A8

2014–15

RESEARCH REPORT

Innovation through Cooperation

Das Land Steiermark

→ Wissenschaft

The aim of science is not to open the door to infinite wisdom, but to set a limit to infinite error.

Bertolt Brecht

Where the frontier of science once was is now the centre.

Georg Christoph Lichtenberg

Foreword Regional Minister Christopher Drexler

Landesrat
Mag. Christopher Drexler

With a research intensity of 4.9%, the second highest regional rate in Europe, Styria attracts increasing attention. But what makes our regional science and research landscape so successful?

Firstly, Styria is excellently positioned as a science location: together 9 universities with 5,700 scientists, almost 60,000 students, nearly 15,000 employees, 60% international partners, more than 9,000 university publications a year, and the research company JOANNEUM RESEARCH represent a substantial science basis. This encourages many forms of cooperation and enables interdisciplinary approaches which are increasingly regarded as important for excellence and innovative companies.
And secondly, it is exactly this collaboration between science and industry which makes our internationally impressive research intensity possible in the first place. Research is not undertaken – and funded – for its own sake. Styrian science and research determine our future prosperity and jobs. This Science Report offers a condensed overview of these impressive and diverse activities.

Mag. Christopher Drexler, Regional Minister for Science

4,9 %

Styria has a research intensity of 4.9%, ranking second among European regions.

30 %

High international reputation as a research location: some 30% of R&D are financed from abroad.

5.700

5,700 researchers (FTE) in the science sector

450

JOANNEUM RESEARCH has 450 staff, making it the largest non-university research institution in Styria.

Total of 9 higher education institutions: 5 universities, 2 university colleges of teacher education and 2 universities of applied sciences

Full range of disciplines with a focus on engineering and natural sciences

15.000

Styrian universities have a total of 15,000 employees (headcount), making them the third largest employer in the region

22 %

Horizon 2020: over 210 participations from Styria (start 2016)

Enhanced cooperation between universities:

Styrian University Conference maintains a common position on the relevance of the Graz universities for Styria as a research location.

Knowledge Transfer Centre South (WTZ Süd) marks the first cooperation between Styrian and Carinthian universities.

10.300

10,300 international students from 125 nations

9.200

Universities publish more than 9,200 scientific publications per year

60 %

Universities: 60% of partners are international

60.000

Some 60,000 students are enrolled at the Styrian universities

Styria at a glance

1

The science and research system in the Austrian province of Styria has continued to evolve successfully in recent years. Styria is now a modern region with the second highest regional research intensity in Europe and a fully differentiated research landscape. Research is carried out in virtually every scientific discipline with the emphasis on the natural sciences and engineering.

Today higher education establishments are an integral part of regional development strategies and are aware of their role as key institutions. Alongside their traditional functions of research and teaching they are actively involved in a third mission, knowledge transfer, with stakeholders from industry and society.

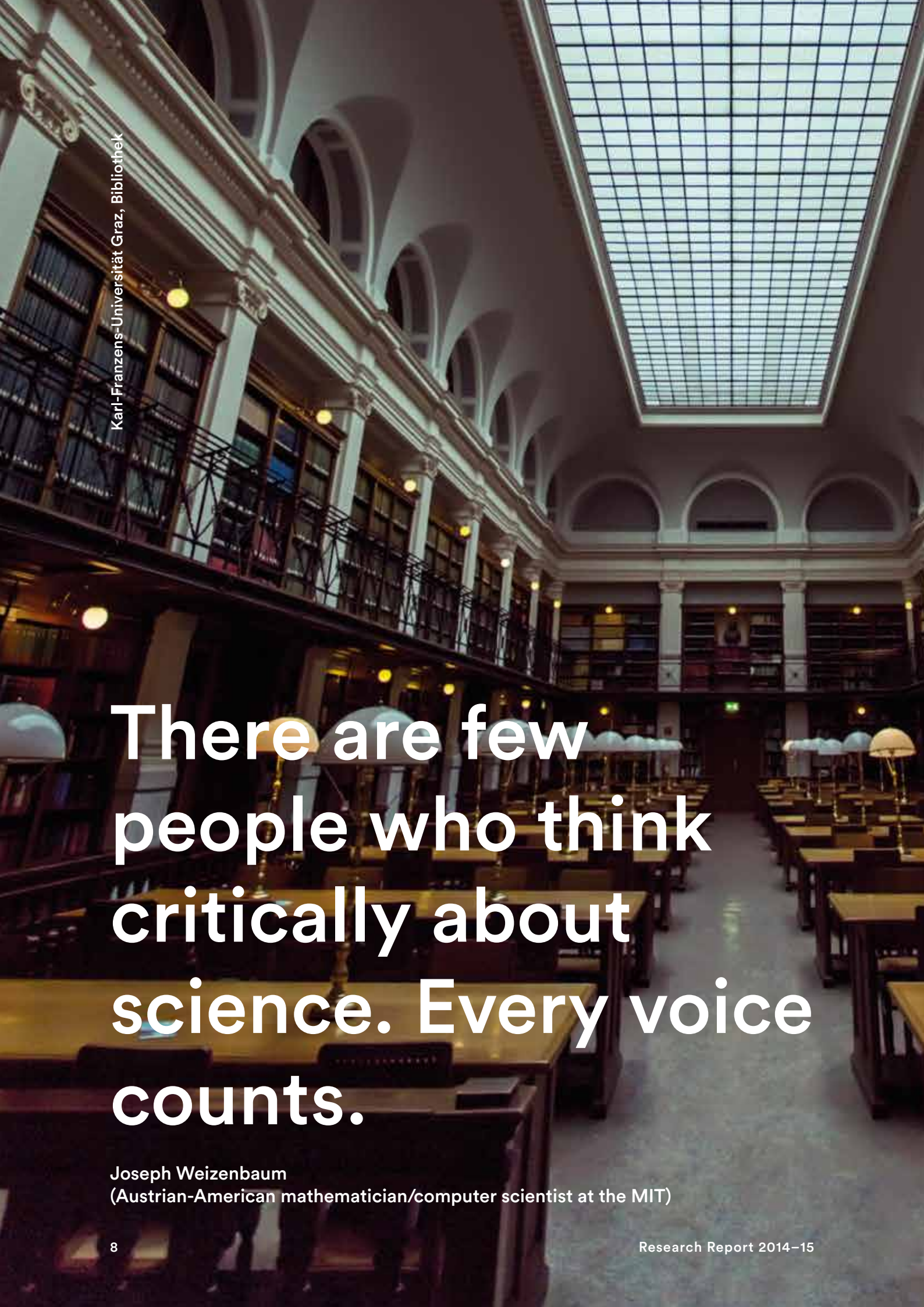
Styria is one of Austria's model regions as regards cooperation and interdisciplinarity. Cooperation has been intensified at various levels in the scientific sector. Examples include the Styrian University Conference, the Knowledge Transfer Centre South (WTZ Süd) and the BioTechMed strategic research partnership. Collaboration with industry has also been given new impetus in recent years. New endowed professorships have been introduced and strategic partnerships strengthened between universities and companies.

Styria enjoys an excellent international reputation as a research location. This is not only seen in the high proportion of foreign R&D investment but also in the many strategic international cooperative initiatives by Styrian scientific institutions and the over 20% external university funding from abroad. Styria is also popular internationally as a place to study: over 10,300 of its almost 60,000 students come from abroad, representing around 125 nationalities.

Higher education institutions and R&D facilities strengthen Styria as a research and business location in a variety of ways. Each year the majority of Styria's approx. 8,600 graduates enter the job market as highly qualified employees, making tomorrow's innovations possible. Higher education institutions are also a significant factor in adding value. With almost 15,000 academic and non-academic staff, higher education institutions are the third largest employer of the region.

This volume offers an overview of Styria's science and research activities and traces core developments in recent years.

Styria is one of Austria's model regions as regards cooperation and interdisciplinarity.



Karl-Franzens-Universität Graz, Bibliothek

There are few people who think critically about science. Every voice counts.

Joseph Weizenbaum
(Austrian-American mathematician/computer scientist at the MIT)

What drives the science and research system: third mission and the regional factor

2

Science plays a central role in dealing with the major challenges which affect our future such as climate change, migration and demographic issues, etc. It makes a decisive contribution both in understanding the challenges and in developing new solutions. The move to address the Grand Challenges will be further intensified through the EU's and federal government's new focus for R&D funding. The aim of research is no longer solely geared towards acquiring knowledge within a particular discipline but directed more at exploiting the social and economic value of the results to develop and implement solutions for issues relevant to the future.

Third mission as a new role for universities

The role of universities has evolved over the decades. The knowledge sector has become a central factor in regional development. While the flow of knowledge from university to industry and society was, for a long time, a by-product of scientific activity, today the transfer of (university) knowledge has an incomparably greater significance for regional development. Universities are actively seizing this new role as a third mission alongside their traditional responsibilities of research and teaching.

This development is driven by the growth in knowledge intensity and the significance of innovation for regional economic development. Knowledge transfer takes place via many different channels. A central element is cooperation between science and industry through strategic partnerships, (R&D) projects and shared infrastructures and knowledge transfer institutions. The dissemination and use of knowledge also encompasses civil society however, so that the universities are increasingly engaging in science communication and transfer (science to public). Innovative activities and initiatives (such as the "Long Night of Research", for example) are creating an appreciation of research at a wider level.

Science as a key factor in regional development

The important role of higher education institutions and research facilities for the region as regards the third mission is also reflected in the new generation of regional strategies. These follow the concept of smart specialisation which currently forms the EU's frame of reference for developing regional innovation systems. The concept highlights the region's ability to develop and innovate based on specific local strengths and expertise in order to boost potential for development. Combining forces creates critical mass, encouraging innovation and reinforcing visibility and success at an international level. A core element is collaboration and interaction between the relevant stakeholders in a region. These include industry as well as the knowledge and research sector, the public sector and civil society. Universities take on a central role as key institutions in establishing a regional profile through knowledge and innovation. The Research Strategy Styria is also characterised by this smart specialisation approach.

Science opens up: interdisciplinarity and cooperation

Science's new third mission role coupled with increasingly complex issues (Grand Challenges) also has a direct impact on the research process itself. To tackle many issues today it is no longer sufficient to conduct research within a single discipline. Instead science must follow an interdisciplinary approach in order to be able to derive solutions to specific problems through the interaction and integration of many different perspectives. Particular opportunities can be seen in the long neglected association of the natural sciences with the humanities, social sciences and cultural studies, giving rise to a more comprehensive understanding of the possibilities and consequences of technological solutions.

In addition to interdisciplinarity within science, cooperation with stakeholders outside the academic world is also gaining in importance. Alongside traditional R&D partnerships, transdisciplinary approaches and open innovation are increasingly finding their way into research practice. These terms define concepts which specifically involve people with real world experience and users in science and innovation. The aim is to include issues relevant to society in the research process, to work on them together and develop practical solutions.

Science with a global and regional focus

Modern science takes place in a global context and is measured against an international level of knowledge rather than on a regional scale. Consequently it is vital to be engaged in international collaborations and networks in order to remain up-to-date with new scientific findings, innovative technologies and international market developments and to keep pace with the fast rate of scientific and economic developments. International positioning and networking is therefore crucial for developing and maintaining the competitiveness of Styria as a research location.

This international focus does not however dispense with the need for scientific activity at a regional level. Innovation research shows that regional proximity is a significant factor for successful research and innovation processes. Personal contact nurtures trust between the parties involved and thus remains crucial for collaboration, despite the many different opportunities for virtual communication. This applies not only to cooperation within science but also with business. Evolving regional networks concentrate expertise, support community building, improve the innovation environment and reinforce the positive image of the region as a centre for science and research.

Consequently, both facets are needed for a successful and viable science and research system: regional integration in business and society as well as international orientation and participation in global competition.

Read the **full version:**

www.wissenschaft.steiermark.at/Wissenschaftsbericht

Implementing the Austrian RTI Strategy: central points from the mid-term report

The Austrian Federal Government launched its Strategy for Research, Technology and Innovation in 2011. Its implementation was recently reviewed in the form of a mid-term report[1]. The following central points relate to higher education institutions and R&D facilities:

Strengthening teaching and research: The quality of teaching and staff-student ratios have been improved through a series of measures. These include introducing structural funding for the higher education sector and restricting access in heavily enrolled fields. A tenure track model has also been introduced and funding for doctoral students increased.

Excellence in basic research: Although none of the excellence cluster programmes described in the RTI Strategy have been implemented, a series of measures have been taken which point in this direction. These include expanding existing programmes (e.g. FWF [Austrian Science Fund] Special Research Programmes, START Programme) and existing institutions (such as the Austrian Academy of Sciences and the Institute of Science and Technology Austria).

Research infrastructure: Structural funding for the higher education sector is an important tool for expanding R&D infrastructure. It also provides an incentive to intensify synergy and collaboration between the different stakeholders in research.

In summary it can be seen that, since its introduction, the Federal Government's RTI Strategy has delivered a strong impetus for change in certain areas. Nevertheless achieving the broader aims (e.g. Innovation Leader, R&D intensity of 3.76%) has become increasingly unlikely so that a substantial effort will be required to overcome the shortcomings identified in the mid-term report.

The progress of scientific development is ultimately a permanent escape from amazement.

Albert Einstein

„Conserving existing knowledge while developing new: our advanced medicine impressively reflects this symbiosis of past and future.“

Rektor Univ.-Prof. Dr. Hellmut Samonigg, Medizinische Universität Graz

„Whether climate change, lifestyle diseases or social transformation, there is international demand for the findings of researchers at the University of Graz on these and other global challenges.“

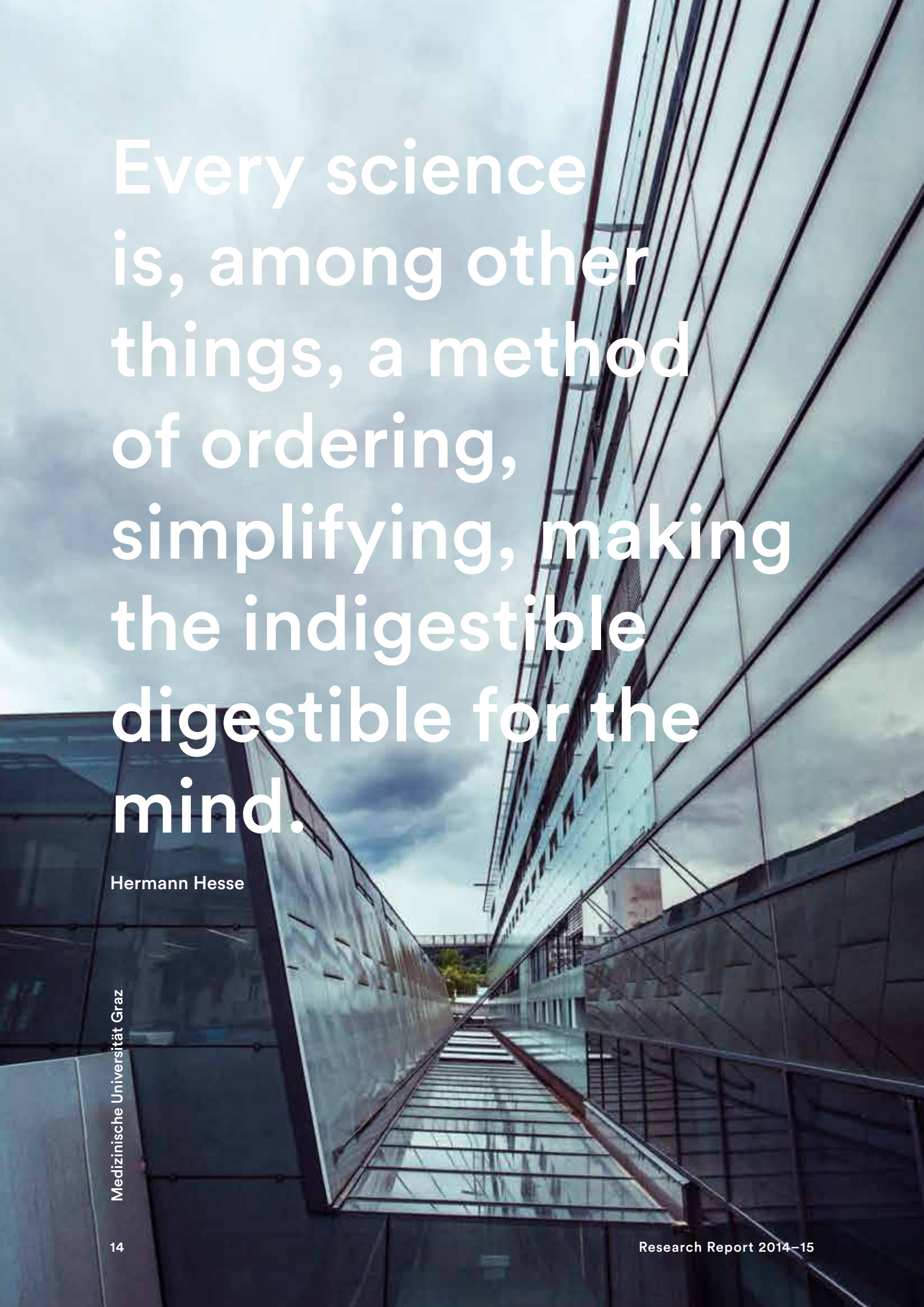
Rektorin Univ.-Prof.in Christa Neuper, Karl-Franzens-Universität

„JOANNEUM RESEARCH has the mission not only to provide research and development services, but also to promote knowledge and innovation transfer. Research and development are not ends in themselves; they should make people’s lives easier.“

Univ.-Prof. Dr. Wolfgang Pribyl, Managing Director of JOANNEUM RESEARCH

„The value creation cycle for resources and materials, as interpreted in research and teaching at the Montanuniversität Leoben, is the ultimate embodiment of sustainability: from extraction through to recycling. Its realisation requires a high degree of expertise and is the subject of extensive research projects.“

Rektor Univ.-Prof. Wilfried Eichelseder, Montanuni Leoben



Every science is, among other things, a method of ordering, simplifying, making the indigestible digestible for the mind.

Hermann Hesse

Interdisciplinarity and cooperation: Styria as a research location

3

R&D expenditure exceeds the 2 billion euro mark for the first time

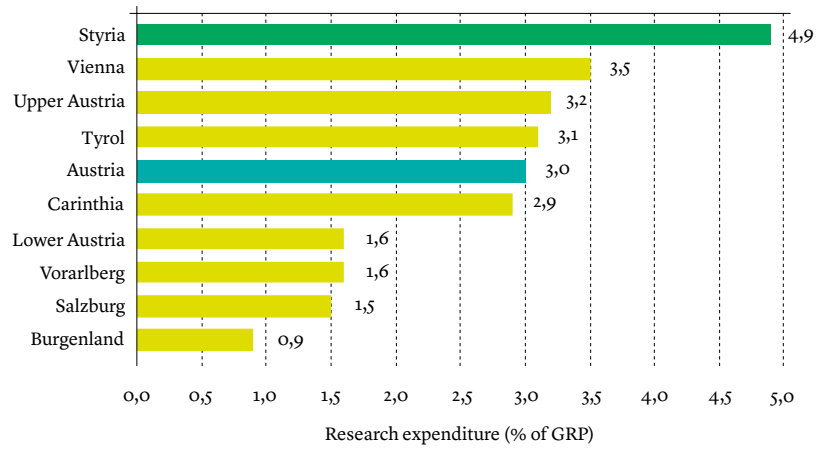
Styria is Austria's most research-intensive federal province. With a research intensity just under 4.9%[2] Styria is the undisputed leader in the Austrian rankings. Styria accounts for one in five euros spent on R&D in Austria. This pole position is also evident in an international context: Styria is Europe's second strongest R&D region in terms of R&D intensity.

In 2013 R&D expenditure in Styria topped the 2 billion euro mark for the first time. So the R&D sector has proved to be extremely dynamic and resistant to crises, even in difficult economic times. R&D expenditure has risen continually, both in the time up to the 2009 economic crisis and in subsequent years.

Moreover R&D expenditure is rising at a faster pace in Styria than in Austria as a whole. While Austrian R&D expenditure has risen by +28% since 2009, the figure for Styria is +35%. This expansion has been driven primarily by the business sector

Styria is Europe's second strongest R&D region

Figure 1: Research intensity 2013 by province



Source: Statistics Austria, analysis by JOANNEUM RESEARCH, regionalisation by corporate R&D locations.

But the business sector is not only the driving force behind the increase in R&D expenditure, it also plays the major part in absolute terms. 75% of R&D activity (measured by R&D expenditure) takes place in the business sector[3]. A quarter of R&D expenditure is in the higher education sector[4].

The business sector also occupies the major share in R&D financing. Austrian companies provide funding for around 40% of Styrian R&D activities (in absolute terms: 734 million euros)[5]. The public sector accounts for a third of funding (in absolute terms: 613 million euros). Just under 30% (in absolute terms: 527 million euros) is funded from abroad. This includes research funding from the EU, but the major part consists of direct investments by foreign companies in their subsidiaries in Austria.

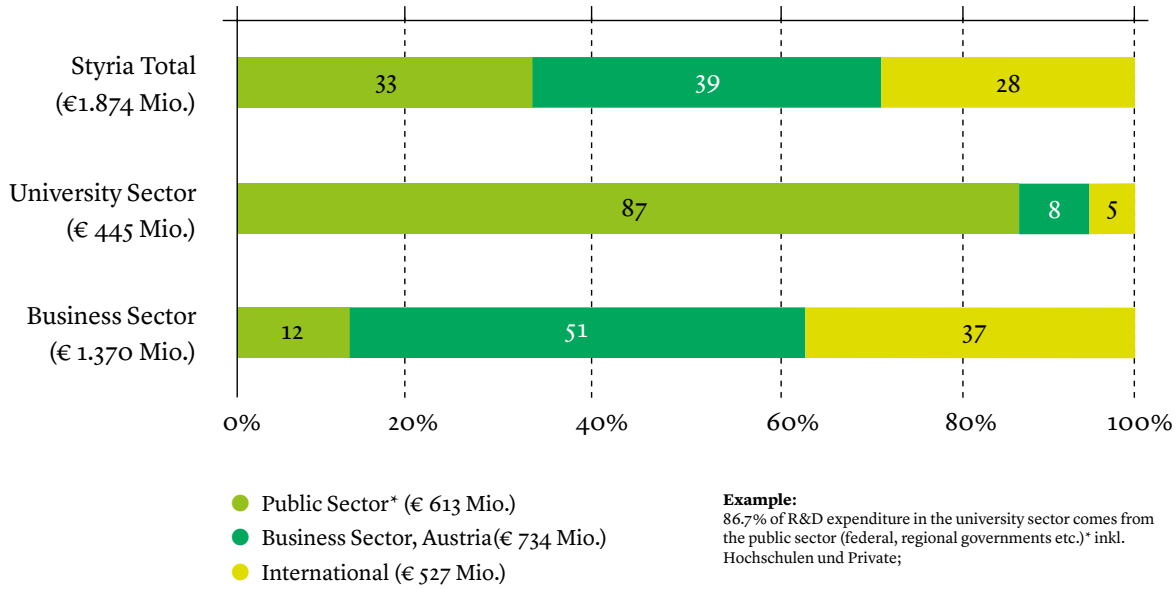
Looking at how the various types of R&D organisations are funded, a differentiated picture emerges:

- Universities are mainly publicly funded with a financing share of 87%.
- About one half (51%) of industrial research is carried out by the businesses themselves. Over a third of corporate research is conducted by parent companies abroad and around one tenth is financed by the public sector (Austrian Research Promotion Agency (FFG), etc.)

  The overall extremely high proportion of funding coming from abroad demonstrates that Styria has established strong international networks in research, underlining Styria's solid international reputation as a research location.

The very high proportion of R&D funding coming from abroad confirms the international reputation of Styria as a research location.

Figure 2: Financing shares by R&D sector / Styria 2013



Example:
86.7% of R&D expenditure in the university sector comes from the public sector (federal, regional governments etc.)* inkl. Hochschulen und Private;

* inc. universities and private institutions, source: Statistics Austria, based on business location concept

Source: Statistics Austria, WIBIS Styria

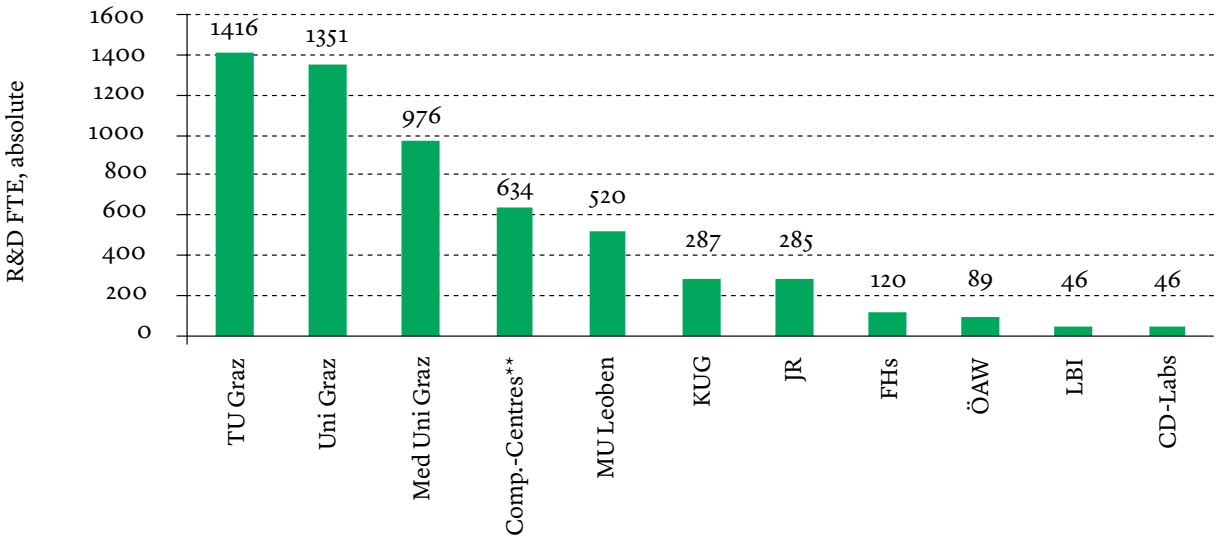
R&D institutions: from Christian Doppler laboratories to universities

The strong commitment to research in Styria is accompanied by a fully differentiated portfolio of R&D institutions. With five universities, two universities of applied sciences (FH) and two university colleges of teacher education the higher education sector has a broad institutional base and covers virtually the full range of subjects. The same applies to non-university research with a large number of institutions engaged both in basic and in applied research. Joanneum Research, which is majority owned by the Styrian government, is one of the largest non-university institutions in Austria.

In 2015 over 5,700 scientists (measured in full-time equivalents) were employed in the Styrian research establishments, four fifths (4,550 full-time equivalents) of them in the universities[6]. The two large universities (University of Graz and Graz University of Technology) each account for one quarter of research capacity.

Styria is the only federal province with two technical universities.

Figure 3: Research staff at Styrian R&D institutions



Total: 5,700 FTE, of which 4,549 at universities

* Data do not claim to be complete, but include the majority of R&D institutions. Universities, universities of applied sciences and most non-university institutions were fully included, while smaller R&D institutions were only partly included. Data is not identical to research FTE, as scientists at universities are also involved in teaching
** Data does not include K-projects.

Source: uni:data, direct information by the institutions
Note: Data in full-time equivalents (FTE), dates of data may vary, data for universities refer to winter semester 2015 , analysis by convelop

Technological opportunities through research mix

What type of research is more important for a region? Is it basic research which raises the general knowledge base but where concrete results are often hard to assess? Or is it applied research which places less emphasis on a generic gain in knowledge but offers the prospect of exploiting that knowledge in the form of concrete products or services? There are many indications that this “either-or” approach is too narrow and should be replaced by a “not only-but also” view.

The significance of applied research lies in the fact that it focuses on the opportunities to exploit scientific discoveries in practice. In contrast the significance of basic research only becomes obvious in the long term. It continually expands the knowledge base and opens up new fields of knowledge. Applied research often relies on, and is based on, results from basic research, developing knowledge further with a practical focus on implementation. At the same time research practice shows that knowledge creation is not a one-way street leading from basic to applied science. Concrete issues in applied research often lead to questions to be dealt with in basic research.

It thus requires the interplay between, or mix of, basic and applied research to expand the technological opportunities of a region[7]. A research location should therefore have a balanced mix of basic and applied research. If the approach is too one-sided, this can restrict the innovative force of science over the long term and lead down a blind alley.

In this regard Styria is essentially well positioned in this context and has a differentiated mix. The R&D focus ranges from explicit basic research in some parts of the universities and the Austrian Academy of Sciences through applied research (e.g. JR, CD laboratories, LBI, COMET) to experimental developments (e.g. universities of applied sciences).

Styria offers full range of disciplines

Research is undertaken in virtually every scientific discipline in Styria's many different research establishments.[8] At the same time Styria's research portfolio clearly focuses on engineering and the natural sciences.

Expressed in figures this means that, of the almost 3,250 full-time equivalents engaged in R&D at the higher education institutions, over one third of scientists are active in engineering and some 30% in the natural sciences. The medical field accounts for one fifth of full-time equivalents. The social sciences and humanities are also important for the region, although the figures are lower: the social sciences account for one in ten academics, the humanities for one in twenty.

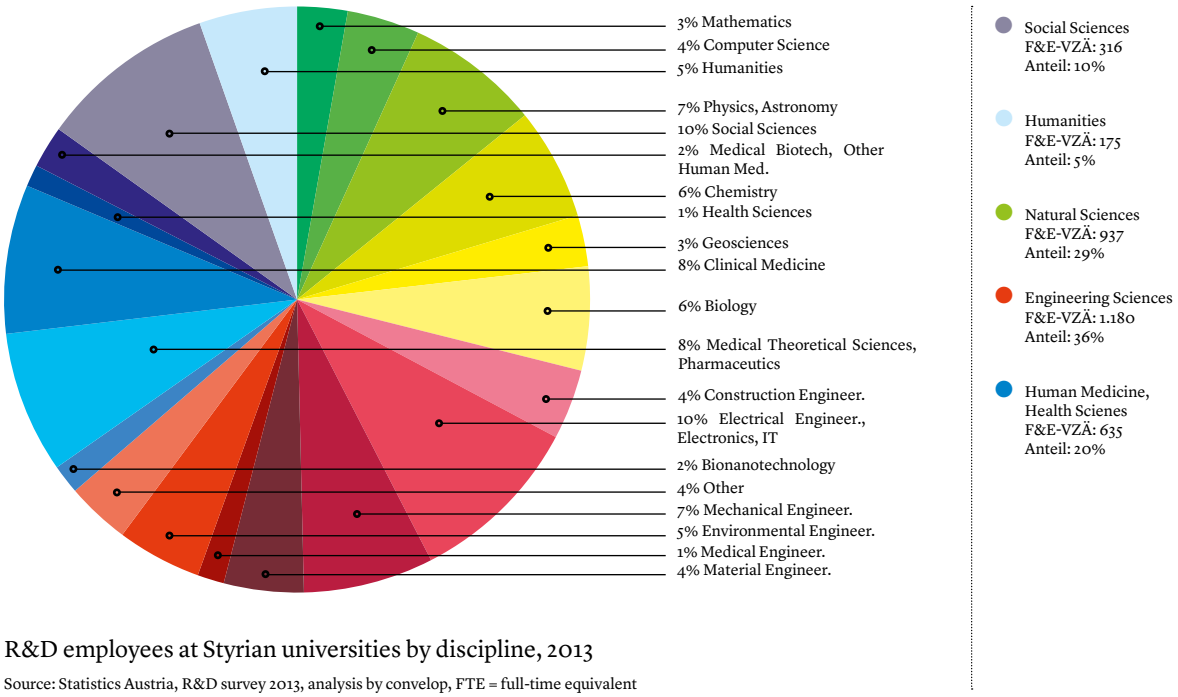
The focus on natural sciences and engineering essentially results in higher education institutions being heavily geared towards industry. One example of many: Graz University of Technology has, for several years, concentrated its research initiatives and activities in five Fields of Expertise (FoE). These subject areas correspond to the economic strengths promoted by the Styrian government and so directly support the implementation of Styria's economic strategy.

The technical and scientific orientation of Styrian research is reinforced further if, alongside the higher education sector, the cooperative area is included in the analysis. This essentially includes non-university research such as Joanneum Research, the COMET Competence Centres, Austrian Academy of Sciences, etc. Overall the cooperative area is heavily focused on engineering disciplines[9].

Full range of subjects with a focus on the natural sciences and engineering.

Figure 4: R&D employees at Styrian universities by discipline, 2013

R&D employees at Styrian universities by discipline, 2013



R&D employees at Styrian universities by discipline, 2013

Source: Statistics Austria, R&D survey 2013, analysis by convelop, FTE = full-time equivalent

Interdisciplinarity in action – it‘s all in the mix

The ever more complex nature of scientific issues makes an interdisciplinary approach to problems more essential than ever for the success of state-of-the-art research.

Thanks to the breadth of its research portfolio the outlook is good for Styria on two counts: firstly, both basic and applied research fields are covered and secondly there is a broad spread of disciplines. The numerous cooperative initiatives by research establishments both at an institutional and project level show that existing potential is already being exploited, encouraging active interdisciplinary engagement.

A selection of research projects funded by the Styrian government can be found in the section on implementing the Research Strategy Styria.

„We are a global source of inspiration in many areas as the result of the excellent artistic education we offer. The spectrum ranges from innovations in sound design, jazz and popular music through to organ research.“

Rektorin Dr.in Elisabeth Freismuth, KUG

„Graz University of Technology is part of this research landscape, addressing new challenges of interdisciplinary and inter-university collaboration, for example in the natural sciences and biomedical technology via NAWI Graz, BioTechMed or state-of-the-art teaching and learning technologies. This is joint research for innovative Styrian success!“

Rektor Univ.-Prof. Dipl.-Ing. Dr. Dr. h.c. Harald Kainz, TU Graz

„The FH CAMPUS 02 is focused on teaching, research & development designed to meet the needs of our domestic economy in a global context, which can only be guaranteed through the mutual exchange of knowledge. Our claim here is to offer the most direct support possible for the regional economy with knowledge derived from research, development and innovation.“

Dr. Erich Brugger, FH CAMPUS 02
Dr.in Anette Zimmer, FH CAMPUS 02

Cooperation as a Styrian strength

For many decades the reluctance of science and industry to work together was a weak point in the Austrian innovation system. This has fundamentally changed in the past 15 to 20 years. The number of collaborations in Styria has increased dramatically in recent years and now covers both cooperation between various scientific institutions within Styria both in a national and international context as also between science and industry. The strong practical culture of cooperation is now a Styrian hallmark and is also identified in the research strategy as one of the strengths which should be reinforced further. The focus here is not merely on cooperation within individual R&D projects but, above all, on establishing strategic cooperative partnerships.

Cooperation between universities

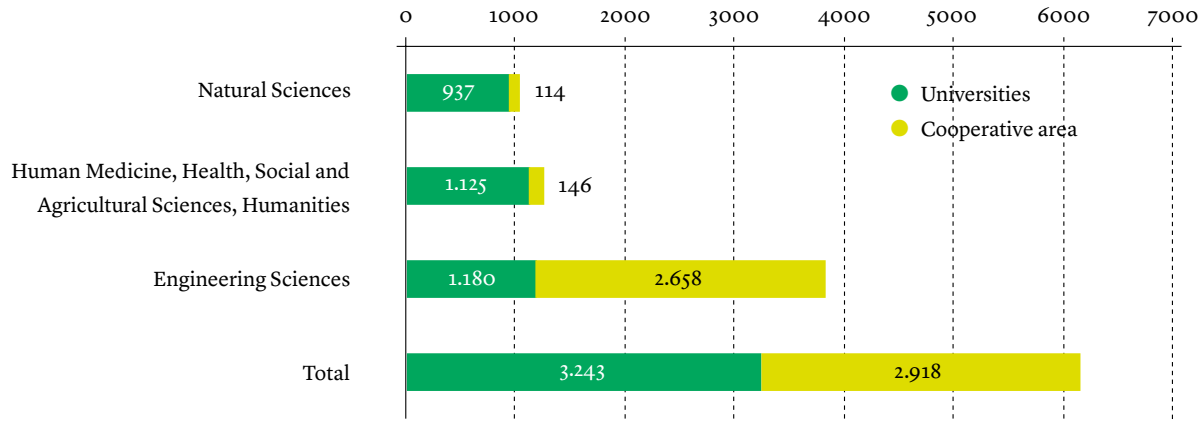
The Research Strategy Styria aims to establish a Science Space Styria, assisted in part by strengthening cooperative relationships in the scientific sector. Numerous activities in recent years have been moving in this direction with the result that the pace of cooperation within the higher education sector has become increasingly dynamic. This is true both at the strategic institutional level (Styrian University Conference, TU Austria) and the strategic research sector (BioTechMed, FWF Special Research Programmes, TCM Centre) as well as teaching.

Important institutional collaboration

Styrian University Conference: Since 2011 the Styrian University Conference has been strengthening cooperation between the nine Styrian higher education institutions and has already launched a series of successful initiatives. These include both mutual collaborations as well as projects with stakeholders from science, industry, the media and politics. This collaboration between the higher education establishments successfully showcases Styria as a research location and strengthens its position in the long term. Moreover a joint vision and strategy paper has created the basis for joint development at higher education level while maintaining the separate profiles of the individual institutions. The fact that, within their performance agreements, Graz universities have adopted a common position as regards their relevance to Styria as a research location is unique throughout Austria.

Strong practical culture of cooperation as a Styrian hallmark.

Figure 5: R&D employees (FTE) at universities and in the cooperative area, 2013



Total R&D staff (universities/cooperative area): 6,160 FTE

Source: Statistics Austria, R&D survey 2013, analysis by convelop, FTE = full-time equivalent

10 years of NAWI Graz: NAWI Graz was established in 2004 by Graz University of Technology and the University of Graz (KFU) as a strategic cooperative venture in the fields of bioscience, chemistry, earth, space and environmental science (ESES), mathematics and physics. It is one of Austria's flagship initiatives for inter-university cooperation. 18 joint Bachelor's and Master's degree programmes demonstrate the track record of the first ten years. In addition cross-cutting issues such as infrastructure and gender projects are implemented jointly. In 2015 the partners decided to appoint all future professors relating to NAWI Graz through a panel drawn from both universities.

BioTechMed: This initiative links the University of Graz (KFU), Graz University of Technology and the Medical University of Graz at the interface between biomedical fundamentals, technological developments and medical application with the aim of conducting joint research for the healthcare sector. The interaction between the different disciplines enables highly complex issues to be addressed and the many different methods/skills and infrastructures to be exploited efficiently. In 2014 three new professors were appointed within BioTechMed and 13 post-doctoral positions awarded. A project to further develop the organisational structure and governance of BioTechMed-Graz was also launched. In parallel, the broadly based network ‚BioTechMed-Graz – Research for Health' will be developed into a research association with a series of interdisciplinary flagship themes.

Knowledge transfer: The recently established Knowledge Transfer Centre South (WTZ Süd) represents a cooperative venture between Styrian and Carinthian universities. It sees itself as an intermediary communicating expertise and knowledge between academic research, science, industry and society. Particular attention is paid to exploiting the potential offered by university inventions. Specific training on knowledge transfer and exploitation is also offered for students and researchers.

The Science Fit Plus initiative also assists the transfer process, especially for Styrian SMEs. Science Fit Plus is a cooperative venture between Graz University of Technology, MUL (Montanuniversität Leoben), the University of Graz (KFU) and Joanneum Research and is funded by the Styrian government, the City of Graz and the Styrian Economic Chamber (WKO Steiermark).

Research collaborations

National and international research collaborations: Styrian universities are not only closely connected with one another but are also well integrated within the national and international research community through a tight network of cooperative relationships. The number of cooperation partners has risen continually in recent years and in 2015 reached over 2,300 partner organisations. Some 60% (1,341) of partner organisations are from the higher education sector, 12% (289) are businesses. The high number of cooperation partners from the EU and also from third countries (60%) demonstrates the international competitiveness of the Styrian universities.

Knowledge Transfer Centre South (WTZ Süd) as first cooperative initiative between Styrian and Carinthian universities.

Technische Universität Graz

Today‘s technology is tomorrow‘s bread – today‘s science is tomorrow‘s technology.

Richard von Weizsäcker

Table 1: Number of partner organisations of Styrian universities actively involved in cooperation agreements (2015)

	National	EU	Third countries	Total
Total	929	845	540	2.314
... of which universities	193	681	467	1.341
... of which non-university R&D institutions	82	15	8	105
... of which businesses	183	82	24	289
... of which other organisations	471	67	41	579

Source: Intellectual capital reports 2015 published by the universities

Strategic cooperative research in Styria: The strong culture of cooperation within Styria is also evident in the numerous examples of strategic scientific cooperation. Special mention should be made of the multi-year Special Research Programmes (SFB) and Doctoral Programmes (DK) funded by the FWF. Styrian researchers are disproportionately represented in both programmes. Two current SFBs, Lipotoxicity and Mathematical Optimisation, are based in Styria. Styrian scientists are also participating in three other Austrian SFBs. Eight of the current 39 Doctoral Programmes are located at research facilities in Styria, with Styrian scientists involved in a further three. The DK in Molecular Enzymology is one of the first FWF-funded Doctoral Programmes and thus plays a pioneering role in this field.

Styrian universities are also heavily involved in joint research on the themes within the COMET Programme launched by the FFG (Austrian Research Promotion Agency). Special mention should also be made of the TCM (Traditional Chinese Medicine) Research Centre, a bilateral research partnership between the University of Graz and the Medical University of Graz.

Styrian government funds scientific cooperation

In recent years, the Styrian government has directed particular attention to the funding of interdisciplinary cooperative research. This has encouraged a series of cooperative alliances through thematic calls for proposals and endowed professorships. Specific incentives have succeeded in initiating new, hitherto rather unusual, partnerships. Historians and architects, for example, are working together on innovative world heritage approaches in the ‚Roofs of Graz' project. For further details see the section on implementing the Research Strategy Styria in this volume.

Cooperation in teaching: Joint teaching is also progressing. Alongside NAWI Graz further cooperative teaching formats have been established in recent years. Montanuniversität Leoben, for example, delivers the university course NATM (New Austrian Tunnelling Method) Engineering jointly with Graz University of Technology. The Medical University of Graz offers a Bachelor's degree programme in Human Medicine in cooperation with Johannes Kepler University Linz. The Styrian government supports cross-institutional teaching within funded endowed professorships by defining specific criteria for appointment.

Collaborations between science and industry

Research on applied topics and the transfer of research results to concrete products and services often takes place in direct collaboration between science and industry.

University revenue from R&D projects: Business finances 40% (just under 70 million euros) of universities' revenue from R&D projects in Styria (2015). This figure is significantly higher than the equivalent figure for Austria, which is 25%. The figures obviously vary between the

universities depending on the relevance of the topic to industry. At Montanuniversität Leoben 70% of externally-financed R&D projects are funded by companies. At the Medical University of Graz this figure is 52% and at Graz University of Technology 32%.

Table 2: Revenue from R&D projects and arts-based research projects (EUR), 2015

Universities	Total revenue (public/private)	Revenue from companies	Revenue from companies as a percentage of total revenue
University of Graz (Uni Graz)	27.562.969	1.140.468	4 %
Medical University of Graz (MedUni Graz)	46.020.674	24.043.418	52 %
Graz University of Technology (TU Graz)	68.131.109	21.737.884	32 %
Montanuniversität Leoben (MUL)	31.960.751	22.306.897	70 %
University of Music and Performing Arts Graz (KUG)	1.119.448	135.391	12 %
Styrian universities	174.794.950	69.364.058	40 %
Austrian universities	654.368.676	160.771.642	25 %

Source: uni:data, analysis by convelop

Competence Centres Styria occupies the very top position within Austria in the COMET Programme. It is involved in 20 out of 38 Competence Centres throughout Austria, 17 of which are based in Styria. These Competence Centres cover Styria's key topics and core expertise[10].

Cristian Doppler Laboratories (CDL): CDLs also form an integral part of cooperative research in Styria. Eleven of Austria's 72 CD laboratories are located in Styria, focusing on metals/alloys and chemistry. Montanuniversität Leoben and Graz University of Technology are particularly active, with 6 and 4 CD laboratories, respectively.

Strategic partnerships: A series of strategically focused partnerships has been set up in recent years. Graz University of Technology, for example, has partnerships with the automotive supplier Magna International Inc. (since 2003) and with Siemens AG (since 2006). The latter was extended in 2015 to a CKI (Centre of Knowledge Interchange) partnership, with a focus on increasing innovation management, talent development and technology transfer.

Endowed professorships in cooperation with business partners: Endowed professorships in applied research fields are also an indication of ever closer cooperation. In late 2015, for example, two new endowed professorships with business involvement in the areas of big data and aviation were approved at Graz University of Technology by the Federal Ministry of Transport, Infrastructure and Technology (BMVIT).

Overall Styria is leading the way in Austria as regards collaboration between science and industry and can point to a number of successful cooperative partnerships.

One fifth of external funding for universities comes from abroad.

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Styria as an international research location

The strong international position of Styria as a research location can be seen in a series of key figures: above all, at nearly 30%, the high proportion of foreign R&D investment (in absolute terms: 527 million euros) shows that the reputation of Styria as a centre for research extends well beyond Austria's borders.

The ability of Styrian research to compete on the international stage is evident when considering participation in international R&D programmes. R&D funding worth 97 million euros flows into Styria through 211 project participations and 35 project coordinations within the EU's Horizon 2020 Programme. With a share of nearly 25% of the funding which Austria receives under Horizon 2020, Styria is therefore the second strongest federal province in this EU programme after Vienna[11]. Styria's top scientific players in Horizon 2020 are Graz University of Technology, the COMET Centre Virtual Vehicle, the University of Graz and Joanneum Research.

Universities' international focus: Maintaining an international focus is essential for science in order to remain at the cutting edge in research and teaching. Styria's universities and higher education institutions therefore all seek to further increase their international activities and have consequently incorporated internationalisation in their mission statements. The external focus is on the universities' visibility, both as internationally attractive and competent cooperation partners and as internationally established centres of education and research. Over 20% of external funding (in absolute terms for 2015: 37 million euros) for Styrian universities originates abroad, which is comparable to the percentage for the whole of Austria. At 30%, Graz University of Technology in particular shows a high proportion of external funding from abroad, followed by the University of Graz and the Medical University of Graz. The internal aim is to enhance the international competitiveness of the university staff and graduates.

Styria is a highly sought after research location at the international level.

Table 3: External funding from abroad (EUR), 2015

	External funds total	of which from abroad	External funds from abroad as a percentage of total
University of Graz	27.562.969	5.918.257	21 %
Medical University of Graz	46.020.674	7.354.331	16 %
Graz University of Technology	68.131.109	20.207.807	30 %
Montanuniversität Leoben	31.960.751	3.385.918	11 %
University of Music and Performing Arts Graz	1.119.448	80.933	7 %
Styria total	**174.794.950**	**36.947.246**	**21 %**
Austria total	**654.368.676**	**145.871.977**	**22 %**

Source: uni:data, analysis by convelop

International R&D and strategic collaborations by universities: 1,380 of the 2,300 cooperation partners (with active contracts) of Styrian universities are international, which corresponds to roughly 60%. Strategic cooperative initiatives have been established with many international universities. Graz University of Technology, for example, is in cooperation with the Technical University of Munich, Politecnico di Milano and Tongji University. In addition there are a number of international university partnerships which are geared primarily towards the exchange of students and teaching staff around the world.

One fifth of students are from abroad: The fact that 10,300 (18%) of the nearly 58,000 students at Styrian universities and universities of applied sciences are from abroad demonstrates that Styria is an attractive place to study. At the University of Music and Performing Arts Graz, in particular, the proportion is well above average at 56% foreign students (2015). And the proportion of international researchers is also on the increase. At Graz University of Technology, for example, the proportion of foreign researchers grew within two years from 19.5% to 22% in 2015.

Science boosts Styria as a centre for research and industry

The days when science was conducted in ivory towers are definitely a thing of the past. Today higher education establishments are an integral part of regional development strategies and are conscious of their role as key institutions. They help increase the appeal of the region in many ways, including:

Training and educating a qualified workforce: Some 8,600 of the around 60,000 students attending Styrian higher education institutions successfully complete their studies each year. These highly qualified graduates provide a sustained basis for the development of high quality products and services for industry in the future. They also guarantee the quality of public sector-related areas such as public services (health, social services, judiciary, administration, etc.) and culture (University of Music and Performing Arts Graz) which are also essential for the development of an attractive place to live and do business.

Structural change and regional branding: The results of research are exploited and converted to market innovations through the numerous collaborations with industry[12] and increased activity in the area of technology transfer (e.g. Knowledge Transfer Centre South, ScienceFit-Plus, industrial liaison offices at the universities). Knowledge-intensive and technology-driven start-ups and spin-offs initiated by the academic sector also serve to leverage change. Graz Science Park plays an important part here. At the same time the higher education institutions accelerate change through their ability to attract technology- and knowledge-based businesses for whom the broad knowledge base is a central locational factor. Overall a high degree of knowledge intensity supports the development of a dynamic innovative environment and reinforces the positive economic image of the region (regional branding).

More added value: Higher education institutions are amongst the largest employers in Styria. With almost 15,000 academic and non-academic staff and around 60,000 students from Austria and abroad the higher education institutions are a major factor in adding value. Measured by the number of staff, the universities are the third largest employer in the province. Studies[13] show that the turnover of Styria's higher education institutions roughly corresponds to the production value of the traditional economic sector paper and cardboard or of the money, credit and insurance industry in Styria. Around 70% of this turnover remains in Styria's regional economy.

Networks with industry: Universities play an increasingly active role in Styria's cluster and network initiatives. Styria's network-based areas of expertise have increasingly been intensifying their R&D focus in recent years, in line with the concept of smart specialisation. Examples include the ACstyria Autocluster, EcoWorld Styria, the Human.technology Styria cluster and the Bionanonet network.

Styrian research institutions see themselves more than ever as stakeholders and innovation drivers active in boosting the province as a centre for research and as a business location in particular. This applies not only to the universities and universities of applied sciences in the central Graz area but also to the Montanuniversität Leoben and the Kapfenberg campus of FH Joanneum University of Applied Sciences, which play a major role in developing Upper Styria as an industrial and knowledge-based region.

Output: more than 9,200 scientific publications

Alongside teaching, scientific output is the universities' main "production indicator"[14]. In 2015 Styria's universities published 9,215 publications in total, thus accounting for over one fifth (22%) of Austrian university output. Around one third of these are first publications in edited volumes (inc. proceedings) (3,059) and articles in peer-reviewed journals (2,735). Just under one quarter (2,189) are articles in other scientific journals. Around 8,000 presentations were given at scientific/artistic events. The 30 patents issued are concentrated in the Medical University of Graz (12 patents), MUL (Montanuniversität Leoben) (10 patents) and Graz University of Technology (6 patents).

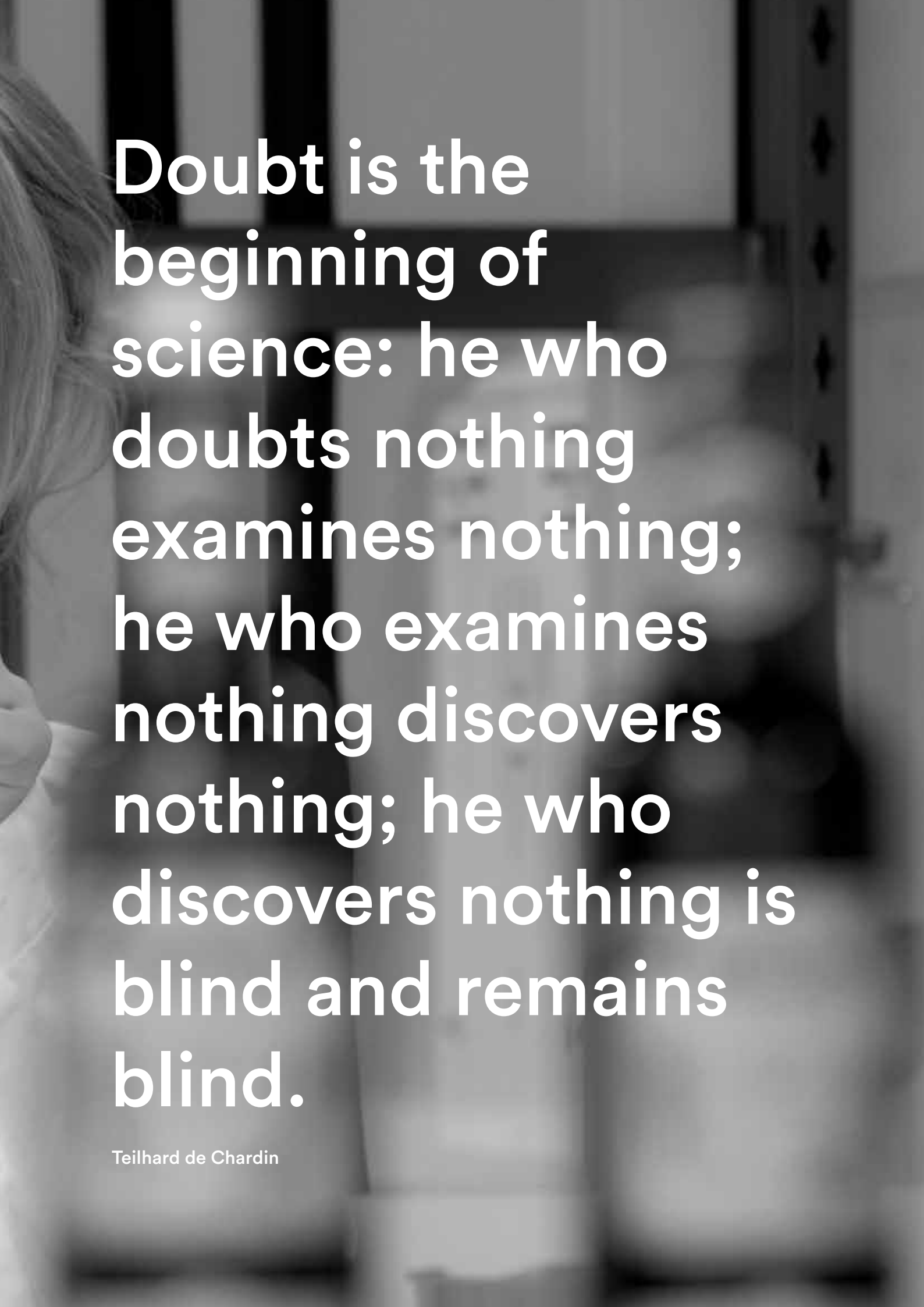
The regional R&D institutions see themselves as stakeholders, active in boosting Styria's position as a centre for research and industry.

Table 4: Scientific output, 2015

Scientific output	Uni Graz	TU Graz	Med Uni	KUG	MUL	Total
Publications	3.123	2.365	2.486	207	1.034	9.215
First editions of scientific books or textbooks	262	38	10	14	10	334
First publications in SCI, SSCI or A&HCI journals	825	697	913	4	296	2.735
First publications in other scientific journals	808	263	998	35	85	2.189
First publications in edited volumes and proceedings	1.154	1.103	400	84	318	3.059
Other scientific publications	74	264	165	12	325	840
Artistic publications (e.g. audio, video, data media, art catalogues)	-	-	-	58	-	58
Presentations (inc. posters) at scientific conferences	2.966	1.580	2.556	200	627	7.929
Patents granted to the university	2	6	12	-	10	30
Artistic output						**KUG**
Artistic performances (e.g. artistic activities, stage appearances)						3.080
Artistic/scientific events organised by universities						1.245

Source: Intellectual Capital Reports issued by universities, uni:data, compiled by convelop

Karl-Franzens-Universität Graz, Forschungslabor


Doubt is the beginning of science: he who doubts nothing examines nothing; he who examines nothing discovers nothing; he who discovers nothing is blind and remains blind.
Teilhard de Chardin

Increasing number of students

The number of students at Styria's higher education institutions continues to grow and, in the 2015/2016 winter semester, lay just under the 60,000 threshold.

Nearly 90% of students are registered at universities, 9% at universities of applied sciences and 3% at university colleges of teacher education. The ratio of male to female students in the tertiary sector is, on the whole, fairly balanced (48% women / 52% men). There are marked differences in preferred areas of study however. The technical universities (Graz University of Technology, Montanuniversität Leoben) are heavily male dominated. At the University of Graz with its high proportion of humanities, social sciences and cultural studies and at the university colleges of teacher education there is a distinct female majority. The ratio between male and female students at the universities of applied sciences, the Medical University and the University of Music and Performing Arts Graz is relatively well balanced.

Full range of subjects with a focus on the natural sciences and engineering.

Table 5: Students at Styrian universities, winter semester 2015/16

	Students			Proportion (%)	
	Female	Male	Total	Female	Male
University of Graz	17.955	10.834	28.789	62	38
Graz University of Technology	3.159	10.613	13.772	23	77
Medical University of Graz	2.319	1.847	4.166	56	44
Montanuniversität Leoben	913	3.029	3.942	23	77
University of Music and Performing Arts Graz	949	1.010	1.959	48	52
Universities total	25.295	27.333	52.628	48	52
CAMPUS 02	523	679	1.202	44	56
FH JOANNEUM	1.901	2.226	4.127	46	54
Universities of applied sciences (FH) total	2.424	2.905	5.329	45	55
University of Teacher Education Styria	916	438	1.354	68	32
Catholic University College of Education Graz	375	252	627	60	40
University colleges of teacher education total	**1.291**	**690**	**1.981**	**65**	**35**
Students total	**29.010**	**30.928**	**59.938**	**48**	**52**

Source: uni:data, data provided by individual institutions, compiled by convelop

New R&D infrastructures strengthen the science and research system

Ongoing development of R&D infrastructures is an essential element in cultivating a base for science and research. They make it possible to pursue research at a high level and to establish new research fields. Consequently a series of infrastructure initiatives were launched in Styria in recent years. Two of the most important steps in this area are:

Centre for Knowledge and Technology Transfer in Medicine (ZWT): The ZWT, opened in 2014 at the Medical University of Graz, is the first Austrian research and technology centre to be totally integrated in a university campus, both in terms of location and organisation. The ZWT is a place where business and researchers come together occupying 10,800 m² laboratory and office space. It employs 250 highly qualified staff. One of the core elements of the ZWT is the Biobank Graz: over 7.5 million biological specimens and associated data are held in the biobank at the Medical University of Graz and made available for research purposes. The quality and significance of the biobank was underlined in 2016 when it was named Best European Academic Biobank.

Zentrum am Berg: In Upper Styria an internationally unique underground facility is being created through the flagship project of the Styrian Future Fund, Research@ Zentrum am Berg (ZaB). When fully operational, the facility which is mainly housed in tunnels in the Styrian Erzberg mountain will be an ultra-modern research and seminar centre for the construction and operation of underground facilities (tunnelling, underground railways, underground power stations, underground mining, deep drilling, etc.). The infrastructure will also serve as a training centre. The Austrian Federal Ministry of Science, Research and Economy, the Ministry for Transport, Innovation and Technology, the Styrian government and the Montanuniversität Leoben agreed in September 2014 to jointly finance the project. This move lays the foundation stone for establishing a central EU core facility for research into the construction, operation, maintenance and renovation of underground facilities and a European hub for the associated sciences in Upper Styria.

Example: KinderUniGraz

"Sparking children's interest in science, research and art" is the motto of the KinderUniGraz, a cross-institutional university for children and young people. Lecturers from all local higher education institutions take part in this initiative to answer the questions of the KinderUniGraz students and arouse the interest and curiosity of their young audience.

The programme is tailored to the interests and needs of children and young people and offers an insight into the everyday life of university students as the events take place directly on campus. The programme combines lectures with workshops so that KinderUni students get to know different perspectives and are able to carry out their own experiments.

Zentrum am Berg provides internationally visible R&D infrastructure for mining research.

Science goes public

Alongside their research and educational function the higher education establishments are increasingly aware of their social role as part of the third mission and are introducing a range of activities designed to improve their visibility as institutions and to communicate research results to a wider audience. To achieve this the universities are striking innovative paths such as the seventh faculty, for example - the Centre for Society, Science and Communication at the University of Graz (KFU). Under this umbrella brand the KFU is grouping several ‚science to public' initiatives. Further examples of modern formats designed to give the interested public an insight into university research are Montagsakademie (KFU), Offene Labors Graz (KFU), Styrian Science Slam (Graz University of Technology), Nikola Tesla Lectures on Science (Graz University of Technology), Dorf voll Musik (University of Music and Performing Arts Graz), and MEDITIO Printmedium (Medical University of Graz).

A series of cooperative formats has also been developed in recent years delivered jointly by higher education establishments. These include the Long Night of Research as well as a joint weekly online radio programme and the children's university, KinderUniGraz.

„Educational research at our institution is relevant to practice, reflects current educational policy, and is a driver for innovation in the education system. We investigate what constitutes good educational methodology, how children learn and what makes education successful.“

Rektorin Prof.in Elgrid Messner,
Pädagogische Hochschule

„Alongside teaching, educational research is taking on an increasingly important role because evidence-based teaching methodology is needed for teaching and schools in order to create the ideal conditions in which children and young people can learn successfully.“

Rektor Dr. Siegfried Barones, Kirchl. Päd. Hochsch.

„One of FH JOANNEUM’s strengths lies in its focus on application, ensuring that its programmes are relevant to practice. Our intensive research and development activity leads to a transfer of knowledge both outwards to industry as well as inwards to teaching.“

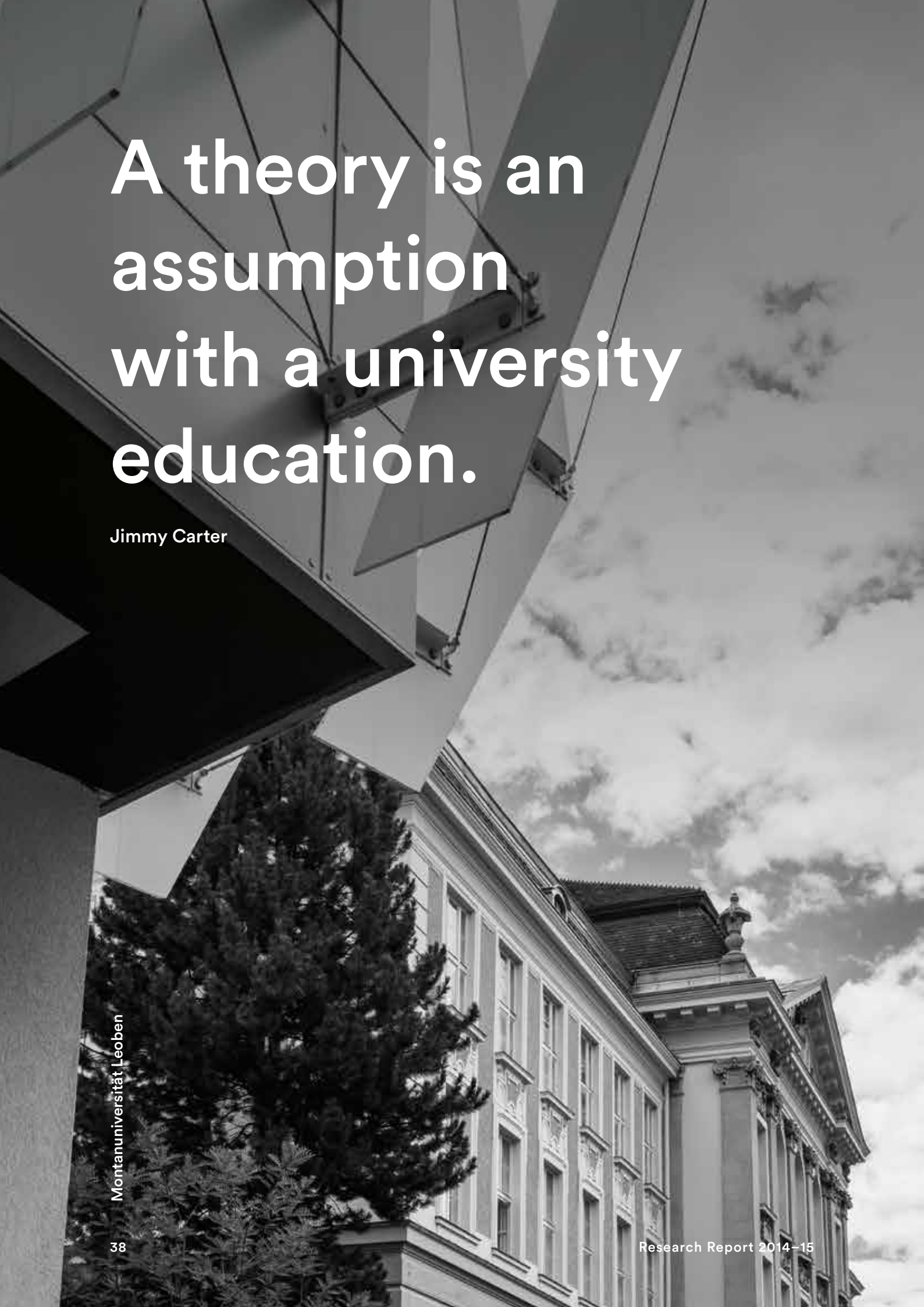
Rektor Karl Peter Pfeiffer,
FH JOANNEUM

„Many Styrian as well as Austrian and international businesses profit from the research undertaken at Styrian universities. We are proud that FH JOANNEUM is making a significant contribution in this field.“

Kaufm. Geschäftsführer Günter Riegler,
FH JOANNEUM

What the world of tomorrow will be like is greatly dependent on the power of imagination of those who are learning to read today.

Astrid Lindgren



A theory is an assumption with a university education.

Jimmy Carter

Implementing the Research Strategy Styria: targeted funding

4

Research strategy: shared space for science and innovation

In 2012 a new research strategy[15] was drawn up together with the main stakeholders and passed by the Styrian parliament as an extension of the Styrian Research Strategy 2005+.

The strategy recognises the current breadth in science and research as one of Styria's strengths. The hallmarks of Styria's position as a research location are its distinct culture of cooperation and specialised engineering expertise covering the full range of disciplines. The strategy aims to expand on the existing strengths and position Styria as a shared space for science and innovation with international visibility. The core criteria for developing this position are defined as follows:

- **Interdisciplinarity and cooperation** will be expanded with a strong focus on interdisciplinary collaboration with the humanities, social sciences and cultural studies.
- **The next generation of scientists will be promoted.**
- **Regionally effective - internationally significant:** Projects funded by the Styrian government must be relevant to the province and meet high quality standards, i.e. they must also be significant at an international level.

Main points for implementing the strategy: calls, interdisciplinarity and R&D infrastructure

Implementation of the research strategy is mainly the responsibility of Department 8 – Science and Research in the provincial government. With the current research strategy in mind the department has restructured, and in some cases refocused, its funding in line with this new direction.

- **Interdisciplinarity and cooperation** now play a crucial role in the funding criteria of the different instruments.
- The funding system has been shifted to **thematic calls for proposals.** This makes it possible to pool themes and resources and integrate new topics such as humanities, social science and cultural studies in the funding portfolio.
- **New instruments** have been introduced, above all endowed professorships and match funding (in cooperation with the FWF).
- Regionally significant **flagship projects** support Styria as a centre for science in core areas and consolidate this position through infrastructural measures.

Research funding

Research funding switched to calls for proposals: With an average annual operational budget of 4.5 million euros, Department 8 provides funding for R&D projects based on thematic calls for proposals. This approach helped to focus the limited resources available on Styria's core themes and promote cooperation and interdisciplinarity in line with specific funding criteria. Surprising and new cooperative ventures have been implemented in recent years in all call topics:

- **Polarity in the knowledge society:** In line with the recommendations of the Research Strategy Styria a new series of calls for proposals was launched, primarily aimed at the humanities, social sciences and cultural studies. Under the title ‚Polarity in the Knowledge Society' two calls were released in 2014/15 on the themes of ‚The increase of non-knowledge' (2014) and ‚The persistence of stereotypical arguments' (2015). The response was high and a total of 13 projects were funded. The variety of disciplines participating in the call

was striking: from law and political sciences through traditional humanities subjects (e.g. philosophy, educational sciences, history), social sciences and human geography to applied disciplines at Graz University of Technology and the Medical University of Graz. This shows that Styria has a largely untapped potential for interdisciplinary collaboration, especially for approaches to resolving social issues. Moreover, the call for proposals also made it possible to develop institutional and thematic collaborations with internationally renowned universities (e.g. Michigan, Cardiff) and establish regional partnerships (e.g. Almenland, ZEBRA, Universalmuseum JOANNEUM).

- **Future Fund:** This fund, set up in 2001, aims to support innovative and forward-looking projects to strengthen Styria's position and prepare it for the European and global challenges of the coming decades. So far over 270 projects have received funding. The 7th round of calls in 2014 focused on the theme ‚GTR:InGe – GreenTechResearch: Smart Buildings'. 6 projects were approved dedicated to topics such as solar technology integrated in buildings and roofs and energy schemes for renovating existing buildings.

- **Styrian research – planning, direction, impulses:** This initiative provides funding for projects organised along corridor themes which drive innovation and encourage networking. The focus in recent years has been on the Styrian future-oriented field of human technology with a total of three calls related to the topic ‚Human Technology Interface'. 7 projects were approved in the last call for HTI:Tech4Med, including projects in the fields of medical technology, cancer research and rehabilitation.

Endowed professorships

Endowed professorships are a new and important instrument for strengthening Styria's position as a research and business location. The Styrian government grants funding to outstanding (young) scientists working in highly innovative interdisciplinary research fields and using new teaching concepts. The funding model, in which a second institution must act as a partner, provides a strong incentive for cooperation and has attracted interest throughout Austria. The funding is not restricted to specific subjects and is directed equally to all scientific disciplines. Endowed professorships funded so far include:

- Sound Design (University of Music and the Performing Arts Graz, FH JOANNEUM University of Applied Sciences)

- Energy and Resource Innovation (University of Graz, FH JOANNEUM University of Applied Sciences)

- Bioinformatics (Graz University of Technology, University of Graz, Medical University of Graz)

- Building Physics for Timber Construction (Graz University of Technology)

Flagship projects

In 2009 the Future Fund created the opportunity to finance flagship projects in addition to the regular calls for proposals. So far funding agreements have been concluded with six research establishments relating to the following projects:

- Establishing a research infrastructure for biobanks and biological resources at the Medical University of Graz (Medical University of Graz)

- Implementing sustainable construction through optimised project management processes and integral building shells (Graz University of Technology)

- Research@Zentrum am Berg (Montanuniversität Leoben)

The following flagship projects have already been completed:

- eseia – european sustainable energy innovation alliance at Graz University of Technology

- Interdisciplinary R&D centre for micro- and nanotechnology in polymer engineering. Focus: compounding and surfaces/interfaces of polymers and polymer composites (Montanuniversität Leoben)

- Integration of the HEALTH Institute in the Centre for Knowledge and Technology Transfer in Medicine (ZWT) (JOANNEUM RESEARCH Forschungsgesellschaft mbH).

Individual project funding

Match funding: An agreement between the Styrian government and the FWF makes it possible to implement Styrian research projects that have been classed as eligible for funding in the FWF review process but denied funding due to budget restrictions. Funding is directed particularly at the new generation of scientists and women in research on topics which are of special significance to Styria. The match funding model ensures that every euro invested in a project by an Austrian

federal province is matched from federal funds of the Austrian National Foundation.

Cooperation between federal and provincial governments (BBK): Cooperation between the federal and provincial governments (BBK) was also continued in the 2014/15 reporting year. This scheme is designed to coordinate and finance applied projects which are in the common interest of individual provinces and Austria as a whole. The funding focus is on research projects structured on an interdisciplinary basis and addressing interdisciplinary issues or tackling specific problem areas relevant for Austria which are not covered by other instruments of research funding.

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www.wissenschaft.steiermark.at/Wissenschaftsbericht

See in order to foresee, this is the principle of true science.

Auguste Comte

Overview of Styrian government incentives for science and research

Experience gained so far from implementing this research strategy is extremely promising.

Enhanced cooperation and interdisciplinary research:

The culture of cooperation in Styria has been strengthened both at an R&D project level and an institutional level. Funded initiatives include the Styrian University Conference, BioTechMed and networks such as the Styrian brain research initiative. By providing most project funding based on calls for proposals, the limited resources available have been focused on core Styrian themes and interdisciplinary approaches. These calls have encouraged new and, in some cases, surprising cooperative ventures which have also incorporated the humanities, social sciences and cultural studies and the University of Music and the Performing Arts Graz, in particular.

Stronger position as a research location:

Styria's position as a research location has been strengthened through a series of core infrastructure projects (e.g. Zentrum im Berg, Biobank). The introduction of endowed professorships also follows this line. The specific criteria defined for these professorships have also contributed to cooperation and interdisciplinarity.

Marked increase in average amount of project funding:

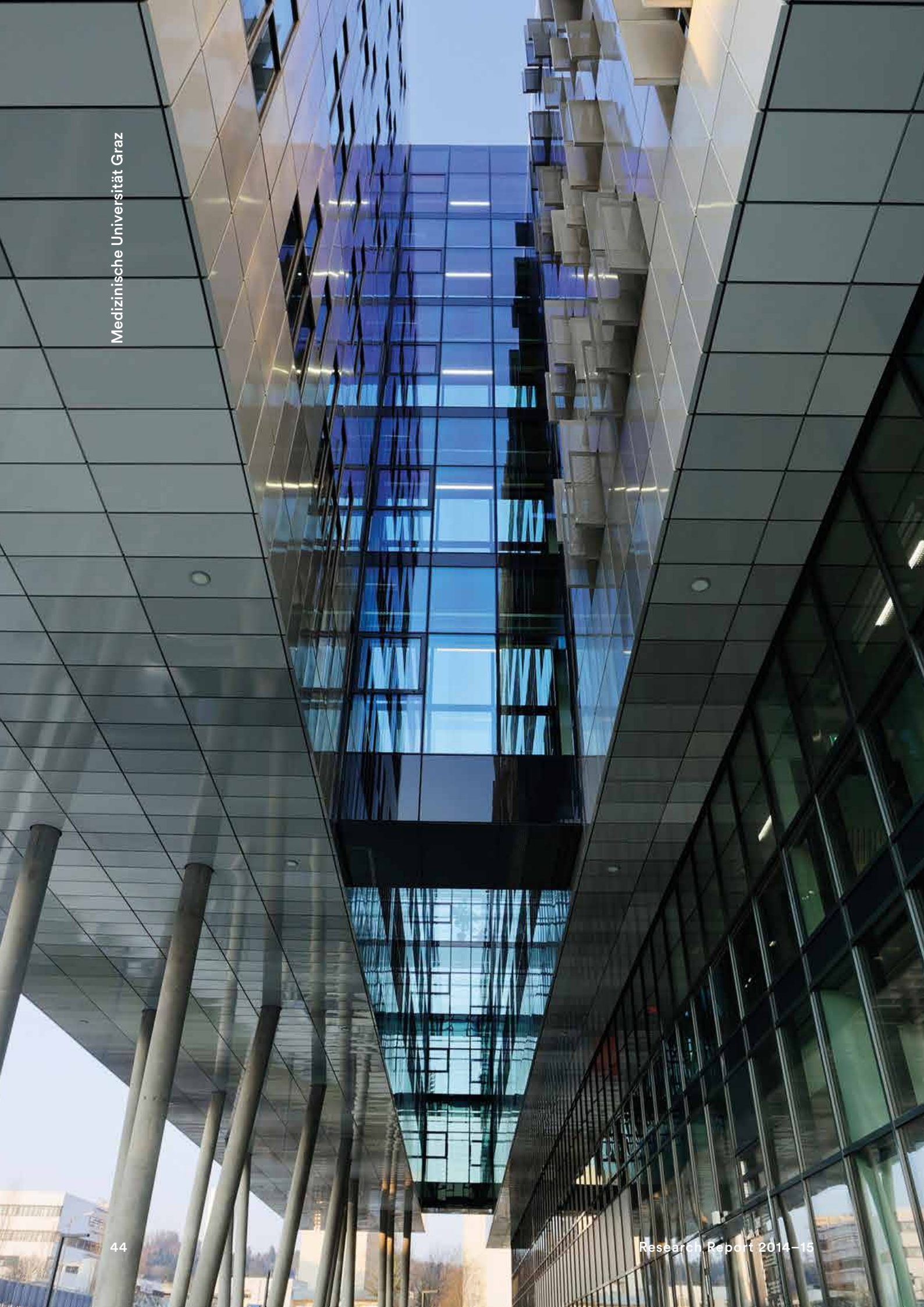
Due to the call system and the match funding projects, average project size has risen sharply from approx. 3,000 euros to approx. 16,000 euros[16].

Support of knowledge transfer:

Funding important transfer initiatives such as the Centre for Knowledge and Technology Transfer in Medicine (ZWT), for example, and developing the GreenTechResearch Styria network has also provided a stimulus towards exploiting expertise to create added value.

Continued science communication:

Previously successful initiatives at regional level such as awards, prizes and discursive dialogue forums (Geist&Gegenwart, Whitsun Dialogue) have been continued.


Medizinische Universität Graz

2014	
23. 1.	Launch of the Health Perception Lab – a health oriented sensory lab at FH JOANNEUM Graz
12.3.	10 years of NAWI Graz (cooperative venture of University of Graz and Graz University of Technology in the field of natural sciences)
22. 5.	10 years of FSI (Frank Stronach Institute) – strategic partnership between Graz University of Technology and Magna and extension of cooperation agreement until 2018
4. 6.	Extension of collaborative BioTechMed Graz initiative (University of Graz, Graz University of Technology, Medical University of Graz)
24. 6.	Opening of ZWT Graz: first Austrian research and technology centre to be totally integrated in a university campus, both in terms of location and organisation.
16. 9.	Green light for 'Zentrum am Berg' – cutting edge research and seminar centre for the construction and operation of underground facilities (Montanuniversität Leoben)
14. 10.	COMET Centre 'Virtual Vehicle' wins Innovation Award 2014 for friction dynamometer FRIDA
17. 10.	10 years of Medical University Graz
20. 10.	acib wins CPHI award for 'Innovation in Process Development' at the world's largest pharmaceutical and chemical exhibition
21. 10.	University of Graz goes East: new cooperation agreements with Chinese universities
10. 12.	Montanuniversität Leoben: first Austrian participation in 'Knowledge and Innovation Community'
16. 12.	Joanneum Research establishes ROBOTICS – Institute for Robotics and Mechatronics based in Klagenfurt
2015	
2015	Montanuniversität Leoben celebrates 175 years of existence
2015	The KUG institutes Jazz, Oberschützen and Electronic Music and Acoustics celebrate 50 years of existence
1. 1.	Launch of CBmed Competence Centre for Biomarker Research in Medicine
20. 4.	20th anniversary of FH JOANNEUM
22. 4.	Louis-Jeantet Prize for Medicine 2015, worth CHF 700,000, is awarded to biochemist Univ.-Prof. Dr. Rudolf Zechner
23.–25. 4.	University of Music and Performing Arts Graz hosts European Platform for Artistic Research in Music (EPARM)
11. 6.	Launch of NIKON Center of Excellence (BioTechMed Graz)
1. 7.	New COMET funding period for K1 Centres Bioenergy2020+, KNOW and RCPE
1. 10.	University of Teacher Education: Start of NEW teacher education scheme
28. 10.	Presentation of the winning project of the architectural competition for the renovation and expansion of the Graz University Library
30. 10.	Launch of the Siemens Center of Knowledge Interchange (CKI), making Graz University of Technology one of nine strategic research partners of the Siemens Group worldwide
6./15. 11.	Opening of the Federal Centre for Professionalisation in Educational Research (BZBF) as successor institution to ARGE Education Research (University Colleges of Teacher Education Styria, Catholic University College of Education Graz, Federal Ministry of Education and Women)

List of figures and tables

Notes

1 For details of the mid-term report see also BMWFW, BMVIT (2016): Österreichischer Forschungs- und Technologiebericht 2016 (Austrian Research and Technology Report 2016).

2 Research intensity equates to R&D expenditure in relation to regional GDP. Data in this section relate to the R&D location concept.

3 Alongside conventional businesses these include cooperative, predominantly non-profit research institutions, e.g. ACR (Austrian Cooperative Research).

4 inc. the very small private non-profit sector.

5 Source: R&D survey by Statistics Austria

6 The figure is not equivalent to R&D capacity (see section „Styria offers full range of disciplines“) as some of the scientists at the universities are also involved in teaching.

7 Cf. Schibany /Gassler (2010): Nutzen und Effekte der Grundlagenforschung.

8 Only veterinary medicine is barely represented in Styria.

9 It should be mentioned that, for historical reasons, one large research-intensive and technology-driven business is assigned to the cooperative and not the business sector. Consequently, the engineering element of cooperative research in the Styrian science landscape is overestimated. This does not affect the underlying claim however.

10 For a detailed description of the Competence Centres see also the full version of the 2014/15 science report available online.

11 Cf. FFG (2016): Überblicksbericht zu Österreich in Horizon 2020 (Summarised report on Austria in Horizon 2020), dataset: February 2016.

12 see also section on collaboration between science and industry

13 Cf. OGM (2010): Styrian Science Study. Summary

14 It has to be emphasised that no conclusive comparison of any kind can be made from the table “Scientific output” in terms of intensity or quality of the universities or across different scientific disciplines. The way in which publications are done in the different disciplines varies greatly and publications can therefore only be compared within the same discipline – for example at different universities. (It is not within the remit of this report to do such a comparison.)

15 Cf. www.gesundheit.steiermark.at/cms/dokumente/11806970_96572397/d8246e6e/Forschungsstrategie_A8_07.01.13.pdf

16 The figures for genuine R&D projects are often far higher. The average value is however significantly reduced by small funding schemes such as allowances covering the cost of travel or publications etc.

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The information contained in this report has been carefully compiled and reviewed several times. Special attention was placed on gender-neutral wording. Nevertheless, errors cannot be completely excluded.

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