the composition of the group of innovation leaders has changed slightly for the first time since the RTI Strategy was adopted in March 2011. The Netherlands have now also joined the previous innovation leaders of Sweden, Denmark, Finland and Germany. Since 2014 the Austrian Council has already taken the Netherlands into account in its Global Innovation Monitor, which since 2015 is also part of the Performance Report. This results in some shifts, which however, do not have any significant effects on the overall result.

Once again this year the Global Innovation Monitor compares selected Austrian key per-

<sup>14</sup> The indicators generally demonstrate a time lag of one to three years vis-à-vis the current year, so that the effects of implemented measures can only be assessed quite a while after the event.

<sup>15</sup> The Federal Government's RTI Strategy: The Path to Becoming an Innovation Leader. Vienna 2011, p. 9.

<sup>16</sup> For Austria: Work Programme of the Austrian Federal Government 2017/2018. Vienna 2017, p. 1.



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formance indicators with those of the leading innovation nations outside the EU. This year, Canada replaces the Netherlands in the previous comparison countries, China, Israel, South Korea, Switzerland and the USA. A comparison of the innovation performance on global levels should help shed light on Austria's performance in the context of worldwide trends.

This report follows the same methodology as previous reports. Details are provided in the Appendix and on the Austrian Council's website under the menu item "Performance Reports"<sup>17</sup>. As well as information about the report and a range of download options, the site also offers an interactive depiction of the indicator sets, which makes it possible to retrieve detailed information about the status quo and developments in individual areas interactively.

<sup>17</sup> <http://www.rat-fte.at/documents.html>



Evaluation of Austria's Performance Relative to the Goals and Measures of the RTI Strategy



## Priority Objectives and Effects of the RTI Strategy

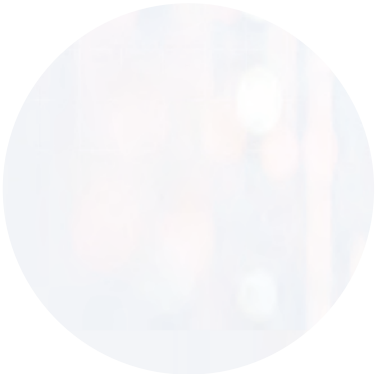
A research, technology and innovation policy strategy must be measurable on both the degree to which its detailed goals are achieved, and on the whole on the higher level effects that the RTI activities can have. The Austrian Government's Research, Technology and Innovation Strategy pursues two priority objectives and all detailed goals. In total, the paper contains more than 70 objectives. In previous reports on Austria's scientific and technological performance the main focus was on achieving these objectives. This report, by contrast, concentrates on achieving the two top priority objectives of the RTI Strategy:

- We want to continue developing the potentials of science, research, technology and innovation in Austria, to make our country one of the most innovative in the EU by

2020, strengthening the competitiveness of our economy and increasing the prosperity of our society.

- We want to continue developing the potentials of science, research, technology and innovation in Austria, using them in a holistic manner to deal with the major societal and economic challenges of the future.<sup>18</sup>

This chapter first analyses the impact of the RTI activities on a socio-economic level and attempts to answer the question as to how the innovation efforts contribute to achieving the priority objectives of the RTI Strategy. Austria's performance in science, technology, innovation and economy is then evaluated using a new method for determining frontiers, in order to enable an expansive insight into the various aspects of the effect of RTI activities.



18 The Federal Government's RTI Strategy: The Path to Becoming an Innovation Leader. Vienna 2011, p. 9.

## Priority Objectives: Innovation Effect on Economic, Social and Ecological Level

The priority objectives of the RTI Strategy therefore address areas which generally represent the overriding target of political measures and which are especially important for a country's citizens. These in particular include the economic capability, performance in the environment area and in the areas of quality of life, health and life expectancy. Innovation performance is also addressed here on the whole as an RTI Strategy priority goal. The Austrian Council uses 10 indicators in the following four categories to evaluate Austrian performance in the area of the priority objectives:<sup>19</sup>

1. *Economic performance* – Measured on the basis of the indicators, GDP per capita, unemployment rate and employment rate.
2. *Performance in the social ambit* – Measured on the basis of the indicators, Better Life Index, life expectancy in good health for men and women.
3. *Ecological performance* – Measured on the basis of the indicators, greenhouse gas emissions, energy intensity and resource productivity.
4. *Innovation performance and efficiency* – Measured using the European Innovation Scoreboard (EIS) and alternative calculation methods for the effect of innovation efforts and for the ratio of input to output.

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.

Figure 1 provides an overview of the developments in these areas from 2010 to today. On the whole the level of the innovation leaders could only be achieved or exceeded with three of the ten indicators: GDP per capita, energy intensity and unemployment rate. With the development trend remaining constant, nothing will change here by 2020 either. From today's point of view the development dynamic does not, however, appear to be sufficient in any other area to even come close to the leading nations. On the contrary, the trend is predominantly declining. Positive trends could only be seen in three areas – GDP per capita, resource productivity and greenhouse gas emissions. However, here too the dynamic is still significantly behind that of the innovation leaders.

Figure 1 illustrates how Austria's performance is above-average with economic objectives in particular. The achievement of goals by 2020 in the areas of innovation, environment, health and quality of life by contrast appears unrealistic, and therefore so too does the goal of becoming an innovation leader. On one hand this means Austria's economic success is not only innovation-based, but that it also depends on other factors, such as Austria's location in the dynamic centre of Europe, its high quality and reliability in production due to qualified specialist workers, and a well established tourism business, for example. On the other hand these findings mean that potential is evidently there to drive forward innovation efforts in the areas of energy, environment, health and quality of life, in addition to the general intensification of RTI activities, even if these are influenced by many other factors.

priority objectives

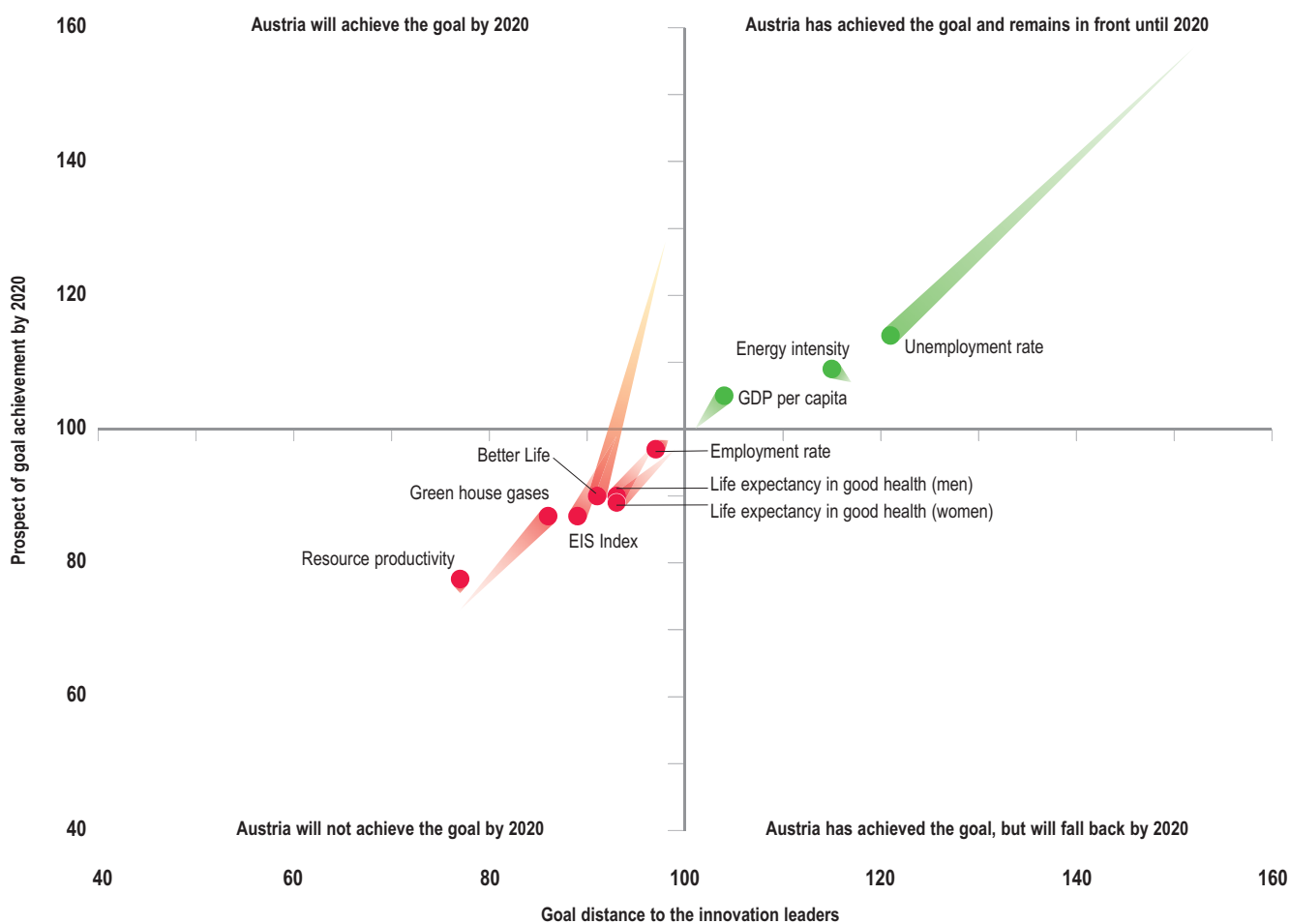
<sup>19</sup> These and all other indicators used in this Report were proposed by the WIFO, subjected in the cooperation with WG 8 (RTI rankings) of the RTI Task Force to a wide-ranging discussion with experts and coordinated with the ministries responsible for implementing the RTI Strategy.



The international comparison shows, however, that Austria's share of public sector R&D spending for social, ecological or healthrelevant research is below-average. According to the OECD the

share of the corresponding research spending in Austria in 2016 was only 7.5 percent. In the EU average it was 14.8 and in the OECD average it was even 23.4 percent.<sup>20</sup>

**Figure 1: Development of goal distance and prospect of goal achievement in the area of priority objectives of the RTI Strategy, 2010 to 2017**



Sources: See Appendix 1, WIFO presentation. 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 for the most recent available year for DE, DK, FI, NL, SE) 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.

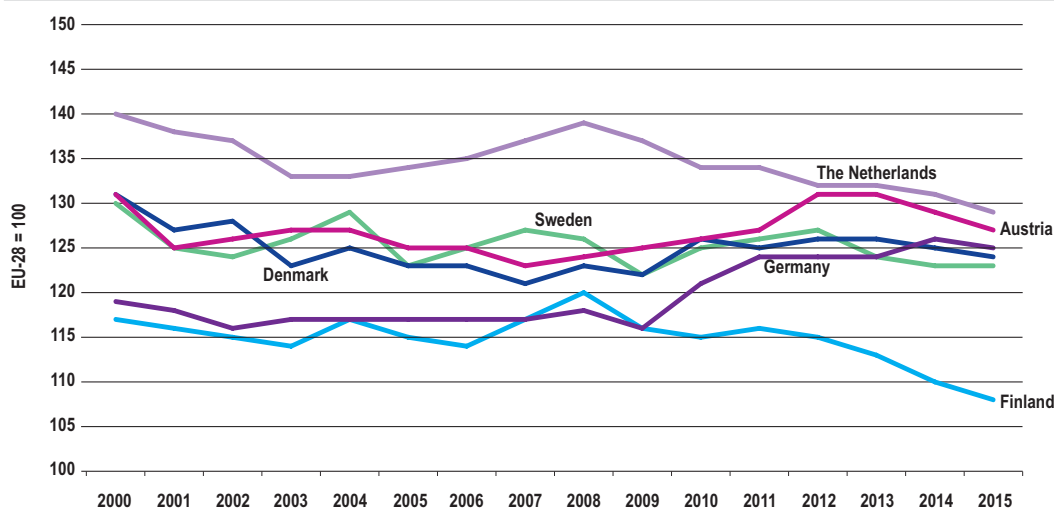
<sup>20</sup> OECD Government budget appropriations or outlays for RD: <https://stats.oecd.org/>

### Economic performance above-average

Compared with the innovation leaders, Denmark, Germany, Finland, Sweden and the Netherlands as a recent addition, Austria's economic performance is very high. GDP per capita in Austria has increased slightly since 2010 and is reflected in social prosperity that is clearly ahead of the leading innovation nations. Both with regard to growth in real GDP and with respect to the development of GDP per capita, Austria is stable below the best performers worldwide. As figure 2 shows, GDP per capita has been constant for some years, and in part is significantly above the level of the leading innovation nations. With EUR 36,000 (reference year 2015),

Austrian GDP per capita exceeds the EU average by 27 percent. Within the EU 28, Austria is in fourth place after Luxembourg, Ireland and the Netherlands, followed by Germany, Denmark and Sweden. With regard to growth in real GDP, Austria showed<sup>21</sup> a growth edge<sup>22</sup> relative to other economies with similar development status for some time (and even during the financial crisis), which, however, has been receding in recent years. A fall behind the Euro zone average was even registered for 2014–2015. Productivity development is one of the main determinants of GDP growth.<sup>23</sup> Innovation generally affects GDP via higher productivity, i.e.

Figure 2: Development of GDP per capita, 2000 to 2015



Source: Eurostat.

21 International Monetary Fund, Article IV Consultation Austria, Washington, p. 4.

22 The real GDP growth rate must always be considered in comparison with countries with a similar development status, as countries in the catching-up process always show higher growth rates (which decline with advancing level of development). This is known as the “convergence process”.

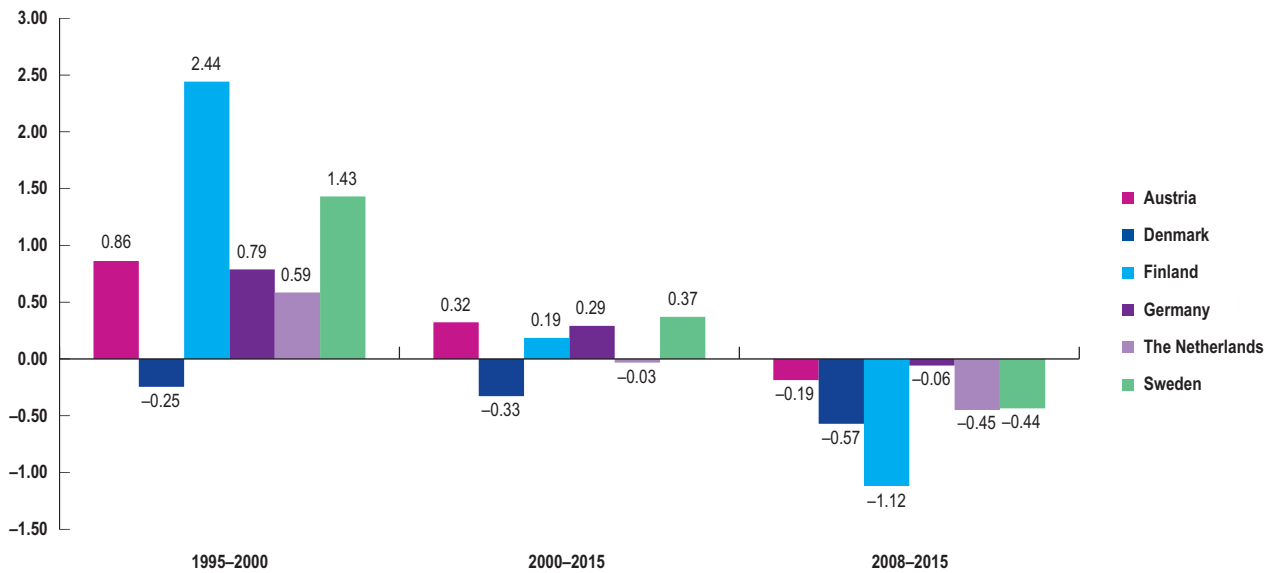
23 Gnan, E. / Janger, J. / Scharler, J. (2004): Determinants of Long-Term Growth in Austria: A Call for a National Growth Strategy. In: Monetary Policy & the Economy, No. 1 (2004): 23–46; Jorgenson, D. W. / Gollop, F. / Fraumeni, B. (1987): Productivity and U.S. Economic Growth. Harvard University Press, Cambridge, MA.

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the ability to achieve higher economic performance with given resources. Productivity can be measured in GDP per working hour or as a simple efficiency change (“total factor productivity”).<sup>24</sup> Figure 3 shows how Austria’s efficiency in the period between 2000 and 2015 grew more or less the same as Germany’s and Sweden’s. This is mainly attributable to better performance in the crisis years, because Austria’s efficiency growth after 2008 visibly fell less intensively than that of the comparison countries, with the exception of Germany. Figure 4 shows the growth of GDP per hour worked. While Finland is currently far behind, Sweden was able to overhaul Austria for good at the beginning of the 2000s. Denmark and in

particular Germany have been clearly ahead of Austria’s level for some time now. The Netherlands have been stable and ahead of the comparison countries for a good 20 years. On the whole, in recent years Austria’s productivity per working hour did not actually increase as sharply as in earlier decades, but nor was it any less than in comparable countries. Austria’s distance to the innovation leaders between 1995 and 2016 actually remained unchanged, and is relatively stable at a level of 92 to 93 percent of GDP per hour worked of the comparison countries. With regard to the unemployment rate, Austria is traditionally included among the industrial countries that show a relatively low unemployment rate. Even if unemployment has risen sharply recently and at 9.1 percent (Austrian

**Figure 3: Efficiency growth (total factor productivity), Austria compared with the innovation leaders, 1990–2013**



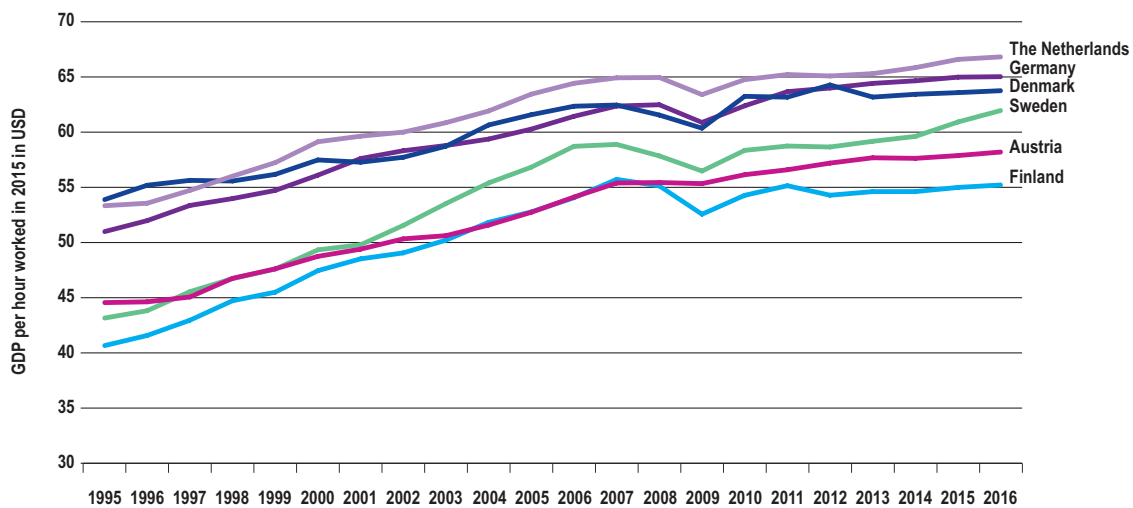
Source: Total Economy Databas™.

<sup>24</sup> GDP per hour worked can be compared in levels, but there are many other factors that influence GDP per hour worked besides innovation (e.g. capital intensity). In principle, efficiency change is very much determined by innovation, but its level cannot be compared, so that only the Austrian productivity growth performance can be compared with the innovation leaders.

definition according to Public Employment Service Austria) and 5.7 percent (definition according to Eurostat) in 2015 is unusually high for Austrian standards, it is still relatively low compared with the leading innovation nations. The changes in the observation period are not

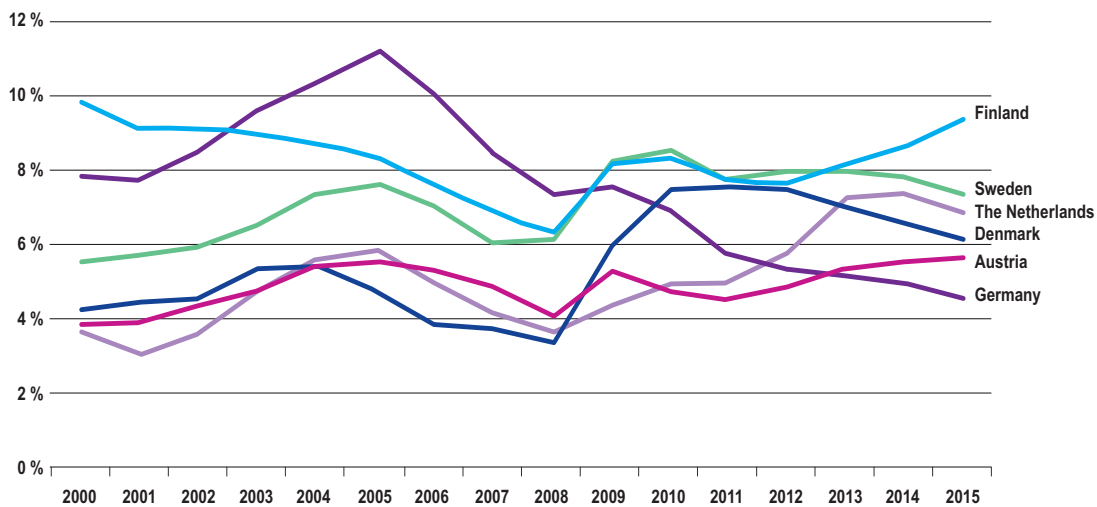
expected to contribute to any change in Austria's lead position by 2020 either (see figure 5). Compared with Austria, only Germany still shows a lower unemployment rate. While unemployment in Austria remained at a low level

Figure 4: Development of GDP per hour worked, for purchasing power parities, 1995 to 2016



Source: Total Economy Database™.

Figure 5: Unemployment rate development from 2000 to 2015



Source: Eurostat.

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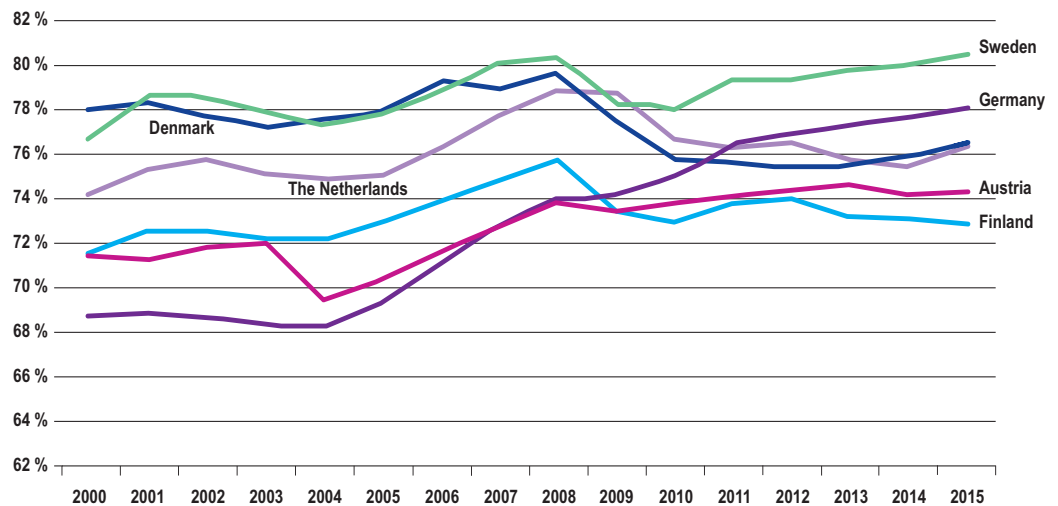
for some years, the proportion of those in work relative to the total population actually stagnated. The employment rate has scarcely changed since 2010, but it does show a clear increase in the rate of women in employment. As figure 6 shows, Germany overtook Austria in the crisis year 2008 and is currently ranked number 2. Finland by contrast fell back at the same time and is therefore behind Austria.

**Downward trends in the social ambit**

The indicators used to map the social developments in the areas of quality of life, health and

life expectancy show a sharply downward trend relative to the innovation leaders' average. It must be emphasised here that this estimation is relational, as it also is in the other areas. This means that Austria's backslide is primarily attributable to the faster growth of the comparison countries, and not to the fall in its domestic level. Seen in absolute terms, life expectancy in Austria does indeed rank among the highest in the world. According to the WHO, Austria is ranked number 18 in the top 20 of approximately 200 countries.<sup>25</sup> In the OECD states, life expectancy has risen continuously since the mid-19th century.<sup>26</sup> In the OECD countries'

**Figure 6: Employment rate development from 2000 to 2015**



Source: Eurostat.

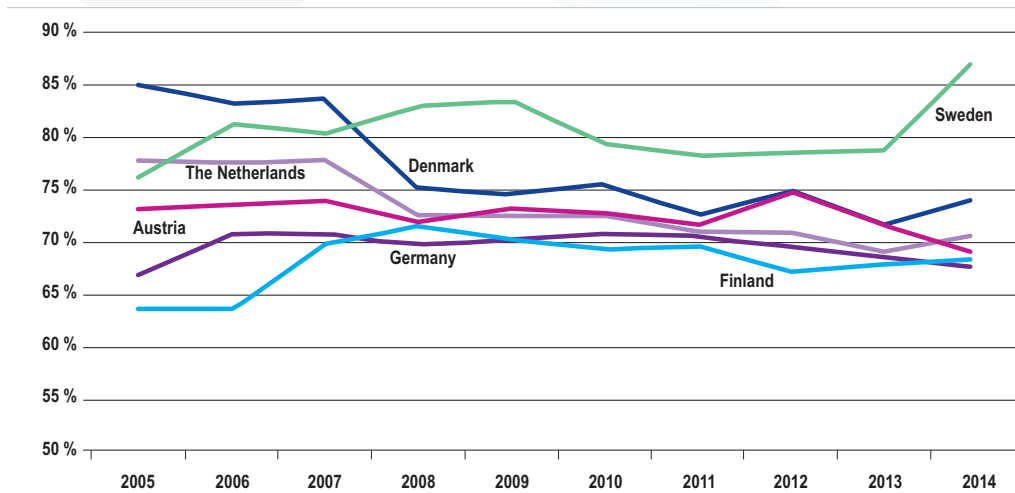
25 WHO (2016): World Health Statistics 2016: Monitoring health for the SDGs.

26 OECD (2014): How was Life? Global Well-being since 1820. OECD Publishing, Paris, p. 107; Knell, M. (2011): Pay-As-You-Go – A Relict from the Past or a Promise for the Future? Winning Contribution to the Hannes Androsch Prize 2011 on “The Design of a Social Security System Which Can Withstand the Dual Threat of Demographic Developments and Financial Market Risk”. Austrian Academy of Sciences Press, Vienna, p. 20 f.

average, life expectancy for the total population is currently just under 80 years, which is an increase of more than ten years since 1970.<sup>27</sup> Life expectancy in the OECD countries has therefore doubled since the end of the 19th century. This will also continue as a linear development in coming years: life expectancy at birth increases in all OECD countries by 3 months each year. An end to this trend is not in sight. In accordance with the development of most developed economies, the life expectancy of men and women has therefore also risen further in Austria. In 2012 it was calculated to be over 80 years for both genders for the first time. Today the life

expectancy for women and men together is 81.5 years. All indications are that it will also increase further in the coming years and decades. Parallel with general life expectancy, the number of years spent in good health is also increasing. Figure 7 shows that the percentage of life expectancy in good health of the total life expectancy of women in Austria has ranged in the midfield area compared with the innovation leaders for some years now. It did, however, fall slightly recently. With men the situation looks similar, whereby the percentage of years spent in good health of total life expectancy is consistently at a lower level.

**Figure 7: Development of the percentage of total life expectancy spent in good health in women from 2005 to 2014**



Source: Eurostat.

<sup>27</sup> OECD (2016): The OECD in Facts and Figures 2015–2016: Science, Environment, Society. OECD Publishing, Paris, p. 202.

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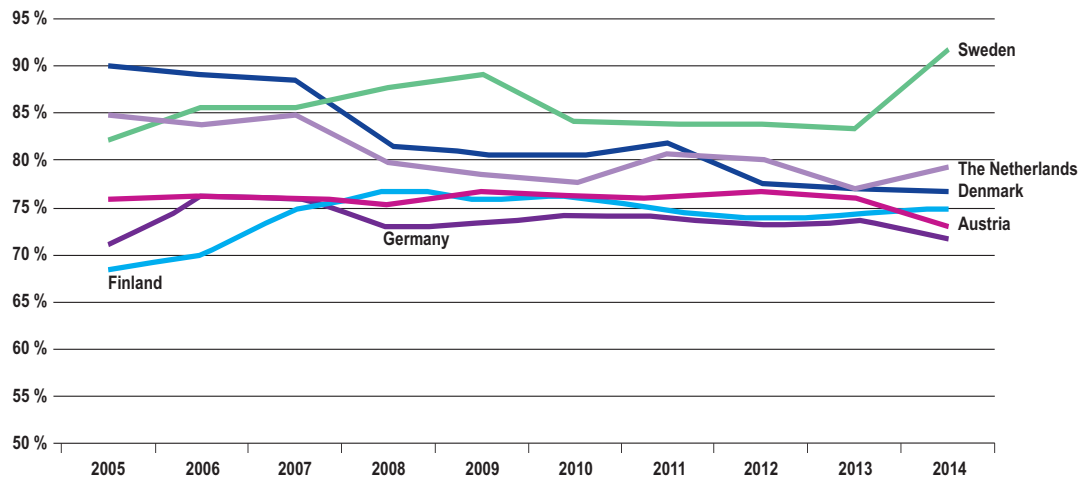
Figure 8 shows that a downward trend can also be seen here.

A basic statement with regard to quality of life is difficult, as the measurement of this factor cannot be illustrated in one single value.<sup>28</sup> An international, at least more standard composed indicator is provided by the OECD’s “Better Life Index”, which measures quality of life as the total of various individual indicators (divided into social, ecological and economic categories). While Austria is clearly ahead of the innovation leaders in the economic categories, in areas such as education, living conditions, health,

life satisfaction, work-life balance or environment, it is even significantly behind in places.

The RTI Strategy places great emphasis here on the area of education in particular – see section, “Education System (without tertiary education)”, whose consistent implementation would also have positive effects on social developments.<sup>29</sup> The strategic goal of increasing innovation success, would also have a positive effect on, for example, economic competitiveness, employment and unemployment;<sup>30</sup> all of the aforementioned are important determinants of quality of life.

**Figure 8: Development of the percentage of total life expectancy spent in good health in men from 2005 to 2014**



Source: Eurostat.

28 Quality of life is a highly subjective term, which is interpreted individually by each person, and can differ greatly at national level in particular. One country’s population may find different aspects of quality of life more important than the population of another country. Aggregated comparisons of quality of life must therefore be interpreted with great care, or should be made using different quantifiers of aspects of quality of life. For the Better Life Index the OECD uses 24 individual indicators in the following 11 sub-areas: Education, employment, income, living conditions, health, life satisfaction, work-life balance, public spirit, civil engagement, security and environment.

29 For this, see also Klingholz, R. / Lutz, W. (2016): Who survives? Education decides on the future of humanity. Campus Verlag, Frankfurt, pp. 175 ff.

30 For this, see Keuschnigg, C. / Ecker, B. / Sardadvar, S. Reiner, C. (2017): Innovation nation Austria – R&D, corporate development and location attractiveness. Study commissioned by the Austrian Council for Research and Technology Development. Vienna, pp. 1 ff.

Figure 9 shows how the values of the Better Life overall index are slightly regressive for all comparison countries, but nevertheless above Austria's level.

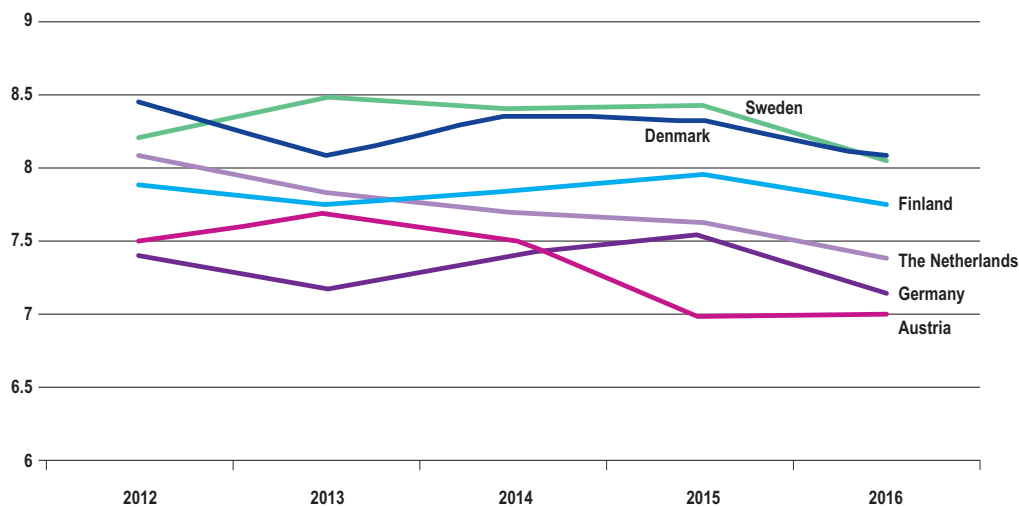
The Scandinavian countries in particular score above-average well compared with other countries in the Better Life Index for some years now. Their figures in almost all subject areas are even far above the average in some cases. Austria, by contrast, is continuously in the midfield in the OECD comparison. In relation to Austria, Sweden, Denmark, Finland and the Netherlands show distinctly higher scores in

the categories of education, health, life satisfaction and work-life balance in particular.<sup>31</sup>

**Performance in parts of the environmental area significantly below average**

In the area of the environment indicators, Austria's position compared with the innovation leaders has scarcely changed. With resource productivity and greenhouse gas emissions Austria is some distance behind the leading nations, but clearly ahead in the energy intensity area.

Figure 9: Quality of life development (Better Life Index) from 2012 to 2016



Source: OECD.

31 <http://www.oecdbetterlifeindex.org/de/>

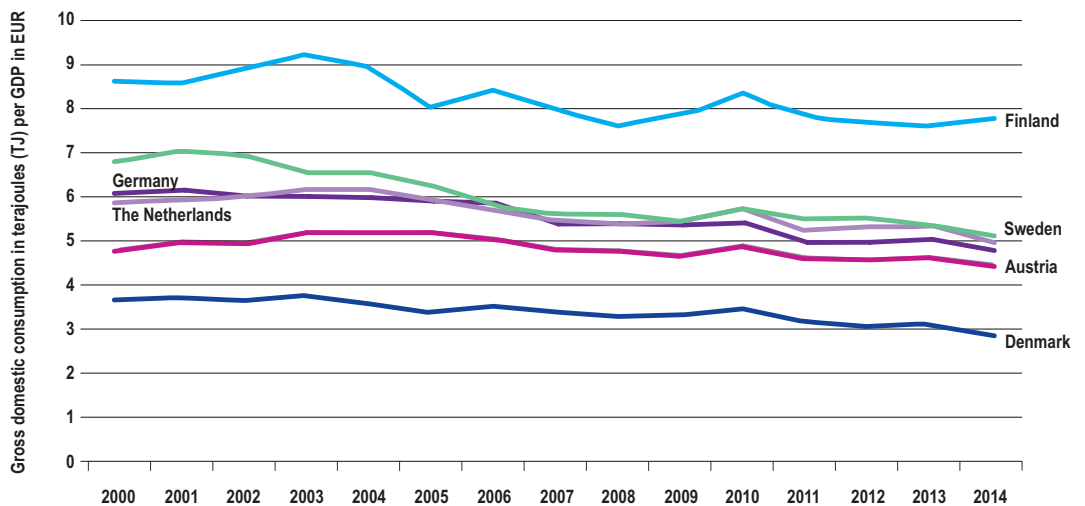
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With regard to energy intensity, Austria remains unchanged ahead of the innovation leaders (see figure 10). This means that the Austrian economy is less energy-intensive than the leading nations. Energy intensity in Austria has fallen continuously since 1990 because of a decline in final energy consumption, especially in the sectors of transport, private homes and services.<sup>32</sup> In the long-term, as in all OECD countries, the increase in energy efficiency is also accompanied by a relative decoupling of energy consumption from the economic development. Although the GDP in Austria between 1973 and 2012 grew by 138.5 percent, energy consumption in 2012 was only at

54.8 percent above the 1973 level. The energy intensity of the Austrian economy therefore fell by 35.1 percent.<sup>33</sup>

With the emission of greenhouse gases an improvement over the 2010 figures can indeed be seen; however, this is not sufficient to even just begin to achieve the goal of reducing greenhouse gas emissions to 13 percent below the figure from 1990 to 2020. Austria is therefore the only EU member state that has not produced a reduction in greenhouse gas emissions compared with the base year 1990. Compared with 1990 the emission of greenhouse gases has not even been reduced by 2 percent. Austria is therefore part of a group including countries such as Spain, Portugal and Greece. Figure 11

Figure 10: Energy intensity development from 2000 to 2014



Source: Eurostat.

32 Federal Ministry of Science, Research and Economic Affairs (2014): Energy efficiency in figures 2014. Vienna, p. 4 f.

33 Federal Ministry of Science, Research and Economic Affairs (2014): Energy efficiency in figures 2014. Vienna, p. 2.

shows how greenhouse gas emissions in Austria are higher today than in the leading nations, despite the reductions.

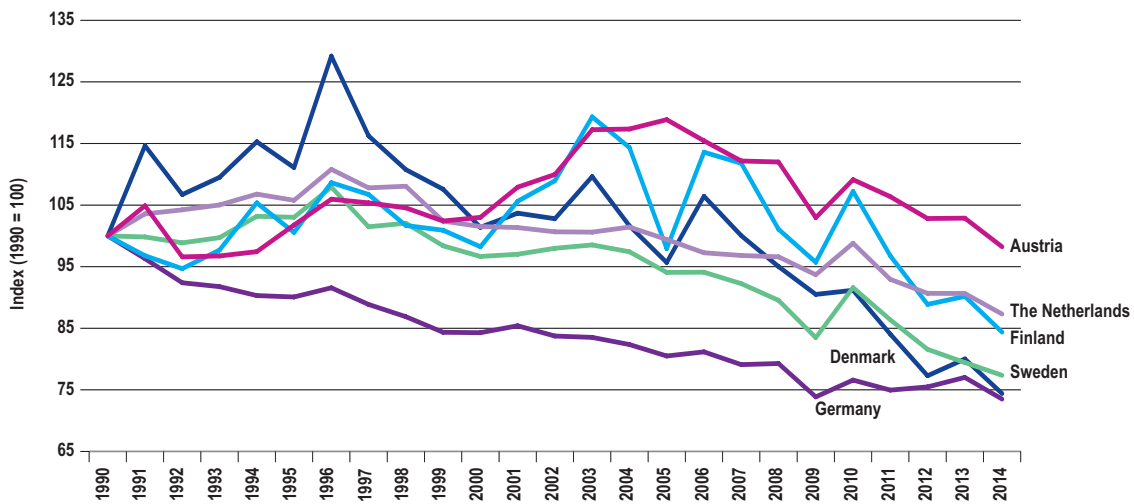
In contrast to Austria, the leading innovation nations have in part undertaken major efforts to shift their greenhouse gas emissions towards the Kyoto targets – in particular the reduction of the emission of green house gases to 13 percent below the 1990 figure: the Netherlands have achieved the Kyoto goal, and with a reduction of 13 percent are right on the goal line. Finland has reduced its greenhouse gas emissions by 16 percent below the 1990 figure; Sweden has even achieved 23 percent. The top achievers are Denmark and Germany, whose greenhouse gas emission reductions of more than 26 percent go far be-

yond the Kyoto Protocol's requirements. Definitive redoubled efforts are therefore required here to improve Austria's performance. The measures adopted in the Federal Government's Work Programme on the subject area of energy and sustainability nonetheless give cause for optimism that Austria's performance in this respect can improve in the near future.<sup>34</sup>

Greenhouse gas emissions can only be reduced in the shortterm conditionally with an increase in RTI activities. Regulations, taxation measures and an effective diffusion of existing technologies have a faster effect here in reducing greenhouse gases. Compared with the innovation leaders, Austria does, however, invest relatively

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Figure 11: Development of greenhouse gas emissions, 1990 to 2014



Source: Eurostat.

34 For Austria: Work Programme of the Austrian Federal Government 2017/2018. Vienna 2017, pp. 20 ff.

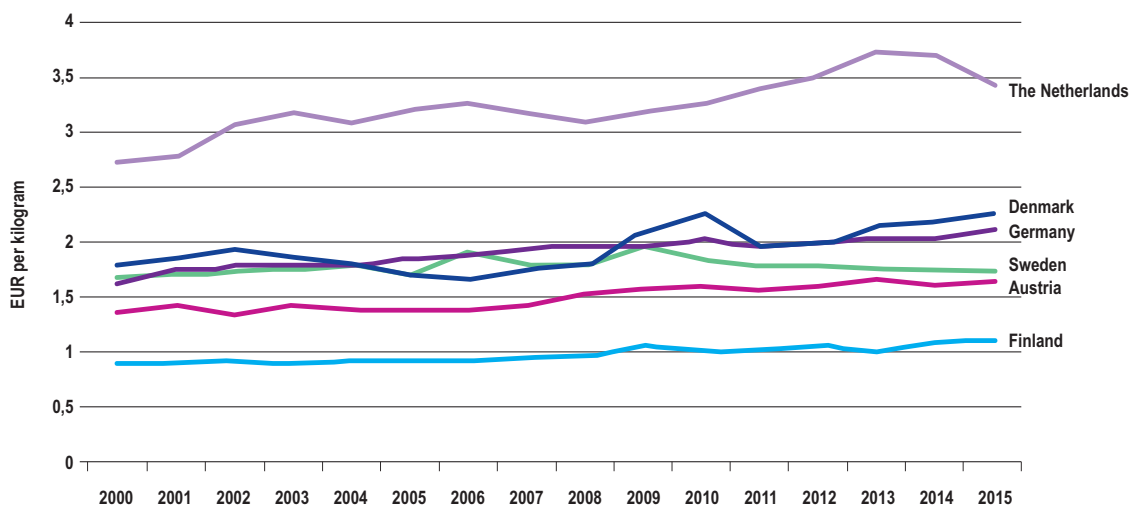
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little in energy and environmental research and the promotion of climate-friendly technologies.<sup>35</sup> The percentage of energy research spending by the public sector relative to gross domestic expenditure for R&D in Austria has therefore recently fallen to 3.5 percent.<sup>36</sup>

Austria scores worst in the area of resource productivity. Increases in resource productivity are generally seen as a result of technological progress.<sup>37</sup> Austria has scarcely gained any ground here since 2010 compared with the leading nations. Resource productivity in Austria is actually continuously increasing, which means the Austrian economy essentially uses resources more efficiently than in the past. Ac-

ording to calculations by the Ministry of the Environment, resource productivity in Austria has improved over the last 50 years by a factor of 2.5, or 146 percent. In 1960, EUR 550 of GDP were generated per ton of material use; in 2008 it had already risen to EUR 1,353. Absolute material consumption has risen by 73 percent, despite these considerable efficiency gains. The economy has however grown in the same period by a factor of 4.3, i.e. 325 percent.<sup>38</sup> Furthermore, the resource productivity of most innovation leaders is even significantly higher than Austria's, as shown in figure 12. Despite a recent decline, the Netherlands is ahead of the other countries by some distance in this area. Germany and Denmark are evidently increas-

Figure 12: Resource productivity development from 2000 to 2015



Source: Eurostat.

35 OECD Government budget appropriations or outlays for RD: <https://stats.oecd.org/>

36 Indinger, A. / Katzenschlager, M. (2016): Energy Research Survey 2015: Public sector spending in Austria. Survey for the IEA, p. 102 f.

37 Hawken, P. / Lovins, A. / Lovins, L.H. (2008): Natural Capitalism: Creating the Next Industrial Revolution. Little, Brown and Company, Boston-New York-London.

38 Federal Ministry of Agriculture and Forestry, the Environment and Water Management, Federal Ministry of Economics, Family and Youth (publ.): Resource Usage in Austria – Report 2011. Vienna.

ing their resource productivity visibly more efficiently than Austria. Sweden is just ahead of Austria, but it has lost some dynamic in recent years. Although Austria has shown an almost uninterrupted positive trend since 2000, this is not sufficient to catch up with the level of the leading nations by 2020.

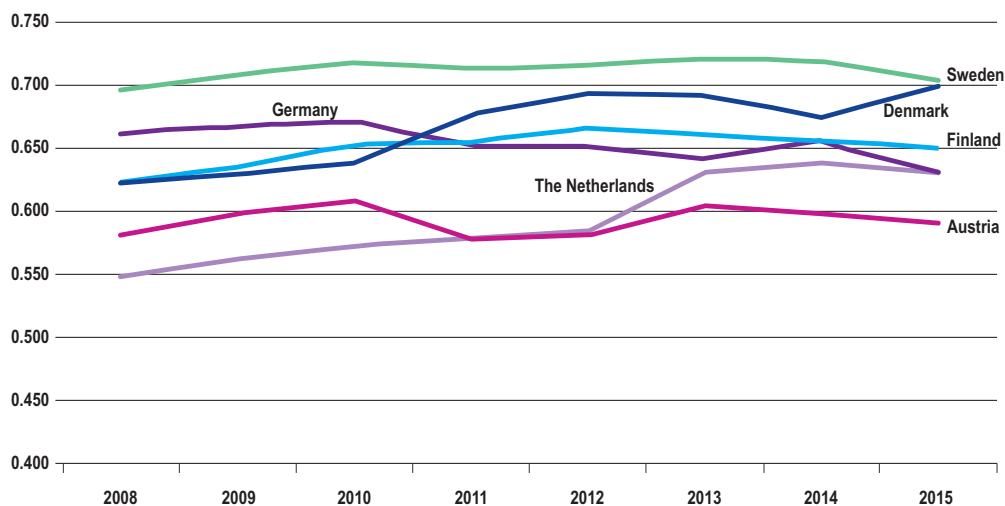
On the whole, the modest performance in the area of climate and environmental protection compared with the leading innovation nations results in Austria scoring rather badly in various international rankings. In the 2017 Climate Protection Index, for example, which was presented in November 2016 at the UN Conference on Climate Change in Marrakesh, Austria is ranked second last among the EU mem-

ber states.<sup>39</sup> And in the Living Planet Report 2016 by the WWF, which measures the use of resources of all countries and their ecological footprint, ranked at number 14, Austria is not only way ahead in the global ranking list of the countries with the highest resource consumption, it also ranks among the inglorious lead group across Europe.<sup>40</sup>

**Innovation performance to achieve the “Innovation Leader” goal is insufficient**

Compared with the innovation leaders, Austria’s innovation performance has deteriorated slightly on the whole since 2010 (figure 13) – measured on the European Innovation Score-

**Figure 13: Innovation performance according to European Innovation Scorebord (EIS)**



Source: European Innovation Scoreboard 2016.

39 Germanwatch / Climate Action Network Europe (2016): The Climate Protection Index – The Most Important Results 2017.

40 WWF Austria (2016): Living Planet Report 2016.



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board (EIS, formerly the Innovation Union Scoreboard – IUS), which also acts as a comparative variable for the RTI Strategy. In 2010 the level reached 93 percent of the performance of the innovation leaders – today it is 89 percent. Austria has indeed improved by one place in the EIS 2016 compared with the previous year up to number 10 in the ranking.<sup>41</sup> A very negative dynamic was, however, registered in the years prior to this: In 2009 Austria was at number 6 and therefore occupied a lead position in the group of innovation followers (today referred to as “Strong Innovators”). Austria has since fallen five times in a row by one place each year. The lowest point came in 2015 when Austria fell to number 11, and therefore hit the bottom end of the chasing pack. In the period from 2010 to 2016, Austria’s distance to the five leading innovation nations increased slightly by 0.02 points.

Today, three years before reaching the RTI Strategy’s target horizon, Austria ranks among the midfield of the Strong Innovators. It must be noted here that the indicators of EIS have a time lag of 3 years vis-à-vis the current year, so that it will not be possible to assess the actual goal achievement with absolute certainty by 2022 at the earliest. The improvement by one place over the previous year is indeed to be welcomed, but it should not be overrated, as the gaps between the individual countries in the chasing pack are relatively small. The main problem is clearly the lost development dynamic, which means Austria is not in a position to sufficiently gain lost ground. From today’s point of view the goal of the RTI Strategy to advance to the group of leading nations by 2020 is therefore scarcely achievable.

## Summary evaluation of Austrian performance in the area of priority objectives

In summary, the development of Austrian performance in the area of the priority objectives of the RTI Strategy cannot be evaluated as very positive. Two thirds of the 10 indicators used are currently significantly below the level of the leading nations. Due to the development dynamic it cannot be assumed that this situation will change by 2020 either. With above-average high GDP per capita, continuously falling energy intensity and a comparably low unemployment rate, only three of the indicators perform above the level of the leading nations. The other indicators from the areas of innovation, health, quality of life and environment also show a regressive development dynamic, with the exception of the greenhouse gas emissions indicator.

Even if numerous factors generally influence the respective performance, RTI activities and the measures defined in the RTI Strategy can nonetheless stimulate effects in all areas. Education reforms, for example, are not only important for innovation success, they also have a strong social impact. The consistent implementation of the measures of the RTI Strategy for the education system could therefore strengthen Austria’s positions in the social ambit. Increased investments in energy and environmental research can contribute to an improved performance in the environment sector. And research, innovation and diffusion in the health sector can further optimize Austria’s performance with regard to life expectancy in good health and quality of life.

In any case, the analysis shows that Austria’s distance to the innovation leaders has increased, contrary to the intentions of the RTI strategy in

<sup>41</sup> European Innovation Scoreboard 2016, pp. 12 ff.

most areas. It also shows that the RTI activities related to the priority objectives of the RTI Strategy in Austria can be extended even further. In this context, it must be pointed out in particular that innovation performance, as meas-

ured in the European Innovation Scoreboard (EIS), has deteriorated on the whole since 2010. These findings are analysed in detail in the following section.

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### Effectiveness and Efficiency of Innovation Efforts

As both innovation efforts and other policy areas (e.g. taxation, competition policy, product and labour market regulation, administration efficiency, etc.) influence the achievement of the priority objectives of the RTI Strategy, the effects of innovation activities on the economic, social and ecological developments illustrated in the previous section can only be attributed directly within limits.

The effectiveness of the innovation efforts will therefore first of all be illustrated in this chapter on the basis of their effect on Austria's distance to the science, technology and innovation frontier. This enables an indepth assessment of the direct effects on innovation performance.<sup>42</sup> The efficiency of the innovation efforts will then be assessed as the ratio of inputs to outputs.

#### Distance to the frontier

This section illustrates Austria's distance to the frontier – i.e. to the highest performance level of the leading nations, Germany, Denmark, Finland, the Netherlands and Sweden – in science, technology and innovation. These three areas – therefore 1) the *scientific frontier*, 2) the *technological frontier*, and 3) the *innovation frontier* – are defined briefly in the following.<sup>43</sup>

1. The *scientific frontier* refers to the highest distinct capability of countries to contribute to the growth in scientific knowledge. It is measured on the quantity and quality of publications relative to the population size.

2. The *technological frontier* refers to the production of technological knowledge and the technical properties of new products or processes. It is measured on the quantity and quality of patents.

3. The *innovation frontier* refers to the ability to transform knowledge and technology into economic successes and is measured on two dimensions: i) Structural change, i.e. the development of the proportion of the value creation of knowledge-intensive sectors of the overall economic performance and ii) Upgrading, i.e. a country's shift on the quality ladder of a sector, or successful penetration into knowledge-intensive areas within a sector.

This performance concept takes Austria's specific economic structure into account by differing between structural change in the direction of knowledge-intensive sectors and upgrading in all sectors. 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.<sup>44</sup>

Table 1 shows Austria's values in the individual indicators for the base year 2010 (= RTI Strategy completion) and at the last available point, which differs for the individual indicators. These values are also referenced for the average of the innovation leaders. A value over 100

<sup>42</sup> This overlaps in part with that illustrated by the EIS. The EIS does however mix input and output indicators, and therefore provides a distorted image of the effectiveness of innovation efforts. Nor does the EIS take the specific economic structures and innovation systems of the member states into account.

<sup>43</sup> This new concept for measuring effectiveness in the areas of science, technology and innovation is based on Janger, J., Kügler, A., Reinstaller, A., Unterlass, F., "Die 'Frontier' in Wissenschaft, Technologie und Innovation: Messung und Bestimmungsfaktoren", WIFO-Monatsberichte 2017, 90(2), pp. 141–151.

<sup>44</sup> See 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.

means a higher level here, or a better performance for Austria. Furthermore, the values for Austria are compared with Switzerland's, which is not an EU member and therefore is not included by the EIS in the group of innovation leaders either. Switzerland is, however, generally ahead of the leading innovation nations' average with many performance indicators, which is why it is still a more demanding benchmark for Austria. Using traffic light colour arrows, the last column graphically shows Austria's develop-

ment relative to the leading nations from 2010 to the last available year of the respective indicators.

As the green arrows in the right column of table 1 show, the positive dynamic essentially dominates. Negative developments are the exception (identifiable with the two red arrows in the area of innovation and in the areas of structural change and upgrading). In summary, this graphic shows that Austria's performance level

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**Table 1: Austria's distance to the frontier in science, technology, innovation and economy, 2010 to 2017 (or last available year)**

Frontier area	Indicator	AT (absolute value 2010)	AT (absolute value, current)	AT vs IL (IL=100, current)	AT vs Switz. (Switz.=100)	Development 2010–2017 relative to IL
Science	Quality of publications (publications in the top 10% per 1,000 inhabitants)	0.64	0.76	72	41	→
	Quantity of publications per 1,000 inhabitants	2.09	2.25	80	53	↑
Technology	Patent applications per 1,000 inhabitants	0.21	0.19	102	57	↑
	Patent applications with more than 5 citations per million inhabitants	1.79	0.71	125	26	↑
	Triad patents per 1,000 inhabitants	0.05	0.02	83	29	↑
Innovation	Structural change					
	Percentage of science-intensive sectors in employment	14.40	14.50	89	67	↓
	Value creation percentage of research-intensive material goods industries	0.16	0.15	83	45	→
	Percentage of science-intensive services in services export	73.56	79.16	103	97	↑
	Upgrading					
	Structurally adjusted R&D intensity of businesses	0.52	0.61	90	–	↓
	Percentage of high quality segment with exports of complex products	54.18	57.56	109	84	↑
	Complexity of exported products	1.72	1.76	100	79	↑

Source: WIFO. AT = Austria, CH = Switzerland, IL = Innovation leaders in the EIS 2016 (Germany, Denmark, Finland, The Netherlands, Sweden). Values over 100: AT > IL or CH.

priority objectives

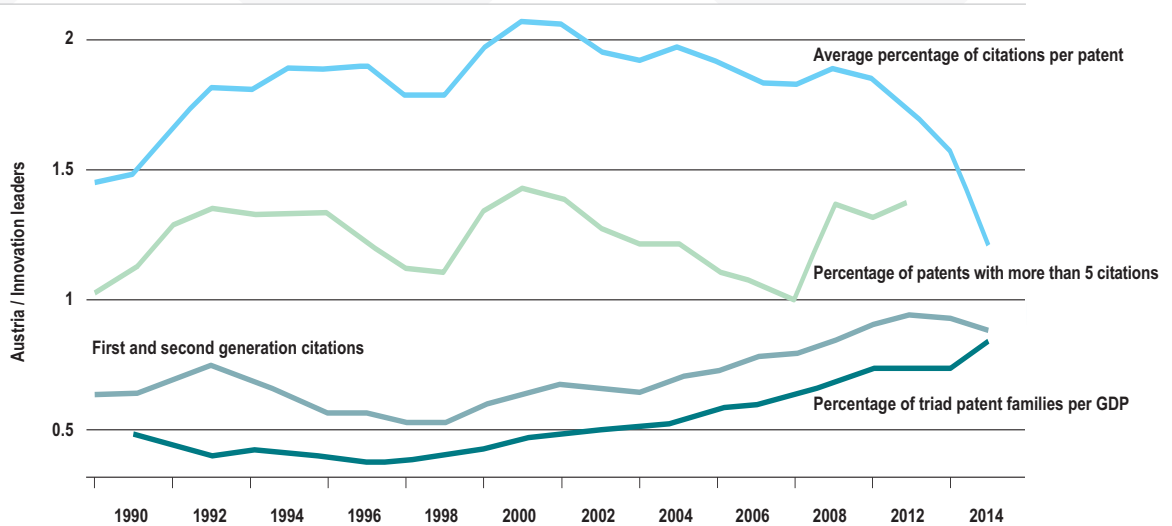
in science, technology and innovation has improved in most areas since 2010 compared with the performance of the leading innovation nations.<sup>45</sup>

The distance to the *frontier* has been reduced on the whole. A deficit can however be seen in some areas, which is more distinctly evident in science and with the innovation component of “structural change” than in the technology areas and in the “upgrading” innovation component. With the latter Austria partially even achieved higher values than the innovation leaders, Germany, Denmark, Finland, the Netherlands and Sweden. Austria is not, however, ahead of Switzerland in any area. Austria’s biggest distance to the *fron-*

*tier* is in the science area. The respective performance is discussed in more detail in the “Research at Universities and Non-University Research Institutions” section.

Figure 14 shows further quality indicators for estimating Austria’s proximity to the technological frontier over time. A mixed picture emerges here on the whole, whereby with two indicators Austria is above the level of the innovation leaders, and with two it is below. With the triad patents essentially interesting for commercial reasons we can see a catch-up process since the end of the 90s. Basically these indicators are based on the findings of what is in any case only a marginal distance to the technological frontier.

Figure 14: Quality of Austrian invention activities: Applications to the European Patent Office (EPO), according to inventors in relation to innovation leaders



Source: PATSTAT (autumn 2016), World Bank, WIFO calculation. Innovation leaders: Average of DE, DK, FI, SE, NL=1.0. Percentage of the patents with more than 5 citations is no longer shown because of the insufficient number of cases from 2011 already.

<sup>45</sup> This graphic is more positive than the EIS, after another performance concept and corresponding indicators are applied.

A new analysis of the significance of patent registrations in six technology areas, which the European Commission defines as key technologies or *Key Enabling Technologies* (KETs)<sup>46</sup>, also confirms this view for the inventive activities in these key technologies.<sup>47</sup> In all technology areas named we can see that Austrian inventors have also contributed patents with a high level of significance for the respective technology area. It is also clear that the significance of inventions with Austrian participation also increased sharply in places in the technology area in the last ten years. This in particular applies in the areas of advanced materials and advanced manufacturing technology, and (to a lesser degree) in photonics, in which Austria has developed into a significant player in Europe and around the globe in the last twenty years. It can also be seen, however, that despite the increasing significance of Austrian contributions to these technologies, ground-breaking, paradigm-forming inventions (the aptly named “super patents”), were not produced in Austria. It is, however, precisely such “super patents”, which on one hand mostly underlie new industries, and on the other hand produce the highest financial returns. A subarea of the technological performance is the control and further development of digital information and communication technologies. These are mapped on European level with the

DES Index (Digital Economy and Society Index).<sup>48</sup> The Index does not, however, compare the performance of countries in ICT research, but rather the use of ICT – such as the Internet – by the general public, businesses and administration, as well as the ICT infrastructure (broadband, mobile connections). ICT skills and STEM graduates are also recorded. This Index can therefore only be applied conditionally for the classification of technological ICT research capabilities. In using ICT Austria scores considerably better with businesses (rank 10) and administration (rank 6) than with the general public (rank 25). In the ICT infrastructure, Austria ranked 14; with ICT skills it ranked 8. The corresponding measures for the digitalization from the Federal Government’s Work Programme are therefore to be welcomed.<sup>49</sup> On the whole, however, the efforts in the technological area appear to go more in the direction of the capability of leading nations than those in the scientific area. This view is reflected by both Austria’s economic structure and the effects of RTI promotion. Austria specializes in less science-related sectors, which have sharply increased their research efforts in the last 15 years, not least of all with higher public sector support, and also cooperate intensively here

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<sup>46</sup> Therefore industrial biotechnology, nanotechnology, microelectronics and nanoelectronics, photonics and advanced material and advanced manufacturing technology apply as key technologies.

<sup>47</sup> See Reinstaller, A. / Reschenhofer, P. (2017): Austrian inventors’ contribution to the development of key technologies: Results on the basis of a new patent gazette. Study for the Austrian Council for Research and Technology Development. Austrian Institute of Economic Research (WIFO), Vienna. As part of this study a new indicator was developed, which contrary to the norm does not map a country’s activities on the basis of simple patent counting, but rather records the significance of individual patents for the technological development of a technology area. This makes it possible to evaluate a country’s significance for the development of a specific technology area over time. The significance of a patent is determined recursively here by the number of citations that the patent incurs, and the number of citations that direct and indirect citing patents in turn incur. The significance of a patent is therefore determined by the significance of the citing patents. This approach is based on the empirical evidence that citations and the financial value of patents correlate starkly with one another.

<sup>48</sup> <https://ec.europa.eu/digital-single-market/en/scoreboard/austria>.

<sup>49</sup> For Austria: Work Programme of the Austrian Federal Government 2017/2018. Vienna 2017, p. 19 f.



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with universities in the research applied. This results in advances in the area of technological performance without any pronounced broadening in the quality of academic research, which is especially relevant for the structural change.<sup>50</sup>

The performance in the science area is not least of all attributable to the varying intensity of the competitive promotion of basic university research. Empirical evidence shows that the resources awarded in competition to promote basic research are intensively linked with the quality of the scientific output.<sup>51</sup>

The level of competitive financing for basic research in Austria is, however, significantly less than that in the leading nations. In its previous reports on Austria's scientific and technological performance, the Austrian Council has therefore defined the expansion of the competitive financing of basic research several times as one of five priority areas of action (for this, see also chapter, "Research at Universities and Non-University Research Institutions"). In contrast to this, public sector funding of business research in Austria according to the OECD in 2014 (i.e. still without an increase in the research premium to 12 percent) was 0.27 percent of GDP, while in the extreme example it hard-

ly even exists in Switzerland, and in the leading innovation nations it is 0.07 to 0.17 percent of GDP.

A difference can also be seen, as mentioned, between the two dimensions of the innovation frontier. Austria traditionally scores badly with its percentage of knowledge-intensive sectors in value creation, the so-called structural change. More science-related sectors develop slower here in this country due to a mixture of factors, including suboptimum conditions for the growth of younger, more innovation-intensive businesses (see chapter, "Research and Innovation in the Corporate Sector") and the interaction of more knowledge-intensive sectors with the quantity and quality of higher education research and university graduates.<sup>52</sup>

At the same time Austria must, however, remain competitive in sectors with medium to medium-high knowledge and technology intensity with the continuous improvement of existing competencies. This development is illustrated by the term "Austrian Paradox". This refers to the obvious success of the Austrian economy in "old structures".<sup>53</sup> This is demonstrated 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

50 For this, see also Keuschnigg, C. / Ecker, B. / Sardadvar, S. Reiner, C. (2017): Innovation nation Austria – R&D, corporate development and location attractiveness. Study commissioned by the Austrian Council for Research and Technology Development. Vienna, pp. 6 f., 102 ff.; and Janger, J. / Böheim, M. / Falk, M. / Falk, R. / Hölzl, W. / Kletzan-Slamanig, D. / Peneder, M. / Reinstaller, A. / Unterlass, F. (2010): Research and innovation policy after the economic crisis. In: WIFO-Monatsberichte, 83 (8); pp. 675–689.

51 Aghion, P. / Dewatripont, M. / Hoxby, C. / Mas-Colell, A. / Sapir, A. (2010): The governance and performance of universities: evidence from Europe and the US. In: Economic Policy 25, no. 61 (January 2010), 7–59; van Wijk, E. / Costas Comesaña, R. (2014): Bibliometric Study of FWF Austrian Science Fund 2001 2010/11. FWF, Vienna.

52 For this, see Abel, J. R. / Deitz, R. (2012): Do Colleges and Universities Increase Their Region's Human Capital? In: Journal of Economic Geography, 12(3), pp. 667–691; Dohse, D. / Vaona, A. (2014): Start-up Complexity and the Thickness of Regional Input Markets. In: Economics Letters, 124(3); pp. 424–427.

53 Peneder, M. (1999): The Austrian Paradox: 'Old' Structures but High Performance? In: Austrian Economic Quarterly, no. 4 (1999), pp. 239–247.

from the quality of the vocational training system in Austria. With the “Upgrading”, Austria is more or less equal with the innovation leaders, but there is still room for manoeuvre in the comparison with Switzerland in particular.

### Innovation efficiency: Input vs. output

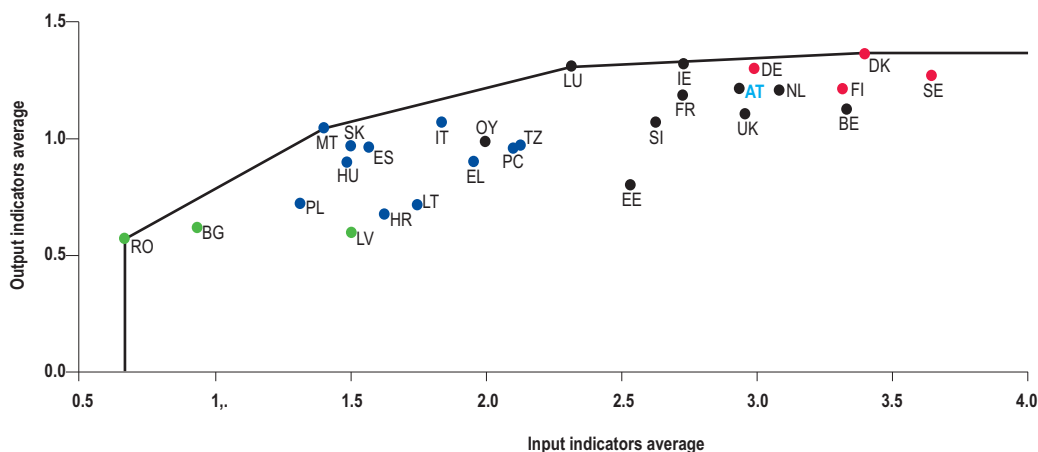
The performance indicators shown in table 1 do not include any information about the resources that were required to create them. To further illustrate the aspect of the efficiency of efforts in science, technology and innovation, the input indicators of the EIS are compared with its output and outcome indicators as part of a statistical efficiency analysis. The latter were changed here in a second WIFO calculation method in order to take both the structural change and the upgrading into account, and therefore to evaluate Austria’s performance more realistically

than it had been in the EIS with its focus on structural change.<sup>54</sup>

In principle the most efficient countries are determined on the input, output and outcome ratio of the innovation indicators of the EU countries. These are those that hover around the so-called “efficiency frontier”. These do not have to be the strongest innovation nations, as the level of efficiency is determined by the amount of outputs and outcomes that can be generated with the given input resources. Figure 15 shows the calculated efficiency frontier for the 28 EU countries with the assumption of variable returns to scale in accordance with the WIFO method. It is evident that, not only in the comparison with that of the leading nations, Austria’s position shows real improvement potential, which could simply be exploited via efficiency increases.

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Figure 15: Innovation efficiency in the EU: Input to output ratio



Source: Eurostat, EIS, WIFO Calculations.

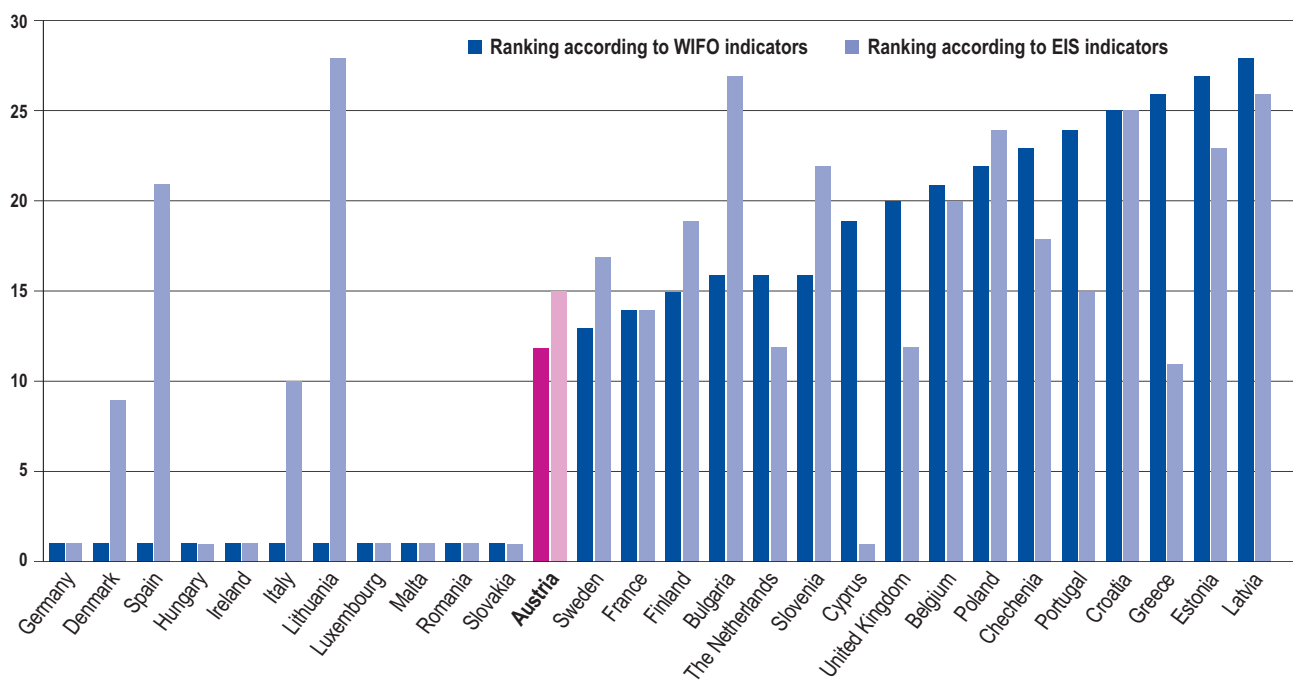
<sup>54</sup> For this, see Austrian Research and Technology Report 2014, chap. 4.3, pp. 151 ff.; Janger, J. / Schubert, T. / Andries, P. / Rammer, C. / Hoskens, M. (2017): The EU 2020 innovation indicator: A step forward in measuring innovation outputs and outcomes? In: Research Policy, 2017, 46(1), pp. 30–42.

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Figure 16 identifies the ranking of the countries in accordance with both methods, whereby the multiple first places represent the efficiency frontier, which can be achieved for different input and output combinations.<sup>55</sup> It is evident that among the innovation leaders, Germany and Denmark are the most efficient in con-

verting input into output and outcomes. However, the most efficient countries also include less innovative ones, such as Spain, Hungary, Ireland and Italy, which generate comparatively high output with relatively little input.<sup>56</sup> Austria sits in the forward midfield, just ahead of Sweden and ahead of Finland and the Netherlands. Even with a cautious interpretation, the

Figure 16: Ranking of the countries according to innovation efficiency, 2015 and respective last year available



Source: Eurostat, EIS, WIFO Calculations.

55 Cf. Kügler, A. / Janger, J. (2015): Innovation efficiency in EU countries. A Data Envelopment Analysis method (DEA). WIFO, June 2015. The results should be considered with caution, as the statistical determination is based on numerous assumptions.

56 This suggests that countries with lower efficiency can also become innovation leaders, if correspondingly more is invested in inputs. The calculations also show that it is becoming increasingly more difficult at the frontier to generate more output per additional unit of input. This diminishing frontier benefit can also be attributed to the fact that at the frontier it is not possible to simply transfer the results from overseas, but rather that more own innovation power is required. For detailed explanations, however, the countries would have to be analysed individually.

data indicates that Austria can still improve significantly with regard to innovation efficiency. The increase in innovation efficiency should therefore be afforded greater attention than it has been to date. A first measure to increase efficiency might be to enable more micro-data-based evaluations of research funding (i.e., the calculation of causal effects using individual, anonymous business data), as is possible, for example, in Sweden and Denmark. On this basis, knowledge could be gained on the areas in which research funding contributes to verifiable effects on corporate performance. Funding mechanisms could then be adapted accordingly, in order to generate the desired effects, and to prevent undesired effects.

#### **Summary evaluation of the effects of Austrian innovation activities**

The effects of the innovation system based on the impact analysis show that Austria is actually in a better position than that measured in the European Innovation Scoreboard (EIS). However,

it continues to have a performance deficit compared with the leading innovation nations. This has indeed been reduced to some extent since 2010, but the development dynamic does not allow us to conclude that Austria's performance is sufficient enough to close the distance to the frontier and join the group of leading nations by 2020.

This summative evaluation is explored in more detail in the following subchapters addressing the topics of the RTI Strategy from "Education System" to "Funding of Research, Technology and Innovation". The development of the individual areas since 2010 is, however, only illustrated as an overview. It is intended to briefly describe the most important trends and addressing the priority areas of action, which are especially crucial for the RTI Strategy to achieve its goal. A more detailed analysis of these areas was made in the Report on Austria's Scientific and Technological Capability 2016.

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## **Development Trends in Further RTI Strategy Areas of Action**

With the European Innovation Scoreboard 2016, the group of innovation leaders is for the first time composed slightly differently since adoption of the RTI Strategy in March 2011. The Netherlands have now joined the previous innovation leaders, Germany, Denmark, Finland and Sweden. For the 2017 Report on Austria's Scientific and Technological Capability, all data points of the Netherlands were therefore also incorporated into the calculation for all indicators since 2010, compared with previous

years, this results in some changes in the details. The effects on the overall result are, however, not substantial and can be neglected.

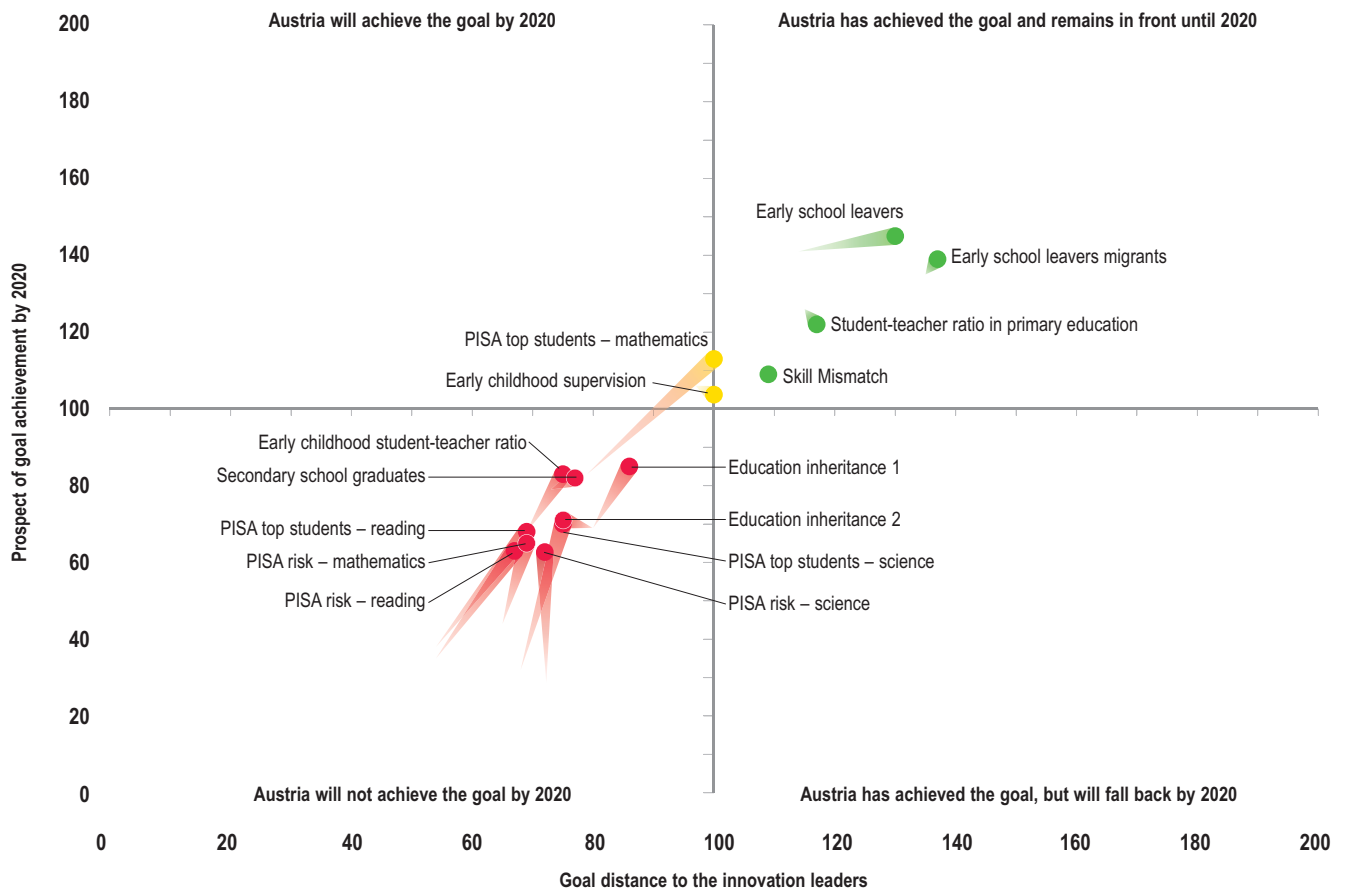
A more detailed analysis of the areas of the RTI Strategy outlined in the following was made in the Report on Austria's Scientific and Technological Capability 2016. The recommendations in the current report are based equally on this detailed analysis and on the results of the Austrian Council's 2015 Mid-Term Review and the conclusions derived from it.

### Education System (without Tertiary Education)

As in past years, the indicators for the pre-tertiary education system are essentially unchanged: for the pre-tertiary education system objective was not achieved for 9 of 15 indicators. Although most of these indicators show a positive development trend, which, however, is not sufficient to catch up with the level of the leading countries.

Apart from the objectives that were partially achieved when the RTI strategy was adopted, – e.g. in the areas of “early school leavers” or “student-teacher ratio in primary education” –, there are no positive developments worth mentioning. With some important indicators, however, there is currently still no significant forward de-

**Figure 17: Development of goal distance and prospect of goal achievement in the education system (without tertiary area)**



Sources: See Appendix 1, WIFO presentation. Raw Data see Appendix 2. Explanation, see Appendix 3.

Note: Goal Distance = Austria's actual value relative to the national target or the innovation leaders' actual value (average value for the most recent available year for DE, DK, FI, NL, SE); Prospect of Goal Achievement = Value projected for Austria in 2020 relative to the national goal or the value projected for the innovation leaders 2020.

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velopment, such as with “Pisa Risk – Maths”, “Pisa Risk – Science” and “Education Inheritance”, for example.

Education inheritance and early social selection are therefore (as topicalized in the RTI Strategy) still key problems in the Austrian education system.<sup>57</sup> There have clearly been no real changes in this respect since 2010. This also applies to the area of early childhood education. And with respect to the need for qualitative improvements in the education system, there have not been any sufficient improvements either. This is valid especially for the area of educator training but even more for their further training. The Austrian Council essentially welcomes the autonomy package in the assessment as well as activities to increase interest in research and innovation, as

well as STEM subjects. The effects of these measures cannot, however, be assessed at this point. In summary, this means that Austria’s distance to the group of innovation leaders in pre-tertiary education was not reduced in recent years. Even if the development direction does concur with the multitude of indicators, comparison countries are evidently developing quicker and more efficiently towards a modern education system. With trends continuing as they are, Austria will therefore not achieve the goals of the RTI Strategy for the pre-tertiary education system. It therefore remains to be seen whether or not the adopted measures to upgrade early childhood supervision, to implement school autonomy and for the “School 4.0” digitalisation package from the Federal Government’s Work Programme will change this situation significantly.<sup>58</sup>

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### Recommendations of the Austrian Council for Achieving the Goals of the RTI Strategy (Excluding Tertiary Education)

In view of the educational screening that continues to exist in Austria, following on from the education reform package, further measures for **early childhood development** and a **significant increase** in the number of qualified and in particular multilingual **educators** are required in the early childhood area. The measures adopted in the Federal Government’s Work Programme for the further development of kindergartens from care facilities into education facilities are therefore expressly welcome.

**Better financial and staffing provisions** (keyword: support staff) are also urgently required for those schools that are confronted with spe-

cial challenges, especially with regard to the socio-economic structure of the students. The Austrian Council also recommends further steps to **modernise the structures** of the education system, in particular the revision of competencies between federal and regional authorities.

To **tackle early social selection in the education system**, the Austrian Council recommends a commitment to comprehensive, wholeday schools in the area of secondary level I with parallel performance differentiation and talent development and the corresponding implementation with suitable measures.

<sup>57</sup> Only in the area of higher vocational schools (VHS) is it impossible to determine a connection between the education level of parents and children (for this, see Austrian Council for Research and Technology Development – 2016). Report on Austria’s Scientific and Technological Capability 2016, pp. 16 ff.

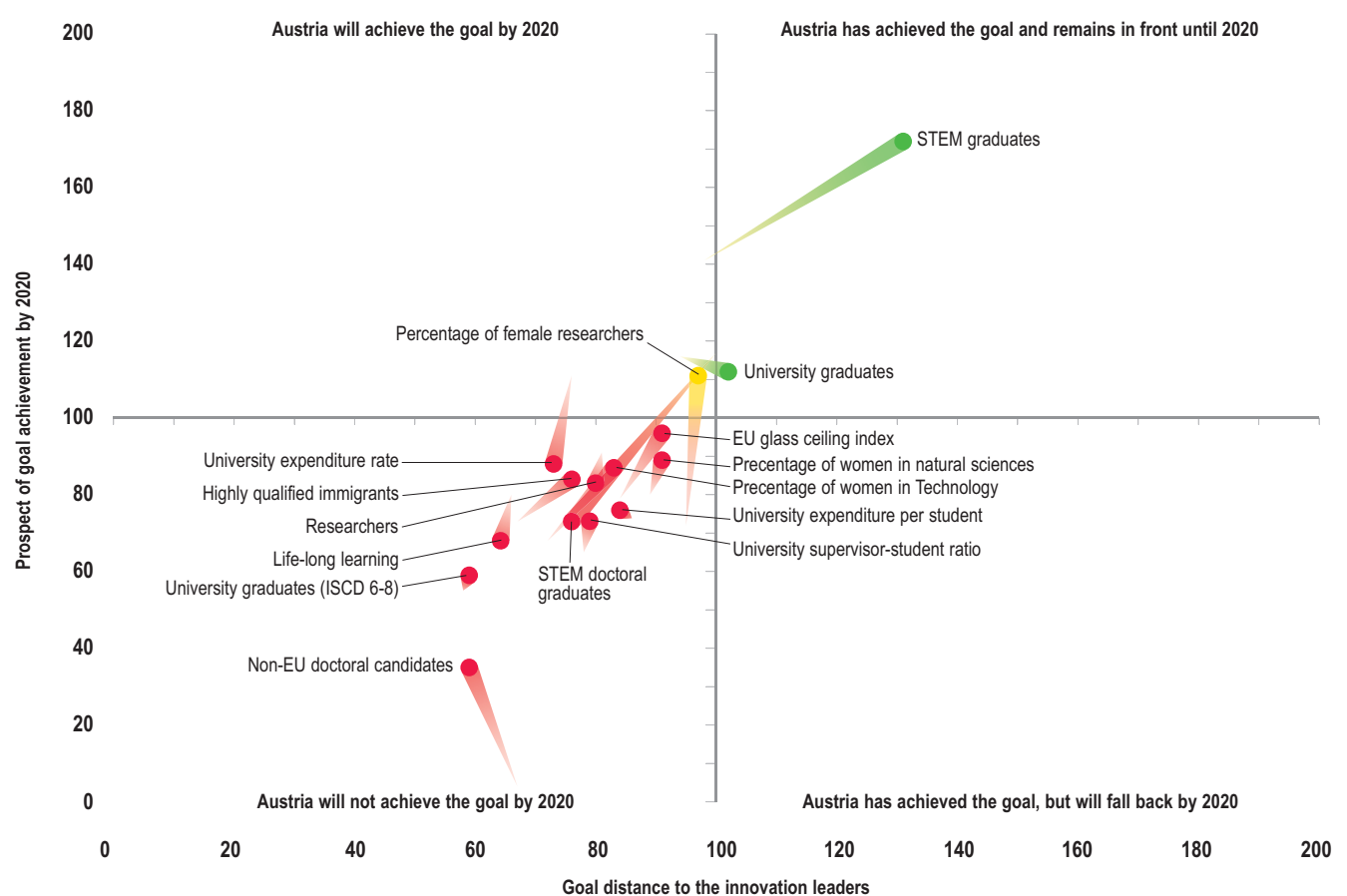
<sup>58</sup> For Austria: Work Programme of the Austrian Federal Government 2017/2018. Vienna 2017, pp. 16 ff.

### Tertiary Education System

In the tertiary education area, Austria's basic position compared with the comparison countries has not changed significantly since 2010. With the Netherlands' move into the group of innovation leaders, however, we can see a significantly adjusted trend for some specific indicators in places, compared with previous years, which, generally speaking, causes a slight deterioration for Austria. On the whole it can

be seen that Austrian performance in the tertiary education system is better than that of the leading nations with only two of the fifteen indicators. Considered in detail, the "STEM Graduates" indicator underwent the most significant increase, which, however, is due in large part to a change in the ISCED classification, which results in a structural adjustment of the

**Figure 18: Development of goal distance and prospect of goal achievement in the tertiary education system**



Sources: See Appendix 1, WIFO presentation. Raw data, see Appendix 2. Explanation, see Appendix 3.

Note: Goal Distance = Austria's actual value relative to the national target or the Innovation Leaders' actual value (average value for the most recent available year for DE, DK, FI, SE); Prospect of Goal Achievement = Value projected for Austria in 2020 relative to the national goal or the value projected 2020. Scaling deviates to better illustrate.



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different university systems.<sup>59</sup> The 4th and 5th years of study of the vocational higher level schools are now added to the “University Graduates” indicator. With this alternative ISCED classification, the national goal of increasing the proportion of 30 to 34-year-old university graduates (“University Graduates” indicator) to more than 38 percent was already achieved in 2012.

The proportion of those graduates that are included to calculate the “University Graduates ISCED 6–8” indicator (bachelor, master and doctoral studies) with approximately 24 percent of the applicable age cohort continues to be low in Austria and clearly behind the leading nations, whose proportion in this respect is 41 percent. This relatively large discrepancy is, however, partially attributable to the above-mentioned structural differences between the individual university systems (i.e. which courses are situated at university level).

The “STEM Doctorate Holders” indicator is also relatively far behind the innovation leaders’ average. Per 1,000 inhabitants in Austria, this has been stable at a value of 0.9 for some years now. The innovation leaders have, however, successively increased this (with the exception of the Netherlands) to 1.5 per thousand, which is why Austria has fallen very far behind in comparison.

University expenditure in particular is also worth mentioning in this respect. Despite the budgetary increases for the universities as part of past performance agreements and a valorisation of the funding rates for study courses at universities of applied sciences, to date it has not been possible to close the distance to the leading nations. The university expenditure rate has stagnated at a value of approximately 1.47 or 1.75 percent of GDP, respectively.<sup>60</sup> As in the current federal financial framework approximately EUR 3.8 billion is lacking for the university sector, it is unlikely that the goal of achieving a university expenditure rate of 2 percent by 2020 will be achieved.<sup>61</sup> The Austrian Council believes it is a serious failure that neither the Federal Government’s 2017/2018 Work Programme nor the “Research Package” specifically address this issue.

As, in relation to the leading nations the “university expenditure per student” has also been stagnant since 2010, the “Supervisor-Student Ratio (University)” indicator coupled indirectly with this development also misses its goal of coming close to the supervision intensity of the universities in the comparison countries. It must therefore be emphasised as especially positive that the Federal Government’s Work Programme adopted in January addresses some of the most important points in this area – keywords: Optimisation of supervisor-student ra-



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<sup>59</sup> Since the 2012 report year, a revised version of the ISCED classification (ISCED 2011) has been used, which influences the delimitation of the higher education sector from the secondary education sector. The ISCED 1997 classification was used up to and including 2011, which, as a result of the tertiary sector incorporates the ISCED levels 5A, 5B and 6 (universities, technical colleges, teacher training colleges, university courses, trades colleges, etc.). Since 2012, the ISCED 2011 classification has been applied, whereby the 4th and 5th years of the vocational higher level schools are allocated under ISCED Level 5 to the tertiary sector. Together with the ISCED Level 6–8 (which includes bachelor, master and doctoral studies), this education area therefore now forms the tertiary sector.

<sup>60</sup> The difference is caused here by different approaches – university expenditure according to ISCED 1997 or ISCED 2011.

<sup>61</sup> Accumulated additional expenditure, which would have been required for 2016–2020 to achieve the target rate of 2%, with a 78% contribution from federal funding to university expenditure; see Hofmann, K. and Janger, J.; Research rate targets 2020, update 2017, WIFO, as commissioned by the Austrian Council.

tios and study place financing.<sup>62</sup> The Austrian Council believes consistent implementation in this respect until 2020 will very much enable substantial improvements. A prerequisite here, however, is a consistent increase in basic financing of the universities. As a result and with the

increase in the university expenditure rate to 2 percent of GDP, positive effects on the “Research at Universities and Non-University Research Institutions” area can also be achieved.

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### **Recommendations of the Austrian Council for Achieving the Goals of the RTI Strategy in the Tertiary Education System**

The Austrian Council urgently recommends the goal formulated by the Federal Government on the basis of a resolution proposal of the National Council in its Work Programme 2013 to 2018 to raise the **university expenditure rate by 2020 to 2 percent of GDP** be vigorously pursued. The **basic funding** for universities to improve teaching and research conditions must be increased for this for the performance agreement period 2019–2021 by at least EUR 1.4 billion.<sup>63</sup>

The Austrian Council also recommends the swift implementation of the study place financing announced in the Federal Government’s Work Programme, on the basis of capacity-

oriented **study place management** and sufficient budgetary resources. An appropriate adjustment of the universities’ autonomy to the existing framework conditions with regard to **capacity-oriented study access** and to improving study conditions should be defined in the respective legislation.

Ultimately the Austrian Council recommends, in accordance with the commitment of the Federal Government to improving the staff-student ratio at universities, that the number of scientific teaching staff, especially **professors** and equivalent positions be increased continually and that the budgetary funds required for this be provided.

62 For Austria: Work Programme of the Austrian Federal Government 2017/2018. Vienna 2017, pp. 15 ff.

63 The Austrian Council for Research and Technology Development’s recommendation on funding universities and public sector research and development in Austria in the federal funding framework 2017 to 2020, chapter, “Science and Research” of 5 February 2016.

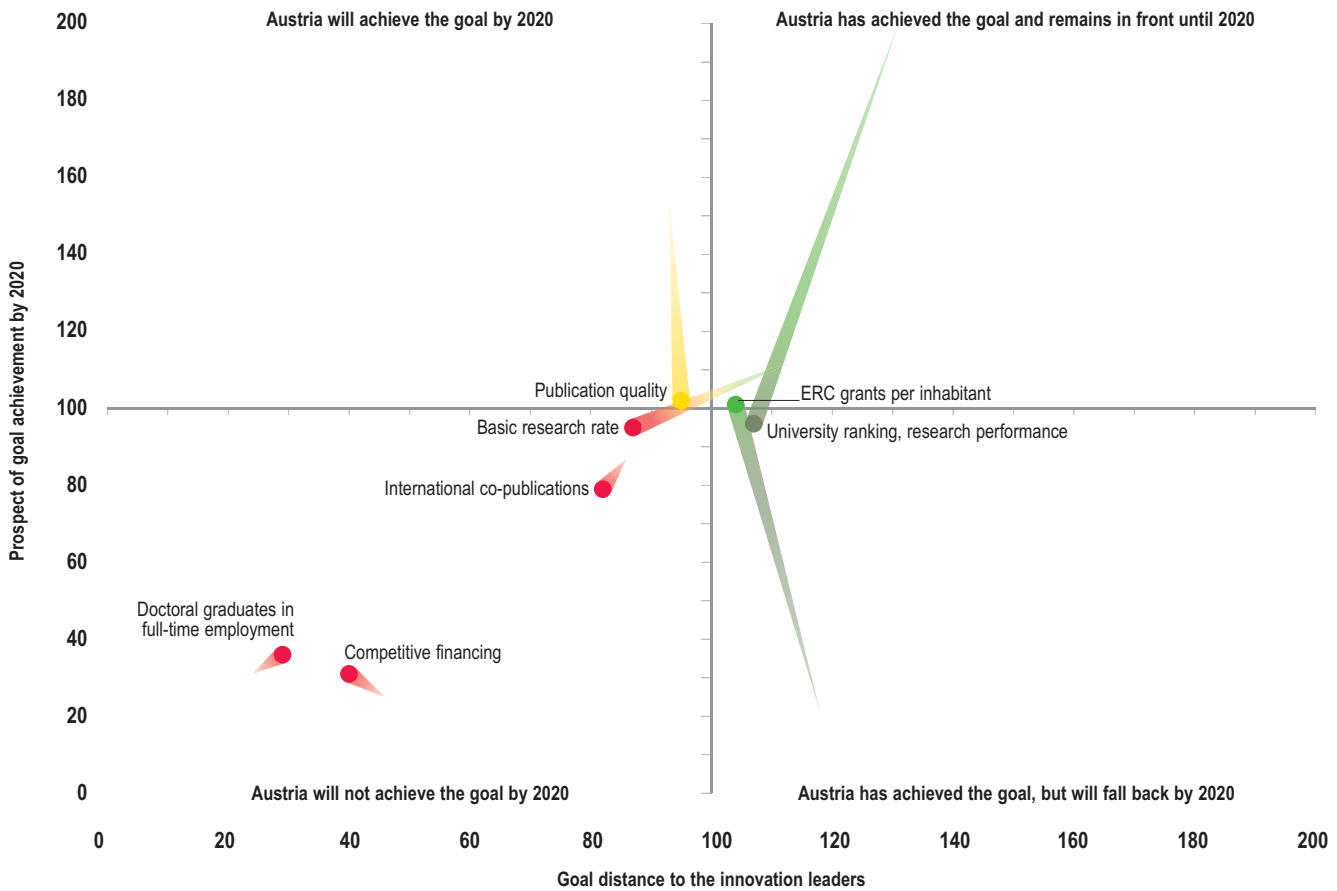
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**Research at Universities and Non-University Research Institutions**

The developments in the area of research at universities and non-university research institutions tend to be rather negative compared with the innovation leaders. Although two of the total of seven indicators for this area have been relatively stable within the target area since 2010,

the development trends tend to indicate that this situation could change again by 2020. The dynamic of the other indicators is either stagnant or declining compared with 2010. It is therefore unrealistic that the corresponding objectives of the RTI Strategy can be achieved. On the whole these findings are cause for concern,

**Figure 19: Development of goal distance and prospect of goal achievement in the area of research at universities and non-university research institutions.**



Sources: See Appendix 1, WIFO presentation. Raw data, see Appendix 2. Explanation, see Appendix 3.

Note: Goal Distance = Austria's actual value relative to the national target or the innovation leaders' actual value (average value for the most recent available year for DE, DK, FI, NL, SE); Prospect of Goal Achievement = Value projected for Austria in 2020 relative to the national goal or the value projected for the innovation leaders 2020.

as university and non-university research, and especially in the area of basic research, is a fundamental element of the RTI system.<sup>64</sup>

Together with the non-university research institutions, with a share of approximately 71 percent, the universities are the most important research establishments in basic research in Austria.<sup>65</sup> Very welcome in particular are the continuing successes in securing ERC grants in the university and non-university sector. The Leiden Ranking, on which the “University Ranking/ Research Performance” evaluation is based, also accredits Austria’s universities a good position in the comparison with the innovation leaders, whereby, however, we can see a sharply declining dynamic here. To counter this decline, sufficient resources for funding excellence in basic research must be guaranteed, as is also allowed for in the Federal Government’s “Research Package”.<sup>66</sup>

This is especially necessary because the input-oriented indicators in particular do not show any or only very small improvement. The rate target of the Federal Government for basic research is 0.94 percent of GDP. The Austrian basic research rate is currently 0.56 percent. Austria has indeed joined a group of scientific leading nations in the international comparison.<sup>67</sup>

As the comparison countries have, however, developed considerably more dynamically since 2010, Austria has fallen back here in relation to the others. There has been a special catch-up requirement for some years now in the area of resources awarded in competition to fund basic research (“Competitive Funding” indicator) compared with the leading nations. In Austria, approximately EUR 24 is spent on this per inhabitant; with the innovation leaders it is an average of approximately EUR 60. Finland and Sweden are the top achievers with EUR 75 per inhabitant. The Austrian Council therefore expressly welcomes the increase in competitive funding for basic research announced in the “Research Package”. The Council does, however, point out that this measure still, as before, omits a secured funding basis.<sup>68</sup> The increase in the number of career opportunities and qualified positions has also been a difficult issue for some years now. Structured doctoral programmes not only ensure professional scientific training for young researchers with positive effects for later research quality, they also make a significant contribution to bringing scientific talent to Austria, as is the exemplary case with IST Austria, for example. The “Doc-

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64 For this, see Keuschnigg, C. / Ecker, B. / Sardadvar, S. Reiner, C. (2017): Innovation nation Austria – R&D, corporate development and location attractiveness. Study commissioned by the Austrian Council for Research and Technology Development. Vienna, pp. 65 ff.; and Janger, J. / Böheim, M. / Falk, M. / Falk, R. / Hölzl, W. / Kletzan-Slamanig, D. / Peneder, M. / Reinstaller, A. / Unterlass, F. (2010): Research and innovation policy after the economic crisis. In: WIFO-Monatsberichte, 83 (8); pp. 675–689.

65 Statistic Austria: Expenditure for R&D 2013 according to implementing sectors and types of research.

66 Federal Ministry of Transport, Innovation and Technology / Federal Ministry of Science, Research and Economic Affairs: Presentation to the Cabinet on 8 November 2016 regarding a package of measures developed by Work Group 5: Research, Technology, Start-ups, pp. 3 ff.

67 Denmark, France, Italy, Japan, South Korea, China and the US are evaluated as comparison countries. Austria already has the third highest basic research rate; only Switzerland and South Korea are clearly ahead of Austria. See Hofmann, K. and Janger, J.; Research rate targets 2020, update 2017; fig. 19; WIFO, as commissioned by the Austrian Council.

68 Federal Ministry of Transport, Innovation and Technology / Federal Ministry of Science, Research and Economic Affairs: Presentation to the Cabinet on 8 November 2016 regarding a package of measures developed by Work Group 5: Research, Technology, Start-ups, p. 3.



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toral Candidates with Employment Contracts” indicator, however, is stagnant in the entire monitored period. It must be assumed, however, that the expan-

sion of structured doctoral programmes with the EUR 30 million provided as part of the Higher Education Area Structural Funding from 2017 will improve the situation.

**Recommendations of the Austrian Council for achieving the goals of the RTI Strategy in the area of research at universities and non-university research institutions**

In order to broaden the spearhead of superb research in Austria and to improve the research conditions of Austria as a science location, in addition to the **increase in the competitively awarded funds for basic research** defined in the Federal Government’s “Research Package”, the Austrian Council also urgently and emphatically recommends this be targeted at the level of the leading nations. In this context, the **contin-**

**uance of the excellence initiative in basic research** (special research areas – SRAs, among others) should also be guaranteed with the provision of sufficient budgetary resources. Furthermore, the Austrian Council also recommends funding to guarantee an **increase in career positions and structured doctoral programmes**, to ensure attractive conditions for international researchers and candidates.

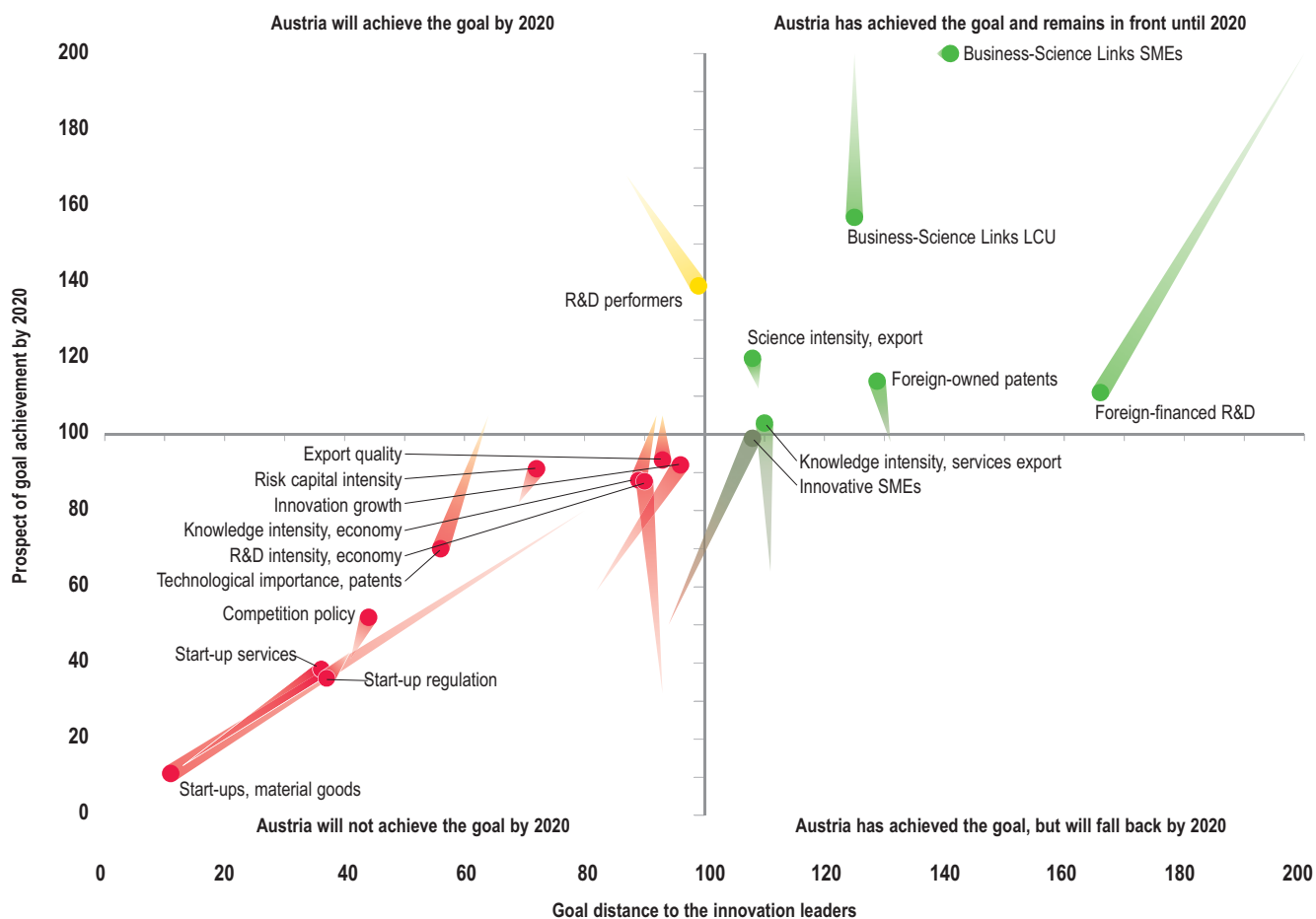
## Research and Innovation in the Corporate Sector

There have not been any major changes in the overall situation on the indicators landscape of the corporate area compared with 2010.<sup>69</sup> Of the 9 of the 19 indicators that are in the goal area

or on the goal line, most had already achieved the goal or were at least in the final stage of doing so since the base year. Approximately half of the indica-

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**Figure 20: Development of goal distance and prospect of goal achievement in the area of research and innovation in the corporate sector**



Sources: See Appendix 1, WIFO presentation. Raw data, see Appendix 2. Explanation, see Appendix 3.

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

Prospect of Goal Achievement = Value projected for Austria in 2020 relative to the national goal or the value projected for the innovation leaders 2020.

<sup>69</sup> The indicators in the corporate sector make special consideration of the Austrian economic structure with a high proportion of less science-related industries with medium or medium-high technology intensity, in which Austria remains competitive with top quality (indicators on export quality, knowledge and R&D intensity). The Austrian innovation system also has the specific feature of a high level of foreign R&D financing.



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tors for measuring performance in research and innovation are in the corporate sector at the level of the leading nations or above. On the whole, “Research and Innovation in the Corporate Sector” is therefore clearly still the most successful of the Austrian RTI system.

With its share of the collaborations by businesses with universities, Austria has for some years now been by far ahead of the leading nations and is currently the European frontrunner. In the area of knowledge-intensive export, the Austrian level has also been stable above the innovation leaders’ average since 2010.

The almost doubling in venture capital intensity is very welcome. The positive development in the venture capital area suggests that a series of both private and public sector initiatives in recent years are now starting to take effect. This is also demonstrated by the results of the current Global Entrepreneurship Monitor for Austria.<sup>70</sup> Also to be welcomed is the increase in innovative SMEs coupled with a rise in turnover from innovation. The R&D intensity of the economy has increased on the whole, and is now close to the average value of the European innovation leaders. The measures for funding the innovation performance of Austria’s SMEs are evidently having an effect.

We must not, however, lose sight of the fact that the indicators for venture capital intensity and for innovation performance of the Austrian

SMEs are still below the level of the innovation leaders, and their dynamic will not achieve this level by 2020 either. This is due not least of all to the, according to AVCO, lack of attractiveness of the “Austria location” for private venture capital.<sup>71</sup> The body politic is urgently required to create more attractive framework conditions here, both to bring investors to Austria, and to mobilise potential private Austrian investors, such as for example 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.<sup>72</sup> A point in this context is certainly also the regulations governing start-ups, which as figure 19 shows, remain unchanged in their prospect of goal achievement and far behind the innovation leaders. There is still an urgent requirement for action here.

The Austrian Council therefore welcomes the measures package for funding innovative start-ups proposed in the Federal Government’s Work Programme.<sup>73</sup> However, when identifying topical areas, the Austrian Council believes that this is primarily a manifestation of the status quo, which might also serve to solidify this status, which in turn could inhibit the development of new areas of strength. Any definition of topical areas should also leave scope for new definitions, as unexpected, mostly disruptive innovation potential can often be revealed here in particular.



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*See Appendix – Page 101*

70 GEM Austria 2016.

71 Der Standard (18 May 2106): Start-ups: Still too little venture capital in Austria.

72 See, for example, Peneder, M. (2013): From the “dry valleys” of venture and growth funding. In: WIFO-Monatsberichte, 86 (8); pp. 637–648.

73 For Austria: Work Programme of the Austrian Federal Government 2017/2018. Vienna 2017, pp. 13 f.

## Recommendations of the Austrian Council for achieving the goals of the RTI Strategy in the area of research and innovation in the corporate sector

The Austrian Council recommends the **funding package for start-ups** be better coordinated and access for entrepreneurs be made easier. Just a few programmes of critical financial spending should be offered. More intensive communication and publication work is also required, as is increased coordination between the funding of offer service and the advisory service.

The Austrian Council recommends setting up a central and highly visible **contact point for innovative entrepreneurs** for each region (with the appropriate adjustment of the existing AplusB centres or adjustment of the services of the Economic Chamber's start-up service) and that the **bureaucratic and regulatory framework conditions for funding start-ups must also be continuously improved.**

The Austrian Council supports measures to further reduce debt relief after insolvency and liquidation times for honest entrepreneurs, so that failed start-ups get a second chance quicker than they used to.<sup>74</sup> For this reason, the current **move towards the amendment on personal bankruptcy**

(as laid down in the Austrian "Insolvenzordnung") in the Federal Government's Work Programme is also very welcome.

The Austrian Council recommends **tax relief and support with social security funds in wage moderation.** It therefore welcomes the current proposal in the Federal Government's Work Programme.<sup>75</sup> This is, however, limited to three years and intended for all businesses. To also contribute structural effects, these measures should be arranged for the **start-up area** as a permanent facilitation.

In addition to funding by banks, the Austrian Council also recommends developing **funding options for innovative entrepreneurs and SMEs.** A rethinking of mechanisms such as tax breaks for investments in young companies, accompanied by corresponding legal framework conditions is required to increase equity capital intensity from the private side.

For implementation, we would refer to the Austrian Council's individual recommendations in this respect.<sup>76</sup>

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<sup>74</sup> See European Commission (2014): Trade and Industry, SBA data sheet 2014, AUSTRIA.

<sup>75</sup> For Austria: Work Programme of the Austrian Federal Government 2017/2018. Vienna 2017, p. 3 f.

<sup>76</sup> Recommendation of the Austrian Council for Research and Technology Development on the amendment to the Alternative Investment Fund Manager Act (AIFMG) of 6 March 2014; Recommendation of the Austrian Council for Research and Technology Development to optimize RTI-related start-ups of 19 November 2012; Recommendations of the Austrian Council for Research and Technology Development for the efficient implementation of research results in innovations, to create suitable framework conditions for private equity, and to introduce a tax exempt participation amount (all of 24 November 2011).

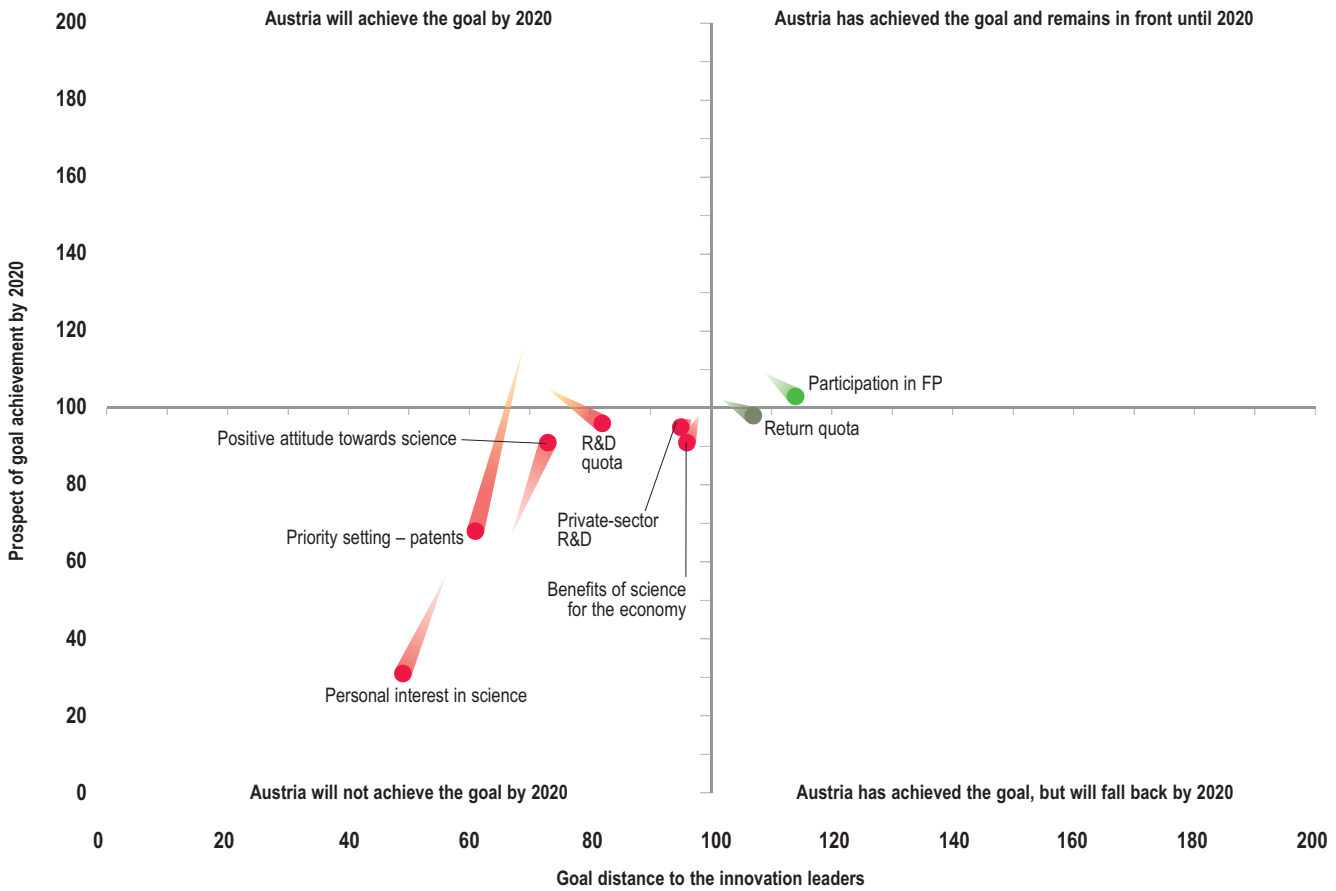
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**Governance and Financing of the RTI System**

The overall situation in the area of governance and financing of the RTI system has changed very little since 2010. Of this area's eight indicators, two are continuously above the average level of the innovation leaders. All other indicators show a significant distance in places to the goal area and demonstrate a development dynamic that actually rules out objective achievement by 2020. It must, however, be

pointed out that the majority of the goals set in this chapter cannot be mapped by indicators. On the basis of the prioritisation of this report of the priority objectives of the RTI Strategy, these areas will not be considered here in detail. As in past years, the two indicators for the participation in the EU framework programmes and the return quota are above the average of the leading nations. Support offered for the long term and advice for domestic researchers

**Figure 21: Goal distance and prospect of goal achievement in the area of governance and financing of the RTI system**



Sources: See Appendix 1, WIFO presentation. Raw data, see Appendix 2. Explanation, see Appendix 3.

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

Prospect of Goal Achievement = Value projected for Austria in 2020 relative to the national goal or the value projected for the innovation leaders 2020.

in securing and managing international projects must be welcomed as an important contribution. This support also continues to be necessary to succeed in European competition and consequently maintain a high return quota. The Council therefore welcomes the expansion of appropriate activities as provided for in the Federal Government's "Research Package".<sup>77</sup>

The situation in the area of science and society has not changed since 2010. The corresponding indicators continue to be below the level of the leading nations. It therefore remains an urgent task of the entire RTI system, despite all initiatives already established, to further improve the image of science and research among the general public with various awareness activities, and to position research as an attractive field to work in. As the Austrian public is defined in all international comparisons and surveys as not very scientific and above-average technology-unfriendly, the Council believes it is unfortunate that no attention was paid to this in the Federal Government's Work Programme and in the "Research Package".

The funding of research, technology and innovation is an important cornerstone in achieving the objectives of the RTI Strategy. The extensive stagnation in this area is therefore a problem, which the Austrian Council has repeatedly drawn attention to in its previous performance reports, as well as in other contexts.<sup>78</sup> As figure

20 shows, sufficient dynamic is not identified with the two key indicators for financing ("R&D Quota", "R&D Private") to achieve the goal of being above the innovation leaders' average by 2020.

This observation is confirmed by recent study results, which outline the required path to achieving the research quota goal of 3.76 percent by 2020.<sup>79</sup> For this to happen, R&D spending would have to increase from currently EUR 10.7 billion to approximately EUR 15 billion in 2020 (see figure 22).

The current distance to the goal value, which is the result of a uniform increase in expenditure since 2011 to achieve the goal in 2020, amounted in 2016 to 0.24 percentage points. This is equivalent to EUR 851 million or 7.9 per cent of the estimated global expenditure in 2016. By assuming two different scenarios (pessimistic/optimistic), the rate in 2020 will be between 3.13 per cent (pessimistic scenario) and 3.36 per cent (optimistic scenario).

It is therefore a very positive signal that the Federal Government's Work Programme has specified that research expenditure in Austria will now actually increase towards the goal of 3.76 percent of GDP.<sup>80</sup> This will be done by building on the "Research Package" adopted by the Cabinet and the research billion defined in it. It specifies that a total of EUR 700 million will be additionally invested by the public

## RTI Strategy areas of action

## RTI Strategy Objectives *See Appendix – Page 102*

77 Federal Ministry of Transport, Innovation and Technology / Federal Ministry of Science, Research and Economic Affairs: Presentation to the Cabinet on 8 November 2016 regarding a package of measures developed by Work Group 5: Research, Technology, Start-ups, p. 3.

78 Recommendation on funding universities and public sector research and development in Austria in the federal funding framework 2017 to 2020, chapter, "Science and Research" of 5 February 2016; Recommendation on funding research and development in Austria of 30 May 2016; Recommendation on funding education, research and innovation in Austria of 5 Sept. 2016; Recommendation on setting budgetary priorities in Austria of 19 Dec. 2016.

79 Hranayai, K. / Janger, J. (2017): Research rate targets 2020. Study commissioned by the Austrian Council for Research and Technology Development. Vienna, WIFO.

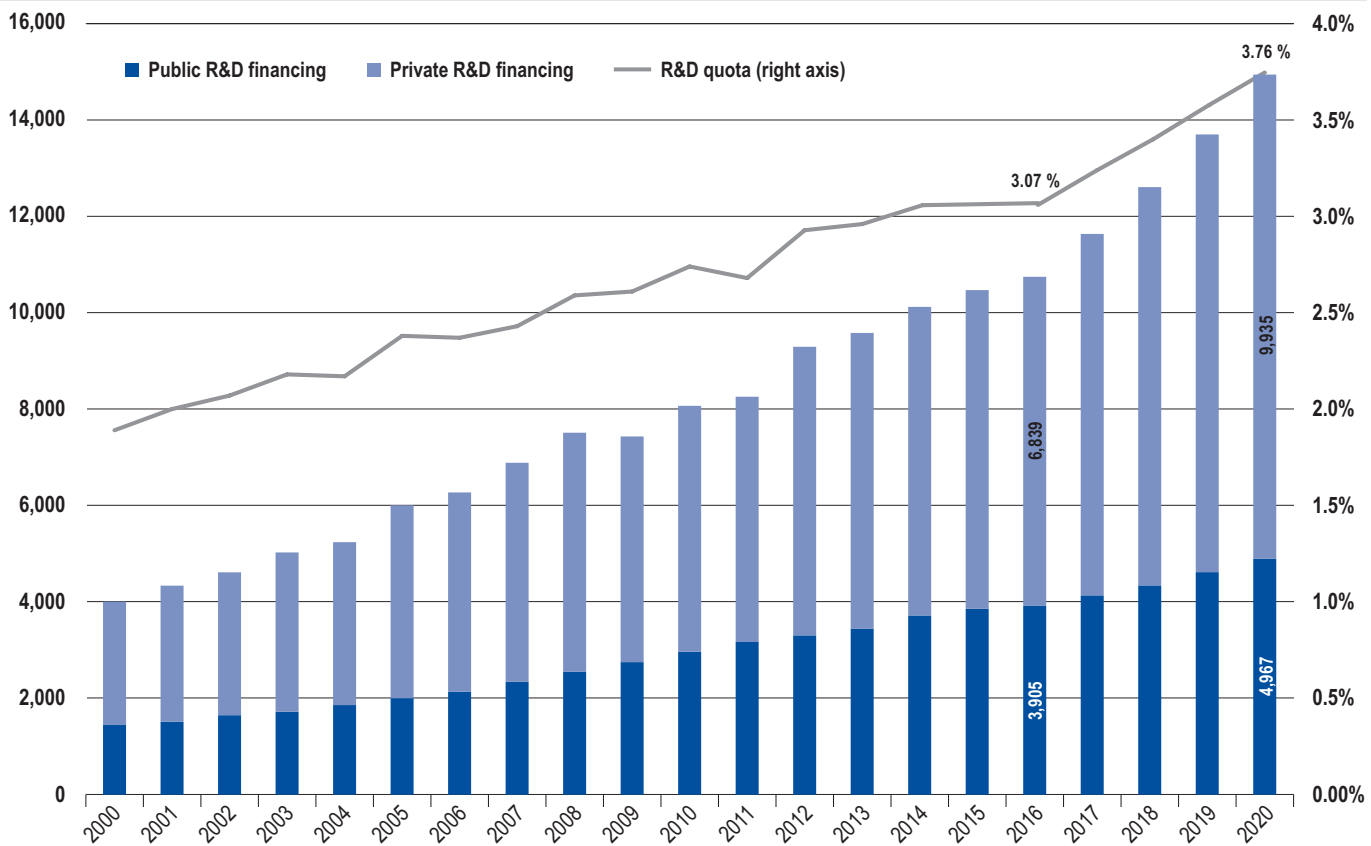
80 For Austria: Work Programme of the Austrian Federal Government 2017/2018. Vienna 2017, pp. 16 ff.

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sector in the Austrian RTI system by 2021.<sup>81</sup> Targeted research funding with high leverage effect, whereby in the “Research Package” the increase in the research premium is also subsumed, will also stimulate an additional EUR 500 million from private financing sources. At first glance this looks extremely promising. On closer examination, however, the

measures package reveals itself to be “dreams of the future”, as only 16.4 of the EUR 700 million are earmarked for 2017. The rest depends on how expeditious the implementation of the federal financial framework by 2021 is. It is also totally unclear what leverage effect the planned increase in the research premium will reveal; the results of the evaluation of the research premium by the BMF do at any rate give

**Figure 22: Financing method to achieve the R&D quota target of 3.76 percent in 2020, in EUR millions**



Source: WIFO research rate targets 2020.

<sup>81</sup> Federal Ministry of Transport, Innovation and Technology / Federal Ministry of Science, Research and Economic Affairs: Presentation to the Cabinet on 8 November 2016 regarding a package of measures developed by Work Group 5: Research, Technology, Start-ups, p. 9.

cause to doubt any high expectations in this respect. It therefore remains to be seen when and how the increase in the research quota will actually manifest itself.

The same also applies for the RTD National Foundation. As an important strategic element of research funding in recent years, it was no longer capable of performing its function to any degree of satisfaction due to its difficult financial situation. The Austrian Council therefore welcomes the creation of a legislative basis provided for in the Federal Government's

2017/2018 Work Programme for the annual funding of the National Foundation over the next three years with EUR 100 million per year from the Jubilee Fund of the National Bank. It will however be important to ensure longterm budget security that goes beyond these three years. The Austrian Council also believes the National Foundation should also be amalgamated with the "Austria Fund" to utilise funding and administration-related synergies.<sup>82</sup>

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### **Recommendations of the Austrian Council for achieving the goals of the RTI Strategy in the areas of governance and financing**

Despite diverse existing initiatives, the Council reiterates its recommendations for the further significant **expansion of dialogue activities in society** as a whole. Researchers should be given an incentive to contribute personally to the dialogue with society, especially for career opportunities, in order to awaken interest for science and research on all levels of the general public. The Austrian Council urgently recommends the immediate implementation of the measures for achieving both quota targets (**2 per cent for the tertiary area and an R&D quota of 3.76 per cent by 2020**), as defined in the Federal Government's Work Programme and in the "Research Package". This is necessary because only a continuous increase in expenditure will guarantee sustainable growth in science and research. For implementation we would refer to the **Austrian Council's individual recommendations** in this respect.<sup>83</sup>

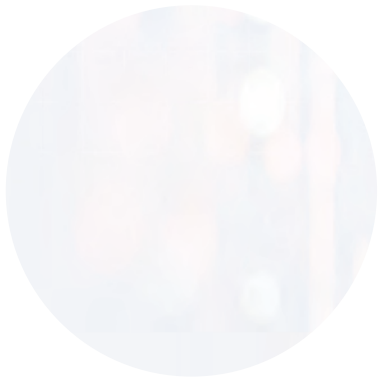
The Austrian Council recently recommended, as also intended with the Federal Government's

"Research Package", concentration of the use of public sector resources and mechanisms on increasing the leverage effect to **raise the incentive effect on private R&D expenditure** and for raising the private financing share. In addition to the mechanisms of direct research funding, with which substantial additionality effects have already been achieved, indirect research funding in particular has a higher funding leverage effect. In this context the Austrian Council in particular welcomes the initiatives to increase the private financing share, such as the public benefit package, for example, the crowdfunding initiatives and the change in taxation law to reinforce public benefit institutions.

The Austrian Council also recommends allocating the Nationalstiftung ("National Foundation") more funds longterm in line with the original financial allocation. The National Foundation should also be amalgamated with the Österreich-Fonds ("Austria Fund") to utilise funding and administration-related synergies.

82 Recommendation on setting budgetary priorities in Austria of 19 Dec. 2016.

83 The Austrian Council for Research and Technology Development's recommendation on funding research and development in Austria of 30 May 2016; The Austrian Council for Research and Technology Development's recommendation on funding for education, research and innovation in Austria of 5 September 2016; The Austrian Council for Research and Technology Development's recommendation on budgetary priority setting in Austria of 19 December 2016.





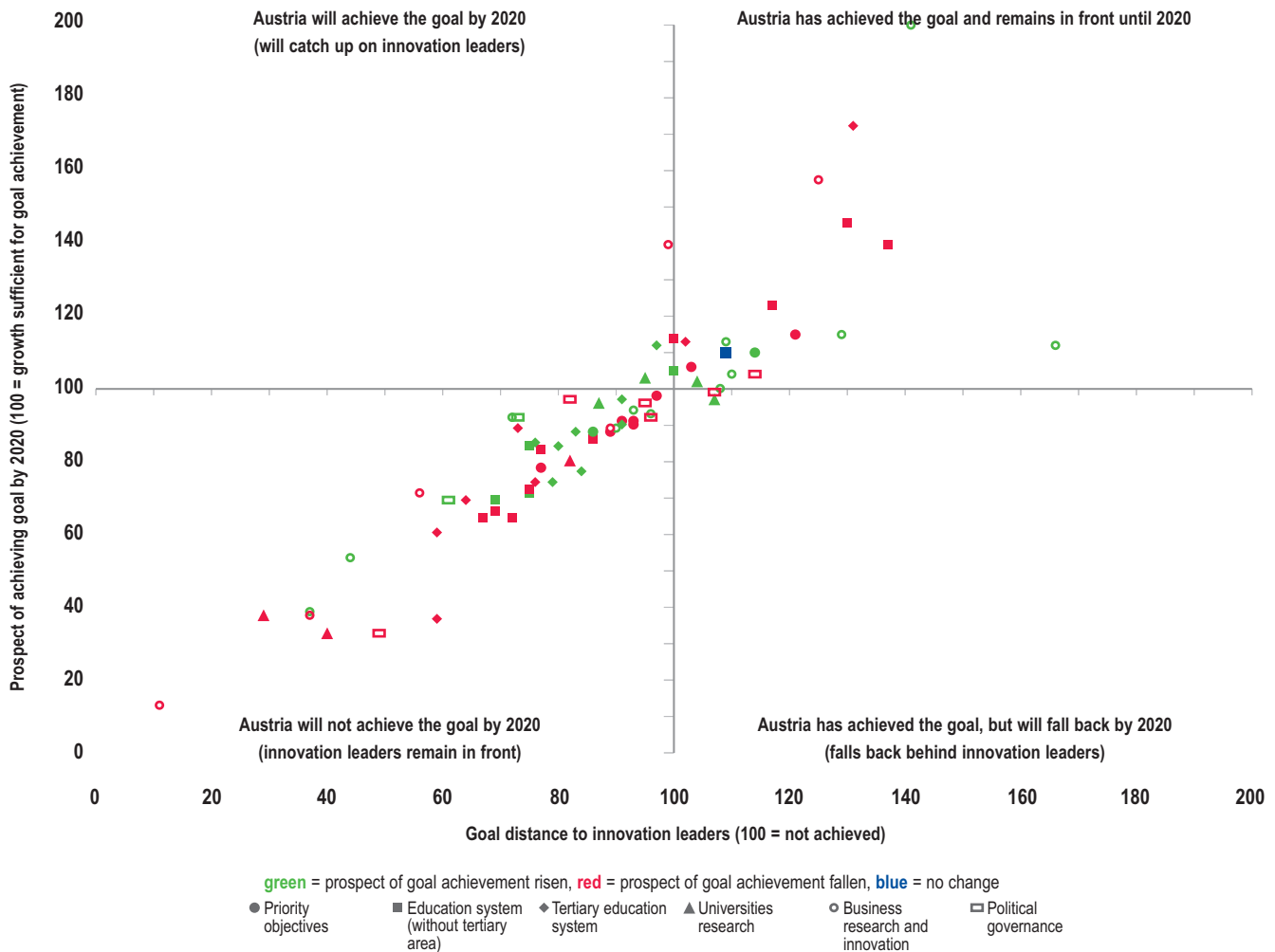
summary

### Key Results

The performance of the Austrian RTI system compared with the leading innovation nations is illustrated in figure 23. This maps all indicators for the 74 objectives of the RTI Strategy in the com-

parison with the average level of the innovation leaders. This provides a good overview of Austria's performance in all areas of the RTI strategy in relation to the leading nations. The figure illustrates the areas in which the objectives

**Figure 23: Overview of Austria's performance in all areas of the RTI strategy and in relation to the leading nations**



Sources: See Appendix 1, WIFO presentation. Raw data, see Appendix 2. Explanation, see Appendix 3.

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

Prospect of Goal Achievement = Value projected for Austria in 2020 relative to the national goal or the value projected for the innovation leaders 2020.

of the RTI Strategy have been achieved and Austria's performance and development dynamic is better than that of the innovation leaders – all indicators in the right top quadrant – and in which it is behind the leading nations without a realistic chance of achieving the level of the leading nations by 2020 with development trends remaining as they are (all indicators in the left bottom quadrant).

It is quite clear that the greater part of the indicators are in the left lower quadrant of figure 23. This overall situation has not changed much since 2010. This means that Austria's catchup dynamic is insufficient on the whole to achieve the objectives of the RTI Strategy and the level of the innovation leaders. Those areas that will not achieve their objectives by 2020 as they currently stand, predominantly affect the problem areas of the Austrian innovation system already addressed several times by the Austrian Council:

- Education aspects from the early childhood area to higher education area (social selection, quality, supervision ratio).
- Structural problems at universities (insufficient funding, bad supervision ratios, bad scoring in places with research output and in research rankings).
- Weak start-up dynamic and growth of innovation-intensive young companies, connected with a slow structural change towards knowledge-intensive industries.
- Orientation of innovation efforts towards environment and society.
- Financing aspects in the area of university expenditure, competitively awarded funds for basic research and the private sector share of funding.

The overview in table 2 illustrates the insufficient level of goal achievement with regard to the objective of the RTI Strategy. On the whole, positive trends can only be seen in about half of the goal areas, i.e. only 47 per cent of the indicators show an improvement in the goal distance and prospect of goal achievement com-

pared with 2010. Across and beyond all areas the average goal distance (87) from the innovation leaders (=100) has remained almost unchanged compared to 2010 below the dynamic required to achieve the goal. It is therefore quite clear that the development process of all indicators is currently insufficient. With Austrian innovation performance on the whole there continues to be a catchup requirement if the Federal Government's goal of joining the innovation nations is to be achieved.

As table 2 shows, compared with the base year 2010 the overall findings have deteriorated on the whole. For all indicators of the 74 objectives of the RTI Strategy taken together, the average goal distance is greater by 1 percent and the prospect of goal achievement is smaller by 7 percent. Comparable positive developments can only be seen for one area of the RTI Strategy: the education system (without tertiary area). In this area goal distance and prospect of goal achievement have improved since 2010 with 73 percent of the indicators. In the other areas there were positive changes with a maximum of half of the indicators – for the most part even with less than 50 percent of the indicators.

The area of "Research at universities and non-university research institutions" currently scores the worst. Goal distance (79) to the leading nations continues here at the highest and the prospect of goal achievement (77) at the lowest.<sup>84</sup> With an unchanged trend in 2020 only 29 percent of the objectives in this chapter of the RTI Strategy will be achieved. Measured on the percentage of indicators that will have achieved the goal by 2020, the areas of "Tertiary Education System" with 20 percent and "Governance and Financing" with just 13 percent are still significantly further behind.

In contrast to this, measured on the level of goal achievement, the area of "Research and Innovation in the Corporate Sector" currently displays the best performance. On the basis of the relatively good development dynamic, it

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<sup>84</sup> See Appendix 3 for an explanation of these values.

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will also be the area in which most objectives of the RTI Strategy are achieved by 2020. From today's point of view then, 42 percent of the indicators will have achieved or exceeded the average level of the innovation leaders.

This report has dealt with the developments relating to the priority objectives of the RTI Strategy in particularly great detail. As already mentioned, in this area the level of the innovation leaders was achieved or exceeded with only three of the ten indicators, whereby nothing will change by 2020 either with the development trend remaining as it is. From today's point of view the development dynamic with the other 7 indicators does not appear to be sufficient to get close to the leading nations. On the contrary, the trend is predominantly declining.

With the priority objectives the average goal distance and the prospect of goal achievement are actually just below the average level of the innovation leaders, which on the whole makes it the most successful sub-area of the RTI Strat-

egy. compared with previous years, however, there has been a distinct decline, as in the first years after the RTI Strategy was adopted this area was the only one in which the average goal distance was above the level of the comparison countries. The situation also looks considerably less positive when we look at the percentage of indicators that will be in the goal area by 2020. As it stands today that will only be 30 percent.

When interpreting the results it must be remembered that Austria's performance in this context is not only influenced by RTI activities. And yet even if numerous factors generally have effects on the respective performance, RTI activities and the measures defined in the RTI Strategy can nonetheless emphasise key points in all areas.

In summary, therefore, the development of Austrian performance in the area of priority objectives of the RTI Strategy cannot be evaluated as especially positive. Seven of the 10 indicators used for this area are currently significantly below the level of the leading nations of Denmark,

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

	Number of objectives	Average GD	Average PGA	Goal achievement 2017: percentage of indicators	Goal achievement 2020: percentage of indicators	Indicators risen in %	Indicators fallen in %	Average GD change in percentage points	Average PGA change in percentage points
Total	74	87	89	30%	30%	49%	50%	-1	-6
Priority objectives	10	97	94	30%	30%	40%	60%	-4	-9
Education	15	90	98	33%	33%	73%	20%	6	16
Tertiary education	15	83	87	13%	20%	53%	47%	2	4
Research at universities	7	78	77	29%	29%	43%	57%	-10	-13
Corporate innovation	19	90	94	42%	42%	47%	53%	-3	-13
Governance and financing	8	85	84	25%	13%	13%	88%	1	-20

Sources: See Appendix 1, raw data see Appendix 2. Note: Average innovation leaders (IL) = 100- Average goal distance (GD): Where is Austria currently relative to the ILs? Average prospect of goal achievement (PGA): Where will Austria probably be in 2020 relative to the ILs, on the basis of development in the past? Goal achievement 2016: What proportion of the goals have currently been achieved? Goal achievement 2020: What proportion of the goals will probably be achieved in 2020?

Germany, Finland, the Netherlands and Sweden. And the development dynamic does not allow us to conclude that this will change significantly by 2020. Performance compared with the leading nations also diminished with 60 percent of the indicators since 2010. This is the second worst value of all areas of the RTI Strategy – only the “Governance and Financing” area showed an even sharper fall with 88 percent. With above-average high GDP per capita, continuously falling energy intensity and a comparably low unemployment rate, only three of the indicators show performance above the level of the leading nations. The other indicators also show a declining development dynamic, with the exception of the greenhouse gas emissions indicator. This means that Austria’s distance to the innovation leaders has increased in most areas, contrary to the intentions of the RTI strategy. In this context innovation performance in particular has predominantly deteriorated since 2010. Austria clearly has not been able to successfully utilise the relatively favourable starting position in 2010, as indicated by the RTI Strategy.<sup>85</sup>

### Conclusion and Recommendations

The overall findings of the Austrian Council compared with the reports on Austria’s scientific and technological performance of previous years have not changed. From today’s point of view the Federal Government’s priority goal of becoming one of the leading innovation nations by 2020 will not be achieved. Very little has changed in the implementation intensity of the RTI Strategy of recent years. In its previous reports the Austrian Council had therefore repeatedly emphasized that the Strategy’s measures require more specification and emphasis to achieve the objectives defined in the Strategy by 2020 in the intended form.

The Austrian Council therefore welcomes the recent decisions of the Federal Government, which in its Work Programme 2017/2018 adopted in January 2017 and in the Package of

On the whole, while considering the prospect of goal achievement, only 30 percent of all objectives of the RTI Strategy will be achieved by 2020. There is currently not one single area of the RTI Strategy in which both goal distance and prospect of goal achievement are above the average level of the innovation leaders. With this insufficient development dynamic, from today’s point of view it must therefore be assumed that the goals of the RTI Strategy cannot be achieved by 2020, and it must be assumed that Austria will not become an innovation leader.

Whether or not the recent initiatives of the Federal Government, defined in the Work Programme for 2017 and 2018 and in the “Research Package” can generate sufficient momentum to counter this accordingly cannot be conclusively determined from today’s point of view. The Austrian Council considers the signals received to be thoroughly positive, the actual implementation and secured financing in particular, however, have yet to take place.

Measures for research, technology and start-ups adopted by the Cabinet has taken important steps for the required intensification of the RTI activities. The Council believes the objectives and measures presented with these decisions are an expression of the Federal Government’s intention to afford greater importance to the topics of education, science, research, technology and innovation as key future-related factors for Austria than it has previously done.

In its previous reports on scientific and technological capability the Austrian Council has repeatedly emphasized and recommended the measures of the RTI Strategy be implemented with more emphasis to achieve the ambitious objectives. It has also urged the qualification of the objectives and specific budgetary provisions for individual measures several times. This has

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<sup>85</sup> The Federal Government’s RTI Strategy: The Path to Becoming an Innovation Leader. Vienna 2011, pp. 4 ff.



## summary

now been addressed accordingly by the Federal Government in its Work Programme 2017/2018 and the “Research Package”. All recommendations of the Austrian Council have also been accepted and proposals from its Performance Reports and its White Paper on controlling research, technology and innovation in Austria have also been accepted.<sup>86</sup> The Council believes this is all entirely positive.

The agreed upgrading of the RTI Task Force for the implementation of the RTI Strategy, which the Austrian Council emphatically welcomes, merits special mention here. The Council had already recommended this measure in 2013 in its White Paper and more recently as part of the Mid-Term Review in its Performance Report 2015. The Council believes a new policy development phase is required to achieve the goal of becoming an innovation leader. A package of reform steps must be pursued in place of the fragmented individual measures seen to date. This package must be harmonised with the entire RTI system. This, however, also requires stronger political commitment and a higher degree of political energy. The Austrian Council therefore believes the planned annual sessions of the Task Force at political level, with which the results of operative activity will be discussed and a work programme for the next year will be defined are an important step in this direction. These decisions and announcements must now be followed by the corresponding actions. The Austrian Council is however confident that the Federal Government will utilise the order of the day, and the setting of policy priorities will be developed while focusing on the relevant future-oriented areas. If focus on the future-critical areas of education, science, research, technology and innovation is not forthcoming, the Council believes the goal of establishing Austria

as a leading innovation nation by 2020 will be missed entirely.

To navigate the path to innovation leader foreseen by the RTI Strategy, the Council in any case believes that the priority areas of action in the education system, in basic research, with start-ups and with the private financing of R&D defined in the Mid-Term Review and analysed in detail in the 2016 Performance Report must continue to be addressed.<sup>87</sup> The Council believes that an improvement in Austria’s performance with regard to the priority objectives of the RTI Strategy will therefore also succeed in the long-term, as the achievement of the strategic goal of increasing innovation success generates multiple positive effects.

In addition to realizing the claim of being an innovation leader, beneficial effects on economic competitiveness, employment and unemployment can therefore also be expected. These are important quality of life determinants, as well as determinants for a society’s high level of education. The consistent implementation of the RTI Strategy’s measures for the education system is therefore not just essential for the required increase in innovation success, but rather is also equally decisive for strengthening Austria’s positions in the social ambit. Research and innovation and their diffusion in the health sector can also make a crucial contribution to further optimising Austria’s performance with regard to life expectancy in good health or quality of life. Finally, increased investments in energy and environmental research can contribute to improving Austria’s performance in the environment sector as a whole, which in turn also has a positive effect on health and quality of life.

In any case the analysis shows that the RTI activities related to the priority objectives of the RTI Strategy in Austria can be extended still

<sup>86</sup> Austrian Council for Research and Technology Development (2013): White Paper on controlling research, technology and innovation in Austria – Recommendation of the Austrian Council for Research and Technology Development.

<sup>87</sup> Austrian Council for Research and Technology Development (2015): Report on Austria’s Scientific and Technological Capability 2015, pp. 80 ff.; Austrian Council for Research and Technology Development (2016): Report on Austria’s Scientific and Technological Capability 2016.

further. The Austrian Council therefore not only considers the following recommendations to be a substantive conclusion of this report, but rather also and especially as a contribution to achieving the priority goals of the RTI Strategie

and the realisation of the Federal Government's goal of making Austria an innovation leader and a "global frontrunner in the industries of the future".<sup>88</sup>

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## The Austrian Council's Recommendations on Priority Areas of Action

### Modernisation of education system structures

In view of the educational screening that continues to exist in Austria, following on from the education reform package, further measures for early childhood development and a significant increase in the number of qualified and in particular multilingual educators are required in the early childhood area. The measures adopted in the Federal Government's Work Programme for the further development of kindergartens from care facilities into education facilities are therefore expressly welcome.

Better financial and staffing provisions (keyword: support staff) are also urgently required for those schools that are confronted with special challenges, especially with regard to the socio-economic structure of the students. The Austrian Council also recommends further steps to modernise the structures of the education system, in particular the revision of competencies between federal and regional authorities.

To tackle early social selection in the education system, the Austrian Council recommends a commitment to comprehensive, wholeday schools in the area of secondary level I with parallel performance differentiation and talent development and the corresponding implementation with suitable measures.

The Austrian Council also recommends the swift implementation of the study place financing announced in the Federal Government's Work Programme, on the basis of capacity-oriented study place management and sufficient budgetary resources. An appropriate adjustment of the universities' autonomy to the exist-

ing framework conditions with regard to capacity-oriented study access and to improve study conditions should be defined in the respective legislation.

### Increasing competitively allocated financing for basic research

In order to broaden the spearhead of superb research in Austria and to improve the research conditions of Austria as a science location, in addition to the increase in the competitively awarded funds for basic research defined in the Federal Government's "Research Package", the Austrian Council also urgently and emphatically recommends this be targeted at the level of the leading nations. In this context, the continuance of the excellence initiative in basic research (special research areas – SRAs, among others) should also be guaranteed with the provision of sufficient budgetary resources.

### Further optimisation of the legal and financial framework conditions for business start-ups

The Austrian Council recommends the funding package for start-ups be better coordinated and access for entrepreneurs be made easier. Furthermore, a central and highly visible contact point for innovative entrepreneurs for each region should also be set up (with the appropriate adjustment of the existing AplusB centres or adjustment of the services of the Economic Chamber's start-up service). The bureaucratic and regulatory framework conditions for funding start-ups must also be continuously improved. The Austrian Council supports measures to

<sup>88</sup> The Federal Government's RTI Strategy: The Path to Becoming an Innovation Leader. Vienna 2011, pp. 4 ff.; for Austria: Work Programme of the Austrian Federal Government 2017/2018. Vienna 2017, p. 1.

further reduce debt relief after insolvency and liquidation times for honest entrepreneurs, so that failed start-ups get a second chance quicker than they used to.<sup>89</sup> For this reason, the current **move towards the amendment on personal bankruptcy** (as laid down in the Austrian “Insolvenzordnung”) in the Federal Government’s Work Programme is also very welcome.

The Austrian Council recommends tax relief and support with social security funds in wage moderation. It therefore welcomes the current proposal in the Federal Government’s Work Programme.<sup>90</sup> This is, however, limited to three years and intended for all businesses. To also contribute structural effects, these measures should be arranged for the start-up area as a permanent facilitation.

In addition to funding by banks, the Austrian Council also recommends developing funding options for innovative entrepreneurs and SMEs. A rethinking of mechanisms such as tax breaks for investments in young companies, accompanied by corresponding legal framework conditions is required to increase equity capital intensity from the private side.

For implementation, we would refer to the Austrian Council’s individual recommendations in this respect.<sup>91</sup>

### **Implementation of measures to achieve research quota targets and to increase the private sector share of R&D funding**

The Austrian Council urgently recommends the immediate implementation of the measures for achieving both quota targets (2 per cent for the tertiary area and an R&D quota of 3.76 per cent by 2020), as defined in the Federal Government’s Work Programme and in the “Research Package”. For **implementation** we would refer to the **Austrian Council’s individual recommendations** in this respect.<sup>92</sup> For the performance agreement period 2019–2021 **the basic funding for universities** to improve teaching and research conditions must also be increased by at least **EUR 1.4 billion**.<sup>93</sup>

The Austrian Council recently recommended, as also intended with the Federal Government’s “Research Package”, concentration of the use of public sector resources and mechanisms on **increasing the leverage effect to raise the incentive effect on private R&D expenditure and for raising the private financing share**.

The Austrian Council also recommends allocating the Nationalstiftung (“National Foundation”) more funds long-term in line with the original financial allocation. The National Foundation should also be amalgamated with the Österreichfonds (“Austria Fund”) to utilise funding and administration-related synergies.

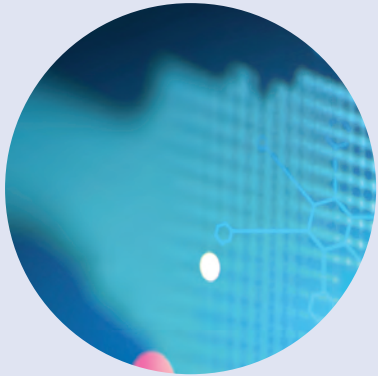
89 See European Commission (2014): Trade and Industry, SBA data sheet 2014, AUSTRIA.

90 For Austria: Work Programme of the Austrian Federal Government 2017/2018. Vienna 2017, pp. 3 f.

91 Recommendation of the Austrian Council for Research and Technology Development Austrian Council recommendation on the amendment to the Alternative Investment Fund Manager Act (AIFMG) of 6 March 2014; Recommendation of the Austrian Council for Research and Technology Development to optimize RTI-related start-ups of 19 November 2012; Recommendations of the Austrian Council for Research and Technology Development for the efficient implementation of research results in innovations, to create suitable framework conditions for private equity, and to introduce a tax exempt participation amount (all of 24 November 2011).

92 The Austrian Council for Research and Technology Development’s recommendation on funding research and development in Austria of 30 May 2016; The Austrian Council for Research and Technology Development’s recommendation on funding for education, research and innovation in Austria of 5 September 2016; The Austrian Council for Research and Technology Development’s recommendation on budgetary priority setting in Austria of 19 December 2016.

93 The Austrian Council for Research and Technology Development’s recommendation on funding universities and public sector research and development in Austria in the federal funding framework 2017 to 2020, chapter “Science and Research” of 5 February 2016.





## global innovation monitor

### Background

The Global Innovation Monitor of the Austrian Council for Research and Technology Development was published for the first time in 2014 and presented at the Alpbach Technology Forum. It has been part of the Report on Austria's Scientific and Technological Capability since 2015. Based on the indicators from the areas of education, university research, business research, economy, society and environment used in the report, the Global Innovation Monitor compares the development of selected countries (China, Israel, Canada, Switzerland, South Korea and the USA) with that of Austria.<sup>94</sup> This comparison on global levels should help shed light on Austria's performance in the context of worldwide trends.

The comparison countries for the Global Innovation Monitor were chosen for a number of reasons: Firstly, they have been defined as goal countries of priorities 1 and 2 from the recommendations of Work Group 7a and the RTI Task Force.<sup>95</sup> Secondly, the selected countries (with the exception of China) apply as global innovation leaders, which 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.

<sup>94</sup> The corresponding values were accepted into the set of indicators of the Performance Report with the Netherlands' move up into the group of innovation leaders according to the European Innovation Scoreboard. The Netherlands are therefore handled together with Denmark, Germany, Finland and Sweden in the actual report text, and no longer as before in the Global Innovation Monitor, whereby Canada immediately replaces the Netherlands.

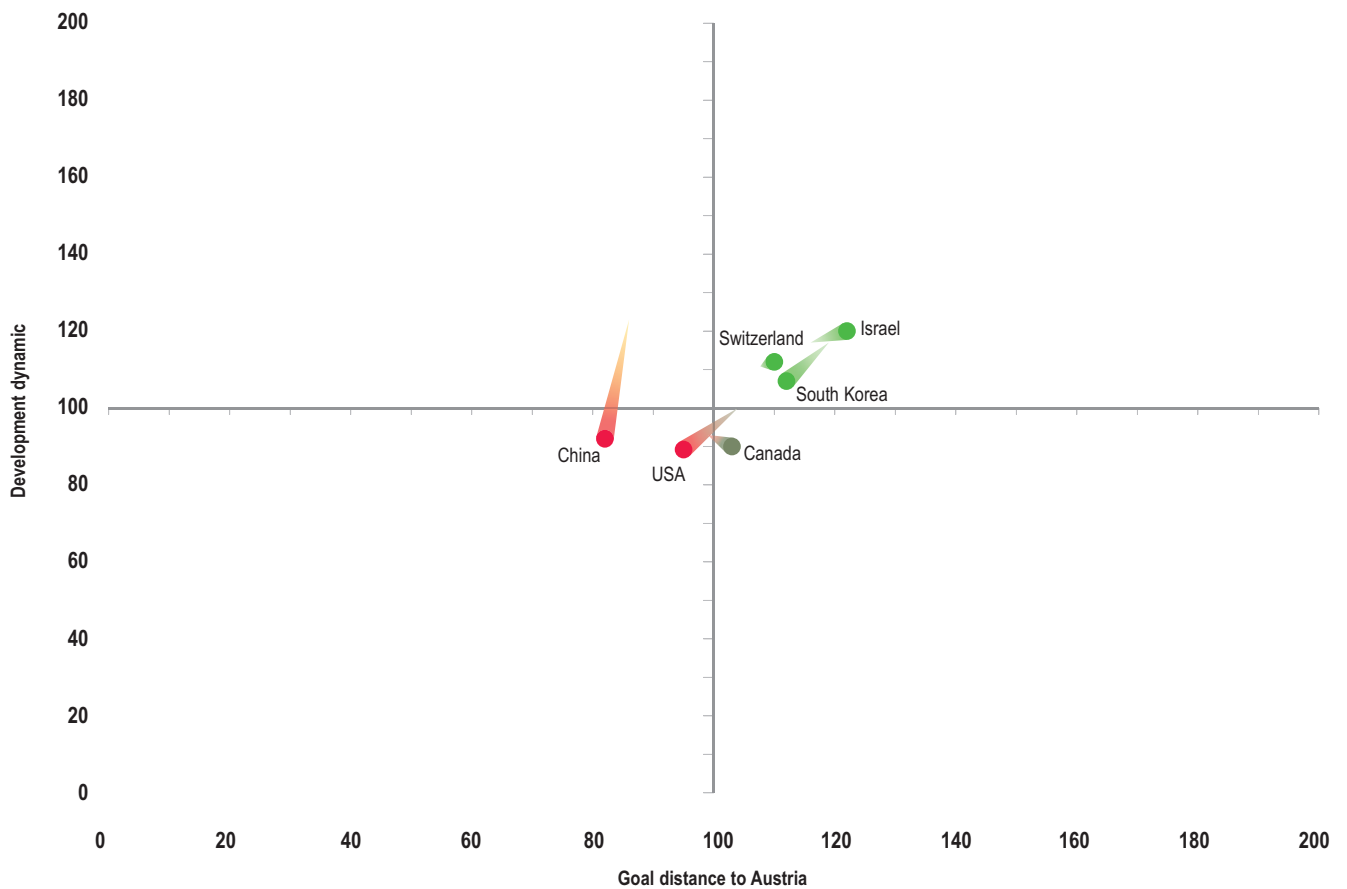
<sup>95</sup> Beyond Europe: Austria's internationalization in research, technology and innovation beyond Europe. Recommendations of Work Group 7a to the Federal Government's Task Force (July 2013), p. 7.

## 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 and Canada, more or less on a par with the USA, but behind that of the Israel, South Korea and Switzerland (see figure 24). With regard to the performance of education systems,

Switzerland, South Korea 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 catching up on Austria by 2020.

Figure 24: Education in international comparison



Source: See indicators list Appendix 4, WIFO presentation; Methodology and Notes for Interpreting the Figures and Indicators, see Appendix 5.

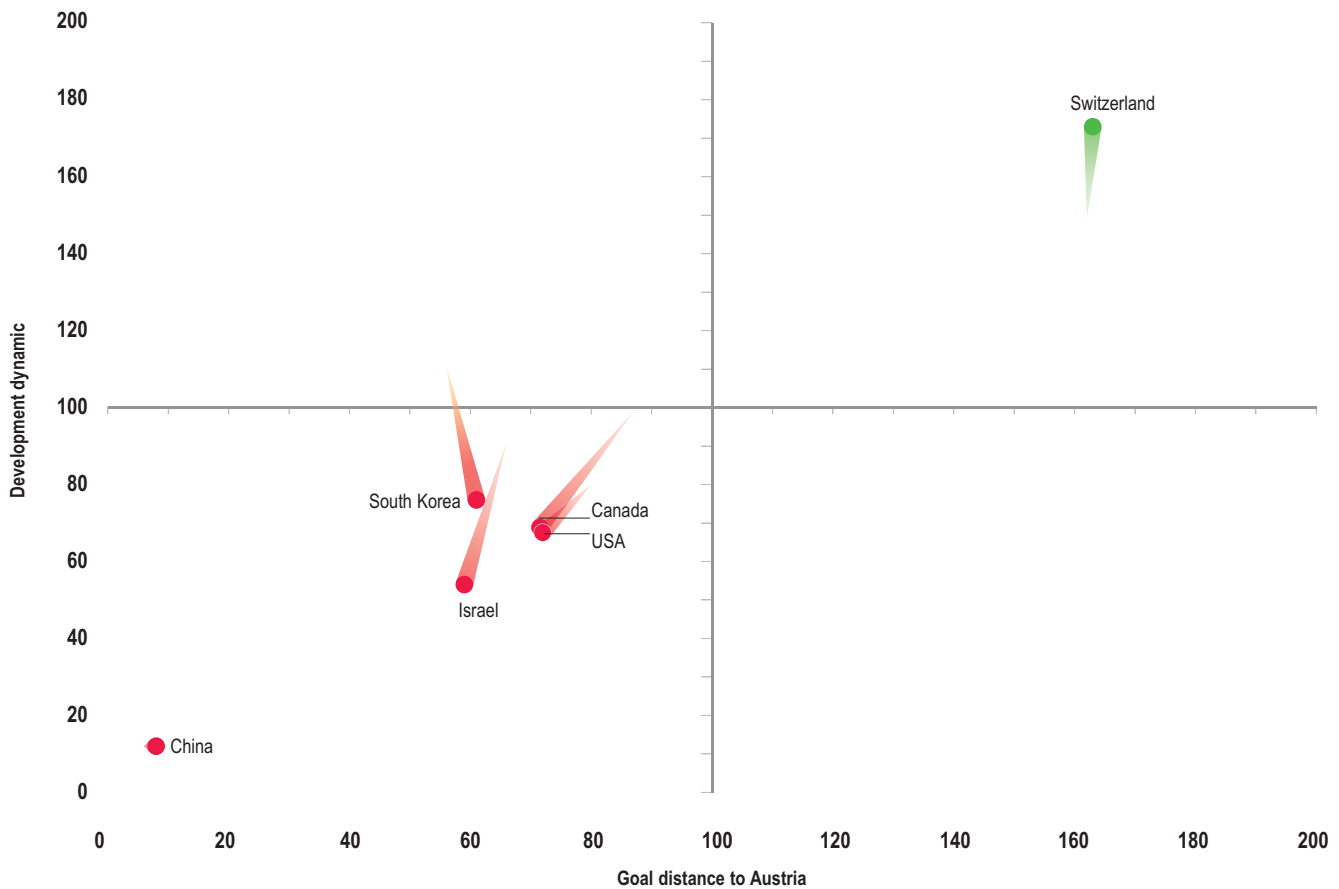


### University Research

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 China, Canada, South Korea, Israel and the USA (see figure 25).

Switzerland is the top research nation in the most diverse international rankings. This will hardly change if the development trend does not change. Austria will therefore not even come close to catching up on Switzerland by 2020. 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 25: 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.

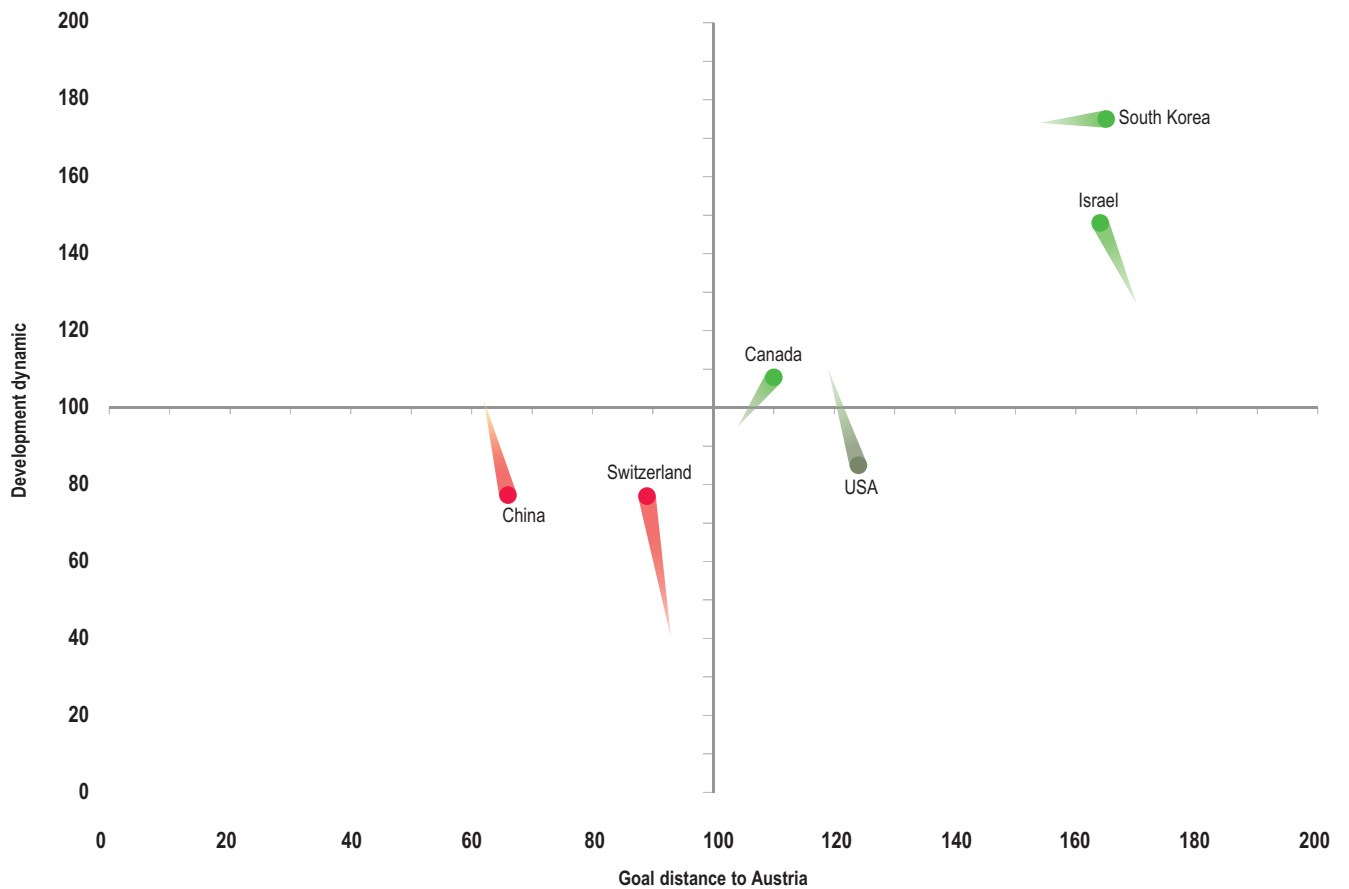
## Business Research

Figure 26 shows a catch-up requirement for Austria with regard to performance in the indicators for business research and innovation, which have been summarised for this illustration. Apart from China and Switzerland, all selected countries are ahead of Austria, and three of these – Canada,

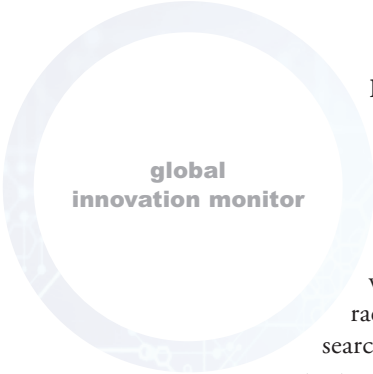
South Korea and Israel – will further increase their lead on Austria on the basis of their dynamic development. With the trend remaining constant in the area of business research, Austria could, however, close the gap on the USA

global  
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Figure 26: International business research comparison



Source: See indicators list Appendix 4, WIFO presentation; Methodology and Notes for Interpreting the Figures and Indicators, see Appendix 5.

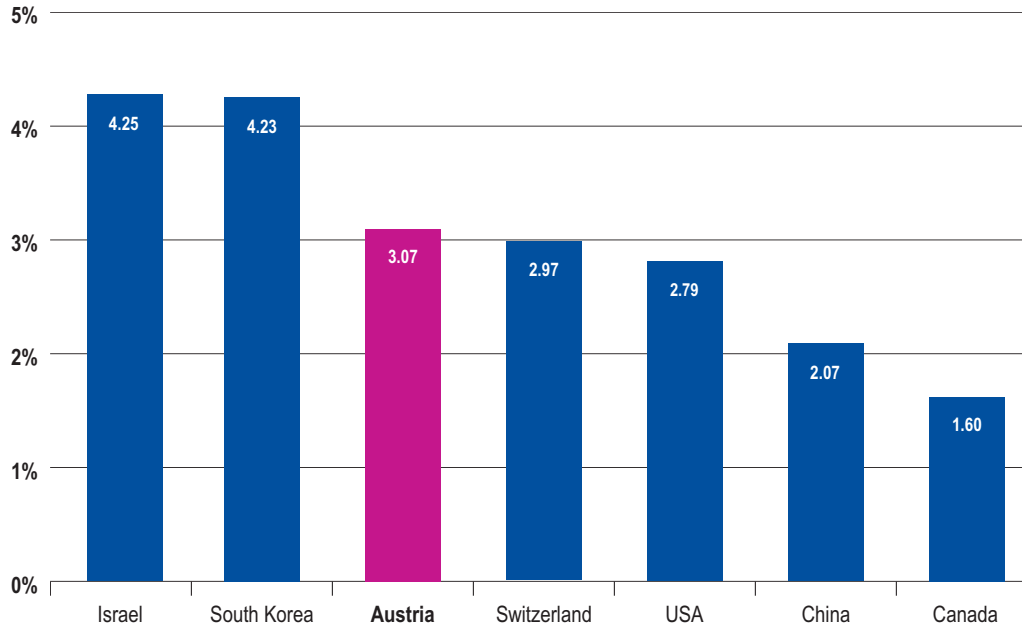


### R&D Financing

Figure 27 shows a comparison of the R&D quotas for the countries selected for the Global Innovation Monitor. There are hardly any changes compared with previous years. South Korea and Israel continue to have by far the highest research quota; Switzerland and the USA are more or less on a par with Austria. Measured on

the overall volume, with approximately US\$ 400 billion China is already ranked number 2 behind the USA (US\$ 470 billion). In the comparison for this, with R&D spending of approximately US\$ 11 billion (at purchase power parity), in 2015 Austria ranked among the TOP 20 in the global list of countries. In per capita terms it even ranks at number 6.

Figure 27: R&D quotas (in % of GDP) selected countries, last available year



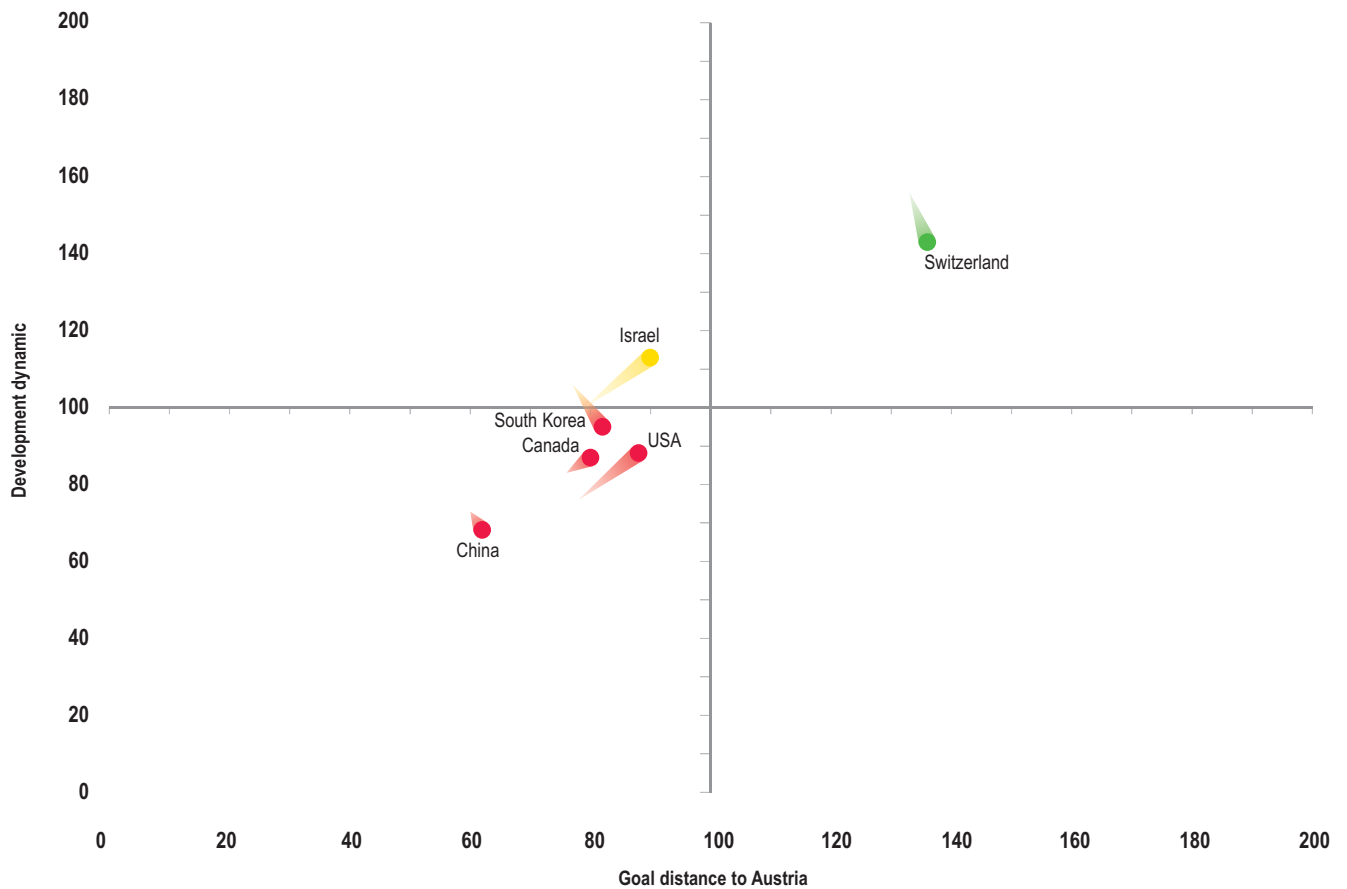
Source: OECD MSTI (2016).

### Economy, Society and Environment

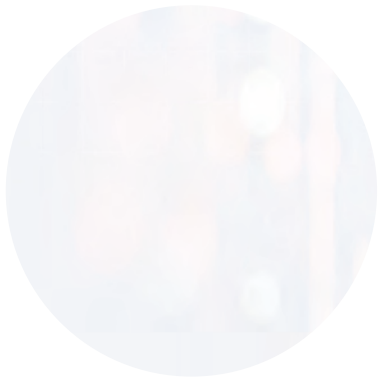
Figure 28 shows that Austria is positioned relatively well with regard to the economic, social and environment-relevant KPIs in relation to the countries considered here. Only Switzerland currently scores better than Austria with these indicators. With regard to the development dynamic only Israel is in an area that indicates that

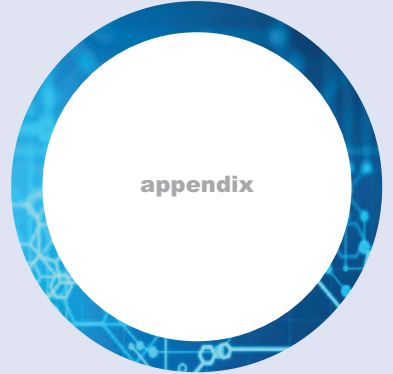
it could achieve Austria's level by 2020. The performance of China, Canada, South Korea and the USA is insufficient to be able to overtake Austria by 2020. China and South Korea's development is even slightly regressive.

Figure 28: 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

appendix

Strategic Objectives	Indicator to track target achievement	Abbreviation	Numerator
<b>Priority Objectives</b>			
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

Objective target of the strategy	Indicator to track target achievement	Abbreviation	Numerator
<b>Educational System – Pre-Primary and Primary Education</b>			
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
<b>Educational System – Secondary Education</b>			
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 equivalent 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

Objective target of the strategy	Indicator to track target achievement	Abbreviation	Numerator
<b>Education System – Secondary Level</b>			
		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

Objective target of the strategy	Indicator to track target achievement	Abbreviation	Numerator
<b>Educational System – Tertiary Education</b>			
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 student
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	Percentage of GDP spent on higher education	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.	OECD, Education at a Glance	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 indicator university expenditure per student 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 among STEM graduates (ISCED 5–8), who are frequently integrated into technological innovation processes.	Eurostat		35
	STEM graduates engineering in total	This indicator measures the percentage of women among STEM graduates (ISCED 5–8), who are frequently integrated into 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

Objective target of the strategy	Indicator to track target achievement	Abbreviation	Numerator
<b>Education System – Further Education/Skill Structure Migration</b>			
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
	Doctoral students from non-EU countries	Number of Doctoral candidates non-EU	Doctoral students from non-EU countries
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
<b>Research at Universities and Non-University Research Institutions – Basic Research and Universities</b>			
Increase investments in basic research by 2020 to the level of leading research nations.	Basic research expenditure as a percentage of GDP	Basic research expenditure as a percentage of GDP	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.	OECD		38
	All doctoral students	Doctoral students from non-EU countries as a percentage of total 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 on basic research. 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 co-operation normally increases scientific productivity.	EIS European Innovation Scoreboard		43
	Total population in million	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 or OECD MSTI		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

appendix

Objective target of the strategy	Indicator to track target achievement	Abbreviation	Numerator
<b>Research at Universities and Non-University Research Institutions – Basic Research and Universities</b>			
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 for funds to support basic research per academic researcher	Competitive funding	Budget for funds to support basic research per academic researcher
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 candidates	Doctoral students with an employment contract at university
<b>Research and Innovation in the Corporate Sector – Innovation and Business Research</b>			
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 spending, 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.
	Number of researchers in the university sector according to research statistics	As a rule, funds to finance basic research allocate their resources on a project basis following a competitive procedure. The budget per academic researcher is thus an indicator of the structure of university funding.	OECD MSTI, FWF		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

Objective target of the strategy	Indicator to track target achievement	Abbreviation	Numerator
<b>Research and Innovation in the Corporate-Sector – Innovation and business research</b>			
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
<b>Research and Innovation in the Corporate Sector – Cooperation between Science and Business</b>			
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 2016) 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	Eurostat, PATSTAT, WIFO calculations		60

Objective target of the strategy	Indicator to track target achievement	Abbreviation	Numerator
<b>Research and Innovation in the Corporate Sector – Start-Ups and Venture Capital Financing</b>			
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 business start-up (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
<b>Research and Innovation in the Corporate Sector – Innovation and Competition</b>			
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
<b>Political Governance of the RTI System – Setting Priorities</b>			
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 competences and potentials 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: Patents	PCT patent applications in selected technological fields (climate change mitigation and health)
<b>Political Governance of the RTI System – Funding System and International Positioning</b>			
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.

	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
	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)	65
	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).	EIS European Innovation Scoreboard		66
	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		67
	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		68

appendix

Objective target of the strategy	Indicator to track target achievement	Abbreviation	Numerator
<b>Political Governance of the RTI System – To Society Research and Society</b>			
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	
<b>Financing Research, Technology and Innovation</b>			
Increase research intensity by one percentage point, from 2.76% today to 3.76% 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.
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		69
				70
				71
GDP	R&D Intensity: Gross domestic expenditure as a percentage of GDP	OECD MSTI, Statistik Austria	National target	72
Total expenditure on R&D	The share of private-sector research funding is the share of total R&D spend that is financed by business enterprises.	OECD MSTI, Statistik Austria	National target	73

## Appendix 2: Indicators' Raw Data

Indicator	Current Value		Unit	Goal Distance	Growth		Productive Growth	Prospect of Goal Achievement	Time Series	ID
	AT	Inno. Lead.			AT	Inno. Lead.				
EIS Index	0.59	0.66	Normalized, 0–1	89	0.21%	0.42%	3.11%	87	2008–2015	1
GDP per capita	127.00	121.80	Volume Index of Real Expenditure in PPS (EU28=100)	104	-0.21%	-0.23%	-1.12%	105	2000–2015	2
Employment-to-Population Ratio	74.30	76.86	in per cent	97	0.27%	0.29%	0.96%	97	2000–2015	3
Unemployment Rate	5.70	6.90	in per cent	121	2.56%	0.13%	5.20%	114	2000–2015	4
Better Life	6.99	7.68	Index: 0–10	91	-1.75%	-0.71%	0.85%	90	2012–2016	5
Healthy Life Years (F)	68.80	73.68	in per cent	93	-0.67%	0.25%	1.22%	89	2005–2014	6
Healthy Life Years (M)	72.90	78.80	in per cent	93	-0.45%	0.14%	1.34%	90	2005–2014	7
Greenhouse Gases	98.23	84.00	in per cent	86	-0.34%	-1.45%	-2.57%	87	2000–2014	8
Energy Intensity	4.45	5.11	Gross Domestic Consumption (in Terajoule/GDP)	115	-0.53%	-1.54%	0.95%	109	2000–2014	9
Resource Productivity	1.65	2.13	GDP/Material Consumption (in kg)	77	1.24%	1.18%	6.66%	77	2000–2015	10
Early Childhood Care	95.00	95.00	in per cent	100	0.78%	1.27%	0.00%	104	2000–2015	11
Teacher-Child Ratio Early Childhood	13.89	10.40	Number (children/preschool teacher)	75	-2.24%	-2.65%	-5.64%	81	2002–2014	12
Student-Teacher Ratio in Primary Education	12.00	14.02	Number (children/teacher)	117	-1.34%	-0.67%	2.04%	122	2001–2014	13
Early School Leavers	7.30	9.50	in per cent	130	-2.21%	-1.31%	5.41%	145	2000–2015	14
Secondary School Graduates	42.60	55.00	in per cent	77	1.04%	n.a.	5.24%	82	2000–2015	15
Early School Leavers Migrants	82.03	60.00	in per cent	137	0.32%	n.a.	-6.06%	139	2011–2015	16
Inheritance of Education 1	45.10	38.65	Increase of Socio-economic Gradients	86	0.12%	-0.51%	-2.98%	85	2000–2015	17
Inheritance of Education 2	14.57	10.96	Percentage of Declared Variance	75	-0.88%	-1.65%	-7.36%	71	2000–2015	18
PISA Risk – Reading	22.54	15.00	in per cent	67	1.04%	0.59%	-7.82%	63	2000–2015	19
PISA Risk – Mathematics	21.75	15.00	in per cent	69	1.24%	1.15%	-7.16%	65	2003–2015	20
PISA Risk – Science	20.83	15.00	in per cent	72	2.73%	3.68%	-6.35%	63	2006–2015	21
PISA Top – Reading	7.24	10.54	in per cent	69	-0.20%	-0.58%	7.79%	68	2000–2015	22
PISA Top – Mathematics	12.46	12.44	in per cent	100	-1.13%	-3.37%	-3.50%	113	2003–2015	23
PISA Top – Science	7.72	10.31	in per cent	75	-2.80%	-1.03%	4.32%	70	2006–2015	24
Skill Mismatch	89.20	82.00	in per cent	109	n.a.	n.a.	-0.76%	n.a.	2009	25
University Graduates	38.70	38.00	in per cent	102	1.93%	2.02%	5.32%	112	2004–2015	26
University Graduates (ISCED 6-8)	24.16	41.00	in per cent	59	1.33%	0.98%	11.16%	59	2004–2015	27
Supervisor-Student Ratio (University)	16.74	13.27	University Expenditure Quota	79	2.15%	0.45%	-3.00%	73	2002–2014	28
University Expenditure Quota	1.47	2.00	in per cent	73	2.66%	0.94%	4.51%	88	2000–2013	29
University Expenditure per Student	16,742.08	19,964.57	in EUROS	84	3.39%	4.70%	7.54%	76	2000–2013	30
Researchers	9.87	12.27	in per cent	80	3.41%	2.37%	7.28%	83	2002–2015	31
STEM Doctorate Holders	0.90	1.18	in per cent	76	2.94%	3.23%	8.50%	73	2000–2014	32
STEM Graduates	22.50	17.16	in per cent	131	8.48%	3.54%	-0.88%	172	2000–2014	33
Share of Female Researchers	29.59	30.38	in per cent	97	3.30%	1.38%	1.81%	111	2002–2013	34
Share of Women in Science	33.64	36.86	in per cent	91	-0.32%	0.08%	1.59%	89	2000–2014	35
Share of Women in Engineering	21.79	26.12	in per cent	83	2.75%	1.35%	5.19%	87	2000–2014	36
EU Glass Ceiling Index	1.76	1.61	Index (Ratio Value)	91	-3.34%	-2.77%	-3.93%	96	2004–2013	37

Indicator	Current Value		Unit	Goal Distance	Growth		Productive Growth	Prospect of Goal Achievement	Time Series	ID
	AT	Inno. Lead.			AT	Inno. Lead.				
Highly-qualified Immigrants	19.22	25.22	in per cent	76	2.58%	0.93%	5.12%	84	2000–2013	38
Non-EU Doctoral Candidates	9.32	15.73	in per cent	59	-1.97%	7.10%	16.92%	35	2008–2014	39
Lifelong Learning	14.40	22.62	in per cent	64	3.74%	2.71%	12.13%	68	2000–2015	40
Basic Research Rate	0.56	0.64	in per cent	87	4.05%	2.79%	4.75%	95	2002–2013	41
Publication Quality	11.71	12.38	Top Publications (as a percentage of all publications)	95	2.32%	0.61%	1.81%	102	2008–2015	42
International Co-publications	1225.52	1501.03	Number Per Million Inhabitants	82	7.14%	7.63%	12.43%	79	2008–2015	43
ERC Grants per Inhabitants	3.51	3.38	Number (grants/inhabitant)	104	13.10%	13.25%	12.98%	101	2009–2015	44
University Ranking Research Performance	28.10	26.32	Number per Rank Group/Population	107	-2.05%	-0.78%	-1.36%	96	2009–2014	45
Competitive Funding	23.87	59.73	in EUROS/Population	40	2.57%	7.36%	30.00%	31	2007–2015	46
Doctoral Candidates with Employment Contracts	28.99	100.00	in per cent	29	4.61%	n. a.	28.10%	36	2010–2015	47
Knowledge Intensity Business	14.50	16.38	in per cent	89	0.61%	0.65%	3.11%	88	2008–2015	48
Knowledge Intensity Exports	57.56	52.67	in per cent	109	0.40%	-0.31%	-1.93%	112	2005–2015	49
Knowledge Intensity Exports Service Industry	72.11	65.40	in per cent	110	-1.86%	-0.17%	-2.51%	103	2010–2015	50
R&D Intensity of the Economy	0.61	0.67	in per cent points	90	11.21%	7.47%	13.08%	88	2008–2012	51
Export Quality	78.83	85.07	in per cent	93	-0.30%	-0.36%	1.14%	93	2010–2015	52
R&D Performers	3,326	3,375	Number	99	5.01%	n. a.	0.21%	139	2002–2013	53
Innovative SMEs	40.71	37.76	in per cent	108	-2.00%	-2.28%	-1.79%	99	2006–2014	54
Foreign-funded R&D	15.90	9.58	in per cent	166	-1.47%	5.74%	-3.55%	111	2000–2015	55
Foreign-owned Patents	24.62	19.07	in per cent	129	-0.94%	1.65%	-2.76%	114	2000–2013	56
Innovation Revenue	8.40	8.72	in per cent	96	1.90%	-3.47%	3.33%	92	2004–2014	57
Business-Science Links LCU	56.80	45.42	in per cent	125	4.62%	1.17%	-2.96%	157	2004–2014	58
Business-Science Links SMEs	29.90	21.24	in per cent	141	8.03%	1.30%	-4.60%	211	2004–2014	59
Patents' Technological Significance Venture	4.86	8.65	Number of Applications/GDP	56	2.25%	-0.80%	7.62%	70	2000–2013	60
Capital Intensity	0.32	0.44	in per cent	72	0.04%	-5.49%	1.85%	91	2007–2015	61
Start-ups Material Goods	-0.43	3.00	in per cent	11	-3.13%	n. a.	44.13%	11	2010–2014	62
Start-ups Service Industry	-4.31	3.00	in per cent	37	-3.68%	n. a.	17.97%	37	2010–2014	63
Start-up Regulation	111	41	Ranking	37	4.14%	3.21%	-19.24%	36	2006–2016	64
Employment in Fast-growing Companies	19.45	19.21	in per cent	101	2.83%	0.09%	-0.15%	116	2008–2015	74
Competition Policy	0.35	0.15	Compound Indicator Index Value	44	-10.00%	-11.65%	-18.04%	52	2003–2013	65
Priority Setting (Patents)	1.07	1.74	Applications/GDP	61	1.20%	-1.96%	6.29%	68	2005–2012	66
Returns Ratio	145.64	135.91	Index Value	107	2.62%	2.97%	3.11%	98	2002–2015	67
Participation in FP	129.96	114.43	Index Value	114	-0.26%	3.15%	-0.81%	103	2012–2015	68
Personal Interest in Science	9.20	18.60	in per cent	49	-24.06%	-19.17%	-10.42%	31	2010–2013	69
Benefits of Science for the Economy	63.63	66.58	in per cent	96	-2.16%	-1.55%	-0.77%	91	2010–2013	70
Positive Attitude Towards Science	44.52	60.71	in per cent	73	2.37%	-0.70%	3.77%	91	2010–2013	71
R&D Quota	3.07	3.76	in per cent	82	3.29%	0.23%	4.12%	96	2000–2015	72
Private-Sector R&D	62.73	66.00	in per cent	95	-0.05%	-0.19%	1.02%	95	2000–2015	73

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.<sup>96</sup> 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.<sup>97</sup> 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.<sup>98</sup>

<sup>96</sup> 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.

<sup>97</sup> The term “innovation leader” refers to those EU countries in the top group in the annual European Innovation Scoreboard (EIS) of the European Commission.

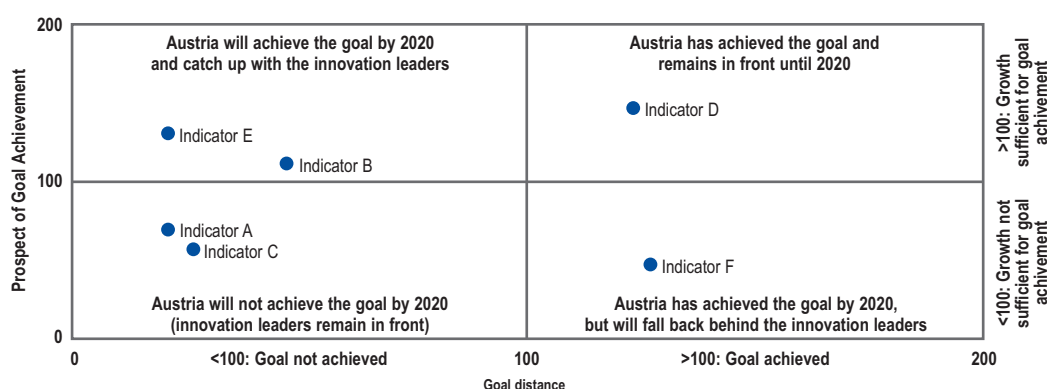
<sup>98</sup> The argument for this is that it is unlikely that the innovation leaders will remain at their current level. Austria’s placing in the European Innovation Scoreboard is therefore always made increasingly more relative to the placing of the other countries, i.e. it always considers the growth 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 29: 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, NL, SE); 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 29).

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.<sup>99</sup> 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 longterm. The development should be observed very closely here to also counteract in good time where required.

<sup>99</sup> Trend changes are however recorded rather quickly due to the annual updating of the indicator sets.

## Appendix 4: Indicators for the Global Innovation Monitor Including Raw Data

	Indicator	Available Time Series
		Austria
Economy, Society and Environment	GDP per capita at Purchasing Power Standards (PPS)	2000–2015
	Employment-to-Population Ratio	2000–2015
	Unemployment Rate	2000–2015
	Life Expectancy at Birth	2000–2014
	Efficiency Increase: Resource Productivity	2000–2014
	Efficiency Increase: Energy Intensity	2000–2014
Education	Teacher-Child Ratio Early Childhood	2002–2014
	University Expenditure per Student	2000–2013
	Average PISA Score – Reading	2000–2015
	Average PISA Score – Mathematics	2003–2015
	Average PISA Score – Science	2006–2015
	PISA Education Inheritance	2000–2015
	University Graduates (Age Cohort 25-34 Years)	2000–2014
	STEM Graduates	2000–2014
University Research	STEM Graduates – Women	2000–2014
	University Ranking Research Performance	2009–2014
	University Expenditure for R&D/Population	2002–2015
Business Research	Basic Research Rate	2002–2013
	R&D Quota	2000–2016
	Private-Sector Research Funding Quota (financed by industry & abroad)	2000–2015
	Number of Researchers per 1,000 Employees	2002–2015
	PCT Patent Applications Relative to GDP	2000–2013
	Start-up Regulation	2006–2016

	Available Time Series						
	China	Israel	South Korea	Canada	USA	Switzerland	Source
	2000–2014	2000–2015	2000–2015	2000–2015	2000–2015	2000–2015	OECD
	2000–2014	2000–2015	2000–2015	2000–2015	2000–2015	2005–2015	OECD, World Bank (Data for China)
	2000–2014	2000–2015	2000–2015	2000–2015	2000–2015	2010–2015	OECD, World Bank (Data for China)
	2000–2014	2000–2014	2000–2014	2000–2011	2000–2014	2000–2014	OECD
	2000–2014	2000–2014	2000–2014	2000–2014	2000–2014	2000–2014	IEA, Energy balances, 2015 ed.
	2000–2014	2000–2014	2000–2014	2000–2014	2000–2014	2000–2014	IEA, Energy balances, 2015 ed.
	2002–2014	2004–2012	2002–2014	–	2002–2014	2004–2014	OECD Education at a glance
	2007–2008	2000–2013	2000–2013	2007–2013	2000–2011	2000–2013	OECD Education at a glance
	2003–2015	2006–2015	2000–2015	2003–2015	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	2003–2015	2000–2015	2000–2015	OECD PISA
	2010–2014	2003–2014	2000–2014	2000–2014	2000–2014	2000–2014	OECD Education at a glance
	2003–2006	2000–2000	2000–2014	2002–2002	2000–2014	2000–2014	UNESCO
	2003–2006	2000–2000	2000–2014	2002–2002	2000–2014	2000–2014	UNESCO
	2009–2014	2009–2014	2009–2014	2009–2014	2009–2014	2009–2014	CWTS Leiden Ranking, WIFO Calculation
	2001–2015	2000–2015	2000–2015	2001–2014	2000–2015	2000–2014	OECD MSTI, World Bank
	2000–2014	2000–2014	2000–2015	2011–2014	2000–2013	2000–2012	OECD MSTI
	2000–2015	2000–2015	2000–2015	2000–2014	2000–2015	2000–2012	OECD MSTI
	2000–2015	2000–2013	2000–2015	2001–2014	2000–2013	2000–2012	OECD MSTI, WIFO Calculation
	2000–2014	2011–2012	2000–2015	2000–2013	2000–2014	2000–2012	OECD MSTI
	2000–2013	2000–2013	2000–2013	2000–2013	2000–2013	2000–2013	OECD
	2006–2016	2006–2016	2006–2016	2006–2016	2006–2016	2006–2016	World Bank

## appendix

### 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

#### RTI Strategy Objectives – Priority objectives and Effects of the RTI Strategy

- 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**

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