Federal Ministry
Republic of Austria
Education, Science
and Research

Federal Ministry
Republic of Austria
Climate Action, Environment,
Energy, Mobility,
Innovation and Technology

Federal Ministry
Republic of Austria
Digital and
Economic Affairs

Austrian Research and Technology Report 2021

Report of the Austrian federal government to the National Council in accordance with Section 8 (2) of the Research Organisation Act (FOG) on the position and the needs of research, technology and innovation in Austria

This report was commissioned by the Federal Ministry of Education, Science and Research (BMBWF), the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK), and the Federal Ministry for Digital and Economic Affairs (BMDW). It was written by a working group consisting of WPZ Research, the Centre for Social Innovation (ZSI) and the Austrian Institute for SME Research (KMU Forschung Austria) with the support of VDI/VDE Institute for Innovation and Technology (iit), Technopolis, the Industry Science Institute (IWI) and Statistics Austria.

Team of authors: Brigitte Ecker (Coordination, WPZ Research), Philipp Brunner (IWI), Philipp Gross (iit), Ernst A. Hartmann (iit), Peter Kaufmann (Austrian Institute for SME Research), Jakob Kofler (Austrian Institute for SME Research), Stefan Krabel (iit), Stefan Philipp (ZSI), Verena Régent (WPZ Research), Sascha Sardadvar (WPZ Research), Herwig W. Schneider (IWI), Klaus Schuch (ZSI), Christine Seth (iit), Mila Staneva (iit), Dorothea Sturn (ZSI), Brigitte Tiefenthaler (Technopolis), Katharina Warta (Technopolis), Harald Wieser (KMU Forschung Austria) und Simon Zingerle (Technopolis).

Imprint
Media owners:
Federal Ministry of Education, Science and Research (BMBWF), 1010 Vienna
Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK), 1030 Vienna
Federal Ministry for Digital and Economic Affairs (BMDW), 1010 Vienna

Designed and produced by:
barrierefrei PDF OG, Vienna,
Translated by: Young Translations LLC, Vienna
Cover: © stock.adobe.com
Printed by:
Print Alliance HAV Produktions GmbH

Vienna, 2021

Preface

In accordance with Section 8 (2) of the Research Organisation Act (FOG), the Research and Technology Report 2021 of the Austrian federal government describes the position and the needs of research, technology and innovation in Austria.

Prevailing topics that dominated the whole of 2020 are covered in this report, including the impact of the global COVID-19 pandemic, and developments associated with climate change. These were reviewed both from the perspective of Austrian research and development, and in terms of international comparisons. Particular attention is paid to research and development in these topic areas, and to the crisis management, resilience and ongoing processes of transformation that will go beyond them, which will also result in improved innovation capability and performance in the future. Research related to COVID-19 and climate-related research are explained in more detail in separate chapters and provide an overview of the numerous measures and funding programmes as well as the key players in these areas.

The strategy for research, technology and innovation (RTI Strategy 2030) adopted by the federal government at the end of 2020 sets the course for the next ten years, identifying strategic fields of activity which will support sustainable growth and improve resilience throughout our research and economic systems. The Research Financing Act passed in July 2020 established a specific legal basis for financing of the ten central research and research funding institutions, allowing long-term, growth-oriented financing, planning security and priority-setting. Its key elements, based on the RTI Strategy 2030, are the three-year RTI Pacts with agreed research budgets for the three ministries of relevance to research – namely the Federal Ministry of Education, Science and Research (BMBWF), Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK), and the Federal Ministry for Digital and Economic Affairs (BMDW) – together with three-year performance and funding agreements with the central non-university research and research funding institutions. For the first RTI Pact, covering 2021–2023, the federal government is providing a total of €3,858.3 million, which constitutes a pleasing increase of +27% in comparison to the resources allocated in the previous federal budget.

The ten central research and research funding institutions are subject to an annual monitoring process, as stipulated by the Research Financing Act; this forms a core chapter of the present report. In addition to a profile description and an outlook on future developments, the report attempts to generate an overall systemic picture of the institutions in all their diversity on the basis of eight standardised indicators. This monitoring review was first included in the 2020 Research and Technology Report and has been further developed in the 2021 report. An analysis comparing the budgeted values with actual outcomes will be completed once all the performance and funding agreement periods have concluded, and will be presented in the 2022 report.

Statistics Austria estimates that total research expenditure for the year 2020 amounted to €12.14 billion, just €200 million (1.6%) less than in 2019. R&D intensity, however, reached a new record level of 3.23%, partly due to the fall in GDP. The global estimate illustrates the key role of public funding for research in times of crisis, with an increase in federal funding of almost €300 million, making a total of approximately €3.4 billion (an increase of 10%), and additional support from the research premium which amounted to approximately

€1.04 billion in total (a 38% increase). Austrian companies contributed €5.03 billion (not including the research premium), and despite a decline of approximately €700 million, remained the most important source of funding for R&D.

An important element of the Research and Technology Report is the review of Austria's performance from an international perspective, and the productivity of Austrian research institutions in R&D, digitalisation, innovation and transformation capability. Recent developments are presented in terms of rankings such as the Global Innovation Index (GII), the European Innovation Scoreboard (EIS), the Digital Economy and Society Index (DESI), the iit Innovation Capability Indicator and other ranking systems. In addition, following the expiry of Horizon 2020, the EU's previous Framework Programme for Research, this report includes a summary of Austria's successful participation, and introduces the new Framework Programme, Horizon Europe, which will provide €95.5 billion for the period 2021 to 2027 – an increase of around 30% in funding. In the context of Austria's term of chairmanship for 2020/21, this report includes a chapter on the activities of the European research initiative Eureka.

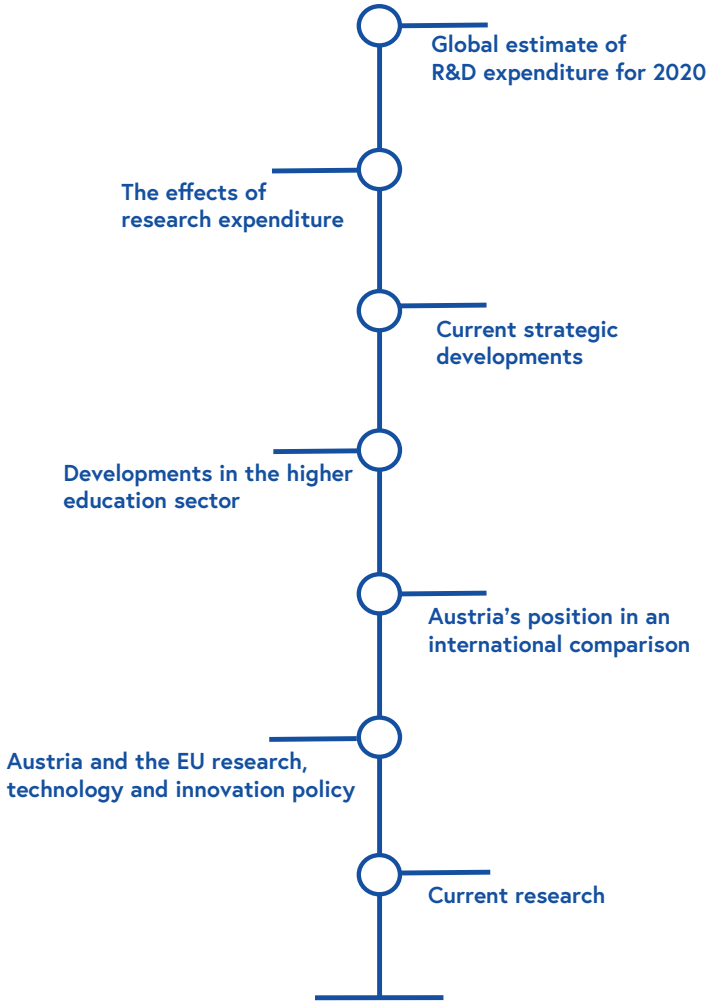
Univ. Prof. Dr Heinz Faßmann
Federal Minister of Education, Science and Research

Leonore Gewessler, BA
Federal Minister for Climate Action, Environment, Energy, Mobility, Innovation and Technology

Dr Margarete Schramböck
Federal Minister for Digital and Economic Affairs

Table of Contents

Executive Summary



The Research and Technology Report 2021 is the Austrian federal government's report in accordance with Section 8 (2) of the Research Organisation Act (FOG), describing the position and the needs of research, technology and innovation in Austria

The Research and Technology Report 2021 is the Austrian federal government's report in accordance with Section 8 (2) of the Research Organisation Act (FOG), describing the position and the needs of research, technology and innovation in Austria.

The **Austrian Research and Technology Report 2021** presents the **global estimate of R&D expenditure in the country for 2020** and analyses the **performance of the Austrian innovation system compared to international standards**. The report also describes numerous **strategic measures and initiatives** in the areas of research, technology and innovation. During the period covered by this report these were significantly affected by the adoption of the Research Financing Act, which has introduced fundamental framework changes for the central research performing and research funding institutions. Consequently in this report all the **key players in non-university research and research funding** are portrayed in a monitoring context.

Core topics of the 2021 Research and Technology Report are **COVID-19 research** and **climate-related research**. Austria has been profoundly affected both by the COVID-19 pandemic and by climate change. The response from Austrian RTI policy has been correspondingly wide-ranging, using flexible funding and award procedures to enable Austrian players to take an internationally prominent role in pandemic-related research. Climate-related research has been given extensive consideration in the recently adopted RTI Strategy 2030. Current trends, initiatives, measures and projects in both these research areas are described in this report.

Austrian RTI policy is characterised by an **evaluation culture** that is firmly anchored and widely applied in the system. This report therefore also provides some insights into the evaluation culture and a synopsis of recent evaluations of RTI programmes and research institutions.

The analyses presented in the 2021 Research and Technology Report also take account of the dramatic changes resulting from the COVID-19 pandemic. The central importance of science and research has become evident to a wider public over the course of the pandemic. R&D performance is of key significance with regard to crisis management and resilience. Any reduction in R&D expenditure would have serious consequences not only for the research sector itself, but also for the economy and society.

Global estimate of R&D expenditure for 2020

Due to the economic uncertainties caused by the COVID-19 pandemic, no overall (global) estimate of annual R&D expenditure has been compiled for 2021. Instead, Statistics Austria revised its global estimate for 2020 in April 2021.

In 2020, **expenditures on research and development (R&D) in Austria amounted to €12.14 billion**, 1.6% below the figure for 2019 (revised total €12.34 billion). **Estimated R&D intensity** (percentage of gross domestic expenditure on R&D relative to gross domestic product) was **3.23%**, according to the global estimate for 2020, which constitutes an increase over 2019 (revised value 3.10%). This means Austria has **exceeded the European target value of 3%, for the seventh consecutive year.**

The **federal government spent about €3.33 billion on R&D in 2020** – in nominal terms 9.8% more than the previous year, funding just **over a quarter (27.4%)** of all R&D conducted in Austria. In 2020 the **regional governments** allocated approximately **€0.55 billion (4.6%)** of R&D funding, putting total public-sector R&D expenditure at €3.88 billion. **Austrian companies** provided **€5.03 billion, just over 41.4% of all R&D funding**. In percentage terms this is less than in previous years (2019: 46.4%; 2018: 47.1%). **€2 billion (16.5%)** of R&D funding **came from abroad** and mainly comprised R&D funded by foreign companies on behalf of their Austrian subsidiaries as well as return flows from the EU's research programmes. The **research premium** contributed **€1.05 billion** in 2020, some 8.6% of R&D expenditure: a significant increase compared to the previous year. Other public-sector funding and the private non-profit sector played only a relatively minor role in 2020 with a combined total of 1.5%.

The effects of research expenditure

In the context of these data, it is particularly important to assess the economic impact of Austria's consistently rising R&D intensity. A detailed innovation model was used to evaluate the macroeconomic effects of R&D expenditure on the Austrian economy. In a growth scenario based on the pattern of the last ten years, **some 28% of Austria's growth is attributable to the impact of its innovation system.** This effect is achieved with R&D expenditure of just 3.18% of GDP. An **increase in public-sector expenditure for R&D by 1 euro can potentially enhance GDP by up to 6 euros in the long term**. At company level it is evident that **companies funded by the Austrian Research Promotion Agency (FFG) have developed significantly better** (compared to a control group) **with regard to employment figures and revenue**. Manufacturing, the sector which was by far the most important for funding from the Austrian Research Promotion Agency (FFG) reported employment growth of around 5% in funded companies, compared to the control group with only 1.7%; growth in revenue was 15.9% compared to 8.7% in the control group. **Positive effects** were also evident **on the survival rates of companies**. 2,548 out of 2,806 companies funded by the Austrian Research Promotion Agency (FFG) survived from 2017 to 2020, which represents a 90.8% survival rate. In the control group only 88.7% survived, constituting a statistically significant lower rate.

Current strategic developments

The 2021 Research and Technology Report includes an overview of significant developments at governance level in the field of RTI. The most important of these is the **Austrian federal government's strategy for research, technology and innovation (RTI Strategy 2030)**, which was adopted on 23 December 2020, creating a new strategic framework for Austrian research policy. It defines strategic fields of activity which are geared towards ensuring sustainable growth and stronger resilience throughout the entire economic system, targeted towards the following overarching goals:

1. Become an international innovation leader and strengthen Austria as an RTI location
2. Focus on effectiveness and excellence
3. Focus on knowledge, talents and skills

Implementation of the RTI Strategy 2030 is directly linked to the **Research Financing Act (FoFinaG)**, which requires the federal government to agree a **Pact on Research, Technology and Innovation (RTI Pact)** every three years, starting from 2021–2023. These Pacts will provide financing and planning security to facilitate growth, and contain measures explicitly designed to achieve the RTI Strategy's objectives and pursue the fields of activity specified in it. The priorities defined in the RTI Pacts are derived from regular evaluation of the measures implemented, assessing their contribution to progress towards the goals set out in the RTI Strategy 2030. To complement the RTI Pact, the **Future Austria Fund** will be established, as a further development of the National Foundation for Research, Technology and Development, so creating a financing tool for strategic prioritisation of key future-oriented fields and technologies in research. There will also be continued focus on strong participation by Austria in the European Research Area, particularly in connection with the new research programme, **Horizon Europe**.

In addition, the **Research Funding Amendment 2020** creates a stable institutional framework of governance for the RTI sector. It defines the central research institutions and research funding institutions. These are:

- Austrian Institute of Technology GmbH (AIT)
- Institute of Science and Technology Austria (IST Austria)
- Austrian Academy of Sciences (OeAW)
- Silicon Austria Labs GmbH (SAL)
- Ludwig Boltzmann Gesellschaft (LBG) – Austrian Association for the Promotion of Scientific Research
- Austria Wirtschaftsservice Gesellschaft mbH (aws)
- Christian Doppler Research Association (CDG)

- Austrian Science Fund (FWF)
- OeAD-GmbH – Agency for Education and Internationalisation
- Austrian Research Promotion Agency (FFG)

Performance and financing agreements are made with these central research and funding institutions, based on the RTI Pact, which ensure not only planning security but also flexibility in implementation. The **Research Financing Act (FoFinaG)** also requires **regular monitoring of these institutions**. The overarching goal is to create a picture of the system as a whole while also recognising and respecting any differences between the individual institutions, which in some instances are related to their roles in that system. This requirement is fulfilled by Chapter 3 of the present 2021 Research and Technology Report: here each institution is described with a general profile and **monitoring based on eight selected indicators**, devised in consultation with the relevant federal ministries. The indicators examined are: i) funding and third-party resources, ii) quality assurance and evaluations, iii) human resources and qualifications, iv) output, innovation and excellence, v) internationalisation, vi) knowledge and technology transfer, vii) communication and interaction with society, and viii) gender and promotion of equality. The report also looks ahead to future developments.

In some individual strategic priority areas the public sector launched **numerous initiatives and measures**, which were essential for further development of the innovation system and optimisation of RTI-related potentials. Among the most important were the IP Strategy, the Strategy for the Future for Life Sciences and Austria as a Location for Pharmaceuticals, the Creative Industries Strategy, the Open Innovation Strategy, the RTI Strategy for Mobility 2040, the Higher Education Mobility and Internationalisation Strategy 2020–2030, Public Procurement Promoting Innovation, the RTI initiative on the "Circular Economy", and the Austrian security research programme KIRAS.

Austria is also committed to involvement in the expansion of EU defence research. The EU Common Security and Defence Policy (CSDP) provides for a European defence research programme, designed to strengthen the innovation capability and competitiveness of the EU defence sector, and support Europe's strategic autonomy. The European Defence Fund (EDF), launched in 2021, will complement the Austrian defence research programme (FORTE) and promote collaboration between member states on the manufacture of ultra-modern and interoperable defence technologies and equipment. Starting in 2021, this EU initiative will provide valuable support for small and medium-sized Austrian companies and ground-breaking innovative solutions. EDF participation by the Austrian RTI community from 2021 onwards will add another R&D contribution to Austria's position as a country of innovation and to the national value added.

Developments in the higher education sector

Higher education institutions inject momentum into social, economic and technological progress and perform a crucial role in the RTI system as key pillars of knowledge societies. Consequently targeted measures were also introduced in the Austrian higher education system to improve the country's academic performance and implement the RTI Strategy 2030. The **universities' budget** was **increased by 12% for the period 2022–2024** compared to the preceding period, to a **total of €12.3 billion**. The **funding rates per study place at universities of applied sciences were also increased by 10%** with effect from 1 January 2021. With 340 extra government-funded places being allocated for new students at universities of applied sciences from the 2022/23 academic year onwards, this fourth and final expansion met the quantitative targets in the 2018/19–2022/23 Development and Funding Plan for universities of applied sciences. This stage of the expansion was focused on **digitalisation and STEM subjects**. It has also increased the total number of dual study programmes

(i.e. those with an integrated practical element) offered by Austrian universities of applied sciences to twelve (eight bachelor's and four master's degrees).

The COVID-19 pandemic had a particularly dramatic effect on teaching during the year 2020, with a large proportion of course elements converted to "distance learning" formats. The remarkable achievements accomplished in the core activity of teaching have triggered a multi-layered process of innovation and reflection at universities and other higher education institutions that will have a lasting impact on teaching in the future.

In the higher education sector as a whole, the process of **generating synergy effects between research and higher education** has been advanced further. In parallel with endeavours at European level, 2020 in Austria was a year of closer collaboration and leveraging of synergies between the key players in the research and higher education sectors.

Austria's position in an international comparison

Austria is one of the **world's leading nations in terms of expenditure on research and development**. In 2018 Austria ranked second amongst the EU countries, behind Sweden, and ahead of leading innovation nations such as Finland and Belgium. Together with Sweden, Germany and Denmark, Austria is one of only four EU countries to regularly meet the European target of 3%.

The country enjoys a strong **upper midfield** position in terms of its **research and development performance**, which is measured against core quality-oriented parameters such as international patent applications and citation rate. From the **perspective of global innovation rankings**, which are central measurement tools referenced in the new RTI Strategy 2030, **Austria has been catching up** and now holds positions in the upper midfield (19th in the Global Innovation Index and 8th in the European Innovation Scoreboard). Although Austria has not yet managed to break into the forefront of innovation in the overall rankings, it has enjoyed a top position among the following group for some time now.

In the area of digitalisation, the European Commission's Digital Economy and Society Index (DESI) for 2020 places **Austria close to the European average**. Since last year Austria has ranked 13th amongst the EU-28, and its position in the mid-range has remained steady. The field continues to be led by the Nordic countries of Finland, Sweden and Denmark alongside the Netherlands. With regard to its **digital strengths**, Austria fares well in international comparisons, particularly in terms of people's digital skills, international e-commerce by small and medium enterprises (SMEs) and the use of digital public services. However Austria is still some way off the target set in the RTI Strategy 2030, which is to become one of the top five countries. The more average position in the DESI rankings is primarily due to comparatively low use of fixed and mobile broadband networks, and low take-up of internet services, and the limited availability of fast broadband connections, which is still below the EU average. Austria's "Broadband strategy 2030" is an important step towards meeting its targets for digitalisation.

If other indicators for **innovation capability** are included, such as existing knowledge and human capital, as well as the ability to consolidate various types of knowledge, Austria reports **scores above the EU-28 average** almost across the board. It is only in the context of human capital that Austria reports comparatively low figures for tertiary education graduates, which is partially due to the particular characteristics of the Austrian education system with regard to vocational training. In Austria and other countries with a dual vocational education system, a substantial part of the training for the necessary specialist staff is provided outside the tertiary education sector. On the other hand, when it comes to the ability to produce complex products, Austria's position is well above average (in second place).

Austria and EU research, technology and innovation policy

Participation in Horizon 2020, the eighth EU Framework Programme for Research and Innovation, which came to an end last year, can once again be counted as a **success for Austria.** The **total amount of project funding allocated to Austria has now reached €1.78 billion**. With a **success rate of 17.6% in terms of participations**, Austria ranks significantly above the average success rate of 15.5% for Horizon 2020, ranking third amongst the member states of the European Union, after Belgium (19.3%) and France (17.8%). The largest volume of funding for Austria was acquired under Pillar III, "Societal Challenges". This amounted to €662.2 million, or 2.8% of the total for Europe. Austria's performance in the – relatively modestly funded – programme line "Science with and for Society" was significantly above average (proportion of Austrian coordinations was 9.1%, the share of all project participations was 5.6%, and the proportion of funding acquired was 6.7%). The largest budget share, in relative terms, was raised under Pillar II, "Industrial Leadership", with 3.2%.

All major types of institution contributed to this success. The **majority of Austrian participations under Horizon 2020 came from the business enterprise sector (36.9%), of which almost half were small and medium-sized enterprises (SMEs)**. Austrian companies obtained total funding worth €546.6 million over the programme's duration (with a particular emphasis on the "Industrial Leadership" pillar). Overall, more than 500 Austrian companies participated successfully in Horizon 2020, with funding concentrated on the largest successful companies (of which a few managed to carry out several dozen successful funded projects).

Besides companies, however, the **universities/higher education institutions and non-university research institutions were the most significant contributors to Austria's successes in Horizon 2020**. The universities acquired €690.7 million in funding (predominantly in the "Excellent Science" pillar, followed by "Societal Challenges"), while the non-university research institutions raised €448.0 million (chiefly for the "Societal Challenges" pillar).

At the beginning of 2021 the ninth European Framework Programme for Research and Innovation was launched (duration: 2021–2027) under the title **Horizon Europe.** This new EU research and innovation programme allocates approximately €95.5 billion of funding for the period 2021–2027. This represents a budgetary increase of some 30% compared to Horizon 2020. The **key new features** of Horizon Europe are the European Innovation Council and the R&I Missions. The plans for integration of the Social Sciences and Humanities (SSH) into Horizon Europe have also been expanded, to improve the impact focus of the programme.

On 1 June 2020, for the second time, Austria assumed the **chairmanship of Eureka, the international network** which was last chaired by Austria in 1989. Eureka provides a framework for collaboration between the member states through cooperation between the ministries responsible for innovation at a strategic level, and the agencies responsible for the administration of innovation funding. The Austrian Chairmanship of Eureka coincided with the 35-year anniversary of its founding, as well as the start of Horizon Europe, the new research framework programme. The Austrian Chairmanship of Eureka took this as an ideal opportunity to launch a new start for collaboration through Eureka. The work programme of the Austrian Chairmanship facilitated **increased international networking and collaboration for SMEs working in innovation, and provided an opportunity for substantial involvement in shaping the future direction of Eureka** at a strategically crucial time.

Current research

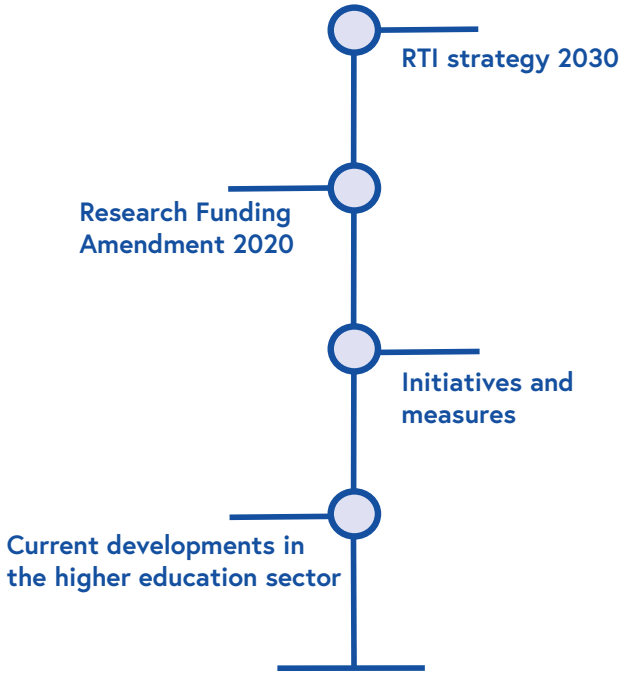
The period covered by the Austrian Research and Technology Report 2021 was dominated by the COVID-19 pandemic, which also presented an unparalleled challenge for Austrian and international RTI policy. Consequently in the present report, the cen-

tral focus is on **developments in COVID-19 research and climate-related research in Austria**.

Austrian research is playing a prominent role in the international response to COVID-19. As in other significantly affected countries, substantial public funds have been provided in Austria for research into the SARS-CoV-2 virus and its effects on our health, social and economic wellbeing. **Processes for awarding and distributing funds were adapted and accelerated flexibly**. This report provides an overview of the measures introduced so far by research funding organisations, with a close look at five particularly relevant institutions: the Austrian Science Fund (FWF), the Austrian Research Promotion Agency (FFG), the Vienna Science and Technology Fund (WWTF), the European Commission in the context of Horizon 2020, and projects directly commissioned by the Federal Ministry of Education, Science and Research (BMBWF). The subject focus of these funding measures was mainly on biological and medical/public health priorities, but also included research into economic, political, cultural and social implications.

Austria is also being profoundly affected by climate change, with average temperatures increasing substantially more than the global average, and the impact of this on numerous areas of our lives and economic activities is being investigated and documented. Austrian RTI policy recognises its responsibility, in line with international strategies and agreements, to help meet the climate targets. At the strategic level the federal government has formulated a technology and climate offensive in the area of "science and research", to strengthen both basic and applied research. Based on this, several initiatives have already been launched. The climate targets were considered in the development of the RTI Strategy 2030 and the contribution of research to climate protection is explicitly spelled out; additional measures targeted towards meeting the climate targets were specified in the "RTI Pact for 2021–2023".

1. Current Trends



Today, society and the economy are marked by dramatic changes resulting from the COVID-19 pandemic.

This chapter provides a brief outline of significant developments at governance level in the field of RTI. These include the new RTI Strategy 2030, the Research Funding Amendment 2020 – a key component in implementing the RTI Strategy – and a raft of initiatives and measures geared towards further developing the RTI system as well as the higher education sector.

1.1 RTI Strategy 2030

The federal government's strategy for research, technology and innovation 2030 (RTI Strategy 2030) and the first "Pact on Research, Technology and Innovation 2021–2023" (RTI Pact 2021–2023), based on the Research Financing Act, were adopted by the Austrian Council of Ministers on 23 December 2020.[1]

The RTI Strategy 2030 was devised taking account of the detailed analysis entitled "OECD Reviews of Innovation Policy: Austria 2018" and the European Commission's smart specialisation concept and is founded on a **clear commitment to efficiency and increasing output** within the system. The strategy incorporated cross-cutting issues such as the Sustainable Development Goals, digitalisation and strengthening gender equality in RTI as well as initial anchor points of the Excellence Initiative, the Location Strategy and the Technology Offensive. It was possible to draw on the expertise of a wide range of stakeholders in formulating the RTI Strategy 2030.

The strategy, which has now been published, reflects the cross-departmental governance in RTI policy. The RTI Task Force, which coordinates the federal government's RTI policy and is accompanying the RTI Strategy 2030, is made up of high-level representatives of the Federal Chancellery (BKA), the Federal Ministry of Finance (BMF), the Federal Ministry of Education, Science and Research (BMBWF), the Federal Ministry for Digital and Economic Affairs (BMDW) and the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK).

Objectives

The overarching objectives listed below provide the strategic direction for the next ten years and reinforce the clear and focused orientation of the RTI Strategy 2030. This is indicated by specific **targets**, making it easier to measure the extent to which objectives have been achieved.

Objective 1: Become an international innovation leader and strengthen Austria as an RTI location

- Rank improvement in international indices (European Innovation Scoreboard (EIS): from top 8 to top 5; Digital Economy & Society Index (DESI): from top 13 to top 5; Global Innovation Index (GII): from top 19 to top 10);
- Attract 5–10 new leading RTI-intensive firms and further develop existing ones;
- Increase the number of companies that perform R&D on an on-going basis by 20%;
- Bring Austria into a stronger position in the European value chains by participating in at least 3 additional "Important Projects of Common European Interest" (IPCEIs – currently participation in 2);
- Exploit the opportunities of digitalisation for society, the economy, climate protection and administration in Austria and drive forward digital transformation with determination.

Objective 2: Focus on effectiveness and excellence

- Successively increase R&D expenditure relative to GDP, to make Austria one of the top 5 countries in international innovation rankings (currently in 7th position according to the OECD ranking);

1 https://www.bundeskanzleramt.gv.at/themen/forschungskoordination_fti.html

- Expand the venture capital pool (including five corporate venture funds to be established in Austria), to raise venture capital expenditure from 0.02% to 0.1% compared to GDP;
- Increase the number of commercially successful academic spin-offs by 100%;
- Achieve top 10 ranking for European Research Council (ERC) grants (per resident);
- Intensify participation in Horizon Europe and consolidate Austria's top 3 ranking in terms of success rate;
- Raise the success rate for the business enterprise sector under Horizon Europe from 18.2% to at least 20%.

Objective 3: Focus on knowledge, talents and skills

- Increase the proportion of graduates in science, technology, engineering and mathematics (STEM subjects) by 20%, and the proportion of women amongst graduates in technical subjects by 5%;
- Secure a top 3 ranking in the Institute for Management Development (IMD) World Talent Ranking (currently ranked 4th);
- Create incentives for researchers to pursue entrepreneurial careers;
- Advance two Austrian universities into the top 100 (the Times Higher Education World University Ranking currently places one in the top 200);
- Increase the proportion of academic and research personnel recruited from abroad to 45%, particularly at universities;
- Double the number of Austrian students of STEM subjects who complete a study programme or study semester abroad with support from funding programmes.

Key fields of activity

To achieve the objectives, eight interlinked and interdependent fields of activity have been defined that **pursue clear priorities** and can be allocated to the various objectives. The individual fields of activity will help to achieve several objectives even if they are primarily assigned to a specific one below.

Fields of activity for Objective 1: Become an international innovation leader and strengthen Austria as an RTI location

The key fields of activity for Objective 1 ("Become an international innovation leader and strengthen Austria as an RTI location") are as follows:

Expand research and technology infrastructure (RTIS) and facilitate access

- Integrate national RTIS into European and international large-scale research infrastructure projects;
- Evidence-based planning and long-term competitive financing models for participation in European and international research infrastructures;
- Create flexible access to RTIS for science and industry;
- Expand data infrastructures and data management, with due regard for the business secret of companies.

Increase participation in EU missions, EU partnerships and IPCEIs

- Pursue active mobilisation of stakeholders as well as funding and support for Austrian participation in EU missions and partnerships;
- Define national areas of strength and future-oriented themes (e.g. digitalisation, Tech4Green, production, energy, health and transport) and reinforce these at European level;
- Establish an evidence-based monitoring system and a flexible mechanism for adjusting the focus of participations;
- Consolidate Austria's position in strategically important value creation chains through participation in IPCEIs.

Promotion and strategic targeting of internationalisation

- Selection of international priority countries and expansion of targeted bilateral and multilateral research cooperations;

- Increased visibility for Austria as a location for research and innovation, and appropriate positioning of the country's image;
- Pursue expansion and settlement in Austria of internationally active technology companies, supported by appropriate instruments.

Fields of activity for Objective 2: Focus on effectiveness and excellence

The key fields of activity for Objective 2 ("Focus on effectiveness and excellence") are as follows:

Promote excellence in basic research

- Launch an excellence initiative to strengthen leading-edge research and collaborations extending beyond the boundaries of disciplines, institutions and countries;
- Develop and expand future-oriented fields of research and encourage freedom of scope in research;
- Accelerate the progress with profile building and priority setting, and strengthen knowledge valorisation;
- Establish three research clusters of world-ranking status including an ongoing process of definition for such clusters;
- Strengthen the universities as key institutions of basic research and expand the Institute of Science and Technology Austria (IST Austria), and the Austrian Academy of Sciences (OeAW);
- Increase the share of competitive research funding.

Support applied research and its impact on the economy and society

- Launch a technology offensive, including research, technology and innovation projects as well as support for business start-ups and attracting companies to Austria, in order to strengthen the RTI foundations of innovation-intensive companies and enhance Austria as a production location (focus on crisis-resilience, system-relevant production and technological leadership, digital transformation of the economy, positioning Austria as a champion of digitalisation and Tech4Green, and as a centre for life sciences);
- Increase long-term planning and finance security for applied research, and optimise the conditions (simplify the funding system, provide advice for small and medium-sized enterprises (SMEs) and involve key stakeholders, create more extensive programme lines, strengthen risk financing, boost support for innovations through public procurement);
- Strengthen private sector research with an open attitude to topics and on technology-neutral principles; increase collaboration between science and industry, as well as the valorisation of knowledge and technology (including further development of exploitation management);
- Improve innovation capability and output of small and medium-sized enterprises;
- Increase public awareness of the value of research and innovation;
- Strengthen R&D in (key) technologies in the area of digitalisation, particularly to contribute to the development of new digital products and services and to support the digital transformation of the economy.

RTI for achievement of the climate targets

- Strengthen research with an open attitude to topics and on technology-neutral principles which addresses the influencing factors, effects and mitigation of the climate crisis and in the areas of climate adaptation and resource efficiency (including by stimulating private funding and participation in EU programmes);
- Develop key technologies to improve climate protection, intensify cross-sector collaboration and implementation of integrated solutions (e.g. in the construction and energy sector, transport etc.), respecting the principle of technology neutrality;
- Develop model regions and large-format experimental areas;
- Expand relevant data collection and use digitalisation as well as networking of stakeholders.

Fields of activity for Objective 3: Focus on knowledge, talents and skills

The key fields of activity for Objective 3 ("Focus on knowledge, talents and skills") are as follows:

Develop and promote human resources

- Integrate creativity, critical research thinking and environmental consciousness into education at all levels;
- Strengthen training and continuing education, particularly in STEM subjects;
- Ensure transferability between educational institutions and beyond this, to the business enterprise sector;
- Strengthen gender equality and diversity in R&D and enhance the attractiveness and promotion of research careers, particularly for women, by intensifying equal opportunity programmes and measures in human resources and career planning.

Support researchers and students in developing an international outlook

- Encourage active participation in international mobility programmes (particularly ERASMUS);
- Develop "internationalisation at home" in all levels of the education system;
- Participate in European research programmes (Horizon Europe) and increase participation by higher education institutions in international study programmes (Joint Study Programmes, European Universities, Fulbright);
- Improve the visibility of Austria as a research location and create attractive conditions that will appeal to international talents.

Monitoring and evaluation system for the RTI Strategy 2030

- The measures implemented and objectives agreed are to be analysed based on the progress made towards the objectives set in the RTI Strategy 2030; the findings gained in this process are to be taken into account when devising the RTI Pacts.
- External evaluations are also to be carried out midway through the ten-year RTI Strategy 2030 and after it has come to an end.

Budgetary and European situation

If the RTI Strategy 2030 is to be properly implemented, it will need to be furnished with adequate resources, which will be determined by the underlying conditions at national and European level. The **main instruments for securing the resources for the budget for the RTI Strategy 2030** are described below.

National framework conditions include the **Research Financing Act** (FoFinaG) and the **RTI Pact** (for details see Chapter 1.2) and Future Austria Fund.

Future Austria Fund

The RTI Strategy 2030 also contains statements about developing the National Foundation for Research, Technology and Development further into a Future Austria Fund. This is designed to create a financing tool for setting strategic priorities for key future-oriented fields and technologies in basic and applied research, complementing the RTI Pact. The Future Austria Fund is to be given secured funding and have its priorities set on an annual basis by the federal government.

Leveraging the opportunities of a common Europe

This key instrument involves collaborating with the best researchers in Europe, funding for studying abroad, acquiring additional research funding by participating in European programmes and the Structural Fund support (smart specialisation), and much more.

As the world's largest coordinated research programme, Horizon Europe is particularly relevant in this context. Austrian research institutions and research funding institutions are involved in the programme and align their activities towards it.

The European Research Area (ERA) is to be

strengthened and Austria's active participation in it pursued in order to further increase the impact of European research and innovation. The ERA's objectives include creating attractive career opportunities for researchers and putting research findings into practice quickly and efficiently.

1.2 Research Funding Amendment 2020

The Research Funding Amendment 2020, the centrepiece of which is the Research Financing Act, was announced in the Federal Law Gazette (BGBl. I No. 75/2020) on 24 July 2020 following a public consultation process in autumn 2019 and resolutions passed by the National Council[2] and Federal Council.[3] The Research Financing Act entered into force on 27 July 2020 and the amendments to the relevant implementing regulations on 1 January 2021. The Research Financing Act has created a specific **legal basis for research funding** that establishes a stable institutional governance framework, taking account of long-term financing and planning security. It encompasses the ten central non-university research and research funding institutions.

The **central research institutions** are as follows: Austrian Institute of Technology GmbH (AIT), the Institute of Science and Technology Austria (IST Austria), the Austrian Academy of Sciences (OeAW), Silicon Austria Labs GmbH (SAL) and the Ludwig Boltzmann Gesellschaft (LBG).

The **central research funding institutions** are as follows: the Austria Wirtschaftsservice Gesellschaft mbH (aws), the Christian Doppler Research Association (CDG), the Austrian Science Fund (FWF), the Agency for Education and Internationalisation (OeAD) and the Austrian Research Promotion Agency (FFG).

As well as identifying the federal government's research and research funding institutions, **RTI Pacts are also designed to improve the strategic management of research policy**. This will define roles more clearly and streamline processes, giving the central institutions more autonomy. The law contributes to priority-setting within the scope of performance and financing agreements and ensures maximum transparency through efficient reporting (particularly annual monitoring reports to Parliament and the public in the form of the Austrian Research and Technology Report, see Chapter 3) and controlling and will result in leaner administrative processes overall.

The main elements deriving from the RTI Strategy 2030 are the three-years lasting RTI Pacts, starting with 2021–2023, and the financing and performance agreements, also starting in 2021.

Improved strategic management thanks to RTI Pacts

The **RTI Pact 2021–2023**, adopted for the first time by the federal government on 23 December 2020 based on the Research Financing Act, makes setting cross-departmental priorities for research and innovation policy a fundamental principle of Austria's RTI policy.[4] This is intended to make implementation and the achievement of objectives better aligned while avoiding duplication. The RTI Pacts, which are to be agreed every three years in future, will ensure that the RTI Strategy 2030, financing and the implementing institutions are all linked. A new, inclusive element is thus being created in Austria's RTI landscape that is establishing a stable, reliable framework for RTI players. All non-university research and research funding, from basic research through to readiness for market launch, is being managed in a coordinated

2 7 July 2020 – 43rd Session of the National Council.
3 16 July 2020 – 911th Session of the Federal Council.
4 22 December 2020 – government resolution 43/10.

way for the first time. The federal government is providing a total of €3,858.3 million for the Federal Ministry of Education, Science and Research (BMBWF), Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) and Federal Ministry for Digital and Economic Affairs (BMDW) to implement the RTI Pact 2021-2023, based on the Medium-Term Budgeting Framework Act (BFRG) 2021-2024.

The strategic priorities of the first pact primarily serve to implement the RTI Strategy 2030. As a basic principle, however, it does not focus exclusively on the strategy as each RTI Pact can also address other RTI-related initiatives and strategies. The RTI Pact is not limited to the central institutions defined in the Research Financing Act, but can also implement measures of other institutions within the scope of Section 1(2) of the Research Financing Act. However, this does not rule out meaningful overlaps with other policy areas taking a "whole of government" approach since the government resolution to the RTI Pact can also include contributions from sectoral ministerial department.

The priorities set in the first RTI Pact 2021–2023 are primarily of structural nature. In order to ensure leaner processes and clear structures for the interaction between federal ministries and research funding institutions, the focus will initially be on reforming research funding governance through the implementation of the Research Financing Act. Furthermore, the range of programmes and instruments is to be overhauled to give funding applicants clearer and more comprehensible access and create larger programme lines while retaining programmes for experimental formats. Finally, bottom-up single-project funding in the field of basic research and mission-focused priorities in the field of applied research also need to be taken into account.

Becoming an international innovation leader, focus on effectiveness and excellence, and focus on knowledge, talents and skills: the measures in the first pact encompass the entire Austrian innovation system and incorporate various European programmes to a very significant degree, primarily Horizon Europe and Digital Europe. Smart specialisation is also to be promoted in order to better coordinate the research policy activities of the federal government and the states.

Performance and financing agreements

Performance and financing agreements are to be concluded between the various ministerial departments and the central research and research funding institutions based on the RTI Pact. Besides the necessary planning security, this will also inject flexibility into the implementation process time so it is possible to respond to new priorities. These agreements thus represent the federal government's most important financing and management tool in its dealings with the central institutions.

Both types of agreement contain **objectives and specific implementing measures** for each RTI institution, provisions on how the federal government disburses funds, reporting obligations and quality assurance measures, rules for annual implementation planning, consequences of non-fulfilment, and indicators for measuring the achievement of the desired objectives and impact of each agreement. The financing agreements with the central research funding institutions also include the funding programmes and individual funding packages covered together with their legal basis, accompanying measures, research contracts and provisions on maximum limits for funding commitments.

2021 to 2023 will be a transitional period. The Institute of Science and Technology Austria (IST Austria) and the Austrian Academy of Sciences (OeAW) will start working with a performance agreement based on these new provisions as early as the 2021–2023 period. The first performance agreement period under the new regime for Austrian Institute of Technology GmbH (AIT) and the Ludwig Boltzmann Gesellschaft (LBG) will be from 2022 to 2023, with the agreements valid for 2021 being taken into account in both cases. The period

covered by the performance agreement to be signed with Silicon Austria Labs GmbH (SAL) will start later, running from the 2024 to 2026 calendar years, as an agreement is already in place for the years up to and including 2023. Financing agreements covering 2021–2023 are to be concluded with the Austrian Science Fund (FWF) and the Agency for Education and Internationalisation (OeAD). Taking account of ongoing agreements, the first financing agreements with the Austria Wirtschaftsservice Gesellschaft mbH (aws), the Christian Doppler Research Association (CDG) and the Austrian Research Promotion Agency (FFG) will be concluded for 2022–2023, with so-called overall contracts ("*Gesamtbeauftragungen*") being signed with the aws and FFG in 2021. From 2024 onwards, all institutions will have performance and financing agreements running synchronously.

In addition, the universities are helping to implement the strategy and the RTI pact by **working in step with the Austrian National Development Plan for Public Universities (GUEP)**, a factor that is also being reflected in the performance agreements. Likewise, the GUEP represents one of the foundations for the plan to develop and fund universities of applied sciences, which defines priorities for (further) developing the portfolio of universities of applied sciences and sets out prospects for the sector's structural development and its quantitative development framework. With regard to the university colleges of teacher education, the Development Plan for University Colleges of Teacher Education (PH-EP) establishes the framework for the next six years and aims to position this type of higher education institution within Austria's overall higher education landscape and steer it in a quality- and development-focused way. Priorities for the next performance period will be set in the three-yearly target-setting and performance meetings between the university colleges of teacher education and the Federal Ministry of Education, Science and Research (BMBWF).

1.3 Initiatives and measures

Further developing the innovation system and leveraging all RTI-related potential will require a wide range of initiatives and measures to be launched by the public sector, not only to create lasting incentives for RTI but also to provide targeted support to the digital and green transformation in Austria and, ultimately, the fight against the COVID-19 pandemic through science and research. A number of ongoing initiatives and measures will therefore be outlined below. Specifically, these are:

- The IP Strategy
- The strategy for the future for life sciences and Austria as a location for pharmaceuticals
- The Creative Industries Strategy for Austria
- The Open Innovation Strategy for Austria
- The Research, Technology and Innovation Strategy "Mobility 2040"
- The National Mobility and Internationalisation Strategy for Higher Education 2020–2030
- Public Procurement Promoting Innovation
- The "Circular Economy" RTI initiative
- Austria's ambition to help build up EU defence research
- The Austrian security research programme KIRAS

Implementation of the IP strategy

The three years following the adoption of the federal government's IP Strategy saw the rapid implementation of many of the measures that it proposed and the expansion and further development of the services provided for protecting intellectual property, which are presented below.

Raising awareness and sharing knowledge of IP

Measures have been taken in the **education sector** to prepare teachers and students for dealing with IP, primarily with regard to "pre-university dissertations" ("*Vorwissenschaftliche Arbeiten*", or VWA) at academic high schools (AHS) and diploma theses in vocational education.

The research work done by the **universities of applied sciences** exerts a strong leverage effect for private investments and promotes activities conducive to the establishment of start-ups. Universities of applied sciences generate around 20% of their research revenue from private-sector partnerships and incubate some 50 start-ups every year. They set great store by treating the results of their employees' and students' research work in a professional manner. All universities of applied sciences have set out standards governing IP rights and, in particular, service inventions in staff employment contracts and in training contracts with students based on the applicable copyright law. This allows their collaboration with external partners and companies to run smoothly and provides a clear decision-making process for marketing issues. In their internal process management, the universities of applied sciences rely on research institutes working closely with service facilities (e.g. Finance & Controlling, HR and Legal, Quality Management, Science Mediation and Communication) and external partners such as the Austria Wirtschaftsservice (aws).

Since 2019, the universities of applied sciences across Austria have joined universities in getting involved with the knowledge transfer centres in order to make knowledge transfer at Austrian higher education institutions even more professional, expand their networks and develop them further through their joint efforts.

The intellectual property rights and exploitation strategies being pursued by the **higher education** and research institutions have been further developed on a continuous basis, with pleasing results being achieved in terms of academic knowledge transfer. For instance, the number of patents granted to Austrian universities has risen steadily in recent years, up from 85 in 2017 to 111 in 2019. There has also been an upward trend in the number of university spin-offs, from 12 in 2017 to 19 in 2019 (source: uni:data). 2019 saw a total of 74 spin-offs by universities, universities of applied sciences and research institutions.

The **services of the National Contact Point for Knowledge Transfer and Intellectual Property (NCP-IP)** have been assessed by external evaluators after around ten years of their existence in Austria. The extremely positive findings show that the NCP-IP is firmly embedded in the Austrian knowledge transfer system and the services have been well received. For example, more online events were held in 2020. Over 130 people took part in "Freedom to Operate – Your Pathway to Internationalisation", where they had the opportunity to discuss internationalisation projects focused on intellectual property with a patent attorney. The theme for 2020's World IP Day – a global day of action to raise awareness of the value of intellectual property rights – was "Artificial Intelligence: Do Patents Still Have a Role to Play?". The event reaffirmed the economic importance of intellectual property rights to Austria as a centre for innovation, with more than 150 experts discussing issues relating to intellectual property rights with a focus on digitalisation and artificial intelligence. The Open Innovation Toolkit (https://www.fair-open-innovation.at/) was also translated into English in the first half of 2020 and presented to the OECD and the ERAC Standing Working Group on Open Science and Innovation, where it was met with great interest. The evaluators recommend continuing the NCP-IP and suggest, amongst other things, giving the range of services a sharper focus and forging stronger links with European initiatives.

Implementation of specific measures to support IP

Together with its national partners and European stakeholders, the **Austrian Patent Office** (ÖPA) develops an extensive portfolio of tailored services and support schemes for Austrian SMEs. The European Union Intellectual Property Office (EUIPO) has recently devised an SME support programme for 2021. Endowed with a total volume of €20 million across the whole of the EU, it serves to give them financial assistance with trademark and design applications in

Austria and the EU and funding to take advantage of consultancy services. The new scheme (https://www.patentamt.at/bleibeinzigartig) is designed to strengthen the competitiveness of SMEs throughout Europe by providing direct financial support. In addition, the funding programme should lead to an increase in overall use of intellectual property rights overall, particularly since only around 9% of SMEs in the EU use the intellectual property rights system at present.

The awareness-raising measure **discover.IP** (a partnership between the Austria Wirtschaftsservice (aws) and the Austrian Patent Office), which offers companies a low-threshold service for familiarising themselves with the possibilities presented by IP, was strengthened in 2020 with the launch of a dedicated website. This is even easier to access for anyone interested, includes tailored packages of information and allows applications to be filed on the spot (www.discoverip.at).

Interest remains very high, with 1,858 **Patent.Vouchers** (a 2016–2021 partnership between the Austrian Research Promotion Agency (FFG) and the ÖPA) having been redeemed to date – including 496 last year. The number of applicants has risen steadily and was up by 17% year on year in 2020. An online self-test makes it even easier for funding recipients to find out their eligibility for a Patent.Voucher in just a few clicks. Finally, the way funding is processed was modified in response to the on-going COVID-19 crisis: diverging from the guidelines, the option to extend the funding period by up to three months was introduced until further notice (https://www.ffg.at/en/programme/patentvoucher).

With its unique industry and market expertise, **the aws innovation protection team** covers customer-specific funding programmes throughout the entire IP life cycle, from generation and exploitation through to enforcement. Since 2020, the Austria Wirtschaftsservice (aws) has also been able to promote the internationalisation of patent applications and the performance of FTO (freedom to operate) analyses in specific markets to a greater extent once again.

The proven focus of the **coaching provided by the aws protecting innovation** (www.aws.at/en/aws-protecting-innovation) lies on developing and implementing strategies specific to individual products or product lines of start-ups and SMEs. The activities are intended to help companies with coaching (on-site and online workshops) and funding. In addition, the prerequisites for integrating a company's IP strategy into the – increasingly digital – business models are to be created and resources built up for this purpose. The need for financial support in order to implement the company's specific IP strategy is identified during the coaching process in several steps borrowed from agile methods. The Austria Wirtschaftsservice (aws) is also in a position to support SMEs, start-ups and corporates thanks to its expertise in exploitation services and/or in licensing technology services.

Implementation of the Future strategy for life sciences and the pharmaceutical sector in Austria

Unveiled in 2016, the "Future strategy for life sciences and the pharmaceutical sector in Austria" tackles key scientific and economic issues relating to the life sciences. These are discussed in a broad-based dialogue with stakeholders and corresponding measures are proposed in order to further increase the scientific and economic competitiveness of this key sector for Austria as a business location. Essentially, many of these measures have been successfully implemented in the short time since the strategy was published. For the current reporting period, therefore, the focus is on whether and to what extent measures that have been started or are under way, instigated by the strategy are to be continued or which perspectives, that still require further action, should be incorporated into the existing RTI steering instruments.

Key tasks within the remit of the Federal Ministry of Education, Science and Research (BMBWF) in 2020 were continuing and expanding measures al-

ready initiated and bringing various crucial measures to a successful conclusion.

Extending the Vienna Biocenter Vision **to 2030** meant that, not only could one of the most ambitious projects in the Strategy be progressed, but also – and much more important – the long-term viability of the Vienna Biocenter Core Facilities and thus an excellent and essential research infrastructure initiative could be guaranteed. The Vienna Biocenter Vision includes a funding package for purchasing and operating high-tech research infrastructure and the provision of research services by Vienna Biocenter Core Facilities GmbH[5] (VBCF) at the Vienna Biocenter centre of excellence for life sciences and in the entire Vienna region. This successful initiative, which the Federal Ministry of Education, Science and Research (BMBWF) launched back in 2010 together with the City of Vienna, has been implemented successfully on an ongoing basis and is now being extended to mid-2030.

The Vienna Open Lab has also been successfully integrated into the Vienna BioCenter Vision as part of this extension. Under this vision, the close collaboration between the Vienna Open Lab and the VBCF on the site is leveraging synergy effects.

Another success was achieved in a European context with the integration of the Austrian BioImaging Network (Austrian BioImaging/Correlated Multimodal Imaging) into the ESFRI Research Infrastructure Euro-BioImaging (ERIC).[6] Austria's imaging platform is made up of imaging facilities at VBCF GmbH, the Medical University of Vienna, Vienna University of Technology, the University of Veterinary Medicine Vienna, the University of Vienna, Austrian Institute of Technology GmbH (AIT), the Research Center for Virtual Reality and Visualization (VRVis), the Institute of Science and Technology Austria (IST Austria), the Ludwig Boltzmann Gesellschaft (Ludwig Boltzmann Institute for Experimental and Clinical Traumatology) and the University of Applied Sciences Upper Austria.

In line with the Life Sciences Strategy, more European research infrastructure measures were actively pursued in 2020 and involvement in projects (e.g. BBMRI, EMPHASIS) was developed further.

As part of efforts to develop Horizon Europe, the EU's new Framework Programme for Research and Innovation, steps were also taken to pave the way for **Austria's participation in future transnational European initiatives and partnerships**, which included organising a national workshop on the *"Krebs"* ("Cancer") mission. In response to the COVID-19 crisis, the Federal Ministry of Education, Science and Research (BMBWF) has launched relevant studies in close collaboration with the universities and research institutions as part of its fight against the pandemic. These include prevalence and clinical studies at the medical universities as well as improving and validating diagnostic techniques and tests. As part of an urgent SARS-CoV-2 funding pool, the Austrian Science Fund (FWF) has also given its fast-track approval to procedures that could help to combat this and future pandemics (see Chapter 2.4.1).

Within the remit of the Federal Ministry for Digital and Economic Affairs (BMDW), the activities in the field of science-industry partnerships and translation were and continue to be stepped up. The **five COMET centres with relevance for the life sciences** have received continuous support since the strategy was unveiled as part of efforts to fund cooperative research. In addition, **21 new Christian Doppler Laboratories and Josef Ressel Centres** (JR Centres) with a research agenda focusing on medical applications in the Life sciences and environment and Medicine thematic clusters were opened during the period. The 31 CD Laboratories and three JR Centres made up 31.5% of the 108 active CDG research institutions in all in these two thematic clusters in 2020.

5 www.viennabiocenter.org/facilities/
6 https://www.bioimaging-austria.at/

The **Translational Research Center flagship project** for life sciences also became fully active in 2020 after the Austrian subsidiary Wings4Innovation GmbH had been set up quickly after the fund was launched (July 2019) and efforts to recruit Austrian projects had been driven forward successfully right from the start. Four Austrian projects were included in the fund's portfolio by 31 December 2020, which means that a pleasing 25% of all the projects selected in a competitive process come from Austria. In line with the fund's plan, 2020 saw only investments being made, with no income yet being received from any commercialisation of the projects as had been expected. The fund will be evaluated at the end of the investment phase based on the success achieved by its projects, on the returns that can potentially be generated, particularly only in the long term, and on the income actually earnt. If appropriate, the Federal Ministry for Digital and Economic Affairs (BMDW) will then extend its involvement in the fund as it is continued or relaunched.

The planned ***medical engineering networking platform*** designed with community consensus is to be adapted in line with the changing requirements due to COVID-19 so that the network of experts/expertise can also help to support the Austrian federal government in the event of a crisis.

Improving Austria as a location in the context of strengthening innovation services and research companies and supporting start-up projects is another field of activity that is a priority for the Federal Ministry for Digital and Economic Affairs (BMDW). The research premium, an indirect funding instrument, was increased to 14% in 2017. The investment premium, focusing particularly on health/life sciences, amongst other areas, was launched in 2020 during the pandemic. Other pandemic-related measures, including a call for tenders worth €26 million, are described in Chapter 2.4.1.

Administered by the Austria Wirtschaftsservice (aws), the **LISA** (Life Science Austria) initiative has provided seed financing to 30 life sciences projects and pre-seed financing to 38 projects, including six and eleven respectively in 2020. These (pre-)start-up projects are also being supported by the many varied instruments offered by the Austria Wirtschaftsservice (aws) and the Austrian Research Promotion Agency (FFG), including the general programmes and the newly launched Spin-off Fellowship programme. Via its funds, the aws also makes private equity available to fledgling companies in their growth phase. In 2020, for example, 22 initial and follow-up investments were made by *aws Gründerfonds* alone.

Numerous **prizes and awards** for bottom-up research were presented, while a number of topic-specific life sciences prizes were also awarded: the "*Best of Biotech* (BoB)" business plan competition was judged in 2017 and 2019. In its most recent incarnation, it had been overhauled and split into three categories: "Biotech/Pharma", "Digital Health" and "Medtech". The Life Science Research Awards Austria, presented by the Austrian Society for Molecular Biosciences and Biotechnology (ÖGMBT), have been sponsored by the Federal Ministry for Digital and Economic Affairs (BMDW) since 2017, with a new category for outstanding research with social relevance being added in 2018.

The Austrian Business Agency (ABA) – Invest in Austria is responsible for showcasing the country as a location including the numerous improvements. In the sector of life sciences companies, the Life Science Austria (LISA) programme line also organises joint appearances at international trade fairs, enabling Austrian life sciences companies to be represented by the LISA umbrella brand even if they are not taking part individually. These events have been held online during the COVID-19 crisis.

Implementation of the Creative Industries Strategy for Austria

Promoting the creative industries has been a key component of Austria's national RTI policy for over a decade. The focus is clearly on the innovative and transformative impact that the creative industries have on the economy as a whole. With its Creative

Industries Strategy, published in 2016, Austria has formulated a comprehensive national concept for promoting the role played by the **creative industries as a driver of innovation and transformation** for the entire economy even further. Austria can thus be regarded as an example of best practice and a pioneer, both across the EU and further afield. Strategic support with implementing the strategy comes from the Creative Industries Advisory Board, which was set up at the Federal Ministry for Digital and Economic Affairs (BMDW) specifically for the purpose. Its independent experts are on hand to provide advice, assess the progress made in implementing the strategy and make recommendations.

The creative industries were one of the first sectors of the economy to be hit hard by the COVID-19 pandemic from March 2020 onwards due to their close links with the event, tourism and culture industries. According to *Kreativwirtschaft Austria's* autumn 2020 barometer for the creative industries, 80% of the companies surveyed in the creative industries have suffered a fall in demand (as against 66% in other industries). Two-thirds of companies in the creative industries have been affected by trade fairs and other events being cancelled. The barometer also indicates that short-time working is used less often in the creative industries than in the economy as a whole (48% as against 67%) as it is not well suited to the flexible forms of working and patchwork structure encountered in these industries. According to EU estimates, the cultural and creative industries, alongside with tourism and culture, are amongst the sectors hit hardest by the crisis.

This situation led the Creative Industries Advisory Board to produce a **position paper entitled "Strategies and measures for the creative industries during and after the coronavirus crisis – focus on building up the economy"** in May 2020. The main thrust of the position paper is the idea that the creative industries, as a driver of digitalisation, can help numerous companies to transform their business models and services during the crisis to make them fit for the future and thus generate new sales streams. To this end, the members of the Advisory Board proposed three measures that would have a low threshold and a broad impact.

Following these recommendations, additional **funding was provided in the second half of 2020 as part of a dedicated COVID-19 priority area**. Two special calls for tender were organised that were geared towards supporting potential solutions that were relevant to the economy as a whole and that addressed challenges caused by COVID-19. In particular, these focused on new digital and sustainable business models for revitalising the economy and strengthening resilience as well as on crisis management solutions from the social impact sector. In total, over 100 innovation projects were supported with around €7 million in 2020.

A further €800,000 was made available for additional support services for 2020–2022. All measures devised are specifically intended to make active use of the creative industries and their companies in the economic restart that is now required and to develop their expertise further to this end. The measures include:

- Coaching in order to develop new added value systems and help businesses start again following the crisis;
- Pilot mentoring schemes for female entrepreneurs in the creative industries after the crisis in order to have more women-led companies in fast-growing sectors in the long term. This also serves to implement a recommendation by the Creative Industries Advisory Board;
- Workshops for developing new post-COVID-19 business models for cross-sectoral technology transfer (likewise implementing a demand by the Creative Industries Advisory Board);
- International co-working spaces for re-establishing international relations and re-building new international networks;
- Webinars with successful foreign companies for importing new potential solutions and innovative business models into Austria in a targeted manner in response to the crisis;

- Co-creation formats for SMEs, specifically those from the sectors trade, manufacturing and tourism that are facing a major digitalisation-induced disruption that has been exacerbated even further by the coronavirus crisis. The plan here is to devise new sales and communication channels and new digital business models together with the creative industries in order to make the individual sectors fit for the future. Here too, the Federal Ministry for Digital and Economic Affairs (BMDW) is acting on a recommendation by the Creative Industries Advisory Board.

Monitoring implementation of the "Open Innovation Strategy for Austria"

In July 2016, Austria became the first EU member state to put forward a comprehensive national Open Innovation Strategy (OI Strategy).[7] Numerous activities and interventions have already been implemented since then by the ministries entrusted with implementation – the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) and the Federal Ministry of Education, Science and Research (BMBWF) – as well as by stakeholders at federal, state and local authority level.

In the spirit of open innovation, the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) is continuing to focus on **innovation laboratories** with different thematic specialisms and on **test environments and test regions** that provide a broad basis for generating knowledge with the involvement of stakeholders. This goes a long way towards implementing measure 1 of the OI Strategy to set up open innovation and experimentation spaces. The "open4innovation platform" of the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) makes research results from funded projects available on a large scale, thus demonstrating how open data and open access principles have become embedded in research ("Measure 12").

With a **call for proposals for "Digital and social transformation in higher education"**, the BMBWF is making a key contribution to "Measure 12" of the Open Innovation Strategy (anchoring open data and open access principles in research). The call was targeted at public universities and rewarded projects that generally tackle various aspects of the digital transformation. Projects such as "Austrian Transition to Open Access 2" and "Open EducationAdvanced" from the previous calls for proposals to receive higher education funds were also continued.

The **Innovative Youth** school competition is organised jointly by the Federal Ministry of Education, Science and Research (BMBWF) and Federal Ministry for Digital and Economic Affairs (BMDW) and forms a key building block in implementing "Measure 2" of the OI Strategy (embedding open innovation elements at kindergartens and schools). Innovative Youth supports creative and innovative projects and highlights the potential for ideas and action that schoolchildren possess. Participation allows pupils and apprentices aged 15–20 to formulate their creative and innovative ideas and suggestions in the form of projects, put them into action and present them to the general public. They can submit proposals in four categories – Design, Engineering, Science and Entrepreneurship – and in the special Sustainability prize category. The winners of the school competition are chosen and rewarded with attractive sums of prize money at the annual Austria-wide finale. Preparations are currently under way for the 34th edition of the Innovative Youth school competition for 2020/2021.

Through the **Citizen Science Award**, organised by the Agency for Education and Internationalisation (OeAD), the Federal Ministry of Education, Science and Research (BMBWF) helps selected scientifically oriented citizen science and open innovation projects

7 http://openinnovation.gv.at/wp-content/uploads/2016/08/Open-Innovation-barrierefrei.pdf

to get committed citizen scientists interested in collaborating on research projects. It does this via its PR work and networking as well as through the Citizen Science Awards, which are worth a total of €3,000 per project. 2021 saw two introductory workshops for the Citizen Science Awards being offered ahead of the collaborative research period for the first time. Run in cooperation with the various projects and the University Colleges of Teacher Education in Vienna and Tyrol, these give teachers the opportunity to get to know the projects up close and network with the researchers directly.

At the Federal Ministry of Education, Science and Research (BMBWF) and Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK), meanwhile, the annual Open Innovation stakeholder dialogue for monitoring implementation of the OI Strategy was held online for the first time as a result of the pandemic. Three success stories were showcased at this event. The first of these was the "Community creates Mobility" project, the brainchild of the Institute for Advanced Studies (IHS). Its core component is a "mobility manifesto", because there is a need for the pooling of different perspectives and areas of expertise, a shared vision for the future of mobility, and a push towards more collaboration. The competence centre of Salzburg's innovation centre (ITG) was also introduced. This competence centre is a pilot venture implementing OI projects with practical relevance together with industries, clusters, associations, local governments and regions in the areas in which Salzburg is strong (e.g. tourism, healthcare, the timber industry, smart digitalisation). It is being developed further until mid-2021. The third open innovation project showcased was presented by the Austrian Economic Chambers (WKO) and involves an open innovation process with the creative industries for SME sectors hit hard by the COVID-19 pandemic. An OI pilot was launched back in 2019 together with the austriaguides iRd Strategy for the Creative Industries of the Federal Ministry for Digital and Economic Affairs (BMDW) and was scaled up in 2021 as a post-COVID-19 measure.

The federal funding agencies remain important intermediaries for implementing the Open Innovation Strategy. The Austrian Research Promotion Agency (FFG) anchors OI in existing programme lines and promotes the implementation of the OI strategy through targeted measures, such as a module on "Innovation Basics", which gives potential applicants a crash course in innovation, specifically open innovation, methods (crowdsourcing and lead-user methods).

The aws is providing considerable support to efforts to implement "Measure 9" of the OI Strategy, which concerns fair sharing and remuneration models for crowd working. The online guide www.fair-open-innovation.at, which is designed to provide a toolbox for applying fair open innovation processes, was completed back in autumn 2019. Since its completion, the guide has been presented at international events and will also be showcased internationally on various stages in 2021 as an example of best practice.

Together with 24 international partner organisations making up "cOAlition S" (www.coalition-s.org/), the Austrian Science Fund (FWF) launched Plan S on 1 January 2021. For the FWF, this means that all research projects funded from 2021 onwards are required to publish the quality-assessed scientific publications derived from them on an open access basis.[8]

By establishing the Open Innovation in Science (OIS) Center and continuing to develop it further, the Ludwig Boltzmann Gesellschaft – Austrian Association for the Promotion of Scientific Research has created an important interface for the practical implementation of "Measure 6" of the OI Strategy (building up research expertise for applying Open

8 There are three options for open access publication: publishing via an open access publication medium (gold), publishing individual articles in subscription journals (hybrid) or archiving the accepted manuscript in a registered repository (green). See https://www.fwf.ac.at/en/research-funding/open-access-policy/open-access-to-peer-reviewed-publications

Innovation in science and academia). The project entitled "The Open Innovation in Science research field: a collaborative conceptualisation approach" aims to accelerate the development of an integrative framework for debating the role and significance of openness and collaboration in scientific research.

With its OI implementation initiative "exploration space", the Austrian Academy of Sciences (OeAW) intends to operate an innovation and experimentation ecosystem in order to stimulate, design, facilitate and scientifically analyse new forms of knowledge generation at the interface between science, technology and society. In the context of an open innovation research infrastructure movement, this will involve running through various different demonstrators and scenarios and developing scientific partnerships on a cross-cutting basis across disciplines, industries and organisations.

The Austrian Patent Office continues to manage data on hundreds of thousands of intellectual property rights such as patents, registered designs and trademarks and is making an on-going contribution towards implementing "Measure 12" of the OI Strategy (anchoring Open Data and Open Access principles in research) through its open data initiative.

Universities and universities of applied sciences are also implementing corresponding projects with OI relevance within their field of activity.

Although these examples merely provide a rough overview of ongoing OI initiatives,[9] they illustrate a pleasing willingness amongst all stakeholder types to take action. This can be seen across the board in terms of the content of the measures defined in the OI Strategy for Austria.

The Research, Technology and Innovation Strategy (RTI Strategy) "Mobility 2040"

With the national RTI programme *"Mobilität der Zukunft"* ("Mobility of the Future") and the current EU Framework Programme for Research and Innovation "Horizon 2020" coming to an end, a **"Mobility 2040" RTI Strategy** was developed for the first time between November 2019 and September 2020 under the aegis of the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK). This is geared towards laying the groundwork for the future mission-based design of innovation policy measures in the mobility sector, particularly in order to meet climate targets, and supporting Austria's successful efforts to position itself in mobility-related areas of the EU's upcoming "Horizon Europe" Framework Programme for Research and Innovation. The "Mobility" RTI Strategy is also intended to bridge the gap between the as-yet unformulated mobility master plan for 2030, mobility policy and the federal government's new Research, Technology and Innovation Strategy for 2030.

An extensive stakeholder process and broad-based co-creation approach were chosen for the development process in order to take account of the various stakeholders in the mobility system with their diverse interests and objectives. The result is the first-ever **fully coordinated strategy document** for implementation, which contains a single vision, mission and structure for determining the priority content for transforming the mobility system as well as four RTI measures and a steering concept. The vision is to support innovations in and from Austria for a climate-neutral mobility system in Europe by 2040, while also making progress in research and innovation policy towards creating a sustainable, climate-neutral and inclusive mobility system.

With a clear focus on system solutions, the thematic RTI focus areas and the framework for the content of RTI policy measures were not sketched out based on individual fields of technology, sub-systems or modes of transport this time, instead being based on **four mission fields**. Two of these – "Cities: making urban mobility climate-neutral" and "Regions: mobilising rural areas and linking them sustainably" – shine the spotlight on the spatial dimension, which

9 A table providing an overview of the current OI initiatives can be found in Annex III.

shapes the requirement and demand for mobility. The other two – "Digitalisation: running infrastructure, mobility services and logistics services in an efficient and climate-friendly way" and "Technology: developing environmentally friendly transport technologies" – emphasise two technology-based key areas and address the potential that digitalisation and other technological developments offer for a climate-neutral mobility system. Close links are to be established via strategic alliances.

With its four RTI measures entitled "RTI funding", "Experimental spaces", "Alliances and implementation partnerships" and "European and international positioning", the BMK is aiming to implement the four mission fields while taking gender equality and diversity aspects into account in an integrative way.

At the closing event in September 2020, 18 high-ranking representatives from the worlds of science, industry, politics and administration came together to signal their commitment to the RTI Mobility 2040 vision through their signature and declare their willingness to do their utmost to help implement the RTI Mobility Strategy.[10]

National Mobility and Internationalisation Strategy for Higher Education 2020–2030: There are many routes to internationalisation

The "National Mobility and Internationalisation Strategy for Higher Education 2020–2030. There are many routes to internationalisation" – or HMIS 2030 for short – was published as part of the OeAD's Higher Education Conference on 3 November 2020. It is the result of further developing the higher education mobility strategy from 2016 and was formulated based on the findings from the discussions held in a participatory process with the dedicated assistance of numerous experts from the whole of Austria's higher education sector. The aim was to expand the focus beyond the boundaries of mobility in higher education in order to produce a holistic approach to the internationalisation of studying and teaching that includes mobility and permeates all levels and areas of a higher education institution. The HMIS 2030 highlights some alternative routes and, for the first time, addresses all areas of the higher education sector: the universities, universities of applied sciences, private universities and university colleges of teacher education.

Not all students are able to become physically mobile for all manner of different reasons. Nevertheless, everyone must have the opportunity to acquire international and intercultural skills. The strategy plan therefore proposes **five goals**, which are to be met by 2030:

- Goal 1 – Promote an all-encompassing culture of internationalisation at higher education institutions
- Goal 2 – Promote mobility for all members of higher education institutions
- Goal 3 – Develop and implement innovative digital forms of mobility
- Goal 4 – Effective skills improvement and institutional learning
- Goal 5 – Global Mindset – Austria's higher education institutions and their position in the world

These goals, each of which comes with several objectives for implementation, were deliberately worded concisely and are to be understood as instructions for action. The strategy thus gives higher education institutions a degree of leeway in its implementation and allows them to use their discretion in determining what they see as the appropriate measures to achieve the goals. An interim report on progress with implementing the HMIS 2030 is planned for 2024. The HMIS 2030 is available in German (PDF) and English (PDF).

Public Procurement Promoting Innovation

Public Procurement Promoting Innovation (PPPI) is now a key factor in demand-side innovation policy in

10 https://mobilitaetderzukunft.at/resources/pdf/broschueren/BMK_FTI_Strategie_Mobilitaet_barrierefrei.pdf

Austria and a core element of an impact-oriented RTI policy mix. It is geared towards **increasing the percentage of the public procurement volume that goes on innovations**. Worth some €45 billion a year, public procurement has clear potential to drive innovation forward.

The PPPI initiative was launched in conjunction with Austria's 2011 RTI Strategy, on the basis of which the guiding concept behind PPPI was formulated as a strategic framework and signed off in 2012. A major milestone was reached in 2013 with a PPPI service centre being set up within the Federal Procurement Agency (*Bundesbeschaffung GmbH* – BBG).

An interim evaluation[11] of the PPPI initiative completed in 2018 set out to review the implementation of its guiding concept and the measures devised therein. This evaluation pronounced a positive verdict on the initiative and contained recommendations for improving it further, which looked at issues including the political and strategic framework in which PPPI is embedded, creating incentive systems and carrying out impact analyses.

The recommendations have been and continue to be acted on as part of the continuous **further development of the PPPI initiative** by the Federal Ministry for Digital and Economic Affairs (BMDW) and the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK), the ministerial departments responsible for it. The impact analysis conducted by Joanneum Research and the Austrian Institute of Technology (AIT) confirms the impact and added value of procurement projects that promote innovation (see also Chapter 2.5) in various dimensions.

Elements creating incentives have been established in the shape of the PPPI Toolbox (aws) and R&D Innovation Partnership (FFG) funding formats as well as a special PPPI prize as part of the Austrian Administration Award (in partnership with the Federal Ministry for Arts, Culture, the Civil Service and Sport (BMKÖS)). The long-term future of the PPPI service centre run in cooperation with the Austrian Federal Procurement Agency (*Bundesbeschaffung GmbH* – BBG) has also been secured and its services developed further on an on-going basis. Besides established services such as the PPPI innovation platform, training, consulting and guides, a specific offering for innovative firms was also created in BBG's online shop in the form of the *Direktvergabeplattform Innovation*, a direct contract award platform for innovation. In addition, innovations now play a more prominent role in the Austrian Federal Procurement Agency's core process. This is being done throughout the entire procurement process and, amongst other things, makes use of the PPPI Challenges as an instrument for open innovation.

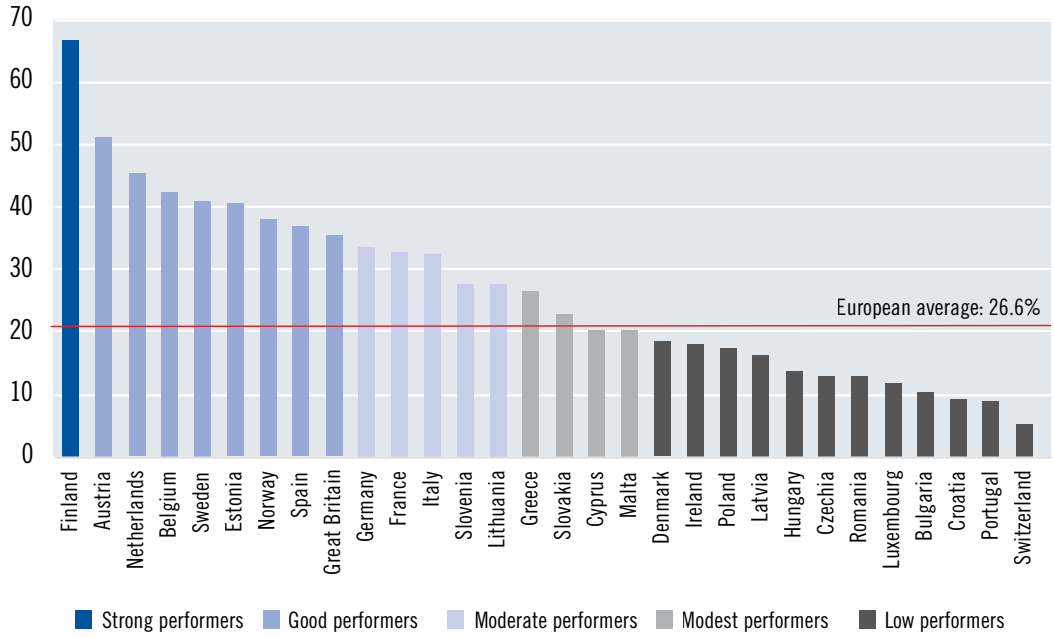
The PPPI service centre's strategic partnerships with ASFINAG, Österreichische Bundesforste AG and Wiener Linien have been strengthened and a form of on-going, structured collaboration that is aligned with the specific needs of each partner has been established as part of the so-called "PPPI Game Changer Programme". A new Game Changer partner has also been acquired in the shape of the Austrian Agency for Health and Food Safety (AGES).

PPPI benchmarking – Austria versus the rest of Europe:[12] Austria has performed well in international benchmarks since implementing its guiding concept for PPPI in 2012.[13,14] The most recent benchmarking studies[15,16,17] also confirm that the country is playing a leading role, albeit with clear indications of areas for further development.

The benchmarking study on the underlying national policy conditions for PPPI run by PwC on behalf of

11 See Ruhland et al. (2018).
12 See Buchinger (2021).
13 See ERAC (2015).
14 See OECD (2017).
15 See PWC (2021).
16 See PWC (2020).
17 See European Commission (2020).

Fig. 1-1: Country rankings for conditions underlying PPPI policy



Source: PwC (2021, 24).

the European Commission puts Austria in an excellent second position behind Finland (Fig. 1-1). The underlying policy conditions are measured using ten indicators that represent each country's specific mix of conducive policy measures. These indicators range from a PPPI action plan and embedding PPPI in horizontal and sectoral policies through to PPPI incentive schemes, PPPI targets and PPPI monitoring.

According to the benchmarking study, **Austria's strengths** lie in its well-formulated PPPI action plan and how this dovetails with its development of extensive PPPI capacity (website, case studies, training courses, services, tools, coordination, networking, "one-stop shop" approach). The study also highlights Austria's well-structured monitoring and incentive system. Finally, Austria is performing well in embedding PPPI in sector-specific policies.

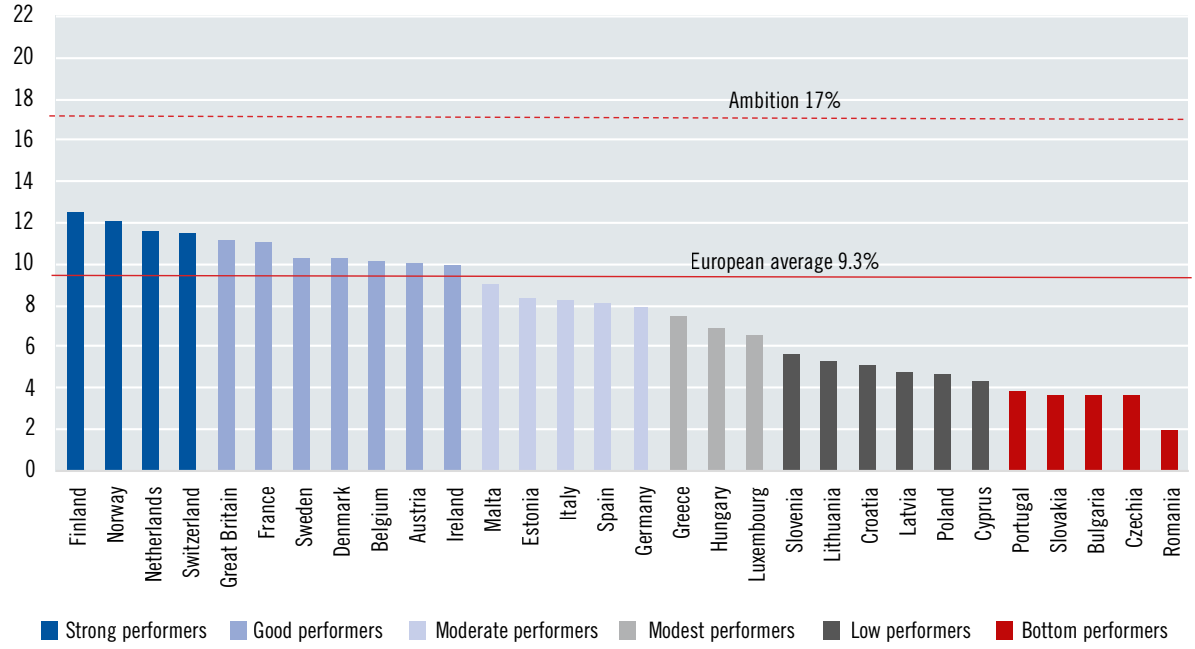
The benchmarking study identifies some **room for improvement** for Austria, particularly with regard to the objective to "increase PPPI expenditure", as well as coordinating capacity-building activities with the financial incentives introduced. The study also recommends simplifying the monitoring system (e.g. by running regular surveys).

The PwC benchmarking study commissioned by the European Commission that compares PPPI expenditure across Europe puts Austria amongst the top performers, placing it tenth (Fig. 1-2) for PPPI as a percentage of total procurement volume. The figures are calculated from assessments at European level[18] combined with national data on public-sector tenders and additional research.

However, it is worth pointing out here that the figures on PPPI expenditure in the benchmarking study differ significantly from the Austrian survey results published by Statistics Austria.[19,20] Whilst Statistics Austria calculated that PPPI made up between 2.3% and 3.3% of the total procurement volume in the government sector (2013 reporting year) based on a direct survey, the benchmarking study

18 TED Tenders Electronic Daily; https://simap.ted.europa.eu/en
19 See Bauer et al. (2015).
20 See Buchinger und Schiefer (2017).

Fig. 1-2: Country rankings for PPPI as percentage of total procurement volume



*All countries excluding military expenditure

Source: PwC (2021, 144).

puts the same figure at 10.0% (2018 reporting year). The two figures cannot be directly compared as both the reporting year and the method used to arrive at them are different.

Overall, Austria is one of the pioneers in Europe when it comes to PPPI. However, a closer look at the relationship between underlying policy conditions and the implementation of PPPI reveals signs of a potential "gap" between underlying policy conditions and the broad-based implementation of procurement.

The current government programme includes a clear mission to update the guiding concept behind PPPI. Based on the RTI Strategy 2030 and the RTI Pact 2021–2023 and taking previous evaluations and recommendations into account (e.g. Council for Research and Technology Development (RFTE),[21] European Commission) the strategic PPPI framework for 2030 is therefore being devised as an evolution of its guiding concept and is expected to be ready by the fourth quarter of 2021.

The strategic framework for 2030 is intended to renew the commitment to PPPI at policy level and will include tangible measures for developing the PPPI initiative further, e.g. with regard to embedding it in strategy, broadening the community, helping to tackle current societal challenges, monitoring and the data situation as well as procurement law.

The "Circular Economy" RTI initiative

With reference to the government programme for 2020–2024, an Austrian strategy for creating a circular economy is currently being devised and prepared using clear sub-goals, priorities and measures for implementation. With research and development forming a key part of these efforts, the "Circular Economy" RTI initiative is being launched at the same time to improve understanding of the system and bring innovative technologies to life. This is aligned with the EU's Circular Economy Action Plan and, as such,

21 https://www.rat-fte.at/files/rat-fte-pdf/einzelempfehlungen/2016/160915_Empfehlung%20zur%20IOeB.pdf

focuses on the following **key value chains in the manufacturing industry**:

- Electronics and ICT
- Batteries and vehicles
- Packaging
- Plastics
- Textiles
- Construction and buildings
- Food, water and nutrients

The overriding aim is to **reduce environmental pollution** by extending the lifecycle of products and making significant energy savings in manufacturing processes. The competitiveness of Austria's industry for a sustainable future is being ensured and strengthened through innovations in the system that take the whole of a product's lifecycle into account.

The circular economy calls for systemic changes surrounding and within the economic system. In the past, innovations were often born in "silos" and were optimised for a specific aspect of the product or material in question. Whilst these innovations brought improvements in one area, they often weakened the creation or preservation of value in other, generally downstream stages of the value chain. There is thus a need for system-wide innovations that generate value for both the player and the system as a whole.

In the "Circular Economy" RTI initiative, therefore, relevant challenges at every stage of the value creation cycle are being identified and addressed in order to lay the foundations for a circular approach to the economy through innovation, technology and considering the system as a whole.

This requires new technologies, systems and processes to be developed and existing ones improved. This includes purchasing and using recyclable, harmless and, as far as possible, biobased materials and covers all aspects of design (material selection and the ability of a product to be disassembled, repaired and reused) as well as the resource-efficient, low-emission manufacture of reusable products. Innovative business models that allow consumers to adapt their behaviour (leasing, sharing, reuse, refurbishment, repair) are crucial, as are the recovery of raw materials (treatment) and recycling.

With annual calls for proposals, the multi-year "Circular Economy" RTI initiative is supporting innovative research and development projects and thus helping to make Austria's industry more competitive over the long term. It is making a major contribution towards implementing national and European strategies for the circular economy and bioeconomy and achieving the Sustainable Development Goals set by the United Nations (UN).[22] This is going a long way towards cementing the country's position as a technology leader and solving urgent societal challenges such as the climate crisis and resource scarcity.

Austria's ambition to help build up EU defence research

Austria's ambition as part of the European Defence Fund[23] (EDF) is to help build up EU defence research in order to strengthen itself as a place to do business and technology hub, to **position Austrian companies and research institutions** as innovative, highly valued partners **in European defence research projects** and to put available EU funding (some €8 billion in all) towards research and development. To get the RTI community ready for the issues involved in defence research, a national defence research programme – FORTE – was launched back in 2018 under an administrative agreement between the Federal Ministry of Agriculture, Regions and Tourism (BMLRT) and the Federal Ministry of Defence (BMLV) (three calls for proposals worth €5 million each have already taken place). To ensure that the EDF was being coordinated in a harmonised way at national level, an Austrian strategy for EU defence research was drafted and adopted by the Austrian Council of Ministers

22 https://sdgs.un.org/goals

23 The EDF is embedded in the EU's Horizon Europe Framework Programme for Research and Innovation as a specific programme.

on 22 August 2018. This national strategy is geared towards producing a coordinated, effective RTI policy in the area of defence research as well as a suitable structure for helping RTI players (companies and research institutions) to participate successfully in EU programmes. The EDF has also been incorporated into the government programme and is being implemented in line with the RTI Strategy 2030. Participation in the EDF is being coordinated by an interministerial committee led by the BMLV. The necessary communication and information activities for the EDF programme are being carried out with support from the experts at the Austrian Research Promotion Agency (FFG) and in coordination with the national defence research programme (FORTE). Given that only EDF research projects are fully funded by the EU whilst EDF development projects (from the prototype stage to market-readiness) merely attract partial funding from the EU, a national commitment to co-financing is needed at an early stage, specifically when EDF development projects are being submitted. A decision on the kind of whole-of-government co-financing mechanism envisaged in the current government programme has not yet been made and represents an as-yet unsolved challenge facing Austria's involvement in the EDF programme.

The Austrian security research programme KIRAS and its close interrelationship with European defence research

As the first-ever defence research funding programme anywhere in Europe, KIRAS has had a significant influence on the design and structure of the European Security Research Programme (ESRP) since the seventh Framework Programme for Research and Innovation, i.e. right from the very start. Besides targeted national research, for instance, KIRAS also plays a central role in preparing researchers, business owners and consumers for more extensive cooperation at European level. This groundwork and many years' experience are also proving their worth in terms of the returns generated from research: defence research is one of the most lucrative fields of research for Austria, yielding a steadily increasing rate of return – latterly some 159% of the funds invested. This can only be achieved by having the two research programmes closely aligned with each other in order to fulfil the scientific purpose of the research using an application- and needs-based approach to new technologies.

What makes KIRAS unique is how it forces the involvement of consumers in all research network projects. This goal-oriented research is also a key component of the ESRP, thus benefiting Austrian members of the consortium in that a partnership of this kind is already familiar to them and has already proved its worth in KIRAS. This is demonstrated by the above-average success enjoyed by 15 Austrian defence research project coordinators and 135 participants in ESRP projects in the most recent EU Framework Programme for Research, Horizon 2020. A further USP of KIRAS from a technical programme point of view is the requirement to involve a representative of the humanities, social sciences and cultural studies. When new projects are being developed, this enables their social compatibility to be addressed right from the start. The positive experiences gained from integrating consumers and representatives of the humanities, social sciences and cultural studies mean that an increasing number of ESRP projects share the same submission criteria, which is benefiting Austrian participants to a greater extent.

With more experience being gathered all the time, Austrian players being well prepared as part of KIRAS and Austrian researchers enjoying an excellent reputation at European level, a symbiotic relationship between national and European defence research activities can also be expected for Horizon Europe. KIRAS and the Austrian defence research funding programme FORTE are aligned as closely as possible with each other in terms of their organisation and content as part of the "Security Bracket" in order to achieve maximum complementarity in the field of defence research, including the national level.

1.4 Current developments in the higher education sector

Higher education institutions inject momentum into social, economic and technological progress and perform a crucial role in the RTI system as key pillars of knowledge societies. This chapter outlines some of the recent developments in the Austrian higher education system that are helping to improve the country's academic performance and implement the RTI Strategy 2030.

Increasing the university budget and the funding rates for universities of applied sciences

Providing Austrian higher education institutions with sufficient funding is essential if they are to catch up with Europe's leading universities. It is therefore all the more pleasing that the university budget, which to date has been increased continuously for each performance agreement period, has now also been expanded for the next such period from 2022 to 2024. A total amount of €12.3 billion was agreed in October 2020, €1.3 billion or a substantial 12% higher than for the previous period. The successful journey towards improving quality in teaching and research that began with the new university funding arrangements can thus continue.

The funding rates per study place at universities of applied sciences were also increased by 10% with effect from 1 January 2021. This was only the third time that they had been changed since universities of applied sciences became a sector in their own right in 1994. The increase will be used to cover investments that the universities of applied sciences need to make in digitalisation, internationalisation and innovation as well as general price and salary rises and will thus serve to improve and guarantee quality on their courses, which ensure a high-quality education through low staff/student ratios and highly qualified teachers and researchers.

Expansion and setting a strategic course in the universities of applied sciences-sector

With 340 extra government-funded places being allocated for new students at universities of applied sciences from the 2022/23 academic year onwards, the quantitative planning targets in the 2018/19–2022/23 plan to develop and fund universities of applied sciences were met in 2021 in a fourth and final expansion stage. In all, the fully expanded universities of applied sciences sector will have more than 3,700 additional government-funded places available from the 2024/25 academic year onwards, resulting in a total of nearly 57,700 places in the 2024/25 academic year. In terms of content, this stage of the expansion focused on digitalisation and STEM, with preference given to projects in fields of activity and technology such as Industry 4.0, information technology, automation, artificial intelligence, cybersecurity, and digitalisation and e-government. These priorities were set in view of the persistent skills shortage affecting more highly qualified IT and engineering positions, which is curbing Austria's innovative potential and development as a business location. Increasing the total number of graduates in the digitalisation and STEM fields is key to shaping the digital transformation that affects all areas of our lives and work. This expansion implements the recommendation by the Austrian Council for Research and Technology Development.

Dual degree programmes at universities of applied sciences – integrating theory and practice

The latest stages of the expansion in the universities of applied sciences sector have also increased the total number of dual degree programmes offered by Austrian universities of applied sciences to twelve: eight bachelor's and four master's degrees offer places to students on these courses. Most recently, a total of 300 students embarked on a dual degree programme at a university of applied sciences in the 2020/21 winter semester.

Dual degrees, or those with an integrated practical element, are a unique form of degree programme at a university of applied sciences that, with particular rigour, fulfil the educational mission enshrined in law of Austrian universities of applied sciences to offer academically grounded vocational training at higher education level. Unlike extra-occupational degree programmes, which allow students to combine their studies with a part-time job, working forms an integral component of the education and training provided on a dual degree. The university of applied sciences is joined by a training company, which acts as a second place of learning of equivalent value. A varying sequence of theoretical and practical modules is coordinated in terms of content and structure. A year-long period of initial training at the higher education institution is generally followed by a placement at a company that also assumes training responsibility in its role as partner firm. Training with a practical and professional element allows students to apply and try out at their training company what they have learnt at their higher education institution as well as enabling experiences gained and issues raised at the company to be integrated into teaching at the higher education institution.

Distance learning

As a global trend and cross-cutting issue in RTI, digitalisation plays a significant role in Austria's innovative potential. In the higher education sector, COVID-19 and the associated public safety measures have prompted a major shift in the use of digital technologies, particularly for the purpose of online teaching. Austria's higher education institutions, teachers, students and support institutions coped well with the "sudden" switch to online teaching in the 2020 summer semester. Within just a few days and weeks, many higher education institutions not only managed to significantly ramp up their technology but also organised special training sessions and support services for students and teachers in to teach them the skills required in using digital teaching and learning environments. In order to enable higher education institutions to share their practical experiences across Austria, the Federal Ministry of Education, Science and Research (BMBWF) put on two hybrid events and one online expert workshop entitled "Distance Learning – Lessons Learned" in autumn 2020. A number of key common areas were identified during these sessions despite the universities and universities of applied sciences having different teaching profiles. However, it also became clear that not every course and examination can reasonably be held online in reality. For practicals, laboratory exercises and art seminars in particular, practical teaching that could not be replaced by something else was therefore mainly held on site at the higher education institutions, over the summer in some cases, ensuring that the necessary hygiene precautions were taken.

The genuinely remarkable things achieved in the core process of teaching have triggered a multi-layered process of innovation and reflection at the universities and other higher education institutions that will have a lasting impact on teaching in the future, especially in terms of quality assurance, digital equity, virtual mobility, didactics in higher education, digital examinations and the digitalisation of university teaching. For this reason, a "Digital Learning, Teaching and Examining" working group was set up by the Austrian Higher Education Conference and began its work on 16 February 2021. Its mission is to formulate recommendations for improving the quality of higher education teaching, learning and examinations based on the (current) evidence and experience gathered to date.

Austria's involvement in the European Graduate Tracking Initiative

Following the European Council's 2017 recommendation to introduce the regular Europe-wide tracking of university graduates (2017/C423/01), some significant progress has been made: In 2018, for instance, Austria was one of eight pilot countries to take part

in EUROGRADUATE, a European survey that targets graduates one and five years after they complete their higher education degree. More than four in five graduates are in permanent employment five years after graduating. Around 40% of these jobs involve a high level of ICT requirements, according to the respondents, which graduates are also able to meet thanks to their qualifications. Austria also ranks among the top countries in terms of job satisfaction among graduates. This indicates that Austrian bachelor's and master's degrees are a good preparation for future working life compared to the situation in other countries.

However, nearly a third of Austrian MA graduates report a "mismatch", either due to being (temporarily) unemployed or overqualified (vertical "mismatch") or being employed in an industry that does not fit their qualifications (horizontal "mismatch"). Thus, a double "mismatch" exists if a graduate is both overqualified and working in an industry that does not fit their qualifications.

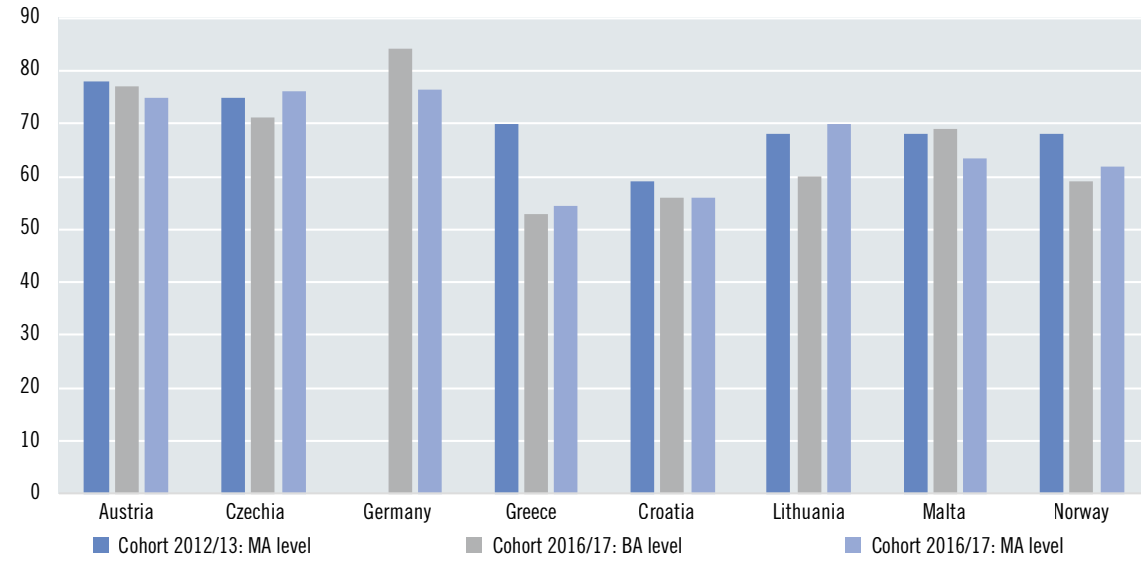
Austria is taking part in the European Graduate Tracking Initiative (EGTI) in order to achieve further progress in the follow-up monitoring of higher education graduates. The aim is to develop national structures and capacities to enable participation in a Europe-wide tracking initiative planned for the future. A tracking system based on administrative data is already in place at the public universities as a result of the "ATRACK" graduate tracking initiative, which was provided with start-up funding from higher education structural funds in 2017. The underlying legal framework has also been developed further to make it easier to run regular graduate surveys of the kind envisaged in the European Commission's plans. A rollout that will encompass another survey of graduates in half of the EU's member states is planned for 2022, with as many as 80% of EU countries set to take part in 2025.

Generating synergy effects between research and higher education

At both national and, particularly, European level, 2020 was a year of closer collaboration and leveraging of synergies between the key players in the research and higher education sectors.

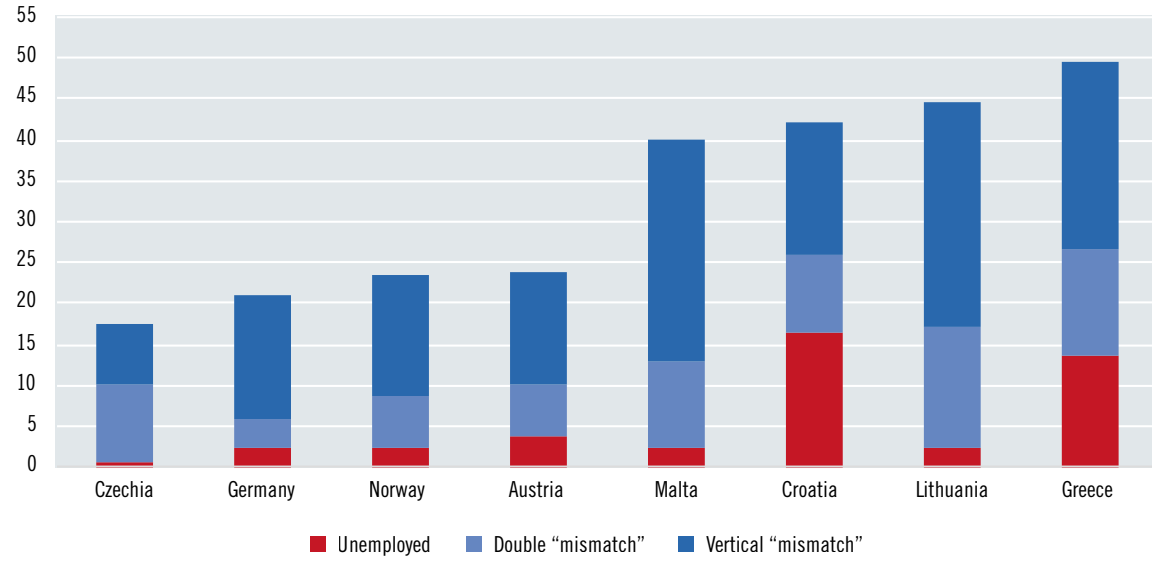
This stronger sense of togetherness was embedded in various political documents both within the EU and in the European Higher Education Area. In

Fig. 1-3: Job satisfaction, percentage of (very) satisfied graduates



Source: European Commission (2020a, 10).

Fig. 1-4: Percentage of graduates experiencing a "mismatch"



Source: European Commission (2020a, 8).

their Rome Communiqué of November 2020, the ministers of the now 49 member states of the European Higher Education Area committed themselves to cooperating more closely with the European Research Area, especially in the areas of research-led teaching, safeguarding academic and scientific freedom and achieving the UN's Sustainable Development Goals. Closer collaboration is also envisaged between the EU's Bologna Follow-up Group and the European Research Area and Innovation Committee (ERAC).

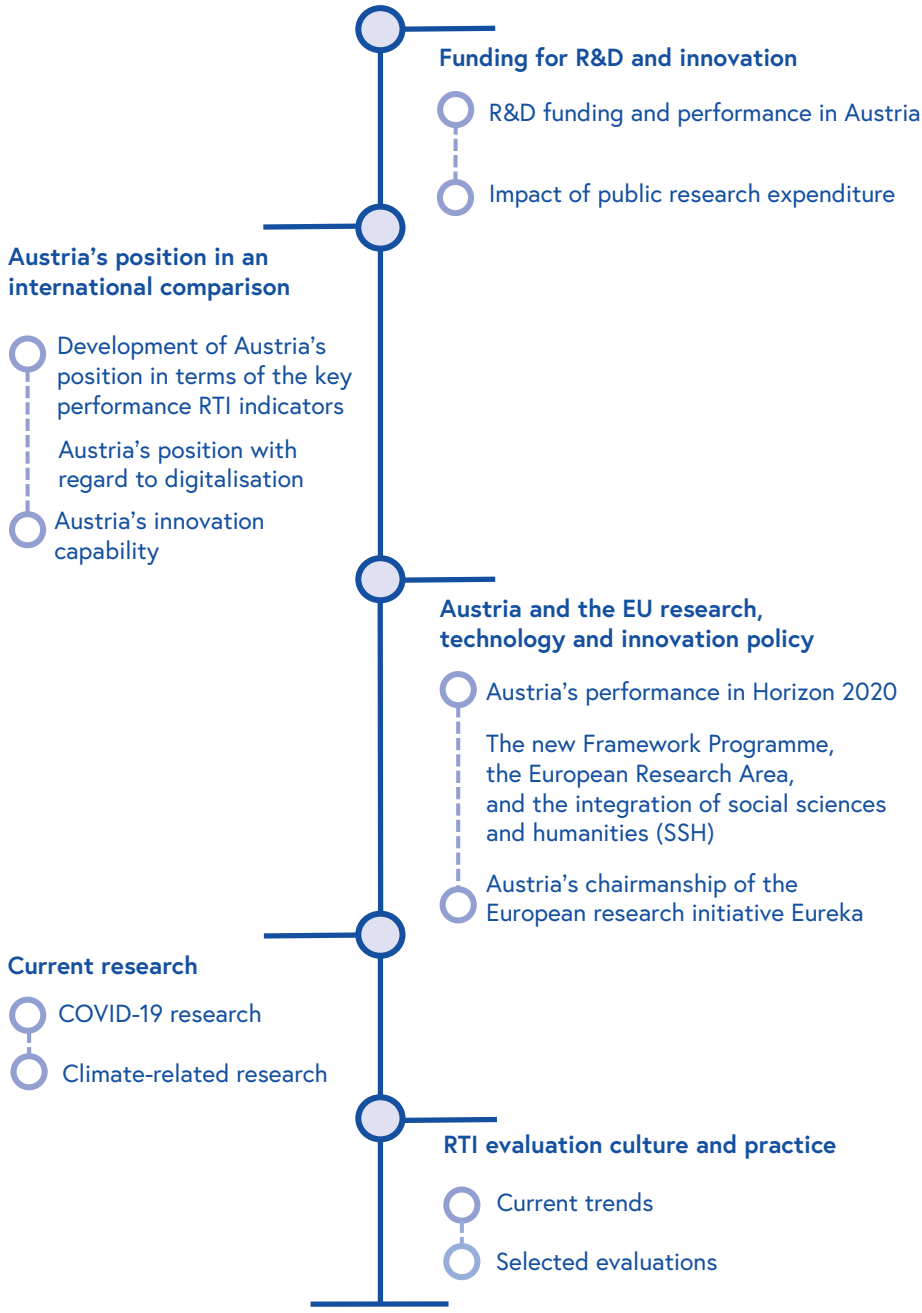
As the European Commission sets out in the communications published in September 2020, the objective is to generate synergy effects between the European Research Area and the European Education Area. The European Universities, which aim to achieve excellence in education and research, have a key role to play in this endeavour. Austrian higher education institutions are members of eight out of the 41 alliances chosen overall. The alliances involving the University of Natural Resources and Life Sciences Vienna and the University of Graz were selected back in the first call in 2019. In a pleasing development, the University of Leoben and St. Pölten University of Applied Sciences, which were successful in the second call, have even been nominated as coordinators of their alliances. In the future, there are plans to leverage synergies between the European Institute of Innovation and Technology (EIT) and the European Universities as well as the EIT and the Erasmus+ scheme. Various European committees are currently debating how exactly research and higher education can work together in order to harness synergy effects.

Best Practice Guide for Research Integrity and Ethics

The Austrian Higher Education Conference agreed on 14 October 2020 to introduce the "Best Practice Guide for Research Integrity and Ethics". Back in April 2018, the "Research Integrity/Research Ethics" working group had been set up, tasked with formulating proposals for implementing these in Austria based on the European Code of Conduct for Research Integrity and national and European expertise and with developing them further for the Austrian science system and its institutions. The best practice guide presented by the working group contains a collection of standards for good research practice and principles of research ethics that is designed to provide guide-

lines for individual researchers and teachers as well as for academic and research institutions in terms of how to conduct research responsibly and in a way that protects third parties (people, animals, the environment and health). The fields of activity covered in the guidelines can change rapidly and will therefore be updated and developed further at regular intervals. The institutions themselves are to be responsible for effecting and shaping day-to-day implementation, taking account of the unique features of specific disciplines and topics.

2. Facts, Figures and Trends in Research, Technology and Innovation



2.1 Funding for R&D and innovation

In recent years Austria's R&D intensity has increased consistently. Chapter 2.1.1 provides an overview of the various R&D sectors and their funding. Since government funding is an increasingly important source of finance for R&D, not least to compensate for reduced R&D expenditure from the business enterprise sector, Chapter 2.1.2 examines the effects of public funding for R&D.

2.1.1 R&D funding and performance in Austria

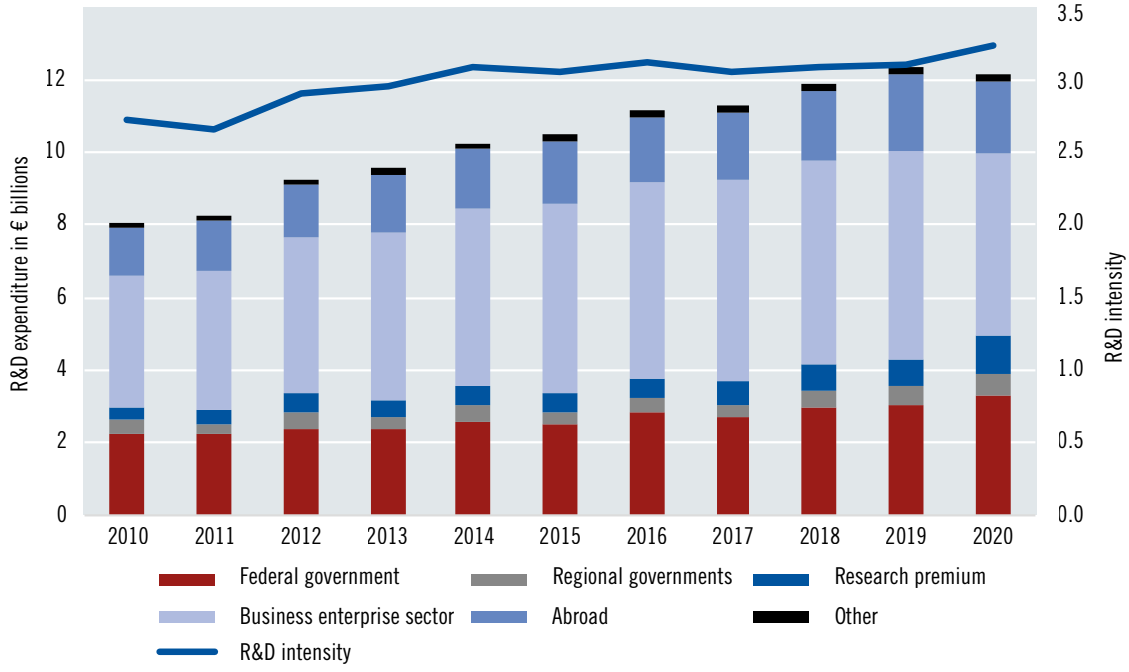
The upward trend in R&D intensity in Austria continued during the crisis year of 2020, and Austria now ranks third within the EU. The decline in research expenditure from Austrian companies, which is largely due to the procyclical tendency of innovation activity[24], was to a large extent compensated by the public sector. There is an overall benefit to the economy and society which goes beyond the impact of expenditure, as R&D has a self-amplifying effect.

Global estimate for 2020

As in the previous year, it is not possible to make a forecast for the current year due to the uncertainties resulting from the pandemic. Instead this report presents an estimate of research expenditure for 2020, and considers the statistical impacts of the pandemic and the development of the R&D intensity. In 2020 GDP declined in nominal terms by 5.5%, and research expenditure by 1.6%.[25]

Fig. 2-1 shows the development of R&D expenditure in Austria since 2010 by funding source and the R&D intensity (= R&D expenditure as a percentage of GDP). The bars represent the absolute R&D expendi-

Fig. 2-1: Development of R&D funding and R&D intensity in Austria, 2010-2020



Source: Statistics Austria, global estimate as at 22 April 2021. Graphic: WPZ Research; the category "Other" combines the two categories "Other public funding" (incl. the "Higher education sector") and "Private non-profit sector".

24 See Reinstaller (2020).

25 Statistics Austria, accessed on 26 April 2021.

ture, and the solid line indicates R&D intensity. In 2020 R&D intensity rose to 3.23%, its highest level yet, partly because of the 5.5% decline in nominal GDP over the same period to €375.6 billion. As Fig. 2-1 shows, research expenditure also decreased in 2019–2020 in nominal terms, by 1.6% to a total of €12.14 billion.

A closer look shows that while private sector expenditure declined significantly in 2019–2020, public expenditure increased. The federal government increased nominal expenditure by 9.8%, the regional governments by 2.7%, and the volume of the research premium grew by a remarkable 38.3%. Funding from the business enterprise sector, in contrast, declined by 12.2%, funding from abroad (particularly from Austrian subsidiaries and EU research programmes) by 4.0%, and from "other" sources (= other public funding including the higher education sector, plus the private non-profit sector) by 11.2%.

Total R&D expenditure of €12.14 billion in 2020 included €3.33 billion from the federal government, and €0.55 billion from the regional governments, representing 27.4% and 4.6% respectively of all expenditure. The public sector thus provided almost a third of all R&D expenditure (31.96%) – the highest figure since 2010 (33.01%). The business enterprise sector contribution to R&D funding declined to 41.4% (€5.03 billion) in 2020 – the lowest since 1999.[26] The January 2018 increase in research premium to 14% is now clearly reflected in the figures, reaching a total amount of €1.05 billion in 2020.

As every year, calculation of the global estimate also includes retrospective adjustments and updates of the figures for the preceding three years. The R&D intensity for 2019 was subsequently revised downwards from 3.18% to 3.10%. There are several reasons for these retrospective adjustments to R&D expenditure and R&D intensity: estimates for the current year always include a review of the three preceding years, subject to the availability of up-to-date information, such as final account data instead of forecast data, the latest GDP figures and current economic data from the R&D survey.

Fig. 2-2 maps the development of relevant values since 2010. This shows that initially funding from companies and from abroad grew faster than GDP and overall R&D expenditure, such that the business enterprise sector and foreign sources were making a disproportionately large contribution to the increase in R&D intensity. This is still true despite the drastic reduction in both categories that occurred in 2020. However, this interpretation is only valid because, in line with the guidelines of the revised Frascati Manual, since last year the research premium is no longer included under government funding, but is regarded as funding from the business enterprise sector. Without the research premium, i.e. using the former method of calculation, expenditure from the business enterprise sector would have fallen so sharply in 2020 that the increase compared to 2010 values would be less than that of overall R&D expenditure.

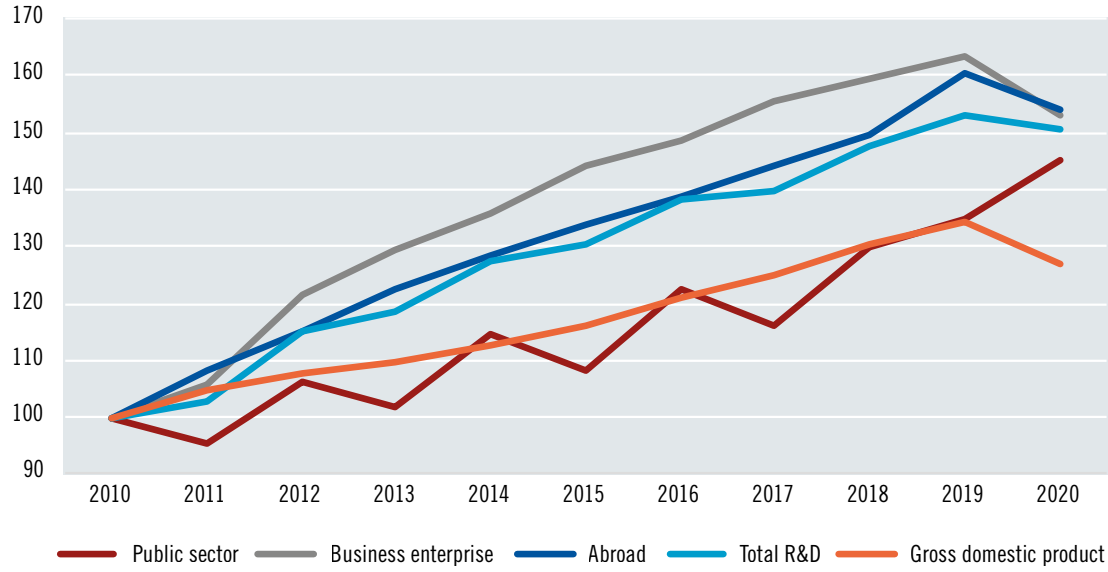
Fig. 2-3 shows the annual proportions for the most important funding categories and illustrates clearly once again that the share of funding from the business enterprise sector (not including the research premium) reached its highest level in the middle of the last decade, and that it has been falling since then. Instead, the share of the research premium has increased continuously, reaching €1.049 billion in 2020, representing 8.63% of R&D expenditure, equivalent to 0.28% of GDP.

International comparison of R&D intensity and R&D funding

By international standards, Austria's R&D intensity for 2018 is amongst the highest, exceeded only by South Korea, Sweden, Japan, Switzerland and Germany. Fig 2-4 shows R&D intensity and R&D funding for 2018 for all EU countries, all EFTA countries (except Liechtenstein), the EU candidate countries

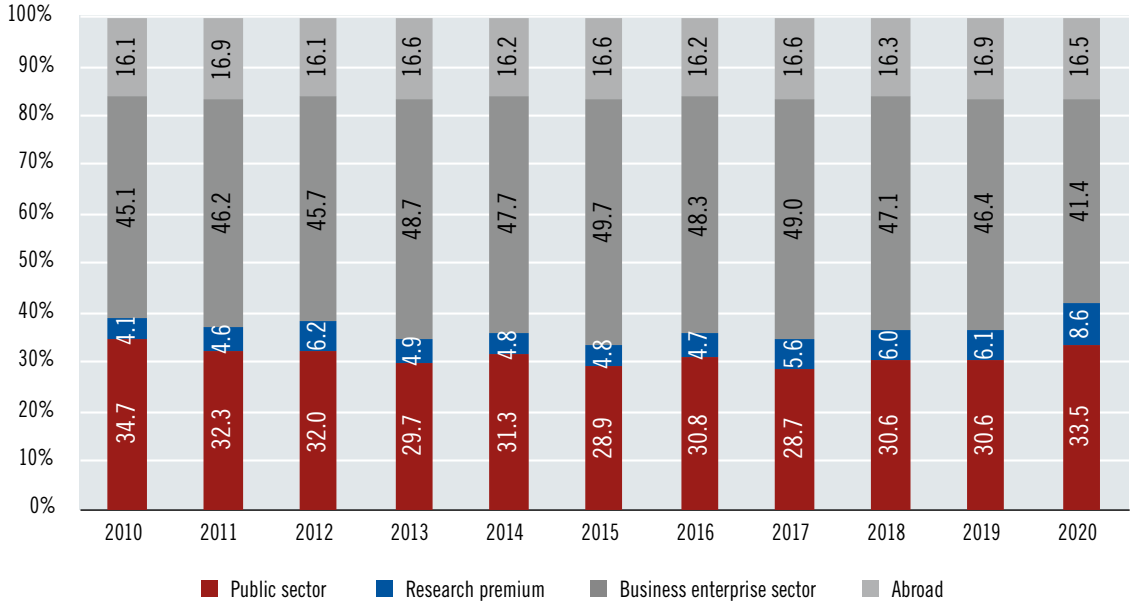
26 In 1999 the pr oportion was 41.08%.

Fig. 2-2: Development of R&D funding, 2010-2020 (index, 2010=100)



Source: Statistics Austria, global estimate as at 22 April 2021. Calculation and graphic: WPZ Research; the category "Public sector" includes the categories "Federal government", "Regional governments", "Other" (= "Other public-sector funding" incl. the "Higher education sector" + "Private non-profit sector"), the category "Business enterprise" includes the categories "Business enterprise sector" and "Research premium".

Fig. 2-3: Share of R&D funding by sources of funds, 2010–2020



Source: Statistics Austria, global estimate as at 22 April 2021. Calculation and graphic: WPZ Research; the category "Public sector" includes the categories "Federal government", "Regional governments", "Other" (= "Other public-sector funding" incl. the "Higher education sector" + "Private non-profit sector").

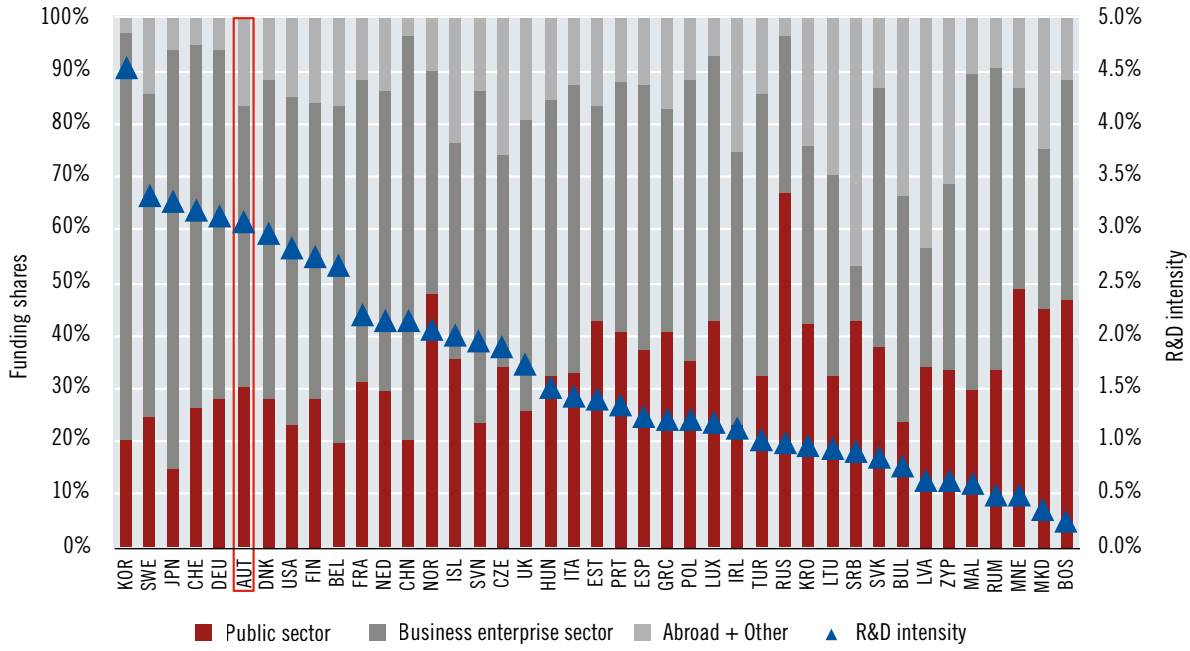
(except Albania) plus Bosnia and Herzegovina, the People's Republic of China (without Hong Kong), Japan, Russia, South Korea and the USA. Amongst the ten countries with the highest R&D intensity values (> 2.5%), Austria is distinguished by the following characteristics: Firstly Austria has the highest proportion of funding from the public sector, at 30.3%; note that the research premium is included under expenditure from the business enterprise sector[27]. Secondly Austria has the highest proportion of funding from abroad, which includes R&D financed by foreign companies and conducted by their Austrian subsidiaries.

A large proportion of the business enterprise sector funding facilitates further development in any case, since in terms of international statistics there is a positive correlation between R&D funding from the business sector and R&D intensity. This applies not only to the lead group, but also across all countries surveyed (where the correlation coefficient is 0.6922). Here again it is important to note that the category "Abroad + Other" includes R&D funded by foreign companies; smaller and geographically central countries tend to show higher values here (including Belgium, Denmark, Finland, Sweden), while large and less centrally-placed countries tend to show lower values (including China, Japan, Russia, South Korea).

2.1.2 Impact of public research expenditure

In the context of the developments described in Chapter 2.1.1, it is important to consider what impact public expenditure has. This question is examined here both at macroeconomic and at company level. Knowledge is the prerequisite for R&D, and these interactions were investigated by Keuschnigg et al. (2020) in detail with regard to Austria.

Fig. 2-4: R&D intensity and R&D funding in OECD countries and further selected countries, 2018



Note: Arranged by degree of R&D intensity. The category "Public sector" includes the categories "Federal government", "Regional governments", "Other public funding" incl. the "Higher education sector", the category "Business enterprise sector" includes the research premium and equivalent subsidies, "Abroad + Other" includes "Abroad" and "Private non-profit sector"

Source: Eurostat (date: 10 March 2021), Statistics Austria Calculations and graphic: WPZ Research.

27 Here, in contrast to other charts, the private non-profit sector is not included in the public sector.

What are the macroeconomic effects of research and development?

Since Robert Solow devised his ground-breaking model of economic growth (1956, 1957), technological progress has been regarded as more important than capital accumulation. This is because depreciation of capital assets at some point leads inevitably to a situation where new investments are only maintaining and replacing old ones. At that point, if not before, the only way to increase output (per worker) is by means of technological innovation.

The situation is similar for human capital. This was defined by Romer (1996) as "skills, talents and knowledge accumulated by employees" making it clear that even human capital cannot be infinitely increased, because at some point people have to deploy their human capital in the production process, otherwise nothing is produced. And since every employee will inevitably leave the production process at some point, human capital also has to be constantly renewed.

According to Krugman (1994), prosperity is ultimately dependent on productivity, i.e. how much one unit of labour produces within one unit of time. The higher the productivity, according to this theory, the higher the income. In Austria, labour productivity in 2019, measured in terms of GDP per hour worked, was just over €54.[28] Workers and employees earn more in Austria than in most other countries because they are more productive. This can in turn be attributed to the availability of physical and human capital.

Physical and human capital cannot be infinitely augmented, whereas technology on the other hand generally can. In the long term, productivity can only be increased by means of technologically induced improvements in physical and/or human capital; technology here represents the sum total of abstract knowledge available within an economy. Technological innovations which increase productivity lead to either the capacity to produce more in the same amount of time, and/or that the same amount can be produced in a shorter time. This increases prosperity.

However, technological development and prosperity go beyond what can be measured in terms of GDP. GDP measures the amount of revenue generated, but is only one of several indicators for prosperity. Social security, a clean environment and other aspects of quality of life are also part of prosperity.

If growth in the long term can only be achieved through technological progress, then the question inevitably arises of how this occurs and how it can be improved further. One possibility is imitation. Backwarded economies can grow relatively quickly if they imitate tried and tested production methods, whether by copying them independently (including "reverse engineering" and espionage) or as a result of technologies being introduced into the country as a form of direct investment from abroad. For a relatively advanced economy such as Austria's, these options are limited. In terms of productivity, Austria's position is not as strong as in GDP per inhabitant.[29] Overall, Austria is close to the technological frontier, so the principal way to increase living standard is by means of innovation.

For several reasons, this requires an effective and performing innovation system. The first reason is that innovation is seldom generated by a single player or entity, but rather, in most cases, results from the interplay of several elements of the innovation system. This includes the basic research that generates knowledge which can be applied by the business enterprise sector. Although pivotal innovations such as the steam engine, satellites or the internet emerged over a short space of time, they do not evolve by chance, but as the result of research work and in-

28 As calculated by STATISTICS AUSTRIA (2020), GDP 2019: €397.58 billion; hour s worked: 7.356 billion.

29 In 2019, Austria's productivity (= gross value added per hour worked) was €48.3, placing it tenth in the EU, while in terms of GDP per inhabitant for the same year, Austria was in sixth position (with the UK excluded from both these rankings). The countries with lower GDP per inhabitant, but higher productivity, are Belgium, Germany, Finland and France (figures from Eurostat, data accessed on 30 April 2021).

vestment decisions. They emerge where overall conditions are favourable. These may, as the above examples demonstrate, be socio-economically very diverse. What is common to all of them, however, is that systemic conditions were in place which facilitated innovation.

Secondly, R&D and the resulting output are of benefit to others as well as the owner. They also increase the prosperity of those who are not directly involved in R&D. Thirdly, the knowledge acquired is disseminated within a society and beyond its geographical boundaries. New knowledge stems both from basic research in the public sector and from the results of private R&D. It functions as a public asset, since anyone can make use of it. Of course it is possible to temporarily prevent others from exploiting this knowledge by establishing patents. But a part of the newly created knowledge "spills over" to other players, such as companies, so increasing the gains from R&D in a process of reciprocal amplification. Development in one company thus builds on the discoveries of others.

Consequently, even in the age of globalisation, R&D is increasingly focused in certain locations. This is why innovative start-ups are concentrated in Silicon Valley, and why universities and other research institutions are concentrated in large cities. Innovative companies, and public research institutions too, are more productive, creative and innovative if there is more knowledge pooled around them, so that more knowledge "spills over" to them. Investments in research, intelligently applied, achieve disproportionately positive results, due to this "knowledge spillover".

Macroeconomic effects of research funding

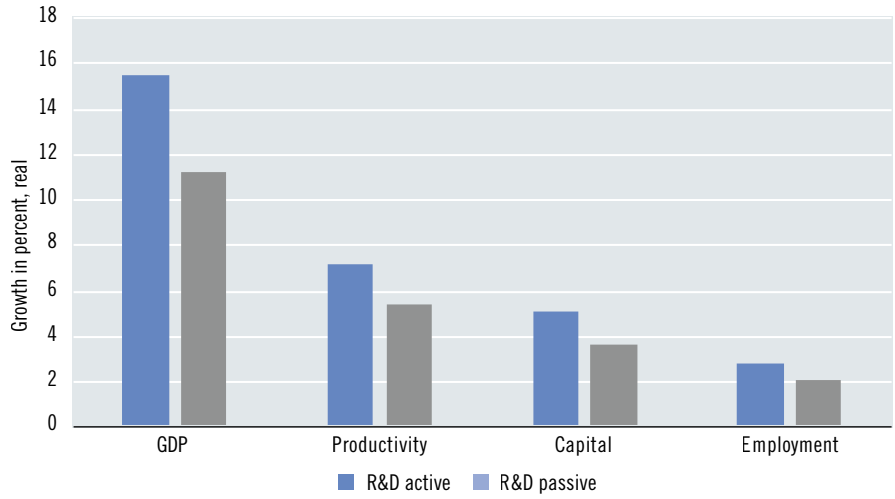
A recently published study models the effects of research expenditure with regard to the specific situation in Austria.[30] The modelling focuses on the influence of policy on R&D outcomes, for example through support for basic research, or tax incentives and grants for R&D. The growth effects are as described earlier: first of all a direct effect, as a result of increased productivity, secondly a self-amplifying effect, by stimulating investment and consequently higher employment levels. Various effects are taken into account, some of which may be contradictory, such as the need for higher taxes to finance additional research expenditure. Fig. 2-5 shows that the overall effects of research expenditure are positive.

While increased tax revenue initially slows growth because of lower investments and employment, in the long run, however, GDP grows by a multiple of public research expenditure (which also raises long-term tax revenue and thus compensates for the higher expenditure). Fig 2-5 shows the long-term effect based on the actual figures for the last ten years ("active") and compares these indicators against a scenario with no spillovers ("passive"). The total, cumulative effect of GDP growth is broken down further in this chart, showing the impact of productivity increases (second bar), capital formation through investments (third bar) and the growth in employment (fourth bar).

Comparison of the grey and blue bars shows that a lot depends on how the innovation system operates, and on the fact that it exists at all: Publicly funded innovation incentives and basic research have a stimulating effect through "spillovers" to privately funded innovation activities, and amplify their impact. This is illustrated here using the example of productivity: the largest part of the increase amounts to 5.3% in itself, but the reaction in the innovation system generates a rise by 7.1%. This strengthens the incentives for investment and employment, so multiplying the growth contributions of capital and labour. All three sources of growth function more strongly and combine to produce a substantial cumulative effect of 4.3% additional growth. In a growth scenario following the pattern of the last ten years, as illus-

30 See Keuschnigg et al. (2020).

Fig. 2-5: Long-term growth contributions of innovation



Source: Keuschnigg et al. (2020, 32).

trated in Fig. 2-5, this means that **some 28% of the cumulative growth is attributed to the retroactive effects of the Austrian innovation system**.

The impact of the public R&D expenditure discussed in the previous section thus takes effect through the innovation system. These effects are significant, but can only be modelled and estimated. The long-term effects are in any case very positive, considering that public R&D expenditure is only a small part of GDP.

With regard to the long-term macroeconomic impacts, the question arises what cumulative effect of the expenditure is. According to the model, **each additional euro of public expenditure for research, development and innovation results in long-term GDP growth of around six euros**. In this model it takes 22 years for half of the overall long-term GDP growth to be realised. This means the process is very slow, but sustained. The effects are not "lost", but produce a lasting increase in GDP. Research funding that is financed from tax revenue should therefore be seen as an investment in the future.

Effects of research funding at company level

By investing in R&D, companies can – even without funding support – develop a competitive advantage. Innovative companies invest substantial amounts in R&D, are more often able to acquire competitively awarded funds, and are successful in implementing product and process innovations. Knowledge spillovers benefit the economy and society beyond the success of the company itself.

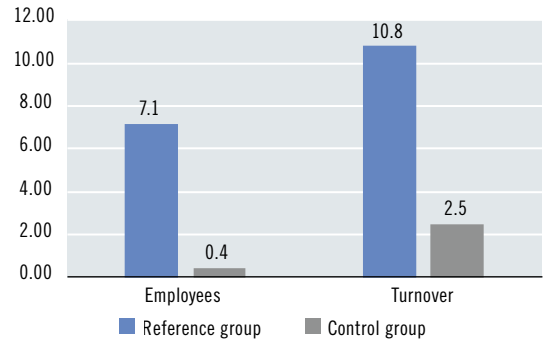
For this reason, Keuschnigg et al. (2020) studied the contexts and specific outcomes of research funding from the Austrian Research Promotion Agency (FFG) at the micro level of companies. Their study also included a reference group and a control group. The reference group consisted of companies which were awarded funding at least once in the period 2010–2016 by the FFG. A sample was then drawn from the pool of all companies included in the enterprise database held by WPZ Research, which was statistically as similar as possible to the reference group. Both samples included 2,260 companies, using their data from 2016.

The results show that the companies which received funding from the Austrian Research Promotion Agency (FFG) have developed significantly better with regard to employment figures and revenue. Fig. 2-6 shows the corresponding growth rates for all economic sectors across the entire period from 2016 to 2019.[31] In some areas the growth rates vary significantly by sector. The sector which was by far the most important for funding from the FFG was manufacturing, showing employment growth of almost 5% (4.95%) in funded companies, compared to the control group where it was only 1.7%; growth in revenue was 15.9% compared to 8.7%. It is noteworthy that the differences in other economic sectors studied are also positive for companies funded by the FFG.

Survival rates for companies funded by the Austrian Research Promotion Agency (FFG) were also compared with those of non-funded companies, with the conclusion that FFG funded companies have a higher chance of survival. 2,548 out of 2,806 companies funded by the Austrian Research Promotion Agency (FFG) survived from 2017 to 2020, which represents a 90.8% survival rate. In the control group only 88.7% survived, constituting a statistically significant lower value ($p = 0.00017$).[32]

A more detailed calculation uses regression analyses to estimate how funding from the Austrian Research Promotion Agency (FFG) affects the companies themselves. It is of particular interest to consider whether the high levels of R&D intensity and the extent of funding by the FFG affect subsequent growth in the number of employees and revenue, the export ratio or the survival rate. In fact, the results show that the more a company invests in R&D, the higher its growth is in the subsequent years. Furthermore, with a higher funding volume, the export ratio and survival rate also increase.

Fig. 2-6: Growth of employment and turnover after FFG funding in %, 2016-2019



Source: Keuschnigg et al. (2020, 41).

2.2 Austria's position in an international comparison

The year 2020 was marked by dramatic changes in society and the economy, as a result of the COVID-19 pandemic. In order to curb the spread of the coronavirus, government health measures were introduced throughout the world which continue to have a substantial impact on economic development – and which are also linked with lower tax revenues. Producers and consumers have considerably reduced their economic activity during this period.[33] All around the world, governments have taken on debt to compensate for the shortfall in economic output.

Over the next few years, many economies will aim to do more than just stimulate demand for goods and services, rebuild the (temporarily) reduced demand for labour, and restore economic productivity to its pre-crisis position. The question that really needs to be addressed, in the spirit of "building back better", is how the crisis can pave the way for an economic, social and ecological transformation of the economy and society – which was already need-

31 The revenue figures given here and below are provided for purposes of comparison and are not inflation-adjusted. From January 2016 to December 2019, the cumulative inflation rate was 8.3% (calculated using the consumer price index of Statistics Austria).

32 The attributes of the companies at the time of the survey refer to the previous year, which is why the observation period for the survival rate is displaced by a year (the reference and control groups are identical in these respects).

33 See ifo – Institute for Economic Research (2020).

ed anyway – with the aim of enhancing resilience against potential crises in the future.

There are three aspects of particular relevance here: digitalisation, productivity in research and development (R&D), and the associated capacity for innovation and transformation in a broader sense.

The central importance of digitalisation is immediately evident in the way digital technologies and processes are helping to improve the efficiency of the healthcare sector – from the speedy and effective analysis and integration of relevant data to the communication of these data to the media and the general public.[34]

In the broader economic context, the previously achieved level of digitalisation initially enabled or facilitated the further flow of business processes, and the pandemic has also given an additional boost to the digitalisation of business processes.[35]

Productivity and effectiveness in research and development are also of key significance with regard to crisis management and resilience. The Austrian Council for Research and Technology Development points out that in the economic and financial crisis of 2009, the countries which did not reduce their R&D expenditure during the crisis were better able to sustain their economic performance during and after the crisis than others.[36] Empirical analyses also point to a positive correlation between research and development performance and crisis resilience.[37]

In addition to digitalisation and R&D performance, another important factor is innovation capability, which helps to overcome disruptions caused by the effects of a crisis and enables resilience to be developed. This concerns innovation capability in the narrower sense, meaning structures and processes that promote innovation, on the level of innovation processes themselves, particularly in the business enterprise sector.[38] However, at the broader level of policymaking and society as a whole, the question is to what extent capacities have been developed that can help to go beyond just withstanding the crisis, and actually support processes of transformation which will produce economic, social and environmental improvements compared to the position before the COVID-19 pandemic. The recent special report by the World Economic Forum uses the term "transformation readiness" (the findings are described in more detail in section 2.2.3).[39]

The OECD published a series of discussion papers that take the current crisis and the way it has been handled as a starting point for some more fundamental questions about socio-economic resilience and the related challenges for innovation policy. Recommendations include, for example, replacing the existing, predominantly linear concept of innovation and innovation policy with a systemic concept, paying more attention to the complex interactions of subsystems in the economy, society and natural environment; this would require, amongst other things, a new, system-oriented set of innovation indicators.[40] More specific suggestions relate to linking COVID-19 recovery measures with environmental targets, so that the behavioural changes triggered by the current crisis management measures, such as the increase in working from home, can be systematically sustained.[41] Similarly, it has been suggested that innovation policy and development policy should be integrated, with a view to creating more resilient

34 See Murray et al. (2020).
35 See Grömling (2021).
36 See Austrian Council for Research and Technology Development (2020).
37 See Friesenbichler et al. (2020).
38 See Hartmann et al. (2014).
39 See WEF (2020).
40 See OECD (2020c).
41 See OECD (2020d).

structures on a global level.[42] In addition to the environmental aspects, social targets are also a key consideration in the context of systemic innovation policy geared towards greater resilience; the idea is to generate a "people-centred recovery".[43] The latest findings on all these aspects are presented at the end of section 2.2.3.

In this context, the following section examines Austria's position in international rankings with regard to performance and effectiveness in research and development, digitalisation and the capacity for innovation and transformation. Section 2.2.1 reports on key indicators for inputs to and outputs from research and development (R&D), followed in section 2.2.2 by evaluations of the degree of digitalisation in commerce, industry and society. Section 2.2.3 then examines various aspects of innovation and transformation capability, using appropriate indicators. Section 2.2.4 summarises the key findings.

Relevant indicators from a range of sources are used to make comparisons in these three topic areas across the (previously) 28 or (now) 27 EU countries[44]. The EU average values are always included as well. In case of missing data for individual countries, the average is calculated based on the EU countries for which data are available. Where the underlying data permit it, there is also a comparison with the USA, Canada, Brazil, South Africa, China and Australia, representing the largest economies on their respective continents (in terms of GDP). In addition, Switzerland is included as another important player among the global research and innovation leaders, provided that data are available. The analyses include information from the sources listed in Annex I.

2.2.1 Development of Austria's position in terms of the key performance RTI indicators

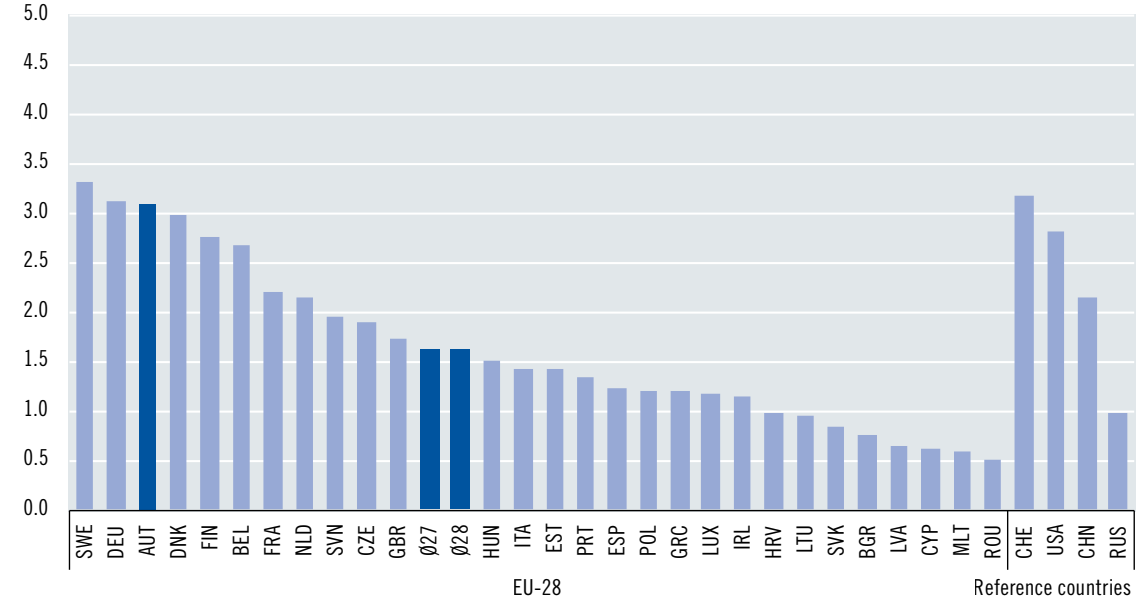
This section uses R&D expenditure and employees in R&D as key indicators of input into research and development, while patent applications and research publications serve as a basis for determining the output of the innovation system.

Investments in research and development are a key motivating force of innovation capability, technological and digital change and, in the long run, economic growth processes. That is why in the technology policy discussion, R&D intensity – i.e. the overall economic expenditures for research and development in proportion to the gross domestic product (GDP) – is used. This indicator enables a comparative analysis of inputs of economies in research and development.

Fig. 2-7 demonstrates this indicator for European countries in 2018. Austria takes a lead position in the European country comparison and, with a proportion of 3.09% of R&D expenditures in GDP, is, next to Sweden and Germany, only one of three countries which fulfil the objective target of the European Union, namely to spend at least 3.0% of GDP on research & development[45]. In the face of the challenges in connection with the COVID-19 pandemic, it is necessary to continue to keep investments in research and development at a high level, so that the financial conditions exist that will enable a high number of innovations and new products. The successive increase of R&D expenditures measured in terms of GDP has also been laid down as an objective target of the Austrian RTI Strategy 2030.[46]

42 See OECD (2020e).
43 See OECD (2020f).
44 The sources used show EU averages which are sometimes based on the EU-28 countries and sometimes on the EU-27. Where this is not the case, the average values were calculated using the data available.
45 See European Commission (2010); Eur opean Commission (2020b).
46 See Austrian federal government (2020).

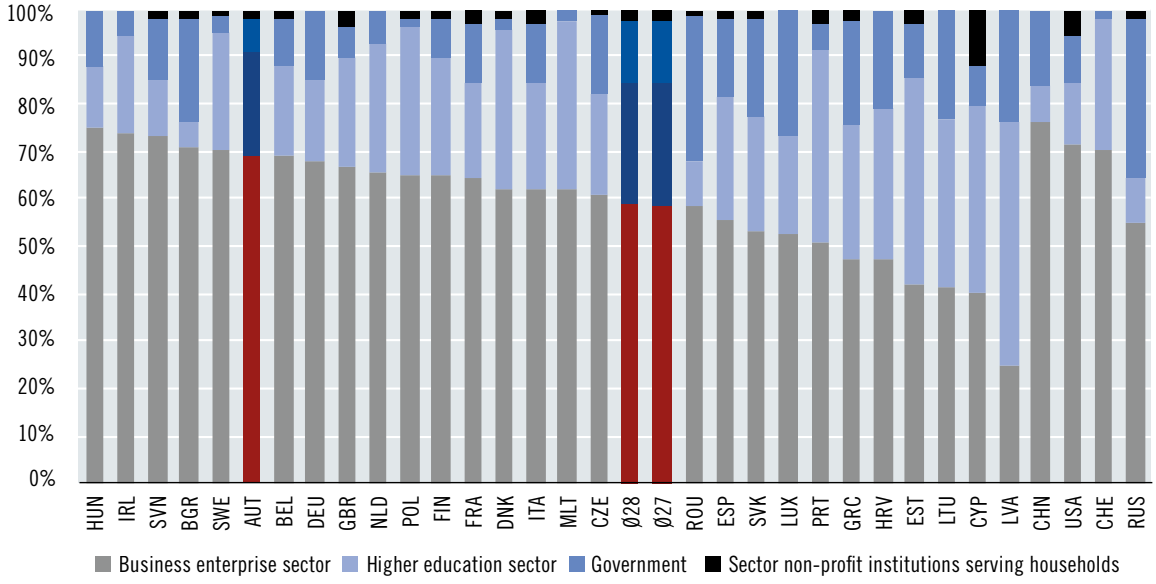
Fig. 2-7: R&D intensity in international comparison, 2018



* No current data are available for Australia, Brazil and South Africa

Source: Eurostat (2021); Graphic: iit

Fig. 2-8: R&D expenditures by sectors of performance in international comparison, 2018



Source: Eurostat (2021); Graphic: iit.

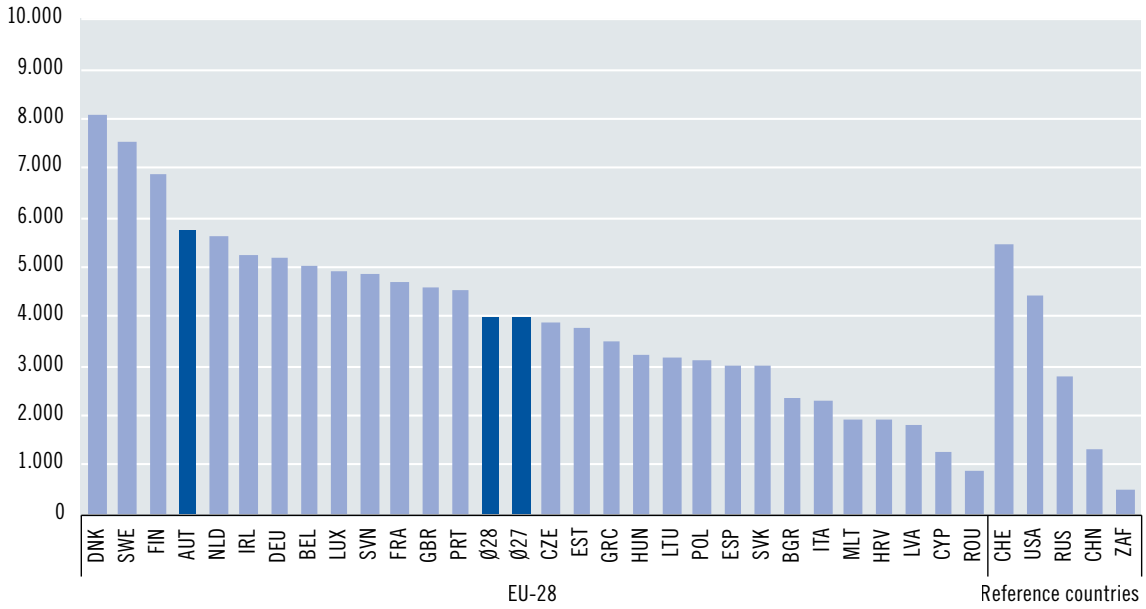
Fig. 2-8 shows the make-up of Austria's R&D expenditure in a cross-country comparison, broken down into the following sources of R&D expenditure by sector: the business enterprise sector, the higher education sector, the government sector and non-profit institutions serving households. The shares in percentages of R&D expenditures by sector are presented as a stacked bar chart, meaning that the total expenditures for each country add up to 100% in total.[47]

The biggest share in investments in research and development occurs in the business enterprise sector in almost all European countries. When looking at these R&D expenditures in this sector, Austria figures ahead of other industrial nations with a share of 69.9% in a cross-country comparison. This result indicates that Austrian business enterprises contribute substantially to the innovation capability of the country and thereby create the preconditions to stay internationally competitive also in the future.

R&D employees

Input of human capital resources into the innovation system is shown here as the number of R&D employees per million inhabitants.[48] R&D employees include researchers and specialists involved in conceptualisation and development of new knowledge, processes, methods and systems. In 2018 there were 5,733 R&D employees in Austria per million inhabitants (Fig. 2-9). This represents the fourth-largest pool of R&D staff in the EU-28 countries. Only Finland (with 6,861), Sweden (7,536) and Denmark (8,065) had more R&D employees relative to the population size. The European average was 4,000 R&D employees per million inhabitants.

Fig. 2-9: R&D employees per 1 million inhabitants, 2018

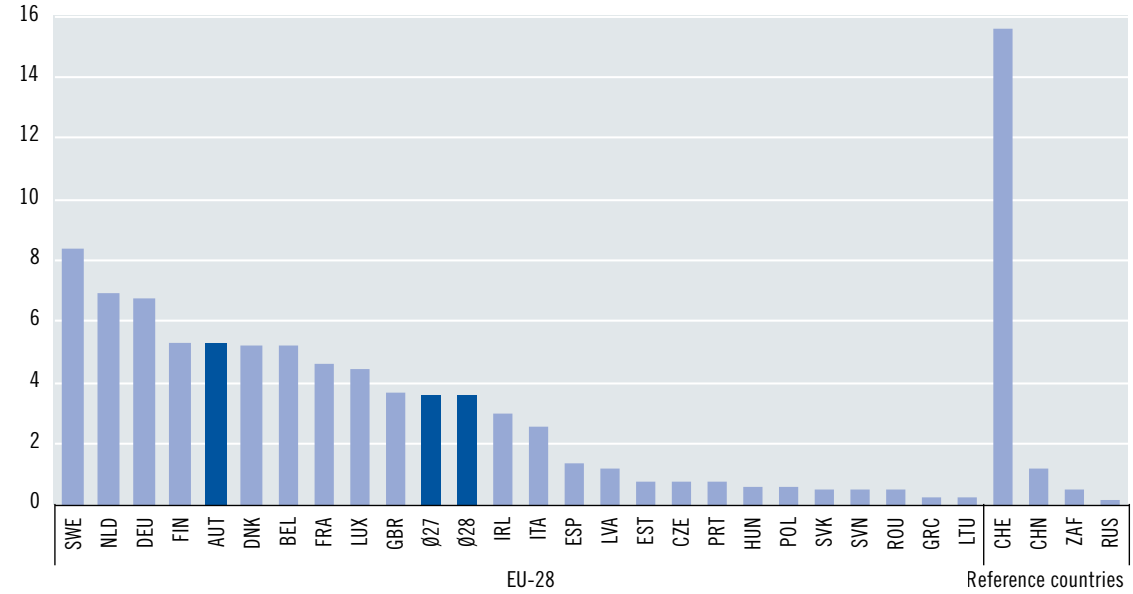


Note: The figures for Switzerland, South Africa and the USA are from 2017. No current data are available for Brazil and Australia.
Source: World Bank (2021); graphic: iit.

47 In a two-year interval, Statistics Austria conducts a complete survey on the funding and performance of research and experimental development (R&D) in all economic sectors of Austria. The survey units comprise four sectors: Higher education institutions, business enterprises, government und private non-profit research institution. The methodological basis is the internationally recognized Frascati Manual of the OECD. The latest R&D survey includes the survey year 2019. Results will be available in summer 2021; i.e. the figur es presented as related to 2018 ar e estimates.

48 See World Bank (2021).

Fig. 2-10: Patent intensity (triadic patents) by country of origin, standardised by employees in R&D, 2018



Note: No current data are available for Lithuania, Bulgaria, Croatia, Malta, Cyprus, the USA, Australia and Brazil. R&D employee figures for Switzerland and South Africa are from 2017 and 2016 respectively.

Source: OECD (2020a). Graphic: iit.

Patent applications

The OECD defines a triadic patent as a set of patents for the same invention, that are registered simultaneously with the European Patent Office (EPO), the Japanese Patent Organization (JPO) and the United States Patent and Trademark Organization (USPTO). The concept of triadic patents is particularly suitable for international comparisons and allows conclusions to be drawn about a country's R&D output (i.e. its capability to innovate). It reflects the technological and economic value of inventions as patent applications in several countries can serve as an indicator of the quality of inventions.

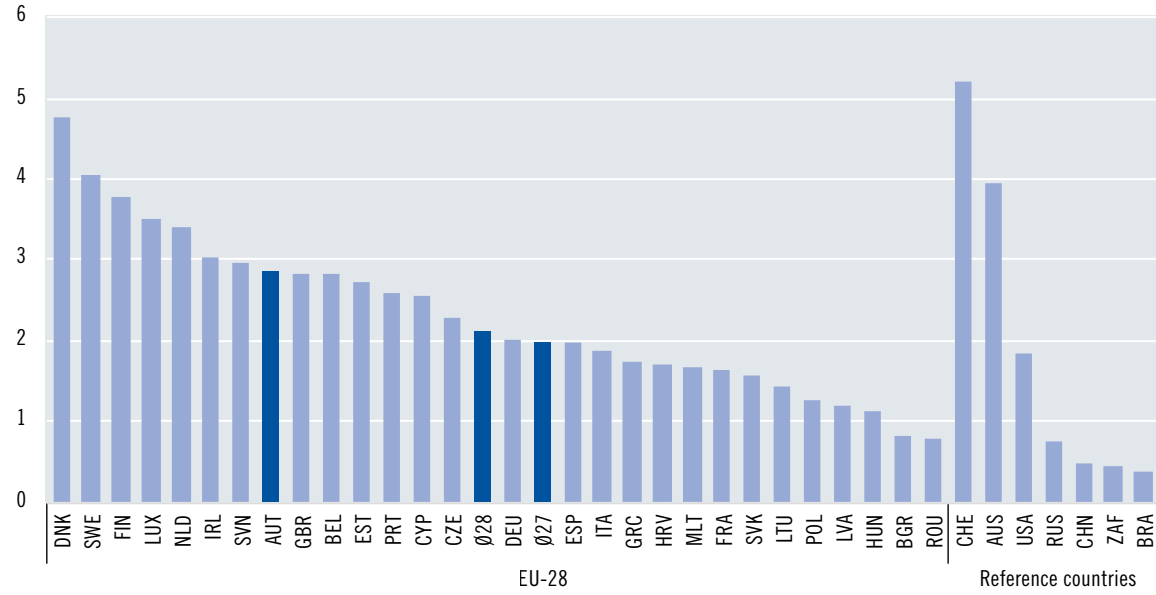
Fig. 2-10 depicts triadic patent intensity by country of origin for the year 2018.[49] It is shown as the number of triadic patents per 1,000 R&D employees. For Austria this value is 5.28, placing the country fifth in the EU-28 comparison, just behind Finland (5.32). The EU leaders are Germany (6.74), the Netherlands (6.93) and Sweden (8.39). At 15.59 patent applications per 1,000 R&D employees, Switzerland boasts the highest figure amongst the countries covered here. Triadic patent intensity has increased in the EU since the previous year – from an average of 2.84 triadic patents per 1,000 R&D employees in 2017 to 3.56 patent applications in 2018. This trend is mirrored in Austria, where the number of patents relative to R&D employees has grown by 0.48 since 2017.

Austria's international position with regard to scientific publications

Another key output indicator for a country's science and research performance is the number of scientific publications. These figures include only the citable publications (e.g. scientific studies, reviews, books

49 See OECD (2020a).

Fig. 2-11: Number of scientific (citable) articles in all disciplines, standardised by country population, 2019



Source: Scimago Journal & Country Rank (2020). Graphic: iit.

and articles) originating in each country, expressed in relation to population size. This quantitative evaluation of scientific research is based on the assumption that research results only become relevant when they are reported to the outside world and can be cited.

This bibliometric analysis is underpinned by the Scimago publication database.[50] Fig. 2-11 shows the number of citable published articles per 1,000 inhabitants for 2019. Austria (2.86) is tenth out of the EU-28, putting it in a strong midfield position. It is interesting to note that the countries with most publications – the USA (1.85) and China (0.48) – lag significantly behind Austria in terms of science and research publication output relative to population size, as presented here. Denmark is the leader in the EU, publishing 4.78 scientific articles per 1,000 inhabitants.

Compared to the previous year, Austria registered a gain of 0.25 points on the publications indicator (from 2.61 publications per 1,000 inhabitants in 2018 to 2.86 in 2019), advancing two places up the rankings in the EU-28 comparison. Calculated across all EU countries the average output remains constant at 2.1 publications.

Austria's position from the perspective of global innovation rankings

For an overall international classification of innovation capability and performance of different countries, it can be useful to consolidate the many individual aspects of innovation performance into a single index and thus obtain an internationally comparable total value for each country. Two central international overall indices for innovation are presented below: the Global Innovation Index (GII)[51] and

50 See Scimago Journal & Country Rank (2020).
51 See Cornell University, INSEAD and WIPO (2020).

Table 2-1: Austria's international position in GII 2020 and EIS 2020

Index	Austria's position				EU-28 comparison	EU-27 comparison
	Value previous year	Ranking previous year	Value	Ranking		
Global Innovation Index 2020	**50.94** (Scale 0 to 100)	**21** (out of 129)	**48.35** (Scale of 0 to 100)	**19** (out of 131)	**10** (out of 28)	**9** (out of 27)
European Innovation Scoreboard 2020	**125** (Scale of 0 to 180)	**9** (out of 28)	**128** (Scale of 0 to 180)	**8** (out of 27)	**9** (out of 28)	**8** (out of 27)

Source: Cornell University, INSEAD and WIPO (2020); European Commission (2020c); graphic: iit.

the European Innovation Scoreboard (EIS)[52]. Austria's position in these indices is of particular significance since the Austrian federal government's new RTI Strategy 2030[53] uses the GII and the EIS as key metrics of Austria's progress in research, technology and innovation.

The Global Innovation Index (GII) reflects countries' innovation capability and performance. Updated annually, this overview incorporates numerous indicators for innovation input – such as infrastructure, human capital, effectiveness and stability of political institutions – as well as indicators for knowledge and technology output, and creativity output. Between 2019 and 2020 Austria improved its position from 21st to 19th, regaining its place amongst the top 20 countries (with index values of 50.94 in 2019 and 50.13 in 2020) (see Table 2-1). Leading countries in 2020, as in the previous year, are Switzerland (66.08), Sweden (62.47) and the USA (60.56). Looking ahead to the future, Austria has set itself the ambitious objective of reaching at least 10th place in the GII ranking.[54] The country is performing well on the input dimension of the index (18th place) and particularly well in the indicators for human capital (7th place); it has also improved by two places to rank 23rd in the output dimension. In many areas there is potential for innovation that could be exploited even further, which would enable the country to progress to a leading position in the future. This is particularly true for "market development", where in terms of the indicators for funding from the enterprise sector and for the capital markets, Austria ranks only 48th.

The European Innovation Scoreboard (EIS) is a way to analyse the research and innovation performance of the EU countries using four dimensions for comparison – framework conditions, investment, innovation activity and impact. While the first two of these dimensions are based principally on input indicators such as completed doctoral degrees and R&D expenditure, the latter two are largely based on innovation output, such as patent applications or export of knowledge-intensive services. For 2020 Austria is in 8th place, in the mid-range of the EU-27 ranking, amongst the "Strong Innovators". The target set in the RTI Strategy 2030 is to become one of the top five countries. In 2020 the Innovation Leaders are Sweden, Finland, Denmark, the Netherlands and Luxembourg.

In some individual dimensions of innovation referenced by the EIS, Austria is already one of the top-ranking countries. In the area of "Linkages", for instance, Austria is the leader. This sub-index includes collaboration between innovative SMEs, public-private co-publications and private funding to cover R&D expenditure by the public and higher education sectors. Austria's fourth place in the "Intel-

52 See European Commission (2020c).
53 See Austrian federal government (2020).
54 Ibid.

lectual assets" sub-index (patent and trademark applications as well as design applications) and third place in the "Innovators" sub-index (percentage of SMEs launching innovative products and processes, and percentage of SMEs launching innovations in marketing and company organisation) are evidence of positive development here. In other areas, however, Austria has some catching up to do, especially with regard to broadband infrastructure, the percentage of the population employed in fast-growing companies in innovative sectors, and exports of knowledge-intensive services.

In the overall analysis, Austria's technological and scientific performance and innovation capability put it in a strong midfield position globally. Austria has not yet succeeded in joining the group of innovation leaders overall, but the country has been in a top position among the followers for some time now. In implementing the RTI Strategy 2030, Austria's efforts should continue to be directed towards achieving a balanced relationship between input and output volumes – with a focus on output and effectiveness of research.

2.2.2 Austria's position with regard to digitalisation

This section assesses Austria's progress in digitalisation, compared to other countries. While digitalisation is described here as a separate phenomenon, it should not be forgotten that digital systems and services are increasingly reshaping and transforming fundamental processes in research, technology and innovation.[55] In this sense digitalisation itself is not a separate topic, but rather a cross-cutting aspect of relevance to all the areas of interest addressed in this report. In the specific area of science and research, the OECD's International Survey of Scientific Authors (ISSA)[56] has provided a way to map digitalisation processes in detail using empirical evidence. The latest evaluation from this perspective confirms that the extent of digitalisation depends on the subject discipline – with highly digitalised processes in computer science for instance, and low levels of digitalisation in the humanities and social sciences. However, it is also clear that digitalisation has an impact in all disciplines, with varying patterns of use of different digital tools and services between the disciplines.[57] It may make sense in future, as well as examining the indicators described below for digitalisation in business, society and administration, to also consider indicators for digitalisation in science and research.

The status of digitalisation in Austria is measured quantitatively using the European Commission's Digital Economy and Society Index (DESI)[58], and presented in terms of EU ranking. This index is based on detailed information about the availability and use of information and communication technologies, and how they are used in business and administration. It covers five key aspects of digitalisation: Connectivity, human capital, internet use, integration of digital technology and digital public services. For each of these five dimensions, a separate sub-index is compiled, consisting of several indicators (see box). The data for most of these indicators were recorded in 2019, i.e. before the pandemic. Some individual indicators refer to 2017 or 2018. Country comparisons can be made at the level of these indicators and sub-indices, as well as the overarching level of the DESI index.

55 See OECD (2020b).

56 http://www.oecd.org/sti/survey-of-scientific-authors.htm

57 See Bello and Galindo-Rueda (2020).

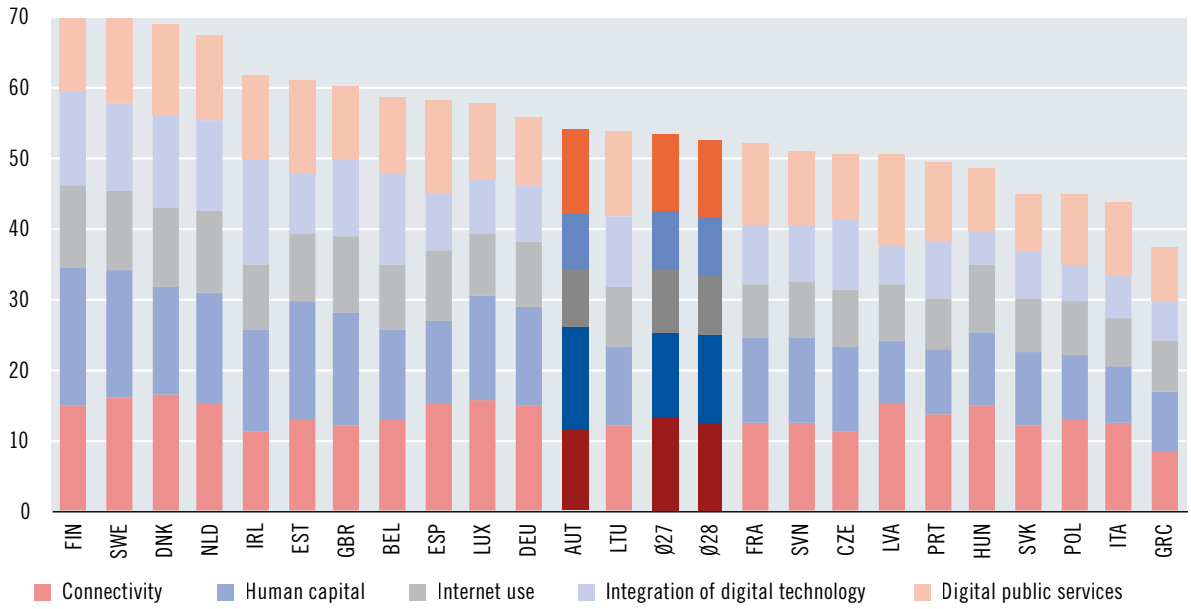
58 See European Commission (2020d, 2020e, 2020f, 2000g, 2000h). This surveys companies with at least ten employees from the following sectors: manufacturing of goods; energy supply; water supply, sewerage, waste management and remediation activities; construction; trade; repair of motor vehicles and motorcycles; transportation and storage; accommodation and food service activities; information and communication; real estate activities; professional, scientific and technical activities (not including veterinary services); administrative and support service activities; repair of data processing and telecommunications equipment. Financial and insurance activities are for example not included.

Indicators and weighting of the Digital Economy and Society Index (DESI) 2020

- **Indicator 1: Connectivity**
  Connectivity is calculated as the weighted average of four sub-indicators: 1a Fixed broadband take-up (25%), 1b Fixed broadband coverage (25%), 1c Mobile broadband (35%) and 1d Broadband price index (15%).
- **Indicator 2: Human Capital**
  Human capital is calculated as a weighted average of the advanced digital skills of internet users (50%) and advanced skills in terms of occupation or professional and educational qualifications (50%).
- **Indicator 3: Use of Internet**
  Internet use is calculated as the weighted average of extent of internet use (25%), communication and online activities excluding transactions (50%) and online transactions by the general public (25%).
- **Indicator 4: Integration of Digital Technology**
  Integration of digital technology is calculated as the weighted average of two sub-indicators: digitalisation of business operations (60%) and e-commerce (40%).
- **Indicator 5: Digital Public Services**
  This dimension encompasses electronic government services in administration, open data policies and public services (such as for enterprise creation or information for foreign users).

In the overall analysis of the DESI index – i.e. considering the cumulative scores for EU countries across all five dimensions – Austria (with 54 points) is close to the European average, alongside large countries like Germany (56 points) and France (52 points) (see Fig. 2-12). The leading countries in digitalisation are well ahead: the Scandinavian countries, with scores between 72 and 69, and the

Fig. 2-12: Digital Economy and Society Index, 2020



Source: European Commission (2020i); graphic: iit.

Netherlands with 68 points. Austria's position in the overall index has hardly changed since the previous year. As in the previous year, Austria has an above-average score in two of the sub-indicators (human capital and digital public services) and a below-average score in three (connectivity, internet use, integration of digital technology). Austria's performance in these five dimensions is examined in closer detail below, to allow specific advances and challenges in digitalisation to be identified.

Connectivity

"Connectivity" assesses the availability and take-up of broadband and mobile networks. In both respects Austria shows potential for development (Table 2-2). On the supply side, in 2019 Austria's 4G rollout had reached 98% coverage of all households, which was above average for the EU. The situation is similar with Austria's 5G readiness, measured here in terms of the number of frequencies available for 5G by 2020. However, the number of households with fast broadband connections in 2019 (84%) was below the European average (86%) and this has not improved significantly over the last two years. In particular, the coverage with very high capacity networks is relatively limited: in 2019 this reached barely 14% of households – 30 percentage points below the EU average.

Where demand for mobile networks and fixed broadband is concerned, Austria showed very positive development in recent years. The proportion of households with fixed broadband connections with speeds of at least 100 Mbit/s increased from 5% in 2018 to 29% in 2019, and is currently above the EU average of 26%. Mobile broadband take-up has also increased over this period – from 86 subscriptions per 100 people in 2018 to 90 in 2019. However, this is still below the European average of 100 subscriptions per 100 people. With regard to overall take-up of fixed broadband connections, Austria also scores below average. In 2019, 72% of households had fixed broadband connections, compared to 78% in the EU.

Table 2-2: Connectivity

	Austria				EU-Average
	DESI 2018	DESI 2019	DESI 2020		DESI 2020
	Value	Value	Value	Ranking	Value
Fixed broadband take-up total % of all households	71% 2017	69% 2018	72% 2019	19	78% 2019
Fixed broadband take-up, minimum 100 Mbit/s % of all households	5% 2017	7% 2018	29% 2019	13	26% 2019
Fast broadband (NGA) coverage % of all households	84% 2017	84% 2018	84% 2019	18	86% 2019
VHCN coverage (fixed broadband with very high capacity) % of all households	12% 2017	13% 2018	14% 2019	25	44% 2019
4G coverage % of all households (average of operators)	97% 2017	98% 2018	98% 2019	15	96% 2019
Mobile broadband take-up Subscriptions per 100 people	83 2017	86 2018	90 2019	18	100 2019
5G readiness Assigned spectrum as a % of total harmonised 5G spectrum	---	33% 2019	33% 2020	9	21% 2020
Broadband price index Value (0–100)	---	---	75 2020	7	64 2020

Source: European Commission (2020i); graphic: iit.

Since Austria ranks quite highly on the broadband price index, indicating relatively cheap prices, it seems that high costs are not the reason for the low take-up.

The "Broadband strategy 2020" (*Breitbandstrategie* 2020) aims to close gaps in the broadband infrastructure, and has provided €1 billion in funding since 2015. The specific target of this initiative is to achieve almost complete coverage with ultra-fast high performance broadband connections throughout the country by 2020.[59] By 2019 this was only partially achieved, as shown by the DESI indicators of Fast broadband (Next Generation Access, NGA) and Very High Capacity Network (VHCN) coverage. The successor programme "Broadband strategy 2030" (*Breitbandstrategie* 2030) is intended to advance the expansion of the broadband data networks further.[60] In addition, by the end of 2025, it aims to have achieved a countrywide supply of gigabit-capable connections and countrywide 5G availability. Austria is making good progress with the 5G rollout, compared to other EU countries.

Human capital – digital skills

To harness the potential of the digital transformation in industry, research and society, and also to extend and help shape it, people need digital skills. The importance of this human capital for the process of digitalisation is reflected in the DESI index, which uses six indicators to measure digital skills amongst the population generally, in the labour market and in the education system. All six indicators place Austria above the EU average (Table 2-3). In 2019 two thirds of the Austrian population – compared to 58% of the EU population – had at least basic digital skills, meaning they have basic knowledge of information processing, communication, content creation and problem solving using the internet. 39% of Austria's inhabitants – compared to 33% of EU inhabitants – have more advanced skills in internet use. 69% of Austria's inhabitants – compared to the EU average of 61% – have at least basic software skills. These skills include familiarity with text editing software, using programs to prepare presentations, figures or tables, and basic programming knowledge. Furthermore it is worth noting that the digital skills of the

Table 2-3: Human capital

	Austria				EU-Average
	DESI 2018	DESI 2019	DESI 2020		DESI 2020
	Value	Value	Value	Ranking	Value
At least basic digital skills % of residents	67% 2017	67% 2017	66% 2019	7	58% 2019
Above basic digital skills % of residents	36% 2017	36% 2017	39% 2019	6	33% 2019
At least basic software skills % of residents	71% 2017	71% 2017	69% 2019	7	61% 2019
ICT specialists % of employees	4.2% 2016	4.4% 2017	4.5% 2018	9	3.9% 2018
Female ICT specialists % female employment	1.5% 2016	1.5% 2017	1.7% 2018	10	1.4% 2018
ICT graduates % of all graduates	4.0% 2015	4.1% 2016	3.9% 2017	10	3.6% 2017

Source: European Commission (2020i); graphic: iit.

59 See BMVIT (2014).
60 See BMVIT (2019).

population is being supported by political initiatives, for instance by the association fit4internet[61], which pursues the objective target of quality and quantity of digital skills of the Austrian population to enable competent use of digital technologies and a broad participation of the entire society in digitalisation.

In addition to digital skills, employment and education in ICT are another dimension of human capital covered by the DESI index. This reflects the level of advanced skills and qualifications, which equip people for work in the digital economy.[62] In 2018, 4.5% of all employees and 1.7% of all female employees in Austria were working as ICT specialists. In the EU-28 these proportions were lower, at 3.9% and 1.4% respectively. Those categorised as ICT employees include specialists who are able to develop, use and maintain ICT systems, and those for whom the use of ICT is a major component of their work activities.[63] These specialist staff are categorised according to their professional role (e.g. software and multimedia developers, database specialists and system administrators). In 2017 Austria still had the tenth-largest proportion in the EU of university graduates in ICT subjects (Austria: 3.9%, EU: 3.6%). However, this indicator does not take account of the fact that countries with highly developed education systems such as Austria also have graduates from vocational training programmes who are potential employees in the digital economy.

Internet use

A detailed analysis of the individual indicators for internet use (Table 2-4) shows that compared to the EU average, a larger proportion of individuals between 16 and 74 years of age never use the internet (10% in Austria, compared to 9% in the EU in 2019), while at the same time a larger proportion of the population uses the internet regularly (86% compared to 85% in 2019). In Austria there are still relatively few people using the internet as source of news, compared to the EU as a whole (67% versus 72%), for music, video and games (80% versus 81%), video on demand (28% versus 31%), video calls (47% versus 60%), to participate in social networks (63% versus 65%), to take online courses (9% versus 11%), and for online sales (14% versus 23%). In contrast, however, the proportion of people using online banking is higher than in the EU, while the proportion who shop online is the same as the EU average.

In view of the data on human capital described above, the low level of internet use in Austria appears to be less due to any lack of digital skills, and more a consequence of limited availability of broadband networks. Survey data from Eurostat also suggest that another reason for the low level of internet use is a lack of interest in what is available online. In 2019, for instance, 70% of households without internet access reported that they have no need for the internet.[64] In the EU this view is held by 46% of the households with no internet access.

61 www.fit4internet.at
62 See European Commission (2020d).
63 See OECD (2019).
64 See Eurostat (2020).

Table 2-4: Internet use

	Austria				EU-Average
	DESI 2018	DESI 2019	DESI 2020		DESI 2020
	Value	Value	Value	Ranking	Value
Persons who have never used the internet % of residents	10% 2017	10% 2018	10% 2019	15	9% 2019
Internet users % of residents	85% 2017	85% 2018	86% 2019	13	85% 2019
Messages % of internet users	71% 2017	71% 2017	67% 2019	23	72% 2019
Music, videos and games % of internet users	79% 2016	80% 2018	80% 2018	17	81% 2018
Video on Demand (VoD) % of internet users	14% 2016	28% 2018	28% 2018	10	31% 2018
Video calls % of internet users	42% 2017	45% 2018	47% 2019	28	60% 2019
Social networks % of internet users	58% 2017	61% 2018	63% 2019	24	65% 2019
Participation in online courses % of internet users	5% 2017	5% 2017	9% 2019	13	11% 2019
Online banking % of internet users	65% 2017	67% 2018	72% 2019	14	66% 2019
Shopping % of internet users	70% 2017	69% 2018	71% 2019	14	71% 2019
Online sales % of internet users	15% 2017	16% 2018	14% 2019	19	23% 2019

Source: European Commission (2020i); graphic: iit.

Integration of digital technology

The sub-index "Integration of digital technology" measures the degree of digitalisation in trade and industry (Table 2-5). A closer look at the individual indicators for this index reveals a differentiated picture: Firstly, electronic information exchange and social media are used comparatively frequently in Austrian business enterprises. Business use of social media in particular has increased substantially since 2017. Secondly, only a relatively small percentage of firms in Austria make use of big data and cloud services. However, the latest data available on this are from 2018, where only 6% of all Austrian companies used big data (EU average: 12%). Cloud services (including hosting corporate databases, finance or accounting software, CRM software, processing capacity for running their own software as cloud services) were used by 11% of all Austrian companies (EU average: 18%). Thirdly, between 2018 and 2019, Austria recorded positive developments in e-commerce. The proportion of SMEs with online sales operations rose from 13% to 19% (EU average for 2019: 18%). The turnover reported by SMEs in internet trade has grown by a similar percentage and in 2019 was just below the EU average. The proportion of SMEs making electronic sales to other countries remains high, the fourth highest in 2019, which may be because Austria benefits from its proximity to countries that use the same language. These three trends combined suggest that the digital transformation is increasingly significant in Austrian companies.

Improvements are required above all in how businesses use the opportunities presented by digital solutions. Based on the technical prerequisites and the skills of the population, this use can be increased, and it is being supported by various measures at

Table 2-5: Integration of digital technology

	Austria				EU-Average
	DESI 2018	DESI 2019	DESI 2020		DESI 2020
	Value	Value	Value	Ranking	Value
Electronic information sharing % of all business enterprises	40% 2017	40% 2017	43% 2019	7	34% 2019
Social media % of all business enterprises	21% 2017	21% 2017	30% 2019	10	25% 2019
Big data % of all business enterprises	-- 2016	6% 2018	6% 2018	26	12% 2018
Cloud % of all business enterprises	11% 2017	11% 2018	11% 2018	23	18% 2018
SMEs selling online % of all SMEs	16% 2017	13% 2018	19% 2019	13	18% 2019
e-Commerce turnover % of SME turnover	6% 2017	7% 2018	9% 2019	16	11% 2019
SMEs selling online, cross-border % of all SMEs	14% 2017	14% 2017	15% 2019	4	8% 2019

Source: European Commission (2020i); graphic: iit.

policy level, including the *"KMU.DIGITAL"*[65] and "Digital Innovation Hubs"[66] funding programmes, which focus particularly on fostering the digital transformation at small and medium-sized enterprises.

Digital public services

Digital public services is the digitalisation dimension where Austria performs best. In the current ranking Austria has moved up two places and is now in eighth place in the EU-28.

This comparison is based on the following indicators: e-government users (people who submitted forms to government authorities online during the last year, as a percentage of all internet users who had to submit such forms); pre-filled forms (the extent to which data are pre-populated into online forms); online service completion (the number of administrative services in connection with important life events, such as the birth of a child, which can be completed online); digital public services for businesses (proportion of the services needed when starting up a company or for general business activities, which can be completed online); and open data (various indicators such as the development of an open data policy, assessment of the societal and economic impact of open data, development of public data portals). In terms of the first four indicators, Austria is well ahead of the European average. With regard to the last indicator, the score for Austria is similar to the EU average.

Overall, the DESI index analysis has shown that Austria is making good progress with digitalisation in many areas, particularly in the digitalisation of administration, expansion of 4G and 5G networks, supply of qualified ICT staff for businesses and industry, and increasingly, in e-commerce. However, at 13th position in the EU-28 comparison, Austria is still some way off the target set in the RTI Strategy 2030, which was to become one of the five best countries in the DESI rankings.[67] This rather average position with regard to digitalisation is partly due to comparatively low take-up of fixed and mobile broadband networks, and low take-up of internet services. By EU standards there is also below-average availability of fast broadband connections. In order to come closer to the DESI index, Austria needs to make substantial

65 www.kmudigital.at
66 www.ffg.at/dih
67 See Austrian federal government (2020, 7).

Table 2-6: Digital public services

	Austria				EU-Average
	DESI 2018	DESI 2019	DESI 2020		DESI 2020
	Value	Value	Value	Ranking	Value
E-government users % of all internet users required to submit forms	64% 2017	68% 2018	70% 2019	13	67% 2019
Prefilled forms Value (0-100)	79 2017	81 2018	81 2019	7	59 2019
Online services transactions Value (0-100)	97 2017	97 2018	97 2019	5	90 2019
Digital public services for business enterprises Value (0-100) – domestic and cr oss-border	84 2017	87 2018	93 2019	10	88 2019
Open data % of maximum score	--	--	66% 2019	16	66% 2019

Source: European Commission (2020i); graphic: iit.

investments to improve the coverage of very high capacity networks. Good broadband infrastructure would very probably also boost the demand for digital content and services. Austria's "Broadband strategy 2030" is an important step towards meeting its targets for digitalisation. The digital transformation of the Austrian economy is being supported by measures such as the "fit4internet", "KMU.DIGITAL", "KMU.E-Commerce"[68], the "Qualifizierungsoffensive" (qualification offensive)[69] and the "Digital Innovation Hubs" funding programmes.

2.2.3 Austria's innovation capability

A key objective of the Austrian federal government's new RTI Strategy 2030 is to become an international innovation leader and to strengthen Austria as an RTI location.[70] Austria's success in meeting these targets will depend on the country's innovation capability.

The following section examines this capability for innovation, using the methodology of the Innovation Capability Indicator devised by the German Institute for Innovation and Technology (iit).[71] In contrast to the Global Innovation Index (GII) and European Innovation Scoreboard (EIS) described in the previous section, the iit indicator measures purely the innovation capability, meaning the prerequisites for innovation, not the outcomes of innovation (e.g. patents, product innovations), which are included in the GII and EIS analyses. The iit indicator measures innovation capability more specifically, and more separately from other aspects than is the case with other indicators. Another distinctive feature is its clear orientation on individual and organisational aspects of knowledge.

The iit Innovation Capability Indicator defines the capability for innovation as the ability to generate new content and to translate it into products, processes and services which can compete on the market. The indicator takes account of existing knowledge and human capital as well as the ability to consolidate various types of knowledge. The iit Innovation Capability Indicator comprises the following four areas or pillars:

- **Human capital**: the knowledge of individuals, particularly working people
- **Complexity capital**: the diversity of useful knowledge which makes it possible to produce complex products

68 www.aws.at/aws-digitalisierung/kmue-commerce
69 www.ffg.at/qualifizierungsoffensive
70 See Austrian federal government (2020, 6).
71 See Hartmann et al. (2014).

- **Structural capital**: the ability to consolidate knowledge within a business enterprise
- **Relationship capital**: the ability to consolidate knowledge beyond organisational borders

These four pillars form the prerequisites for generating new ideas and content, and the ability to translate these into products, processes and services which can compete on the market.

Human capital

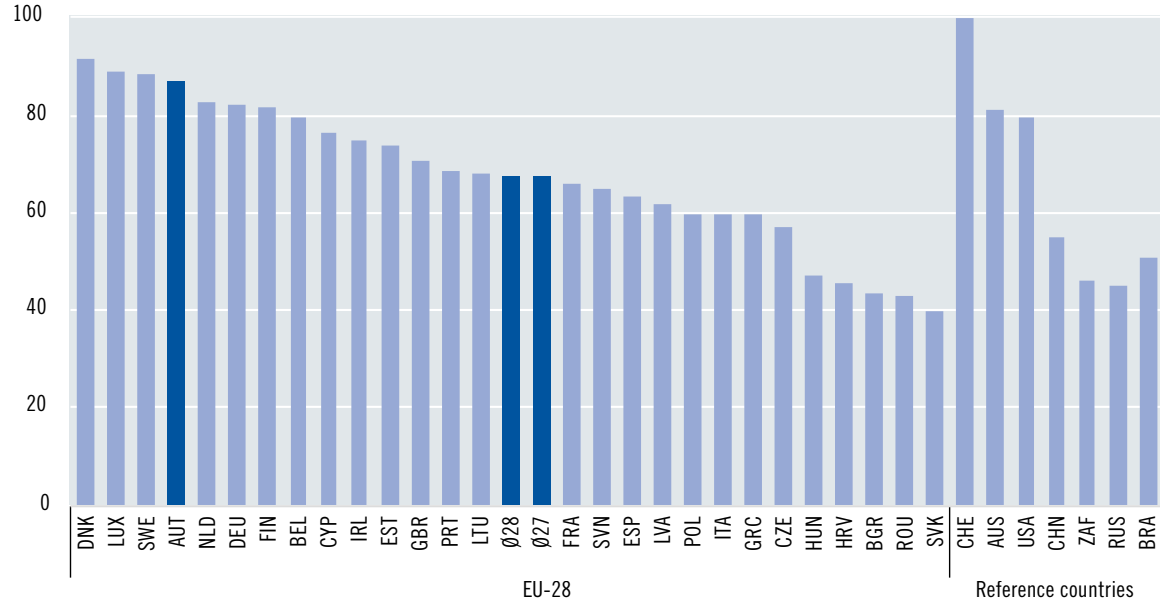
Formal, non-formal and informal learning processes all contribute to human capital. However, since informal learning is largely unrepresented in the relevant statistics and indicators, the charts below refer predominantly to formal (tertiary education) and non-formal learning (training and continuing education).

As an introductory overview of developments in human capital, Fig. 2-13 shows the latest World Talent Ranking by the Institute for Management Development (IMD), which places Austria in fourth position, with a score far above the European average. This evaluation not only includes data on the education system – such as education expenditure and graduates in STEM subjects – but also on local factors and conditions which influence the ability of each country to attract international specialist and managerial expertise. These factors include the quality of life, living costs and salaries for specialist and managerial staff.

Two further indicators on human capital are shown below which refer to specific aspects of the education system: the percentage of 25- to 64-year-olds with a tertiary qualification and the percentage of 25- to 64-year-olds taking part in continuing education. The first of these indicators quantifies the proportion of potential employees with higher education qualifications. This is based on the assumption that tertiary education is particularly important for developing people's capacity for innovation. The second indicator is an approximation of the extent of continuing education.

Fig. 2-14 shows the percentage of higher education graduates in the population. A distinction is made here between short-cycle tertiary education, bachelor's and master's degrees or equivalent qualifications,

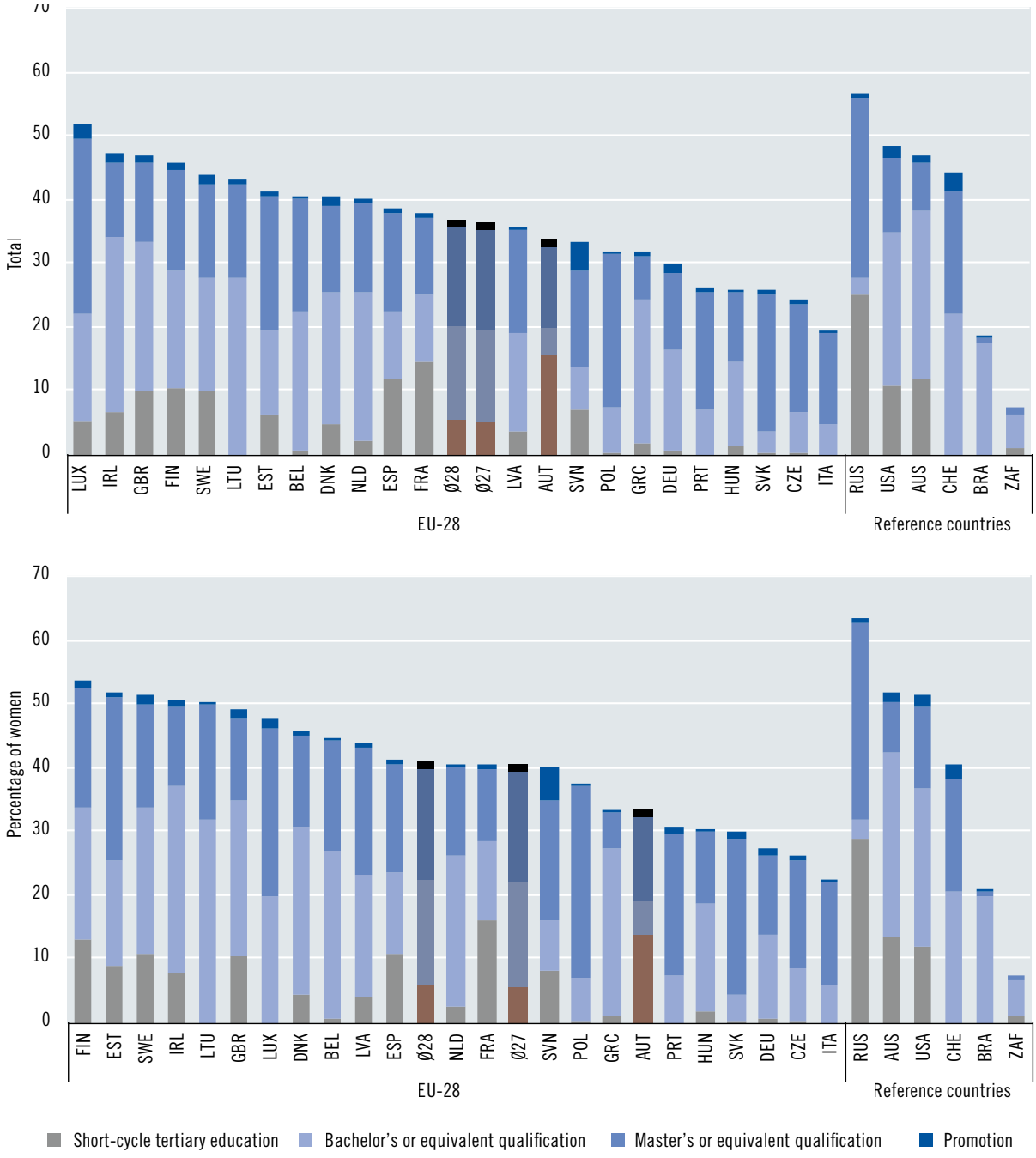
Fig. 2-13: IMD World Talent Ranking 2020



Note: No data available for Malta.

Source: IMD World Competitiveness Center (2020); graphic: iit.

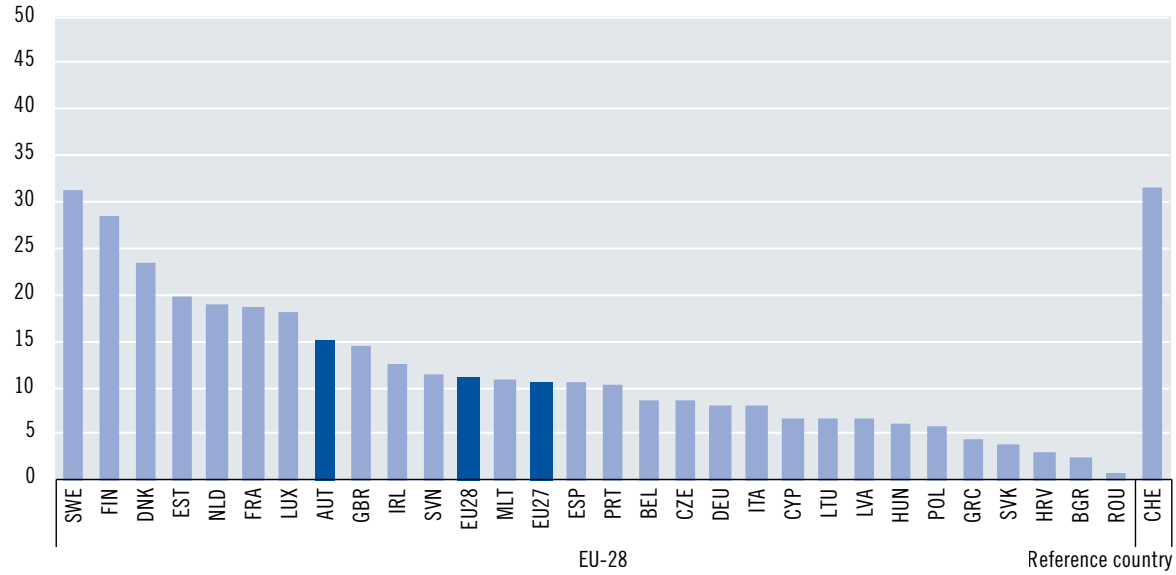
Fig. 2-14: Percentage of 25-64 year-olds with tertiary education, 2019



Note: The most recent figures available were used for Brazil (2018), Russia (2018) and South Africa (2018)

Source: OECD (2020); graphic: iit.

Fig. 2-15: Percentage of 25-64 year-olds taking part in continuing education in 2018



Source: European Commission (2020c); graphic: iit.

and PhDs. Across all forms of qualification, there has been an increase in participation in tertiary education in Austria compared to the previous year. The largest percentage of tertiary qualifications in 2019 is made up of short-cycle tertiary education (such as qualifications from Colleges for Higher Vocational Education (BHS)[72], universities and higher education institutions) (15.5%), followed by master's degrees (12.8%). In Austria 1.2% of the population between 25 and 64 years old have a doctorate, which is just above the EU average of 1.1%. As far as overall participation in tertiary education is concerned, Austria is just below the European average. Germany – where the education system is comparable with Austria's – is four places behind Austria. As in Germany (and Switzerland), in Austria the vocational education system plays an important role, since it educates a large share of the population, and so is a contributing factor in the relatively small proportion of the population with a university degree. Conversely it is striking that despite including qualifications from Colleges for Higher Vocational Education (BHS) the proportion of people with a tertiary educational qualification is not higher by international standards. Overall, it should be noted when making comparisons between countries with a dual education system, and others which do not have this education sector, or not in such a clear and systematically visible form, that a significant portion of the specialist personnel needed in Austria and comparable countries is educated outside the academic system. The demand for specialist staff is therefore met jointly by the academic and vocational education systems.

A gender-related evaluation furthermore shows that 33.4% of women and 34.3% of men have a degree from the tertiary educational sector. There are no clear gender differences. However, the proportion of men with a degree from the tertiary educational sector ranks 12th, yet the one of women only 17th in a European cross-country comparison. The distribution of the different types of degrees in the tertiary sector between men (short-cycle tertiary education: 17.2%, bachelor or equivalent education:

72 Colleges for Higher Vocational Education (BHS) are categorised by the ISCED classification system 2011 as Level 5, and therefore as short-cycle tertiary education. See UNESCO Institute for Statistics (2012)

3.6%, master or equivalent education: 12.1%, PhD: 1.4%) and women (13.9%, 5.0%, 13.5%, 1%) does not differ materially.

In view of the continuing developments and changes in science and technology, and the trend towards longer working lives, continuing education is becoming increasingly important in comparison to initial education. So as a second indicator for human capital, Fig. 2-15 shows the percentage of 25- to 64-year-olds who took part in continuing education in 2018.

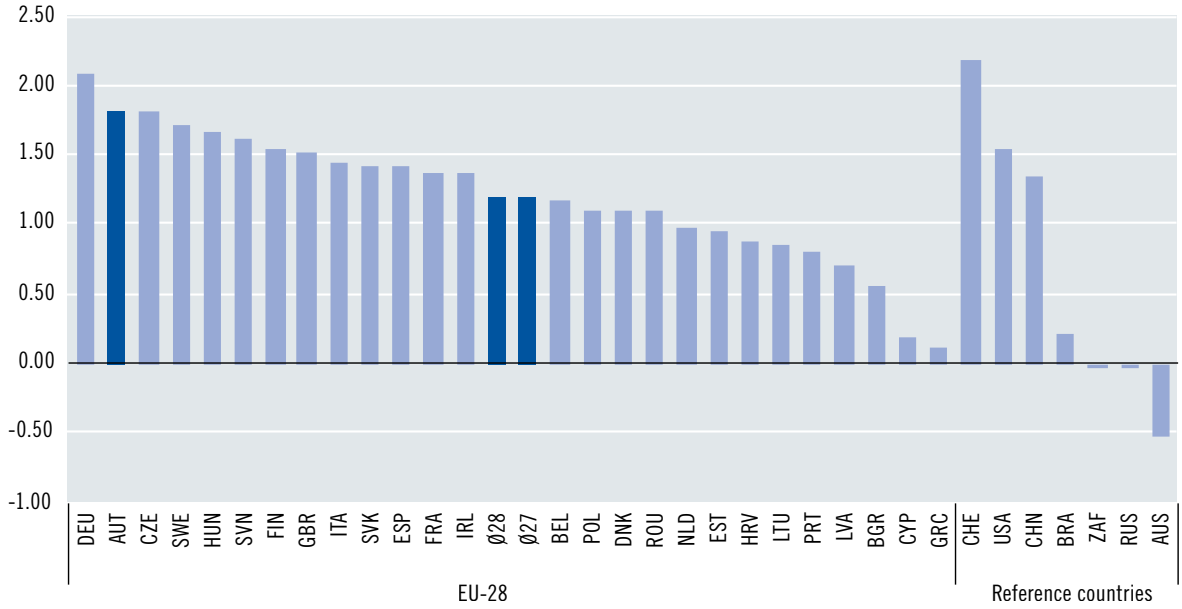
Austria's score is above the EU average. The leaders in the EU are the Scandinavian countries. Austria still lags significantly behind these countries, with the leader, Sweden, reporting easily twice as high a level of participation in continuing education as Austria.

Complexity capital

Highly productive economies are able to produce highly complex products. This requires a wide range of accumulated knowledge to be combined and brought together in the R&D, innovation and production process.

With this in mind, the Economic Complexity Index (ECI)[73] depicts the knowledge intensity of various different products. This means that an economy is deemed economically complex if a high percentage of its total export volume is made up in particular by the kind of complex products that very few other countries are able to produce. In contrast, if a country only exports products that (many) other countries also export, its economic complexity rating is low. The ECI analysis is based on export data and is standardised to values between -2.5 and +2.5.

Fig. 2-16 Economic complexity, 2018



Note: No data available for Luxembourg or Malta.

Source: The Growth Lab at Harvard University (2020); graphic: iit.

73 See The Growth Lab at Harvard University (2020).

Fig. 2-16 shows Austria's international ranking compared to other countries, using the latest available data, which are for 2018. Austria's strong position (second place amongst EU countries) indicates a very high level of economic complexity[74]. Austria's index score has risen from 1.71 in the previous year to 1.81, rising more strongly than some leading countries in this ranking such as Germany (first place; 2017: 2.02 and 2018: 2.09) and Czechia (in third place; 2017: 1.79 and 2018: 1.80). In the global country ranking Austria is ahead of the US and China, but behind Switzerland.

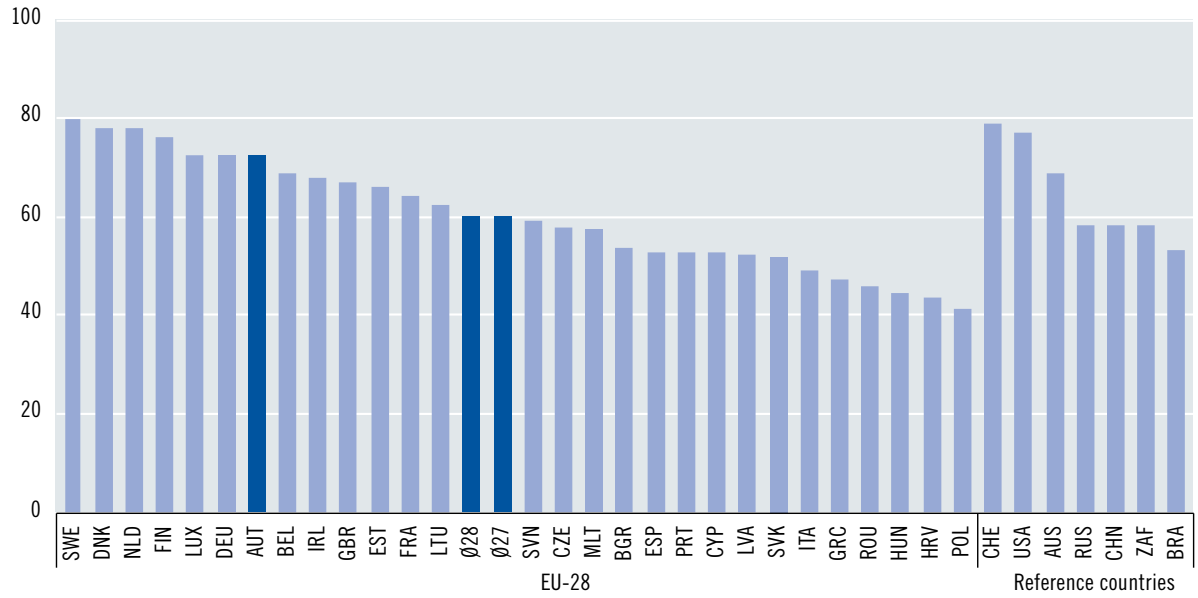
Structural capital

Structural capital refers to the structures and processes in companies that bring disparate strands of knowledge together within the organisation to form the structural foundations needed for innovation. The defining features of structural capital include ways of organising work that foster learning and creativity, and the existence of R&D units within the organisation; the latter has already been described indirectly above, reflected in the number of people working in R&D as a proportion of the population: the score for Austria is the fourth highest in the EU.

This report was expected to incorporate data from the European Working Conditions Survey (EWCS), showing the varying extent to which work structures in companies and administrative bodies foster learning and creativity. However, since the pandemic prevented the data gathering for the EWCS being completed on schedule in 2020, here two indicators from the Executive Opinion Survey conducted by the World Economic Forum (WEF) are used instead. The charts here represent responses to individual questions in the survey.

Fig. 2-17 shows the responses to the question asking to what extent different departments and groups within a company typically work together in development and innovation processes, and share ideas,

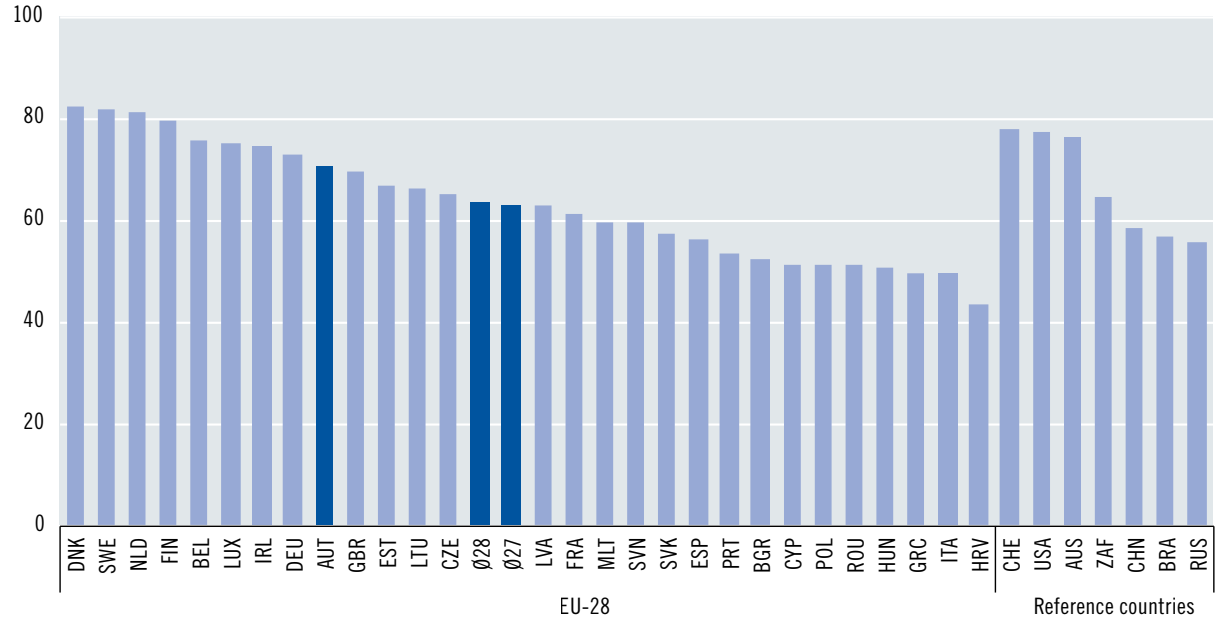
Fig. 2-17: Collaboration and sharing of ideas within the company, 2019



Source: World Economic Forum (2020); graphic: iit.

74 Highly complex products exported by Austria include mechanical engineering products such as machinery for processing rubber and plastics, calendering and rolling equipment, as well as measuring instruments, serums and vaccines, automobiles and vehicle parts. Cermets (composite materials made of ceramic and metal) have a particularly high complexity value, and are a specialist industry where Austria has a relatively high proportion of the market – although the total trading volumes are not very large. https://atlas.cid.harvard.edu.; https://comtrade.un.org

Fig. 2-18: Willingness to delegate authority, 2019



Source: World Economic Forum (2020); graphic: iit.

which is regarded as an indicator of a company culture that fosters learning and innovation. Here Austria is amongst the leading countries, together with Germany, the Benelux countries and Scandinavian countries.

The perceived willingness of upper management to share authority gives an indirect indication of participation and autonomy as key determinants of work structures that foster learning. Here Austria falls within a leading group that includes Germany, the Scandinavian and Benelux countries, and also Ireland.

Relationship capital

Relationship capital is defined by collaborations with other organisations as part of the innovation process. These collaborative relationships may be between companies, or between companies and higher education institutions or other research institutions.

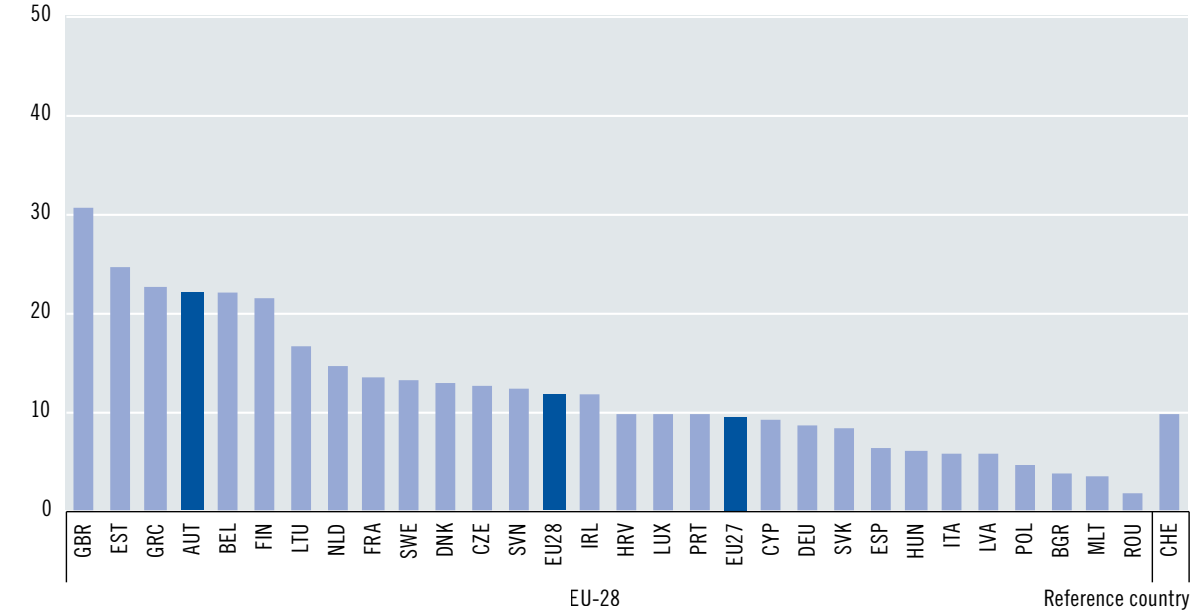
Fig. 2-19 represents responses to the question about the extent to which innovative small and medium-sized enterprises (SMEs) collaborate with other partners in the innovation process. Austria ranks fourth in Europe.

This section analyses in more detail the way that private and public players involved in research and innovation processes work together.

Fig. 2-20 shows joint publications by public and private partners per million inhabitants. Austria has the third-highest number of co-published research articles, placing it significantly above the EU average. The leading EU countries are Denmark and Sweden, while in global terms, Switzerland is in the lead.

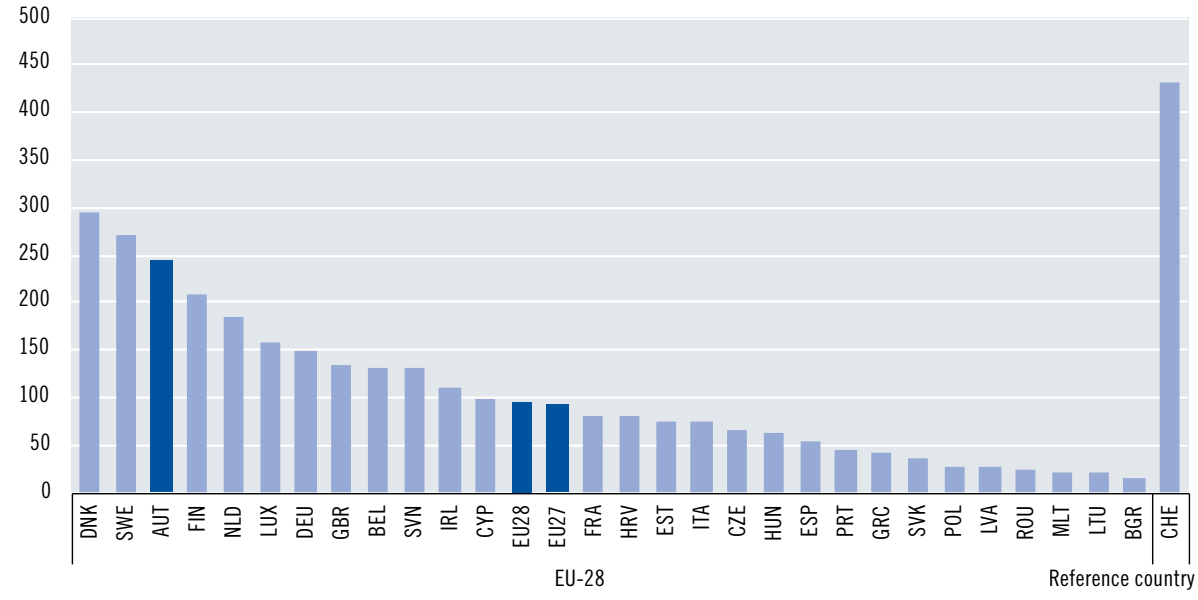
Fig. 2-21 shows the proportion of public R&D that is financed by co-funding from the commercial sector, as a percentage of GDP. Here Austria is amongst the leading countries in the EU, in fourth place compared to other EU countries. The percentage of co-funding from the commercial sector for public R&D has increased in recent years, while in some other countries, such as Switzerland, it has stagnated. Germany has the highest level worldwide, around double that of Austria.

Fig. 2-19: Collaboration by SMEs with partners in the innovation process, 2019



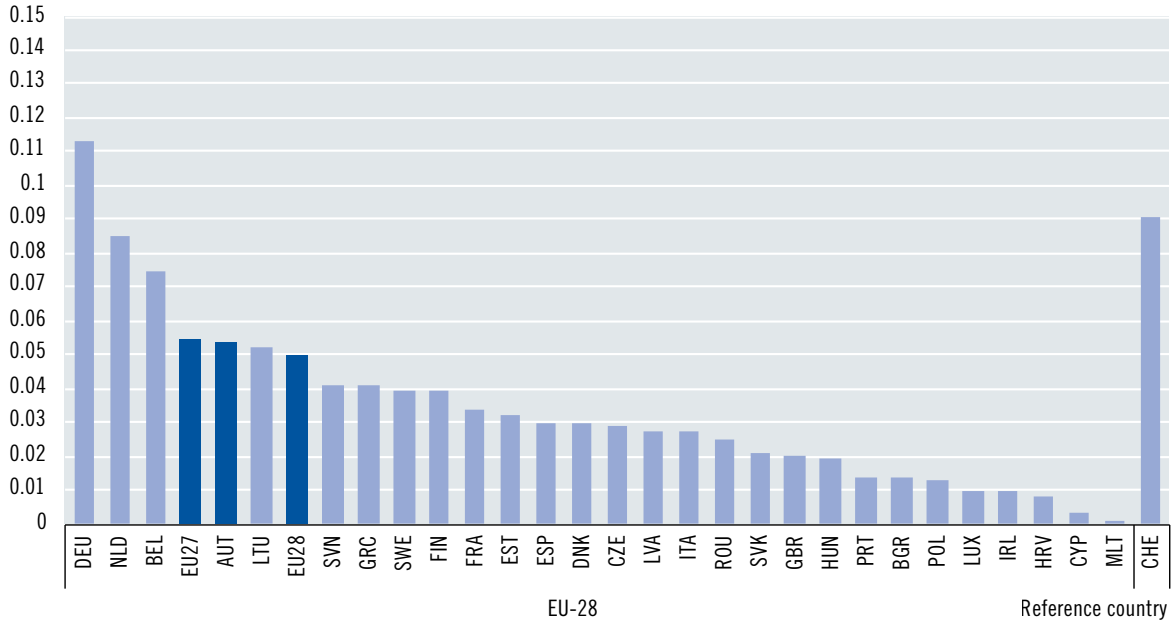
Source: European Commission (2020j); graphic: iit.

Fig. 2-20: Joint publications by public and private partners per million inhabitants, 2018



Source: European Commission (2020j); graphic: iit.

Fig. 2-21: Co-funding of public R&D by the commercial sector as a percentage of GDP, 2017



Source: European Commission (2020j); graphic: iit.

Capacity for transformation and resilience

In the context of the COVID-19 pandemic, there is increased emphasis not only on how well economies are meeting the current challenges, but also – in the sense of "building back better" – how well they are able to frame processes of transformation that will go beyond the current crisis management, geared towards improved innovation capability and performance in the future.

To this end, the latest special edition of the Global Competitiveness Report[75] published by the World Economic Forum (WEF) in December 2020 combines indicators relating to four areas of action: (1) Economic recovery and development, (2) Work and incomes, (3) Education and learning, and (4) Diversity, inclusion and social justice.

For these four areas of action, a total of eleven descriptive dimensions were formulated[76]:

1. Governance: Strong public institutions which serve their citizens
2. Infrastructure: upgrade of infrastructure for future forms of energy supply and broad access to digital information technology
3. Taxation: fair taxation of work, wealth and companies
4. Education: curriculum updates and investment in skills for the markets of tomorrow
5. Work: renewal of labour market and job protection regulations for the future world of work
6. Social system: infrastructure for children, seniors and healthcare, investment in access and innovation in the social system
7. Finance: incentives to direct funding streams towards future-oriented areas
8. Competition: securing market access and preventing unfair competition

75 See WEF (2020).

76 The concepts for identifying these dimensions were selected by iit itself, using the descriptions in the WEF report.

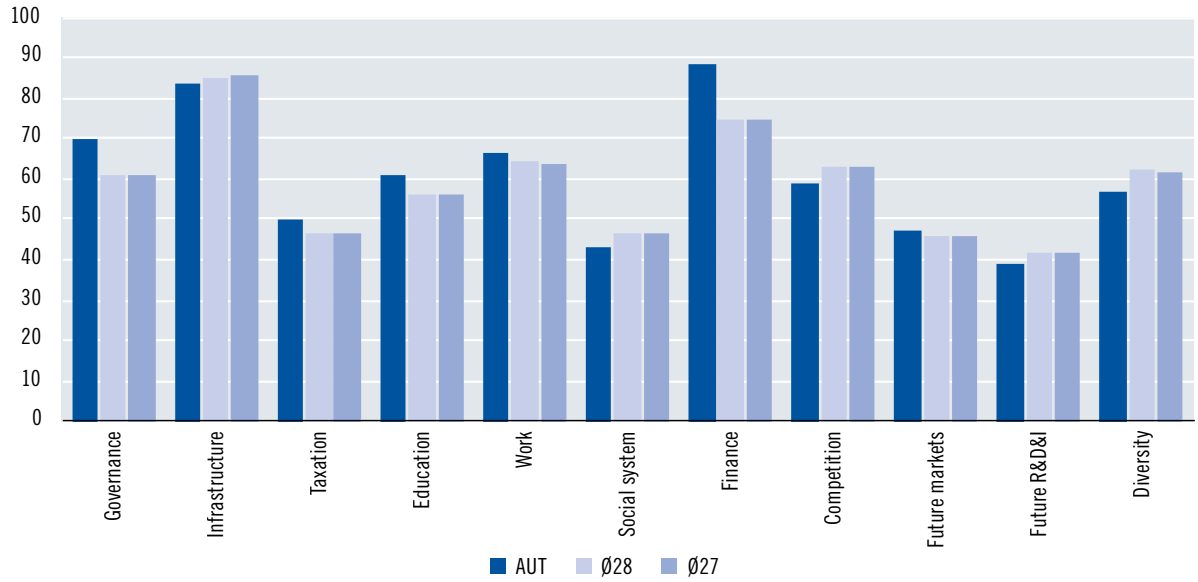
9. Future markets: creation of future markets, especially in areas that require public-private collaboration
10. Future RDI: investment in long-term RDI activities
11. Diversity: promotion of diversity and inclusion in companies, to enhance creativity

These dimensions are themselves based on two to nine indicators per dimension. The indicators themselves are long-established, and include items from the WEF Executive Opinion Survey, plus data from international organisations such as the World Bank, the International Telecommunication Union (ITU) and the International Labour Organisation (ILO). What makes this approach new, however, is to combine these indicators in the eleven dimensions. The findings are provisional, since there are still some gaps in the data which make a full analysis of the eleven constructs difficult. With this in mind, the analyses below should be seen as a provisional "snapshot" of the international situation.

Fig. 2-22 compares the Austrian values for all eleven dimensions with the European averages. In four dimensions – infrastructure, work, future markets and future RDI – there are only marginal differences between the Austrian and European scores, of less than three points. In four other dimensions the Austrian scores are significantly (at least three points) above the EU average; these are Governance, Taxation, Education and Finance. Austria shows marked strengths in Governance (plus 8.7 points) and Finance (plus 13.6 points). In three dimensions Austria is at least three points below the EU average, namely in the dimensions Social system, Competition regulations and Diversity in companies.

Austria's strengths in the dimensions Governance, Taxation and Finance[77] are evidence of a sound basic structure embodied in the country's political and economic institutions. With regard to the social system, the relatively poor coverage of childcare facilities and providers of early childhood education has a

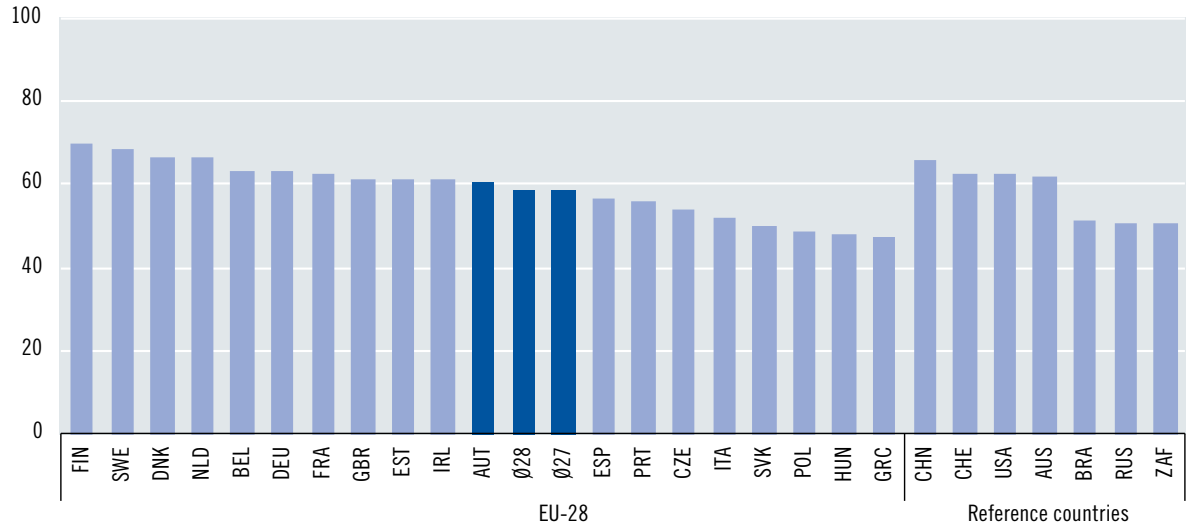
Fig. 2-22: Dimensions of the capacity for transformation and resilience; Austria compared to the EU



Source: World Economic Forum (2020); graphic: iit.

77 The "Governance" dimension includes indicators such as independence of the judicial system, perceived corruption, data protection and reliability of digital media, the index of egalitarian democracy, adaptation of legislation to suit digital business models. The "Taxation" dimension incorporates indicators for progressiveness of taxation and the impact of taxation on social (in)equality. The "Finance" dimension is measured using indicators such as share buybacks, firms' commitment to ethical standards and the use of digital financial services by poorer segments of the population.

Fig. 2-23: Capacity for transformation and resilience – an international comparison



Source: World Economic Forum (2020); graphic: iit.

noticeable impact. One of the indicators in the area of competition is the availability of venture capital, which is relatively limited in Austria.

Fig. 2-23 shows the averages across all eleven dimensions for EU countries and the reference countries. Austria's score is just above the EU average. In contrast to other indicators portrayed in this section, there is less difference here between countries. This – apparent – relative uniformity between countries, however, can hide substantial differences between the individual dimensions, as was clearly evident in the case of Austria.

2.2.4 Summary

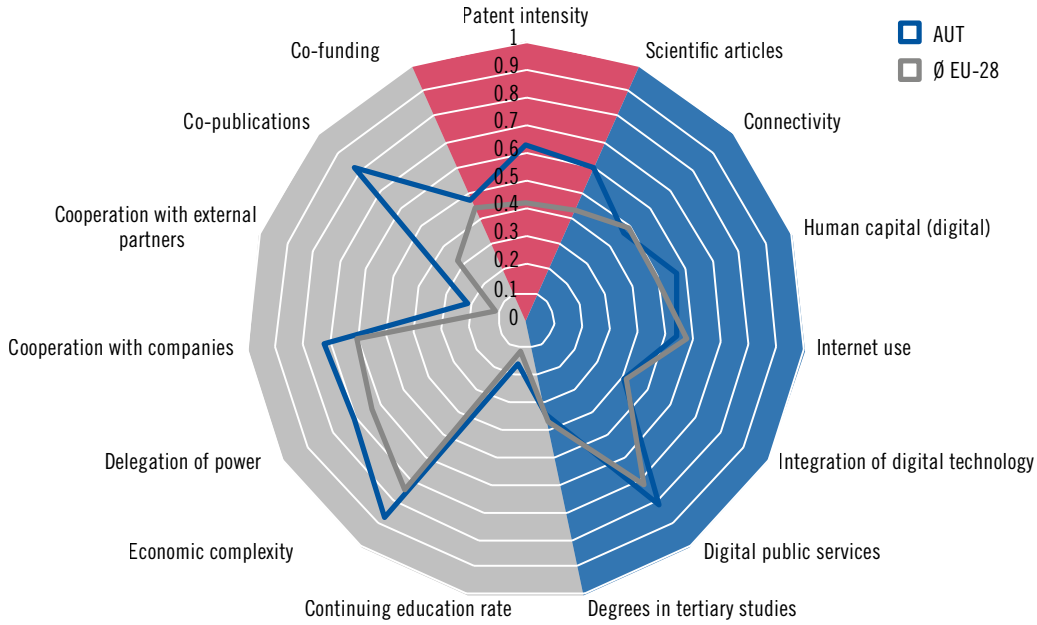
Overall the indicators presented in this chapter provide a varying picture of Austria's position in international rankings. Fig 2–24 summarises the key findings in a radar chart; the various scales are standardised uniformly to norm values between 0 and 1.

In the fundamental RTI indicators of patent intensity and research publications (red segment in the figure), Austria is consistently and significantly above the EU average.

Austria's position with regard to digitalisation is more differentiated (blue segment in the figure). Here, strengths in human capital of relevance to digitalisation and the digitalisation of public services stand in contrast to weaknesses in connectivity and use of the internet.

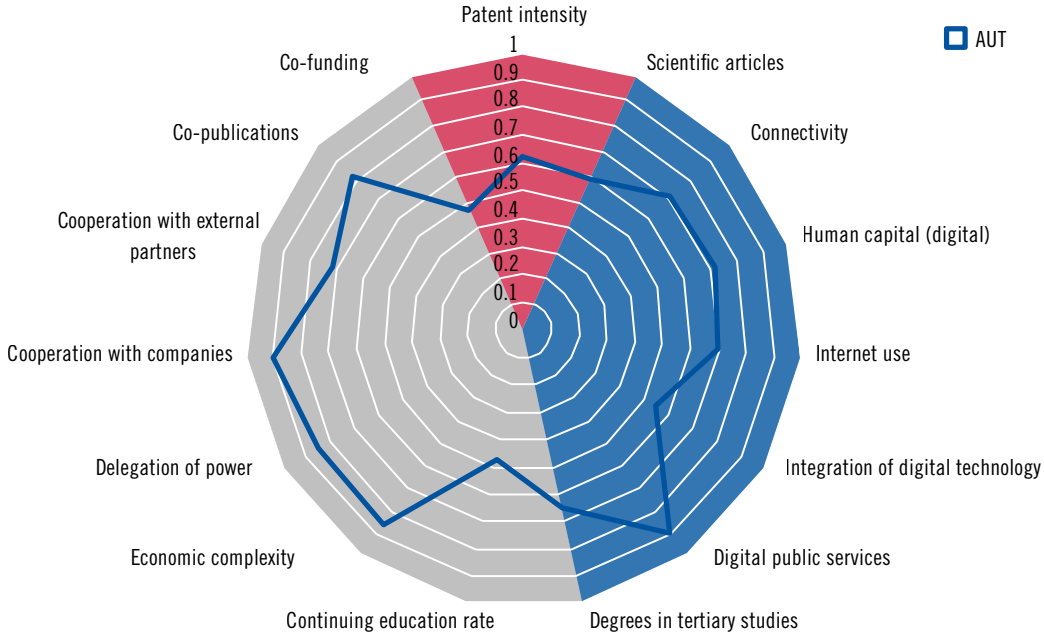
As far as the indicators for innovation capability are concerned, Austria shows scores which are almost all – and sometimes significantly – above the European average. The only exception in terms of human capital is tertiary education, where the particular characteristics of the Austrian education system, particularly with regard to vocational education, must be kept in mind. In Austria and other countries with a dual vocational education system, a substantial part of the training for the necessary specialist staff is provided outside the tertiary education sector. Complexity capital – the ability to produce complex products – is shown as outstandingly strong in Austria, which ranks second in the EU. In the indicators for structural capital – collaboration in companies and delegation of power – Austria is significantly, but not hugely above the European average. The situation with regard to relationship capital is more differentiated: all of Austria's scores are above the EU average, but while the level of public-private co-publications is substantially above average, for private co-funding

Fig. 2-24: Summary of Austria's position compared to the EU average



Note: RTI indicators are marked in red, digitalisation indicators in blue and innovation capability indicators in grey.
Source: Graphic: iit.

Fig. 2-25: Summary of Austria's score compared to the leading scores



Note: RTI indicators are marked in red, digitalisation indicators in blue and innovation capability indicators in grey.
Source: Graphic: iit.

of research and development it is only very slightly above.

An alternative perspective is provided by Fig. 2-25. Here Austria's score for each indicator is shown as a proportion of the highest score in the EU. This illustrates the gap between Austria's score and that of the current champion for each indicator. This enables some other aspects to be recognised than in the comparison made in Fig. 2-24. It reveals that Austria is above the EU average for indicators such as "Continuing education" and "Co-funding", for instance, but is still only achieving around 50% of the scores for the champions in each of these areas (Sweden and Germany).

2.3 Austria and the EU research, technology and innovation policy

This chapter examines Austria's role in European RTI policy. The focus of this review is on: Austria's performance in the Horizon 2020 programme, where for the first time it is possible to take an overall view, since the programme has now come to an end; and a look ahead to the new EU Research Framework Programme, Horizon Europe, together with a look at developments in social sciences and humanities, and the European Research Area as a whole, current developments in the European Research Initiative Eureka, where Austria currently holds the chair.

2.3.1 Austria's performance in Horizon 2020

The following overview of Austria's performance in Horizon 2020 is based on contract data from the reporting date of 20 February 2021. The data were provided by the European Commission via the eCORDA monitoring system, and the analyses were prepared by the Austrian Research Promotion Agency (FFG). Since the Horizon 2020 programme came to an end last year[78], these data allow at least a provisional overall evaluation of Austria's participation in Horizon 2020. Overall, the data confirm the positive achievements of Austrian institutions and researchers from science and industry under the (now concluded) eighth EU Framework Programme for Research and Innovation. The **total amount of project funding allocated to Austria was €1.78 billion**, approximately **2.8% of the funds distributed**. This means that Austria received proportionately more funding from Horizon 2020 than it paid in.

Austria's **proportion of funding acquired from the Horizon 2020 budget stands at 2.8%,** approximately parallel **with the share of participations. There were 162,705 participations in total** of funded Horizon 2020 projects, **of which 4,627 were Austrian.** This places Austria in tenth position in comparison with other European countries and eleventh position in international rankings, just behind Switzerland (4,696) and ahead of Denmark (3,642). Naturally enough the larger European countries have the highest numbers of participations in absolute terms: Germany (19,145), Spain (17,208), United Kingdom (16,303), France (15,752) and Italy (15,650). The **percentage of Austrian project coordinators amongst all coordinators** was **2.7%** (in absolute figures a total of 867).

With a success rate of 17.6% in terms of participations, Austria ranks significantly above the average success rate of 15.5% for Horizon 2020, ranking third amongst the member states of the European Union, after Belgium (19.3%) and France (17.8%).[79]

The **involvement of Austrian participants in individual "pillars"** and their budget chapters (see Table 2-7) varies greatly according to their nature. From the budgetary perspective, the major programme areas ("pillars") of "Societal Challenges", "Excellent Science" and "Industrial Leadership" are the most significant. In this respect the largest

78 The final calls for proposals on the topic "Research and innovation in support of the European Green Deal" ended in January 2021.

79 For comparison: the success rate for Swiss participations is 17.7%, and f or US participations 18.2%.

Table 2-7: Austria's performance in Horizon 2020 according to pillars, project participations, projects, coordinations and budget

	Approved participations (all countries)	Approved Austrian participations	Austria's share (in %)	Approved coordinations (all countries)	Approved coordinations (Austria)	Proportion of projects with Austrian coordinators out of all coordinations (in %)	EU contribution (all countries, in € millions)	EU contribution (Austria, in € millions)	Austria's share of the EU contribution (in € millions)
Horizon 2020 total	**162,705**	**4,627**	**2.8**	**32,461**	**867**	**2.7**	**62,798.3**	**1,780.2**	**2.8**
Excellent Science	51,629	1,221	2.4	18,291	437	2.4	22,961.6	629.5	2.7
of which ERC	9,117	254	2.8	7,298	208	2.9	12,225.3	358.7	2.9
Industrial Leadership	37,344	1,211	3.2	6,485	192	3	13,313.9	432.2	3.2
Societal Challenges	66,781	1,978	3	6,709	210	3.1	23,504.7	662.2	2.8
Spreading Excellence and Widening Participation	1,548	49	3.2	436	1	0.2	1,019.4	11.7	1.2
Science with and for Society	2,330	131	5.6	231	21	9.1	439.3	29.4	6.7
Cross-Theme	1,013	17	1.7	211	3	1.4	467.9	6.6	1.4
EURATOM	2,060	20	1	98	3	3.1	1,091.5	8.5	0.8

Source: European Commission/Austrian Research Promotion Agency (FFG) as of Feb 2021, contract data

amount of funding acquired for Austria was under Pillar III, "Societal Challenges", amounting to €662.2 million. The Austrian share under Pillar III represents 2.8% of all budgeted funding for projects under this pillar. In Pillar I, "Excellent Science", €629.5 million was acquired by researchers based in Austria, corresponding to a 2.7% share in this pillar. In Pillar II, "Industrial Leadership", €432.2 million was acquired by Austria: a 3.2% share of the funding, i.e. above-average success under this pillar for Austria, in contrast to the other two pillars. With a 2.4% share of both participations and project coordinations, Austrian contributions to the "Excellent Science" pillar are significantly below the averages for Austria under Horizon 2020, which stand at 2.8% (participations) and 2.7% (coordinations) respectively. The Austrian shares in the other two pillars are above average by a similar amount: "Industrial Leadership" (3.2% and 3.0%) and "Societal Challenges" (3.0% and 3.1%). Austria's performance in the programme line "Science with and for Society" is significantly above average: here the proportion of Austrian coordinations is 9.1%, the proportion of funding acquired is 6.7% and the share of all project participations is 5.6%. However, it should be noted that this programme line only has a small amount of budgeted funding (only 0.7% of the total funding is allocated to this programme line). Austrian participation is particularly low in the similarly modest funding areas of "Cross-cutting issues" (1.7% of all participations and 1.4% of all coordinations) and EURATOM (1% of all participations and 3.1% of coordinations).

Under Pillar III, "Societal Challenges", Austrian institutions have the highest levels of project participation in the thematic clusters "Smart, Green and Integrated Transport", with 4.0% in comparison to all participations in this cluster (3.7% of coordinations, and 3.2% of funding); "Inclusive, Innovative and Reflective Societies" with 3.8% (coordinations 3.3%, and funding 4.2%); and "Secure, Clean and Efficient Energy" with 3.3% (coordinations 3.5%; funding 3.2%). These thematic Societal Challenges may be seen as Austrian areas of strength in comparison to the rest of Europe. Below-average level participations occur particularly in the clusters "Food security, sustainable agriculture and forestry, marine and inland

water research and the bio-economy" with 2.1% (coordinations 2.0%; budget 2.0%) and "Health, demographic change and wellbeing" with 2.1% (coordinations 2.7%; funding 2.3%). In purely quantitative terms, the clusters "Transport" (€176.9 million), "Energy" (€145.3 million) and "Health" (€134.5 million) are the most significant for Austria within this pillar.

In the "Industrial Leadership" pillar, Austrian institutions have the highest proportion of project participations in the thematic clusters "Materials"[80] with 4.6% (coordinations 2.6%; funding 5.1%), and "ICT" with 3.6% (coordinations 4.1%; funding 3.4%); these industry-related themes are recognised strengths for Austria. To a lesser extent this is also true for the "Advanced Manufacturing" cluster, with a participation share of 3.1% (coordinations 6.0%; funding 4.2%), and "Biotechnology", with 2.3% (coordinations 0.8%; funding 2.6%). In the "Excellent Science" pillar, Austrian institutions have an above-average proportion (3.3%) of project applicants within the programme area "Future and Emerging Technologies (FET)" (coordinations 4.4%; funding 3.3%), and in applications to the European Research Council (ERC) with 2.8% (coordinations 2.9%; funding 2.9%). There are comparatively low levels of participation in "Research infrastructures", with 1.9% (coordinations 3.2%; funding 1.7%). In terms of monetary value, the ERC with €358.7 million and the *Marie Skłodowska-Curie Actions (MCSA)*, with €148.5 million, are of particular relevance to Austria, despite relatively low levels of participation in the MCSA, at 2.2%.

The **largest number of Austrian participations under Horizon 2020** – relative to the total number – **come from the business enterprise sector (36.9%), of which approximately 46.8% are in small and medium-sized enterprises (SMEs)** – slightly below the European average for SMEs in the business enterprise sector involved in Horizon 2020, at 51.2%[81]. This is followed by the **higher education sector (29.2%) and the non-university research sector (23.2%)**. These three sectors combined make up almost 89% of Austrian participations in Horizon 2020 projects. The rest is attributable to the public sector (3.1%) and the "other" category (7.6%).

In monetary terms, €690.7 million (or 38.8%) **is attributed to universities and higher education institutions, €546.6 million** (or 30.7%) **to firms** and **€448.0 million** (or 25.2%) **to non-university research institutes**.

These **types of institutions are involved to a varying degree** in each programme line. In terms of funding acquired, the proportion for the Austrian higher education sector under Pillar I "Excellent Science" is 71.0%. This can be attributed – unsurprisingly – to a high proportion of participations in European Research Council (ERC) projects, at 76.6%. However, in the programme lines FET and MCSA, the higher education sector's share of acquired funding is very high, at 69.5% and 68.1% respectively. The corresponding proportion for the non-university sector under Pillar I is 17.0%, and for the business enterprise sector, 11.1%. Within Pillar II "Industrial Leadership" and Pillar III "Societal Challenges" in contrast, the picture – measured in terms of acquired funding – is completely different. Under these two pillars the level of participation by the Austrian business enterprise sector is ahead of that by the Austrian non-university sector. The Austrian higher education sector was allocated just 17.2% of the total funding amount. In terms of funding acquired, the proportion for the Austrian business enterprise sector under Pillar II is 51.2%. The corresponding share for the Austrian non-university sector is 28.1%. Under Pillar III, in terms of funding acquired, the proportion for the

80 Nanotechnologies, Advanced Materials and Production (NMP) programme.

81 Data on the proportion of SMEs amongst business enterprise sector participants in Horizon 2020 was kindly provided by the Austrian Research Promotion Agency (FFG). Funding approvals for Austrian SMEs constituted 46.3% of successful applications from the entire Austrian business enterprise sector. The comparable figure at European level is 52.0%. It should be noted here that there are, for instance, a further 196 participations by Austrian SMEs, but these are categorised as "non-university research institutions" and were not included in this analysis.

Austrian business enterprise sector is 37.3%. The corresponding proportion under this pillar for the non-university sector is also comparatively high, at 29.2%. For the higher education sector the proportion of funding acquired under Pillar III is just 23.1%. In the horizontal programme area "Science with and for society", Austrian participation can be broken down by organisation type and amount of funding acquired: Higher education sector: 28.9%, business enterprise sector: 11.7%, and non-university sector: 44.5%. In the programme area "Spreading excellence and expanding participation" the proportions are 50.4% (higher education sector) and 41.5% (non-university research).

2.3.2 The new Framework Programme, the European Research Area, and the integration of social sciences and humanities (SSH)

At the beginning of 2021 the ninth European Framework Programme for Research and Innovation was launched (duration: 2021–2027) under the title "Horizon Europe". This new EU research and innovation programme will be supported by approximately €95.5 billion of funding for the period 2021–2027. This represents a budgetary increase of some 30% compared to Horizon 2020.

The programme is organised in **three pillars**: **Pillar I "Excellent Science"**, with a budget share of 26.18%, **Pillar 2 "Global Challenges and European Industrial Competitiveness"**, with a budget share of 56.03%, and **Pillar 3 "Innovative Europe"**, with a budget share of 14.24%. A horizontal element encompassing all three pillars also provides measures to widen and strengthen the European Research Area (ERA), with a budget share of 3.55%. The first pillar covers the European Research Council (ERC), Marie Skłodowska-Curie Actions and research infrastructures. The second pillar includes the "Joint Research Centres" (JRCs) and six thematic clusters supporting collaborative research of relevance to societal challenges. The thematic clusters here are "Health"; "Culture, Creativity and Inclusive Society"; "Civil Security for Society"; "Digital, Industry and Space"; "Climate, Energy and Mobility"; "Food, Bioeconomy, Natural Resources, Agriculture and Environment". This second pillar is intended to make the optimal contribution to the industrial and socio-political goals of the EU, and integrates the previous Horizon 2020 pillars of Leadership in Enabling and Industrial Technologies (LEIT) and Societal Challenges (SC). The third pillar consists of the European Innovation Council (EIC), the new European Innovation Ecosystems (EIE) and the European Institute for Innovation and Technology (EIT).

Fig. 2-26 below provides an overview of the configuration and structure of the pillars and programme areas of Horizon Europe.

The **key new features** of Horizon Europe are the European Innovation Council and the R&I Missions, which were described in the last Austrian Research and Technology Report 2020[82]. Other new developments relate to international collaboration, with extended options for association to Horizon Europe, additional measures in the field of Open Science, new approaches to European partnerships[83] and measures to widen excellence and participation in Europe. The plans for integration of the Social Sciences and Humanities (SSH) into Horizon Europe have also been expanded, to improve the impact focus of the programme. Furthermore, for the first time in the history of the European Framework Programme for Research and Innovation, significant budget funds (€8 billion) from the common EU budget are available

82 See Federal Ministry of Education, Science and Research (BMBWF), Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK), Federal Ministry for Digital and Economic Affairs (BMDW) (2020, 67).

83 See Federal Ministry of Education, Science and Research (BMBWF), Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK), Federal Ministry for Digital and Economic Affairs (BMDW) (2020, 68).

Fig. 2-26: Structure of the Horizon Europe programme

Source: European Commission (2021):

for the defence sector, specifically for strengthening the European Defence Technological and Industrial Base (EDTIB), with the new specific programme of the European Defence Fund (EDF) embedded in Horizon Europe. This opens up new opportunities for Austrian industry to participate in EU research and development projects in the field of defence research.

Integration of Social Sciences and Humanities (SSH) in Horizon Europe

"Many societal challenges that need to be addressed through research and innovation are too complex to be overcome by a single scientific discipline"[84], wrote the European Commission's Director-General of Research and Innovation, Jean-Eric Paquet, in the foreword to the monitoring report on social sciences and humanities (SSH). *While technical innovations are often a prerequisite, in the context of societal challenges they are not sufficient to achieve strategic objectives, since lasting societal change is often just as dependent on research findings from SSH. Insights from SSH research about people, society, behaviours and values make an important contribution to addressing societal challenges. Consequently, the European Commission regards the effective integration of SSH as a key factor for achieving long-term social impact.*

Under Horizon 2020, projects in the social sciences and humanities (SSH) were generally funded under the challenge category of "Inclusive, Innovative and Reflective Societies (SC6), the programme "Science with and for society" (SWAFS) and by integrating SSH into the programmes on "Societal Challenges (SC)" and "Leadership in Enabling and Industrial Technologies (LEIT)". This involved "flagging" individual calls for proposals as relevant to SSH. In calls for proposals identified in this way, integration of SSH was encouraged. In the **period 2014–2018 a total of 508 calls were identified as of relevance to SSH**, and under these calls 1,153 projects were funded

84 Integration of Social Sciences and Humanities in Horizon 2020: Participants, Budget and Disciplines - 4th Monitoring report on SSH flagged projects funded in 2017 under the Societal Challenges and Industrial Leadership priorities. EC Brussels, 2019. https://op.europa.eu/en/publication-detail/-/publication/f094a641-30dd-11e9-8d04-01aa75ed71a1

which involved at least one SSH partner. The total budget for these SSH players SSH was €1.2 billion. In the 2018 calls for proposals alone, calls with a total volume of approximately €1.9 billion were categorised as relevant to SSH. Players focusing specifically on SSH received €415 million (22%) of this. In 2018 **Austria** was **the eighth most successful country with over 50 SSH project participations** and **five coordinations** by key players in SSH.

To develop this further, the **integration of social sciences and humanities (SSH) is to be improved in Horizon Europe**, with funding for SSH research continuing to be administered on three levels. Firstly, bottom-up "blue sky research proposals" will be financed under Pillar I by the ERC. Secondly, in Cluster 2 of Horizon Europe's Pillar II, top-down driven, applied, solutions-oriented research projects will be funded in three priority focus areas ("destinations"). Thirdly, SSH expertise will be integrated into technology and natural science projects, taking a transverse approach to social aspects. This will be implemented through the cluster work programmes for 2021–2022. Article 4 of the draft regulation on Horizon Europe, dated 29 September 2020[85], emphasises that SSH should play an important role in all clusters. It is reasonable to assume that there will be a greater need for expertise from the SSH on social, cultural, behavioural and economic aspects in Horizon Europe clusters than was the case under Horizon 2020.[86]

The second cluster, "Culture, creativity and inclusive society", is central to the funding of SSH, with a total of €2,280 billion allocated to this area for the period 2021–2027. This cluster remains small in comparison to the other clusters, but has significantly higher funding than under Horizon 2020. The European Parliament in particular has pushed for this budget increase. Priority topics for this second cluster in Pillar II of Horizon Europe are "democracy and good government", "European cultural heritage and the cultural and creative industries", and research into "social and economic transformations".

The ERC is also an important source of funding for research in social sciences and humanities (SSH). ERC's total budget for Horizon Europe is approximately €16 billion. In recent years the SSH share of ERC funds has risen from 17% in 2014, to 25% in 2018. Based on these figures, a further three to four billion euros could be available for SSH projects. Other elements of the programme that offer opportunities for SSH research include the Marie Skłodowska-Curie Actions, the "Research infrastructures" programme, and the horizontal, cross-pillar programme areas for "Widening Participation and Strengthening the European Research Area". The contribution of SSH to technological and natural science projects will also be central to their role in Horizon Europe. In the jargon of the framework programme, this is described in short form as "SSH integration". The legal framework, political interest and a community that has learned from experience in the problems and benefits of SSH integration, now offer much better prospects for this area than in the past.

During its presidency of the European Council, Austria held an event on the "Impact of Social Sciences and Humanities for a European Research Agenda – Valuation of SSH in mission-oriented research"[87], to raise awareness of the need for stronger inter- and transdisciplinary links, and to facilitate some preliminary discussion. To widen the use of this approach at national level, the Federal Ministry of Education, Science and Research (BMBWF) initiated a range of awareness-raising activities, and has recently also published a practical guide under the title *"GSK-Forschung einbinden"* (Integrating SSH research), intended for anyone involved in planning and conducting research and innovation (R&I) programmes.[88]

85 https://era.gv.at/horizon-europe/documents/horizon-europe-regulation-general-approach/
86 https://era.gv.at/policy-support/policy-briefs/era-portal-austria-policy-brief-ssh-in-horizon-europe/
87 https://www.ssh-impact.eu/
88 See IHS (2021).

New developments in the European Research Area

One central political goal of the European Union in the field of science, research and innovation[89] is the **creation of a European research area, with freedom of movement for researchers, and where scientific insights and technologies which will enhance European competitiveness can be freely shared and exchanged**. This objective has resulted in a requirement for EU institutions and the 27 member states to introduce appropriate measures which will be conducive to realising this aim.

The European Research Area (ERA) came into being in the year 2000, and was designed to create a common European research agenda in addition to the national research agendas of individual member states, to enable collaboration beyond national boundaries, to promote mobility for researchers, and to develop common European initiatives with a broader reach than research funding through the framework programme.

Over time, several priority **areas for action** have emerged within the ERA:

- Modernisation of national research systems
- Transnational initiatives for targeted research funding
- European research infrastructures
- European careers and mobility for researchers
- Gender equality
- Knowledge valorisation, and Open Science
- International (global) cooperation

The European Research Area functions largely through the commitment and voluntary participation of the member states in individual initiatives. In contrast to the four well-established basic freedoms of the EU, there are hardly any mandatory provisions. The EU did not previously set any rules for realisation of the ERA, although the powers to do so were established in Article 182(5) of the Treaty on the Functioning of the European Union (TFEU)[90]. Although much progress has been achieved as a result of European cooperation and coordination, e.g. in the area of research infrastructures or the development of the European Open Science Cloud – which is expected to be fully operational by 2025 at the latest, and will then be available to all researchers in the EU – the extent and intensity with which individual priorities have been implemented is inconsistent among the member states, and in some cases has faltered repeatedly.

To enhance the visibility, relevance and effectiveness of the ERA, on 30 November 2018 the European Council therefore called for a new narrative, new goals and effective governance for the ERA. As a result, on 30 September 2020 the European Commission presented their proposal document, "A new ERA for Research and Innovation"[91]. Following Council approval on 1 December 2020 for a series of initiatives, the Commission and the member states will now work together, under the leadership of the European Commission, to define specific plans for the **new initiatives** and implement them promptly. These include:

1. **Prioritise investments and reforms**: Reaffirmation of the 3% target for R&D intensity; a new target of 1.25% of GDP for publicly funded research expenditure; support for reforms to RTI systems or elements of these in member states
2. **Translate R&I results into economic activity** through closer integration with industrial policy; increased directional research funding; update to the "Code of Practice for smart use of intellectual property"[92]
3. **Consolidate the European Research Area**, particularly with regard to support for research careers; Open Science and innovation funding; further development of the research infrastructure ecosystem; exploiting synergies between the Eu-

89 Article 179 of the T reaty on the Functioning of the European Union.
90 Treaty on the Functioning of the European Union.
91 See European Commission (2020k).
92 See European Commission (2020l).

ropean Research Area and the European Higher Education Area; reaffirmation of commitment to gender equality

4. **Improve access to excellent research and innovation** (inclusiveness): increase direct investment in research and innovation (R&I) by 50% within five years in the countries which perform below average in the EU Framework Programme for Research and Innovation; reform R&I policy in the countries which are weaker in R&I
5. **Visibility and relevance of R&I for society:** Expand Citizen Science programmes; improve science communication

Horizon Europe will also support these plans, particularly through the programme's focus area on "Widening participation and strengthening the European Research Area".

However it seems likely that a ERA Forum for Transition established by the Commission will form the operational nucleus of the new governance, and that the "European Research Area and Innovation Committee" (ERAC) and the European Council will be the other principal elements.

2.3.3 Austria's chairmanship of the European research initiative Eureka

On 1 June 2020, for the second time, Austria assumed the chairmanship of Eureka, the international network which was last chaired by Austria in 1989.[93] Eureka is an international organisation that was founded in 1985 with the aim of promoting cross-border cooperation between small and medium-sized enterprises in the field of innovation. The founding members of Eureka were the members states at that time of the EU and the EFTA.

Eureka promotes collaboration between member states on two levels. Firstly the member states cooperate on the strategic level, through their national ministries with responsibility for innovation. Secondly, collaborations are arranged by the agencies responsible for carrying out innovation promotion. The principal form of innovation support through Eureka is funding for projects involving at least two companies from two different countries, working together on a joint innovation project.

Collaboration between the member states in Eureka has always been based on **three guiding principles**:

1. Decentralised collaboration
2. Variable geometry
3. Bottom-up

Decentralised collaboration means that Eureka funding is implemented at the national level in the countries concerned. Although the projects supported always involve international consortia, the funding for each individual project participant is administered at national level according to national funding guidelines (in Austria this is handled by the Austrian Research Promotion Agency (FFG)).

Variable geometry means that Eureka initiatives require a minimal subset of all member states. These initiatives are possible in principle as soon as at least two companies and two member states are involved.

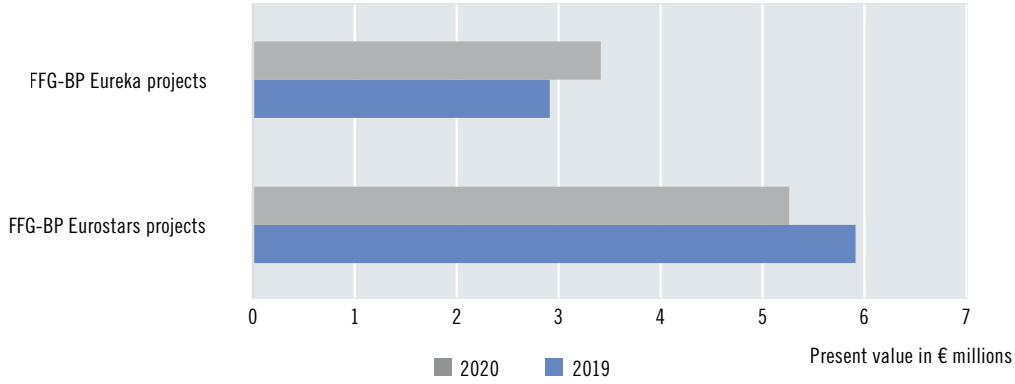
The **bottom-up principle** means that Eureka does not set thematic requirements for collaborative projects in innovation. Apart from military research and development projects, any topic with innovative content is eligible for Eureka funding.

Eureka has evolved over time and is now a global organisation. In 2020 Eureka had 48 members (47 member states + European Commission). In addition to member states of the European continent (including Russia and Turkey), the network also includes Israel, South Korea, Argentina, Chile, South Africa and Canada.

Collaboration through the Eureka network is coordinated by the Eureka Secretariat in Brussels. Ultimate responsibility for the fortunes of Eureka as an

93 https://www.eurekanetwork.org/about-us/eureka-history

Fig. 2-27: Austria's funding activity within the Eureka network in 2019/2020



Note: In Austria, the General Programmes of the Austrian Research Promotion Agency (FFG) (FFG-BP) are in principle made available for projects in industry and for commercial enterprises (because of this, bottom-up Eureka and Eurostar projects are financed via FFG-BP).

Source: Austrian Research Promotion Agency (FFG).

international organisation and for the Eureka Secretariat lies with the incumbent chairing country. The chairmanship changes every year.

Austria is represented in Eureka by the Federal Ministry for Digital and Economic Affairs (BMDW), which also acts as the representative for the Federal Ministry for Europe, Integration and Foreign Affairs (BMEIA). The Austrian Economic Chambers (WKO) and the BMDW each provide half of the annual membership fee, and the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) makes a separate contribution to the "Eureka Cluster" programme. In 2019 the Federal Ministry for Digital and Economic Affairs (BMDW) tasked the Austrian Research Promotion Agency (FFG) with preparing and implementing Austria's second term as Chair of Eureka; the first was in 1989.[94]

Fig. 2-27 shows the amount of funding awarded to Eureka projects in 2019 and 2020. The annual volume of funding in both years was just under €9 million. The Eurostars programme, run jointly with the European Commission, receives around two thirds of the total volume.

The Austrian Chairmanship of Eureka coincided with a particularly significant point in time:

- Eureka celebrates its 35th anniversary during the Austrian Chairmanship since its foundation
- Horizon Europe – the new EU Research Framework Programme – is launched during the Austrian Chairmanship
- Eureka's strategic programme for 2021–2027 begins during the Austrian Chairmanship

These key points are all reflected in the work programme for the Austrian Chairmanship. It should be noted, however, that while the distinctive feature of Eureka is that it supports international cooperation between SMEs, the relative significance of Eureka for the promotion of innovation has been diminishing continuously over time, and currently only plays a rather minor role in all member states.

The Austrian Chairmanship of Eureka has taken this situation as an invitation to launch a **new start for collaboration through Eureka**, as part of the work programme. This new start, under the slogan of the Austrian Chairmanship, "New Eureka", is made up of three pillars:

Renewal of funding instruments used: The most substantial instrument for collaboration through Eureka is currently the Eurostars programme[95], which is run jointly with the European Commission through

94 https://www.ffg.at/eureka-austrian-chairmanship
95 https://www.eurekanetwork.org/countries/austria/eurostars/

Horizon 2020. Under the Austrian Chairmanship, the successor programme Eurostars 3 (= Partnership for Innovative SMEs) starts under the new Horizon Europe research programme. The Austrian Chairmanship will also launch the new Eureka Clusters Programme (ECP)[96]. The ECP supports international collaboration for innovation in various fields of technology (microelectronics, telecommunications, innovative manufacturing processes), by actively seeking industry involvement. In this area Eureka's bottom-up approach is enhanced by targeted thematic calls for proposals (e.g. on artificial intelligence).

Improving and intensifying collaboration: Collaboration through the Eureka network benefits from the activities of individual member states. There is considerable potential to make better use of the opportunities offered by collaboration. To this end, under the Austrian Chairmanship, the technical frameworks for collaboration will be expanded by investing in IT infrastructure at the Eureka Secretariat. There is also an emphasis on encouraging participation from member countries in the West Balkan region.

Extending and enhancing the global significance of Eureka: As a small, open economy, Austria has a heightened interest in global cooperation in the field of innovation. The Austrian Chairmanship will welcome Singapore to the network, as a new member and an outstandingly attractive partner for collaboration. Another priority will be a joint call for proposals with a number of African countries.

The work programme for the Austrian Chairmanship will facilitate increased international networking and collaboration for SMEs working in innovation, and also provide an opportunity for substantial involvement in shaping the strategic orientation of Eureka at a crucial point in time.

2.3.4 Summary

Austrian engagement in RTI at European level is consistently strong. This is reflected in the fact that Austrian institutions and researchers had managed to acquire more than €1.7 billion in funding just before the end of Horizon 2020. This exceeded the ex ante objective of €1.5 billion by a substantial amount. Austria has been particularly successful in Horizon 2020 in the following thematic clusters: under Pillar III – "Smart, Green and Integrated Transport", "Inclusive, Innovative and Reflective Societies", "Secure, Clean and Efficient Energy"; under Pillar II – "Materials", "ICT", "Advanced Manufacturing", "Biotechnology"; and under Pillar I in the programme line "Future and Emerging Technologies (FET)", as well as in the European Research Council (ERC). The Austrian success rate in Horizon 2020 is amongst the highest in the EU.

Since the fundamental structure of the new programme, Horizon Europe, is not radically different from that of its predecessor, Horizon 2020, although it is significantly more impact-oriented, it can be assumed that the new European Framework Programme for Research and Innovation will also be positively received and actively engaged with in Austria. Alongside individual new features which have already been described in the last two Austrian Research and Technology Reports, such as the Missions, the European partnerships and the new instruments for innovation funding (especially the European Innovation Council EIC), Horizon Europe may also offer researchers in Social Sciences and Humanities (SSH) more extensive scope for involvement. In addition to the ERC, which is strengthening SSH in basic research, under Pillar II of Horizon Europe a specific cluster has been created which not only has a marked emphasis on SSH, but is also better resourced financially than the comparable so-called "Challenge 6" was under Horizon 2020. Furthermore, while the integration of

96 https://www.eurekanetwork.org/countries/austria/clusters/

SSH had already begun in Horizon 2020, this will be more fully incorporated in the other programme lines of Horizon Europe.

In RTI policy a refocusing process is under way for the European Research Area, which will also be supported by the programme priority "Widening participation and strengthening the European Research Area". There will be a special emphasis on efforts to counter the divide in Europe between EU member states which are stronger or weaker in RTI, and to integrate them more closely. Accompanying measures will support the processes and work toward the necessary reforms in European member states and associated countries. In addition to other initiatives, efforts will be intensified to improve access to excellent research and innovation in the countries which perform below average in the European Framework Programme for Research and Innovation.

The technology and innovation network Eureka, which now operates globally, also has new impetus, with the aim of further advancing cross-border cooperation between small and medium-sized enterprises. Part of this is a new start for Eureka, launched by Austria during its chairmanship of the network, under the slogan "New Eureka". This comprises three pillars, targeting firstly the renewal of the funding instruments, secondly the improvement and intensification of collaborative partnerships, and thirdly expanding and intensifying the global significance of Eureka.

2.4 Current research

The pandemic is creating major social and economic challenges. There has never been a more urgent need than there is today for innovative solutions in response to external developments such as a pandemic or climate change. Science and research are enormously important. RTI policy has responded to these challenges, and will continue to do so, by setting new priorities. Consequently in the following chapter, the central focus is on developments in COVID-19 research as well as climate-related research in Austria.

2.4.1 COVID-19 research

The COVID-19 pandemic has posed an unprecedented challenge for policymakers in research and technology policy all over the world. Every day that the virus continues to spread costs lives, and causes significant detriment to our health and economic systems. Under urgent time pressure, huge amounts of work have been done on a global level to develop effective vaccines and medications, in order to curb the spread of the pandemic as quickly as possible. In addition to epidemiology and biomedicine, the social science disciplines have also played a major role in formulating appropriate measures to combat the virus and mitigate its effects. The COVID-19 pandemic has consequently resulted in an unparalleled mobilisation of researchers, across many countries and many disciplines.

Austrian research is playing a prominent role in the international response to COVID-19. This is partly due to the relatively high impact the pandemic has had in Austria. From a global perspective, Austria was one of the earliest countries to be affected, albeit mildly at first. Subsequently, however, measured by the number of infections per head of population, Austria, like most other European countries, has been amongst the most severely affected countries in the world.

As in other affected countries, substantial public funds have been provided for research into the coronavirus and its effects on our health, social and economic wellbeing. By April 2020 the majority of this financial support had already been allocated to understanding, containing and combating the virus. Processes for awarding and distributing funds were also adapted and accelerated flexibly. This chapter presents an overview of the programmes implemented so far by the research funding institutions. The following description outlines the funding programmes from five relevant institutions: the Austrian Science Fund (FWF), the Austrian Research Promotion Agency (FFG), the Vienna Science and Technology Fund (WWTF), the European Commission (Horizon 2020), and finally the projects directly commissioned

by the Federal Ministry of Education, Science and Research (BMBWF).[97]

The following table and figure show the key elements of these supporting measures, and are followed by the description.

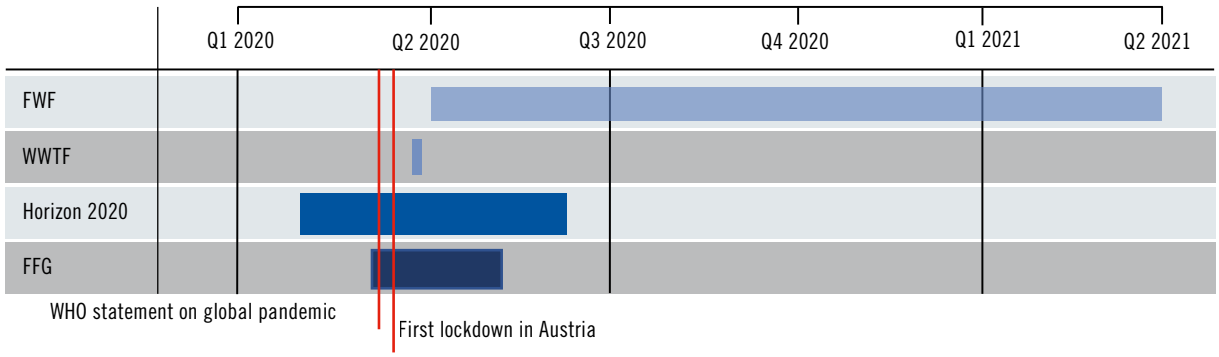
Table 2-8: Overview of funding measures provided by the FWF, FFG, WWTF, Horizon 2020 and the BMBWF

	FWF	FFG	WWTF	Horizon 2020	BMBWF
Funding volume In € millions	5.1	25	1.06	176.4	5.1
Number of projects	16	53	24	41	13
Start of submission period for proposals	6 Apr. 2020	9 Mar. 2020	26 Mar. 2020	30 Jan. 2021	Directly commissioned projects
End of submission period	Ongoing awards	8 Apr. 2020 (1st call) 11 May 2020 (2ndcall)	31 Mar. 2021	12 F eb. 2020 (1st call); 11 Jun. 2020 (2nd call)	-
Average time to decision	Approx. 2 months	2 weeks	2 days	Approx. 1 month (Call 1) or 2 months (Call 2)[1]	-
Average funding volume per project (in €)	318,902.54	472,000	44,096	Approx. 2,800,000 (Call 1) Approx. 5,600,000 (Call 2)	392,000
Median funding amount (in €)	366,869.48	250,000	49,800		-
Focus areas	BioMed (transmissibility, interactions, treatments, therapy etc.) Humanities and Social Sciences (political and cultural implications, behaviours, reactions etc.) Natural and Technical Sciences	Biology and transmission of the virus; infection prevention and control therapeutics and diagnostics; clinical studies; protective clothing	Understanding and combating the virus; expansion of testing capacity; epidemiology and public health; understanding society in crisis; education and schooling; economic activities and logistics	Broad range of topic areas: three in the first call, five in the second call.	Data availability and economic impact; prevalence of the virus in the Austrian population; coronavirus and schools; effectiveness of therapeutics
Procedural adaptations	Additional extraordinary meetings of the Executive Board and accelerated decision procedures by the Board of Trustees of the Austrian Science Fund (FWF)	Normal but accelerated procedure of the General Programmes (rapid review of projects by the FFG's own experts), funding decision prepared by the Advisory Board	Preselection of submissions by university management; Austrian reviewers only	Normal submission procedure, but with a shorter application format (45 pages)	-

1 Time from submission deadline to presentation of projects.

Table: Austrian Institute for SME Research and Institute of Industrial Science (IWI).

Fig. 2-28: Start date and duration of COVID-19-specific calls for proposals by the major research promotion funds



Note: The calls for proposals issued by the FWF, FFG and Horizon 2020 were processed in two or more phases; the duration shown here is from the start of the first call for proposals to the final submission deadline.

Table: Austrian Institute for SME Research and Institute of Industrial Science (IWI).

97 Additional support mechanisms are described elsewhere such as in the report by the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) to the relevant Committee of the National Council under Section 3(5) of the Federal Law on Establishment of the COVID-19 Crisis Management Fund (COVID-19-F ondsG). https://www.parlament.gv.at/PAKT/VHG/XXVII/III/III_00262/index.shtml

2.4.1.1 Austrian Science Fund (FWF)

As a direct response to the COVID-19 pandemic, in March 2020 the Austrian Science Fund (Fonds zur Förderung der wissenschaftlichen Forschung, FWF) launched the Urgent Funding SARS-CoV-2 programme – a fast-track procedure for Austrian research proposals on coronavirus-related basic research in any subject area of relevance to prevention, early detection, containment and study of COVID-19, particularly those emphasising international collaboration.[98]

Organisation

The decisions on allocation of the urgent funding were made on a continuous basis by the FWF's board of trustees, based on an international review process. The initial submission period ran until the end of September 2020. The first funding award went to a project by the Medical University of Vienna, "COVID-19 and RAS inhibition", which got under way in May 2020. This project is investigating the previously little studied role of antihypertensive medications in COVID-19 patients. In August four COVID-19 research projects, and on 3 September three urgent projects were approved at an extraordinary meeting of the Executive Board, and using an accelerated decision procedure by the FWF's board of trustees, based on circulated documents. The FWF Executive Board also agreed to extend the duration of the fast-track procedure in place since March 2020, by a further six months, to the end of March 2021. This enabled a further eight urgent projects to be approved by the end of 2020.

Overview of funding awarded

In 2020 the Austrian Science Fund (FWF) approved a total of 16 urgent projects with overall funding of approximately €5.1 million, and an average time to contract of two months. The projects can be categorised in terms of scientific disciplines into three focus areas, with the majority of the projects (eleven) in the field of Biology and Medical Sciences.

Focus area 1: BioMed (Biology and Medical Sciences)

The eleven projects approved in the field of Biology and Medical Sciences concern topics such as the transmissibility and infection mechanism of the SARS-CoV-2 virus, interactions, treatment and therapeutic methods, extending even to investigating the impact on speech-related processes of concealing details of lip movement by the use of protective face coverings. For example, the first transnational urgent research project is exploring "New methods for coronavirus decontamination" (St. Anna Children's Cancer Research Institute, Vienna, in collaboration with the University of Chemistry and Technology (UCT), Prague, Czechia); the project is financed by the Austrian Science Fund (FWF) and the GACR (Czech Science Foundation), and is adapting CAP (cold atmospheric plasma) technology for disinfecting heat- and liquid-sensitive items, so that these can be re-used after decontamination. The focus is on re-using highly effective face masks and decontaminating other sensitive items. The efficacy of cold atmospheric plasma is being investigated using selected human respiratory viruses with a range of characteristics, including SARS-CoV-2, influenza A, adenovirus and rhinovirus.

Focus area 2: Humanities and Social Sciences

The four urgent projects in the area of Humanities and Social Sciences are looking into the political and cultural implications of SARS-CoV-2; new logistics planning methods; the attitudes, behaviour and reactions of people living in Austria to the COVID-19 crisis; and changes in the paid and unpaid work of couples in Austria. The Austrian Corona Panel, coordinated by the Vienna Center for Electoral Research (VieCER), for example, is investigating the changing

98 https://www.fwf.ac.at/en/research-funding/fwf-programmes/urgent-funding-sars-cov-2

everyday lives of people in Austria, based on a panel survey of 1,500 individuals. The study is producing important insights into the attitudes and behaviours of people living in Austria, and how well-informed they are. The project was initially funded by the Vienna Science and Technology Fund (WWTF), the Rectorate of the University of Vienna, the Vienna Chamber of Labour and the Federation of Austrian Industry. Since October 2020, funding from the Austrian Science Fund (FWF) has allowed the project to be continued.

Focus area 3: Natural and Technical Sciences

In the focus area of Natural and Technical Sciences, a project conducted by the Institute of Chemistry at the University of Graz on "Flexible flow synthesis of critical chiral medication" („*Flexible Flow-Synthese kritischer chiraler Arzneistoffe*") is creating a toolkit of methods based on flow chemistry which will accelerate the production of medications for COVID-19, and are also flexible enough to be used in other types of epidemic in the future.

2.4.1.2 Austrian Research Promotion Agency (FFG)

In March 2020 the Austrian Research Promotion Agency (FFG) was allocated a budget framework of €26 million from the Federal Ministry for Digital and Economic Affairs (BMDW) and the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) to support research in the fight against coronavirus, of which €25 million was used. Funding through the Corona Emergency Calls was intended for Austrian companies and was administered through two calls for proposals.[99] Funding was awarded to R&D projects in the following four topic areas: (i) biology of the virus and its transmission, (ii) prevention and control of infection, (iii) research and development of medications and other therapeutic procedures, and the development of new diagnostic approaches, and (iv) planning and conducting clinical studies. In the second call for proposals additional projects were supported in alternative and innovative industrial manufacturing strategies in medically critical areas (e.g. protective materials). Criteria for the award of funding included not only relevance to one of the five topic areas, but also the feasibility of rapid implementation of the projects. This had to be possible in less than 12 months.

Organisation

The calls for proposals were issued and completed in the shortest possible time. From the start of the submission period on 9 March 2020, companies had one month in the first call, and two in the second, to prepare their proposals. Funding decisions were made using an accelerated procedure by the Advisory Board for the FFG's General Programmes, within two weeks after submission deadline. The Advisory Board was able to refer to empirical data from previous project funding programmes in the same topic areas. Despite the accelerated procedure, the aim was to uphold the quality requirements in evaluating the projects, which involved a significant increase in work to be completed within a short timeframe.

Overview of funding awarded

Fifty-three projects were awarded funding amounting to a total of approximately €25 million. This represented 36% of the submissions. Funding was distributed purely in the form of grants, with a maximum amount of €3 million. The median funding amount for the projects was approximately €250,000. Almost two thirds of the projects were conducted by small enterprises, including six start-ups. In terms of topic area, the majority of the project proposals (29, i.e. 66%) concerned research and development of diagnostic approaches and therapeutic procedures, followed by eight projects on protective materials and four on prevention and control of infection.

99 https://www.ffg.at/en/ausschreibung/emergencycall-covid-19

In addition to the national call for proposals, two further project applications with Austrian participation were also successful in the multilateral call for proposals by the European Eureka Network for COVID-19 research, and one more is still under consideration. The focus of this multilateral call for proposals was on short- to medium-term research projects on solutions to combat the SARS-CoV-2 virus; the programme was announced in April 2020, and is managed in Austria by the Austrian Research Promotion Agency (FFG). Austria and six other countries took part. The Austrian projects awarded funding in this call for proposals came from the Styrian company AMS AG and medPhoton GmbH from Salzburg. Both projects are working to develop solutions for use in diagnostics of the SARS-CoV-2 virus.

The nationally funded projects have already produced first results. After eight months the first companies awarded funding were ready to launch products onto the market which are now already being used successfully to fight the pandemic. Some of the financed projects from the three main topic areas supported are described in outline below:

Focus area 1: Diagnostics and therapeutics

Funded research in diagnostics included the development of a rapid testing process, created by the Upper Austrian company GENSPEED Biotech GmbH, in a project titled "*COVID-19 Schnelltest zur Erhebung des Immunstatus und zum gleichzeitigen Nachweis einer akuten Infektion*" (COVID-19 rapid test to show immune status and simultaneously test for acute infection). This allowed a portfolio of three rapid tests to be developed, based on the patented µELISA method. This portfolio includes a high-quality test for antibodies which is already available on the market. The high level of sensitivity and specificity of the procedure developed was confirmed in a paper published in the Journal of Clinical Virology. An antibody test based on the same method will shortly be launched on the market. The third rapid test, based on GENSPEED's patented µELISA platform, is a combined antibody and antigen test. This is a global innovation, and will be the first to enable simultaneous detection of both antibodies and acute infections. Market launch for this product is scheduled for early 2021.

Focus area 2: Protective materials

The FFG funded a project titled "Conventional and cellulose-based COVID-19 protection" by Lenzing AG from Vorarlberg, which is researching protective clothing made from the sustainable material cellulose. A new nozzle has already been designed which allows more finely spun nonwoven fabrics to be produced, so maximising the filter effect of the material. Research continues into potential additional functions of nonwoven fabrics, for instance investigating their antibacterial and antiviral properties. These developments should make it possible in future to supply the Austrian and European market with high-quality and sustainable protective clothing.

Focus area 3: Prevention and control of infection

One outstanding example of funded research in the area of prevention and control of infection is a project by the Upper Austrian company Symptoma GmbH, which is developing a COVID-19 Chatbot Test, using artificial intelligence. Support from the FFG enabled the chatbot, which is the product of 14 years of research, to be developed further and adapted specifically for evaluating the risk of a COVID-19 infection. Its high level of sensitivity and specificity have been confirmed by two scientific studies. With an accuracy rating of 96.3% this procedure is a global leader amongst chatbot processes based on artificial intelligence. The Symptom Checker has been approved as a medical product and is already being used by the City of Vienna authorities to relieve pressure on the coronavirus hotline.

2.4.1.3 Vienna Science and Technology Fund (WWTF)

The Vienna Science and Technology Fund (Wiener Wissenschafts- Forschungs- und Technologiefonds, WWTF) set up "COVID-19-Rapid Response Funding"[100] within in a week in March 2020, to enable rapid collection of data needed to help fight the pandemic. The resources for this funding came both from the WWTF and from contributions by two private organisations.

Organisation

Instead of the three months usually needed when calls for proposals are issued for projects of comparable magnitude, this award process was administered in less than eight days. One crucial factor was that the rectors of Austrian universities were contacted directly and invited to put forward two to three project ideas each. For the majority of these preselected ideas, the responsible researchers were then invited to submit a corresponding proposal, within a timeframe of just 36 hours. Selection of projects was then made by an interdisciplinary jury of six Austrian expert reviewers. This step was also completed within hours. This meant that work could begin on the first financed research projects by early April 2020.

Overview of funding awarded

Twenty-four research projects were sponsored through the Vienna Science and Technology Fund (WWTF), each receiving support of up to €50,000, with a total funding volume of €1,058,321.65. Most of the projects were scheduled for a duration of 12 months, with the majority of projects being completed in the meantime (date: 22 January 2021). Funding was principally directed towards basic research in both university and non-university institutions, with the majority of projects based on inter-institutional collaboration and focused on the following topic areas:

Focus area 1: Understanding and fighting the virus

The four projects commissioned in this topic area addressed the behaviour of the virus and its interactions with the human body. The funded projects thus contributed directly to the development of possible therapeutic methods and vaccines. One such example is the project "Mutational dynamics of SARS-CoV-2", which was entrusted to a consortium set up by the Center for Molecular Medicine. In this project the viral genomes from 1,000 patients in Austria were sequenced and the resulting information was made available for international research in a global database. The analytical capacity established in Austria as part of this project is now proving critical to tracking the spread of the latest mutations of the virus.

Focus area 2: Expansion of test capacities

Three projects were supported on research and development of testing procedures and expanding test capacities. This project, "Rapid repurposing of laboratory infrastructure for enhanced testing capacity during the COVID-19 pandemic" ("*Schnelle Umwandlung von Laborinfrastruktur zum Aufbau von COVID-19-Testkapazität in der Pandemie*") made a substantial contribution to setting up the necessary testing infrastructure within the shortest possible timeframe. The initiative funded under this programme brought together several researchers, thus creating a framework for essential knowledge transfer between and beyond individual institutions.

Focus area 3: Epidemiology and public health

In this priority area six projects were financed, with the common objective of contributing to the scientific understanding of how the virus is spread, and of

100 https://www.wwtf.at/covid/

levels of immunity within the population. The funded projects mobilised various different methodical approaches, from self-reported symptom tracking and lab tests to simulations based on network data. The results were published in prestigious journals such as The Lancet.

Focus area 4: Understanding society in the crisis

The four projects funded in this focus area addressed either the social implications of the pandemic, particularly for mothers and refugees, or individual reactions to the change in circumstances. One project by Vienna University of Economics and Business and the Vienna Chamber of Labour for example, investigated the extent to which working from home arrangements affected the way unpaid domestic tasks were shared out. The online survey of over 2,100 Austrians showed that working from home did not result in any change to the (traditional) way domestic tasks were shared within households. Indeed, in many cases women took on even more domestic responsibilities than previously.[101]

Focus area 5: Education and school

Three projects studied the implications of the pandemic for learning. Subjects investigated included the capacity for self-regulated study in home-learning situations and the impact of digitalisation and increased home support on social inequalities in education. A study conducted by the Institute of Advanced Studies (IHS) showed that home-schooling increased the influence of the parental home on learning achievements.[102]

Focus area 6: Economy and logistics

The sixth priority area addressed economic issues. Topics researched included changes in the investment activities of companies and the probability of supply shortages, linked with the question of what a restart of the Austrian economy might look like. A consortium led by Vienna University of Technology, for instance, gathered relevant data on procurement strategies and the logistics chain of leading food retailers, in order to develop a model for forecasting supply shortages.

2.4.1.4 Horizon 2020 – EU COVID-19 research with Austrian involvement

European funding providers also responded swiftly to the COVID-19 pandemic with their own programmes. Under its Horizon 2020 research funding programme, the European Commission approved approximately €1 billion of financing for the fight against the pandemic; as of January 2021 €780.8 million of this had already been distributed. In the past year the European Commission issued two COVID calls for proposals, through which Austrian institutions and companies also participated successfully in international research projects. The number of Austrian participants is comparable to the level in Ireland and Sweden. Italy, which was affected particularly severely by the pandemic, reported the highest number of participants. [103]

Organisation

By 30 January 2020 the European Commission had already announced a call for expressions of interest under the title "SC1-PHE-CORONAVIRUS-2020: Advancing knowledge for the clinical and public health response to the [COVID-19] epidemic", with an initial budget of €10 million, which was subsequently increased to €48.5 million. At the end of March a total of €48.2 million was then awarded to 18 projects under the "Health" programme, involving 151 research teams from across the entire EU and beyond.[104] In May 2020 an additional COVID-19 call was issued for

101 https://www.wu.ac.at/en/vw3/research/current-projects/genderspecificeffectsofcovid-19
102 https://www.ihs.ac.at/fileadmin/public/2016_Files/Documents/2020/IHS_Homeschooling_Studie.pdf
103 https://ec.europa.eu/info/sites/default/files/research_and_innovation/research_by_area/documents/ec_rtd_eu-research-innovation-against-covid.pdf
104 https://ec.europa.eu/info/sites/info/files/research_and_innovation/research_by_area/documents/ec_rtd_cv-projects.pdf

collaborative projects under Horizon 2020, with a budget of €129.5 million.[105] On 11 August 2020 the European Commission announced that a further 23 projects were to be supported with a total of €128.2 million. These 23 projects are now under way, involving research work by 344 teams from 39 countries in Europe and beyond. This second call for proposals under Horizon 2020 subsidised various projects including eight on diagnosis and treatment, which were allocated €117 million in funding through the "Innovative Medicines Initiative (IMI)", and measures to support innovative concepts that were launched via the European Innovation Council.

An overview of funded projects with Austrian participation

In the first call for proposals, the SOLNATIDE project was coordinated by the Austrian company Apeptico GmbH. Another project, CORONADX, involves the Medical University of Vienna:

- The SOLNATIDE project has already carried out testing of treatment for acute lung failure in a Phase I clinical study, and in two Phase II studies. The active substance Solnatide-IMP is now being tested on COVID-19 patients. Since there are very few existing active substances for treating patients infected with the new coronavirus, SOLNATIDE offers a promising solution for minimising the severe lung problems caused by the virus.
- The focus of the CORONADX project is on the development of COVID-19 tests which require only brief training for use by staff in primary healthcare facilities, mobile laboratories or even at home. These include point-of-care tests for frontline and second-line diagnostics which can be administered using portable devices. This development is supported by clinical and molecular epidemiological studies.

Two of the 23 projects in the second call are led by Austrian companies (CleanAir and COVINFORM).

- In the CleanAir project, seven partners led by Villinger GmbH from Tyrol are working on a system for decontaminating air in order to protect health workers from infection with COVID-19.
- The COVINFORM consortium includes 17 partners, coordinated by the Vienna company Synyo GmbH, and is developing an information and research system to assess and model coronavirus risks.

Four more projects involve Austrian organisations:

- The CO-VERSATILE project (Vienna University of Technology) aims to optimise the responsiveness of manufacturers of life-saving medical equipment.
- ICU4Covid (University of Vienna, Medical University of Vienna, City of Vienna) is specifically concerned with the medical care of COVID-19 patients in intensive care units (Cyber-Physical Intensive Care Medical System).
- INNO4COV 19 (Joanneum Research) is designed to support the commercialisation of new products to combat COVID-19 throughout Europe in the next two years. Joanneum Research has key skills in the large-scale manufacture of rapid tests and antiviral surfaces.
- PERISCOPE (Institute for Advanced Studies) is working on the pan-European response to the impact of COVID-19 and future pandemics and epidemics.

2.4.1.5 Projects directly commissioned by the Federal Ministry of Education, Science and Research (BMWFW)

Since the start of the COVID-19 pandemic the Austrian Federal Ministry of Education, Science and Research (BMBWF) has commissioned numerous research projects, providing €5.1 million in funding[106]. Whilst some initial surveys and pilot studies were already completed in the first half of 2020, other projects are expected to run until summer 2021. The focus of these has so far been on assessing the spread

105 https://ec.europa.eu/info/sites/default/files/research_and_innovation/research_by_area/documents/ec_rtd_coronavirus-new-research-projects.pdf

106 https://www.bmbwf.gv.at/Themen/Forschung/Aktuelles/Corona-Studien.html

of the virus, for which the Ministry commissioned some surveys to be conducted repeatedly amongst the Austrian population. Another focus area was on scientific assistance with school activities. Support for a large-scale clinical platform study helped to assess the effectiveness of therapeutic methods being used to fight COVID-19. The Austrian Federal Ministry of Education, Science and Research (BMBWF) also focused on activities to improve the accessibility of research data in the field of social sciences.

Focus area 1: Data availability and economic impact

The Austrian Social Science Data Archive (AUSSDA) was tasked with making social science research data of relevance to the coronavirus crisis available speedily to the academic and scientific community in Austria, while maintaining compliance with the FAIR principles. A specially established data storage area makes Scientific Use Files and Open Data datasets available, including the prevalence studies by Statistics Austria, the Austrian Corona Panel, and data from education studies.[107]

The Federal Ministry of Education, Science and Research (BMBWF) also supported conceptualisation and research behind the COVID-19 Social Data Austria database of the Institute for Advanced Studies (IHS). This database is compiled from research projects on the societal, social and economic impact of the COVID-19 pandemic in Austria, and by the beginning of 2021 included over 200 sets of records across a broad range of topics; the aim is for this to be expanded on an ongoing basis. Its purpose is to improve the visibility of research projects and the resulting publications and data, and to enhance networking between researchers. Background information and an overview of international databases can be found on the website.[108]

The Complexity Science Hub Vienna was commissioned to carry out a study on the effectiveness of political responses to the first wave of the pandemic. The focus here was particularly on the timing of the measures introduced on 16 March 2020 as part of the first national lockdown. The simulation showed that delaying the introduction of these measures by two weeks probably led to four times as many cases and deaths by the beginning of May.

Focus area 2: Prevalence of the virus amongst the Austrian population

Quantifying the prevalence and distribution of the virus accurately is essential for monitoring its development and putting appropriately targeted measures in place. For this purpose, at the beginning of April the Federal Ministry of Education, Science and Research (BMBWF) commissioned an initial pilot survey to be carried out by SORA, the Medical University of Vienna and the Austrian Red Cross . At the end of April, Statistics Austria together with the Medical University of Vienna and the Red Cross were tasked with continuing this, carrying out further prevalence studies and calculating extrapolations for the Austrian population.[109] The additional surveys took place at the end of April, in May and in November 2020. Parallel to these, an experimental study of antibodies was carried out in 27 local governments with a high incidence of coronavirus. The November prevalence study used not only PCR tests to detect acute infection but also antibody tests to measure seroprevalence in Austria.

A further study on seroprevalence in the workplace was carried out by the Medical University of Vienna, taking particular account of the work situation (working from home or usual place of work) of the individuals tested and the possible build-up of immunity over a longer period.

Another method for investigating the prevalence of the virus is being developed in the project *"Coron-A: Nachweis von Coronaviren im Abwasser"* (Coron-A: evidence of coronaviruses in wastewater) by a consortium around the University of Innsbruck. In contrast to traditional surveys which carry out tests in

107 https://data.aussda.at/dataverse/covid19
108 https://covid19studien.ihs.ac.at/co vid19
109 http://www.statistik.at/web_de/statistiken/menschen_und_gesellschaft/gesundheit/covid19/index.html

the population, this project is investigating to what extent data from analysis of wastewater can help to monitor the virus. Besides the Federal Ministry of Education, Science and Research (BMBWF), the project is funded by the Federal Ministry of Agriculture, Regions and Tourism (BMLRT), the Austrian Association of Cities and Towns (Österreichischer Städtebund) and eight federal states.

Focus area 3: Corona and schools

In an extensive monitoring study which has become known as the "Gurgel-Studie" (gargling study), a mouth and throat rinse was used by several thousand school pupils and teachers to investigate the spread of the virus in Austrian schools. Monitoring developments in the distribution of the virus is a key factor for decision-making with regard to opening up schools, including beyond Austria's borders.

An ongoing research project carried out by the Austrian Society of Pediatrics and Adolescent Medicine (ÖGKJ) is studying the acceptance in schools of antigen rapid tests for the anterior nasal area. This new measure, which requires school pupils to administer their own tests, was introduced at the beginning of 2021, with the aim of making face-to-face teaching in schools safer.

Financial support was also provided for research projects making a more detailed analysis of the dataset from the study *"Covid-19 und Distanz-Unterricht"* (Covid-19 and distance schooling) by the Institute for Advanced Studies (IHS), as well as the Austrian contribution to the European study "Kids' Digital Lives in Covid-19 Times".

Focus area 4: Effectiveness of therapeutics

As part of the university funding arrangements, a major study is being coordinated by the Medical University of Vienna's Department of Clinical Pharmacology. This adaptive clinical platform study on COVID-19 is testing the effectiveness of using therapeutics developed for other infectious diseases to treat COVID-19. These include antiviral and immune-modulating substances and the use of plasma containing antibodies or antibody cocktails. Besides the Medical University of Vienna, there are nine other study centres in Austria involved in this large-scale platform study (all the medical universities, the Faculty of Medicine in Linz, and the hospitals of the Vienna Hospital Association (KAV)). The active substance APN01, created by the biotech firm Apeiron, is being tested for its effectiveness in severe cases of COVID-19 as part of a clinical study by several institutions including the Medical University of Vienna and the Medical University of Innsbruck.

Another study commissioned by the Federal Ministry of Education, Science and Research (BMBWF) was coordinated by the Medical University of Vienna's Department of Clinical Pharmacology. This study is titled "Austrian Corona Virus Adaptive Clinical Trial" (ACOVACT) and is based on a collaborative partnership between a group of university and industrial institutions, with the objective of developing an innovative approach to treating COVID-19 patients. This involves an experimental procedure, in which individuals with severe COVID-19 disease are treated with different medications. The researchers hope that the therapeutic substances being tested could also be used to treat other viral illnesses such as influenza. Research and development work on a medication to treat COVID-19 by the Austrian company Apeiron also received funding.

2.4.1.6 Summary

With the start of the first lockdown in Austria, national funding institutions made substantial funds available within a very rapid timeframe, amounting to over €37 million[110], to help combat the novel virus and minimise its social and economic effects. This meant that many of the research projects were able to start in April 2020 and some cases delivered initial

110 This includes funding from the Austrian Science Fund (FWF), Austrian Research Promotion Agency (FFG), the Federal Ministry of Education, Science and Research (BMBWF) and the Vienna Science and Technology Fund (WWTF) up to January 2021; funding under Horizon 2020 is not included in this total.

results within just a few weeks. As far as the timing aspect is concerned, Austrian research and technology has done very well by international standards, as an analysis by the OECD reveals.[111] This was due not only to the rapid response, but also the extraordinary acceleration of the project selection processes. In all the funding organisations mentioned in this chapter, the time taken for processing applications and approving comparable projects was reduced to a fraction of the usual time.

It is particularly noteworthy in this context that this acceleration was achieved without being tempted to relax the standards for quality assurance. The crucial factor above all was the collective recognition of the urgency of research relevant to COVID-19. This meant that these calls for proposals were given very high priority, and where necessary the selection process was carried out at weekends. Another factor in this context was a strong focus on relatively small projects, which often require less complex selection procedures. Consequently no changes were needed in the basic guidelines for award decisions in any of the funding institutions.

There were however some minor adaptations in the calls for proposals themselves. For instance, the submissions to the Vienna Science and Technology Fund (WWTF) were based on preselection by the management bodies of Austrian research institutions. As a result the number of contributions submitted and the associated work for funding institutions was significantly reduced. The selection criteria were also adapted to suit the situation. The focus was principally on rapid collection of data and funding for promising, experimentally ambitious research proposals. The achievement of marketable results was to some extent considered less important.

This makes it even more impressive that not only the quality standard but also the research output to date are considered to be of very high merit. Particularly in the areas of diagnostics, therapy and prevention, which were amongst the key focus areas for funds open for tender, the research projects supported have contributed to the fight against the COVID-19 pandemic. There was a very high level of interest from the national media, even in smaller projects, and some projects have also attracted international attention. Part of the newly developed technologies however will only be ready for market launch early in 2021 and so will only begin to make a visible contribution in the coming months.

Another important aspect of COVID-19 research has been knowledge sharing. One example of this is the Vienna COVID-19 Diagnostics Initiative, which was set up to expand test capacities beyond institutional boundaries. This initiative, which is jointly sponsored by the Vienna Science and Technology Fund (WWTF) and Federal Ministry of Education, Science and Research (BMBWF), is an outstanding example of cross-institutional funding. International knowledge exchange has also been important, and was particularly enabled by the Corona Platform established by the European Commission in May 2020. This platform provides information, support and real-time updates on funding opportunities for research and innovation, pooling information on current projects and any extensions to submission deadlines as well as links to answers for common questions on the EU funding programmes. The platform is accessible via the Horizon 2020 Funding Tenders Portal and is one of the ten principal measures of the first "ERAvsCORONA Action Plan", which is based on the common objectives and instruments of the European Research Area (ERA), and is designed to promote close coordination of research and innovation activities in the fight against the coronavirus. Another noteworthy aspect is the sharing of research data via the Austrian Social Science Data Archive (AUSSDA). This has allowed the datasets of the Austrian Corona Panel, which has been conducting empirical studies of the societal, economic and social effects of the COVID-19 crisis in Austria right from the start, to be downloaded over 1,500 times.

111 https://stip.oecd.org/covid/

Researchers from Austrian universities are also involved in the Ministry of Health's Coronavirus Taskforce, and in this way are contributing to evidence-based policy formulation and policy making; this means that expert knowledge and experience from research projects is directly informing policy and the response to the crisis.

In view of the rapid acceleration and the remarkable extent of multi-institutional research activities which have been stimulated by the global spread of the virus, it is entirely possible that the experiences of recent months will lead to long-term changes in the Austrian research landscape. With regard to the funding institutions, the acceleration of the tendering and award processes and the joint funding of projects are particularly noteworthy. Similar effects were also evident amongst researchers. During the pandemic there was a huge upsurge in the availability of Open Science portals and platforms, making research results publicly accessible. The public review process was also accelerated, spurred on by the popularity of open public review processes. It remains to be seen to what extent these new trends will also have long-term structural effects in the way funding is administered.

2.4.2 Climate-related research

Since the beginning of the Industrial Revolution, greenhouse gases emitted by humans have been intensifying the naturally occurring greenhouse effect. As a result, global average temperatures have increased significantly over this period, leading to global warming, which has far-reaching effects on the earth's systems and consequently also on human society and economic activities, and on the environment. In Austria, average temperatures have increased substantially more than the global average and the impact of this on numerous areas of our lives and economic activities is being investigated and documented.[112] Correspondingly, the Austrian government sees this worrying change in our climate as one of the greatest challenges of our generation – from ecological, economic and social perspectives.

Limiting and managing climate change is a fundamental element of numerous high-level international strategies and cross-border treaties: Climate action is one of the United Nations' Sustainable Development Goals[113] and the Paris Climate Agreement[114] aims to reduce greenhouse gas emissions and drive forward essential adaptations to climate change. At the end of 2019, the European Commission launched the European Green Deal[115], which aims to make Europe the "first climate-neutral continent" by 2050. Embedded in this context, Austria's climate policies also follow a two-pillar principle, Focusing on the reduction of greenhouse gas emissions in order to directly mitigate climate change, and on adaptation to those effects of climate change which can no longer be avoided. Measures for adaptation to climate change and for climate protection often overlap, particularly in the areas of energy, building, home life and the economy, and they are closely interconnected in terms of their effects. For instance, thermal refurbishment of buildings not only reduces the consumption of energy for room heating in winter (climate protection) but also helps to avoid over-heating in summer (adaptation). It is important to ensure that measures for climate change adaptation and protection do not counteract each other, but instead provide mutual support and generate synergy effects.

Climate protection and adaptation to climate change do not only serve to protect the earth's ecosystems, but ideally, with appropriate consideration of social issues, also have significant advantages for the whole of society. They minimise the negative societal impact of climate change, reduce the risks to democracy, health and security, and result in greater

112 APCC (2014) and subsequent Special Reports (https://ccca.ac.at/wissenstransfer/apcc/special-reports)
113 https://sdgs.un.org/goals
114 https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement
115 https://ec.europa.eu/info/strategy/priorities-2019-2024/eur opean-green-deal_en

social equality, since the adverse consequences of climate change generally have a greater impact on socially vulnerable groups. The far-reaching changes needed in many socio-technical systems, particularly with regard to energy supply, mobility and manufacturing, are also seen by RTI policy-makers as a great opportunity for Austrian companies to enhance their reputation as innovation leaders and to enjoy commercial success in international markets with promising climate protection technologies and solutions.

Research can and should make key contributions to both these objectives– mitigation and adaptation: measures need to be guided by the latest relevant scientific findings and insights. While there are still many gaps in knowledge which make it more difficult to take action towards meeting the climate targets, we do have well-substantiated research results of relevance to practical implementation, which are already available for use. RTI policy therefore needs to consider two central questions: (i) How can research, technology and innovation help achieve the necessary transformations, and (ii) what sort of RTI policy is needed to make this possible, in a targeted and efficient manner?

What is climate-related research? Definition and special characteristics

The term "climate research" encompasses the scientific examination of climate change, its physical, political, economic, cultural and social causes, the consequences of climate change for society, the economy and the environment, climate mitigation and adaptation strategies and identification of vulnerabilities and capacities.[116]

The interdisciplinary nature of climate-related research makes it difficult to categorise, and it is not limited to individual academic disciplines. Indeed, researchers in many different subject areas may conduct climate-related research, since the climate and climate change affect almost all natural and social contexts and processes on Earth, so that there is practically no discipline which cannot and should not contribute to our understanding of these matters. Apart from a few disciplines such as climatology, the subject-based categorisation of research gives little indication of the extent to which this research is concerned with climate (change) issues or related environmental topics. Furthermore, there are areas of overlap between the concepts of "environment" and "sustainable development". Consequently, this chapter is based on a correspondingly broad understanding of "climate research".

In addition to the breadth of expertise required, the complexity and diversity of climate research also require the full range of forms of research – from long-term basic research and research into the widest possible range of practical issues, including ministerial department research, to the development of specific technical or non-technical solutions. Inter- or transdisciplinary collaboration is often desirable, to formulate research questions appropriately and to tackle them, i.e. collaboration beyond the frontiers of individual scientific or academic disciplines, and collaboration between research institutions and wide-ranging players in practical contexts. These include not only companies with experience in RTI, but also a variety of other players, particularly the many institutions of public administration, civil society and non-industrial economic sub-sectors such as tourism, or land management and forestry.

These complex and, in many cases, newly configured groups of stakeholders present new challenges for those involved and also for the established tools of RTI policy.[117] The value system of the academic and scientific community, and of RTI policy currently places the strongest emphasis on research designed to advance the level of knowledge in the international scientific community, and to research which contributes to industrial development. By contrast, research targeted towards addressing societal challenges,

116 Definition by Climate Change Centre Austria (CCCA): https://ccca.ac.at/ueber-ccca

117 This was also illustrated by the evaluation of the Austrian Climate Research Programme. See Tiefenthaler and Ohler (2019).

and research for and with users beyond industry, has so far received relatively little systematic support within RTI policy. Research agendas in the context of climate change therefore have a responsibility to ensure that framework conditions evolve appropriately, which in turn requires that mission-oriented research is given more emphasis and developed further. The current research-related strategies are intended to forge new, innovative pathways to this end.

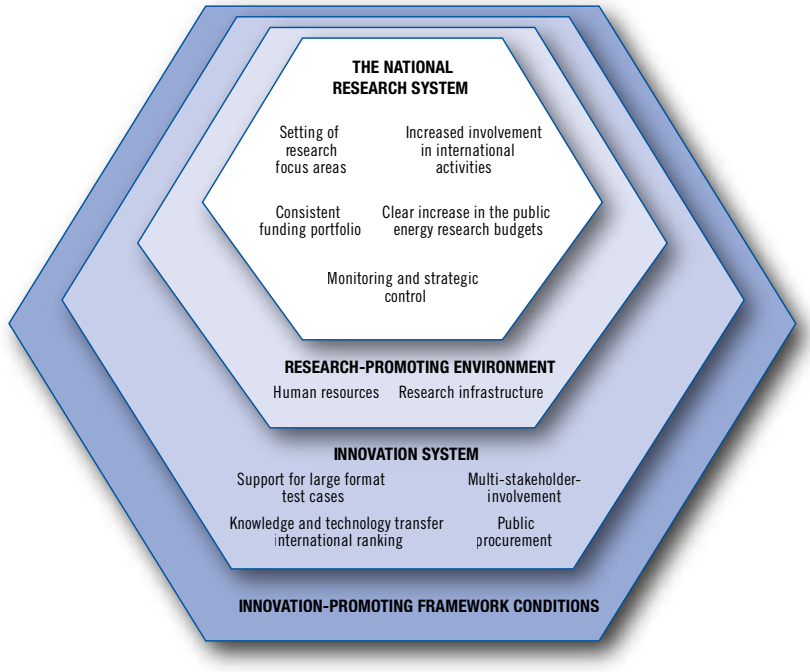
Strategic integration of climate and environmental research

Combating climate change and maintaining the Paris climate goals[118] is one of the eight fundamental objectives defined by the Austrian federal government in its 2020–2024 programme.[119] These objectives can only be achieved if all ministerial departments work together, so corresponding proposals are integrated into all topic areas of the governmental agreement – including science and research. Research is central to tackling these major challenges, particularly in any area where there is not sufficient in-depth knowledge to provide a foundation for targeted action. This applies not only to our understanding of climate change and its impact on life on Earth, but also to the development of solutions to mitigate and manage climate change. Consequently the federal government has formulated a proposal for a technology and climate offensive in the area of "Science and research", to strengthen not only basic research but also applied research, and has already launched several initiatives for this purpose, including the creation of a new national Centre for Climate Research and Wellbeing, by merging the Geological Survey of Austria (Geologische Bundesanstalt – GBA) and the Central Institute for Meteorology and Geodynamics (Zentralanstalt für Meteorologie und Geodynamik – ZAMG)[120], and reporting on all existing activities in environmental and climate research.[121]

As elaborated in Chapter 1, the plan to consider the climate targets when developing the RTI Strategy 2030 has already been realised: The federal government's RTI Strategy 2030 was adopted in December 2020[122], and explicitly includes the contribution of research to climate protection. One of the fields of activity for Objective 2, "Focus on effectiveness and excellence" is relevant for RTI for achievement of the climate targets, and was elaborated in further detail in the RTI Pact for 2021–2023[123]. The aim is to create new pathways for research funding, in order to overcome the limited potential of isolated research projects. The complexity of the issues requires research with a long-term perspective, oriented towards solutions and practical implementation, open to diverse technical and non-technical solutions, and experimental in character. In addition, the research programmes must facilitate transdisciplinary approaches, and the integration of relevant stakeholders and civil society. Several initiatives are specified in the RTI Pact which are geared towards meeting the climate targets[124], including mission-oriented funding programmes that encourage a holistic, cross-sectoral approach, take account of regulatory frameworks, respond to the needs of stakeholders, and strive to involve all key players including those of civil society. Core topic areas are heat and power generation, agriculture, mobility, buildings and industrial production. Plans also include funding for RTI projects and key technologies focused on sustainable economic activity geared towards a circular economy, climate-friendly building structures, and social inclusion and equal opportunity; increased emphasis on sustainability, climate and environmental protection in funding programmes; and supervision of cross-sectoral initiatives

118 https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement
119 See Federal Chancellery (BKA) (2020).
120 These plans were described in the Austrian Research and Technology Report 2020.
121 See CCCA (2020). The central findings of this study form the basis for this chapter.
122 See Austrian federal government (2020b, 10).
123 See Austrian federal government (2020a).
124 See Austrian federal government (2020a, 11f).

Fig. 2-29: Action levels and areas for action in the Energy Research and Innovation Strategy



Source: BMVIT (2017, 30).

such as sustainable urban development, pilot and model regions which make a contribution to mission-oriented strategies. Other elements include enhancing the impact of climate and environmentally relevant technologies through public procurement of innovations, technology transfer and export; real-world laboratories and experimental areas; promotion of social and organisational innovations; and monitoring and observation-based research for impact analysis and avoidance of adverse effects.

In addition to the RTI Strategy 2030 there are several subject-specific strategies for research areas of relevance to climate issues, particularly on the bioeconomy, energy, circular economy and mobility. These were developed in consultation with numerous players from research and practical contexts and form the basis for mission-oriented funding programmes addressing specific topic-based measures for mitigating climate change.

The Energy Research and Innovation Strategy[125] forms the basis for RTI policy on decarbonisation of the energy system. Energy research and innovation is targeted towards fulfilling important societal needs and goals, rather than purely for its own sake. The strategy plan takes a comprehensive approach, in which measures are defined on various levels of action, with the aim of ensuring not only that the environment is conducive to research, but also that the findings and products of research can be realised effectively and in the interests of societal goals (see Fig. 2-29).

Based on this strategy, an implementation plan was formulated which includes the focus areas of "Plus energy districts" ("*Plus Energie Quartiere*"), "Integrated regional energy systems" ("*Integrierte regionale Energiesysteme*") and "Breakthrough technologies for industry" ("*Break-Through-Technologien für die Industrie*").[126] This plan was developed jointly

125 See Federal Ministry for Transport, Innovation and Technology (BMVIT), 2017.
126 https://nachhaltigwirtschaften.at/de/e2050/highlights/mission-innovation-austria-fokusgruppen.php

by the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK), Austrian Economic Chambers (WKO) and the Climate and Energy Fund (KLIEN), in consultation with numerous companies and research institutions.

The Bioeconomy Strategy[127] also addresses the topic of climate change, as well as issues such as food and water shortages, and the ever-increasing impact of human activity on the environment. "Bioeconomy" is an economic concept that seeks to replace fossil resources with renewable raw materials in as many areas and applications as possible. An action plan is currently in development, based on this strategy.

Last but not least, the Mobility Research Strategy[128] adopted in autumn 2020 has the overall objective of working towards a climate-neutral transport system, making use of RTI policy instruments – including new and innovative ones. Plans for implementation of this strategy are being prepared in 2021.

2.4.2.1 Finance and support for climate research in Austria

Key players in Austrian climate research include a large part of the public universities and research institutions. Basic financing for these institutions comes from the federal government, and partly also from the regional governments, thus establishing the institutional framework for a large proportion of the climate research undertaken in Austria. Climate research – like other research priorities – is specified in the relevant management mechanisms, particularly the performance agreements. In the context of the preparations currently under way for the fifth series of performance agreements (2022–2024) with the public universities, the Federal Ministry of Education, Science and Research (BMBWF) has defined the universities' contributions towards the United Nations Sustainable Development Goals as a priority; work towards the Austrian climate targets is also included.

Third-party funding plays a key role in the financing of climate research in Austria. Climate-related research is funded through different programmes from several federal government agencies, in both bottom-up programmes and top-down (topic-specific) ones. In addition to the agencies which are central to RTI policy as a whole – the Austrian Science Fund (FWF) and the Austrian Research Promotion Agency (FFG) – the Climate and Energy Fund (KLIEN)[129] also plays a central role. Selected initiatives are outlined below, although this is by no means a complete listing.

Climate and Energy Fund in brief (KLIEN)

The Climate and Energy Fund (KLIEN) was established by the federal government in 2007.[130] It is owned by the Republic of Austria, represented by the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK). The funding strategy of the Climate and Energy Fund (KLIEN) is oriented around three statutorily defined target areas:

- Research and development in sustainable energy technologies and climate research,
- increased focus on projects on local and regional public transport, environmentally-friendly freight traffic and mobility management, and
- increased focus on projects supporting market penetration for climate-relevant and sustainable energy technologies

The Climate and Energy Fund (KLIEN) focuses its funding on the topic areas of energy, mobility and heating transition and on climate change and adaptation, operating on a purely thematic basis. It works with various different funding channels (e.g. the Austrian Research Promotion Agency (FFG), Kommunalkredit Public Consulting (KPC), the Environment Agency Austria (UBA)), making it the only

127 See BMNT, BMBWF, BMVIT (2019).
128 See BMK (2020).
129 https://www.klimafonds.gv.at/
130 See Federal Act on Establishing the Climate and Energy Fund (KLI.EN-FondsG).

federal agency with access to all instruments of research and environmental support schemes. This allows comprehensive funding to be provided for projects from basic research to the demonstration phase, enabling speedy implementation in practical contexts and on the market.
Since it was founded, the Climate and Energy Fund (KLIEN) has supported over 144,000 projects with a funding amounting to €1.5 billion in total.

Source: https://www.klimafonds.gv.at/ueber-uns/

For projects in basic research the Austrian Science Fund (FWF) is the most important national source of funding. Analyses by the Climate Change Centre Austria (CCCA, 2020) show that between 2015 and April 2020, the Austrian Science Fund (FWF) supported a total of 126 projects of relevance to climate issues, with funding amounting to €33,155,595, and 17 projects of relevance to the topic of sustainability with total funding of €5,668,618. In relation to the total number of projects funded in this period, 3.7% were of relevance to climate issues, and 0.5% were relevant to sustainability.

The central programme for research into the effects of climate change is the Austrian Climate Research Programme (ACRP), launched in 2008 by the Climate and Energy Fund (KLIEN) in collaboration with the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK). The ACRP focuses primarily on researching the national characteristics, impacts and adaptation requirements of climate change. The ACRP pursues two objectives: (i) expanding Austrian research competence in content-related priority areas and integrating this more thoroughly into international research, and (ii) providing decision-makers in politics and administration with sound scientific bases for decision-making for the purposes of managing climate change. The ACRP promotes research projects on various topics within the framework of annual competitive calls for proposals. In the 12 calls for proposals issued so far, 249 projects have received funding of €61.4 million in total – an average of approximately €247,000 per project.[131]

The StartClim programme[132], founded in 2002, has a similar topic focus to that of the ACRP, and also awards project funding every year, although on a significantly smaller scale (on average around €20,000, for a 12-month duration). In many cases, research work supported by StartClim is subsequently developed within ACRP projects. The two programmes complement each other.

Funding in the area of decarbonisation, based on the Energy Research and Innovation Strategy, is increasingly geared towards overcoming the limited effectiveness of isolated research projects. Implementation of large-scale solutions, development stages and testing is given particular emphasis. Individual technologies are integrated into overall systems, so that by observing their interaction in real conditions and involving the end users, important insights and empirical data can be obtained for wider implementation. To make this kind of large-format trial phase possible, different financing tools need to be combined and coordinated within the framework of an extended set-up and test phase. In addition to research funding, long-term test phases of this kind also need investment funding and private investment to be aligned and amalgamated. An initial example of this is the Energy Flagship Region RTI programme ("*Vorzeigeregion Energie*"), initiated by the Climate and Energy Fund (KLIEN).[133] The Energy Flagship Region programme is intended to demonstrate that it is feasible to supply energy based on up to 100% renewable

131 See Annual reports and funding decisions of the Climate and Energy Fund (KLIEN): https://www.klimafonds.gv.at/projekte/foerderentscheidungen/. The projects selected in the 13th call for proposals had not been announced by the time the present report was compiled.

132 http://www.startclim.at/

133 https://www.vorzeigeregion-energie.at/vorzeigeregionen/

sources, using Austrian innovations. Innovative energy technologies are tested in the Flagship Regions, and rolled out subsequently in Austria through the market programme of the Climate and Energy Fund (KLIEN). Three selected Flagship Regions have been supported since 2018:

- The project "New Energy for Industry" is working towards complete decarbonisation of (energy-intensive) industry in selected locations.[134] The consortium of the Austrian Institute of Technology (AIT), University of Leoben, Upper Austrian Energy Conservation Association (OÖ Energiesparverband) and Business Upper Austria brings together partners from science and business, and has so far resulted in eight projects on energy-related topics such as storage efficiency, energy exchange between industrial facilities, energy management and waste heat generation.[135] A cooperative project running until April 2021, conducted jointly by the Austrian Institute of Technology (AIT), Edtmayer Systemtechnik GmbH, Vienna University of Technology and voestalpine Stahl Donawitz GmbH is researching a 40% efficiency increase in steam storage units, which are used in many industries; this technology is expected to allow a potential CO2 saving of 11 million tonnes per year in the EU, as a result of efficiency increases.[136]
- The Green Energy Lab, sponsored by Energie Burgenland, Energie Steiermark, EVN and Wien Energie, with support from the Energy and Environment Agency of Lower Austria (eNu) and the Green Tech Cluster, is investing €150 million towards the objective of supplying energy from 100% renewable energy sources.[137] An important factor here is increasing the flexibility of district heating networks. The €4.6 million lead project "Thermaflex", led by the AEE – Institute for Sustainable Technologies, is therefore pursuing research through seven demonstration projects running until 2022 on topics such as integration of low-temperature industrial heat and low-carbon district heating.[138]
- In the *"Wasserstoffinitiative Vorzeigeregion Austria Power&Gas"* ("Energy Flagship Region WIVA P&G") research and development is focused on hydrogen technologies as a key and crucial component of a future sustainable energy system.[139] Projects in the innovation fields of "Green Energy", "Green Industry" and "Green Mobility" are targeted towards successful transition to a hydrogen-based, CO_2-neutral energy system. "HyTruck – HydrogenTruck Austria"[140], for example, is a project coordinated by AVL List GmbH and various partners including OEM component suppliers, logistics and refrigeration engineering companies, and research institutions, working to develop a fuel-cell solution for goods vehicles; solutions based on battery technologies are still limited in terms of size and weight, so here the aim is to create a cost-effective, emission-free alternative for long-haul freight transport, using fuel cells.

In total there are more than 200 project partners participating in the Energy Flagship Region, with a 60% share from the enterprise sector.

Through FIT4UrbanMission, the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) is also supporting Austrian cities and regions to prepare for optimal positioning in the EU research mission "100 Climate-neutral and Smart Cities", which is part of the new RTI Framework Programme Horizon Europe (HE). With FIT4UrbanMission, the first Austrian cities are starting their journey to climate neutrality by 2040. Starting with formulating a plan for implementation until

134 https://www.vorzeigeregion-energie.at/vorzeigeregion/nefi/; https://www.nefi.at/
135 https://www.nefi.at/projekte/
136 https://www.nefi.at/hysteps/
137 https://www.vorzeigeregion-energie.at/vorzeigeregion/green-energy-lab/, www.greenenergylab.at
138 https://greenenergylab.at/projects/thermaflex/
139 https://www.vorzeigeregion-energie.at/vorzeigeregion/wivapg/
140 https://www.wiva.at/v2/portfolio-item/hydrogen-truck-austria/

2030, this is intended to provide exemplary models with role model effect for achieving climate neutrality.

FIT4UrbanMission was initiated by the specialist departments of the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK). A support process was also put in place, implemented by the Smart Cities networking platform (coordinated by the Salzburg Institute for Regional Planning and Housing (SIR)) and AustriaTech, in collaboration and close coordination with the two specialist departments.

Furthermore, over the next few years the programme *"Stadt der Zukunft"* ("City of Tomorrow") will invite submissions for research, pilot and demonstration projects for realising the implementation plans. Open tender proposals were also invited for creating urban field laboratories, where the infrastructure of tomorrow will be tested in real-world conditions.

The national inititaive *"Die klimaneutrale Stadt"* ("the climate-neutral city), has the following objectives:

- Accelerate progress towards climate neutrality by setting up role model examples of RTI, pilot and demonstration projects;
- Accelerate technological aspects of implementation through RTI, pilot and demonstration projects;
- Establish an ongoing process of dialogue, both between cities and with the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) on the topic of "climate neutrality";
- Initiate information exchange and advisory processes when creating the capacities, processes and structures needed in the cities;
- Ensure results, insights and transferable models from the RTI projects and practical case studies are made available for other cities;
- Establish a monitoring process and checks to ensure projects remain on course towards the target.

The portfolio of programmes administered by the Austrian Research Promotion Agency (FFG) includes topic-specific funding instruments and others which do not specify particular topics. The FFG's own analysis for the years 2017–2019 shows that averaged across all programmes, 9.7% of all funded projects (1,064 out of 11,025) addressed topics of relevance to climate research and the environment. These projects attracted 25% of the funding volume: almost €500 million out of a total €1,795 million.[141] When the projects are grouped by topic, it is clear that the highest proportion of climate-related research funding is allocated to projects concerning energy and the environment. This area receives 59% of all climate-related FFG funding; this also includes funding administered by the FFG for the energy research and innovation strategy. 13% was allocated to manufacturing, 9% to ICT and 6% to mobility (see Fig. 2-30).

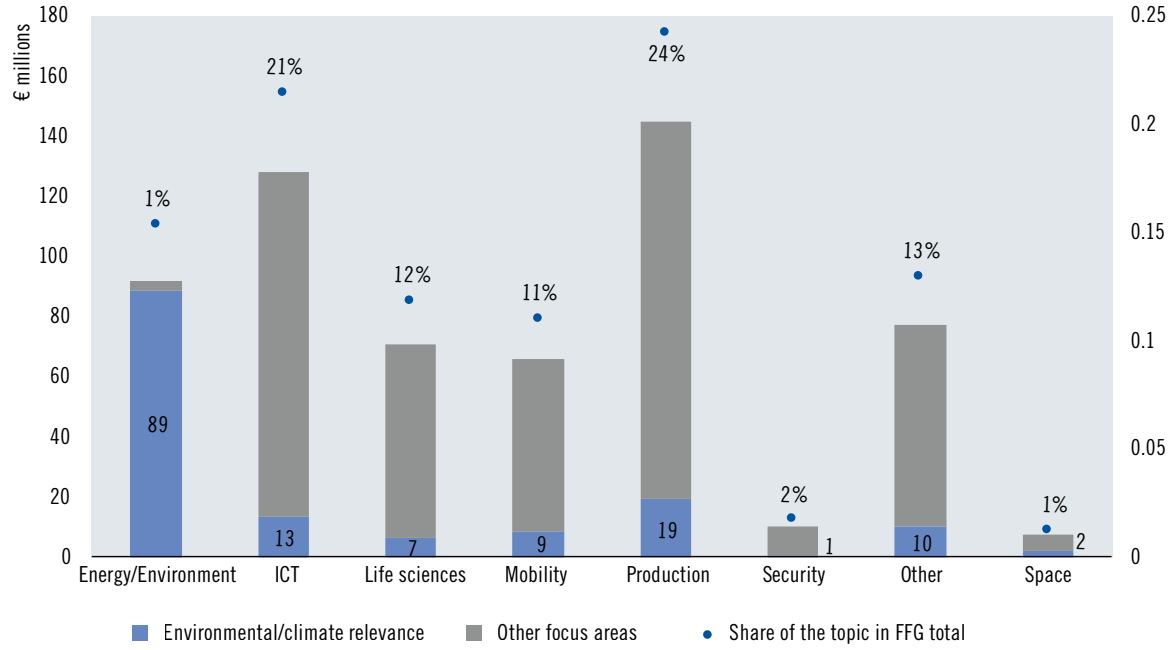
For international collaborations, the central source of funding is the EU, through the European framework programmes. In the Framework Programme for Research and Innovation Horizon 2020, which has just come to an end, the European Commission set a target of at least 35% of the available funds to be allocated to climate-related research. Analysis of the participation and funding data shows that both the involvement and success of Austrian participants in Horizon 2020 projects was higher, the greater the intensity of climate relevance.[142] This is a good indicator of the strength and excellent international networking of the Austrian research community in the field of "Climate Action".

The EU's commitment to tackling societal challenges by supporting research is further strengthened in its new framework programme, Horizon Europe. Some of the central challenges are addressed through the new "mission-oriented" approach, in

141 If small-scale elements of support such as Innovation Vouchers are excluded from these figures, the analysis shows that 17% of projects received 25.4% of all funding.

142 See Tzatzanis (2018).

Fig. 2-30: Overview of climate-related/environmental relevance of FFG funding



Source: FFG; averages for the period 2017 to 2019; key figure: total funding (including loans and guarantees)

Table 2-9: Participation in climate-related projects under Horizon 2020 (date: October 2017)

Participation data		Projects	participations	EU funding [in €]	Coordinators
All projects	All countries	15,056	67,069	26,385,052,255	15,056
	Austria	1,281	1,873	746,707,839	370
	Austria's share	8.51%	2.79%	2.83%	2.46%
Climate-related	All countries	5,004	28,845	7,850,596,275	5004
	Austria	552	883	242,898,560	120
	Austria's share	11.03%	3.06%	3.09%	2.40 %
Climate-focused	All countries	2,532	13,708	5,677,823,027	2,532
	Austria	299	462	190,853,553	85
	Austria's share	11.81%	3.37%	3.36%	3.36%

Source: Data: eCORDA as of 30 Sept. 2017; analysis by Austrian Research Promotion Agency (FFG), see Tzatzanis (2018)

which four of the five "missions" currently in preparation directly concern climate-related topics:[143]

- Accelerating the transition to a climate prepared and resilient Europe
- Regenerating our oceans and waters
- 100 climate-neutral cities by 2030 – by and for citizens
- Caring for soil is caring for life

These missions provide orientation and momentum for climate-related research. At the same time they are a call to action and an obligation for governments: meeting the targets will require contributions from all participating countries, not only by creating suitable conditions for the necessary research, but also by establishing effective regulations and measures for climate protection.

143 https://ec.europa.eu/info/horizon-europe-next-research-and-innovation-framework-programme/missions-horizon-europe_en

2.4.2.2 Climate-related and environmental research in Austrian higher education and non-university research institutions

A recent survey[144] by the Climate Change Centre Austria (CCCA) in higher education and non-university research institutions in Austria showed that many of these institutions declare research priorities of relevance to the climate and environment. Fifteen of the 22 public universities have defined one or more research priorities in the areas of climate, environment and sustainability. As Fig. 2-31 shows, the spectrum is very broad in terms of both content and structure, ranging from discipline-specific work priorities of individual institutes (e.g. Vienna University of Economics and Business, University of Vienna, University of Leoben, University of Veterinary Medicine, Vienna), interfaculty research priorities (University for Continuing Education Krems, University of Natural Resources and Life Sciences Vienna, the Universities of Graz, Linz and Innsbruck, University of Art and Design Linz, Medical University of Vienna, Vienna University of Technology) and doctoral programmes (e.g. at the Universities of Graz and Innsbruck, the University of Natural Resources and Life Sciences Vienna, and Vienna University of Technology), to university-wide research networks (e.g. at the University of Salzburg) and profile-building priorities (e.g. at the Universities of Graz and Klagenfurt).

Furthermore, the universities which do not report any specifically relevant research priorities are also engaging in issues of climate protection and sustainable development, for instance through their teaching and use of their infrastructure, and the large majority of Austrian universities are members of the Alliance of Sustainable Universities in Austria[145] and/or involved in its "UniNEtZ" project[146], in which the participating universities are working together to prepare a set of options for the federal government to support implementation of the UN Sustainable Development Goals.

According to survey data from the CCCA (2020), the major centres of focus on climate research in the higher education sector are primarily in public universities, but climate-related research is also conducted at several Austrian universities of applied sciences, such as the Management Center Innsbruck, University of Applied Sciences Upper Austria, the University of Applied Sciences for Management & Communication in Vienna, University of Applied Sciences Wiener Neustadt and UAS Technikum Wien. Due to the specific orientation and funding of research in the universities of applied sciences, these priority areas are generally smaller and more applications-oriented than those in the universities.

In addition to higher education institutions, there are numerous non-university research institutes that play a central role in climate research in Austria. As Fig. 2-32 shows, many research institutions have relevant research priorities in widely varying subject fields, and the focus of the dominant research emphasis extends from basic research and application-oriented technical and non-technical priorities to government departmental research, which provides key information for policymakers and administration.

In addition to the players who took part in the CCCA survey, there are many other non-university public and private research institutions that are actively involved in climate research, even if on a more selective basis, such as in the context of individual projects run by the Austrian Climate Research Programme (ARCP).

In addition to the individual research priorities at various higher education and research institutions, there are several relevant topic-based in-

144 CCCA (2020). For more detailed information see particularly p. 25ff.
145 http://nachhaltigeuniversitaeten.at/
146 https://www.uninetz.at/

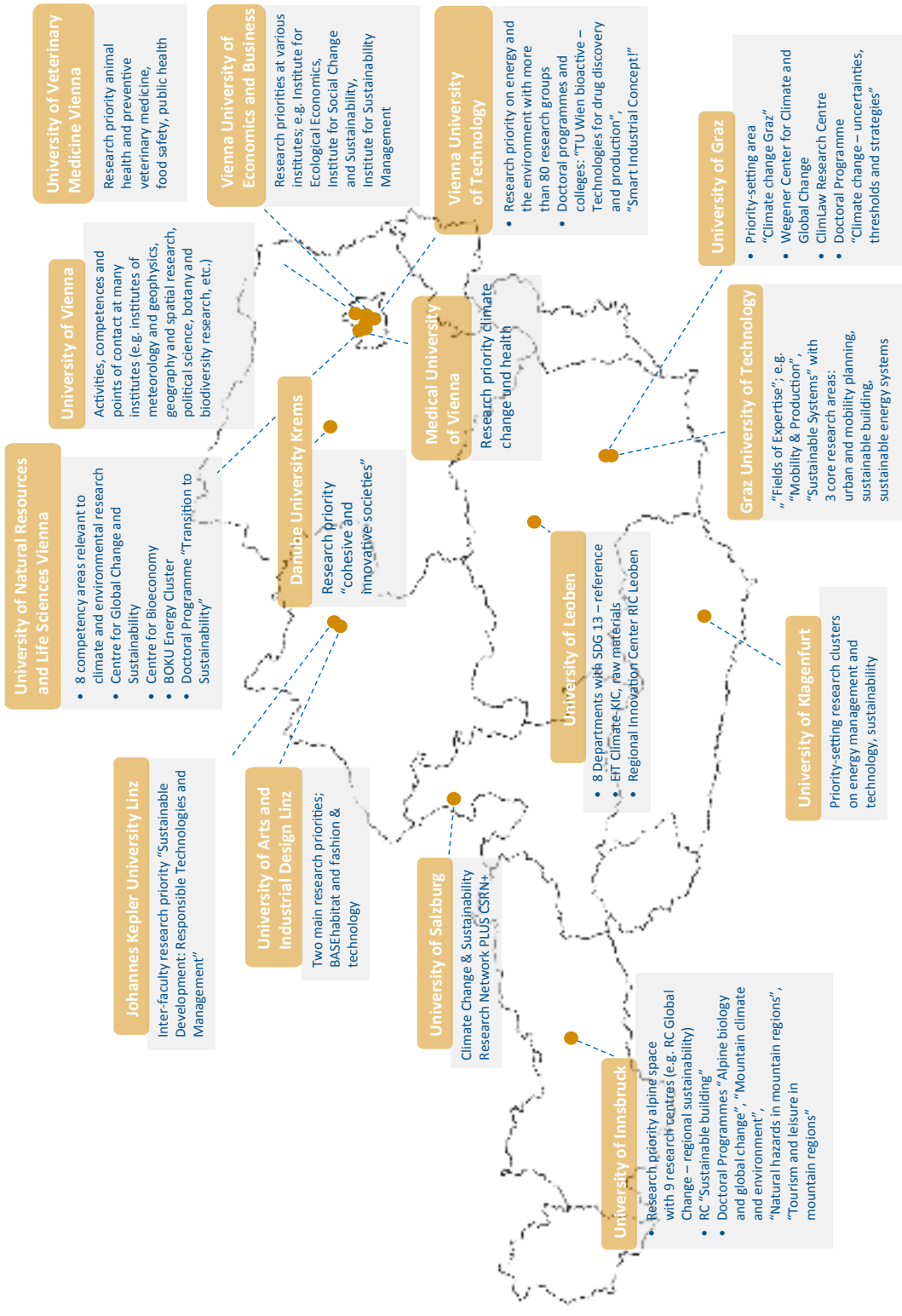
ter-institutional networks and initiatives which promote knowledge exchange between participating institutions and with external groups. One of central importance to climate research is the Climate Change Centre Austria (CCCA)[147], founded in 2011, which functions as a contact point for research, policymakers, the media and the public on all matters concerning climate research in Austria. This network is sponsored by the key research institutions in climate research and currently has 22 full members and six funding members.[148] The objective of the CCCA is to strengthen Austrian climate research by acting as a coordinating institution, to foster early stage researchers, to promote knowledge transfer, and to provide advice for policymakers and society on climate change issues.

There are also many other research-related networks focused on topic areas in which climate change and climate research play a key role.[149]These include the Austrian Long Term Ecological Research Network (LTER)150, the Climate and Air Quality Commission[151], *Kommission für interdisziplinäre ökologische Studien*[152] (Commission for Interdisciplinary Environmental Studies – KIÖS), the Austrian Academy of Sciences, *Netzwerk Biodiversität Österreich*[153] (Austrian Biodiversity Network), the Disaster Competence Network Austria (DCNA)[154] and the *Austrian Polar Research Institute*[155]. These all bring together researchers from different higher education and research institutions to take an interdisciplinary approach to complex issues, and to make existing knowledge available to players involved in practical settings. Some of these also play a key role as research infrastructures, such as the LTER for instance, which is involved in expanding European research infrastructure for long-term environmental research – a project which is part of the 2018 Roadmap of the European Strategy Forum on Research Infrastructures (ESFRI).[156]

In summary, climate research is widely established in Austrian higher education and research institutions, across an extremely diverse range of topics. There is also a broad range of networks and other inter-institutional research initiatives, some of which are still relatively new, providing further evidence of a changing culture of collaboration. These structures serve primarily to facilitate expert dialogue and to inform the public, while inter-institutional collaboration allows the pooling of strengths in specific topic areas, regardless of location. They also have the potential to improve sharing of and access to research data which are often only available in specific locations, with the result that opportunities for fuller exploitation may be missed. The CCCA Data Centre is the first practical inter-institutional attempt to optimise this potential. The GEOCLIM project[157], funded by Higher Education Area Structural Funds, is developing this further: The CCCA Data Centre, together with the Earth Observation Data Centre at the Arsenal site in Vienna, is being expanded, integrated and linked to the high-performance computers of the Vienna Scientific Cluster, in order to create internationally competitive computing and storage capacities for monitoring and modelling purposes (e.g. of climate, atmospheric, land surface, water management and ecological systems).

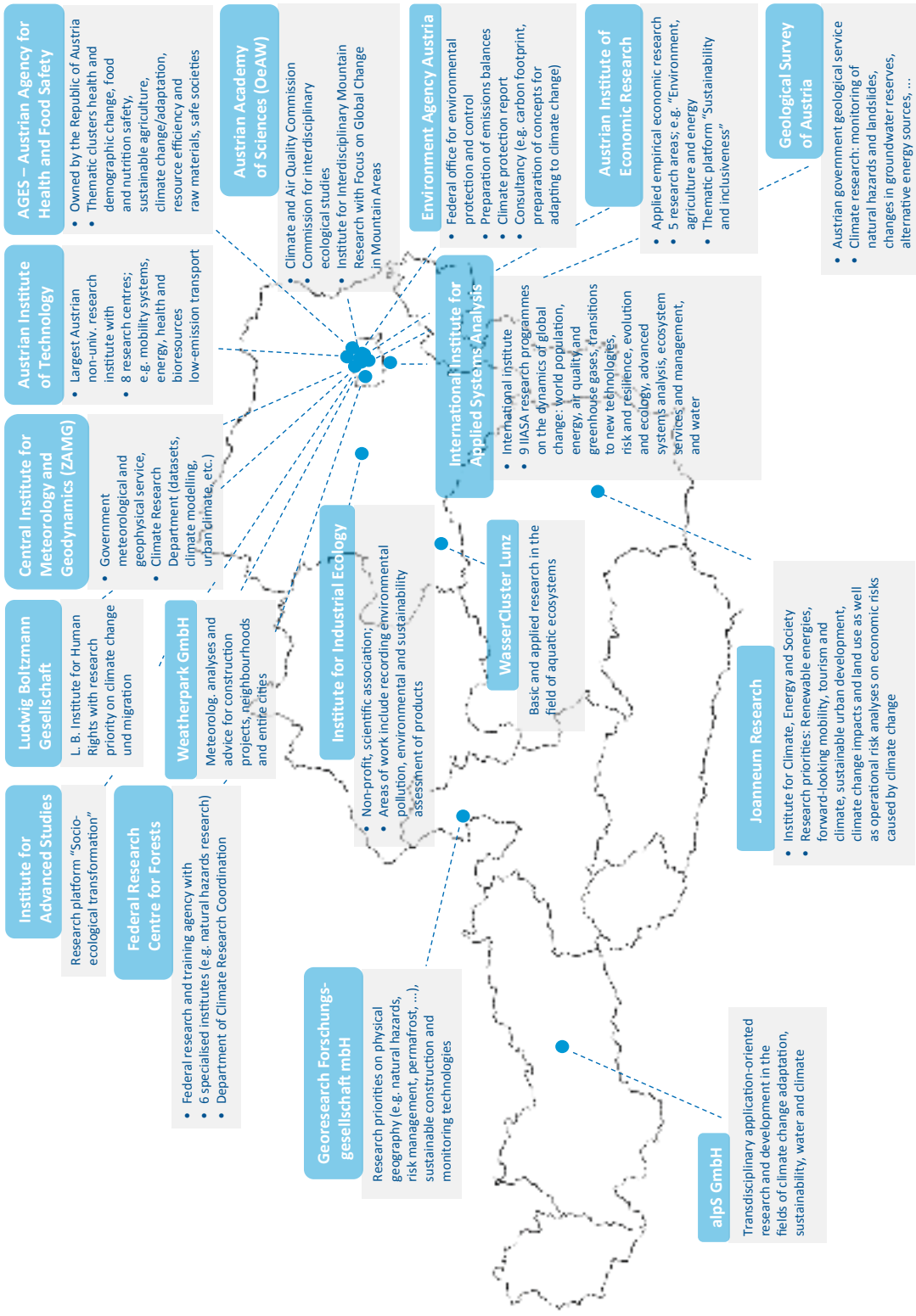
147 https://ccca.ac.at/
148 Date: February 2021.
149 For brief descriptions of these and other relevant initiatives, see CCCA (2020, p. 47ff).
150 https://www.lter-austria.at/verein/
151 https://www.oeaw.ac.at/kkl
152 https://www.oeaw.ac.at/kioes/
153 https://www.biodiversityaustria.at/netzwerk/
154 https://dcna.at/
155 https://www.polarresearch.at/
156 https://www.lter-europe.net/elter-esfri
157 https://wegcenter.uni-graz.at/de/forschen/forschungsgruppe-arsclisys/projekte/geoclim/

Fig. 2-31: Locations of Austrian universities and their research priorities of relevance to climate and environment



Source: CCCA (2020, 26)

Fig. 2-32: Locations of non-university research institutions in Austria and their research priorities of relevance to the climate and environment



Source: CCCA (2020, 33)

2.4.2.3 Industry-related, cross-company initiatives in climate- and environment-relevant research

In addition to clear regulatory frameworks at international and national levels, effective mitigation of the climate crisis also needs a pro-active enterprise sector. Research and innovation, and the use of innovative technologies, should not only deliver solutions, but also aim to transform these challenges into opportunities for Austria as an economic region. Austria has a long tradition to build on in the area of environmental technologies, strong standing in the international market, and Austrian companies are driving forward research in renewable energies, waste management and energy efficiency.[158] An approach focused purely on increased efficiency in the use of resources and energy, with the associated economic advantages, is increasingly being superseded by a proactive attitude, and a system-oriented approach to the development of sustainable future technologies, in cooperation with other companies, research institutions, economic initiatives and clusters. The Energy Flagship Regions described above are examples of this. This section describes some more inter-company initiatives, most of which are being realised with support from the federal or regional governments, thus demonstrating what is possible in public-private partnerships.

The Green Tech Cluster Styria GmbH, for instance, is working to establish an international reputation for Styria as Green Tech Valley, taking a pioneering role in Climate & Circular Solutions.[159] Here there are numerous projects[160] under way in which science and industry are working together to develop solutions which will not only help to mitigate the climate crisis, but also provide security and prosperity for the region. The Green Tech Valley is home to over 220 companies, including more than 40 green tech start-ups, which benefit particularly from support in the form of infrastructure, networks and funding. The close cooperation between science and industry in the region is also illustrated by the strong take-up of the COMET programme: There are 15 COMET initiatives in total based in Green Tech Valley, including two K1 Centres of excellence, one K2 Centre, three COMET Modules and nine COMET Projects.[161]

Ecoplus, the Business Agency of Lower Austria, coordinates research on environmental topics within a highly visible and well-organised cluster and network structure. The focus areas of the Green Building Cluster of Lower Austria, for example, include the development of climate adaptive technologies[162] for the building industry, with the aim of helping to mitigate consequences of climate change such as urban heat islands or increased incidence of torrential rain. Work is also under way on environmental assessment of buildings and climate-neutral construction. The Food Cluster of Lower Austria[163] focuses on sustainable use of resources, through projects on reduction and recycling of waste, including the use of new packaging technologies[164] or development of sustainable pest control solutions[165]. Resource efficiency and lifecycle management are a key focus for the Plastics Cluster.[166] For example current three projects deal with processing and production of post-con-

158 See IWI und P-IC (2020).
159 https://www.greentech.at/strategie/
160 https://www.greentech.at/erfolgsgeschichten/
161 https://www.greentech.at/forschungs-hotspot-green-tech-valley/
162 https://www.ecoplus.at/interessiert-an/cluster-plattformen/bauenergieumwelt-cluster-niederoesterreich/themenfokus-klima-adaptive-technologien/
163 https://www.ecoplus.at/interessiert-an/cluster-plattformen/lebensmittel-cluster-niederoesterreich/schwerpunktthema-nachhaltige-ressourcennutzung/
164 https://www.ecoplus.at/newsroom/branchenforschungsprojekt-stop-waste-save-food
165 https://www.zukunftsraumland.at/projekte/2293
166 https://www.kunststoff-cluster.at/themenschwerpunkte/kreislaufwirtschaft/

sumer recycled plastic materials and their use in wide-ranging areas of application.[167]

The clusters coordinated by Business Upper Austria – OÖ Wirtschaftsagentur GmbH are another economic initiative focused on collaboration, research and innovation in topic areas related to the circular economy. This broad network of clusters in key industrial topic areas (Mechatronics, Plastics, Cleantech, Automotive, Food, Medical engineering, Furniture & timber construction, IT, Software) facilitates projects and solutions that work across multiple sectors and value chains. The Upper Austria economic area is also home to several COMET Competence Centres, such as K1-MET[168] which aims to convert the metallurgical industry to completely climate-neutral operation using innovative processes. The WOOD centre of excellence focuses on wood as a material and its potential uses in climate-neutral systems.[169] Here the participating companies work with scientific research partners on solutions using wood, and possible uses of wood in a circular bioeconomy.

Inter-company collaborations between major Austrian industrial businesses facilitate investment-intensive pilot projects on decarbonisation and the circular economy in heavy industry. In this way the participating companies are making an important contribution to research and development work, and so fulfilling their responsibilities as industry leaders. Here are three examples:

- In "C2PAT", a joint project of Lafarge, OMV, VERBUND and Borealis, research work is under way on cross-sector capture of CO_2, with the aim of reducing the emissions from cement production and making the captured carbon available as a resource for the chemical industry, which will then also enable consumption of fossil resources to be reduced.[170]
- With the aim of realising the important potential of hydrogen technologies in meeting the climate targets, the project "H2Future", a collaboration between voestalpine, VERBUND, Siemens, Austrian Power Grid, K1-Met and TNO, researched efficiency improvements in the production process using electrolysis, and in 2019 constructed the largest pilot installation in the world for emission-free production of hydrogen.[171] This project is also a key contributor for the EU's hydrogen strategy[172], which anticipates massive expansion in the production capacity for "green" hydrogen, up to 10 million tonnes per year by 2030.
- The research project "Underground Sun.Conversion"[173], run by RAG Austria AG, with funding of €7.73 million (including €4.92 million from the Climate and Energy Fund (KLIEN)) is also focused on the topic of hydrogen and its role in energy storage to increase the flexibility and stability of renewable energy systems. In collaboration with its project partners – University of Leoben, University of Natural Resources and Life Sciences Vienna (Department IFA Tulln), acib GmbH (Austrian Centre of Industrial Biotechnology), the Energy Institute at the University of Linz, and Axiom *Angewandte Prozesstechnik GmbH* – RAG Austria GmbH is developing an underground process in which methane is produced by microorganisms from previously generated hydrogen and carbon dioxide. This allows substantial improvements to be made in the storage and use of emission-free energy, by increasing the energy density and making it possible to use existing infrastructure.

167 https://www.kunststoff-cluster.at/news-presse/detail/news/muelltonne-auslaufmodell-und-zukunftsprodukt/
https://www.kunststoff-cluster.at/kooperationen/cluster-kooperationsprojekte/detail/cooperation/ecoline/
https://www.kunststoff-cluster.at/kooperationen/cluster-kooperationsprojekte/detail/cooperation/repetitio/

168 https://www.k1-met.com/

169 https://www.wood-kplus.at/de

170 https://www.lafarge.at/fileadmin/Bibliothek/1_Ueber_Uns/Presseaussendungen/200624_C2PAT-PressRelease_DE.pdf

171 https://www.h2future-project.eu/

172 See COM (2020).

173 https://www.underground-sun-conversion.at/das-projekt/projektbeschreibung.html

2.4.2.4 Summary

The Austrian federal government considers the alarming, man-made change of climate as one of the biggest challenges of our generation. Combating climate change and maintaining the Paris climate goals[174] is therefore one of the eight fundamental objectives defined by the Austrian federal government in its 2020–2024 programme[175]. The achievement of both objectives of the Austrian climate policy, namely to contain climate change (mitigation) and cope with its effects (adaptation), requires the interaction of all ministerial departments. The corresponding plans for the areas of science and research have been formulated accordingly. Research is central to cope with the major challenges related to climate change, particularly in any area where there is not sufficient in-depth knowledge to provide a foundation for targeted action. RTI policy therefore needs to consider two central questions: (i) How can research, technology development and innovation help achieve the necessary transformations, and (ii) what sort of RTI policy is needed to make this possible in a targeted and efficient manner?

The relevant objectives and measures are enshrined both in the federal government's new RTI Strategy 2030 and accompanying RTI Pact and firmly established in several sectoral research strategies (energy, bioeconomy, circular economy, mobility). Innovative RTI policy approaches have been chosen for their design and implementation in the last years, for instance in enabling large-scale tests under real conditions in the field of energy. Additional efforts are required to build up and strengthen the transdisciplinary research with its wide range of players in practical areas of application and the interaction of mission-oriented RTI policy measures with the relevant sector policies.

2.5 RTI Evaluation Culture and Practice

Austrian research, technology and innovation policy (RTI policy) has for more than 25 years been characterised by an evaluation culture which aims to ensure quality and transparency. Programmes, and increasingly institutions and funding instruments too, are assessed regularly to evaluate the extent to which they achieve their objectives, and their impact and efficiency. Most of the evaluation reports are available to the public, and can be accessed in the online repository of the Austrian Platform for Research and Technology Policy Evaluation (fteval). This platform brings together representatives of the institutions which commission and conduct evaluations, and which are subject to evaluation. To ensure an open approach to geographical, methodical and thematic focus, fteval is connected with other related initiatives; examples include the German Evaluation Society, (*Gesellschaft für Evaluation* – DeGEval), the Platform for Registry Research (*Plattform für Registerforschung*), and the Vienna Evaluation Network (VEN). Core activities include the development and publication of evaluation standards (latest version dated 2019), and publication of the fteval Journal, where the key findings from evaluations are discussed from both academic and practical perspectives. Another focus area is the organisation of events, one of which is the international conference: this takes place every three years, placing Austria at the centre of discussions about methods, challenges and the role of evaluations in RTI.

2.5.1 Current trends

The year 2020 was profoundly affected by the COVID-19 pandemic, which also had an impact on evaluations. As early as spring 2020, fteval conduct-

174 https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement
175 Federal Chancellery (BKA) (2020).

ed a survey amongst members, which highlighted the following aspects in particular:

- Overall the coronavirus crisis has demonstrated the importance of evidence-based policymaking, and that evaluations can make a significant discursive and reflective contribution to this process. In view of the complexity of societal challenges and concerns, it is likely that inter- and transdisciplinary collaboration will be increasingly important in future for evaluations and for responsible implementation of their findings, as part of good governance practice.
- The topic of resilience in systems will very probably become a more prominent theme for RTI policy and therefore also be a required aspect of selected evaluations.
- The limited availability of high-quality, independent and current data for science and research in general, and for evaluations in particular, became very apparent (key issues include: registry data, access to data held by Statistics Austria). A commitment to more evidence-based policymaking is also bound to produce corresponding improvements in the data situation in Austria.
- The emergency situation led rapidly to new procedures in calls for proposals and the allocation of research funding, in the form of "Emergency Calls" and "Emergency Policies". In Austria the major research funding agencies (e.g. the Austrian Science Fund (FWF), Austrian Research Promotion Agency (FFG), Vienna Science and Technology Fund (WWTF)) responded promptly with accelerated application procedures to enable research to proceed more quickly. The effect of this breaking through routines and what it means for evaluation will be discussed at the 2021 fteval conference.
- Organisations involved in government administration processes, such as AQ Austria, had to formulate guidelines very quickly – in coordination with their respective boards and supervisory bodies – for deviating from their usual procedures; e.g. to ensure that in justified cases, particularly if physical meetings are not possible, voting on accreditation and certification decisions can be carried out using circulated documents.
- From a methodological point of view, the restrictions on personal contacts affect a wide range of participative methods. By now, however, new online formats have been developed and with increasing experience in using these, new possibilities are emerging for evaluations.

Several fteval events were held in virtual formats. These included "Gender equality policies revisited – Monitoring of the implementation of the ERA Roadmap's Priority 4", a joint event with the Federal Ministry of Education, Science and Research (BMBWF) and the Institute for Advanced Studies (IHS) in October 2020, and the virtual symposium on "Commitment in internal evaluations" in November 2020. In both cases there were more participants than usual from the federal states and from abroad.

Another key topic for 2020 was preparation of the next fteval conference, which will be held in Vienna on 18 and 19 November 2021, with the title "REvaluation Conference 2021". This time the thematic focus, in addition to the overarching subject of conceptual, methodological and empirical advances, is on the evaluation of R&I policy in the following areas: (a) What can we learn from the fast-track COVID-19 R&I policies, (b) Evaluating the resilience of R&I systems and their contribution to public resilience, (c) Understanding and evaluating transformative R&I policy.

2.5.2 Selected evaluations

The RTI evaluations completed since the publication of last year's report are presented below in a new format – briefly, succinctly and clearly. The original, much more detailed evaluation reports are available to read at https://repository.fteval.at/.

Evaluation of the Austrian Science Fund (FWF) Specific Research Areas (SFB)

The Austrian Science Fund (FWF) launched its SFB programme with the aim of enabling research networks of an international standard to be created by

autonomous priority-setting at one university, or under certain conditions at several university locations. The programme is designed to support the development of exceptionally productive, closely networked research units to tackle what are generally multi- or interdisciplinary[176], long-term, challenging research topics[177]. The funded research networks run for eight years, with an interim assessment after four years to confirm that funding should be continued.

The evaluation was carried out by the Austrian Institute of Technology (AIT) and the Katholieke Universiteit Leuven (KU Leuven), and is based on programme data from the years 2004–2018. The evaluation focuses on the analysis of five impact dimensions: 1) support for outstanding research in Austria, 2) enhancement of human resources in science and research and improved gender balance, 3) achievement of broader effects on the Austrian science and research system, 4) effectiveness and efficiency of programme implementation, and 5) coherence of the SFB programme with overarching objectives of the Austrian Science Fund (FWF).

The evaluation was conducted using a mixed-methods approach, which included the following methodologies: 1) portfolio analysis of the projects, 2) bibliometric analysis, 3) counter-factual analysis, 4) interviews, 5) focus groups, and 6) two online surveys.

The evaluation shows that network programmes focused on basic research need better resourcing from the FWF budget, since in the present form they are not sufficiently able to support profile building and priority setting in the research system. Corresponding recommendations in the last programme evaluation have not been implemented.[178] Since 2004 the approval rate has fallen continuously (from 54% to 14%), as has the allocation of resources for SFBs (from 15% to 6%) in the funding portfolio of the Austrian Science Fund (FWF). However, the programme is capable of funding exceptionally high-quality research. This is evident from the outstanding publication and citation record for the funded projects: in all standardised metrics of citation impact, SFB projects exceed both the national average and Austrian Science Fund (FWF) stand-alone projects. The evaluation also sees room for improvement in the way anti-discrimination and gender equality goals are addressed, and in support for inter- and transdisciplinarity. In addition to a significant increase in the budget for Specific Research Areas in the funding portfolio of the Austrian Science Fund (FWF), the evaluation recommends a series of specific improvements in conceptualisation and implementation of the programme.

PPPI impact analysis 2019: More detailed, impact-oriented analysis of Public Procurement Promoting Innovation (PPPI) in various fields of application

The objective of this analysis was to make a differentiated study of the impact of various forms of public procurement projects designed to promote innovation, to ensure lessons were learned from the experiences of previous support mechanisms and to raise awareness of the complex chains of impact. The study was carried out by Joanneum Research and the Austrian Institute of Technology (AIT), commissioned by the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK), and the Federal Ministry for Digital and Economic Affairs (BMDW), between the middle of 2019 and March 2020.

The central focus of the analysis was a systematic study of individual procurement plans and their procurement context, paying particular attention to the players involved and to supportive or obstructive framework conditions. The evaluation approach is based on a theory-based impact analysis (theory of change), implemented by means of contribution

176 Interdisciplinarity is defined as an integration-oriented collaboration by people from at least two disciplines with shared objectives and results, in which the approaches of each discipline are combined to form an overall perspective.

177 https://www.fwf.ac.at/de/forschungsfoerderung/fwf-programme/sfbs

178 See Edler et al. (2004).

analysis. The methodology was applied using an analysis of ten case studies from fields relating to mobility, construction, energy, healthcare, sustainability and digitalisation.

The findings provide a comprehensive overview of the many different possible levels of impact and wide range of target groups affected by PPPI. The procurement programmes are generally focused on performance optimisation for public institutions and on improvement of services for citizens. Innovation is seen as a means to an end. The cases examined largely show a clear, direct benefit for specific target groups, and for citizens in general. These programmes were also found to have an impact on further development of innovation and on innovation capability, and to have an economic impact beyond the volume of procurement itself, for instance in reduced costs, more efficient use of resources, or added value and employment. Other aspects discussed were relevant factors and contexts on which development of the full beneficial effects may depend, as well as unintended effects. The study highlights the importance of early investigation of the chains of impact of specific innovation-supporting procurement programmes, and the need to gather relevant data for this purpose, from the initial project phase onwards. These recommendations form a clear pathway for improvement in future procurement planning and implementation, and for providing evidence in future for the social impact of public procurement which promotes innovation.

Evaluation of the funding programme "R&D Competences for Industry"

The evaluation of the funding programme "R&D Competences for Industry" ("*Forschungskompetenzen für die Wirtschaft*") was carried out by Technopolis, commissioned by the Federal Ministry for Digital and Economic Affairs (BMDW). The goal was to look back and assess the extent to which it achieved its objectives, its impact and the implementation of recommendations made in an interim evaluation[179], and to draft a proposal for the form of the programme after 2020. The evaluation is based on funding data from 2011–2018 and a programme volume of €33.8 million (averaging €4.2 million per year) for 154 projects.

The programme is administered through the Structural Programmes of the Austrian Research Promotion Agency (FFG), supporting measures in the form of qualification seminars, qualification networks and tertiary level courses in companies for the systematic development of their research and innovation staff. The programme also aims to intensify knowledge sharing between higher education institutions and companies, and to integrate industrially relevant teaching and research priorities more fully into Austrian higher education.

The evaluation was based on analysis of documents and data, 30 interviews, four focus groups, a standardised online survey and vignettes, resulting in the following conclusions: "R&D Competences for Industry" had a substantial mobilising effect. The programme reaches a wide range of target groups in terms of industries, fields of knowledge and research, issues, forms of work and consortium structures. Amongst the organisations submitting an application to the Austrian Research Promotion Agency (FFG), 36% did so for the first time, and many of these used this experience to develop subsequent applications. The range and number of higher education institutions participating is extensive. The trained persons have acquired new competences and in most cases have already been able to put these into practice. Those involved in teaching also improved their expertise in communication and collaboration with companies, and gained a better understanding of the requirements in a practical context.

The recommendation therefore is to make a firm commitment to continuing the programme, while making improvements in continuity and certainty for planning purposes, simplifying the range of instruments and improving communication.

179 See Heckl and Wolf (2015).

Evaluation of the "Talents" funding priority

Through its "Talents" funding priority, the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) supports people working in applied research throughout their whole career, to make fuller use of the human potential in application-oriented, science and technology RTI. Its objectives are to encourage young people to start a career in research and development, connecting researchers with businesses, and ensuring equal opportunities for all. The programme is administered by the Austrian Research Promotion Agency (FFG), with an annual budget of approximately €7 million, allocated to the following areas:

- Discovering talents: Encourage early stage researchers with Internships for High School Students, and the "Talents Regional" programme
- Harnessing talents: Promote equal opportunities with FEMtech Internships for Female Students, FEMtech Career and FEMtech Career Check for SMEs (2015 and 2016), FEMtech Research Projects
- Recruiting talents: Support researchers with Career Grants and Job Exchange

When the programme concluded in 2020, a final evaluation was carried out by the Austrian Institute for SME Research commissioned by the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK), which analysed the programme with regard to its conceptualisation, implementation, achievements of objectives and impact, and formulated conclusions to guide its further development. The following methods were used: Document analysis, analysis of monitoring data from the Austrian Research Promotion Agency (FFG), interviews with experts, online surveys of funding recipients, case studies and workshops.

The design of the programme is well suited to its aim of supporting people throughout their career, and addresses challenging points in their career. The programme is also targeted towards structural changes to make fuller use of the human potential in RTI. The breadth of the programme is an important characteristic, but also risks setting overambitious goals and a lack of focus, given the limited resources available.

The programme lines for children and young people are particularly successful in achieving their objectives. Both the interns themselves and the participating organisations can benefit from the positive impact of internships for high school students. The only area where improvement is felt to be needed concerns information activities in schools, particularly in academic secondary schools providing general education (AHS). The evaluation report recommends an annual call for proposals, with a corresponding increase in resources for "Talents Regional", and greater flexibility in the instrument. FEMtech Internships for Female Students are assessed as very effective, although the resources generally do not go far enough and there are evidently some concentrated clusters of funding recipients. The evaluation recommends capping the number of internships funded per organisation. The impact of the FEMtech Career Projects is evident particularly in heightened gender awareness and skills in the participating organisations. There is no identifiable evidence of structural changes, due to the limited demand for the instrument, so there needs to be increased focus on mobilising the target groups. The distinctive feature of the programme line for FEMtech Research Projects is its funding for gender-related research. It was intended to intensify dissemination and networking activities in order to integrate the gender dimension more fully into research proposals. The Career Grants have very little effect, and this instrument is of questionable value. Given that other successful programme lines within the "Talents" programme are oversubscribed, it is recommended that this measure should be withdrawn.

An essential requirement for expanding the impact of this programme is to mobilise the target groups. The evaluation report recommends that appropriate measures should be expanded correspondingly and that the entire programme should be rebranded.

Accompanying monitoring for the National Contact Point for Knowledge Transfer and Intellectual Property (NCP.IP)

In April 2020, Technopolis completed an accompanying monitoring study of the NCP.IP commissioned by the Austria Wirtschaftsservice (aws). The NCP.IP organises events on the topic of knowledge transfer and intellectual property, produces publications on this topic area and provides an Open Innovation Toolkit with detailed guidance on fair remuneration. Another core activity is the preparation of templates (Intellectual Property Agreement Guide, IPAG) to regulate collaborations between R&D institutions and companies in the area of intellectual property (e.g. apportioning intellectual property rights such as patents). The NCP.IP currently consists of 1.5 FTEs (full time equivalents) positions, and is implemented by the Austria Wirtschaftsservice (aws) and the Austrian Research Promotion Agency (FFG), commissioned by the Federal Ministry of Education, Science and Research (BMBWF), the Federal Ministry for Digital and Economic Affairs (BMDW), and the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK).

Its activities are primarily targeted towards establishing more professional knowledge and technology transfer in public research institutions and the higher education sector, and supporting collaboration between science and industry for the national and international transfer of knowledge and technology. The NCP.IP also aims to report on current international developments and examples of best practice, and to share this information. Additional objectives are to support the IP and Open Innovation strategies, and to expand networking in the area of knowledge transfer.

The purpose of accompanying monitoring is, as in this case, to identify and describe the extent to which the activities observed are reaching the intended target groups, their positioning, the needs of the community and any possible areas for further development. The evaluation process included analysis of documents and monitoring data, 39 interviews, two focus groups and preparation of an international comparison.

The key findings are as follows: Austria's NCP.IP is a leader in this field, and a well-established example of good practice. There are only a few countries which provide comparable IP contract templates. In operational terms the activity profile of the NCP.IP is for the most part clearly defined. The strategic aims of the NCP.IP are less clear, as the objectives – including with respect to the use of funds – are very broadly formulated. The objectives should therefore be reviewed with sharper focus and new target groups (e.g. universities of applied sciences) should be addressed more effectively. The IPAG templates are key achievements of the NCP.IP, and are of good quality; they are helpful for inexperienced players as they formulate key aspects of contract negotiations and offer standardised procedures, thus increasing efficiency. The range of IPAGs should be extended in future and made even more service-oriented. The networking impact of events could be improved still further by better coordination with other stakeholders (e.g. the Austrian Patent Office), and the usefulness of publications could be enhanced by better alignment to the needs of the relevant target group.

3. Monitoring in accordance with the Research Financing Act (FoFinaG): Central research and research funding institutions

Austrian Institute of Technology GmbH (AIT)

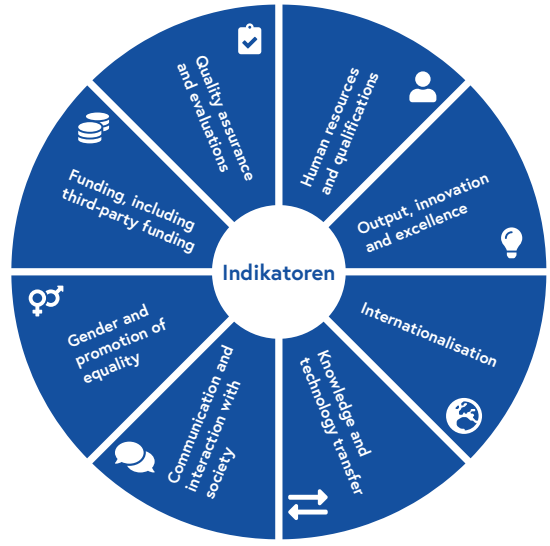
Institute of Science and Technology Austria (IST Austria)

Austrian Academy of Sciences (OeAW)

Silicon Austria Labs GmbH (SAL)

Ludwig Boltzmann Gesellschaft (LBG)

Central research institutions



Austria Wirtschaftsservice Gesellschaft mbH (aws)

Christian Doppler Research Association (CDG)

Austrian Science Fund (FWF)

OeAD-GmbH – Agency for Education and Internationalisation

Austrian Research Promotion Agency (FFG)

Central research funding institutions

As outlined in Chapter 1, a comprehensive Research Funding Amendment affecting several laws in the area of research funding resulted in the creation of the Research Financing Act (FoFinaG) in July 2020, which gives the central research institutions and research funding institutions a three-year planning horizon and funding security. The Act also aims to strengthen the strategic management and control responsibilities of the federal ministries concerned, while at the same time increasing flexibility in the operational business of the research institutions and research funding institutions. Annual monitoring is also stipulated in accordance with Section 8: "In accordance with Section 1(2), the federal ministers must report annually to the National Council within the framework of the Austrian Research and Technology Report as per Section 8(1) of the Research Organisation Act (FOG), Federal Law Gazette No. 341/1981."

The central research institutions and research funding institutions are listed in full in Section 3. The **research institutions** are:

1. Austrian Institute of Technology GmbH (AIT)
2. Institute of Science and Technology Austria (IST Austria)
3. Austrian Academy of Sciences (OeAW)
4. Silicon Austria Labs GmbH (SAL)
5. Ludwig Boltzmann Gesellschaft (LBG) – Austrian Association for the Promotion of Scientific Research

The central **research funding institutions** are as follows:

6. Austria Wirtschaftsservice Gesellschaft mbH (aws)
7. Christian Doppler Research Association (CDG)
8. Austrian Science Fund (FWF)
9. OeAD-GmbH – Agency for Education and Internationalisation
10. Austrian Research Promotion Agency (FFG)

Although the Act did not come into force until the summer of 2020, the key factors had already been established beforehand, so that the Austrian Research and Technology Report 2020 mapped the ten central institutions for the first time based on a profile description and selected indicators that were developed jointly with the responsible federal ministries.

This Austrian Research and Technology Report for 2021 builds on the model developed last year and includes the following further developments:

- The tables have been standardised further; deviating presentations now require a justification regarding the content;
- The texts have been significantly streamlined;
- The definitions and abbreviations have been expanded to include some important terms;
- A new indicator "communication and interaction with society" has been introduced;
- The key survey date for all tables is now 31 December of the respective reporting year;
- The Austrian Research Promotion Agency (FFG) EU Performance Monitor and the Austrian Science Fund (FWF) statistics were used consistently as sources for the data on projects awarded in the ERC and FWF excellence programmes.

The Ludwig Boltzmann Gesellschaft (LBG) was still listed as a research funding institution in last year's draft Act, but now counts as a research institution since the Act has been passed.

The following chapter aims to fulfil the mandate of monitoring while also preserving compatibility with existing reporting formats (such as annual reports, quarterly reports, etc.). The details on all central institutions follow a uniform structure:

- First the profile and the most important key indicators for the institution as a whole (including sections and activities of the institution that are not relevant in terms of the Research Financing Act (FoFinaG)) are presented;
- This is followed by a comparison of key figures from 2019 and 2020 on the following selected indicators i) funding and third-party resources, ii) quality assurance and evaluations, iii) human resources and qualifications, iv) output, innovation and excellence, v) internationalisation, vi) knowledge and technology transfer, vii) communication and interaction with society, and viii) gender and promotion of equality; this section only contains the parts and activities of the institutions that are relevant in terms of the Research Financing Act (FoFinaG);
- Finally, special events from 2020 are presented along with a brief outlook on future projects and developments;
- Explanations of key terms and abbreviations can be found in Appendix II.

As of next year, the monitoring will also contain a required comparison of objectives with the actual performance with respect to the indicators surveyed; this requires a definition of the target values, which is or will be completed for each institution within the framework of the performance and financing agreement. The respective key data and indicators are the responsibility of the central institution together with the respective ministry/ministries.

3.1 Austrian Institute of Technology GmbH (AIT)

3.1.1 Profile and key data

The Austrian Institute of Technology (AIT) takes a leading position in the Austrian innovation system and plays a central role in Europe as an RTO (Research Technology Organisation) focusing on important infrastructure for the future. It supports business and society, in particular with digitalisation, decarbonisation and other challenges related to climate change. The research and technological developments of AIT realise fundamental innovations in the research priority areas of Energy, Mobility Systems, Low-Emission Transport, Health & Bioresources, Digital Safety & Security, Vision, Automation & Control, Technology Experience and Innovation Systems & Policy. At the interface between science and industry, AIT makes innovation possible thanks to its scientific and technological expertise, experience in the markets, close customer ties and an outstanding research infrastructure.

Key figures 2019 and 2020

The key figures refer to the entire Austrian Institute of Technology (AIT) including all wholly-owned subsidiaries.

	2019	2020
Total income in €1,000	167,000	161,252

Number of employees	2019			2020		
	f	m	Total	f	m	Total
Employees (= headcount)	391	887	1,278	410	888	1,298
Full time equivalents (rounded)	328	808	1,136	338	811	1,149

Source: Austrian Institute of Technology (AIT).

3.1.2 Development of indicators

Indicator 1: Funding, including third-party funding

Unlike the "key figures", all indicators in section 3.1.2 refer to the Austrian Institute of Technology (AIT) without including Seibersdorf Labor GmbH or Nuclear Engineering Seibersdorf GmbH.

	2019 in €1,000	2020 in €1,000
Total operational income	**130,862**	**130,253**
of which contributions from partners	49,779	48,923
of which third-party funding	81,083	81,331
of which from non-EU countries and global organisations	1,584	1,113
of which public	137	163
of which private	1,447	949
of which from the EU and European countries or organisations	27,943	26,014
of which public	18,628	17,266
of which private	9,315	8,748
of which national and regional organisations	51,556	54,204
of which public	27,991	31,447
of which private	23,565	22,757

Source: Austrian Institute of Technology (AIT).

Indicator 2: Quality assurance and evaluations

Evaluations of thematic and strategic orientation

The Austrian Institute of Technology (AIT) carries out evaluations for the on-going strategy period in accordance with the articles of partnership and the funding agreement of AIT GmbH. Internationally composed evaluation panels are appointed according to a decision of the Supervisory Board to evaluate and review the scientific quality and application relevance of the Centers' activities and to issue position statements on the planned strategic orientation of the Centers. The process and other details are laid down for the evaluation panels in the procedural rules. These report to the Managing Directors, who report to the Supervisory Board. The last evaluation was conducted in 2016, and the current evaluation was completed in the second quarter of 2020. A total of 39 people took part from 17 countries.

Institutional quality assurance measures

The Austrian Institute of Technology (AIT) acts in accordance with established QM documents and strives for continuous improvement in order to maximise customer satisfaction. While complying with legal requirements, AIT is also guided by QM regulations, economically optimal variants, social aspects, as well as safety and environmental factors. The quality management system is certified according to ISO 9001 and some organisational units additionally have ISO 13485 certification for medical devices or ISO 17025 accreditation as testing laboratories. All employees are obliged to be familiar with the principles of quality management and to stay abreast of new developments. Compliance with the requirements of the quality management system is monitored through both internal and external audits.

Indicator 3: Human resources and qualifications

Number of employees (including LKR Leichtmetallzentrum Ranshofen GmbH)	2019			2020		
	m	f	Total	m	f	Total
Employees (= headcount)	742	324	1,066	741	338	1,079
of which at management level (department management, business field management, executive management)	32	8	40	35	8	43
Full time equivalents (rounded)	670	271	914	673	279	952
of which at the management level	32	8	40	33	8	41

Source: Austrian Institute of Technology (AIT).

Number of PhD students	2019	2020
Employees (= headcount)	197	185
of which employed at the Austrian Institute of Technology (AIT)	153	143
of which in a structured training programme (doctoral schools, etc.)	44	42

Source: Austrian Institute of Technology (AIT).

The following staff development measures were implemented in 2019 and 2020:

- **Recruiting & employer branding:** Expansion of our external presence (career talks, digital career fairs), "gender initiative": Women researchers as role models, internal training of managers on recruiting;
- **Qualification:** Re-evaluation of education and training programme: Consideration of gender & diversity, Conversion of the qualification programme for internal promotions to 100% digital training, special online "Web based selling & acquisition" sales training: Focus on web-based sales calls, gender & diversity training initiative for managers;
- **Career development:** Re-evaluation of the PhD programme, initiation of a relaunch, re-evaluation of job profiles and career paths, formation of the related company agreement
- **Organisational development:** Evaluation of the measures from the 2018 employee survey and implementation of the 2020 employee survey with a special focus on "New Work". Teleworking: Re-evaluation of the framework conditions for teleworking, agreement on a new company agreement on teleworking.

Indicator 4: Output, innovation and excellence

Number of scientific publications	2019	2020
Monographs and editions	13	20
Articles/papers in scientific journals, edited volumes and proceedings	537	548
of which listed in WoS or Scopus	395*	297**

* Updated value for evaluation date 9 February 2021

** The figures for the WoS 2020 consist of preliminary values since not all publications were included in the WoS at the time of the evaluation (9 February 2021).

Source: Austrian Institute of Technology (AIT)

Grants in excellence programmes of the European Research Council (ERC) and Austrian Science Fund (FWF)		2019	2020
ERC	Number	0	0
	Total funding approved in €1,000	-	-
Wittgenstein Award of the Austrian Science Fund (FWF)	Number	0	0
	Total funding approved in €1,000	-	-
Start Programme of the Austrian Science Fund (FWF)	Number	0	0
	Total funding approved in €1,000	-	-

Source: Austrian Research Promotion Agency (FFG) EU Performance Monitor. Starting Grants, Consolidator Grants and Advanced Grants are counted at the ERC. The figure is based on the year in which the contract was concluded.

The AIT always assigns ERC Grants to the year in which the project starts and therefore reports the starting grant https://cordis.europa.eu/project/id/804769 with a start date of 1 January 2019 in 2019, the EU Performance Monitor of the FFG follows the EC's contract database and counts this ERC in 2018.

Indicator 5: Internationalisation

	2019	2020
Share of international co-publications among all publications	58.8%*	68.0%*
Number of newly approved participations in H2020 programmes and initiatives	30	33
Total funding approved in €1,000	16,893	20,535

* Updated value for evaluation date 9 February 2021

** The values stated refer to co-publications with at least one author from abroad as a proportion of the total number of publications in WoS. The figures for the WoS 2020 consist of preliminary values since not all publications were included in the WoS at the time of the evaluation (9 February 2020).

Source: Austrian Institute of Technology (AIT).

Memberships in international umbrella organisations and networks:

European Association representing Research and Technology (EARTO), European Automotive Research Partners Association (EARPA), European Cyber Security Organisation (ECSO), European Energy Research Alliance (EERA), European Forum on Forward Looking Activities (EFFLA), European Conference of Transport Research Institutes (ECTRI), European Green Vehicle Initiative Association (EGVIA), European Heat Pump Association (EHPA), European Machine Vision Association (EMVA), European Technology & Innovation Platforms on Smart Networks for Energy Transition (ETIP SNET), HLG on Innovation Policy, International Energy Agency (IEA) WGs, European Platform on Smart Systems Integration (EPoSS), Alliance IoT Innovation (AIOTI), The Association of European Renewable Energy Research (EUREC), Urban Europe Research Alliance (UERA), European Institute of Technology (EIT) CLIMATE, HEALTH, FOOD, European Industrial Alliances (Battery, Clean Hydrogen)

Indicator 6: Knowledge and technology transfer

	2019	2020
Share of co-publications with industry or practice partners among all publications listed in WoS	38.3%*	41.5%**

Patents and exploitation activities	**2019**	**2020**
Number of patent applications	40	41
of which national	11	14
of which EU/EPC	18	13
of which non-EU countries	11	14
Issued patents	28	36
of which national	11	11
of which EU/EPC	12	19
of which non-EU countries	5	6
Exploitation spin-offs	1	2

* Updated value for evaluation date 9 February 2021

** The figures for the WoS for 2019 consist of preliminary values since not all publications were included in the WoS at the time of the evaluation (29 February 2021).

Source: Austrian Institute of Technology (AIT).

Indicator 7: Communication and interaction with society

The following activities and formats for communicating and transferring knowledge as well as for engaging and addressing civil society actors were implemented in 2019 and 2020:

- Digital and social media channels as well as Austrian news agency APA OTS
- *Lange Nacht der Forschung 2020* (Long Night of Research: video contributions, virtual lab tours)
- AIT experts in print media, radio and TV
- AIT blog https://www.ait.ac.at/blog/
- Alpbach technology symposium, including "Technology in Conversation" yearbooks
- Alpbach health meetings contribution
- Lectures at national and international research institutions
- Lila4Green: Living lab for green https://lila4green.at/
- Leafs: Motivation for the energy transition https://www.ait.ac.at/themen/smart-grids/projects/leafs/
- Successful caregiver communication and everyday situation support in dementia care https://www.ait.ac.at/themen/capturing-experience/projects/success
- hiStory make your story history https://hi-story.eu/visitor-ui/7c78c058-2b46-4ccb-a2da-d3936c2eafee
- Urban academy on the topic of digital resilient cities https://www.ait.ac.at/news-events/single-view/detail/6174?cHash=6b54e0fad827ca3a172816b3c2a3711d
- Microbiomesupport multi-partner initiative, dialogue and know-how transfer https://www.microbiome-support.eu/
- SIMULATE optimisation of people flows in urban areas https://www.ait.ac.at/simulate
- A4F – Requirements and acceptance analysis of age-appropriate automated driving https://www.ait.ac.at/themen/capturing-experience/projects/a4f
- Building self-sustaining research and innovation ecosystems in Europe through responsible research and innovation (SEERRI): Strengthening regional innovation systems https://seerri.eu/
- *Schaltwerk 2030 – Wir schalten auf Zukunft!* (Schaltwerk 2030 – We are switching to the future!) Co-creation / co-learning for strategic orientation of the region https://www.schaltwerk2030.at/

- European Mobile Youth – promoting democratic participation of young EU citizens https://european-mobileyouth.eu/
- Designing more inclusive Fem*Mad making a difference and Makerspaces https://hci.sbg.ac.at/sites/femmad/
- Girls! TECH UP https://www.letstech.at/girls-tech-up/

Indicator 8: Gender and promotion of equality

Share of women in management positions by management level	2019	2020
Managing Directors	0%	0%
Head of Center/Head of Administrative Area	9%	9%
Principal Scientist	33%	20%
Glass Ceiling Index based on management levels*	1.52	1.68

* Calculated as the share of women among all employees/share of women in management positions. The following are considered management positions: head of department/division, head of competence unit/center, managing director and heads of staff units and authorised officers.

Source: Austrian Institute of Technology (AIT).

The following activities were implemented in 2019 and 2020 aimed at promoting gender equality:

- **Recruiting and employer branding:** gender-sensitive designs for job advertisements, explicit programmes aimed at recruiting female early stage researchers, comprehensive information services on gender activities and ensuring balanced selection processes for managers;
- **Qualification and ongoing training:** Access to the company's training services for all employees irrespective of gender or working hours, mandatory training for different target groups and above all specific support and training for women in the organisation;
- **Compatibility of family and career:** Supporting employees in shaping their personal work/life balance with a special focus on flexible working hours and teleworking;
- **Structural measures:** Adoption of the Gender Mission and Gender Action Programme, establishment of a dedicated gender information area on the intranet for AIT staff, brochures and FAQs on gender issues, sexual harassment, bullying and bossing; working groups and discussion forums both for women as well as for the management at the Austrian Institute of Technology (AIT).

3.1.3 Special events in 2020 and outlook for the coming years

Special events for 2020

Smart grids are urgently needed for integration of the growing number of decentralised, renewable energy sources and generators into our energy system. The ERIGrid 2.0 EU project makes significant contributions to the analysis, validation and systematic testing of smart grid configurations and was presented with an award by the Renewable Grid Initiative (RGI).

In the efforts to develop applicable solutions for a reduction in the use of synthetic fertiliser components and therefore for more efficient use of resources and restoration of biodiversity, a comparable fertilisation effect could be shown as with conventional phosphate fertiliser following initial field trials with the addition of selected microorganisms.

In-situ alloying in the wire-based additive manufacturing process with multi-wire versions of different compositions can be used to adjust material properties of different component areas on a targeted basis. This increased flexibility in the production of new alloys allows costs and weight savings.

Regulatory adjustments are often necessary in order to drive forward the decarbonisation and digitalisation of industry, with these tested beforehand in experiments in labs known as real laboratories. The legal conditions for these types of real laboratories in the energy sector were created for the first time in Austria with the support of the Austrian Institute of Technology (AIT).

Outlook

In line with the Austrian Institute of Technology (AIT) Shareholder Vision 2030, the Institute is strengthening its profile in the areas of quantum technology, autonomous systems and assistance systems, as well as electrical grids and sector coupling, using data science and artificial intelligence methods in the process. Existing system and technological expertise is being expanded in the priority area of sector coupling through laboratory infrastructure and simulation skills for industrial heat pumps and hydrogen technologies.[180]

3.2 Institute of Science and Technology Austria (IST Austria)

3.2.1 Profile and key data

IST Austria was established in 2006 by the Federal Government of Austria and the Government of Lower Austria. The campus opened in 2009 in the city of Klosterneuburg, The Institute serves as a centre for cutting-edge research in the physical, mathematical, computer, and life sciences. The objectives of IST Austria are to open up new fields of research and to ensure high-quality post-graduate education in the form of interdisciplinary PhD and postdoc programmes. Research, education and staff selection are internationally oriented; the working and teaching language is English. There will be around 90 research groups and a total of more than 1,000 employees on campus by 2026.

Key figures 2019 and 2020

	2019	2020
Total income in €1,000	**83,720**	**94,652**

Number of employees	2019			2020		
	f	**m**	**Total**	**f**	**m**	**Total**
Employees (= headcount)	341	436	777	382	479	861
Full time equivalents (rounded)	323	429	752	359	472	831

Source: IST Austria.

180 Further information can be found in the Austrian Institute of Technology (AIT) Annual Financial Statement 2020 https://www.ait.ac.at/en/media/annual-financial-statement

3.2.2 Development of indicators

Indicator 1: Funding, including third-party funding

	2019 in €1,000	2020 in €1,000
Total income	**83,720**	**94,652**
of which basic public funding from the federal government	53,232	63,499
of which funding from the federal state of Lower Austria	2,194	2,383
of which other sales revenues and other operating income	9,076	9,701
of which from the release of investment grants	7,304	8,231
of which third-party funding	19,218	19,069
of which from non-EU countries and global organisations	1,009	2,518
of which from the EU and European countries or organisations	12,862	12,062
of which national and regional organisations	5,347	4,490

Source: IST Austria.

Indicator 2: Quality assurance and evaluations

Evaluations of thematic and strategic orientation

IST Austria is managed by a number of executive bodies which perform specifically defined tasks. The Board of Trustees and the Executive Committee oversee the development and strategic direction of the Institute, and the Scientific Board prepares proposals for the scientific orientation and for ensuring high academic performance.

The development of the Institute undergoes regular evaluations, as stated in Section 5 (2) of the Federal Act Establishing the Institute of Science and Technology Austria. One economic evaluation (2014–15) and three scientific evaluations (2011, 2015, 2019) have taken place up until now, with these finding development of the Institute to be excellent.

Institutional quality assurance measures

- Recruitment strategy – People before area. IST Austria's recruitment strategy is based on excellence as the most important basic requirement.
- A tenure-track system is used to ensure high scientific standards for the long term.
- Internal Control System and Risk Management System are parts of the 3 Lines of Defence Corporate Governance Model.

The internal control system (1st Line of Defence) was implemented for central processes. Testing of the internal control system and reporting to the management and the Audit Committee take place at least annually. The risk management system (2nd Line of Defence) pursues the goal of identifying and assessing significant risks in good time. The Board of Trustees and the Audit Committee receive annual updates from management about the risk situation at IST Austria.

Indicator 3: Human resources and qualifications

Number of employees	2019			2020		
	m	f	Total	m	f	Total
Employees (= headcount)	436	341	777	479	382	861
of which at the management level (faculty – professors and assistant professors, general management, division heads, unit heads)	59	18	77	62	20	82
Full time equivalents (rounded)	429	323	752	472	359	831
of which at the management level	59	18	77	62	20	82

Source: IST Austria.

Number of PhD students	2019	2020
Employees (= headcount)	223	250
of which employed by IST Austria	223	250
of which in a structured training programme (doctoral schools, etc.)	223	250

Source: IST Austria.

The following staff development measures were implemented in 2019 and 2020:

- The staff development and career advancement plan drawn up as part of the 2018–2020 performance agreement is implemented on an ongoing basis.
- Target group-specific training for the academic sector includes training in the areas of academic skills, technical skills, career development and training on grant applications.
- Administrative employees and employees in the Scientific Service Units have access to a comprehensive continuing education and training programme as well as to specific training on the topic of leadership.

Indicator 4: Output, innovation and excellence

Number of scientific publications	2019	2020
Monographs and editions	19	32
Articles/papers in scientific journals, edited volumes and proceedings	361	376
of which listed in WoS or Scopus	331	359

Source: IST Austria.

Grants in excellence programmes of the European Research Council (ERC) and Austrian Science Fund (FWF)		2019	2020
ERC	Number	3	4
	Total funding approved in €1,000	4,720	6,455
Wittgenstein Award of the Austrian Science Fund (FWF)	Number	0	0
	Total funding approved in €1,000	-	-
Start Programme of the Austrian Science Fund (FWF)	Number	0	0
	Total funding approved in €1,000	-	-

Source: Austrian Research Promotion Agency (FFG) EU Performance Monitor. Starting Grants, Consolidator Grants and Advanced Grants are counted at the ERC. The figure is based on the year in which the contract was concluded.

In 2019, an additional Proof of Concept Grant in the amount of €149,829 was awarded.

Indicator 5: Internationalisation

	2019	2020
Share of international co-publications among all publications	75.5%	81.6%
Number of newly approved participations in H2020 programmes and initiatives (including ERC grants)	10	5
Total funding approved in €1,000	6,724	5,032

Source: IST Austria.

Central memberships in international umbrella organisations and networks, important internationalisation measures in 2019 and 2020:

- IST Austria is part of the BRIDGE network together with Rockefeller University (USA), the Francis Crick Institute (UK), the Weizmann Institute of Science (Israel) and the Okinawa Institute of Science and Technology (Japan), with this network established with the objectives of carrying out cutting-edge research and training PhD students.
- IST Austria participates in the Erasmus+ Staff Mobility programme.
- The library is part of an international research infrastructure project with a focus on open access.
- IST Austria is a member of PRACE (Partnership for Advanced Computing in Europe).
- Research groups in the field of artificial intelligence are members of ELLIS (European Laboratory for Learning and Intelligent Systems).

Indicator 6: Knowledge and technology transfer

	2019	2020
Share of co-publications with industry or practice partners among all publications	8.2%	7%

Patents and exploitation activities	2019	2020
Number of patent applications	4	10
Issued patents	1	0
Exploitation spin-offs	0	2

Source: IST Austria.

Indicator 7: Communication and interaction with society

The following activities and formats for communicating and transferring knowledge as well as for engaging and addressing civil society actors were implemented in 2019 and 2020:

Events were held online wherever possible due to the COVID-19 pandemic. Examples include:

- Open Campus Day: largest science festival in Klosterneuburg
- *"Lange Nacht der Forschung"* (Long Night of Research)
- Public IST Lectures (internationally recognised top researchers present their work in terms that are generally comprehensible)
- Science-Industry Talk (together with the Federation of Austrian Industry)
- Public lectures by researchers at IST Austria in German (series of lectures: Science. Klosterneuburg. Creates knowledge)
- TWIST Talk (series of lectures aimed at promoting discussions between industry, start-ups and the research community)
- "ideas4future" school competition awards ceremony

The Summer Camp (for primary school children) and Talent Summer (for teenagers) took place based on a reduced format at the campus in 2020.

In addition, the following initiatives have been developed in response to the pandemic:

- *"Pop-up Science - Forschen statt fad"* ("Pop-up Science - Researching instead of bland") online format for science suitable for children during lockdown
- *"Supergscheit!"* ("Super Smart") science show an experiment and science show
- COVID Contact Network: Project with Citizen Science aimed at analysing social interactions during the pandemic
- Virus Alert in Stayhompton: a board game developed for children

Indicator 8: Gender and promotion of equality

Share of women in management positions by management level	2019	2020
General management	0%	0%
Division heads/unit heads	39.1%	39.1%
Faculty (professors and assistant professors)	17.0%	19.0%
Glass Ceiling Index based on management levels*	1.88	1.82

* Calculated as the share of women among all employees/share of women in management positions. The following are considered management positions: Faculty (professors and assistant professors), general management, division heads and unit heads.

Source: IST Austria.

The following activities were implemented in 2019 and 2020 aimed at promoting gender equality:

Increasing the share of women is a key strategic focus for IST Austria. IST Austria relies on various measures in order to achieve this:

- Targeted scouting of female postdocs in awarded research institutes;
- A separate recruitment committee for female professors that specifically searches for appropriate female candidates and actively invites them to apply;
- Bias awareness training for Professors as well as for managers in Administration and the Scientific Service Unit;
- Expansion of the dual career concept in order to be able to take greater account of the careers of partners in the future;
- STEM fatale lecture series: Successful women from the STEM disciplines (science, technology, engineering and mathematics) present their career paths and how they have managed to overcome challenges in their professional careers.

3.2.3 Special events in 2020 and outlook for for the coming years

Outstanding awards

The continued success of researchers in acquiring funding from the European Research Council (ERC) represents another clear sign of excellence.

A total of 39 out of 59 IST Austria professors on campus are ERC Grantees. Overall, 47 ERC Frontier Research Grants (27 Starting, 8 Consolidator, 12 Advanced Grants) with funding values of up to €2, 2.5 and 3 million respectively have been allocated to IST Austria. Furthermore, two ERC Proof of Concept Grants (top-up funding) have been awarded to date.

Outlook – a growing campus

Research and industry are being brought closer together in the adjacent technology park (IST Park). Since 2019, this has offered office and laboratory space for IST Austria spin-offs and companies seeking proximity to the Institute.

With the venture fund "IST cube", more than €40 million will be available from 2021 to develop forward-looking research projects into successful start-ups.

A new building will be completed in 2021 that will be home to chemistry labs, the Graduate School and the Institute library. The start of construction for another laboratory building is scheduled for 2021.

Both bodies that maintain the Institute – the federal government, represented by the Federal Ministry of Education, Science and Research (BMBWF) and the federal state of Lower Austria – have committed to support the further expansion of the Institute after 2026 in a memorandum of understanding signed in March 2021. The existing agreement under Article 15a of the Federal Constitutional Act, which is valid until 2026, will be replaced by a new agreement in 2021, which means that the new agreement will be concluded in 2021, but will only be valid from 2027.[181]

3.3 Austrian Academy of Sciences (OeAW)

3.3.1 Profile and key data

"To promote science in every way" – that is the statutory mandate of the Austrian Academy of Sciences (OeAW), Austria's largest and most diverse non-university institution for basic research.

As a research performing organisation of 25 institutes in the area of humanities, social sciences and cultural studies (GSK) as well as in natural, life and technical sciences, the OeAW embraces pioneering research topics often on an interdisciplinary basis, taking an application-open approach while preserving our cultural heritage.

As a research funding organisation, OeAW supports promising scientific talent, including through an attractive career model, and by awarding scholarships and prizes throughout the entire Austrian research area.

As a national academy of sciences, OeAW is a learned society and dispenser of knowledge that also contributes the latest scientific findings to the public discourse from a multidisciplinary perspective.

The interaction of these areas under one umbrella creates synergies, dynamism and innovation potential for the benefit of science and society.

Key figures 2019 and 2020

The key figures refer to the entire Austrian Academy of Sciences (OeAW): research performing organisations, learned societies, scholarships and commissioned areas.

181 Further information can be found in the IST Austria Annual Report 2020: https://ist.ac.at/wp-content/uploads/2021/05/IST-Annual-Report-2020.pdf

Austrian Academy of Sciences (OeAW) as a whole	2019	2020
Total income in €1,000*	191,312	194,723

Number of employees**	2019			2020		
	f	m	Total	f	m	Total
Employees (= headcount)	774	1,046	1,820	805	1,062	1,867
Full time equivalents (rounded)	620	895	1,515	637	897	1,534

* Total income does not include extraordinary income from the release of provisions or income from the disposal of fixed assets.
** including 100% subsidiaries

Source: Austrian Academy of Sciences (OeAW) The numbers for 2020 are preliminary values.

3.3.2 Development of indicators

Indicator 1: Funding, including third-party funding

Unlike the "key figures", all indicators in section 3.3.2 refer solely to the research performing organisation without learned societies, scholarships and the commissioned area.

Austrian Academy of Sciences (OeAW) research performing organisation	2019 in €1,000	2020 in €1,000
Total income *	**169,589**	**173,354**
of which federal funds based on the Austrian Academy of Sciences (OeAW)/Federal Ministry of Education, Science and Research (BMBWF) performance agreement	99,995	100,489
of which other income (transfer of costs)	23,278	25,525
of which third-party funding**	46,316	47,340
of which global organisations and non-European countries or organisations	270	298
of which from the EU and European countries or organisations	15,272	15,109
of which national and regional organisations	30,774	31,933
of which from the National Foundation for Research, Technology and Development (NFTE) and the Austria Fund	5,319	8,458

* Total income does not include extraordinary income from the release of provisions or income from the disposal of fixed assets.
** Third-party funds are presented according to the time of receipt of payment and do not include accruals and deferrals

Source: Austrian Academy of Sciences (OeAW) The numbers for 2020 are preliminary values.

Indicator 2: Quality assurance and evaluations

Evaluations conducted at the institute and programme level

Regular or special purpose evaluations according to international standards provide crucial momentum for further development at the Austrian Academy of Sciences (OeAW) institutes and initiatives. Evaluations at the institutes are carried out by international teams of high-level researchers, with the independence and expertise of these teams being the responsibility of the members of the OeAW Research Committee, which includes Nobel Prize winners. The evaluation teams usually form an independent opinion of the situation on site. No evaluations were carried out at the institutes in 2020 due to COVID-19, although two evaluations were carried out of cooperation initiatives (Austrian Centre for Stem Cell Research and Tissue Engineering; Erwin Schrödinger Centre for Quantum Science & Technology). Results from the evaluations provide the starting point for decisions by the Executive Board on the institutes' development; decisions are made in coordination with the Research Committee and the Academy Council at the Austrian Academy of Sciences (OeAW).

Institutional quality assurance measures

In addition to evaluations of the Austrian Academy of Sciences (OeAW) research institutions and initiatives, other measures designed in accordance with international standards ensure scientific quality that is competitive internationally on an on-going and transparent basis, whether by filling scientific (executive) positions, scientific advisory boards or through ex-ante and ex-post project monitoring, among many other factors. All quality assurance processes take into account the special aspects and dynamics of the respective research fields as well as special institute missions, such as protecting our cultural inheritance or science-based policy consultancy. In addition to scientific appropriateness, OeAW administration is also guided by legal requirements, complies with the Federal PCGK as far as applicable to the Austrian Academy of Sciences, and follows a comprehensive risk and compliance management system, which is monitored by the Austrian Academy of Sciences Audit Committee as well as by an internal audit commissioned externally.

Indicator 3: Human resources and qualifications

Number of employees of the Austrian Academy of Sciences (OeAW) research performing organisation (incl. wholly-owned subsidiaries)	2019			2020		
	m	f	Total	m	f	Total
Employees (= headcount)	998	719	1,717	1,019	753	1,772
of which at the management level	128	56	184	122	51	173
Full time equivalents (rounded)	853	574	1,427	860	594	1,454
of which at the management level	118	51	169	111	47	158

Source: Austrian Academy of Sciences (OeAW)

Number of PhD students	2019	2020
Employees (= headcount)	N/A	316
of which employed at Austrian Academy of Sciences (OeAW) research institutions	289	293

Source: Austrian Academy of Sciences (OeAW)

The following staff development measures were implemented in 2019 and 2020:

The collective agreement and the career model at the Austrian Academy of Sciences (OeAW) were harmonised in 2020, with new conditions agreed for employment of scientific staff on a permanent basis. This provides an improved framework for transparent career development and staff planning based on career stages that can be compared internationally.

The Austrian Academy of Sciences (OeAW) mentoring programme, which entered its 5th phase in 2020, provides workshops on key skills to young researchers: Career development of the mentees, knowledge valorisation and strategic support from the mentors, accompanied by self-organised peer mentoring among the mentees all play a crucial role.

OeAW offers tailor-made training measures such as Excellence4GRANTed workshops for ERC aspirants or initial training sessions for project leaders etc., aimed at facilitating the acquisition of competitive projects with third-party funding.

Indicator 4: Output, innovation and excellence

Number of scientific publications from projects of the Austrian Academy of Sciences (OeAW) research performing organisation	2019	2020
Monographs and editions	57	61
Articles/papers in scientific journals, edited volumes and proceedings	1,702	1,767
of which listed in WoS or Scopus	1,282	1,329
of which published in other outstanding journals or by specialised publishers of the departments *	119	112

* Since the WoS and Scopus indices do not fully represent publications in the humanities, social sciences and cultural studies (GSK), a further selection of indices was made with external international participation, as well as of other outstanding publication bodies that are placed on an equal footing with the journals indexed in WoS/Scopus in the publication indicators of the Austrian Academy of Sciences (OeAW).

Source: Austrian Academy of Sciences (OeAW)

Projects acquired by Austrian Academy of Sciences (OeAW) research institutions in excellence programmes of the European Research Council (ERC) and Austrian Science Fund (FWF)		2019	2020
ERC	Number	4	3
	Total funding approved in €1,000	6,777	4,713
Wittgenstein Award of the Austrian Science Fund (FWF)	Number	0	0
	Total funding approved in €1,000	-	-
Start Programme of the Austrian Science Fund (FWF)	Number	2	0
	Total funding approved in €1,000	2,232	-

Source: Austrian Research Promotion Agency (FFG) EU Performance Monitor (ERC), Austrian Science Fund (FWF) (Start Programme). Starting Grants, Consolidator Grants and Advanced Grants are counted at the ERC. The figure is based on the year in which the contract was concluded.

In addition to the projects listed in the table, the Austrian Academy of Sciences (OeAW) played a key role in winning further ERC grants in 2019/2020: two ERC grants were awarded at the OeAW and transferred to other research institutions/universities before the start of the project; for five other ERC grants acquired in 2020, the contract with the EU had not yet been concluded at the end of 2020. The Austrian Academy of Sciences (OeAW) also succeeded in a Proof of Concept Grant, was able to acquire a Synergy Grant as a coordinator and was associated with two other grants as a Co-Beneficiary.

In addition to the two Austrian Science Fund (FWF) Start projects listed in the table, OeAW also has a 49% participation in another FWF Start project awarded in 2019.

In total, more than €22 million was awarded in 2019/2020, which will be available to researchers at the OeAW for new, innovative research projects.

Indicator 5: Internationalisation

	2019	2020
Share of international co-publications among all publications* listed in WoS in the reporting year	79.0%	83.8%
Number of newly approved participations by Austrian Academy of Sciences (OeAW) research institutions in H2020 programmes and initiatives	21	19
Total funding approved in €1,000	20,838	17,865

* The following citable publication types are taken into account: articles, proceedings, papers, reviews, letters.

Source: Austrian Academy of Sciences (OeAW)

Central memberships in international umbrella organisations and networks, important internationalisation measures in 2019 and 2020:

The Austrian Academy of Sciences (OeAW) is involved in multilateral academy associations (e.g. ALLEA, EASAC) and professional societies (e.g. ISC). Cooperation with science academies from 50 countries (including China, Iran, Ukraine and the western Balkan region) enable the implementation of joint research activities and short-term scientific guest stays with minimum bureaucracy. The OeAW "Joint Excellence in Science and Humanities" mobility programme (JESH) facilitates cooperation between outstanding young researchers from abroad and Austria. A separate call for proposals was launched in 2020 for the JESH focus country Croatia, which was hit by an earthquake in March 2020.

OeAW memberships in international research alliances and infrastructures on behalf of the Republic of Austria are open to the entire Austrian research community and are complemented by numerous research collaborations entered into autonomously with international players.

Indicator 6: Knowledge and technology transfer

	2019	2020
Share of co-publications with industry or practice partners among all publications listed in WoS	N/A	33.0%

IPR: Patents and exploitation activities	2019	2020
Number of patent applications	68	30
of which national	0	0
of which EU/EPC	16	14
of which non-EU countries	52	16
Issued patents	9	14
of which national	0	2
of which EU/EPC	4	4
of which non-EU countries	5	8
Exploitation spin-offs	3	3
Licensing agreements	4	4
Options agreements	1	1
Sales agreements	1	2
Exploitation partners (companies)	6	7

Source: Austrian Academy of Sciences (OeAW)

Indicator 7: Communication and interaction with society

The following activities and formats for communicating and transferring knowledge as well as for engaging and addressing civil society actors were implemented in 2019 and 2020:

New knowledge is created at the Austrian Academy of Sciences (OeAW) and conveyed to interested parties of all ages throughout Austria in a diverse, low-threshold manner, e.g. as part of events organised by the Federal States Initiative. The Academy also inspires the youngest candidates to take up research, with its offers at the Vienna Children's University and the Austrian Academy of Sciences (OeAW) science comics, which are sent to schools and other institutions. OeAW continued the Austrian Study Foundation in 2020 with the aim of providing non-material support to gifted high school graduates and to support them during their studies, e.g. with mentoring by established researchers or in summer or winter schools oriented around science. OeAW's public prize question is open to people internationally who wish to submit

essays on a socially relevant topic. Podcasts broadcast by OeAW in 2020 clarified facts and myths about the SARS-CoV-2 virus, and the new "Sciences Bites" video format brought science into living rooms via social media. The "Science and Politics in Conversation" event format provided an opportunity for members of the National Council to discuss pressing challenges with researchers in 2019 and 2020.

Indicator 8: Gender and promotion of equality

Share of women in management positions by management level	2019	2020
Institute directors	29%	28%
Scientific directors	20%	18%
(Senior) group leaders	23%	24%
Junior group leaders	24%	27%
Administrative and technical management personnel	45%	37%
Glass Ceiling Index based on management levels*	1.38	1.44

* Calculated as the share of women among all employees/share of women in all management positions.

Source: Austrian Academy of Sciences (OeAW)

The following activities were implemented in 2019 and 2020 aimed at promoting gender equality:
Diversity of opportunities enjoys structural and tangible support. The focus with this remains on reinforcing gender equality in order to embed it further within the institution, as well as on continuous improvement of the compatibility of science and private life. Following the introduction of the "Academy and Child" programme in 2019, the concept was also expanded to "Academy and Family" in 2020.

With its broad-based and diverse composition, the "Working Group on Equal Opportunity Issues" at the Austrian Academy of Sciences (OeAW) drafted the new Equal Opportunities and Women's Advancement Plan for the Austrian Academy of Sciences in 2020, and this will come into force in March 2021.

OeAW launched a series on its Facebook page in 2020 with the hashtag #WomenInScience in order to draw attention to the achievements of women in research in the past and present. Regular lectures on gender & diversity provide the momentum to advance gender equality; two lectures in the series were held in 2020. Inspired by this, a repository was created on the topic of gender bias, which will initially be made available to all evaluation committees at OeAW in order to intensify awareness on how to avoid gender bias.

3.3.3 Special events in 2020 and outlook

Examples of research results from 2020
Created by the Austrian Academy of Sciences (OeAW) together with its cooperation partners, the CLIP supercomputer cluster supports researchers from a wide range of disciplines and research institutions in solving their various issues, which are increasingly driven by data.

More than 40 research projects were launched as a result of the COVID-19 pandemic: These range from studies on the duration of lockdowns, to research on past epidemics with an eye on the present, to new testing methods for SARS-CoV-2 and sequencing to track the mutation pathways and dynamics of the SARS-CoV-2 virus. Life sciences researchers at the Austrian Academy of Sciences (OeAW) were pioneers here in Austria.

Researchers from the Austrian Archaeological Institute (ÖAI) challenged the previous Greek periodisation system with unprecedented dating precision using C14 data. This allowed important historical events as well as the emergence of numerous innovations in philosophy, literature and political organisation to be dated 50-150 years earlier.

Outlook

The three archaeological institutes at the Austrian Academy of Sciences (OeAW) were merged to form the new Austrian Archaeological Institute (ÖAI) as of 1 January 2021. This also provides a boost to the natural science aspects of archaeological research. The 2021–2023 performance agreement period began at the same time, with synergies to be created between the natural sciences and humanities institutes of OeAW and with other scientific organisations at the new *"Postsparkasse"* site; all in the heart of Vienna and providing a strong signal for science and society. There are plans to leverage synergies within the Graz research landscape through the Cori Institute of Molecular and Computational Metabolism, which is to be founded in cooperation with university partners.[182]

3.4 Silicon Austria Labs GmbH (SAL)

3.4.1 Profile and key data

Silicon Austria Labs GmbH (SAL) is an Austrian non-university research centre for electronics-based systems (EBS). SAL conducts research at its three locations in Graz, Villach and Linz that cover the entire EBS added value chain in the fields of sensor systems, RF systems, power electronics, system integration technologies and embedded systems. Research is conducted at both the model and hardware levels (components, assemblies and devices with micro- and nanoelectronics) and at the associated embedded software level, combined with holistic knowledge of comprehensive system integration. Work is carried out on topics such as Industry 4.0, Internet of Things (IoT), autonomous driving, cyber-physical systems (CPS), AI, Smart City, Smart Energy and Smart Health in commissioned and strategic in-house research, as well as in collaborative projects and projects with third-party funding.

Key figures 2019 and 2020

	2019	2020
Total income in €1,000	**14,655**	**21,680**

Number of employees	2019			2020		
	f	**m**	**Total**	**f**	**m**	**Total**
Employees (= headcount)	40	101	141	52	136	188
Full time equivalents (rounded)	34	93	126	47	127	174

Source: SAL.

182 Further information can be found in the Austrian Academy of Sciences (OeAW) Annual Report 2020: https://www.oeaw.ac.at/fileadmin/NEWS/2021/PDF/Web_OEAW_Jahresbericht-2020.pdf

3.4.2 Development of indicators

Indicator 1: Funding, including third-party funding

	2019 in €1,000	2020 in €1,000
Total income	**14,655**	**21,680**
of which contributions from partners	7,716	12,512
of which third-party funding	6,939	9,168
of which from non-EU countries and global organisations	13	0
of which public	0	0
of which private	13	0
of which from the EU and European countries or organisations	1,372	1,725
of which public	479	635
of which private	893	1,090
of which national and regional organisations	5,555	7,443
of which public	3,402	3,730
of which private	2,153	3,712

Source: SAL.

Indicator 2: Quality assurance and evaluations

Evaluations of thematic and strategic orientation

The strategic orientation at SAL was evaluated by the Executive Board together with the management in 2019, resulting in the definition of targets and objectives and ultimately an adapted strategy in 2020. The Austrian Research Promotion Agency (FFG) is responsible for SAL's regular international evaluation. This focuses on the quality of the projects, the suitability of the project partners, utilisation and exploitation, as well as the topics of internationalisation and human resources. In addition to the external evaluation by the Austrian Research Promotion Agency (FFG), the research programme is also subject to regular discussion in the Silicon Austria Labs' Scientific Advisory Board (twice per year) and with the Scientific Board.

Institutional quality assurance measures

SAL was certified according to ISO 9001 (2015) in October 2020 and therefore has a quality management system that is binding for all sites. The new Operational Management role was filled in November 2020. In addition to quality management, it will drive forward improvements and further developments to multidisciplinary processes and support leadership development. Lastly, risk and compliance officers were appointed in 2021 in order to expand and structure existing measures systematically in both areas. A new research process was also rolled out throughout SAL in 2020 in order to ensure research quality, with all the quality criteria stipulated in this for successful project implementation.

Indicator 3: Human resources and qualifications

Number of employees	2019			2020		
	m	f	Total	m	f	Total
Employees (= headcount)	101	40	141	136	52	188
of which at the management level	20	4	24	26	3	29
Full time equivalents (rounded)	93	34	126	127	47	174
of which at the management level	19	4	23	25	3	28

Source: SAL.

Number of PhD students	2019	2020
Employees (= headcount)	21	26
of which employed at SAL	10	16
of which in a structured training programme (doctoral schools, etc.)	11	10

Source: SAL.

The following staff development measures were implemented in 2019 and 2020:

- **Gender equality plans and measures**
  The central goals of the gender equality policy are to achieve a balanced ratio of men and women in research teams and enterprise functions, as well as to integrate gender and gender analysis within the research content.
- Implementation of an **extended flexitime model**
  An "extended" flexitime model has been applied ever since SAL was established (flexitime framework from 06:00 until 21:00; no core working hours).
- **Family & Work Audit** – recertification by 2023
  - Measures:
  - Evaluation of access to working from home
  - Survey of satisfaction levels/concerns/suggestions
  - Intranet focus – Compatibility of family and career
  - Public Relations – Employer Branding
  - Corporate mission statement – Implementing work and family life
  - Introduction of a weekly fruit basket
  - Health promotion
  - Mental health
- **Ongoing life-long learning measures**
  Training on soft skills (project management seminars, etc.) is also offered in addition to technical training.

Indicator 4: Output, innovation and excellence

Number of scientific publications	2019	2020
Monographs and editions	2	0
Articles/papers in scientific journals, edited volumes and proceedings	76	110
of which listed in WoS or Scopus	66	79

Source: SAL.

Grants in excellence programmes of the European Research Council (ERC) and Austrian Science Fund (FWF)		2019	2020
ERC	Number	0	0
	Total funding approved in €1,000	-	-
Wittgenstein Award of the Austrian Science Fund (FWF)	Number	0	0
	Total funding approved in €1,000	-	-
Start Programme of the Austrian Science Fund (FWF)	Number	0	0
	Total funding approved in €1,000	-	-

Source: Austrian Research Promotion Agency (FFG) EU Performance Monitor. Starting Grants, Consolidator Grants and Advanced Grants are counted at the ERC. The figure is based on the year in which the contract was concluded.

Indicator 5: Internationalisation

	2019	2020
Share of international co-publications among all publications	-	37%
Number of newly approved participations in H2020 programmes and initiatives	2	3
Total funding approved in €1,000	818	1,484

Source: SAL.

Central memberships in international umbrella organisations and networks, important internationalisation measures in 2019 and 2020:

SAL is a member of various networks (e.g. ECSEL Austria, Forschung Austria, the Federation of Austrian Industry), international conferences are part of its "day-to-day business" (e.g. MEMS conference in Vancouver in January 2020). A meeting was held with CEA-Tech, CEA-List and CEA-Leti in September 2020 at which joint collaborations were agreed. SAL has dozens of collaborations with international companies, research centres and universities in numerous European projects. SAL's online presence has an international focus: Around 55% of visitors to the SAL website are international ones. SAL communicates in English on social media, the website and in the newsletter in order to reach an international audience. These channels are also used for international recruitment.

Indicator 6: Knowledge and technology transfer

	2019	2020
Share of co-publications with industry or practice partners among all publications	45%	35%

Patents and exploitation activities	2019	2020
Number of patent applications	16	11
of which national	0	0
of which EU/EPC	6	0
of which non-EU countries	6	9
of which international (PCT)	4	2
Issued patents	15	10
of which national	6	0
of which EU/EPC	1	1
of which non-EU countries	8	9
Exploitation spin-offs	0	0

Source: SAL.

Indicator 7: Communication and interaction with society

The following activities and formats for communicating and transferring knowledge as well as for engaging and addressing civil society actors were implemented in 2019 and 2020:

Videos on research content and researchers have been created in order to communicate SAL research content, and they were shared via YouTube, the SAL website and LinkedIn. News on projects is published on the SAL website on an ongoing basis providing knowledge about research work. The monthly SAL Science & Stories newsletter is aimed at employees, shareholders and industry partners, providing information regarding ongoing and new projects as well as milestones at SAL. "SAL Science Talks" also take place regularly and there have been ongoing guided tours and internship days for pupils and other groups (such as with the Vocational Training Institute Vienna (BFI) and the Vocational Education and Rehabilitation Centre (BBRZ)). The focus was on disseminating knowledge, the audience should be able to experience research first hand. SAL hired a PR agency in February 2021 in order to develop its public communications further.

Indicator 8: Gender and promotion of equality

Share of women in management positions by management level	2019	2020
Management level 1 (general management)	0%	0%
Management level 2	33%	33%
Management level 3	17%	9%
Glass Ceiling Index based on management levels*	1.63	2.67

* Calculated as the share of women among all employees/share of women in all management positions.

Source: SAL.

The following activities were implemented in 2019 and 2020 aimed at promoting gender equality:

The limited number of female graduates in technical fields of study (electrical engineering, electronics, computer science) represents a challenge when it comes to improving the share of women, which is why women are specifically targeted for positions at SAL. Measures are being implemented aimed at young people, in particular girls, in order to obtain even more applications from women in the future. These include activities such as visits from secondary school students so as to position Silicon Austria Labs (SAL) as an attractive employer. Existing department heads and researchers present their careers at such events to serve as role models for young women interested in careers in research. Another gender mainstreaming activity aims to achieve the best possible compatibility of family and career for employees. Flexible rules concerning working hours, the option to work from home and mutually agreed-upon part-time work are measures that serve this end. SAL has an internal Gender Equality Officer, who is responsible for consistently evaluating and developing gender mainstreaming measures.

3.4.3 Special events in 2020 and outlook

Many of the events scheduled for 2020 had to be cancelled due to the COVID-19 pandemic, which resulted in increased communication via social media (LinkedIn) and the SAL website. SAL was introduced to interested parties in Vorarlberg and Styria in March and September 2020 as part of the SAL Roadshow. The aim of the roadshow is to open up discussions with potential industry partners and to work together on EBS solutions. Roadshow stops in other federal states had to be postponed until 2021 due to COVID-19. A press conference was held in January 2020 on the joint research labs with Graz University of Technolo-

gy. Researchers work together there on embedded systems and electromagnetic compatibility. There are also additional joint research labs with Johannes Kepler University Linz and the University of Klagenfurt, with further press activities also planned for 2021. A new SAL brochure was produced in autumn 2020 which highlights the diverse research areas and cooperation opportunities. New videos were also created, e.g. about the cleanroom in Villach. With the project "Aeromic", SAL is now also leading the consortium in an EU-funded project for the first time. Further roadshows and numerous press activities for new and ongoing projects are planned for 2021.[183]

3.5 Ludwig Boltzmann Gesellschaft (LBG) – Austrian Association for the Promotion of Scientific Research

3.5.1 Profile and key data

Ludwig Boltzmann Gesellschaft (LBG) is currently a non-university research institution that operates 20 institutes in the priority areas of medicine as well as the humanities, social sciences and cultural studies. The foundation of the Ludwig Boltzmann Institutes (LBI) has led to innovative, interdisciplinary research being initiated on new topics. The LBG Open Innovation in Science (OIC) Center and the LBG Career Center (CC) have been built up in recent years in order to identify topics and ensure the best possible development for early stage researchers both inside and outside the academic sphere.

Different partners from science, business and civil society work together in the LBIs, with these transdisciplinary and interdisciplinary collaborations generating innovative research. Researchers work together with their partners within this structural framework and on the basis of scientific excellence in order to develop new solutions with a significant societal impact.

The Ludwig Boltzmann Gesellschaft (LBG) is currently undergoing a transformation process and aims to position itself more strongly as a funding institution in the area of medical and health research.

Key figures 2019 and 2020

	2019	2020
Total budget in €1,000*	**30,610**	**30,660**

Number of employees	2019			2020		
	f	**m**	**Total**	**f**	**m**	**Total**
Employees (= headcount)	305	231	536	310	235	545
Full time equivalents (rounded)	197	134	331	190	133	323

* for the research units

Source: Ludwig Boltzmann Gesellschaft (LBG).

183 Further information can be found in the SAL Annual Report 2020: https://silicon-austria-labs.com/downloads/

3.5.2 Development of indicators

Indicator 1: Funding, including third-party funding

	2019 in €1,000	2020 in €1,000
Total budget for the research units	**30,610**	**30,660**
of which global budget *	10,748	9,082
of which third-party funding **	19,862	21,578
of which from non-EU countries and global organisations	215	92
of which from the EU and European countries or organisations	2,173	2,122
of which national and regional organisations	17,474	19,364
of which public***	13,852	15,898
of which private	3,622	3,466

* Includes funds from the federal government based on the Ludwig Boltzmann Gesellschaft (LBG)/Federal Ministry of Education, Science and Research (BMBWF) performance agreement and the National Foundation for Research, Technology and Development (NTFE) to fund the basic costs of the institutes

** Including dedicated partner financing in the institutions

*** Includes funds from the National Foundation for Research, Technology and Development (NFTE) for the Ludwig Boltzmann Gesellschaft (LBG) Career Center and OIS Center

Source: Ludwig Boltzmann Gesellschaft (LBG).

Indicator 2: Quality assurance and evaluations

Evaluations of thematic and strategic orientation

The research and development activities of the Ludwig Boltzmann Institutes (LBI) are evaluated every three to four years as part of international peer review procedures. Independent external committees with relevant scientific and evaluation expertise are formed for this purpose, which rate peer-reviewed institutes on a nine-level scale of 1–9; categories 1–3 represent the excellence range. These interim evaluations took place for six institutes in 2019 and for five in 2020. Eight out of the eleven institutes evaluated were within the excellence segment. The results of the evaluation form the basis for the decisions of the LBG Board of Directors to continue the Institute's funding in accordance with the maturity options set out with the Federal Ministry of Education, Science and Research (BMBWF).

Institutional quality assurance measures

Implementation of the research strategy of the Ludwig Boltzmann Gesellschaft (LBG) is supported by an international scientific advisory board. Development plans and performance agreements are agreed with the Federal Ministry of Education, Science and Research (BMBWF) within the course of implementing the Research Financing Act. A Scientific Advisory Board (SAB) exists for each institute for the ongoing institutional quality assurance of the research and development activities, with each Board made up exclusively of international experts (three to five people). There were 16 SABs in place in 2019 with 72 people, with 18 SABs in 2020 with 84 people.

The Ludwig Boltzmann Gesellschaft (LBG) began to institutionalise internal quality assurance in 2020, primarily in the area of process management. A risk management system is being established to improve corporate governance, as is a company-wide compliance management system.

Indicator 3: Human resources and qualifications

Number of employees	2019			2020		
	m	f	Total	m	f	Total
Employees (= headcount)	231	305	536	235	310	545
of which at management level (institute heads, research group heads, centre heads, department heads, executive management, divisional management)	27	17	44	30	15	45
Full time equivalents (rounded)	134	197	331	133	190	323
of which at the management level	17	11	29	18	9	27

Source: Ludwig Boltzmann Gesellschaft (LBG).

Number of PhD students	2019	2020
Employees (= headcount)	178	149
of which employed at the Ludwig Boltzmann Gesellschaft	83	73
of which in a structured training programme (doctoral schools, etc.)	95	76

Source: Ludwig Boltzmann Gesellschaft (LBG).

The following staff development measures were implemented in 2019 and 2020:

Personalised career development was launched in 2017 and was expanded in 2019 to include new individual (e.g. Career Chat as Walk & Talk) and institutional (e.g. Transfer Days) offers. The focus on Leadership & Management for all (young and upcoming) managers was expanded on the one hand, from the LEAD_able Summer School (Junior Researchers and Senior Researchers) to the Leading Researchers Programme (Senior Researchers and Group Leaders) to the LAB – Leadership Academy Boltzmann (Institute Leaders). The focus on entrepreneurship was also made more professional on the other, from individual start-up consultations to the Special Programme 4 Fellowships 4 Entrepreneurs and the LBG Innovators' Road. The LBG Career Center maintains its focus on "people instead of programmes".

Indicator 4: Output, innovation and excellence

Number of scientific publications	2019	2020
Monographs and editions	48	34
Articles/papers in scientific journals, edited volumes and proceedings	590	627
of which listed in WoS or Scopus	395	426

Source: Ludwig Boltzmann Gesellschaft (LBG).

Grants in excellence programmes of the European Research Council (ERC) and Austrian Science Fund (FWF)		2019	2020
ERC	Number	1	0
	Total funding approved in €1,000	757	0
Wittgenstein Award of the Austrian Science Fund (FWF)	Number	0	0
	Total funding approved in €1,000	0	0
Start Programme of the Austrian Science Fund (FWF)	Number	0	0
	Total funding approved in €1,000	0	0

Source: Austrian Research Promotion Agency (FFG) EU Performance Monitor. Starting Grants, Consolidator Grants and Advanced Grants are counted at the ERC. The figure is based on the year in which the contract was concluded.

Indicator 5: Internationalisation

	2019	2020
Share of international co-publications among all publications	N/A	N/A
Number of newly approved participations in H2020 programmes and initiatives	7	2
Total funding approved in €1,000	2,315	528

Source: Ludwig Boltzmann Gesellschaft (LBG).

Central memberships in international umbrella organisations and networks, important internationalisation measures in 2019 and 2020:

As part of its third-party funding strategy, the Ludwig Boltzmann Gesellschaft (LBG) is a member of CROWDHELIX (crowdhelix.com), a professional platform for forming international project consortia and application initiatives under Horizon 2020 and Horizon Europe, as well as the European Association of Research Managers and Administrators – EARMA, which is also a network relevant to the EU Research Framework Programmes and related application and implementation knowledge (earma.org). The Ludwig Boltzmann Gesellschaft (LBG) is involved in the Time Machine Europe organisation (timemachine.eu) in the field of Digital Humanities and is a supporting member of Open Knowledge Maps (openknowledgemaps.org) as part of its focus on open innovation in science. The Boltzmann institutes and their researchers are involved in international scientific associations and networks in a variety of ways.

Indicator 6: Knowledge and technology transfer

	2019	2020
Share of co-publications with industry or practice partners among all publications	10.5%	11%

Patent and exploitation activities	2019	2020
Number of patent applications	1	4
of which national	0	0
of which EU/EPC	1	3
of which non-EU countries	0	1
Issued patents	0	0

Source: Ludwig Boltzmann Gesellschaft (LBG).

Indicator 7: Communication and interaction with society

The following activities and formats for communicating and transferring knowledge as well as for engaging and addressing civil society actors were implemented in 2019 and 2020:

The Ludwig Boltzmann Gesellschaft (LBG) operates its own competence centre for the involvement of civil society groups with the LBG Open Innovation in Science Center, particularly for stakeholders and users. These address social needs, help select the research fields, participate in the research activities and form part of the Advisory Board.

The following are just some of the projects implemented in 2019 and 2020:

- **LBI Digital Health and Prevention:** Co-production of home-based digital support for cardiac patients to continue their rehabilitation during restrictions involving social isolation caused by COVID-19
- **LBI Applied Diagnostics:** Empowerment of a vulnerable social group during the COVID-19 crisis
- **LBI Human Rights:** Open research behind closed doors: an assessment of the impact of COVID-19 regulations on individuals in secure custody

- **LBG Crowdsourcing** *"Reden Sie mit! Was macht COVID mit unserer psychischen Gesundheit?"* ("Have your say! What is Covid doing to our mental health?") with more than 800 contributions on the topics of education & learning, work & career, social isolation & loneliness
- **LBG Meet Science 2019:** Public exhibition on digitalisation in Ludwig Boltzmann Gesellschaft (LBG) research projects

Indicator 8: Gender and promotion of equality

Share of women in management positions by management level in %	2019	2020
Management and divisional management	50%	50%
Institute management and research group management	36.1%	29.7%
Centre management and departmental management	50%	50%
Glass Ceiling Index based on management levels*	1.47	1.71

* Calculated as the share of women among all employees/share of women in management positions. The following are considered management positions: Executive management and divisional management, institute management and research group management, centre management and departmental management.

Source: Ludwig Boltzmann Gesellschaft (LBG).

The following activities were implemented in 2019 and 2020 aimed at promoting gender equality:
The Ludwig Boltzmann Gesellschaft (LBG) received the intended certification as a "family-friendly employer" in 2020. The aim was to make existing measures visible and to develop new measures for improved compatibility of family and career as well as leisure time. The topic of gender equality is subject to particular focus with this, from gender checks in the selection of managers to gender sensitisation in the context of further training for managers. The implementation of working time models oriented around life phases also includes the valorisation of part-time work, part-time management functions for both men and women, as well as professional communication and information before, during and after parental leave. The topic of gender equality is also given special consideration within the framework of the New Work measures.

3.5.3 Special events in 2020 and outlook

With the adoption of the Research Financing Act (FoFinaG) 2020, the Ludwig Boltzmann Gesellschaft (LBG) will now negotiate performance agreements with the federal government for the first time based on a development plan; according to FoFinaG Section 10(2)(3), this will happen for the first time in 2021. There are plans in place for the Ludwig Boltzmann Gesellschaft (LBG) to focus in future on the areas of medicine and health as well as to strengthen its research funding activities. The articles of association were also changed and the Board of Directors replaced following the Ludwig Boltzmann Gesellschaft's inclusion in the Research Financing Act (FoFinaG) 2020. Six out of eleven Board members will be nominated by the Federal Ministry of Education, Science and Research (BMBWF) from now on, with Prof. Freyja Smolle-Jüttner leading the organisation as president since September 2020.

The OIS (Open Innovation in Science) Research and Enrichment Fund supported three out of eight projects submitted from Ludwig Boltzmann institutes that address the societal challenges arising from the COVID-19 crisis. In addition to this, *"Reden Sie mit! Was macht COVID mit unserer psychischen Gesundheit?"* ("Have your say! What is COVID doing to our mental health?") involved the presentation of an action paper via the third crowdsourcing initiative from over 800 contributions from citizens, together with individuals from the scientific world and practice.

The LBG Career Center (CC) is making digitalisation a new priority under the heading "Transforming Careers". The plan is to offer training on digital skills via the CC in order to convey these skills to as many (early stage) researchers as possible. The existing focus on Leadership & Management Development (for managers and pre- and post-docs) will be intensified.[184]

3.6 Austria Wirtschaftsservice Gesellschaft mbH (aws)

3.6.1 Profile and key data

The Austria Wirtschaftsservice (aws) is the federal promotional bank and central point of contact for the promotion of entrepreneurial growth and innovation. It supports companies from the initial idea through to international market success by granting low-interest loans, guarantees, grants and equity capital. The Austria Wirtschaftsservice (aws) also provides support related to the protection of intellectual property. It offers informational, advisory and other services to companies. The Austria Wirtschaftsservice (aws) has played an important role in stabilising the country's economy in 2020 by managing the federal government's COVID-19 measures.

The programme structure of aws has been simplified, with the most relevant programmes that directly address companies consolidated to 18 from 44 originally. This new structure is intended to improve the transparency for companies considerably and put customer needs at the forefront.

Key figures 2019 and 2020

aws total (including COVID-19 assistance)	2019	2020
Number of projects	4,770	81,250
Funding volume including liabilities in €1,000*	1,120,000	6,765,000
Present value in €1,000	135,000	4,089,000

Employees	2019			2020		
	f	m	Total	f	m	Total
Employees (= headcount)	147	108	255	178	134	312
Full time equivalents (rounded)	123	103	227	152	125	277

aws (not including COVID-19 assistance)	2019	2020
Number of projects	4,770	8,020
Funding volume including liabilities in €1,000*	1,120,000	1,030,000
Present value in €1,000	135,000	128,000

COVID-19 assistance**	2019	2020
COVID-19 assistance – number of projects		73,230
COVID-19 assistance – funding volume in €1,000		5,735,000

* The funding volume is calculated as commitments assumed, volume of the credit or loan issued, amount of the grant awarded or established value of a consultationservice.

** These include: the Austria Wirtschaftsservice (aws) investment premium, aws bridging guarantees, COVID-19 package for start-ups, NPO funds, fixed costs grants, comeback grants for film and TV productions

Source: Austria Wirtschaftsservice (aws).

184 Further information can be found in the Ludwig Boltzmann Gesellschaft (LBG) Annual Report 2020: https://www.lbg.ac.at/jahresberichte-wissensbilanzen

3.6.2 Development of indicators

Indicator 1: Funding, including third-party funding

Source of funds (not including COVID-19 assistance) (public funds and third-party funding, not including contributions from companies)	Funding volume	
	2019 in €1,000	2020 in €1,000
ERP Fund	600,000	600,000
Federal ministries acting as owners	206,000	182,000
BMK	6,000	6,000
BMDW	200,000	176,000
BMNT	17,000	17,000
NFTE/Austria Fund	16,000	18,000
Regional governments	9,000	7,000
EU	12,000	10,000
Other (including third-party funding awarded)*	260,000	196,000
Total	**1,120,000**	**1,030,000**

* The Other category relates entirely to funds of the Federal Ministry of Finance (BMF) (Guarantee Act)

Source: Austria Wirtschaftsservice (aws).

Indicator 2: Quality assurance and evaluations

Surveys of (potential) applicants and funded individuals

aws has been conducting a systematic electronic survey of customers since 2013. An invitation to participate in the feedback is sent out for this purpose a few weeks after funding has been approved or rejected. Semi-annual assessments of 250-300 submissions in each case allow conclusions to be drawn on the quality of the funding services provided with respect to information, consultations and procedures. In addition to assessments of standardised questions, verbal comments on experiences in the funding process also provide valuable information on potentials for improvement.

Evaluations of funding programmes, impact analyses

Evaluations represent an essential component in the implementation of support measures. An evaluation plan for the measures is drawn up with the commissioning bodies as part of the process for preparing programme documents and guidelines. Interim evaluations, or at least final evaluations, typically take place before or soon after the end of a programme. External evaluation teams generally carry out the evaluation. The multiannual programme also provides for internal evaluations. A systematic survey is conducted at three-year intervals that is representative of the monetary funding in the portfolio, while internal evaluations are also conducted on selected topics, issues and programmes.

Institutional quality assurance measures

The multiannual programme valid for the 2020–2022 period provides the conceptual framework for the systematic monitoring of customer satisfaction, service quality and effectiveness of support measures. This defines recurring internal quality assurance activities which are intended to identify organisational, technical and thematic opportunities for improvement. It also sets out specifications for an annual evaluation plan which specifies topics and programmes for internal monitoring and evaluation and therefore complements the evaluation projects commissioned externally. The introduction of the new aws pro-

gramme structure aimed at making the services on offer easily accessible to companies was an important quality assurance measure in 2020.

Indicator 3: Human resources and qualifications

Employees at aws (aws Group + ERP fund)	Headcount									
	Total		Women				Men			
	2019	2020	2019		2020		2019		2020	
	Number	Number	Number	%	Number	%	Number	%	Number	%
Support staff/student support	42	85	40	95	65	76	2	5	20	24
Experts	187	201	96	51	102	51	91	49	99	49
3. Management level (team leaders)	18	18	8	44	8	44	10	56	10	56
2. Management level (head of department, staff and service unit)	3	3	1	33	1	33	2	67	2	67
1. Management level (managing directors)	5	5	2	40	2	40	3	60	3	60
Total	**255**	**312**	**147**		**178**		**108**		**134**	

Employees at aws (aws Group + ERP fund)	Full time equivalents (rounded)									
	Total		Women				Men			
	2019	2020	2019		2020		2019		2020	
	Number	Number	Number	%	Number	%	Number	%	Number	%
Support staff/student support	35	71	33	94	55	78	2	6	16	22
Experts	167	181	80	48	86	48	86	52	94	52
3. Management level (team leaders)	18	18	8	44	8	44	10	56	10	56
2. Management level (head of department, staff and service unit)	3	3	1	33	1	33	2	67	2	67
1. Management level (managing directors)	5	5	2	40	2	40	3	60	3	60
Total	**227**	**277**	**123**		**152**		**103**		**125**	

Source: the Austria Wirtschaftsservice (aws), figures include aws, erp funds, aws fund management

The following staff development measures were implemented in 2019 and 2020:

Both professional and personal development topics were on offer in 2019. Digital skills represented one priority and a "Finance Manager course" was held.

2020 was dominated by the federal government's COVID-19 measures. The professional and rapid management for these is primarily due to the huge commitment shown by the Austria Wirtschaftsservice (aws) employees and to the digital processes at aws. Support training in 2020 focused on digital leadership and motivation of teams, digital hosting for events, digital networking, professional use of IT devices and cyber security. A large part of the training was held virtually.

Indicator 4: Output, innovation and excellence

Projects and participations (not including COVID-19 assistance)	2019		2020	
	Number	Share	Number	Share
Funded projects	4,770		8,020	
Funded companies			4,990	
of which SMEs	4,630	97%	4,880	98%
of which enterprise creation	1,570	33%	2,050	41%

Time to contract and consultations	2019	2020
Median processing time (time to contract) in days*	~32	~33
aws guarantee	16	16
aws innovation protection	11	12
Seed/pre-seed funding	39	38
Number of consultations sessions for (potential) funding applicants*	~10,200	~12,700*

* not including COVID-19 assistance

** including consultations conducted internally on COVID-19 supporting measures

Source: Austria Wirtschaftsservice (aws).

Patents and licences Support for IP exploitation (aws Innovation Protection programme)	2019	2020
Number of consultations for start-ups, SMEs and universities	301	375
Number of projects receiving monetary funding	62	85

Source: Austria Wirtschaftsservice (aws).

Indicator 5: Internationalisation

	2019	2020
	Number and volume	Number and volume
EU projects	4 projects with €1 million in the creative industries and digitalisation areas	5 projects with €2 million in the creative industries, digitalisation and circular economy areas

Source: Austria Wirtschaftsservice (aws).

Programmes with a particular focus on internationalisation	Approvals	
	Present value 2019 in €1,000	Present value 2020 in €1,000
TECTRANS/Technology internationalisation	N/A	1,900
Global Incubator Network	1,000	1,000
Guarantees (internationalisation, funding volume)	16,500	18,300
Total	**17,500**	**21,200**

Source: Austria Wirtschaftsservice (aws).

Central memberships in international umbrella organisations and networks, important internationalisation measures in 2019 and 2020:

- European Association of Guarantee Institutions (AECM)
- Network of European Financial Institutions for SMEsc (NEFI)
- European Business Angel Network (EBAN)
- European Venture Fund Investors Network (EVFIN)
- Invest Europe

Indicator 6: Knowledge and technology transfer

Funding programmes in the area of knowledge and technology transfer	2019		2020	
	Projects	Present value in €1,000	Projects	Present value in €1,000
Digital Innovation Call	15	2,500	0	0
Impulse Programme for Transferring Knowledge and Technology in Austria	3	2,700	47	960
Innovative Youth	470	52	481	52
Creative Solutions Call	10	1,200	8	1,360
aws First	12	400	13	400
Austrian Phoenix Founders Award	103	20	180	20
AI Marketplace*			94	0
Wings4innovation	7	1,400	17	1,700

* AI Marketplace is an artificial intelligence (AI) platform. It supports networking activities and provides services, but no commitments are made involving monetary funding.

Source: Austria Wirtschaftsservice (aws).

Indicator 7: Communication and interaction with society

The Austria Wirtschaftsservice (aws) has offered established formats such as Innovative Youth and "aws first" to teach STEM and start-up skills in the entrepreneurship sector.

In the environment of the academic spin-offs, priorities in the area of creating sustainable exploitation strategies and knowledge valorisation were communicated to an interested public, including World IP Day and the Phoenix competition.

Indicator 8: Gender and promotion of equality

	2019		2020	
	Number	Share	Number	Share
Women in funded projects	**1,111**	**24%**	**2,150**	**29%**
Women project leaders	873	25%	1,933	30%
Women founders	238	20%	217	21%
Women on committees and juries				
aws Supervisory Board	5	33%	7	47%
ERP Credit Committee (EKK)	2	20%	1	8%
ERP Expert Committee on Tourism Industry	3	43%	4	57%
ERP Expert Committee on Agriculture and Forestry	3	43%	4	57%
ERP Expert Committee on Transport	3	43%	3	43%
Juries of individual Austria Wirtschaftsservice (aws) programmes				
Processing, Marketing and Development	4	36%	4	36%
Digital Innovation Call	3	30%	4	36%
Film Industry Support Austria (FISA)	7	78%	5	45%
Impulse	11	52%	16	59%
Seed	6	29%	6	29%
Gründung am Land (Rural Enterprise Formation)	2	33%	2	40%
kit4Market or TECTRANS/TecInternationalisation*	5	40%	6	50%

* External expert commission

Source: Austria Wirtschaftsservice (aws).

Programmes/initiatives with gender or gender equality in their funding criteria:
Diversity in companies is included in the economic evaluations for all projects funded by the Austria Wirtschaftsservice. The Austria Wirtschaftsservice (aws) multiannual programme 2020–22 has also defined the topic of "sustainable growth" as an important field of action, with "diversity" as a priority here

3.6.3 New initiatives and instruments 2020 and outlook

New instruments and highlights 2020
One important step for aws involved implementation of a new programme structure to make the services offered more easily accessible to companies. The programmes were consolidated from 44 to 18 without limiting the services offered.

The COVID-19 federal support programmes assigned took a prominent position. A total of 81,171 funding commitments were made to support companies in this difficult phase. This represents a 17-fold increase compared with the 4,745 commitments made in 2019. The funding volume of aws has increased from around €1.1 billion in 2019 to around €6.8 billion in 2020 due to the COVID-19 assistance programmes. The spectrum of these support programmes ranged from bridging guarantees, which provided the necessary liquidity for companies right at the beginning, to special start-up support or assistance for non-profit organisations. The first effective measures were also launched for a post-crisis recovery, including in particular the investment premium (with over 70,000 applications).

Outlook for the coming years
The COVID-19 support programmes will continue to be a major task for aws in 2021. It can also be assumed at the same that there will be intense demand for the traditional innovation and growth funding portfolio, as was the case in 2020. aws supports companies in Austria in overcoming upcoming challenges through loans, guarantees, grants, equity capital, connecting services and coaching.[185]

3.7 Christian Doppler Research Association (CDG)

3.7.1 Profile and key data

The Christian Doppler Research Association (CDG) supports Christian Doppler Laboratories (CD Laboratories) at universities and non-university research institutions and Josef Ressel Centres (JR Centres) at universities of applied sciences.

Around 50% of the Association's funding programmes are financed through public funds (Federal Ministry for Digital and Economic Affairs (BMDW), National Foundation for Research, Technology and Development (NFTE) as well as the Austria Fund) and another 50% by the Association's member companies.

The funding is aimed at application-oriented basic research and strengthens both Austria as a business and science location. Due to this essential bridging function between basic research and innovation, the Christian Doppler Research Association (CDG) is internationally considered a best practice model. The

185 Further information can be found in the Austria Wirtschaftsservice (aws) Performance Report 2020: https://www.aws.at/fileadmin/user_upload/Downloads/Berichte/aws_2020_Leistungsbericht.pdf

work of CDG also produces great benefits to society, as numerous CDG research units contribute to the implementation of the UN 2030 Agenda for Sustainable Development.

Key figures for 2019 and 2020

	2019	2020
Number of CD Laboratories	91	91
Number of JR Centres	15	17
Funding budget in €1,000	17,393	19,254

Office staff	2019			2020		
	f	m	Total	f	m	Total
Employees (= headcount)	13	3	16	13	5	18
Full time equivalents (rounded)	9	4	13	9	5	14

Note: Budgetary data for 2020 corresponds to the maximum budgetary framework since accounting data are not yet available.

Source: Christian Doppler Research Association (CDG).

3.7.2 Development of indicators

Indicator 1: Funding, including third-party funding

Source of funds (public funds and third-party funding, not including contributions from companies)	2019 in €1,000	2020 in €1,000
Federal funding	16,881	19,254
of which basic budget (Federal Ministry for Digital and Economic Affairs (BMDW))	10,313	11,612
of which from the National Foundation for Research, Technology and Development (NFTE) and the Austria Fund	6,568	7,642
Funds from the regional governments		
EU funds		
Other funds (including third-party funding awarded)	512	132
Total funding budget	**17,393**	**19,387**

Note: Budgetary data for 2020 corresponds to the maximum budgetary framework since accounting data are not yet available.

Source: Christian Doppler Research Association (CDG).

Indicator 2: Quality assurance and evaluations

Surveys of (potential) applicants and funded individuals

Surveys of the funded CD Laboratories/JR Centres are conducted roughly every five years in the framework of the programme evaluations. The last programme evaluation took place in 2016.[186]

Evaluations of funding programmes, impact analyses

An analysis carried out in 2020 (SciVal based on Scopus (48 million publications) and the data from five of the world's largest patent offices) confirm that the publications from the Christian Doppler Research Association (CDG) research units have the highest values internationally in terms of patent relevance (out of

186 See Alt et al. (2017).

1,000 publications, 155 are cited in patents) and in the number of joint publications by science and industry. Around 40% of the publications generated in the research units are published in the top 10% of journals in the respective discipline.

The Scientific Board of the Christian Doppler Research Association (CDG) ensures scientific quality based on a multi-stage, international peer review process as part of its funding decision and interim evaluations during the term of the CDG research units.

Institutional quality assurance measures

The Christian Doppler Research Association (CDG) has an Internal Control System (ICS) for institutional quality assurance that covers the entire business activity of the CDG and that figures in the Association's organisational manual. CDG's data protection manual also includes the necessary guidelines and instructions for compliance with the GDPR and national data protection regulations. This ensures the security and cost-effectiveness of all operational processes and compliance with the prescribed business guidelines and statutory regulations.

CDG's business activities are also regularly audited by independent external institutions. CDG is a member of the Austrian Agency for Research Integrity (OeAWI) and the Austrian Platform for Research and Technology Policy Evaluation (fteval).

Indicator 3: Human resources and qualifications

Office staff	Headcount									
	Total		Women				Men			
	2019	2020	2019		2020		2019		2020	
	Number	Number	Number	%	Number	%	Number	%	Number	%
Support staff	4	5	4	100	4	80	0	0	1	20
Experts	9	10	7	78	7	70	2	22	3	30
Management level	3	3	2	67	2	67	1	33	1	33
Total	16	18	13	81	13	72	3	19	5	28

Office staff	Full time equivalents (rounded)									
	Total		Women				Men			
	2019	2020	2019		2020		2019		2020	
	Number	Number	Number	%	Number	%	Number	%	Number	%
Support staff	3	3	2	80	3	100	1	20	0	0
Experts	7	8	5	72	4	51	2	28	4	49
Management level	3	3	2	66	2	66	1	34	1	34
Total	**13**	**14**	**9**	**73**	**9**	**64**	**4**	**27**	**5**	**36**

Source: Christian Doppler Research Association (CDG).

The following staff development measures were implemented in 2019 and 2020:

Staff development at the Christian Doppler Research Association (CDG) is subject to a continuous development process, with training programmes that are important for the development of the organisation (e.g. digitalisation, GDPR), defined for the respective function and adapted to the individual.

Indicator 4: Output, innovation and excellence

Participations	2019	2020
Participating companies	173	189
of which SMEs	38	38
Universities	15	14
Non-university research institutes	2	1
Universities of applied sciences	7	10
Foreign universities	1	0
Foreign non-university research institutes	1	0

Source: Christian Doppler Research Association (CDG).

Time to contract and consultations	2019	2020
Time to contract for applications without revisions in days	153	197
Time to contract for applications with revisions in days	317	349
Number of consultations for (potential) funding applicants	36	31

Source: Christian Doppler Research Association (CDG).

Funded individuals	2019	2020
Total	**1,168**	**1,161**
of which women	439	428
of which men	729	733

Source: Christian Doppler Research Association (CDG).

Number of scientific publications from the funded projects	2019	2020
Monographs and editions	11	1
Articles/papers in scientific journals, edited volumes and proceedings	691	647
Total	**702**	**648**

Source: Christian Doppler Research Association (CDG).

Patents and records of invention	2019	2020
Patents applied for	N/A	N/A
Granted patents	12	17
Records of invention submitted to the university/university of applied sciences/ research institution	26	28

Source: Christian Doppler Research Association (CDG).

Indicator 5: Internationalisation

	2019		2020	
	Number	In %	Number	In %
International CD Laboratories	2	1.9	0	0
Participating companies located abroad	52	30	55	29

Source: Christian Doppler Research Association (CDG).

Possibilities for international cooperation

CD Laboratories can also be established at foreign universities/research institutions. In addition, CD Laboratories offer the option of operating one or more of their modules at a foreign location. A domestic CD Laboratory may also engage foreign company partners.

Indicator 6: Knowledge and technology transfer

	2019	2020
Total funding volume in €1,000	**33,057**	**36,824**
of which cooperation between science/industry	33,057	36,824
Share in %	100%	100%

Note: Budgetary data for 2020 corresponds to the maximum budgetary framework since accounting data are not yet available.

Source: Christian Doppler Research Association (CDG).

Indicator 7: Communication and interaction with society

The following activities and formats for communicating and transferring knowledge as well as for engaging and addressing civil society actors were implemented in 2019 and 2020:

- The opening of CD Laboratories and JR Centres was used for networking and public relations activities. This process takes place in close collaboration with the PR departments of the respective universities or universities of applied sciences.
- Success stories from the perspective of the corporate partners are developed and disseminated in close cooperation with the respective companies.
- The research topics of the Christian Doppler Research Association (CDG) are covered in around 250 media reports overall each year.
- The website underwent a facelift in 2020 and was adapted to new viewing habits. LinkedIn has also been in use since 2020.
- In 2020, the 25th anniversary of the CDG was celebrated, and the funding model and its advantages for innovation and location were communicated to mark the occasion. An anniversary publication was designed and distributed. The CDG Prize for Research and Innovation was awarded for the first time, reaching the attention of a wide audience.
- The CDG is a member of the Open Science Association and Uni.PR.
- Participation in Girls' Day was also planned as an offer to the general public for 2020, but unfortunately this had to be cancelled due to COVID-19.

Indicator 8: Gender and promotion of equality

	2019		2020	
	Number	Share	Number	Share
Women in funded projects				
Women in CD Laboratories and JR Centres	439	38%	428	37%
Female heads of CD Laboratories and JR Centres	17	15%	17	15%
Evaluation committees and reviews				
Women on permanent evaluation committees and advisory councils	12	26%	13	30%
Reviews conducted by women	9	9%	10	12%

Source: Christian Doppler Research Association (CDG).

3.7.3 New initiatives and instruments for 2020 and outlook for the coming years

New instruments and highlights 2020

The introduction of new specific programme elements made it possible to strengthen the promotion of early stage researchers in 2020, particularly in the STEM area, and the more general objective beyond that of promoting women in research (e.g. internships, Girls' Day, endowed professorships).

Around 20 research units of the Christian Doppler Research Association (CDG) overall from the fields of digitalisation and life sciences were busy working on topics in 2020 aimed at overcoming the COVID-19 crisis, or at avoiding similar crises in the future or making these more manageable.

Outlook for the coming years

Due to the principle of the open approach to topics for research at Christian Doppler Laboratories (and Josef Ressel Centres), demand can be expected to continue to be strongly oriented towards issues relevant to business, including in particular the fields of life sciences, medicine and digitalisation, as well as traditional areas such as materials sciences and mathematical modelling.

Despite the welcome enshrinement of the Christian Doppler Research Association (CDG) for the first time in law, the loss of funding from the National Foundation for Research Technology and Development and the Austria Fund threatens to create a major financing gap. The impact of the COVID-19 crisis on the instrument of the CD Laboratories and JR Centres cannot yet be predicted in full. Overall, the CDG model continues to enjoy a high level of popularity among both the scientific community and industry, which enables a consistent number of research units to be forecast, subject to the financing still to be clarified for the funding shortfall.[187]

3.8 Austrian Science Fund (FWF)

3.8.1 Profile and key figures

The Austrian Science Fund (FWF) is Austria's central institution for the promotion of basic research as well as artistic-scientific research. It supports outstanding research projects in accordance with international quality standards, as well as excellent researchers who are dedicated to the acquisition, expansion and consolidation of scientific knowledge.

Its funding activities in all disciplines focus on cutting edge scientific research, and the quality of this is ensured by international peer review. The Austrian Science Fund's objectives are to strengthen Austria's scientific and economic performance in international comparisons and to increase the country's attractiveness as a location for research and science. In this context, the FWF seeks to increase the quantity and quality of research potential according to the principle of "education through research" and promotes dialogue between science and cultural, economic and social life.

187 Further facts and figures can be found at https://www.cdg.ac.at/en/about-us/facts-and-figures-on-the-christian-doppler-model

Key figures 2019 and 2020

	2019	2020
Funding budget in €1,000	**251,743**	**255,479**
of which new or extended projects (amount of new approvals)	237,432	243,618
Number of approved research projects	707	708
Number of individuals funded via funds from Austrian Science Fund	4,176	4,343

Office staff	2019			2020		
	f	m	Total	f	m	Total
Employees (= headcount)	82	39	121	91	36	127
Full time equivalents (rounded)	67	35	102	76	33	108

Source: Austrian Science Fund (FWF).

3.8.2 Development of indicators

Indicator 1: Funding, including third-party funding

Source of funds	2019 in €1,000	2020 in €1,000
Federal funding	247,495	253,503
of which basic budget (Federal Ministry of Education, Science and Research (BMBWF))	221,349	222,832
of which from the National Foundation for Research, Technology and Development (NFTE) and the Austria Fund	26,136	30,671
of which Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK)	9	-
Regional governments	3,209	923
EU	4	6
Other (including third-party funding awarded)	908	1,046
Total	**251,615**	**255,479**

Source: Austrian Science Fund (FWF).

Indicator 2: Quality assurance and evaluations

Surveys of (potential) applicants and funded individuals

The scientific community is surveyed on various aspects of the Austrian Science Fund (FWF) procedure, funding programmes and research agendas every ten years. These surveys are carried out based on calls for proposals by international institutions. The last survey was conducted in 2013 by the (former) Institute for Research Information and Quality Assurance (Berlin) (now the German Centre for Higher Education Research and Science Studies – DZHW).[188]

Surveys among Principal Investigators are conducted on an on-going basis as part of the final project report aimed at evaluating various aspects of application submission, project management and support and supervision from FWF.[189]

188 See Neufeld (2014).

189 https://www.fwf.ac.at/en/research-funding/decision-making-procedure-evaluation/final-report-survey

Evaluations of funding programmes, impact analyses

Evaluations of funding programmes are assigned by default to independent and proven experts based on transparent selection procedures and defined criteria. They follow the Austrian Science Fund (FWF) rules on the quality and transparency of evaluations, studies and research policy services as well as the standards of the Austrian Platform for Research and Technology Policy Evaluation (fteval) for this process. Evaluations are scheduled at appropriate intervals after the programmes have started and for their duration and are freely accessible following publication.

The programme evaluations represent the central impact analyses. In addition to these, higher-level comprehensive impact analyses are carried out by international institutions approximately every ten years.

Institutional quality assurance measures

The Austrian Science Fund (FWF) has a systematic internal quality assurance system (IQS) enshrined within the institution. This defines the responsibilities and authorities of FWF staff and ensures the resources required, and a recurrent management review is also implemented on the suitability, adequacy and effectiveness of the international quality assurance system.

The internal quality assurance system of FWF is designed as a combination of elements involving risk management, process management, internal control system, compliance management and internal auditing with the goal of managing and monitoring the company. The expansion and further development of this overarching holistic system takes place in compliance with the requirements of the Research and Technology Promotion Act (FTFG) and the Federal Public Corporate Governance Code.

Indicator 3: Human resources and qualifications

Office staff	Headcount									
	Total		Women				Men			
	2019	2020	2019		2020		2019		2020	
	Number	Number	Number	%	Number	%	Number	%	Number	%
Support staff	64	67	48	75	53	79	16	25	14	21
Experts	45	47	28	62	31	66	17	38	16	34
Management level	12	13	6	50	7	54	6	50	6	46
Total	**121**	**127**	**82**	**68**	**91**	**72**	**39**	**32**	**36**	**28**

Office staff	Full time equivalents (rounded)									
	Total		Women				Men			
	2019	2020	2019		2020		2019		2020	
	Number	Number	Number	%	Number	%	Number	%	Number	%
Support staff	48	53	34	71	42	79	14	29	11	21
Experts	42	42	27	63	27	63	15	37	16	37
Management level	12	13	6	50	7	54	6	50	6	46
Total	**102**	**108**	**67**	**65**	**76**	**70**	**35**	**35**	**33**	**30**

Source: Austrian Science Fund (FWF).

The following staff development measures were implemented in 2019 and 2020:

As an expert organisation and because of its funding activities, the Austrian Science Fund (FWF) is very aware of the importance of having well-qualified employees. . In order to ensure that the FWF's quality standards, which are supported by its employees, are lived and further developed, the FWF invests in training and continuing education for its staff. An annual budget is available to the departments for this purpose.

Indicator 4: Output, innovation and excellence

Funded projects (new approvals)	2019		2020	
	Number	€1,000	Number	€1,000
Total	**707**	**237,432**	**708**	**243,619**
of which universities*	584	196,389	599	209,224
of which universities of applied sciences	1	223	11	3,618
of which non-university research facilities**	122	40,820	98	30,777

* including private universities; ** including research facilities abroad.

Source: Austrian Science Fund (FWF).

Funded individuals*	2019	2020
Total	773	819
of which women	273	280
of which men	499	539
of which third gender	1	-

* including Principal Investigators as well as researchers (in the Research Groups, Young Independent Researcher Group and ConnectingMinds Workshops programmes) and faculty members (in the Doctoral Programmes and Doc.Funds)

Source: Austrian Science Fund (FWF).

Processing time (time to contract)* and consulting sessions	2019	2020
Time to contract programme for stand-alone projects in days	164	157
Time to contract for international mobility (Schrödinger and Meitner programmes) in days	124	126

Number of consultations for (potential) funding applicants	2019	2020
Total	**40**	**45**
of which coaching workshops	17	4
of which information events	13	23
of which Proposers' Days	10	18

* Period between receipt of the application by the Austrian Science Fund (FWF) and the decision on funding. It generally only takes a few days until the funding agreement is issued.

Source: Austrian Science Fund (FWF).

Scientific publications from the funded projects*	2019	2020
Monographs and editions	61	52
Articles/papers in scientific journals, edited volumes and proceedings	7,265	4,757
of which listed in WoS or Scopus	N/A	N/A
Total	**7,326**	**4,809**

* Information from final project reports received in the respective year.

Source: Austrian Science Fund (FWF).

A significant decrease in the number of publications is evident in 2020 as compared with 2019. This decrease is due to 15% fewer final project reports received due to slightly weaker approval years in the mid-2010s and increased postponements for final report submissions from 2020 to later dates (COVID-19 effect). There are fewer project reports available, particularly in the programmes with the highest publication numbers (doctoral programmes, specific research areas, national research networks) and in programmes that involve many projects (stand-alone projects, international joint projects), and this has a massive impact on the total number of publications. It should be noted that the method (recording the number of publications via final project reports) involves looking to the past, as the final reports list publications that were produced in previous years during the lifetime of the project. The publication activity related to the publication year for the publications is relatively consistent according to databases such as Dimensions.

Patents and records of invention*	2019	2020
Patents applied for	N/A	N/A
Granted patents	1	9
Records of invention submitted to the university/university of applied sciences/ research institution	N/A	N/A

* Information from final project reports received in the respective year.

Source: Austrian Science Fund (FWF).

Indicator 5: Internationalisation

	2019		2020	
	Number	In %	Number	In %
Projects with international partners	1,782	75	1,871	75
Individuals involved located abroad	7,714	54	8,111	54

Source: Austrian Science Fund (FWF).

Bilateral and multilateral agreements with foreign research funding institutions

(these are existing agreements; it does not mean that there is an option for submitting projects or that projects receive funding every year)

		2019	2020
Within Europe	Multilateral	• 14 ERA net participations • Cooperation in the DACH region (Germany, Austria, Switzerland) • CEUS – Central European Science Partnership (Austria, Poland, Slovenia, Czechia)	• 10 ERA net participations • Cooperation in the DACH region (Germany, Austria, Switzerland) • CEUS – Central European Science Partnership (Austria, Poland, Slovenia, Czechia)
	Bilateral	• Belgium / Flanders • Germany • France • Italy / South Tyrol • Luxembourg • Poland • Russia • Switzerland • Slovenia • Czechia • Hungary	• Belgium / Flanders • Germany • France • Italy / South Tyrol • Luxembourg • Poland • Russia • Switzerland • Slovenia • Czechia • Hungary
Beyond Europe	Multilateral	• —	• Belmont Forum
	Bilateral	• Argentina • China • India • Israel • Japan • South Korea • Taiwan • USA	• China • India • Israel • Japan • South Korea • Taiwan • USA

Source: Austrian Science Fund (FWF).

Central memberships in international umbrella organisations and networks, important internationalisation measures in 2019 and 2020:

The Austrian Science Fund (FWF) is involved in a number of international networks and activities and plays a leading role in some of these. The following should be mentioned first and foremost:

- *Science Europe* (scienceeurope.org)
  - High level policy network on cross-border collaboration
  - Task Force on Multilateral Lead Agency Procedure
  - Working Group on Open Access
  - Working Group on Research Data
  - Task Force on Research Assessment
- Global Research Council (globalresearchcouncil.org)
- ERC Programme Committee (national expert)
- Twinning Project Shota Rustaveli National Science Foundation of Georgia
- Research on Research Institute (researchonresearch.org)
- Cooperation with ETH Zurich on analysis of the Austrian Science Fund (FWF) decision-making process
- GRANteD (granted-project.eu)
- Research Integrity (sops4ri.eu)
- cOAlition S (coalition-s.org)
- OA2020 (oa2020.org)

Indicator 6: Knowledge and technology transfer

Funding programmes in the area of knowledge and technology transfer	2019		2020	
	Projects	Total funding approved in €1,000	Projects	Total funding approved in €1,000
Clinical Research programme (KLIF)*	9	2,746	16	5,506
Quantum Research and Technology programme (QFTE)	0	0	2	604
ASMET Research Award	0	0	1	369
Weiss Prize	1	382	1	296
Netidee SCIENCE	1	218	1	396
Projects of the Herzfelder Foundation	2	758	1	115

	2019		2020	
	Approvals in €1,000	Proportion of all approvals (%)	Approvals in €1,000	Proportion of all approvals (%)
All funding from the cooperation between science/industry	4,103	1.7	7,287	3.0

* Commercial companies are not permitted to have a direct interest in the results of the projects. Co-funders are not permitted to act as sponsors for the purposes of the ICH GCP regulations.

Source: Austrian Science Fund (FWF).

Indicator 7: Communication and interaction with society

The following activities and formats for communicating and transferring knowledge as well as for engaging and addressing civil society actors were implemented in 2019 and 2020:

The Science Communication Programme supports communication initiatives that communicate the content of Austrian Science Fund projects to an interested public as well as the value to society of science and research. The "Top Citizen Science" programme promotes projects that actively involve citizens and individuals with specialist expertise in ongoing research. Projects in the new "#ConnectingMinds" programme involve players from civil society from the outset in order to develop the research questions and project objectives on a collaborative basis. Experiences and perspectives of practitioners (e.g. members of NPO/c and health/educational institutions) help to illustrate the social relevance and knowledge gained from the research projects.

The interactive *"Am Puls"* ("On the Pulse") events bring science to an audience and invite them to join in the discussion: researchers funded by the Austrian Science Fund discuss their research topics together with renowned experts and communicate the importance of science to society. The methodologically diverse online magazine "Scilog" makes science visible through background reports, interviews, podcasts and videos by reporting on current topics from basic research and portraying the people behind these.

Indicator 8: Gender and promotion of equality

	2019		2020	
	Number	Share in %	Number	Share in %
Women in funded projects				
Women project employees	1,935	46	2,034	47
Women Principal Investigators	247	35	232	33
Women on committees	70	40	93	44
Executive Board	3	60	3	60
Supervisory Board	7	70	8	80
Assembly of Delegates	23	39	22	38
FWF Board	19	34	25	39
International Strategic Advisory Board	4	50	4	50
Women on Programme Juries				
START-/Wittgenstein Jury	4	33	5	42
PEEK (Programme for Arts-based Research) Board	3	50	3	50
WissKomm Jury (Science Communication Programme Jury)	3	50	3	50
doc.funds programme Jury	4	36	7	50
Young Independent Researcher Group Jury	-	-	4	44
1000 Ideas programme Jury	-	-	9	45
Reviews by women	1,211	26	1,251	26

Source: Austrian Science Fund (FWF).

Programmes/initiatives with gender or gender equality in their funding criteria:
Gender and gender-related aspects must be included in the project description for all programmes except in a few cases (excerpt from the application guidelines): "All potential sex and gender-related components in the planned project: How are these integrated into the research approach?" These topics must be briefly addressed in a separate section of the project description, even if the applicants believe that the project does not contain any components of this type. There are a few exceptions, including the Wittgenstein Award, as there is no need to submit a project description here and nominations are instead submitted by third parties.

3.8.3 New initiatives and instruments 2020 and outlook

Founded in 2019, the non-profit **alpha+ Foundation** supports researchers through private funding and boosts the international exchange of knowledge. Researchers from the Erwin Schrödinger Programme received the Foundation's *"Rückenwind"* Funding Bonus for the first time in 2020.

The **1000 Ideas Programme** also awarded funding for the first time in 2020 for particularly original and courageous research ideas that address forward-looking and highly relevant topics, even if this requires the "courage to fail". A total of 24 projects received funding out of around 400 proposals in the first call. The Austrian Science Fund also broke new ground in the review of project applications: the applications were evaluated anonymously and partly randomised by an international jury with broad-based expertise.

A higher funding budget, longer project durations and year-round proposals – **ESPRIT** (Early Stage Programme: Research, Innovation, Training) will offer highly qualified postdocs an improved range of opportunities as of April 2021 in order to further their scientific careers. The existing "Firnberg" and "Meitner" programmes are being merged into this new programme line. Although ESPRIT is open to all genders, the

programme design places great emphasis on promoting women in their careers: Different measures are implemented to ensure gender equality at all stages of the programme, from the application to decision-making through to project implementation.

The increase in the Austrian Science Fund's budget to €270 million per year brings planning security for several years and boosts the international competitiveness of Austria as a science location. This also includes the decision to launch an **excellence initiative** in accordance with international standards.[190]

3.9 OeAD-GmbH – Agency for Education and Internationalisation

3.9.1 Profile and key data

OeAD-GmbH became Austria's Agency for Education and Internationalisation on 1 January 2021. The new name is explained by the expansion of its scope into the school and educational sectors. In addition to its core mission of supporting the internationalisation of educational institutions through mobility and project funding, OeAD also supports and initiates innovations in education, teaching and research through targeted interventions.

OeAD's head office is located in Vienna, there are also seven regional offices at Austrian higher education sites, five cooperation offices in Eastern and South Eastern Europe with an educational focus, as well as cooperation officesin Lviv and Shanghai and an OeAD Infopoint in Baku focusing on science. OeAD-Wohnraumverwaltungs-GmbH is a subsidiary of OeAD that provides accommodation in student dormitories and OeAD guest houses for approximately 12,000 international students, researchers and professors each year.

Key figures for 2019 and 2020

OeAD overall	2019	2020
Funding budget, disbursements in €1,000	54,688	50,548

Office staff	2019			2020		
	f	m	Total	f	m	Total
Employees (= headcount)	150	67	217	194	75	269
Full time equivalents (rounded)	113	51	164	154	59	213

Source: OeAD-GmbH.

The decrease in disbursements from the funding budget can be explained by the fact that international mobility and cooperation were affected significantly in 2020 by the COVID-19 pandemic and were only possible under difficult conditions. Numerous international stays had to be interrupted, postponed or cancelled and project activities were given a new time frame.

The increase in the number of staff is due to the expansion of OeAD's range of tasks, in particular through the integration of the *"KulturKontakt Austria"* association with the areas of cultural mediation for schools and educational cooperation with countries in Central and Eastern Europe.

190 For more information, see the Austrian Science Fund (FWF) Annual Report 2020: https://www.fwf.ac.at/fileadmin/files/Dokumente/Ueber_den_FWF/Publikationen/FWF-Jahresberichte/fwf-jahresbericht-2020.pdf

3.9.2 Indicators for 2019 and 2020

The Federal Ministry of Education, Science and Research (BMBWF) federal funds involve those research-related activities that are financed from budget chapter 31 "Global Budget 31.03" of the federal budget. This primarily includes incoming and outgoing scholarship programmes, initiatives with our neighbouring countries Hungary, Czechia and Slovakia, the lectureship programme, scientific/technical cooperation, international research cooperation and measures for internationalisation, the support of university networks with Southeast Asia, China and African countries as well as the "Sparkling Science" programme.

Indicator 1: Funding, including third-party funding

	2019 in €1,000	2020 in €1,000
Total research-related funding (all income relevant to research from federal funds and third-party funding)	**15,380**	**11,774**
of which Federal Ministry of Education, Science and Research federal funds (approvals)	12,361	10,374
of which other federal funds (Austr. Development Agency; disbursements)	2,156	800
of which regional governments		
of which from the EU		
of which others (third-party funding, e.g. Indonesia, Pakistan; disbursements)	863	600

Source: OeAD-GmbH.

The decline in funding in the area of federal funding in 2020 is due to the discontinuation of the major Sparkling Science and "APPEAR" programmes. Both programmes will start a new programme phase in 2021.

Indicator 2: Quality assurance and evaluations

Surveys of (potential) applicants and funded individuals

Scholarship holders are surveyed regularly on the progress of their study or research activities and on OeAD-GmbH services. Among other things, these surveys provide information on levels of satisfaction with the way that OeAD is implementing the programme.

Evaluations of funding programmes, impact analyses

The evaluation of the Children's and Youth Universities 2015–2019 funding programme was carried out in 2020.

Institutional quality assurance measures

The quality management system at OeAD-GmbH has been certified according to ISO 9001 for 15 years. Compliance with the requirements of the quality management system is monitored through annual internal and external audits.

Indicator 3: Human resources and qualifications

The headcount stated refers only to those research-related activities that are financed from budget chapter 31 of the "global budget 31.03" of the federal budget.

Employees	Headcount									
	Total		Women				Men			
	2019	2020	2019		2020		2019		2020	
	Number	Number	Number	%	Number	%	Number	%	Number	%
Support staff	3	4	3	100	4	100	0	0	0	0
Experts	21	28	16	76	23	82	5	24	5	18
Management level	3	3	2	67	2	67	1	33	1	33
Total	**27**	**35**	**21**		**29**		**6**		**6**	

Employees	Full time equivalents (rounded)									
	Total		Women				Men			
	2019	2020	2019		2020		2019		2020	
	Number	Number	Number	%	Number	%	Number	%	Number	%
Support staff	3	3	3	100	3	100	0	0	0	0
Experts	17	20	12	70	16	82	5	30	4	18
Management level	3	2	2	80	2	87	1	20	0	13
Total	**23**	**25**	**17**		**21**		**6**		**4**	

Source: OeAD-GmbH.

The increase in the staff reported is due to the fact that those staff members who work in the area of communication and interaction with society as well as science outreach (see indicator 7) were also included in the presentation for the first time in 2020.

The majority of employees worked from home in 2020 due to the COVID-19 pandemic. In a survey conducted in June 2020, 90% of the participants rated their experience with teleworking as very good or good. Likewise, 90% of the employees can imagine doing telework more often in the future.

Employees at OeAD have access to an extensive range of training courses.

Indicator 4: Output, innovation and excellence

Only those projects and individuals are shown here that are financed from budget chapter 31 of the "Global Budget 31.03" of the federal budget.

	2019		2020	
	Number	Share	Number	Share
Funded projects	634		629	
of which at universities	468	73.8%	449	71.4%
of which at universities of applied sciences	24	3.8%	21	3.3%
of which at other institutions	142	22.4%	159	25.3%
Funded individuals	2,896		1,298	
of which men	1,462	50.5%	558	43%
of which women	1,434	49.5%	740	57%

Note: The significant decrease in the number of persons supported can be explained by the fact that international mobility was severely affected by the COVID-19 pandemic in 2020 and was only possible under more difficult conditions. Numerous international stays had to be interrupted, postponed or cancelled. The fall is particularly striking for short-term study and research stays.

Source: OeAD-GmbH.

Processing time* (time to contract) and consultations	2019	2020
Processing time (time to contract) in days	90 to 180	90 to 180
Number of consultations for (potential) funding applicants	N/A	N/A

* The average processing time is defined from the end of the application deadline to the signing of the contract or the issuing of the scholarship.

Source: OeAD-GmbH.

Indicator 5: Internationalisation

All programmes financed from budget chapter 31 of the "Global Budget 31.03" of the federal budget are per se internationalisation programmes in the field of science and research. This applies to both the mobility programmes (1,298 mobile individuals who studied or conducted research in another country in 2020) and 629 cooperation projects, with international cooperation the main focus in each of these.

OeAD is involved in the European EURAXESS initiative financed from Horizon 2020 and is a member of the Academic Cooperation Association, the European umbrella organisation for education and science agencies.

Indicator 6: Knowledge and technology transfer

OeAD-GmbH's scholarship and cooperation programmes involve a knowledge and technology transfer, even though this is not stated as an explicit funding programme objective for many of the programmes.

Indicator 7: Communication and interaction with society

Various measures are implemented in the OeAD's Public Science department aimed at promoting science communication in schools and establishing expertise in the field of Citizen Science. The objective is to create opportunities for cooperation between research institutions and schools, as well as between interested citizens.

OeAD organised various networking opportunities and exchange forums aimed at expanding the citizen science research approach in the scientific community, including e.g. regular meetings of citizen science and young science contact persons at research institutions or topic-based events. The low-threshold initiative of the Young Science Ambassadors was one of the events that contributed to science education in schools. A total of 121 visits by researchers to schools took place in 2019, with only 24 real visits and 11 digital visits in 2020 due to COVID-19. The Sparkling Science research funding programme with 41 out of a total of 299 funded projects completed in 2019 and 2020, and the "Citizen Science Award" research competition, which has been held annually since 2015 (over 2,100 people participated in 2019), also contributed significantly to science communication.

Indicator 8: Gender and promotion of equality

Women on evaluation committees and as reviewer	2019		2020	
	Number	Share	Number	Share
Supervisory Board	5	42%	5	42%
Strategy Advisory Board	3	38%	3	38%
Reviews conducted by women (for written reviews)	N/A	-	N/A	-

Source: OeAD-GmbH.

OeAD's evaluation committees for scholarships and cooperation projects are assembled on an ad hoc programme-specific basis. and efforts are made to ensure a balanced percentage of women and men.

3.9.3 New initiatives and instruments 2020 and outlook

The scholarships, campaigns, support for university networks and the development research programme funded by the Federal Ministry of Education, Science and Research could only be continued in 2020 with the restrictions on cross-border mobility caused by the COVID-19 pandemic. In coordination with the Federal Ministry of Education, Science and Research, OeAD facilitated a very flexible approach regarding the interruption, postponement or extension of research stays and projects. The processing of special support measures for COVID-19 related additional costs in the event of cancellations or rejections resulted in a significant additional administrative burden. Virtual participation in study projects and courses was also encouraged to some extent.

The Austrian-African "AfricaUniNet" Research Network, which was founded in January 2020, held its first round of calls for proposals: A total of 20 Austrian-African research projects will receive funding of around €500,000. The projects selected are due to begin in 2021.

Sparkling Science and APPEAR, a science and research cooperation programme with developing countries, will represent a continuation of major and established programmes at the programme level.[191]

3.10 Austrian Research Promotion Agency (FFG)

3.10.1 Profile and key data

The Austrian Research Promotion Agency (FFG) considers itself as the central agency for the promotion of research, development and innovation in Austria. It is the implementation partner of the federal government in its strategies to strengthen Austria's position as a research and innovation location in global competition and in coordinating the specific strategies needed to achieve this, e.g. in the context of digitalisation and climate protection.

The FFG offers a highly diverse programme portfolio with this core function. In addition to funding RTI projects and structures, the FFG also addresses the development of human potential.

In addition to implementing the research and innovation programmes for the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK), Federal Ministry for Digital and Economic Affairs (BMDW), Federal Ministry of Education, Science and Research (BMBWF), the Austrian Research Promotion Agency (FFG) is also partners with:

- the Climate and Energy Fund (KLIEN)
- the majority of the Austrian regional governments
- the Federal Ministry of Agriculture, Regions and Tourism (BMLRT)

Lastly, the Austrian Research Promotion Agency (FFG) supports companies and research institutions in participating in international research and technology partnerships and reviews applications for the research premium.

191 Further information can be found in the OeAD Annual Report 2020 https://oead.at/fileadmin/Dokumente/oead.at/KIM/Downloadcenter/OeAD/OeAD_Jahresberichte/OeAD_Jahresbericht_2019_FINAL.pdf

Key figures for 2019 and 2020

Austrian Research Promotion Agency (FFG) total not including broadband	2019	2020
Number of projects	3,545	3,917
Participations	5,910	5,748
Players	3,536	3,479
Funding including liabilities in €1,000	618,301	572,411
Present value in €1,000	493,799	461,948
Disbursements in €1,000	523,822	540,318

Employees	2019			2020		
Office staff	f	m	Total	f	m	Total
Employees (= headcount)	218	138	356	215	142	357
Full time equivalents (rounded)	186	131	318	188	135	323

Broadband	2019	2020
Number of projects	308	318
Present value in €1,000	155,257	283,192
Disbursements in €1,000	85,539	122,599

Source: Austrian Research Promotion Agency (FFG).

3.10.2 Indicators for 2019 and 2020

Indicator 1: Funding, including third-party funding

Source of funds (not including commissioned projects or broadband) (public funds and third-party funding, not including contributions from companies)	Present values within the scope of contractual commitments in €1,000	
	2019	2020
Federal ministries acting as owners	383,889	344,873
BMK	323,229	315,293
BMDW	60,660	29,580
BMBWF	3,963	549
BMLRT	-	14,723
BMNT	137	-
NFTE/Austria Fund	46,742	35,081
Climate and Energy Fund (KLIEN)	32,337	42,054
Regional governments	11,154	8,522
EU	15,576	11,699
Other	-	6,018
Total	**493,799**	**461,948**

Source: Austrian Research Promotion Agency (FFG).

Indicator 2: Quality assurance and evaluations

Surveys of (potential) applicants and funded individuals

Ongoing surveys of applicants and funding recipients:

- Annual telephone survey on overall satisfaction with all Austrian Research Promotion Agency (FFG) services (processes, familiarity with services, the Agency's support with services, new topics such as support in the COVID-19 crisis or sustainability, etc.);
- Online survey on satisfaction with the project support or application close to the time of submission (satisfaction with the application, effort, comprehensibility of requirements, etc.) and analysis of the results within the course of process management;
- Focus groups during the project lifetime in order to involve customers properly, particularly when it comes to further development of applications or processing methods;
- The opportunity to make suggestions at any time.[192]

Evaluations of funding programmes, impact analyses

The Austrian Research Promotion Agency (FFG) funding is subject to regular evaluations in accordance with the evaluation plan defined in the relevant programme document. The clients are the respective programme owners. The FFG only commissions evaluations in its own funding areas (e.g. in the case of funding offers financed by the National Foundation for Research, Technology and Development (NFTE) or the Austria Fund).

The FFG commissions an annual survey of the recipients of funding (companies and research institutions) regarding the impact of the funded projects, with each survey commissioned four years after the relevant funded RTI projects have been completed. The survey covers funded RTI projects from the various programmes and areas (General Programmes, Thematic Programmes, Structural Programmes and Aeronautics and Space Agency) and is therefore not programme-specific. The results are published on a regular basis[193].

Evaluation and quality assurance concept; institutional quality assurance measures

The Austrian Research Promotion Agency (FFG) works with a process management system that provides for essential and risk-oriented controls. The entire system is supported and implemented by managers and employees. This ensures that the objectives are achieved, the tasks are carried out transparently and efficiently and by the people with the defined functions, and that careful use of resources is guaranteed. The functions for compliance management and risk management and the continuous performance of internal audits represent the essential cornerstones. This is embedded in constant monitoring based on follow-up checks and monitoring of measures in order to optimise all processes further in addition to the continuous improvement process.

192 The e-mail address for this is anregungen@ffg.at

193 https://www.ffg.at/content/evaluierung-der-foerderung

Indicator 3: Human resources and qualifications

Austrian Research Promotion Agency (FFG) staff	Headcount									
	Total		Women				Men			
	2019	2020	2019		2020		2019		2020	
	Number	Number	Number	%	Number	%	Number	%	Number	%
Support staff	70	67	53	76%	51	76%	17	24%	16	24%
Experts	243	245	144	59%	142	58%	99	41%	103	42%
3. Management level (team leaders)	26	30	13	50%	15	50%	13	50%	15	50%
2. Management level (divisional management)	15	13	7	47%	6	46%	8	53%	7	54%
1. Management level (managing directors)	2	2	1	50%	1	50%	1	50%	1	50%
Total	**356**	**357**	**218**	**61%**	**215**	**60%**	**138**	**39%**	**142**	**40%**

Austrian Research Promotion Agency (FFG) staff	Full time equivalents (rounded)									
	Total		Women				Men			
	2019	2020	2019		2020		2019		2020	
	Number	Number	Number	%	Number	%	Number	%	Number	%
Support staff	57	57	44	78%	45	79%	13	22%	12	21%
Experts	219	223	122	56%	123	55%	97	44%	1001	45%
3. Management level (team leaders)	24	28	12	49%	14	49%	12	51%	14	51%
2. Management level (head of department, staff and service unit)	14	13	7	46%	6	45%	8	54%	7	55%
1. Management level (managing directors)	2	2	1	50%	1	50%	1	50%	1	50%
Total	**318**	**323**	**186**	**59%**	**188**	**58%**	**131**	**41%**	**135**	**42%**

Source: Austrian Research Promotion Agency (FFG).

The following staff development measures were implemented in 2019 and 2020:

One area of focus for the work in 2019 was the implementation of the results from the "Staff development for support staff" project and the start of the "Staff development for experts" project. The job profiles and career paths have been adapted to current requirements in both cases. The results from the staff development projects were implemented in 2020 and the Agency's new salary scheme was also reissued. In parallel with this, the focus for the qualification measures in 2020 was on the digital area. In the training area, the creation of own e-learning content was established as of 2019 with an even greater focus on this in 2020. This means that training can be carried out internally in a time-efficient and quality-assured manner.

Indicator 4: Output, innovation and excellence

Projects and participations	2019		2020	
	Number	Share	Number	Share
Funded projects	3,545		3,917	
Total participations	**5,910**	**100%**	**5,748**	**100%**
Companies	3,271	55%	3,282	57%
of which SMEs	2,151	of participations 36%	2,342	41%
Research institutions	908	15%	874	15%
Higher education institutions	984	17%	814	14%
Intermediaries and others	747	13%	778	14%

Source: Austrian Research Promotion Agency (FFG).

Processing time (time to contract), median values in days

Funding offer	2019	2020
FFG total	**50**	**38**
of which as examples		
Bottom-up programmes*	62	61
Small-scale programmes**	8	7
Research premium	43	40

* Includes all funding offers that are implemented within the scope of the General Programme document: General Programme Classic, Early Stage, Impact Innovation; ** Mainly includes the internships and the Innovation Voucher.

Source: Austrian Research Promotion Agency (FFG).

Number of consultations for (potential) funding applicants	2019	2020
Funded nationally by the Austrian Research Promotion Agency (FFG):	9,109	10,167
Consultations within the scope of the EIP mandate	7,100	6,600

Source: Austrian Research Promotion Agency (FFG).

Patents and licences	2019	2020
Patents applied for*	496	524
Granted patents	N/A	N/A
Licensing agreements	N/A	N/A

* Applications from funded projects up to 4 years after the end of the project and applications from the Patent Vouchers concluded in 2020.

Source: Austrian Research Promotion Agency (FFG), SME Research Austria (impact monitoring).

Indicator 5: Internationalisation

	2019		2020	
	Number	In %	Number	In %
Projects with international partners	320	17%	263	12%
Participating companies located abroad	177	8%	68	3%

Source: Austrian Research Promotion Agency (FFG).

Transnational initiatives - funded or co-funded from national funds	Approvals	
	Present value 2019 in €1,000	Present value 2020 in €1,000
Article 185: AAL	1,306	3,702
Article 185: Eurostars	5,953	5,203
Eranet EU co-funded	5,997	2,326
Eranet not EU co-funded	5,015	11,985
Eureka	2,961	3,337
Joint Programming Initiatives	1,413	549
Joint Technology Initiatives	10,223	11,844
Other transnational projects	1,996	4,259
Total	**34,864**	**43,205**

Source: Austrian Research Promotion Agency (FFG).

Participations of the Austrian Research Promotion Agency in Horizon 2020

Pillar	Instrument	Number of projects 2019	Number of projects 2020
Excellent Science	CSA	1	-
Excellent Science	ERA-NET-Cofund	1	-
Industrial Leadership	CSA	3	1
Industrial Leadership	ERA-NET-Cofund	-	1
Industrial Leadership	H2020-EEN-SGA	-	1
Industrial Leadership	LS-CSA	1	1
Science with and for society	CSA	2	-
Societal Challenges	CSA	1	-
Societal Challenges	ERA-NET-Cofund	1	-
Societal Challenges	LSP-CSA	-	1
Spreading excellence and widening participation	CSA	1	-
Total		**11**	**5**

Source: Austrian Research Promotion Agency (FFG).

Central memberships in international umbrella organisations and networks, important internationalisation measures in 2019 and 2020:

- Member of TAFTIE, the European Network of Innovation Agencies. The Austrian Research Promotion Agency (FFG) runs the TAFTIE Academy on TAFTIE's behalf and has led a working group on the topic of "experimental approaches" since 2019.
- Partner in the Innovation Growth Lab (IGL)
- Partner in the Enterprise Europe Network
- *Agentur für Luft- und Raumfahrt* (Aeronautics and Space Agency): Partner in UNO COPOUS (UN Committee on the Peaceful Uses of Outer Space), the IAA (International Academy of Astronautics), associate member of NEREUS (Network of European Regions using Space Technologies) and COSPAR (Committee on Space Research).
- Member of the International Astronautical Federation (IAF)
- Founding member of ESPI (European Space Policy Institute) with its head office in Vienna

Indicator 6: Knowledge and technology transfer

Funding programmes* in the area of knowledge and technology transfer

TOP 12* by funding volume	2019		2020	
	Projects	Present value in €1,000	Projects	Present value in €1,000
COMET	17	79,751	5	16,676
BASIS	161	44,352	151	30,782
Mobility of the Future (MdZ)	44	21,596	43	25,358
Energy Research (e!MISSION)	23	16,738	31	27,457
Production for the Future	32	19,568	33	20,871
BRIDGE	67	16,605	55	15,391
ICT of the Future	19	9,331	19	12,274
Energy for the Future	24	8,333	24	9,245
TAKE OFF	10	4,654	14	12,324
KIRAS	19	8,224	19	8,656
FORTE	12	5,000	-	-
Emergency Call	-	-	19	14,411

	2019		2020	
	Present value in €1,000	Share of total present value	Present value in €1,000	Share of total present value
All funding from the cooperation between science/industry	**284,942**	**58%**	**233,929**	**52%**

* Cooperation at the interface between science and industry is promoted in the majority of Austrian Research Promotion Agency (FFG) programmes. The programmes listed represent an excerpt, ranked according to the average funding volume from the last two reporting years. Formats for first-time applicants, such as the Innovation Voucher - (2020: 178 Innovation Vouchers, €1,780 thousand)

Source: Austrian Research Promotion Agency (FFG).

Indicator 7: Communication and interaction with society

The following activities and formats for communicating and transferring knowledge as well as for engaging and addressing civil society actors were implemented in 2019 and 2020:

Communication towards civil society and involvement of broad-based interest groups (including users) take place in relation to the respective context. Based on a wide range of requirements, innovation laboratories were used in particular as a framework in supporting systematic involvement, aligning the orientation of innovation projects more effectively with user needs and boosting acceptance for the results. The following activities are examples.

- Production for the Future: Activities are being implemented to involve different groups within the framework of the three pilot factories funded within the context of Industry 4.0. https://www.pilotfabrik.at/?lang=en – https://www.jku.at/en/lit-factory – https://www.smartfactory.tugraz.at/
- Take Off: A drone test infrastructure is being established and operated with the funding for the AirLabs innovation laboratory. https://www.ffg.at/airlabs-austria
- Mobility of the Future (MdZ): A broad range of issues is being addressed within the framework of the five urban mobility laboratories with involvement from users.
- Energy region flagship: green energy lab works with the customer for customers. https://greenenergylab.at/en/
- Benefit: The *"PflegeChallenge 2020"* ("CareChallenge 2020") focused on the "end-to-end supply of information in mobile care and support". https://www.ffg.at/benefit/AS2020-Pflegechallenge

Indicator 8: Gender and promotion of equality

	2019		2020	
	Number	Share	Number	Share
Women in funded projects				
FTEs based on audited reports	1,070	17.5%	1,114	17.8%
Women project leaders*	1,273	22%	1,291	23%
Women on committees and juries				
Austrian Research Promotion Agency (FFG) Supervisory Board	5	33%	8	53%
Bridge Advisory Board	4	29%	4	25%
Advisory Committee for the General Programmes	6	27%	7	32%
Reviews by women	1,613	31%	1728	33%

* Note: refers to all participations with individuals named personally. If no project lead function is recorded, the evaluation is based on the gender of the technical contact person.

Source: Austrian Research Promotion Agency (FFG).

Programmes/initiatives with gender or gender equality in their funding criteria:

For the majority of FFG funding: Gender equality is enshrined as the funding criteria in almost all programmes run by the Austrian Research Promotion Agency – both in terms of the composition of the project team and with regard to the project content.

Funding programmes with a focus on gender equality:

- **The "Talents" funding priority** (Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK)) promotes equal opportunities in companies and applied research as well as early stage researchers, children and young people from kindergarten age.
- **w-fFORTE** (Federal Ministry for Digital and Economic Affairs (BMDW)) provides visibility for women in influential roles in R&I and strengthens career skills for female researchers.
- With its innovation network projects, **Laura Bassi 4.0** is aimed at women and companies that want to shape digitalisation based on equal opportunities.
- **Research partnerships - industry-related PhDs:** 50% of funds are awarded for projects by female PhDs.

3.10.3 New initiatives and instruments 2020 and outlook

With the COVID-19 Emergency initiative set up at short notice, Austrian R&D expertise was mobilised on behalf of the Federal Ministry for Digital and Economic Affairs (BMDW) and Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) for immediate and direct management of the health crisis. The portfolio was also developed further at the same time and an increase was managed successfully in the number of applications in the bottom-up offer (+35% more applications in the General Programmes). The following overview summarises the highlights:

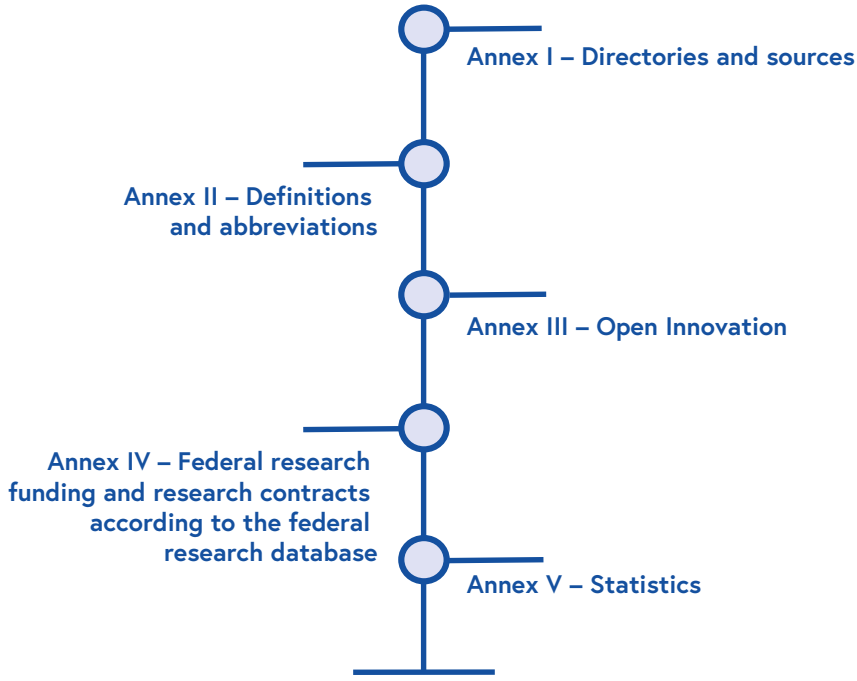
Corona Emergency Call	Around €25 million in two calls for proposals for the development of treatments and production processes.
Climate protection economic stimulus package	Additional funds of €86 million for low-threshold mobilisation for climate protection through the Eco Voucher as well as an increase in funding for climate protection-related projects in the area of the circular economy and green production
IPCEI	In cooperation with the Austria Wirtschaftsservice (aws): Implementation of Austria's participation in IPCEI.
Forest Fund	Implementation partner for the promotion of RTI infrastructure and innovation projects in connection with the Forest Fund established as of July 2020.
Eureka Presidency	The Global Innovation Summit will be organised as a highlight of the Austrian Presidency under the slogan "new Eureka".

Outlook for 2021

- Continuation of the **climate protection economic stimulus package**: Priority areas launched on the circular economy and green production will be continued. Climate relevance will be more widely enshrined as an evaluation criterion for project selection.
- New **Life Science initiative** aimed at strengthening research and production expertise and securing the respective production location.
- Expansion in **support services in the context of digitalisation**. The focus is on measures in the areas of qualification and cybersecurity.[194]

194 Further information can be found in the Austrian Research Promotion Agency (FFG) Annual Report 2020 https://www.ffg.at/publikationen#jahresberichtAnnexes

Annexes


Annex I – Directories and sources
Annex II – Definitions and abbreviations
Annex III – Open Innovation
Annex IV – Federal research funding and research contracts according to the federal research database
Annex V – Statistics

Annex I – Directories and sources

List of Figures

List of Tables

Bibliography

Aghion, P., Askenazy, P., Berman, N., Cette, G., Eymard, L. (2012): Credit constraints and the cyclicality of R&D investment: Evidence from France, Journal of the European Economic Association 10(5), 1001-1024.

Alt, R., Berrer, H., Borrmann, J., Brunner, P., Dolle, B., Helmenstein, C., Jöchle, J., Pirker, J., Pohl, P., Popko, J., Schmidl, M., Schneider, H. (2017): Kombinierte Programmevaluierung der Christian Doppler Labors und Josef Ressel Zentren 2016 (Combined programme evaluation of the Christian Doppler Laboratories and Josef Ressel Centres 2016). Vienna.

APCC (2014): Österreichischer Sachstandsbericht Klimawandel 2014 (AAR14). (Austrian Panel on Climate Change (APCC): Austrian Assessment Report 2014) published by the Austrian Academy of Sciences, Vienna. https://ccca.ac.at/wissenstransfer/apcc/aar14

Bauer, K., Gründler, C., Haitzmann, M., Schiefer, A. & Zach, S. (2015): Quantifizierung innovationsfördernder öffentlicher Beschaffung bei öffentlichen Unternehmen & im öffentlichen Sektor (Quantifying innovation-promoting public procurement in public enterprises and the public sector). Vienna: Statistics Austria.

Bello, M. and Galindo-Rueda, F. (2020): Charting the digital transformation of science: Findings from the 2018 OECD International Survey of Scientific Authors (ISSA2). OECD Science, Technology and Industry Working Papers, No. 2020/03, OECD Publishing, Paris.

BKA (2020): Aus Verantwortung für Österreich. Regierungsprogramm 2020–2024 (Out of a Sense of Responsibility for Austria. Government programme for 2020-2024), Vienna. https://www.bundeskanzleramt.gv.at/en/federal-chancellery/the-austrian-federal-government/government-documents.html

BMBWF, BMK and BMDW (Federal Ministry of Education, Science and Research, Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology, and Federal Ministry for Digital and Economic Affairs) (2020, 68f.): Austrian Research and Technology Report 2020. Report under Section 8(1) of the Research Organisation Act (FOG) on federally subsidised research, technology, and innovation in Austria, Vienna. https://www.bmbwf.gv.at/dam/jcr:515be14b-d356-48c7-8612-fba86af3a279/Austrian%20Research%20an%20Technology%20Report%202020_accessible.pdf

BMK (2020): FTI-Strategie Mobilität. Innovation in und aus Österreich für ein klimaneutrales Mobilitätssystem in Europa. (RTI Strategy for Mobility. Innovation in and from Austria for a climate-neutral mobility system in Europe.) Vienna. https://mobilitaetderzukunft.at/resources/pdf/broschueren/WA_UML_Endbericht_20201112_bf.pdf

BMNT, BMBWF, BMVIT (2019). Bioökonomie. Eine Strategie für Österreich. (Bioeconomy. A strategy for Austria.), Vienna. https://www.bmk.gv.at/themen/innovation/publikationen/energieumwelttechnologie/biooekonomiestrategie.html

BMVIT (2014): Breitbandstrategie 2020 (Broadband Strategy 2020). Staff Unit Information and Communication Infrastructure. Federal Ministry of Transport, Innovation and Technology (BMVIT), Vienna.

BMVIT (2017): Energie Forschungs- und Innovationsstrategie (Energy Research and Innovation Strategy), Vienna. https://nachhaltigwirtschaften.at/resources/e2050_pdf/reports/20170323-eforschung_strategie.pdf

BMVIT (2019): Breitbandstrategie 2030, Österreichs Weg in die Gigabit-Gesellschaft (Broadband Strategy 2030, Austria's path to the gigabit society). Staff Unit Information and Communication Infrastructure – Broadband Office. Federal Ministry of Transport, Innovation and Technology.

Buchinger, E. (2021): Expertenbeitrag im IÖB-Jahresbericht 2019/2020 (Expert contribution in the PPPI Annual Report 2019/2020).

Buchinger, E. & Schiefer, A. (2017): Policy note: Monitoring & measurement of innovation procurement in Austria. Austrian Institute of Technology (AIT). Vienna.

Bundeskanzleramt (Austrian Federal Chancellery) 2020: Aus Verantwortung für Österreich. Regierungsprogramm 2020–2024 (Out of a Sense of Responsibility for Austria. Government programme for 2020-2024), Vienna. https://www.bundeskanzleramt.gv.at/dam/jcr:7b9e6755-2115-440c-b2ec-cbf64a931aa8/RegProgramm-lang.pdf

CCCA (2020): Stand der österreichischen Klima- und Umweltforschung und Entwicklungsperspektiven, Eine Ist-Analyse der Forschungsaktivitäten an den Österreichischen Hochschulen und außeruniversitären Forschungseinrichtungen, (Austrian climate and environmental research and development perspectives, a status analysis of research activities in Austrian higher education and non-university research institutions), Graz/Vienna.

COM (2020): A hydrogen strategy for a climate-neutral Europe.

Cornell University, INSEAD and WIPO (2020): Global Innovation Index 2020: Who Will Finance Innovation? Ithaca, Fontainebleau, and Geneva. https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2020.pdf

Dinges, M., Heller-Schuh, B., Kalcik., R., Scherngell, T., Wang, A., Glänzel, W. and Thijs, B. (2020): Evaluation FWF Special Research Programmes (SFB). Technischer Bericht AIT und KU Leuven (Technical Report AIT and KU Leuven), Vienna.

Dorr, A., Heckl, E. and Kaufmann, J. (2020): Evaluierung des Förderschwerpunkts Talente. Projektbericht KMU Forschung Austria (Evaluation of the "Talents" funding programme. Project report, Austrian Institute for SME Research), Vienna.

Edler, J., Rigby, J., Bührer, S., Lo, V., Bierhals, R., Georghiou, L., & Kuhlmann, S. (2004, April 15): Research Network Programmes Evaluation for the Austrian Science Fund. Zenodo. http://doi.org/10.5281/zenodo.18229

Eurofound (2021): https://www.eurofound.europa.eu/surveys/2020/european-working-conditions-survey-2020

European Commission (2010): Europe 2020 – A strategy for smart, sustainable and inclusive growth, Brussels. https://ec.europa.eu/eu2020/pdf/COMPLET%20%20DE%20SG-2010-80021-06-00-DE-TRA-00.pdf

European Commission (2019): She Figures 2018. https://ec.europa.eu/info/publications/she-figures-2018_de

European Commission (2020): Benchmarking of R&D procurement and innovation procurement investments in countries across Europe. European Commission DG CNECT, Brussels.

European Commission (2020a): Eurograduate pilot study: Key findings, https://op.europa.eu/en/publication-detail/-/publication/91fe9c5a-a66d-11ea-bb7a-01aa75ed71a1/language-en

European Commission (2020b): Ein neuer Europäischer Forschungsraum: Neuer Plan der EU-Kommission zur Unterstützung des grünen und des digitalen Wandels und des EU-Aufbaus (A new European research area: Commission sets new plan to support green and digital transition and EU recovery), Brussels. https://ec.europa.eu/commission/presscorner/detail/en/IP_20_1749

European Commission (2020c): European Innovation Scoreboard 2020. Main Report. Luxembourg: Publications Office of the European Union. https://ec.europa.eu/docsroom/documents/42981

European Commission (2020d): The Digital Economy and Society Index Report 2020. https://ec.europa.eu/digital-single-market/en/digital-economy-and-society-index-desi

European Commission (2020e): The Digital Economy and Society Index Report 2020, Connectivity. https://ec.europa.eu/digital-single-market/en/broadband-connectivity

European Commission (2020f): The Digital Economy and Society Index Report 2020, Human Capital and Digital Skills. https://ec.europa.eu/digital-single-market/en/human-capital-and-digital-skills

European Commission (2020g): The Digital Economy and Society Index Report 2020, Use of Internet and Online Activities. https://ec.europa.eu/digital-single-market/en/use-internet-and-online-activities

European Commission (2020h): The Digital Economy and Society Index Report 2020, Integration of Digital Technology by Enterprises. https://ec.europa.eu/digital-single-market/en/integration-digital-technology-enterprises

European Commission (2020i): Digital economy and society index (DESI, 2020): Austria. Country Profile. https://ec.europa.eu/digital-single-market/en/scoreboard/austria

European Commission (2020j): European Innovation Scoreboard 2019: Methodology Report. https://ec.europa.eu/docsroom/documents/41861

European Commission (2020k): A new ERA for Research and Innovation. COM(2020) 628 final, Brussels, 30.9.2020.

European Commission (2020l): Making the most of the EU's innovative potential. An intellectual property action plan to support the EU's recovery and resilience. COM(2020) 760 final, Brussels, 25.11.2020.

European Commission (2021): Horizon Europe, https://ec.europa.eu/info/sites/info/files/research_and_innovation/sturctureheu.png

Eurostat (2020): Eurostat Database, https://ec.europa.eu/eurostat/data/database

Ruhland, S., Kaufmann, J., Ploder, M., Zinke, G. (2018): Evaluierung der Umsetzung des Leitkonzepts für eine innovationsfördernde öffentliche Beschaffung in Österreich. Endbericht. Technischer Bericht. (Evaluation of the implementation of the guiding concept for innovation-promoting public procurement in Austria. Final report. Technical report.), Vienna. https://repository.fteval.at/323/

ERAC (2015): ERAC opinion on innovation procurement. European Research Area and Innovation Committee (Task Force Members: Laatsit M./rapporteur, Adolphe D., Beley B., Buchinger E., Ortiz Pajares M., Garrido M., Kalytis R., Pavlaković I., Rajalo S., Svendsen L., Vermeulen H., Vilén K., Voort L., Putten M.). Brussels, https://era.gv.at/public/documents/2674/ERAC_Opinion_ST01209_EN15.pdf

Filippetti, A., Gkotsis, P., Vezzani, A. und Zinilli, A. (2020): Are innovative regions more resilient? Evidence from Europe in 2008–2016. Econ Polit 37, 807–832.

Friesenbichler, K.S., Janger, J., Kügler, A. und Reinstaller, A. (2020): Auswirkungen der Covid-19-Pandemie auf die Forschungs- und Innovationsaktivität. (Impact of the COVID-19 pandemic on research and innovation activity.) Austrian Institute of Economic Research (WIFO).

Grill, H. und Radauer, A. (2020) Durchführung eines begleitenden Monitorings für den NCP.IP. Technischer Bericht (Implementation of an accompanying monitoring for the NCP.IP. Technical report) technopolis, Vienna.

Grill, H., Tiefenthaler, B. and Zingerle, S. (2020): Evaluierung des Förderprogramms "Forschungskompetenzen für die Wirtschaft" (Evaluation of the funding programme "Research skills for business". Technical report.) technopolis, Vienna.

Grömling, M. (2021): COVID-19 and the Growth Potential. Intereconomics, 56, 45–49.

Hartmann, E.A., Engelhardt, S.v., Hering, M., Wangler, L., and Birner, N. (2014): Der iit- Innovationsfähigkeitsindikator: Ein neuer Blick auf die Voraussetzungen von Innovationen. (The iit Innovation Capability Indicator: a fresh look at the prerequisites for innovation), Working Paper of the Institute for Innovation and Technology. iit-Perspektive No. 16.

Heckl, E. and Wolf, L. (2015): Evaluierung des Programms Forschungskompetenzen für die Wirtschaft. Projektbericht KMU Forschung Austria (Evaluation of the programme "Research skills for business", project report, Austrian Institute for SME Research), Vienna.

ifo Institute for Economic Research (2020): ifo Schnelldienst 8/2020, Munich. https://www.ifo.de/DocDL/sd-2020-08-corona-folgen-staatsverschuldung.pdf

IHS (2021): GSK-Forschung einbinden: Praktische Hinweise – Hintergrundinformationen – Ausgewählte Literatur. (Integrating SSH research: Practical tips - Background information - Selected literature.) Vienna.

IMD World Competitiveness Center (2020): IMD World Talent Ranking 2020. https://www.imd.org/wcc/world-competitiveness-center-rankings/world-talent-ranking-2019/

IWI, P-IC (2020): Österreichische Umwelttechnik-Wirtschaft. Export, Innovationen, Startups und Förderungen. (Austrian environmental technology sector. Export, innovations, start-ups and funding.) Vienna. https://nachhaltigwirtschaften.at/de/publikationen/schriftenreihe-2020-41-oesterreichische-umwelttechnik-wirtschaft.php

Keuschnigg, C., Gogola, G., Johs, J., Kritzinger, M. und Sardadvar, S. (2020): Wirkung von Forschungsausgaben, Studie des WPZ und der WPZ Research, im Auftrag des Bundesministeriums für Digitalisierung und Wirtschaftsstandort. (Impact of research expenditure, study by WPZ and WPZ Research, commissioned by the Federal Ministry for Digital and Economic Affairs) https://www.bmdw.gv.at/Services/Publikationen.html#AllWiPo

Krugman, P. (1994): Competitiveness: a dangerous obsession, in: Krugman, Paul (1997): Pop Internationalism, Cambridge [MA] and London.

Murray, Ch. J.L., Alamro, N.M.S, Hwang, H. and Lee, U. (2020): Digital public health and COVID-19. The Lancet – Public Health, Volume 5, Issue 9, e469-e470.

Neufeld, J. (2014): FWF Scientists Survey 2013. Executive Summary. Berlin, Institut für Forschungsinformation und Qualitätssicherung – iFQ (Institute for Research Information and Quality Assurance). http://doi.org/10.5281/zenodo.17855

OECD (2017): Public procurement for innovation: Good practices and strategies. Organisation for Economic Co-operation and Development. Paris.

OECD (2019): EUROSTAT-OECD Definition of ICT-Specialists. Working Party on Measurement and Analysis of the Digital Economy. OECD Publishing, Paris. https://ec.europa.eu/eurostat/cache/metadata/Annexes/isoc_skslf_esms_an1.pdf

OECD (2020): Education at a Glance 2020: OECD Indicators. OECD Publishing, Paris. https://www.oecd.org/education/education-at-a-glance-19991487.htm/?refcode=20190209ig

OECD (2020a): OECD.Stat. Main Science and Technology Indicators. https://stats.oecd.org/

OECD (2020b): The Digitalisation of Science, Technology and Innovation: Key Developments and Policies, OECD Publishing, Paris.

OECD (2020c): A systemic resilience approach to dealing with Covid-19 and future shocks. http://www.oecd.org/coronavirus/policy-responses/a-systemic-resilience-approach-to-dealing-with-covid-19-and-future-shocks-36a5bdfb/

OECD (2020d): COVID – 19 and the low-carbon transition. Impacts and possible policy responses. http://www.oecd.org/coronavirus/policy-responses/covid-19-and-the-low-carbon-transition-impacts-and-possible-policy-responses-749738fc/

OECD (2020e): Innovation, development and COVID-19: Challenges, opportunities and ways forward. http://www.oecd.org/coronavirus/policy-responses/innovation-development-and-covid-19-challenges-opportunities-and-ways-forward-0c976158/

OECD (2020f): Building Back Better: A Sustainable, Resilient Recovery after COVID-19. https://www.oecd.org/coronavirus/policy-responses/building-back-better-a-sustainable-resilient-recovery-after-covid-19-52b869f5/

OECD (2021): OECD Science, Technology and Innovation Outlook 2021: Times of Crisis and Opportunity, OECD Publishing, Paris, https://www.oecd-ilibrary.org/science-and-technology/oecd-science-technology-and-innovation-outlook-2021_75f79015-en

Österreichische Bundesregierung (Austrian federal government) (2020): RTI Strategy 2030 – Strategy for research, technology and innovation of the Austrian Federal Government. https://www.bundeskanzleramt.gv.at/en/topics/rti-strategy.html

Österreichische Bundesregierung (Austrian federal government) (2020a): RTI Pact 2021-2023, Vienna. https://www.bundeskanzleramt.gv.at/en/topics/rti-strategy.html

Österreichische Bundesregierung (Austrian federal government) (2020b): RTI Strategy 2030 – Strategy of the Federal Government for Research, Technology and Innovation. Vienna. https://www.bundeskanzleramt.gv.at/en/topics/rti-strategy.html

Tiefenthaler, B. and Ohler, F. (2019): Evaluierung des Austrian Climate Research Programme (ACRP) (Evaluation of the Austrian Climate Research Programme), project report, Vienna. https://www.klimafonds.gv.at/publication/evaluierung-des-austrian-climate-research-programme-acrp-2/

Ploder, M., Streicher, J., Buchinger, E. and Kienegger, M. (2019): IÖB Wirkungsanalyse. Tiefergehende, wirkungsorientierte Analyse von innovationsfördernden öffentlichen Beschaffungsprojekten in unterschiedlichen Anwendungsfeldern. (PPPI impact analysis. More detailed, impact-oriented analysis of Public Procurement Promoting Innovation (PPPI) in various fields of application.) Project report Joanneum Research and Austrian Institute of Technology, Vienna and Graz.

PWC (2019): The strategic use of public procurement for innovation in the digital economy. Brussels.

PWC (2020): Austria country profile: The strategic use of public procurement for innovation in the digital economy. European Commission DG CNECT, Brussels.

PWC (2021) The strategic use of public procurement for innovation in the digital economy. European Commission DG CNECT, Brussels.

Rat für Forschung und Technologieentwicklung – 2020 (Austrian Council for Research and Technology Development – 2020): Empfehlungen für die FTI-Politik in und nach der Corona-Krise, (Recommendations for RTI policy in and after the coronavirus crisis), Vienna. https://www.rat-fte.at/files/rat-fte-pdf/einzelempfehlungen/2020/200618_Empfehlungen%20f%C3%BCr%20die%20FTI-Politik%20nach%20COVID-19.pdf

Reinstaller, A. (2020): Auswirkungen der COVID-19-Krise auf die Forschungs- und Entwicklungsausgaben des Unternehmenssektors in Österreich (Impact of the COVID-19 Crisis on Research and Development Expenditure of the Corporate Sector in Austria), WIFO-Monatsberichte 93, 449-460.

Romer, D. (1996). Advanced Macroeconomics. New York: McGraw-Hill.

Scimago Journal & Country Rank (2020): Country Rankings. https://www.scimagojr.com/countryrank.php

Solow, R. M. (1956): A Contribution to the Theory of Economic Growth, The Quarterly Journal of Economics, 70, 65-94.

Solow, R. M. (1957): Technical Change and the Aggregate Production Function, Review of Economics and Statistics, 39, 312-320

Statistics Austria (2020): National accounts - Main results 1995-2019. Vienna: Verlag Österreich.

The Growth Lab at Harvard University (2020): The Atlas of Economic Complexity. http://www.atlas.cid.harvard.edu

Tzatzanis, M. (2018): ERA Thematic Dossier on Climate Action in Horizon 2020, Austrian Research Promotion Agency (FFG), Vienna. 10.5281/zenodo.1195214.

UNESCO Institute for Statistics (2012): International Standard Classification of Education – ISCED 2011. http://uis.unesco.org/en/topic/international-standard-classification-education-isced

World Bank (2021): World Development Indicators, The World Bank Group, 2021. https://data.worldbank.org/indicator/

World Economic Forum (2020): The Global Competitiveness Report, Special Edition 2020: How Countries are Performing on the Road to Recovery. Geneva. https://www.weforum.org/reports/the-global-competitiveness-report-2020

Data sources

EUROSTAT database[196]**:** The **statistical office of the European Union** provides country comparisons using official data on various topics. **In addition to data from EU member states, information on leading non-EU economies, such as the USA, is also included for some indicators.**

The Global Competitiveness Report, Special Edition 2020 - How Countries are Performing on the Road to Recovery [197]**:** The Global Competitiveness Report is published by the World Economic Forum. For the year 2020, the usual ranking of economies was paused. Instead, data is presented that elaborates on the current crisis management and, in particular, on transformation capacity (see above) and building resilience to future crises.

Education at a Glance 2020[198]**:** In its "Education at a Glance" report, the Organisation for Economic Co-operation and Development (OECD) publishes an annual compilation of education indicators for the purposes of international comparison. Focusing on participation in education, graduate ratios, investment in education and teaching/learning settings.

Global Innovation Index 2020 (GII)[199]**:** This ranking is published annually by the French business school INSEAD, Cornell University and the United Nations' World Intellectual Property Organization (WIPO). In 2020, 131 economies are compared both on the overall index and in terms of more detailed indicators on innovation system inputs and outputs.

Digital Economy and Society Index (DESI) Report 2020[200]: The Digital Economy and Society Index (DESI) is published periodically by the European Commission. The following five areas of the DESI are evaluated: Connectivity, Human Capital, Use of Internet, Integration of Digital Technology and Digital Public Services, as well as ICT research and development.

European Innovation Scoreboard 2020 (EIS)[201]**:** The European Innovation Scoreboard analyses and compares the innovation performance of EU member states as well as other European and non-European countries.

OECD – Main Science and Technology Indicators:The OECD publishes important indicators on a wide range of topics in its database,[202] including industry, education, energy and transport as well as research and development.

The Atlas of Economic Complexity[203]**:** Produced by Harvard University, the Atlas of Economic Complexity features an economic complexity index. Calculated from foreign trade data, the index reflects the knowledge-intensity of products or the processes required to produce these products.

SCImago Journal & Country Rank[204]**:** The SCImago Journal & Country Rank database is a portal accessible by the general public that provides indicators on academic and scientific publications.

IMD World Talent Ranking[205]**:** The IMD World Competitiveness Center of the IMD business school- – International Institute for Management Development presents in its Talent Ranking the development of competencies and the retention as well as the international attractiveness of or for highly-skilled workers.

196 See Eurostat (2020).
197 See World Economic Forum (WEF) (2020).
198 See OECD (2020).
199 See Cornell University, INSEAD and WIPO (2020).
200 See European Commission (2020d); European Commission (2020e); European Commission (2020f); European Commission (2020g); European Commission (2020h).
201 See European Commission (2020c); European Commission (2020j).
202 See OECD (2020a).
203 See The Growth Lab at Harvard University (2020).
204 See Scimago Journal & Country Rank (2020).
205 See IMD World Talent Ranking (2020).

Annex II – Definitions and abbreviations

Definitions from the monitoring activities in accordance with the Research Financing Act (FoFinaG):

Time to contract: The time to contract is the period between the receipt of an application by the research funding organisation and the finalisation (sending) of the contract to the grant recipient. Deviating definitions are explained in footnotes.

Third-party funding: The third-party funding of the research institutions includes both revenue from customers (private and public) and funding raised. Funds of the National Foundation and the Austria Fund are also included under third-party funding, but other income from the onward charging of costs by charging for services, or funding from the Public Employment Service Austria (AMS) and research premiums is not.

Grants: The volumes of the projects acquired by the research institutions are also stated as approval sums ("awarded"). Only those projects newly acquired in the relevant reporting year are shown and not the ongoing projects, in order to avoid double counting.

Funding budget: The research funding agencies use various terms to describe their funding or financing activities. For the purposes of the Research and Technology Report, approvals and commitments are reported at their present value.

Total income: The total income corresponds to the sales revenue and other operational income according to investment and financial controlling as per the Austrian Commercial Code (UGB)

Glass Ceiling Index: According to She Figures, this index compares the percentage of women as a share of all employees with the percentage of women in management positions.[205] The Index can take all values between zero and infinity. A value below 1 means that women are relatively overrepresented in management positions, a value above 1 means that women are underrepresented. The higher the value, the greater the level of underrepresentation.

Global budget: The Austrian "global budget" or the basic funding of the research institutions refers to all grants from the owners/shareholders/supervisors that have not already been earmarked (frequently based on a performance agreement). The institutions allocate the basic funding themselves.

Employees are white-collar workers, leased staff, persons in marginal employment, but not employees on leave, employees on temporary contracts or work and service contracts.

NFTE and Austria Fund: National Foundation for Research, Technology and Development

Practice partners: Practice partners are cooperation partners that are important for the implementation but do not belong to the "industry", such as service companies, hospitals, regional authorities, NGOs.

Publications: The publications only include scientific publications (not project reports, etc.) that have undergone a quality assurance procedure (peer review). All publications have a "persistent identifier" such as a DOI or ISSN and have been published in scientific journals, edited volumes, proceedings or monographs. Publications with multiple authors are evaluated as "whole counts" (i.e. the publication as a whole is attributed to each author).

Reporting dates: All budget figures and employee headcounts are recorded as of 31 December of the relevant reporting year. The numbers for 2020 are preliminary figures.

FTE: Full-time equivalent

WoS and Scopus: The Web of Science (formerly ISI, Web of Knowledge) is a multidisciplinary database run by Clarivate Analytics which lists scientific publications with their citations. Scopus is a similar database from Elsevier with bibliographic references to scientific literature. Scopus contains more entries and also covers disciplines other than natural science on a broader basis. Nevertheless, research organisations were given the option of presenting their publications in accordance with Scopus or WoS.

205 See European Commission (2019).

Country codes

Country	Code	Country	Code	Country	Code
Albania	ALB	France	FRA	Nigeria	NGA
Argentina	ARG	Hong Kong	HKG	Netherlands	NLD
Austria	AUT	Croatia	HRV	Norway	NOR
Australia	AUS	Hungary	HUN	New Zeeland	NZL
Belgium	BEL	Ireland	IRL	Poland	POL
Bulgaria	BGR	India	IND	Portugal	PRT
Brazil	BRA	Israel	ISR	Romania	ROU
Canada	CAN	Iceland	ISL	Serbia	SRB
Switzerland	CHE	Italy	ITA	Russia	RUS
Chile	CHL	Japan	JPN	Sweden	SWE
China	CHN	South Korea	KOR	Singapore	SGP
Cyprus	CYP	Liechtenstein	LIE	Slovenia	SVN
Czechia	CZE	Lithuania	LTU	Slovakia	SVK
Germany	DEU	Luxembourg	LUX	Turkey	TUR
Denmark	DNK	Latvia	LVA	Taiwan	TWN
Estonia	EST	Montenegro	MNE	Ukraine	UKR
Greece	GRC	Macedonia	MKD	United Kingdom	UK
Spain	ESP	Malta	MLT	United States	USA
Finland	FIN	Mexico	MEX	South Africa	ZAF

Abbreviations:

ABA	Austrian Business Agency
ACRP	Austrian Climate Research Programme
AECM	European Association of Guarantee Institutions
TFEU	Treaty on the Functioning of the European Union
AHS	Allgemeinbildende Höhere Schule (Academic Secondary School)
AIOTI	Alliance IoT Innovation
AIT	Austrian Institute of Technology
ALLEA	All European Academies
ASFINAG	Autobahnen- und Schnellstraßen-Finanzierungs-Aktiengesellschaft (operates Austria's motorways and expressways)
AUSSDA	Austrian Social Science Data Archive
aws	Austria Wirtschaftsservice Gesellschaft mbH
BBG	Bundesbeschaffung GmbH (Federal Procurement Agency)
BBMRI	Biobanking and BioMolecular resources Research Infrastructure
BBRZ	Berufliches Bildungs- und Rehabilitationszentrum (Vocational Education and Rehabilitation Centre)
BFI	Berufsförderungsinstitut (Bildung.Freude Inklusive) (vocational training institute)
BGBl	Federal Law Gazette
BHS	Berufsbildende Höhere Schule (College for Higher Vocational Education)
GDP	Gross domestic product

BKA	Bundeskanzleramt (Austrian Federal Chancellery)
BMBWF	Bundesministerium für Bildung, Wissenschaft und Forschung (Federal Ministry of Education, Science and Research)
BMDW	Bundesministerium für Digitalisierung und Wirtschaftsstandort (Austrian Federal Ministry for Digital and Economic Affairs)
BMEIA	Bundesministerium für Europäische und internationale Angelegenheiten (Federal Ministry for European and International Affairs)
BMF	Bundesministerium für Finanzen (Austrian Federal Ministry of Finance)
BMK	Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie (Austrian Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology)
BMKÖS	Bundesministerium für Kunst, Kultur, öffentlichen Dienst und Sport (Federal Ministry of Arts, Culture, Civil Service and Sport)
BMLRT	Bundesministerium für Landwirtschaft, Regionen und Tourismus (Austrian Federal Ministry of Agriculture, Regions and Tourism)
BMLV	Bundesministerium für Landesverteidigung (Federal Ministry of Defence)
BoB	Best of Biotech
CC	LBG Career Center
CCCA	Climate Change Centre Austria
CDG	Christian Doppler Forschungsgesellschaft (Christian Doppler Research Association)

CD Laboratories	Christian Doppler Laboratories
CEA	French Alternative Energies and Atomic Energy Commission
COMET	Competence Centers for Excellent Technologies
COSPAR	Committee on Space Research
CPS	Cyber-physical system
CRM	Customer relationship management
DCNA	Disaster Competence Network Austria
DeGEval	Deutsche Gesellschaft für Evaluation (German Evaluation Society)
DESI	Digital Economy and Society Index
GDPR	General Data Protection Regulation
DZHW	Deutsches Zentrum für Hochschul- und Wissenschaftsforschung (German Centre for Higher Education Research and Science Studies)
EARMA	European Association of Research Managers and Administrators
EARPA	European Automotive Research Partners Association
EARTO	European Association of Research and Technology Organisations
EASAC	European Academies Science Advisory Council
EBAN	European Business Angel Network
EBS	Electronics-based systems
ECI	Economic Complexity Index
ECP	Eureka Cluster Programme
ECSEL Austria	Electronic Components and Systems for European Leadership – Austria
ECSO	European Cyber Security Organisation
ECTRI	European Conference of Transport Research Institutes
EDF	European Defence Fund
EERA	European Energy Research Alliance
EFFLA	European Forum on Forward Looking Activities
EFR	European Research Area
EFTA	European Free Trade Association
EGVIA	European Green Vehicle Initiative Association
EHPA	European Heat Pump Association
EIC	European Innovation Council
EIS	European Innovation Scoreboard
EIT	European Institute of Innovation and Technology
EC	European Commission
ELLIS	European Laboratory for Learning and Intelligent Systems
EMVA	European Machine Vision Association
EPO	European Patent Office
EPoSS	European Research Platform Smart Systems Integration
ERAC	European Research and Innovation Area Committee
ERASMUS	European Community Action Scheme for the Mobility of University Students
ERC	European Research Council
ERIC	European Research Infrastructure Consortium
ESFRI	European Strategy Forum on Research Infrastructures
ESPI	European Space Policy Institute
ESRP	European Security Research Programme
ETIP SNET	European Technology& Innovation Platforms on Smart Networks for Energy Transition
EUIPO	European Union Intellectual Property Office
EUREC	The Association of European Renewable Energy Research
EVFIN	European Venture Fund Investors Network
R&D	Research and Development
FET	Future and Emerging Technologies
FFG	Österreichische Forschungsförderungsgesellschaft (Austrian Research Promotion Agency)
FoFinaG	Forschungsfinanzierungsgesetz (Research Financing Act)
FORTE	Forschung & Technologie (Austrian Defense Research Programme)
fteval	Österreichische Plattform für Forschungs- und Technologiepolitikevaluierung (Austrian Platform for Research and Technology Policy Evaluation)
RTI	Research, technology and innovation
FTIS	Research and technology infrastructure
FTO	Freedom to operate
FWF	Fonds zur Förderung der wissenschaftlichen Forschung (Austrian Science Fund)
GACR	Czech Science Foundation
GBA	Geologische Bundesanstalt (Geological Survey of Austria)
GII	Global Innovation Index
GSK	Geistes-, Sozial- und Kulturwissenschaften (Humanities, social sciences and cultural studies)
GUEP	Gesamtösterreichischer Universitätsentwicklungsplan (Austrian National Development Plan for Public Universities)
HEU	Horizon Europe
HLG on Innovation Policy	High Level Group on Innovation Policy
HMIS	Nationale Hochschulmobilitäts- und Internationalisierungsstrategie (National Mobility and Internationalisation Strategy for Higher Education)
IAF	International Astronautical Federation
IGL	Innovation Growth Lab
IHS	Institut für Höhere Studien (Institute for Advanced Studies)
iit	Institute of Innovation and Technology
ILO	International Labour Organization
IMD	Institute for Management Development

INSEAD	The Business School for the World
PPPI	Public Procurement Promoting Innovation
IoT	Internet of Things
IP	Intellectual Property
IPAG	Intellectual Property Agreement Guide
IPCEI	Important Projects of Common European Interest
ISC	International Science Council
ISCED	International Standard Classification of Education
ISSA	International Survey of Scientific Authors
IST Austria	Institute of Science and Technology Austria
ITG	Salzburg's innovation centre
ITU	International Telecommunication Union
JESH	Joint Excellence in Science and Humanities
JPO	Japanese Patent Office
JRC	Joint Research Centres
JR Centres	Josef Ressel Centre
AI	Artificial intelligence
KIRAS	Austrian Security Research Programme
KPC	Kommunalkredit - Public Consulting
LBG	Ludwig Boltzmann Gesellschaft
LBI	Ludwig Boltzmann Institute
LEIT	Leadership in enabling and industrial technologies
LISA	Life Science Austria
LTER	Gesellschaft für ökologische Langzeitforschung (Austrian Long-Term Ecosystem Research Network)
STEM	Science, technology, engineering and mathematics
MSCA	Marie Skłodowska-Curie Actions
NCP-IP	National Contact Point for Knowledge Transfer and Intellectual Property
NEFI	Network of European Financial Institutions for SMEs
NEREUS	Network of European Regions using Space Technologies
NFTE	Nationalstiftung für Forschung, Technologie und Entwicklung (National Foundation for Research, Technology and Development)
NGA	Fixed broadband coverage
NGO	Non-ggovernmental organisation
NMP	Nanotechnologies, Advanced Materials and Production
NPO	Non-profit organisation
ÖAI	Österreichisches Archäologisches Institut (Austrian Archaeological Institute)
OeAW	Österreichische Akademie der Wissenschaften (Austrian Academy of Sciences)
ÖAWI	Österreichische Agentur für wissenschaftliche Integrität (Austrian Agency for Research Integrity)
OeAD	Agentur für Bildung und Internationalisierung (Agency for Education and Internationalisation)
OECD	Organisation for Economic Co-operation and Development
ÖGMBT	Österrreichische Gesellschaft für Molekulare Biowissenschaften und Biotechnologie (Austrian Society for Molecular Biosciences and Biotechnology)
OIC	Open Innovation in Science Center
OIS	Open Innovation in Science
OI Strategy	Open Innovation Strategy
ÖPA	Österreichisches Patentamt (Austrian Patent Office)
PH-EP	Pädagogischer Hochschulen-Entwicklungsplan (Development Plan for University Colleges of Teacher Education)
PRACE	Partnership for Advanced Computing in Europe
PwC	PricewaterhouseCoopers
RFTE	Rat für Forschung und Technologieentwicklung (Council for Research and Technology Development)
RGI	Renewable Grid initiative
RTO	Research Technology Organisation
SAB	Scientific Advisory Board
SAL	Silicon Austria Labs
SARS-CoV-2	Severe acute respiratory syndrome coronavirus type 2
SFB	Specific research areas
SSH	Social Sciences and Humanities
SWAFS	Science with and for Society
TED	Tenders Electronic Daily
UERA	Urban Europe Research Alliance
UN	United Nations
UNO COPOUS	UN Committee on the Peaceful Uses of Outer Space
USPTO	United States Patent and Trademark Office
VBCF	Vienna Biocenter Core Facilities
VEN	Vienna Evaluation Network
VHCN	Very High Capacity Networks
VieCER	Vienna Center for Electoral Research
VRVis	Zentrum für Virtual Reality und Visualisierung (Research Center for Virtual Reality and Visualization)
VWA	Pre-scientific papers
FTE	Full-time equivalent
WEF	World Economic Forum
WIPO	World Intellectual Property Organization
WKO	Austrian Economic Chambers
WoS	Web of Science
WWTF	Wiener Wissenschafts-, Forschungs- und Technologiefonds (Vienna Science and Technology Fund)
ZAMG	Zentralanstalt für Meteorologie und Geodynamik (The Central Institute for Meteorology and Geodynamics)

Annex III – Open Innovation

		Measure 1	Measure 2	Measure 3	Measure 4	Measure 5	Measure 6
		Building Open Innovation and experimental spaces	Embed Open Innovation elements at kindergartens and schools as well as in teacher training	Further develop public administration by means of Open Innovation and greater public involvement	Set up and operate an Open Innovation platform for social/societal innovation and as a contribution to overcoming global challenges	Set up and operate an innovation map including a matchmaking platform for innovation actors	Build up research competence for the application of Open Innovation in science
Action area 1	Creation of a culture of Open Innovation and teaching of Open Innovation skills to children and adults		BMBWF, BMDW – Innovative Youth FFG, BMK – Regional Talents				LBG – Open Innovation in Science Research and Competence Center (OIS)
Action area 2	Formation of heterogeneous open innovation networks and partnerships across all disciplines, industries and organisations	BMK – test environments for automated driving FFG, KLIEN – flagship region for energy FFG – Energy.Free.Room		PPPI, BMDW, BMK – Matchmaking platform & crowdsourcing challenges	FFG – Laura Bassi 4.0 BMK – innovation platform AAL Austria IHS – Community creates Mobility! ÖAW – exploration space ZSI – careables	Austrian Patent Office – Open Data Initiative BMBWF research infrastructure database PPPI – Open Innovation Strategy MCI – Digital Innovation Hub West	
Action area 3	Mobilisation of resources and creation of the framework conditions for open innovation	ÖBB – MakeAthon on the topic of regional railway FFG – innovation workshops FFG, BMK – innovation laboratories FFG – Education LABs	FFG – Education LABs	BMK, BBG – "naBe" platform	ISB – MINT4future	BMK – Open4Innovation platform	

Measure 7	Measure 8	Measure 9	Measure 10	Measure 11	Measure 12	Measure 13	Measure 14
Establish incentive mechanisms for research partnerships with non-traditional players in research funding to strengthen Open Innovation	Increase involvement of users and members of the public in RTI funding programmes	Develop fair sharing and compensation models for crowd work	Further develop and provide Open Innovation methods and Open Innovation instruments specifically for small and medium-sized enterprises (SMEs)	Develop and implement co-creation and Open Innovation training programmes	Embed principles of Open Data and Open Access in research	Gear the IP and exploitation strategies of companies, universities, research institutions and intermediaries to Open Innovation in order to optimise innovation potential	Implement a comprehensive communication initiative about Open Innovation to raise awareness and create networks
	FFG – Open Innovation workshops with the management of the COMET centres		Salzburg – Competence Centre for Open Innovation FFG – Research competence for the industry – Funding of Open Innovation qualification projects WKO – Open Innovation Workshops UAS Kufstein – INNoCamp	Austrian Patent Office – Training and events FFG – Crash course on Open Innovation methods in the context of Impact Innovation	Austrian Patent Office – Open Data Initiative FWF – "Plan S" implementation	Austrian Patent Office – Raising awareness of exploitation strategies aws (ncp-ip) – Web Guide www.fair-open-innovation.at	BMBWF & BMK – Information & communication work via the official Open Innovation website (www.openinnovation.gv.at) BMBWF & BMK – Focus on networking with OI in workshops UAS St. Pölten – SMARTUP Initiative
FFG – w-fFORTE-INNOVATORINNEN	BMK – AAL test regions IHS – RiConfigure – Democratizing innovation BMK – Involving of future female users in FEMtech Research Projects OeAD – Citizen Science Award		FFG, BMDW – Focus on open innovation in the COIN networks		BMK – "e-genius" open content platform BMK – Exchange of open RTI data pioneers		BMK – Information & communication work within the scope of the Open4Innovation platform
CDG – Partnership in Research IHS – RiConfigure – Democratizing innovation	FFG, BMK – innovation laboratories FFG – Involve end-users in the General Programme	aws (ncp-ip) – Web Guide www.fair-open-innovation.at	Salzburg – Competence Centre for Open Innovation Austrian Patent Office – SME research service offering	FWF – Plan S – Making Open Access a reality by 2020 Universities, BMBWF – Implementation of the OANA recommendations on Open Access BMK – Provision of research results of funded projects (Open4Innovation – Platform) BMBWF – Digital and social transformation in higher education			

Annex IV – Federal research funding and research contracts according to the federal research database

The database for research funding and contracts (B_f.dat) for the federal government has been in place since 1975, and was set up at the then existing Federal Ministry for Science and Research (BMWF) as a "documentation of facts by the federal government". Today, the database is maintained by the Federal Ministry of Education, Science and Research (BMBWF). The mandatory reporting of the ministerial departments to the relevant Science Minister is recorded in the Research Organisation Act (FOG), Federal Law Gazette No. 341/1981, last amended by Federal Law Gazette I No. 31/2018. In 2008, it was changed to a database to which all ministerial departments have access and in which they all enter their research-related funding and contracts independently. Each ministerial department is responsible for the validity and completeness of the data in its respective field of activity. The federal research database has been accessible to the public since 1 June 2016, providing the latest overview of the projects funded by the federal ministries.[206] As a documentation database, the B_f.dat also serves to collect brief information on the content of the listed research promotion schemes and contracts awarded. With regard to the relevant reporting year, the database contains ongoing, newly approved and already completed R&D contracts and grants, their overall funding volume and actual funds paid in the reporting year. All in all, this gives an up-to-date picture of directly commissioned R&D studies, assessments, evaluations, grants and their funding by the federal government.

The federal research database thus contributes to transparency in the allocation of public funds and to the overall picture of research funding in Austria. Overall, however, the volume of research contracts and funding directly commissioned by the ministerial departments is relatively small, especially when compared to the university budgets and the resources of the research funding agencies (for details, see the overview of the federal government's use of research-related funds in the Annex V). The amounts should therefore be seen as supplementary information in the sense of providing maximum transparency and completeness.

Figure A-1 provides an overview of the R&D projects entered in the B_f.dat by the ministerial departments. The percentage share of R&D projects by ministerial department and the percentage share of total funding are shown here. The data in the B_f.dat reveal that a total of 424 R&D projects were funded in 2020 with a volume of €485.89 million. This figure also includes the global institutional funding. In total, approximately 87% of the funds were paid out as global funding to research institutions in 2020. Subtracting this from the total disbursement volume in 2020, the remaining funding amount is €64.87 million, which is €3.78 million or 6.2% higher than in 2019. It should be noted that this funding for each reporting year is usually a partial amount for an ongoing or completed project and this is subject to annual fluctuations depending on the progress of the respective projects.

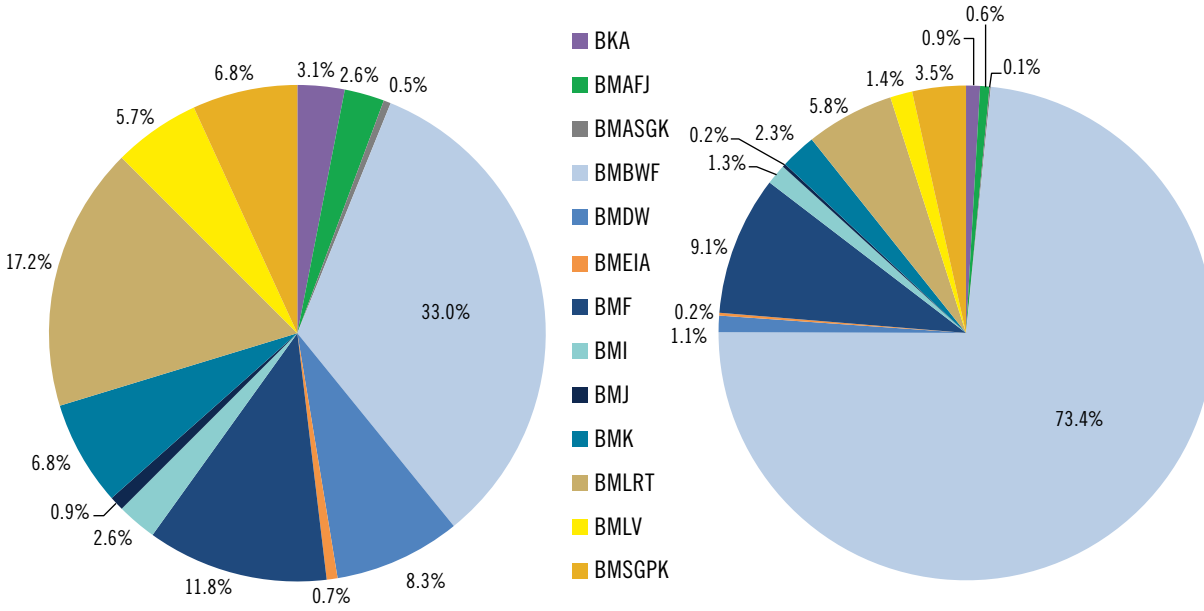
In 2020, as it was in 2019, the Federal Ministry of Education, Science and Research (BMBWF) was the ministerial department with the largest share of entries and funding amounts (see Figure A-1): 33% of the R&D projects[207] or 73.4% of the amounts (excluding global financing) were allocated to the BMBWF. Entries and funding amounts have remained almost constant for the BMBWF compared to 2019. The funding cases increased by 0.4 percentage points,

206 www.bmbwf.gv.at/bfdat-public

207 With this form of presentation there is a possibility of double counting due to projects being shared amongst the ministries.

the amounts by 0.2 percentage points. In terms of the number of RTI contracts and grants, the Federal Ministry of Education, Science and Research (BMBWF) is followed by the Federal Ministry of Agriculture, Regions and Tourism (BMLRT) with a share of 17.2%; in terms of funding amounts it is followed by the Federal Ministry of Finance (BMF) with a share of 9.1%. The reason the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) had a comparatively small percentage (2.3%) was that most of the R&D funds were outsourced to the federal funding agencies Austrian Research Promotion Agency (FFG) and Austria Wirtschaftsservice (aws).

Fig. A-1: Ongoing and completed R&D projects and funding by funding amounts in 2020 (Fig. left) and ministerial department (Fig. right)



Source: Federal Ministry of Education, Science and Research (BMBWF), Federal research database B_f.dat, graphic: WPZ Research.

Annex V – Statistics

Funding of gross domestic expenditure on R&D[208] (Tables A-1 and A-2)

The global estimate of the gross domestic expenditure on research and experimental development (R&D) for the current year was not made in 2021. A reliable estimate of expenditure and the R&D intensity for 2021 is not possible at this point in time (April 2021) due to the as yet unforeseeable economic effects of the coronavirus crisis.

Therefore, the research expenditures for 2020 were estimated based on the available documents on the financial statements and budget estimates of the federal and regional governments, the preliminary trends of the 2019 R&D survey and estimates of the R&D-strongest companies for 2020. In the course of this, the values for 2018 and 2019 were also updated.

For 2020, the R&D intensity is estimated to be 3.23%, a clear increase compared to 3.10% in 2019. However, the increase in the rate is due to the economic slump caused by the pandemic: A slight decline in R&D expenditure is accompanied by a strong decline in economic output, which leads to an increase in the ratio.

Of the total research expenditure in 2020 (about €12.1 billion), 41% (about €5 billion) was financed by Austrian companies. The federal government contributed 27% (about €3.3 billion). Indirect R&D funding in the form of the research premium accounted for 8%, i.e. over €1 billion. 4.5% (about €550 million) were contributed by the federal states, 16% (about €2 billion) came from abroad, often from foreign companies whose subsidiaries conduct research in Austria.

Federal R&D expenditure in 2021

The Tables "Federal expenditure on research and research promotion" show the total research-related expenditure of the federal government, which includes the research-related shares of the contributions to international organisations. The source is the "Detailed overview of research-related appropriation of federal funds" in the R&D supplement to the Federal Finances Act (BFG) 2021 (Part a and Part b). In terms of methodology, this is in line with the internationally applied "GBARD" concept[209] which, in contrast to the domestic concept, includes the research-relevant contributions to international organisations and forms the basis for the classification of R&D budget data according to socio-economic objectives for reporting to the EU and the OECD.

In 2021, the following socio-economic objectives (each as a share of total funding) will account for the largest share of federal expenditure on research and research promotion:

- Promotion of general knowledge advancement: 28.1%
- Promotion of trade, commerce, and industry: 25.9%
- Promotion of the health care system: 21.1%
- Promotion of social and socio-economic development: 5.5%
- Promotion of research covering the earth, the seas, the atmosphere, and space: 4.7%
- Promotion of energy production, storage and distribution: 3.3%

208 Statistics Austria usually creates an annual "Global estimate of the gross domestic expenditure for R&D in Austria" based on the results of the R&D statistical surveys and other currently available documents and information, in particular the R&D-related Cash Flow Budgets and Cash Flow Statements of the federal and regional governments. Within the context of the global estimate, retroactive revisions or updates are made to reflect the latest data. The funding for expenditure on research and experimental development carried out in Austria is presented in accordance with the definitions of the Frascati Manual, which is valid around the world (OECD, EU) and thus ensures international comparability. According to these definitions and guidelines, foreign funding of R&D performed in Austria is included, but Austrian payments for R&D performed abroad are excluded (domestic concept).

209 GBARD: Government Budget Allocations for Research and Development.

R&D expenditure of the regional governments

The research funding by the regional governments shown as a subtotal in Table A-1 is listed from the regional government budget-based estimates of R&D expenditure and financial statements as reported by the offices of the regional governments. The R&D expenditures of the regional hospitals are estimated annually by Statistics Austria according to a methodology agreed with the offices of the regional governments.

An international comparison of R&D expenditure in 2018

The overview in Table A-10 shows Austria's position compared to the other European Union Member States and other countries in terms of the most important R&D-related indices (Source: Eurostat). For the first time in this report, Eurostat is used as the data source for this table. The reason for this is that the values are generally more up-to-date than those of the OECD, which were previously used as a data source. Both organisations use the same statistical concepts.

List of Tables in the Statistical Annex

Table A-1: Global estimate for 2020: Gross domestic expenditure on R&D funding of research and experimental development carried out in Austria, 2006–2020

Funding	2006 [1]	2007 [1]	2008	2009[1]	2010	2011 [1]	2012	2013 [1]	2014	2015 [1]	2016	2017 [1]	2018	2019	2020
1. Gross domestic expenditure on R&D (in € millions)	**6,318.59**	**6,867.82**	**7,548.06**	**7,479.75**	**8,066.44**	**8,276.34**	**9,287.84**	**9,571.28**	**10,275.18**	**10,499.15**	**11,145.02**	**11,289.78**	**11,911.95**	**12,344.57**	**12,143.11**
Funded by:															
Federal government [1]	1,616.31	1,684.20	2,016.20	2,042.83	2,257.58	2,232.63	2,410.22	2,383.70	2,592.80	2,528.17	2,825.34	2,681.89	2,954.62	3,031.01	3,328.28
Research premium [2]	155.75	232.76	340.58	254.63	328.85	381.66	574.05	468.98	493.23	508.02	527.67	637.48	713.00	758.00	1,048.50
Regional governments [3]	219.98	263.18	354.35	273.37	405.17	298.71	416.31	307.45	461.59	344.97	445.78	392.66	500.57	537.59	552.13
Business enterprise sector [4]	3,057.00	3,344.40	3,480.57	3,520.02	3,639.35	3,820.90	4,243.33	4,665.75	4,901.28	5,222.22	5,377.52	5,532.82	5,610.62	5,727.87	5,030.81
Abroad [5]	1,163.35	1,230.24	1,240.53	1,255.93	1,297.63	1,401.67	1,495.94	1,590.21	1,663.95	1,737.69	1,802.16	1,874.27	1,944.37	2,081.07	1,997.83
Other [6]	106.20	113.04	115.83	132.97	137.86	140.77	147.99	155.19	162.33	158.08	166.55	170.66	188.77	209.03	185.56
2. Nominal GDP [7] (in € billions)	267.82	283.98	293.76	288.04	295.90	310.13	318.65	323.91	333.15	344.27	357.61	369.34	385.36	397.58	375.56
3. Gross domestic expenditure on R&D as % of GDP	***2.36***	***2.42***	***2.57***	***2.60***	***2.73***	***2.67***	***2.91***	***2.95***	***3.08***	***3.05***	***3.12***	***3.06***	***3.09***	***3.10***	***3.23***

Date: 22 April 2021.

Source: STATISTICS AUSTRIA. On the basis of funding data from R&D carried out in Austria.

1) 2006, 2007, 2009, 2011, 2013, 2015, 2017: Survey results (federal government including the Austrian Science Fund (FWF), the Austrian Research Promotion Agency (FFG) and National Foundation for Research, Technology and Development). 2008, 2010, 2012: Annex T of the Federal Finances Acts (in each case Part b, Cash Flow Statement); 2014, 2016, 2018, 2019: Detailed overview of research-related appropriation of federal funds for the Federal Finances Acts (in each case Part b, Cash Flow Statement); 2020: Detailed overview of research-related appropriation of federal funds for the Federal Finances Acts (Part b, Cash Flow Budget).
2008: Including €91.0 million National Foundation for Research, Technology and Development.
2010: Including €74.6 million National Foundation for Research, Technology and Development.
2012: Including €51.3 million National Foundation for Research, Technology and Development.
2014: Including €38.7 million National Foundation for Research, Technology and Development.
2016: Including €51.7 million National Foundation for Research, Technology and Development.
2018: Including €141.0 million National Foundation for Research, Technology and Development.
2019: Including €137.5 million National Foundation for Research, Technology and Development.
2020: Including €139.4 million National Foundation for Research, Technology and Development.

2) 2006, 2007, 2009, 2011, 2013, 2015; 2017: Survey results. 2008, 2010, 2012, 2014, 2016, 2018, 2019, 2020: Source: Federal Ministry of Finance (BMF).

3) 2006, 2007, 2009, 2011, 2013, 2015, 2017: Survey results. 2008, 2010, 2012, 2014, 2016, 2018, 2019, 2020: Based on the R&D expenditure reported by the offices of the regional governments. (*Landesrechnungsabschlüsse*, Cash Flow Budget 2020).

4) 2006, 2007, 2009, 2011, 2013, 2015, 2017: Survey results. 2008, 2010, 2012, 2014, 2016, 2018, 2019, 2020: Estimate by Statistics Austria.

5) 2006, 2007, 2009, 2011, 2013, 2015, 2017: Survey results. 2008, 2010, 2012, 2014, 2016, 2018, 2019, 2020: Estimate by Statistics Austria.

6) "Financing by local governments (excluding Vienna), chambers, social insurance institutions and other public financing and financing from the private non-profit sector.
2006, 2007, 2009, 2011, 2013, 2015, 2017: Survey results. 2008, 2010, 2012, 2014, 2016, 2018, 2019, 2020: Estimate by Statistics Austria.

7) 2006-2020: STATISTICS AUSTRIA, date: April 2021.

Table A-2: Global estimate for 2020: Gross domestic expenditure on R&D funding of research and experimental development carried out in Austria as a percentage of GDP, 2006–2020

Funding	2006 [1]	2007 [1]	2008	2009 [1]	2010	2011 [1]	2012	2013 [1]	2014	2015 [1]	2016	2017 [1]	2018	2019	2020
1. Gross domestic expenditure on R&D (in € millions)	**2.36**	**2.42**	**2.57**	**2.60**	**2.73**	**2.67**	**2.91**	**2.95**	**3.08**	**3.05**	***3.12***	***3.06***	***3.09***	***3.10***	***3.23***
Funded by:															
Federal government [1]	0.60	0.59	0.69	0.71	0.76	0.72	0.76	0.74	0.78	0.73	0.79	0.73	0.77	0.76	0.89
Research premium [2]	0.06	0.08	0.12	0.09	0.11	0.12	0.18	0.14	0.15	0.15	0.15	0.17	0.19	0.19	0.28
Regional governments [3]	0.08	0.09	0.12	0.09	0.14	0.10	0.13	0.09	0.14	0.10	0.12	0.11	0.13	0.14	0.15
Business enterprise sector [4]	1.14	1.18	1.18	1.22	1.23	1.23	1.33	1.44	1.47	1.52	1.50	1.50	1.46	1.44	1.34
Abroad [5]	0.43	0.43	0.42	0.44	0.44	0.45	0.47	0.49	0.50	0.50	0.50	0.51	0.50	0.52	0.53
Other [6]	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
2. Nominal GDP [7] (in € billions)	**267.82**	**283.98**	**293.76**	**288.04**	**295.90**	**310.13**	**318.65**	**323.91**	**333.15**	**344.27**	**357.61**	**369.34**	**385.36**	**397.58**	**375.56**

Date: 22 April 2021.

Source: STATISTICS AUSTRIA. On the basis of funding data from R&D carried out in Austria.

Footnotes: see Table A-1

Table A-3: Federal expenditure on research and research promotion, 2018–2021

	Cash Flow Statement				Cash Flow Budget			
	2018[2]		2019[3]		2020[3]		2021[3]	
	€ millions	%	€ millions	%	€ millions	%	€ millions	%
Federal Chancellery (BKA)[4]	40.900	*1.4*	40.816	*1.4*	1.364	*0.0*	1.332	*0.0*
Austrian Federal Ministry for the Civil Service and Sport (BMÖDS)	-	-	-	-	.	.	.	.
Federal Ministry of Arts, Culture, Civil Service and Sport (BMKÖS)	.	.	.	.	38.566	*1.2*	46.639	*1.3*
Federal Ministry for Europe, Integration and Foreign Affairs (BMEIA)	2.220	*0.1*	2.803	*0.1*	.	.	.	.
Federal Ministry for European and International Affairs (BMEIA)	.	.	.	.	2.859	*0.1*	3.325	*0.1*
Federal Ministry of Labour, Social Affairs, Health and Consumer Protection (BMASGK)	11.641	*0.4*	12.938	*0.4*	.	.	.	.
Federal Ministry of Labour, Family and Youth (BMAFJ)	.	.	.	.	7.608	*0.2*	7.584	*0.2*
Federal Ministry of Social Affairs, Health, Care and Consumer Protection (BMSGPK)	.	.	.	.	7.741	*0.2*	8.732	*0.2*
Federal Ministry of Education, Science and Research (BMBWF)	2,195.673	*75.4*	2,314.871	*76.9*	2,524.363	*76.8*	2,666.156	*74.9*
Austrian Federal Ministry for Digital and Economic Affairs (BMDW)	111.038	*3.8*	105.462	*3.5*	115.656	*3.5*	115.656	*3.2*
Austrian Federal Ministry of Finance (BMF)	30.153	*1.0*	29.594	*1.0*	31.691	*1.0*	31.520	*0.9*
Federal Ministry of the Interior (BMI)	1.360	*0.0*	1.126	*0.0*	1.084	*0.0*	1.942	*0.1*
Federal Ministry of Defence (BMLV)	2.988	*0.1*	2.130	*0.1*	1.960	*0.1*	1.981	*0.1*
Austrian Federal Ministry for Sustainability and Tourism (BMNT)	42.643	*1.5*	40.335	*1.3*	.	.	.	.
Austrian Federal Ministry of Agriculture, Regions and Tourism (BMLRT)	.	.	.	.	42.458	*1.3*	49.141	*1.4*
Federal Ministry of Justice (BMJ)	.	.	.	.	0.036	*0.0*	0.064	*0.0*
Federal Ministry of Constitutional Affairs, Reforms, Deregulation and Justice (BMVRDJ)	0.105	*0.0*	0.046	*0.0*	.	.	.	.
Austrian Federal Ministry for Transport, Innovation and Technology (BMVIT)	474.648	*16.3*	459.523	*15.3*	.	.	.	.
Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK)	.	.	.	.	514.886	*15.6*	627.342	*17.6*
Total	**2,913.369**	***100.0***	**3,009.644**	***100.0***	**3,290.272**	***100.0***	**3,561.414**	***100.0***

Date: March 2021.

Source: STATISTICS AUSTRIA.

1) In accordance with the applicable version of the Federal Ministries Act of 1986 valid in the respective year (2018, 2019: Federal Law Gazette I No. 164/2017; 2020, 2021: Federal Law Gazette I No. 8/2020).

2) Federal Finances Act 2020 (BFG 2020), Detailed overview of research-related appropriation of federal funds.

3) Federal Finances Act 2021 (BFG 2021), Detailed overview of research-related appropriation of federal funds.

4) Including the highest executive bodies.

Table A-4: Detailed overview of research-related appropriation of federal funds, 2019 to 2021

Detailed overview
Research-related appropriation of federal funds.

Research-related federal expenditure by ministerial departments, 2019 to 2021

The following overviews are structured according to:

1. Contributions from federal funds to international organisations that have research and research promotion as (one of) their objectives **(Part a)**

2. Federal budget expenditure on research and research promotion in Austria **(Part b, Federal budget for research)**

For the compilation of these expenditures, the decisive aspect is the extent to which an expenditure is research-related, based on the definition of research in the OECD's Frascati Manual. The same definition is also applied by Statistics Austria for its research and experimental development (R&D) surveys.

BUNDESVORANSCHLAG 2021

Detailübersicht Forschungswirksame Mittelverwendungen des Bundes
(Beträge in Millionen Euro)

a) Beitragszahlungen an internationale Organisationen - Finanzierungsvoranschlag														
VA-Stelle	Konto	Ugl	Bezeichnung	Anm	Finanzierungsvoranschlag 2021			Finanzierungsvoranschlag 2020			Erfolg 2019		
					Insgesamt	hievon		Insgesamt	hievon		Insgesamt	hievon	
						%	Forschung		%	Forschung		%	Forschung
			Bundeskanzleramt										
			UG10										
10010100	7800	100	Mitgliedsbeiträge an Institutionen im Ausland		0,119	100	0,119	0,115	100	0,115	0,114	100	0,114
10010100	7800	110	Mitgliedsbeitrag AV-Infostelle		0,032	5	0,002	0,032	5	0,002	0,031	5	0,002
10010200	7800	100	Mitgliedsbeiträge an Institutionen im Ausland		0,006	30	0,002	0,006	30	0,002	0,007	30	0,002
10010402	7800	100	Mitgliedsbeiträge an Institutionen im Ausland	*	0,012	100	0,012	0,012	100	0,012	0,010	100	0,010
			Summe UG10		**0,169**		**0,135**	**0,165**		**0,131**	**0,162**		**0,128**
			Summe Bundeskanzleramt		**0,169**		**0,135**	**0,165**		**0,131**	**0,162**		**0,128**
			BM für europäische und internationale Angelegenheiten										
			UG12										
12020200	7800	101	Mitgliedsbeitrag für OECD	*	4,048	35	1,417	4,048	20	0,810	3,964	20	0,793
12020200	7800	102	OECD-Energieagentur (Mitgliedsbeitrag)	*		20			20			20	
12020200	7840	000	Laufende Transfers an Drittländer		2,750	35	0,963	3,250	35	1,138	2,853	35	0,999
12020200	7840	002	Organisation der VN für industr.Entwicklung(UNIDO)		0,660	46	0,304	0,569	46	0,262	0,770	46	0,354
12020200	7840	003	Org. VN Erziehung,Wissensch.u.Kultur(UNESCO)		2,000	30	0,600	2,028	30	0,608	1,921	30	0,576
12020200	7840	056	Drogenkontrollprogramm der VN (UNDCP)		0,406	10	0,041	0,406	10	0,041	0,406	20	0,081
			Summe UG12		**9,864**		**3,325**	**10,301**		**2,859**	**9,914**		**2,803**
			Summe BM für europäische und internationale Angelegenheiten		**9,864**		**3,325**	**10,301**		**2,859**	**9,914**		**2,803**
			BM für Finanzen										
			UG15										
15010100	7800	000	Laufende Transferzahlungen an das Ausland		0,151	100	0,151	0,100	100	0,100	0,100	100	0,100
			Summe UG15		**0,151**		**0,151**	**0,100**		**0,100**	**0,100**		**0,100**
			Summe BM für Finanzen		**0,151**		**0,151**	**0,100**		**0,100**	**0,100**		**0,100**
			BM für Bildung, Wissenschaft und Forschung										
			UG30										
30010300	7800	104	OECD-Schulbauprogramm		0,031	100	0,031	0,031	100	0,031		100	
30010400	7800	000	Laufende Transferzahlungen an das Ausland	*	0,435	100	0,435	0,435	100	0,435	0,037	100	0,037
			Summe UG30		**0,466**		**0,466**	**0,466**		**0,466**	**0,037**		**0,037**
			UG31										
31030100	7800	000	Laufende Transferzahlungen an das Ausland		0,800	100	0,800	0,800	100	0,800	0,841	100	0,841
31030100	7800	066	Forschungsvorhaben in internationaler Kooperation		0,003	100	0,003	0,003	100	0,003	0,202	100	0,202
31030100	7800	200	Beiträge an internationale Organisationen		1,340	50	0,670	1,340	50	0,670	1,249	50	0,625
31030204	7800	062	ESO		6,100	100	6,100	6,925	100	6,925	6,700	100	6,700
31030204	7800	063	Europ. Zentrum für mittelfristige Wettervorhersage		1,300	100	1,300	1,300	100	1,300	1,176	100	1,176
31030204	7800	064	Molekularbiologie - Europäische Zusammenarbeit		3,133	100	3,133	3,033	100	3,033	2,886	100	2,886
31030204	7800	065	World Meteorological Organisation		0,550	50	0,275	0,550	50	0,275	0,404	50	0,202
31030204	7800	200	Beiträge an internationale		0,885	50	0,443	0,870	50	0,435	0,850	50	0,425

			Organisationen										
31030204	7800	242	Beitrag für die CERN		24,231	100	24,231	24,231	100	24,231	21,889	100	21,889
			Summe UG31		**38,342**		**36,955**	**39,052**		**37,672**	**36,197**		**34,946**
			Summe BM für Bildung, Wissenschaft und Forschung		**38,808**		**37,421**	**39,518**		**38,138**	**36,234**		**34,983**
			BM für Digitalisierung und Wirtschaftsstandort										
			UG40										
40020100	7800	100	Mitgliedsbeiträge an Institutionen im Ausland		0,735	15	0,110	0,735	15	0,110	0,401	11	0,044
			Summe UG40		**0,735**		**0,110**	**0,735**		**0,110**	**0,401**		**0,044**
			Summe BM für Digitalisierung und Wirtschaftsstandort		**0,735**		**0,110**	**0,735**		**0,110**	**0,401**		**0,044**
			BM für Klimaschutz, Umwelt, Energie, Mobil., Innov. u.Technologie										
			UG34										
34010100	7800	200	Beiträge an internationale Organisationen		0,070	100	0,070	0,070	100	0,070	0,079	100	0,079
34010100	7800	600	ESA-Pflichtprogramme		19,462	100	19,462	18,462	100	18,462	18,059	100	18,059
34010100	7800	601	EUMETSAT		8,801	100	8,801	8,801	100	8,801	9,041	100	9,041
34010100	7800	602	OECD-Energieagentur		0,050	100	0,050	0,050	100	0,050	0,039	100	0,039
34010100	7800	603	ESA-Wahlprogramme		30,616	100	30,616	30,616	100	30,616	48,976	100	48,976
34010100	7830	000	Laufende Transfers an Drittländer		0,195	100	0,195	0,125	100	0,125	0,183	100	0,183
			Summe UG34		**59,194**		**59,194**	**58,124**		**58,124**	**76,377**		**76,377**
			UG41										
41010100	7800	200	Beiträge an internationale Organisationen		0,110	6	0,007	0,110	6	0,007	0,107	6	0,006
41020100	7800	200	Beiträge an internationale Organisationen		0,020	100	0,020	0,020	100	0,020		100	
41020402	7800	200	Beiträge an internationale Organisationen		0,066	15	0,010	0,066	15	0,010	0,055	15	0,008
41020500	7800	200	Beiträge an internationale Organisationen		0,030	15	0,005	0,030	15	0,005	0,035	15	0,005
41020500	7830	000	Laufende Transfers an Drittländer		0,482	15	0,072	0,482	15	0,072	0,441	15	0,066
41020601	7800	200	Beiträge an internationale Organisationen		0,050	50	0,025	0,050	50	0,025	0,036	50	0,018
41020700	7800	200	Beiträge an internationale Organisationen			20		0,161	20	0,032	0,544	20	0,109
			Summe UG41		**0,758**		**0,139**	**0,919**		**0,171**	**1,218**		**0,212**
			Summe BM für Klimaschutz, Umwelt, Energie, Mobil., Innov. u.Technologie		**59,952**		**59,333**	**59,043**		**58,295**	**77,595**		**76,589**
			BM für Landwirtschaft, Regionen und Tourismus										
			UG42										
42010100	7800	100	Mitgliedsbeiträge an Institutionen im Ausland		0,003	50	0,002	0,003	50	0,002	0,003	50	0,002
42020202	7800	080	FAO-Beiträge		3,400	51	1,734	3,400	51	1,734	2,919	50	1,460
42020202	7800	083	Int. Vertrag für pflanzengenetische Ressourcen		0,025	100	0,025	0,025	100	0,025	0,024	100	0,024
			Summe UG42		**3,428**		**1,761**	**3,428**		**1,761**	**2,946**		**1,486**
			Summe BM für Landwirtschaft, Regionen und Tourismus		**3,428**		**1,761**	**3,428**		**1,761**	**2,946**		**1,486**
			Teil a -Summe		**113,107**		**102,236**	**113,290**		**101,394**	**127,352**		**116,133**

b) Bundesbudget Forschung - Finanzierungsvoranschlag

(ausgen. die bereits im Abschnitt a) ausgewiesen sind)

VA-Stelle	Konto	Ugl	Bezeichnung	Anm	Finanzierungsvoranschlag 2021			Finanzierungsvoranschlag 2020			Erfolg 2019		
					Insgesamt	hievon		Insgesamt	hievon		Insgesamt	hievon	
						%	Forschung		%	Forschung		%	Forschung
			Parlamentsdirektion										
			UG02										
02010500	7330	086	Nationalfonds für Opfer des Nationalsozialismus	*	1,321	4	0,053	1,977	3	0,059	0,308	12	0,037
			Summe UG02		**1,321**		**0,053**	**1,977**		**0,059**	**0,308**		**0,037**
			Summe Parlamentsdirektion		**1,321**		**0,053**	**1,977**		**0,059**	**0,308**		**0,037**
			Bundeskanzleramt										
			UG10										
10010100	7260	000	Mitgliedsbeiträge an Institutionen im Inland		0,010	28	0,003	0,013	28	0,004	0,008	28	0,002
10010100	7270	000	Werkleistungen durch Dritte		0,320	4	0,013	0,306	4	0,012	0,509	4	0,020
10010200	7260	000	Mitgliedsbeiträge an Institutionen im Inland			50			50		0,005	50	0,003
10010200	7270	000	Werkleistungen durch Dritte		4,312	4	0,172	5,015	4	0,201	2,099	4	0,084
10010401	7340	001	Pauschalabgeltung gem. § 32 Abs.5 BStatG		50,111	1	0,501	50,018	1	0,500	49,965	1	0,500
10010402			Österr. Staatsarchiv		15,171	3	0,455	15,232	3	0,457	14,645	3	0,439
			Summe UG10		**69,924**		**1,144**	**70,584**		**1,174**	**67,231**		**1,048**
			Summe Bundeskanzleramt		**69,924**		**1,144**	**70,584**		**1,174**	**67,231**		**1,048**
			BM für Inneres										
			UG11										
11010200	7270	900	Werkleistungen durch Dritte	*									
11020109	7270	900	Werkleistungen durch Dritte	*									
11020600			Bundeskriminalamt	*	14,906	8	1,192	12,683	8	1,015	12,683	8	1,015
11020600	7270	900	Werkleistungen durch Dritte	*									
11020800	7270	900	Werkleistungen durch Dritte	*	0,039	100	0,039	0,069	100	0,069	0,062	100	0,062
			Summe UG11		**14,945**		**1,231**	**12,752**		**1,084**	**12,745**		**1,077**
			UG18										
18010100	7660	900	Zuschüsse f. lfd. Aufwand an private Institutionen	*									
18010100	7670	309	Projekte des AMIF (EU) (zw)		0,315	100	0,315						
18010100	7672	009	Projekte des AMIF (Kofinanzierung)	*	0,396	100	0,396						
18010200	7281	310	AMIF Sonstige Werkleistungen (EU/zw)								0,049	100	0,049
			Summe UG18		**0,711**		**0,711**				**0,049**		**0,049**
			Summe BM für Inneres		**15,656**		**1,942**	**12,752**		**1,084**	**12,794**		**1,126**
			BM für Justiz										
			UG13										
13010100	6430	000	Sonstige Beratungskosten	*	0,127	50	0,064	0,071	50	0,036	0,091	50	0,046
			Summe UG13		**0,127**		**0,064**	**0,071**		**0,036**	**0,091**		**0,046**
			Summe BM für Justiz		**0,127**		**0,064**	**0,071**		**0,036**	**0,091**		**0,046**
			BM für Landesverteidigung										
			UG14										
14040100			Heeresgeschichtliches Museum	*	3,765	15	0,565	3,629	15	0,544	3,474	15	0,521
14050100	7270	000	Werkleistungen durch Dritte	*	0,200	58	0,116	0,200	58	0,116	0,022	58	0,013
14050100	7270	900	Werkleistungen durch Dritte	*	1,300	100	1,300	1,300	100	1,300	1,572	100	1,572
14050100	7411	028	FFG - Verteidigungsforschung			100			100			100	
14050202	4691	000	Versuche und Erprobungen auf kriegstechn. Gebiet			10			10		0,238	10	0,024
			Summe UG14		**5,265**		**1,981**	**5,129**		**1,960**	**5,306**		**2,130**
			Summe BM für Landesverteidigung		**5,265**		**1,981**	**5,129**		**1,960**	**5,306**		**2,130**
			BM für Finanzen										
			UG15										
15010100	6430	001	Arbeiten des WIIW		0,892	50	0,446	0,777	50	0,389	0,761	50	0,381
15010100	6430	002	Arbeiten des WSR		1,371	50	0,686	1,371	50	0,686	1,371	50	0,686
15010100	6430	003	Arbeiten des Wifo		4,520	52	2,350	4,335	52	2,254	4,250	52	2,210
15010100	7270	000	Werkleistungen durch Dritte	*	1,662	18	0,299	1,329	34	0,452	1,338	18	0,241

15010100	7661	002	Institut für Finanzwissenschaft und Steuerrecht											
15010100	7662	002	Institut für höhere Studien und wiss. Forschung	*	3,920	56	2,195	3,745	56	2,097	3,608	56	2,020
15010100	7669	020	Sonstige Förderungsbeiträge	*	0,400	100	0,400	0,300	100	0,300	0,249	100	0,249
			Forschungswirksamer Lohnnebenkostenanteil		24,993	100	24,993	25,413	100	25,413	23,707	100	23,707
			Summe UG15		**37,758**		**31,369**	**37,270**		**31,591**	**35,284**		**29,494**
			Summe BM für Finanzen		**37,758**		**31,369**	**37,270**		**31,591**	**35,284**		**29,494**
			BM für Kunst, Kultur, öffentlichen Dienst und Sport										
			UG17										
17020100	7411	071	Bundesinst. für Sporttechnologie/Training		2,500	100	2,500						
17020100	7672	132	Sporttechnologie Projekte		5,000	100	5,000						
			Summe UG17		**7,500**		**7,500**						
			UG32										
32010300			Denkmalschutz		39,811	18	7,166	38,711	18	6,968	36,628	18	6,593
32030100			Bundesmuseen		127,890	25	31,973	126,390	25	31,598	127,726	25	31,932
			Summe UG32		**167,701**		**39,139**	**165,101**		**38,566**	**164,354**		**38,525**
			Summe BM für Kunst, Kultur, öffentlichen Dienst und Sport		**175,201**		**46,639**	**165,101**		**38,566**	**164,354**		**38,525**
			BM für Arbeit, Familie und Jugend										
			UG20										
20010101	7340	302	Überweisung an das AMS gem. § 41 (2) (zw)	*	588,834	1	5,250	550,000	1	5,250	482,610	1	4,826
20010201	7270	006	Werkleistungen durch Dritte (zw)		378,500		0,700	274,678		0,700	370,113		0,471
20010201	7668	900	Gemeinnützige Einrichtungen (zw)	*	103,650		0,400	115,000		0,400			
20010202	7270	000	Werkleistungen durch Dritte	*	6,500	1	0,080	6,500	1	0,080			
			Summe UG20		**1.077,484**		**6,430**	**946,178**		**6,430**	**852,723**		**5,297**
			UG25										
25010500	7270	006	Werkleistungen durch Dritte (zw)		0,509	90	0,458	0,583	75	0,437	0,407	82	0,334
25010500	7420	113	Familie und Beruf Management GesmbH. (zw)					2,140	33	0,706			
25010500	7420	313	Familie und Beruf Management GesmbH Förd. (zw)	*	0,940	74	0,696				0,972	73	0,710
25020100	7270	000	Werkleistungen durch Dritte										
25020200	7270	000	Werkleistungen durch Dritte					1,735	2	0,035	1,699	2	0,034
			Summe UG25		**1,449**		**1,154**	**4,458**		**1,178**	**3,078**		**1,078**
			Summe BM für Arbeit, Familie und Jugend		**1.078,933**		**7,584**	**950,636**		**7,608**	**855,801**		**6,375**
			BM für Soziales, Gesundheit, Pflege und Konsumentenschutz										
			UG21										
21010100	7270	000	Werkleistungen durch Dritte		4,229	3	0,127	5,607	3	0,168	3,514	3	0,105
21010300	7270	000	Werkleistungen durch Dritte		1,251	16	0,200	1,178	16	0,188	0,984	16	0,157
21010300	7660	900	Zuschüsse f. lfd. Aufwand an private Institutionen		5,150	2	0,103	4,900	2	0,098	4,070	2	0,081
21010400	7262	001	Beitrag Europ. Zentrum Wohlfahrtspol.u.Sozialfor.		0,587	50	0,294	0,587	50	0,294	0,587	50	0,294
21010400	7270	000	Werkleistungen durch Dritte		8,300	4	0,332	2,402	4	0,096	1,643	4	0,066
21010400	7270	304	Werkleistungen EU-SILC		1,149	100	1,149	1,149	100	1,149	1,169	100	1,169
			Summe UG21		**20,666**		**2,205**	**15,823**		**1,993**	**11,967**		**1,872**
			UG24										
24010200	7420	012	Transferzahlungen AGES		55,878	11	6,147	49,878	11	5,487	49,878	11	5,487
24030100	7270	000	Werkleistungen durch Dritte		6,937	4	0,277	3,948	4	0,158	4,677	4	0,187
24030200	7270	000	Werkleistungen durch Dritte		5,168	2	0,103	5,164	2	0,103	4,756	2	0,095
			Summe UG24		**67,983**		**6,527**	**58,990**		**5,748**	**59,311**		**5,769**
			Summe BM für Soziales, Gesundheit, Pflege und Konsumentenschutz		**88,649**		**8,732**	**74,813**		**7,741**	**71,278**		**7,641**
			BM für Bildung, Wissenschaft und Forschung										

			UG30										
30010400			Qualitätsentwicklung und -steuerung	*	258,058	8	20,645	37,539	8	3,003	31,030	8	2,482
30010400	7340	000	Transferzahlungen an sonst. Träger öffentl.Rechtes			100			100		0,547	100	0,547
30010400	7340	003	Basisabgeltung (BIFIE)			80			80		10,070	80	8,056
30010500			Lehrer/innenbildung		240,550	10	24,055	234,872	10	23,487	227,440	10	22,744
30010800	7270	900	Werkleistungen durch Dritte		2,233	90	2,010	1,429	90	1,286			
30010800	7340	003	Basisabgeltung (BIFIE)			80		6,250	80	5,000			
30020700			Zweckgebundene Gebarung Bundesschulen	*	8,928	3	0,268	8,928	3	0,268	8,928	3	0,268
			Summe UG30		**509,769**		**46,978**	**289,018**		**33,044**	**278,015**		**34,097**
			UG31										
31010100			Zentralstelle und Serviceeinrichtungen		58,791	20	11,758	60,902	20	12,180	56,799	20	11,360
31020100			Universitäten		3.826,615	50	1.913,308	3.696,826	50	1.848,413	3.443,380	50	1.721,690
31020100	7270	000	Werkleistungen durch Dritte		0,330	50	0,165	0,330	50	0,165	0,046	50	0,023
31020100	7353	440	Klinischer Mehraufwand (Klinikbauten)		64,030	50	32,015	112,530	50	56,265	23,328	50	11,664
31020200			Fachhochschulen		369,689	16	59,150	329,499	16	52,720	321,008	16	51,361
31020300	7270	900	Werkleistungen durch Dritte		1,303	22	0,287	2,600	22	0,572	2,759	22	0,607
31030100			Projekte und Programme	*	1,790	100	1,790	15,677	100	15,677	14,973	100	14,973
31030100	7260	000	Mitgliedsbeiträge an Institutionen im Inland		0,171	100	0,171	0,171	100	0,171	0,064	100	0,064
31030100	7270	034	Ersatzmethoden zum Tierversuch			100		0,300	100	0,300	0,115	100	0,115
31030100	7270	900	Werkleistungen durch Dritte		6,721	100	6,721	4,322	100	4,322	2,740	100	2,740
31030100	7280	018	OeAD-Abwicklung		5,442	100	5,442						
31030100	7411	069	OeAD Förderungen		10,237	100	10,237						
31030100	7411	070	OeAD Begleitmaßnahmen		0,003	100	0,003						
31030100	7662	311	Institut für höhere Studien und wiss. Forschung		0,220	100	0,220	0,220	100	0,220	0,150	100	0,150
31030100	7665	007	Stiftung Dokumentationsarchiv		0,405	100	0,405	0,405	100	0,405	0,405	100	0,405
31030100	7679	120	Lfd. Transfers an sonstige juristische Personen		18,972	100	18,972	17,719	100	17,719	15,927	100	15,927
31030201			Zentralanstalt für Meteorologie und Geodynamik		26,047	38	9,898	24,097	38	9,157	25,328	38	9,625
31030202			Geologische Bundesanstalt		11,502	41	4,716	11,502	41	4,716	11,123	41	4,560
31030204			Forschungsinstitutionen	*	8,978	100	8,978	32,658	100	32,658	10,148	100	10,148
31030204	7270	031	Med Austron		1,500	100	1,500	1,500	100	1,500	1,200	100	1,200
31030204	7332	352	FWF Programme		255,100	100	255,100	201,500	100	201,500	195,500	100	195,500
31030204	7332	452	FWF Geschäftsstelle		12,199	100	12,199	12,500	100	12,500	10,500	100	10,500
31030204	7332	552	FWF Begleitmaßnahmen		0,001	100	0,001						
31030204	7340	004	ISTA		80,800	100	80,800	55,800	100	55,800	51,442	100	51,442
31030204	7340	006	ÖAW - LV		137,190	100	137,190	108,376	100	108,376	113,363	100	113,363
31030204	7340	010	ÖAW Beauftragungen und Programme			100		8,814	100	8,814	8,827	100	8,827
31030204	7661	022	Ludwig-Boltzmann-Gesellschaft		9,731	100	9,731	8,031	100	8,031	8,547	100	8,547
31030204	7679	007	Verein der Freunde der Salzburger Stiftung		1,000	100	1,000	1,000	100	1,000	1,000	100	1,000
			Summe UG31		**4.908,767**		**2.581,757**	**4.707,279**		**2.453,181**	**4.318,672**		**2.245,791**
			Summe BM für Bildung, Wissenschaft und Forschung		**5.418,536**		**2.628,735**	**4.996,297**		**2.486,225**	**4.596,687**		**2.279,888**
			BM für Digitalisierung und Wirtschaftsstandort										
			UG33										
33010100			Kooperation Wissenschaft-Wirtschaft		37,000	100	37,000	37,000	100	37,000	36,766	100	36,766
33010200			Innovation, Technologietransfer		63,246	100	63,246	63,246	100	63,246	54,201	100	54,201
33010300			Gründung innovativer Unternehmen		15,300	100	15,300	15,300	100	15,300	14,451	100	14,451
			Summe UG33		**115,546**		**115,546**	**115,546**		**115,546**	**105,418**		**105,418**
			Summe BM für Digitalisierung und Wirtschaftsstandort		**115,546**		**115,546**	**115,546**		**115,546**	**105,418**		**105,418**
			BM für Klimaschutz, Umwelt, Energie, Mobil., Innov. u.Technologie										
			UG34										

34010200	7340	100	Rat f. Forschung und Technologieentwicklung		1,800	100	1,800	1,800	100	1,800	1,800	100	1,800
34010200	7411	021	Important Projects of Common European Interest		24,700	100	24,700	24,700	100	24,700			
34010200	7411	022	Important Projects of Common European Interest-Abw		0,050	100	0,050	0,050	100	0,050			
34010200	7413	001	Austrian Institute of Technology AIT-Förderungen		0,010	100	0,010	0,010	100	0,010	0,020	100	0,020
34010200	7413	002	Austrian Institute of Technology AIT		57,530	90	51,777	57,180	90	51,462	56,690	90	51,021
34010200	7413	003	Nuclear Engineering Seibersdorf NES		11,220	30	3,366	10,950	30	3,285	6,368	30	1,910
34010200	7413	004	Silicon Austria		17,416	100	17,416	10,257	100	10,257	6,910	100	6,910
34010200	7414	002	Austria Tech		0,850	100	0,850	1,000	100	1,000	0,745	100	0,745
34010200	7660	075	F&T-Förderung		0,340	100	0,340	0,320	100	0,320	0,283	100	0,283
34010200	7661	030	Österreichische Computergesellschaft			100			100			100	
34010200	7662	341	Joanneum Research Forsch.ges.m.b.H(Techn.schwerp)		2,559	100	2,559	2,559	100	2,559	2,869	100	2,869
34010200	7666	005	Österreichisches Institut für Nachhaltigkeit			100		0,020	100	0,020	0,020	100	0,020
34010200	7667	006	Sonstige gemeinnützige Einrichtungen		1,245	100	1,245	1,245	100	1,245	1,461	100	1,461
34010200	7668	040	Salzburg Research		0,410	100	0,410	0,410	100	0,410	0,409	100	0,409
34010200	7668	050	Profactor			100			100		0,250	100	0,250
34010200	7690	002	Preisverleihungen		0,005	100	0,005	0,005	100	0,005	0,012	100	0,012
34010300	7260	000	Mitgliedsbeiträge an Institutionen im Inland		0,160	100	0,160	0,160	100	0,160	0,164	100	0,164
34010300	7270	000	Werkleistungen durch Dritte		2,120	100	2,120	2,000	100	2,000	7,259	100	7,259
34010300	7270	180	Werkleistungen durch Dritte (EU-Präs.18)								0,060	100	0,060
34010300	7280	030	FTI-Projekte, Beauftragungen an Dritte		1,000	100	1,000	1,570	100	1,570	1,241	100	1,241
34010300	7411	001	FFG - Basisprogramme		145,000	100	145,000	95,000	100	95,000	111,000	100	111,000
34010300	7411	002	FFG - FTI-Programme, Förderungen		182,655	100	182,655	155,654	100	155,654	129,065	100	129,065
34010300	7411	003	FFG - FTI-Programme (F&E-Dienstleist.,Sonst.WV)		10,000	100	10,000	10,000	100	10,000	2,275	100	2,275
34010300	7411	004	FFG - Administrative Kosten		20,000	100	20,000	17,000	100	17,000	16,418	100	16,418
34010300	7412	001	Austria Wirtschaftsservice GmbH AWS - Förderungen		22,000	100	22,000	10,000	100	10,000	14,379	100	14,379
34010300	7412	003	Austria Wirtschaftsservice GmbH AWS - Admin.Kost.		0,500	100	0,500	0,500	100	0,500	1,179	100	1,179
34010300	7432	030	FTI-Projekte, Förderungen		0,250	100	0,250	0,300	100	0,300	0,192	100	0,192
			Summe UG34		**501,820**		**488,213**	**402,690**		**389,307**	**361,069**		**350,942**
			UG41										
41010200	7330	080	Transferzahlungen an Klima- und Energiefonds	*	47,000	95	44,650	47,000	95	44,650	29,490	95	28,016
41020100	7270	000	Werkleistungen durch Dritte		1,727	50	0,864	1,726	50	0,863	1,098	50	0,549
41020100	7270	800	Dekarbonisierung/E-Mobilität		30,200	45	13,590	20,200	45	9,090	0,166	60	0,100
41020100	7270	801	E-Mobilität für alle: Urbane Elektromobilität		0,001	20		0,001	20			20	
41020100	7411	002	FFG - FTI-Programme, Förderungen		1,000	100	1,000	1,000	100	1,000	0,600	100	0,600
41020100	7411	003	FFG - FTI-Programme (F&E-Dienstleist.,Sonst.WV)		0,010	100	0,010	0,010	100	0,010		100	
41020100	7411	004	FFG - Administrative Kosten		0,010	100	0,010	0,010	100	0,010		100	
41020100	7480	501	Progr.Kombinierter Güterverk.Straße-Schiene-Schiff		4,300	50	2,150	3,300	50	1,650	2,911	50	1,456
41020100	7660	000	Zuschüsse f. lfd. Aufwand an private Institutionen		1,030	95	0,979	1,030	95	0,979	0,845	95	0,803
41020100	7668	055	Technisches Museum Wien		0,601	80	0,481	0,600	80	0,480	0,423	80	0,338
41020300	7411	002	FFG - FTI-Programme, Förderungen						50				
41020300	7411	004	FFG - Administrative Kosten						50				
41020300	7489	001	Breitbandinitiative (admin. Aufwand)						50				
41020300	7489	002	Breitband - Förderungen						50				
41020402	7270	000	Werkleistungen durch Dritte		0,964	5	0,048	0,964	5	0,048	0,522	5	0,026
41020402	7270	006	Werkleistungen durch Dritte (zw)		2,000	5	0,100	1,750	5	0,088	2,086	5	0,104

			Summe UG41		**88,843**		**63,882**	**77,591**		**58,868**	**38,141**		**31,992**
			UG43										
43010200	7700	500	Investitionszuschüsse		74,337	1	0,743	62,500	1	0,625	61,366	1	0,614
43010300			Klima- und Energiefonds		113,800	12	13,656	52,300	12	6,276	35,330	12	4,240
43010500			Nachhaltiger Natur- und Umweltschutz	*	82,614	1	0,826	82,614	1	0,826	64,405	1	0,644
43010500	7270	080	Forschungsaufwendungen		0,240	100	0,240	0,240	100	0,240	0,237	100	0,237
43010500	7420	021	Transferzahlungen an die UBA Ges.m.b.H		14,956	3	0,449	14,956	3	0,449	14,956	3	0,449
			Summe UG43		**285,947**		**15,914**	**212,610**		**8,416**	**176,294**		**6,184**
			Summe BM für Klimaschutz, Umwelt, Energie, Mobil., Innov. u.Technologie		**876,610**		**568,009**	**692,891**		**456,591**	**575,504**		**389,118**
			BM für Landwirtschaft, Regionen und Tourismus										
			UG42										
42010100			Zentralstelle	*	0,270	100	0,270	0,050	100	0,050	0,050	100	0,050
42010200	7411	000	Lfd Transfers an verbundene Unternehmungen	*							37,302	33	12,310
42010200	7411	027	Lfd Transfers an Ernährungsagentur-AGES		21,803	33	7,195	21,803	33	7,195			
42010200	7411	029	Lfd Transf.an Bundesamt u. Forschungszentr.f.Wald		15,500	33	5,115	15,500	33	5,115			
42020300			Forschung und Sonstige Maßnahmen	*	3,000	100	3,000	2,800	100	2,800	2,127	100	2,127
42020401			Landwirtschaftliche Schulen	*	70,908	23	16,309	47,791	25	11,948	46,594	21	9,785
42020402			Landwirtschaftliche Hochschule		5,521	3	0,166	5,523	3	0,166	5,513	3	0,165
42020403			Landwirtschaftliche Bundesanstalten		3,670	65	2,386	3,484	65	2,265	4,201	60	2,521
42020405			HBLA u. Forschungsanst. f. Landw. Ernähr., Lebensm.- u. Biotechn. Tirol	*		1		11,796	1	0,118	6,969	1	0,070
42020501			HBLA für Wein- und Obstbau Klosterneuburg		10,621	30	3,186	10,301	30	3,090	10,360	30	3,108
42020502			Bundesamt für Weinbau		5,500	3	0,165	5,400	3	0,162	5,412	3	0,162
42020900	7411	002	FFG - FTI-Programme, Förderungen		4,920	100	4,920	3,457	100	3,457			
42020900	7411	003	FFG - FTI-Programme (F&E-Dienstleist.,Sonst.WV)		1,230	100	1,230	1,331	100	1,331			
42020900	7411	004	FFG - Administrative Kosten		1,000	100	1,000	0,801	100	0,801			
42030101	7270	000	Werkleistungen durch Dritte		1,322	20	0,264	1,320	20	0,264	0,425	20	0,085
42030104			Forschung und Sonstige Maßnahmen Forst	*	0,300	100	0,300	0,300	100	0,300	0,768	100	0,768
42030204	7270	000	Werkleistungen durch Dritte	*	0,010	100	0,010	0,010	100	0,010	0,216	100	0,216
42030205			Bundesamt für Wasserwirtschaft		5,740	25	1,435	6,500	25	1,625	5,192	25	1,298
42030206			Siedlungswasserwirtschaft	*	0,429	100	0,429						
			Summe UG42		**151,744**		**47,380**	**138,167**		**40,697**	**125,129**		**32,665**
			Summe BM für Landwirtschaft, Regionen und Tourismus		**151,744**		**47,380**	**138,167**		**40,697**	**125,129**		**32,665**
			Teil b -Summe		**8.035,270**		**3.459,178**	**7.261,234**		**3.188,878**	**6.615,185**		**2.893,511**
			Gesamtsumme Teil a + b		**8.148,377**		**3.561,414**	**7.374,524**		**3.290,272**	**6.742,537**		**3.009,644**

BUNDESVORANSCHLAG 2021

Detailübersicht Forschungswirksame Mittelverwendungen des Bundes

Anmerkungen

Allgemeine Anmerkungen
*) F& E Koeffizienten geschätzt
Die Detailübersicht Foschungswirksame Mittelverwendung des Bundes:
a) Beitragszahlungen aus Bundesmitteln an internationale Organisationen, die Forschung und Forschungsförderung (mit) als Ziel haben,
b) Bundesbudget-Forschung - Finanzierungsvorschlag (ausgen. die bereits im Abschnitt a) ausgewiesen sind)
Für die Aufstellung dieser Ausgaben ist in erster Linie der Gesichtspunkt der Forschungswirksamkeit maßgebend, der inhaltlich über den Aufgabenbereich 99 "Grundlagen-, angewandte Forschung und experimentelle Entwicklung" hinausgeht und auf dem Forschungsbegriff des Fascati-Handbuches der OECD beruht, wie er im Rahmen der forschungsstatistischen Erhebungen der STATISTIK AUSTRIA zur Anwendung gelangt.
Forschungswirksame Anteile bei den Bundesausgaben finden sich daher nicht nur bei den Ausgaben des Aufgabenbereiches 99 "Grundlagen-, angewandte Forschung und experimentelle Entwicklung" sondern auch in zahlreichen anderen Aufgabenbereichen.

Finanzierungsvoranschlag

VA-Stelle	Konto	Ugl	Anmerkung
			Parlamentsdirektion
02010500	7330	086	*) Forschungsanteil für FV 2021 liegt bei 3,79 % für den Erfolg 2019 bei 12,01 % (System rundet).
			Bundeskanzleramt
10010402	7800	100	*) jährlicher Betrag des österreichischen Staatsarchivs an den Internationalen Archivbeirat (neu seit BVA 2020).
			BM für Inneres
11010200	7270	900	*) Teilbetrag der Voranschlagsstelle.
11020109	7270	900	Teilbetrag der Voranschlagsstelle.
11020600	7270	900	*) Teilbetrag der Voranschlagsstelle.
11020600			* Teilbetrag der Voranschlagsstelle
11020800	7270	900	*) Teilbetrag der Voranschlagsstelle.
18010100	7672	009	*) Teilbetrag der Voranschlagsstelle
18010100	7660	900	*) Aufgrund einer Budgetstrukturänderung wurde die Voranschlagsstelle 11030100 ab 2018 in die Voranschlagsstelle 18010100 überführt.
			*) Teilbetrag der Voranschlagsstelle.
			BM für europäische und internationale Angelegenheiten
12020200	7840	000	
12020200	7800	101	*) BMG-Novelle
12020200	7800	102	*) BMG-Novelle .
			BM für Justiz
13010100	6430	000	*) Studie des Instituts für Konfliktforschung zum Thema "Schutz der sexuellen Integrität" Auftragsvolumen: 76.500 Euro (hiervon noch offen: 38.250 Euro)
			*) Studie zum Thema "Justizielle Verfahrungserledigung bei Partnergewalt" (Auftragnehmer: IKF), Auftragsvolumen 55.000 Euro, noch offen: 27.500 Euro bezahlt; davon
			13.740 EUR vom BMI refundiert (Auszahlungssumme ohne Refundierung ausgewiesen)
			*) Studie zum Thema "Österreichische Urteile wegen NS-Tötungsverbrechen" (Auftragnehmer: FStN), Auftragsvolumen 5.000 Euro, davon im Jahr 2020 noch offen: 5.000 Euro
			*) Projektentwurf zu einem Forschungsprojekt "Prozessebbe", 4.500 EUR 2019 bezahlt
			*) Konzeptentwicklung Korruptionsstatistik/Sicherheitsbericht (Auftragnehmer: IRKS), Auftragsvolumen: 14.190 EUR zur Gänze offen
			*) Studie zur Unterbringung psychisch Kranker (Auftragnehmer: IRKS), Auftragsvolumen: 88.500 EUR, 59.000 EUR 2019; davon 29.500 EUR vom BMASGK refundiert (Auszahlungssumme ohne Refundierung ausgewiesen)
			*) Evaluierung und Weiterentwicklung des LKZ-Systems (Leistungskennzahlen für die Erwachsenenschutzvereine); Auftragnehmer: IRKS; Auftragsvolumen: 84.000 EUR, davon 50 % (=42.000 EUR) bei Projektbeginn.
			BM für Landesverteidigung
14040100			*) Teilbetrag (eigene Fistl);
14050100	7270	900	*) Teilbetrag der Voranschlagsstelle.
14050100	7270	000	*) Teilbetrag der Voranschlagsstelle.
			BM für Finanzen
15010100	7669	020	*) Teilbetrag der Voranschlagsstelle. Forschungsanteil liegt bei 27,361 % (System rundet).
15010100	7270	000	*) Teilbetrag der Voranschlagsstelle (System rundet: 37,13 %)
15010100	7662	002	*) Forschungsanteil liegt bei 56 %.
			BM für Arbeit, Familie und Jugend
20010101	7340	302	*) Forschungsanteil liegt bei 0,69 % (System rundet auf 1%)

20010201	7668	900	Forschungsanteil liegt bei 0,11 % (System rundet auf 0 %).
20010201	7270	006	
20010202	7270	000	Forschungsanteil liegt bei 1,91 % (System rundet auf 2%).
25010500	7420	313	Die Budgetposition wurde erst 2018 eröffnet, um die Zahlungen an die FBG betreffend Förderungen getrennt auszuweisen.
25010500	7270	006	
25010500	7420	113	
25020100	7270	000	
25020200	7270	000	
			BM für Bildung, Wissenschaft und Forschung
30010400	7800	000	*) Teilbetrag der VA-Stelle.
30010400			Teilbetrag der Voranschlagsstelle
30020700			Teilbetrag der Voranschlagsstelle
31030100			*) Der Restbetrag ergibt sich rechnerisch bei dieser VA-Stelle.
31030204			*) Der Restbetrag ergibt sich rechnerisch bei dieser VA-Stelle.
			BM für Klimaschutz, Umwelt, Energie, Mobil., Innov. u.Technologie
41010200	7330	080	* KLIEN: ab 2016 werden bei dieser Post nur mehr F&E-Projekte finanziert; daher die Erhöhung von 39 auf 95 %.
43010500			*) Teilbetrag der VA-Stelle.
			BM für Landwirtschaft, Regionen und Tourismus
42010100			*) PSP-Element 42P101020001 (bzw. P101020001 bis 2020).
42010200	7411	000	Finanzstellen 90306 (AGES) und 90309 (BFW).
			0 Finanzstellen 90306 (AGES) und 90309 (BFW).
42010200	7411	029	
42010200	7411	027	
42020300			PDP-Element 42P101010001 (bzw. 42 P101010001 und 42P101020001 bis 2020).
42020401			*) Finanzstellen 22010 (Francisco-Josephinum), 22013 (Raumberg-Gumpenstein), 22016 (Gartenbau); 22112 (alpenl. Milchw.)
42020403			
42020405			*) ab 2021 bei DB 42020401.
42030104			*) PSP-Element 42P101010001 (bzw. 42P101010002 und 42P101020002 bis 2020).
42030204	7270	000	*)PSP-Element 42P101010001 (bzw. P101020003 bis 2020.)
42030206			Teilbetrag des DB; lt. Mitteilung der Förderungsabwicklungsstelle.

Ergebnisvoranschlag

VA-Stelle	Konto	Ugl	Anmerkung
			Keine Anmerkungen erfasst.

Table A-5: Federal expenditure on research and research promotion by socio-economic objective, 2005-2021

Breakdown of Annex T of the Auxiliary Documents and the "Detailed overview of research-related appropriation of federal funds" (Part a and Part b) for the Federal Finances Acts

Reporting year		Total federal expenditure for R&D	of which for												
			Promotion of research covering the earth, the seas, the atmosphere, and space	Promotion of agriculture and forestry	Promotion of trade, commerce and industry	Promotion of energy production, storage and distribution	Promotion of transport, traffic and communications	Promotion of schools and education	Promotion of the health care system:	Promotion of social and socio-economic development:	Promotion of environmental protection	Promotion of urban and physical planning	Promotion of national defence	Promotion of other objectives	Promotion of general knowledge advancement
2005[1]	in €1,000	1,619,740	85,101	57,618	347,841	28,320	35,275	9,557	362,000	73,978	46,384	13,349	243	16,165	543,909
	In %	*100.0*	*5.3*	*3.6*	*21.5*	*1.7*	*2.2*	*0.6*	*22.3*	*4.6*	*2.9*	*0.8*	*0.0*	*1.0*	*33.5*
2006[2]	in €1,000	1,697,550	76,887	57,698	411,462	20,951	42,795	18,997	379,776	81,812	53,279	9,602	126	-	544,165
	In %	*100.0*	*4.5*	*3.4*	*24.2*	*1.2*	*2.5*	*1.1*	*22.4*	*4.8*	*3.1*	*0.6*	*0.0*	-	*32.2*
2007[3]	in €1,000	1,770,144	80,962	64,637	435,799	28,001	40,013	19,990	373,431	90,639	56,075	9,673	27	894	570,003
	In %	*100.0*	*4.6*	*3.7*	*24.6*	*1.6*	*2.3*	*1.1*	*21.1*	*5.1*	*3.2*	*0.5*	*0.0*	*0.1*	*32.1*
2008[4]	in €1,000	1,986,775	87,751	66,273	525,573	24,655	39,990	37,636	422,617	90,879	57,535	12,279	142	-	621,445
	In %	*100.0*	*4.4*	*3.3*	*26.5*	*1.2*	*2.0*	*1.9*	*21.3*	*4.6*	*2.9*	*0.6*	*0.0*	-	*31.3*
2009[5]	in €1,000	2,149,787	104,775	66,647	538,539	32,964	47,300	42,581	456,544	97,076	67,985	14,522	133	-	680,721
	In %	*100.0*	*4.9*	*3.1*	*25.1*	*1.5*	*2.2*	*2.0*	*21.2*	*4.5*	*3.2*	*0.7*	*0.0*	-	*31.6*
2010[6]	in €1,000	2,269,986	103,791	67,621	587,124	39,977	56,969	50,648	472,455	99,798	67,114	12,792	123	-	711,574
	In %	*100.0*	*4.6*	*3.0*	*25.9*	*1.8*	*2.5*	*2.2*	*20.8*	*4.4*	*3.0*	*0.6*	*0.0*	-	*31.2*
2011[7]	in €1,000	2,428,143	107,277	63,063	613,692	41,294	54,043	59,479	510,359	115,792	77,578	20,170	99	-	765,297
	In %	*100.0*	*4.4*	*2.6*	*25.3*	*1.7*	*2.2*	*2.4*	*21.0*	*4.8*	*3.2*	*0.8*	*0.0*	-	*31.6*
2012[8]	in €1,000	2,452,955	103,432	60,609	607,920	55,396	47,934	65,537	499,833	121,570	86,776	20,338	120	-	783,490
	In %	*100.0*	*4.2*	*2.5*	*24.8*	*2.3*	*2.0*	*2.7*	*20.4*	*5.0*	*3.5*	*0.8*	*0.0*	-	*31.8*
2013[9]	in €1,000	2,587,586	108,966	70,897	641,851	76,014	53,713	83,087	542,560	117,714	83,556	21,985	280	-	786,963
	In %	*100.0*	*4.2*	*2.7*	*24.9*	*2.9*	*2.1*	*3.2*	*21.0*	*4.5*	*3.2*	*0.8*	*0.0*	-	*30.5*
2014[10]	in €1,000	2,647,489	113,173	60,714	689,214	64,582	64,675	81,354	566,058	119,780	48,381	22,639	961	-	815,958
	In %	*100.0*	*4.3*	*2.3*	*26.0*	*2.4*	*2.4*	*3.1*	*21.4*	*4.5*	*1.8*	*0.9*	*0.0*	-	*30.9*
2015[11]	in €1,000	2,744,844	124,648	58,414	678,572	122,624	51,785	78,241	584,254	128,733	49,176	26,817	1,949	-	839,631
	In %	*100.0*	*4.5*	*2.1*	*24.7*	*4.5*	*1.9*	*2.9*	*21.3*	*4.7*	*1.8*	*1.0*	*0.1*	-	*30.5*
2016[12]	in €1,000	2,875,706	131,240	60,828	747,264	122,903	46,654	82,610	592,407	135,709	49,586	28,435	2,610	-	875,460
	In %	*100.0*	*4.6*	*2.1*	*26.0*	*4.3*	*1.6*	*2.9*	*20.6*	*4.7*	*1.7*	*1.0*	*0.1*	-	*30.4*
2017[13]	in €1,000	2,889,779	144,552	70,329	728,136	106,887	68,214	74,493	609,919	159,300	45,228	35,171	4,899	9,730	832,921
	In %	*100.0*	*5.0*	*2.4*	*25.2*	*3.7*	*2.4*	*2.6*	*21.1*	*5.5*	*1.6*	*1.2*	*0.2*	*0.3*	*28.8*
2018[14]	in €1,000	2,913,369	147,535	69,753	752,214	107,966	69,823	75,212	615,795	158,546	45,196	35,534	5,245	8,955	821,595
	In %	*100.0*	*5.1*	*2.4*	*25.8*	*3.7*	*2.4*	*2.6*	*21.1*	*5.4*	*1.6*	*1.2*	*0.2*	0.3	*28.2*
2019[15]	in €1,000	3,009,644	159,539	69,176	759,069	88,800	82,642	77,147	644,057	166,593	43,452	37,544	5,056	9,291	867,278
	In %	*100.0*	*5.3*	*2.3*	*25.2*	*3.0*	*2.7*	*2.6*	*21.4*	*5.5*	*1.4*	*1.2*	*0.2*	0.3	*28.9*
2020[16]	in €1,000	3,290,272	158,662	74,032	831,235	109,723	91,991	79,644	725,902	178,072	49,692	40,209	4,990	9,368	936,752
	In %	*100.0*	*4.8*	*2.3*	*25.3*	*3.3*	*2.8*	*2.4*	*22.1*	*5.4*	*1.5*	*1.2*	*0.2*	0.3	*28.4*
2021[16]	in €1,000	3,561,414	167,188	80,549	923,839	117,860	106,306	95,286	751,622	195,960	60,249	41,699	5,519	9,426	1,005,911
	In %	*100.0*	*4.7*	*2.3*	*25.9*	*3.3*	*3.0*	*2.7*	*21.1*	*5.5*	*1.7*	*1.2*	*0.2*	0.3	*28.1*

Date: March 2021.

Source: STATISTICS AUSTRIA.

1) Annex T of the Auxiliary Document for the Federal Finances Act 2007 (BFG 2007), Cash Flow Statement. – 2) Annex T of the Auxiliary Document for the Federal Finances Act 2008 (BFG 2008), Cash Flow Statement. Revised data. – 3) Annex T of the Auxiliary Document for the Federal Finances Act 2009 (BFG 2009), Cash Flow Statement. – 4) Annex T of the Auxiliary Document for the Federal Finances Act 2010 (BFG 2010), Cash Flow Statement. – 5) Annex T of the Auxiliary Document for the Federal Finances Act 2011 (BFG 2011), Cash Flow Statement. – 6) Annex T of the Auxiliary Document for the Federal Finances Act 2012 (BFG 2012), Cash Flow Statement. – 7) Annex T of the Auxiliary Document for the Federal Finances Act 2013 (BFG 2013) (Cash Flow Budget), Cash Flow Statement. Revised data. – 8) Annex T of the Auxiliary Document for the Federal Finances Act 2014 (BFG 2014) (Cash Flow Budget), Cash Flow Statement. – 9) Annex T of the Auxiliary Document for the Federal Finances Act 2015 (BFG 2015) (Cash Flow Budget), Cash Flow Statement. Revised data. – 10) Federal Finances Act 2016 (BFG 2016), Detailed overview of research-related appropriation of federal funds, Cash Flow Statement. – 11) Federal Finances Act 2017 (BFG 2017), Detailed overview of research-related appropriation of federal funds, Cash Flow Statement. Revised data. – 12) Federal Finances Act 2018 (BFG 2018), Detailed overview of research-related appropriation of federal funds, Cash Flow Statement. – 13) Federal Finances Act 2019 (BFG 2019), Detailed overview of research-related appropriation of federal funds, Cash Flow Statement. Revised data. – 14) Federal Finances Act 2020 (BFG 2020), Detailed overview of research-related appropriation of federal funds, Cash Flow Statement. – 15) Federal Finances Act 2021 (BFG 2021), Detailed overview of research-related appropriation of federal funds, Cash Flow Statement. – 16) Federal Finances Act 2021 (BFG 2021), Detailed overview of research-related appropriation of federal funds, Cash Flow Budget.

Table A-6: Federal expenditure on research and research promotion by socio-economic objective and ministry, 2021[1]

Breakdown of annual values 2021[1] of the "Detailed overview of research-related appropriation of federal funds" in the Federal Finances Act (BFG) 2021 (Part a and Part b).

Ministries		Total federal expenditure for R&D	of which for												
			Promotion of research covering the earth, the seas, the atmosphere, and space	Promotion of agriculture and forestry	Promotion of trade, commerce and industry	Promotion of energy production, storage and distribution	Promotion of transport, traffic and communications	Promotion of schools and education	Promotion of the health care system:	Promotion of social and socio-economic development:	Promotion of environmental protection	Promotion of urban and physical planning	Promotion of national defence	Promotion of other objectives	Promotion of general knowledge advancement
BKA[2]	in €1,000	1,332	-	-	-	-	2	-	-	687	-	188	-	-	455
	In %	*100.0*	-	-	-	-	*0.2*	-	-	*51.5*	-	*14.1*	-	-	*34.2*
BMKÖS	in €1,000	46,639	5,787	-	-	-	-	-	-	14,666	-	-	-	-	26,186
	In %	*100.0*	*12.4*	-	-	-	-	-	-	*31.4*	-	-	-	-	*56.2*
BMEIA	in €1,000	3,325	-	-	-	963	-	-	-	2,362	-	-	-	-	-
	In %	*100.0*	-	-	-	*29.0*	-	-	-	*71.0*	-	-	-	-	-
BMAFJ	in €1,000	7,584	-	-	-	-	-	-	-	7,584	-	-	-	-	-
	In %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-	-
BMBWF	in €1,000	2,666,156	131,349	36,353	460,130	33,676	48,367	94,165	709,381	153,039	30,880	39,760	3,372	-	925,684
	In %	*100.0*	*4.9*	*1.4*	*17.3*	*1.3*	*1.8*	*3.5*	*26.6*	*5.7*	*1.2*	*1.5*	*0.1*	-	*34.7*
BMDW	in €1,000	115,656	-	-	115,656	-	-	-	-	-	-	-	-	-	-
	In %	*100.0*	-	-	*100.0*	-	-	-	-	-	-	-	-	-	-
BMF	in €1,000	31,520	1,262	1,524	4,926	343	572	955	6,318	8,186	382	457	-	-	6,595
	In %	*100.0*	*4.0*	*4.8*	*15.6*	*1.1*	*1.8*	*3.0*	*20.0*	*26.1*	*1.2*	*1.4*	-	-	*21.0*
BMI	in €1,000	1,942	-	-	-	-	-	-	-	1,942	-	-	-	-	-
	In %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-	-
BMJ	in €1,000	64	-	-	-	-	-	-	-	64	-	-	-	-	-
	In %	*100.0*	-	-	-	-	-	-	-	100.0	-	-	-	-	-
BMK	in €1,000	627,342	27,503	4,275	337,395	82,298	57,315	-	29,103	3,470	28,823	1,294	717	9,426	45,723
	in %	*100.0*	*4.4*	*0.7*	*53.8*	*13.1*	*9.1*	-	*4.6*	*0.6*	*4.6*	*0.2*	*0.1*	*1.5*	*7.3*
BMLV	in €1,000	1,981	-	-	-	-	-	-	-	-	-	-	1,416	-	565
	in %	*100.0*	-	-	-	-	-	-	-	-	-	-	*71.5*	-	*28.5*
BMLRT	in €1,000	49,141	1,287	38,397	5,732	580	50	166	293	1,755	164	-	14	-	703
	In %	*100.0*	*2.6*	*78.2*	*11.7*	*1.2*	*0.1*	*0.3*	*0.6*	*3.6*	*0.3*	-	*0.0*	-	*1.4*
BMSGPK	in €1,000	8,732	-	-	-	-	-	-	6,527	2,205	-	-	-	-	-
	In %	*100.0*	-	-	-	-	-	-	*74.7*	*25.3*	-	-	-	-	-
Total	**in €1,000**	**3,561,414**	**167,188**	**80,549**	**923,839**	**117,860**	**106,306**	**95,286**	**751,622**	**195,960**	**60,249**	**41,699**	**5,519**	**9,426**	**1,005,911**
	In %	***100.0***	***4.7***	***2.3***	***25.9***	***3.3***	***3.0***	***2.7***	***21.1***	***5.5***	***1.7***	***1.2***	***0.2***	***0.3***	***28.1***

Date: March 2021.

Source: STATISTICS AUSTRIA.

1) Cash Flow Budget.

2) Including the highest executive bodies.

Table A-7: General research-related university expenditure by the federal government ("General University Funds"), 2000–2021[1]

Year	General University Funds	
	total	R&D
	€ millions	
2000	1,956.167	842.494
2001	2,008.803	866.361
2002	2,104.550	918.817
2003	2,063.685	899.326
2004	2,091.159	980.984
2005	2,136.412	1,014.543
2006	2,157.147	1,027.270
2007	2,314.955	1,083.555
2008	2,396.291	1,133.472
2009	2,626.038	1,236.757
2010	2,777.698	1,310.745
2011	2,791.094	1,388.546
2012	2,871.833	1,395.130
2013	3,000.004	1,453.596
2014	3,059.949	1,481.744
2015	3,117.320	1,509.576
2016	3,262.376	1,610.742
2017	3,319.288	1,638.460
2018	3,294.879	1,658.500
2019	3,488.597	1,755.220
2020	3,833.110	1,928.267
2021	3,913.842	1,968.355

Date: March 2021.

Source: STATISTICS AUSTRIA.

1) 2000-2021: Based on Annex T of the Auxiliary Document and the "Detailed overview of research-related appropriation of federal funds" for the Federal Finances Acts (BFG).

Table A-8: Research promotion schemes and contracts awarded by the federal government in 2020, by sector/area of performance and awarding ministry

Analysis of the federal research database[1] without "major" global financing[2]

Ministries	Partial amounts 2020	of which awarded to																			
		Higher education sector					Government sector							Private non-profit sector							
		Universities (including teaching hospitals)	Universities of the arts	Universities of applied sciences	Other higher education sector [3]	Combined	Federal institutions (outside of the higher education sector)	Austrian Institute of Technology (AIT)	Austrian Academy of Sciences (OeAW)	private non-profit facilities mostly run on public financing	Ludwig Boltzmann Gesellschaft (LBG)	Other public sector [4]	Combined	private non-profit facilities	Individual researchers	Combined	Company R&D sub-sector ("Firmeneigener Bereich")	Combined	Austrian Science Fund (FWF)	Austrian Research Promotion Agency (FFG)	Abroad
	in €	in %																			
BKA	588,950	*31.3*	-	-	-	*31.3*	*49.4*	*4.1*	-	*11.7*	-	-	*65.2*	-	-	-	-	-	-	-	*3.5*
BMAFJ	393,900	*4.6*	-	-	-	*4.6*	-	-	-	*37.1*	-	-	*37.1*	-	*0.6*	*0.6*	*45.8*	*45.8*	-	-	*11.9*
BMASGK	56,292	-	-	-	-	-	-	-	-	*93.6*	-	*6.4*	*100.0*	-	-	-	-	-	-	-	-
BMBWF	47,640,751	*5.3*	*0.1*	*0.1*	*0.0*	*5.5*	*1.0*	*0.1*	-	*15.8*	-	-	*16.9*	*0.6*	*0.0*	*0.6*	*0.8*	*0.8*	-	*2.7*	*73.5*
BMDW	694,641	*13.2*	-	-	-	*13.2*	*0.6*	*3.8*	-	*45.4*	-	*2.2*	*52.0*	*4.2*	-	*4.2*	*24.5*	*30.1*	-	-	*0.5*
BMEIA	117,940	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*100.0*	*100.0*	-	-	-
BMF	5,904,666	-	-	-	-	-	*29.0*	-	-	*28.3*	-	-	*57.3*	*0.1*	*0.4*	*0.5*	*3.9*	*3.9*	-	*35.5*	*2.8*
BMI	865,582	*7.0*	-	*41.3*	-	*48.3*	-	-	-	*33.6*	*0.3*	-	*33.9*	-	-	-	*17.8*	*17.8*	-	-	-
BMJ	137,407	-	-	-	-	-	-	-	-	*96.4*	-	-	*96.4*	*3.6*	-	*3.6*	-	-	-	-	-
BMK	1,518,078	*30.0*	-	-	-	*30.0*	-	-	-	*28.9*	-	-	*28.9*	*14.1*	-	*14.1*	*3.8*	*18.7*	-	*8.3*	-
BMLV	938,264	*3.9*	-	-	-	*3.9*	*5.8*	*14.3*	*0.8*	-	-	*11.0*	*31.9*	*2.1*	*6.0*	*8.1*	*37.0*	*37.0*	-	-	*19.1*
BMLRT	3,740,731	*41.2*	-	-	-	*41.2*	*38.7*	*0.6*	-	*11.0*	-	-	*50.3*	*0.9*	-	*0.9*	*4.2*	*4.2*	-	*3.4*	-
BMSGPK	2,268,586	*16.3*	-	-	-	*16.3*	*64.0*	-	-	*9.4*	-	*1.0*	*74.4*	*3.1*	-	*3.1*	*5.3*	*5.3*	-	-	*0.9*
Total	**64,865,788**	***8.2***	***0.1***	***0.6***	***0.0***	***8.9***	***8.4***	***0.4***	***0.0***	***17.4***	***0.0***	***0.2***	***26.4***	***1.0***	***0.1***	***1.1***	***2.9***	***3.3***	**-**	***5.6***	***54.7***

Date: April 2021.

Source: STATISTICS AUSTRIA.

1) Data as per: 23 March 2021.

2) i.e. without institutional funding where funding amounts exceed €500,000.

3) Private universities, university colleges of teacher education, testing agencies at technical federal colleges and other institutions categorised within the higher education sector.

4) State, local and chamber institutions as well as facilities of social insurance institutions.

Table A-9: Research promotion schemes and contracts awarded by the federal government in 2020, by socio-economic objective and awarding ministry

Analysis of the federal research database[1] without "major" global financing[2]

Ministries		Partial amounts 2020	of which for											
			Promotion of research covering the earth, the seas, the atmosphere, and space	Promotion of agriculture and forestry	Promotion of trade, commerce and industry	Promotion of energy production, storage and distribution	Promotion of transport, traffic and communications	Promotion of schools and education	Promotion of the health care system:	Promotion of social and socio-economic development:	Promotion of environmental protection	Promotion of urban and physical planning	Promotion of national defence	Promotion of general knowledge advancement
BKA	in €	588,950	-	-	-	-	-	-	-	573,956	14,994	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*97.5*	*2.5*	-	-	-
BMAFJ	in €	393,900	-	-	-	-	-	-	-	391,400	-	-	-	2,500
	in %	*100.0*	-	-	-	-	-	-	-	*99.4*	-	-	-	*0.6*
BMASGK	in €	56,292	-	-	-	-	-	-	-	56,292	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-
BMBWF	in €	47,640,751	7,046,000	-	20,000	-	-	-	6,378,846	2,636,910	90,727	-	-	31,468,268
	in %	*100.0*	*14.8*	-	*0.0*	-	-	-	*13.4*	*5.5*	*0.2*	-	-	*66.1*
BMDW	in €	694,641	-	4,000	-	-	-	-	2,960	383,581	-	-	-	304,100
	in %	*100.0*	-	*0.6*	-	-	-	-	*0.4*	*55.2*	-	-	-	*43.8*
BMEIA	in €	117,940	-	-	-	-	-	-	-	117,940	-	-	-	-
	in %	*100.0*	-	-	-	-	-	-	-	*100.0*	-	-	-	-
BMF	in €	5,904,666	-	-	112,000	-	-	-	239,937	3,411,570	45,700	-	-	2,095,459
	in %	100.0	-	-	*1.9*	-	-	-	*4.1*	*57.7*	*0.8*	-	-	*35.5*
BMI	in €	865,582	-	-	-	-	-	-	357,000	505,582	-	-	-	3,000
	in %	*100.0*	-	-	-	-	-	-	*41.2*	*58.5*	-	-	-	*0.3*
BMJ	in €	137,407	-	-	-	-	-	-	-	132,407	-	-	-	5,000
	in %	*100.0*	-	-	-	-	-	-	-	*96.4*	-	-	-	*3.6*
BMK	in €	1,518,078	-	3,000	375,000	29,000	-	-	165,222	17,000	412,690	72,000	-	444,166
	In %	*100.0*	-	*0.2*	*24.7*	*1.9*	-	-	*10.9*	*1.1*	*27.2*	*4.7*	-	*29.3*
BMLV	in €	938,264	53,975	-	234,520	30,000	-	-	28,000	-	-	-	406,346	185,423
	in %	*100.0*	*5.8*	-	*25.0*	*3.2*	-	-	*3.0*	-	-	-	*43.2*	*19.8*
BMLRT	in €	3,740,731	299,455	1,931,987	211,318	-	-	-	45,000	410,220	688,641	-	-	154,110
	in %	*100.0*	*8.0*	*51.7*	*5.6*	-	-	-	*1.2*	*11.0*	*18.4*	-	-	*4.1*
BMSGPK	in €	2,268,586	-	150,000	-	-	-	-	165,670	1,836,578	116,338	-	-	-
	in %	*100.0*	-	*6.6*	-	-	-	-	*7.3*	*81.0*	*5.1*	-	-	-
Total	**in €**	**64,865,788**	**7,399,430**	**2,088,987**	**952,838**	**59,000**	**-**	**-**	**7,382,635**	**10,473,436**	**1,369,090**	**72,000**	**406,346**	**34,662,026**
	in %	***100.0***	***11.4***	***3.2***	***1.5***	***0.1***	**-**	**-**	***11.4***	***16.1***	***2.1***	***0.1***	***0.6***	***53.5***

Date: April 2021.

Source: STATISTICS AUSTRIA.

1) Data as per: 23 March 2021.

2) i.e. excluding institutional funding where funding amounts exceed €500,000

Table A-10: An international comparison of research and experimental development (R&D) in 2018

Country	Gross domestic expenditure on R&D as a % of GDP	Funding of gross domestic expenditure on R&D through		Employees in R&D in full-time equivalents	Gross expenditure on R&D by the			
		government	business		Business enterprise sector	Higher education sector	Government sector	Private non-profit sector
		in %			in % of gross domestic expenditure on R&D			
Belgium	2.67 e)	20.0 2)	63.5 2)	88,031 e)	69.8 e)	19.7 e)	9.9 e)	0.6 e)
Bulgaria	0.76	23.4	43.1	25,809	71.9	5.4	22.1	0.6
Denmark	2.97	28.2 p)2)	60.4 p)2)	59,778	63.1	33.6	2.9	0.3
Germany	3.12	27.8	66.0	707,704	68.9	17.6	13.5 d)	.
Estonia	1.41	42.8	40.8	6,183	42.3	44.5	11.4	1.7
Finland	2.76	28.3	55.8	50,011	65.7	25.2	8.3	0.8
France p)	2.20	31.6	56.7	452,970	65.5	20.5	12.5	1.6
Greece	1.21	40.6	42.5	51,279	48.2	28.4	22.4	1.1
Ireland	1.14	23.2	51.7	35,817 e)	74.7	21.0	4.3	.
Italy	1.42	32.8	54.5	345,625	63.1	22.8 e)	12.5	1.6
Croatia	0.97	42.4	33.2	13,029	48.0	32.0	19.9 d)	.
Latvia	0.64	34.3	22.3	5,806	24.9	52.4	22.8	.
Lithuania	0.94	32.4	38.0	11,956	41.8	35.9	22.2	.
Luxembourg	1.17	43.1 2)	49.6 2)	5,468	53.2	20.7	26.0	.
Malta	0.60	29.9	59.6	1,530	63.0	35.9	1.2	.
The Netherlands	2.14	29.6	56.7	156,875	66.4	27.7	5.9 d)	0.0 d)
Austria	**3.09 3)**	**30.3 3)**	**53.1 3)**	**80,750 p)**	**69.9 p)**	**22.4 p)**	**7.1 p)**	**0.5 p)**
Poland	1.21	35.4	53.2	161,993	66.1	31.7	1.9	0.3
Portugal	1.35	40.6	47.3	58,154	51.4	41.6	5.3	1.6
Romania	0.50	33.3	57.1	31,933	59.3	9.8	30.6	0.2
Sweden	3.32	25.0 2)	60.8 2)	92,011	71.0	25.3	3.6	0.1
Slovakia	0.84	38.0	48.8	20,268	54.1	24.3	21.2	0.4
Slovenia	1.95	23.7	62.6	15,686	74.2	11.9	13.5	0.3
Spain	1.24	37.6	49.5	225,696	56.5	26.4	16.8	0.3
Czechia	1.90	34.1	39.9	74,969	61.9	21.5	16.4	0.2
Hungary b)	1.51	32.3	52.4	54,654	75.6 d)	12.7 d)	10.9 d)	.
Cyprus	0.62	33.8	34.8	1,826	40.5	40.1	8.4	11.0
EU-27 states (from 2020)	**2.18**	**29.6 e)**	**59.1 e)**	**2,835,810**	.	.	.	.
United Kingdom	1.73	25.9	54.8	463,476 e)	67.6	23.6	6.6	2.2
EU-28 countries (2013-2020)	**2.11**	**29.2 e)**	**58.6 e)**	**3,299,286**	.	.	.	.
Bosnia and Herzegovina 1)	0.26	46.7	41.7	1,767	18.6	61.1	18.8	1.4
Iceland	2.01	36.0	40.2	3,172	64.3	31.5	4.2	0.0
Montenegro	0.50	49.0	37.8	682	38.3	33.3	26.8	1.6
North Macedonia	0.36	45.2	30.1	1,995	30.6	58	9.8	1.6
Norway	2.05	48.0	42.0	46,601	51.5	34.6	13.9	.
Russia	0.98	67.0	29.5	758,462	55.6	9.7	34.4	0.3
Switzerland 2)	3.18	26.5	68.6	81,751	71.0	28.2	0.8	.
Serbia	0.92	43.1	10.0	20,868	39.1	32.7	28.2	0.0
Turkey	1.03	32.3	53.6	172,119	60.4	30.3	9.2	.
Japan	3.28 b)	14.6 e)	79.1 b)	896,901 b)d)	79.4	11.6 b)	7.8	1.3
South Korea	4.52	20.5	76.6	501,175	80.3	8.2	10.1	1.4
United States	2.82 d)e)	23.0 d)p)	62.4 d)e)	.	72.6 d)e)	12.8 d)p)	10.4	4.2 d)e)
People's Republic of China without Hong Kong	2.14	20.2	76.6	4,381,444	77.4	7.4	15.2	.

Date: 10 March 2021.

Source: STATISTICS AUSTRIA

b) Break in the time series. d) Different definition. – e) Estimated values. – p) Preliminary values.

1) 2014. – 2) 2017. – 3) STATISTICS AUSTRIA; according to R&D global estimate 2021.

Full-time equivalent = person-year.