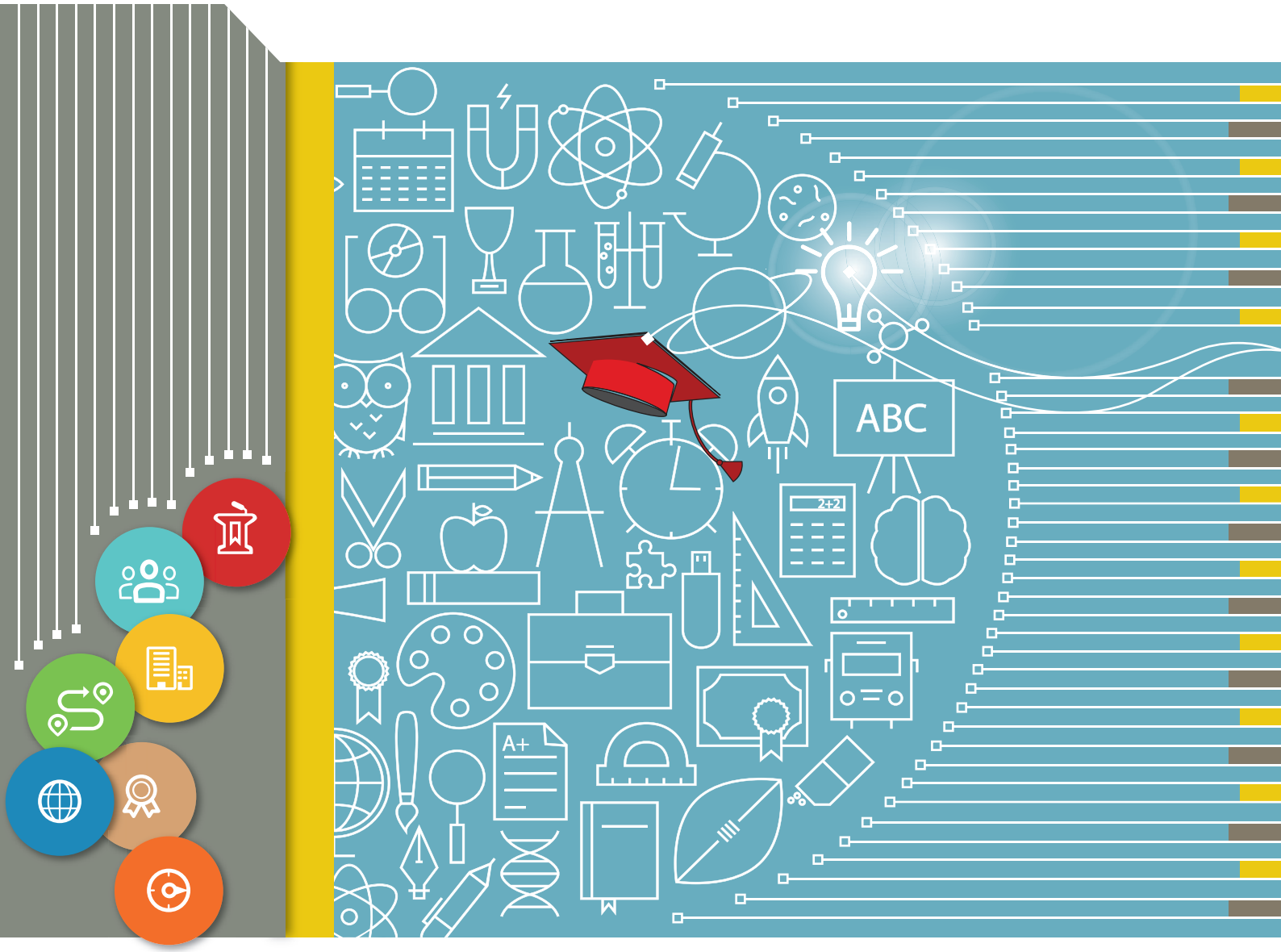
OECD Skills Studies

Supporting Entrepreneurship and Innovation in Higher Education in Austria



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Preface by Austria

Austria places high emphasis on the societal role of higher education institutions as a proactive and stimulating innovation force through the promotion of a broad entrepreneurship definition. This includes the institutions' identities as well as their teaching and research activities. In view of the fast changing world of work, high professional qualifications are a necessary prerequisite, but also key competences such as initiative and entrepreneurial skills, creativity, innovation and willingness to take risks, as well as the ability to organize and execute projects in order to achieve concrete goals, are rapidly gaining in importance.

Governance of higher education institutions – including public universities, universities of applied sciences, university colleges of teacher education, and private universities – plays an important role here. Discussions in the European University Business Forum have been monitored closely in Austria since the beginning and the resulting initiatives and support measures have been exploited actively. For example, the Federal Ministry recommended the use of the HEInnovate Tool for self-evaluation in the performance agreements with the public universities and requested each university to present their own concept of the entrepreneurial university. In 2016, Austria hosted a University Business Forum, which was organised in cooperation with the European Commission and the Austrian Federal Economic Chamber. The showcase examples presented there attracted great interest among the international participants. Austrian higher education institutions are also successful in participating in Knowledge Alliances.

As a logical consequence of the activities described above Austria took part in the HEInnovate country reviews last year and the publication, which you are reading online or holding in your hands right now, is the result. Fourteen higher education institutions have agreed to face the questions and discussions with the review teams, and readily exchanged their views with Austrian representatives from industry and research. Some interesting facts were discovered about the performance in the area of innovation and entrepreneurship on the individual level of the institutions, as well as for the entire Austrian higher education system. The focus of this review is on leadership and governance, entrepreneurial teaching and learning, and preparing and supporting start-ups in higher education. We are pleased that good practices were found in all three areas, but we will also thoroughly analyse the recommendations for further improvement and development. The dissemination of the findings in this review will lead to further activities, and, consequently, to their integration into the steering of higher education institutions and the whole higher education system.

The HEInnovate Country Review Austria complements the analysis presented in the OECD Reviews of Innovation Policy: Austria 2018 and will provide valuable input for current discussions on the new Austrian Strategy for Research, Technology and Innovation.

Many thanks to the higher education institutions for their active engagement and valuable contributions as well as to the review teams, the national steering group, the OECD, the European Commission, and to my colleagues and employees in the Federal Ministry.

Austrian higher education institutions are aware of their comprehensive tasks and the necessity to be active participants and important drivers for a successful economy and society. Together with the institutions, we will integrate the findings and suggestions of the report into the higher education institutions' missions of research and teaching and support them in fulfilling their societal and economic responsibility.

Elmar Pichl

Director General IV Higher Education

Austrian Federal Ministry of Education
Science and Research

Preface by OECD and European Commission

Entrepreneurship and innovation are key drivers of inclusive growth. Higher education systems and institutions that strategically develop innovative and entrepreneurial approaches towards education, research and engagement with stakeholders catalyse these drivers. Policy reforms supporting these trends are emerging internationally. Often, due to the pioneering role of individuals, many higher education institutions (HEIs) have a solid foundation of initiatives on which to build on.

Scaling up entrepreneurial and innovative initiatives and sustaining change at institutional level is a multi-dimensional effort. It requires adopting new rules and practices regarding resource allocation, staff incentives, continuous professional development, and the creation of strategic partnerships – locally, nationally and globally. Importantly, HEIs should include engagement with business and communities in their core functions, funding and staff deployment provisions.

The HEInnovate guiding framework offers policy guidance and advice by identifying and analysing institutional and national practices, and by making information available at international level, to help new initiatives evolve and grow. The HEInnovate guiding framework encompasses a self-assessment tool for higher education institutions, a series of country reviews, and a peer-learning network facilitating exchanges of experiences and best practices among relevant stakeholders.

The HEInnovate country review of Austria shows a collection of good institutional and policy practices. The national higher education system has consistently recognised the need to become more entrepreneurial and innovative with a view to supporting the economic, social and cultural development of the country, and its regions. Over the past decades, the government has been implementing a broad reform agenda to provide strategic funding, diversify higher education institutions (HEIs), and promote an allocation of students that improves the quality of services, empowering them vis à vis the future of work and society.

Going forward, Austria could capitalise on the institutional diversity of its higher education system and promote partnerships and interdisciplinary programmes spurring entrepreneurship and innovation in all students and stakeholders. The higher education system should adopt a clear and shared definition of entrepreneurship, which goes beyond business creation and puts the emphasis on nurturing the entrepreneurial mindset of students and faculty. At the same time, entrepreneurship and innovation practices could take into account the different characteristics and needs of the regional entrepreneurial ecosystems, characterising the country.

The HEInnovate review provides a number of "learning models" contributing to the current discussions in Europe and the wider OECD area on policy practices to support entrepreneurship and innovation in higher education. The OECD and the European

Commission are grateful to the Austrian federal government for the effective and lasting partnership created through this review. We look forward to continued collaboration with Austria in HEInnovate.

Lamia Kamal Chaoui

Director, Centre for Entrepreneurship, SMEs, Regions and Cities, OECD

Antoaneta Angelova-Krasteva

Director for Innovation, International Cooperation and Sport, European Commission

Foreword

This publication presents the findings and recommendations of the HEInnovate review of the impact of higher education institutions (HEIs) on entrepreneurship and innovation in Austria. The review assesses the strategies and practices of HEIs in Austria in supporting entrepreneurship and innovation, along with the government policy context. It highlights the efforts put in place by the Austrian higher education system, which has consistently recognised the need to become more entrepreneurial and innovative with a view to supporting the economic, social and cultural development of the country and its regions.

The review was undertaken by the OECD in partnership with the European Commission, as part of the programme of work of the OECD Local Economic and Employment Development (LEED) Committee. The review is part of the HEInnovate collaboration between the European Commission's Directorate-General for Education, Youth, Sport and Culture and the OECD Centre for Entrepreneurship, SMEs, Regions and Cities.

Investing in innovative and entrepreneurial HEIs is one of the highest return investments that we can make. Innovators and entrepreneurs are not born with all the necessary competencies. Rather, underlying attitudes, skills and knowledge are developed over time in society and through education.

More needs to be done to ensure that these competencies are developed through education, and to ensure that there are the right incentives and support structures to encourage staff and students in HEIs to get more involved in entrepreneurial ventures and engagement with business and society.

HEInnovate is a starting point for governments and HEIs to identify areas for action. It is a guiding framework for supporting entrepreneurship and innovation in higher education. HEInnovate offers an online self-assessment tool for higher education institutions (www.heinnovate.eu), available in 24 languages, a series of country review assessments, including this report on Austria, and a Policy Learning Network that facilitates cross-country exchange and peer learning amongst the countries participating in the country reviews.

Acknowledgements

This review was a collaborative effort between the OECD's Centre for Entrepreneurship, SMEs, Regions and Cities (CFE) led by Lamia Kamal-Chaoui, Director, and the European Commission's Directorate for Innovation, International Cooperation and Sport in the Directorate-General for Education, Youth, Sport and Culture, led by Antoaneta Angelova-Krasteva, Director. It was undertaken in partnership with the Federal Ministry of Education, Science and Research, of Austria.

Raffaele Trapasso, Coordinator of HEInnovate, and Andrea-Rosalinde Hofer, former CFE staff and currently in EDU, prepared the report under the supervision of Lucia Cusmano, Acting Head of the SMEs and Entrepreneurship Division, CFE. Maria Sobron Bernal, CFE, provided major assistance. HEInnovate is part of the programme of work of the OECD Local Economic and Employment Development (LEED) Programme.

The OECD is particularly grateful to Peter Baur, Directorate General for Education and Culture of the European Commission, for his participation in various review activities.

A team of experts contributed to the drafting of this report. These include: Brigitte Ecker, WPZ Research GmbH, Austria; Ruaidhri Neavyn, Policy advisor to the Higher Education Authority, Ireland; Maria Helena Nazaré, Head of the Higher Education Council, Portugal; Magneleus Klofsten, Professor at the Linkoping University, Sweden; Asa Lindholm-Dahlstrand, Professor at the Lund University, Sweden; and Christos Kolympiris Associate Professor at Warwick Business School. Thomas Estermann, European University Union. Andrew Gibson, Trinity College, Dublin, provided additional drafting and expertise. Reem AbouElenain, Erasmus Mundus Joint Master Degree, accompanied the team in one of the study visits. Finally, Stojan Sorčan, Director General for Higher Education in the Ministry for Education, Science and Sport of the Republic of Slovenia participated in one study visit as observer.

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Kristina Edlinger-Ploder (University of Applied Sciences, Graz), Philipp Marxgut (Complexity Hub).

Members of the steering group of this review also provided key insights and comments reflected in this review. Theses members include distinguished professionals of Universities Austria (uniko), the Austrian Council for Research and Technology Development, the Association of Austrian Universities of Applied Sciences (FHK), the Austrian Private Universities Conference (ÖPUK), the Rector's Conference of Austrian University Colleges of Teacher Education, the Federation of Austrian Industries (IV), the Austrian Chamber of Labour, the Federal Economic Chamber (WKO) and the Federal Ministry of Digital and Economic Affairs.

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Abbreviations and acronyms

AE	Alternative extensions
AIT	Austrian Institute of Technology
AQ Austria	Austrian Agency for Quality Assurance and Accreditation
AWS	Austria *Wirtschaftsservice Gesellschaft mbH*
BMBWF	*Bundesministerium für Bildung, Wissenschaft und Forschung*, Federal Ministry of Education, Science and Research
BMDW	*Bundesministerium für Digitalisierung und Wirtschaftsstandort*, Federal Ministry of Digital and Economic Affairs
BMVIT	*Bundesministerium für Verkehr, Innovation und Technologie,* Federal Ministry of Transport, Innovation and Technology
BMWFW	Bundesministerium für Wissenschaft, Forschung und Wirtschaft Federal Ministry of Science,Research and Economy
BOKU	University of Natural Resources and Life Sciences, Vienna
CASE	Competencies for sustainable socio-economic development project
CDG	Christian Doppler Research Association
CDIO	Conceive, Design, Implement and Operate
CeMM	Center for Molecular Medicine
CEO	Chief executive officer
CSE	Chalmers School of Entrepreneurship
CSH	Complexity Science Hub Vienna
DRZ	*De Rotterdamse Zaak*
EC	Extension curricula
ECTS	European Credit Transfer System
EHEA	European Higher Education Area
ESG	European Standards and Guidelines
ETP	Entrepreneurship in Theory and Practice
EU	European Union
FFG	Österreichische Forschungsförderungsgesellschaft Austrian Research Promotion Agency
FH	Fachhochschule, University of Applied Sciences
FTE	Full-time equivalent
FWF	Wissenschaftsfonds,,Austrian Science Fund
GDP	Gross domestic product
GMI	Gregor Mendel Institute of Molecular Plant Biology
GUEP	General University Development Plan
HE	Higher education
HEA	Higher Education Authority
HEI	Higher education institution
HTL	*Höhere Technische Lehranstalten, College for higher technical education*
IIASA	International Institute for Applied Systems Analysis
IMBA	Institute of Molecular Biotechnology Pioneering
IP	Intellectual property
IPAG	Intellectual Property Agreement Guide
IPR	Intellectual property rights
ISCED	UNESCO International Standard Classification of Education

IT	Information technology
ITS	*Instituti Tecnici Superiori*, Technical higher institutions
JR	Josef Ressel
KTC	Knowledge transfer centres
LBG	Ludwig Boltzmann Gesellschaft
LTE	Learning through entrepreneurship
NABC	Need, Approach, Benefit and Competition
NSF	National Science Foundation
OeAW	Österreichische Akademie der Wissenschaften Austrian Academy of Sciences
OECD	Organisation for Economic Co-operation and Development
PA	Performance agreements
PI	Principal investigators
PLN	Policy Learning Network
PMU	Paracelsus Medical University
PPP	Public-private partnership
PRI	provisional patent application
R&D	Research and development
RDI	Research, development and innovation
RTI	Research, technology and innovation
SEI	Strathclyde Entrepreneurship Initiative
SIF	Strategic Innovation Fund
SME	Small- and medium-sized enterprises
STEM	Science-technology-engineering-mathematics
TTO	Tech transfer office
TU	Technical University
UAS	Universities of applied sciences
VCP	Venture creation programme
VET	Vocational education and training
VLSI	Vienna Life-Science Instruments
WKO	Wirtschaftskammer Österreich Austrian Chamber of Commerce

Executive summary

As part of its efforts to develop a world-class innovation system and to connect it with the national productive sector, Austria is supporting the "entrepreneurship and innovation agenda" in higher education. The Austrian higher education system has consistently recognised the need to become more entrepreneurial and innovative with a view to supporting the economic, social and cultural development of the country and its regions. Over the past decades, the government has been implementing a broad reform agenda to diversify higher education institutions (HEIs). Within this framework, the OECD, supported by an international group of experts and peer reviewers, has engaged with federal authorities to analyse the entrepreneurial and innovation agenda of HEIs. The OECD and the European Commission have developed a holistic framework – HEInnovate – that helps national higher education systems and HEIs generate societal and economic value.

Austria's higher education system is characterised by the presence of public universities operating as international research hubs and universities of applied sciences (UAS), *Fachhochschulen* in German, generating economic and societal value for firms and communities, in their own ecosystems. Both types of HEIs have been developing their capacity to collaborate with external stakeholders through technology transfer offices, incubators, accelerators, etc.

Regional characteristics related to the presence of an urban centre or firm density remain key variables affecting the capacity of HEIs to engage with stakeholders. Federal and regional policies have played an important role in promoting the entrepreneurship and innovation agenda in all regions throughout the country. Policy reforms have mainly been aimed at two key dimensions of the HEInnovate framework. First, promoting leadership and governance arrangements to support HEIs' engagement capabilities. Second, incentivising the entrepreneurial skills of students, and supporting academic entrepreneurship with specialised services, also to strengthen the linkages between science and industry.

The Federal Ministry of Education, Science and Research has negotiated performance agreements for 2019-21 with universities' leadership in which entrepreneurship is a strategic issue. Performance agreements are the main government steering mechanism for universities, and are negotiated every three years. Several public universities, especially in science, technology, engineering, and mathematics (STEM) disciplines have already put in place governance arrangements to promote interdisciplinary competencies and/or transferable skills for students, and for faculty and staff. Some of them are internationally renowned practices for their capacity to "implement" research in economy and society.

The new performance agreements generate a new institutional framework for initiatives that were already in place in the country and provide them with funding and incentives for scaling up and mainstreaming. In parallel to this policy reform, federal authorities have been financing additional study places in UAS and aim to double the share of students enrolling in this sector – from 20% to 40% – in the future. This will take advantage of UAS' capacity to engage with their ecosystems and provide specialised study programmes and lifelong learning courses in response to regional skills needs.

The strategic focus on HEI engagement has been promoting entrepreneurship teaching and learning in all Austrian HEIs. Once perceived as a domain mostly for UAS, entrepreneurship education has been included in development plans and missions of leading public research universities and universities of the arts, for example. Initiatives to encourage entrepreneurial behaviour and action take different forms in different regions and different kinds of HEIs. Importantly, entrepreneurship teaching and learning activities have created the opportunity for collaboration with external stakeholders. Regional development agencies, chambers of commerce and, of course, subnational governments have been working in partnership with HEIs in incubators and other infrastructure to deliver entrepreneurship education and services. As a result, there are many start-up schemes, entrepreneurship courses and ecosystem-level initiatives in different kinds of HEIs, all supporting entrepreneurship and innovation.

Austria´s thriving industrial sector, while attracting talent and reducing the potential pool of entrepreneurs, presents an opportunity because it creates the potential for entrepreneurs to collaborate with resourceful actors. Along the same lines, a strong industrial sector indirectly promotes high risk and high return entrepreneurship insofar as it can act as a safety net for employment in case of entrepreneurial failure. Within this context, Austrian HEIs, and in particular UAS and public universities specialised in STEM disciplines, have capitalised on the quality of their research or applied research, activities to prepare or support entrepreneurs. Importantly, HEIs' initiatives are well connected with regional and federal policies.

While providing numerous good practices that feed into the international policy dialogue regarding the entrepreneurial and innovation agenda in higher education, the case of Austria also offers the opportunity to discuss some key challenges. For example, while the strategic aim to engage with the economy and society has percolated throughout the higher education system, the capacity to implement the entrepreneurship and innovation agenda effectively depends on the governance arrangements, organisational capacity and the institutional culture of HEIs as well as characteristics of the surrounding economy, including density, size and age of firms, types and amount of business innovation, and the presence of a large urban hub. These "exogenous" conditions should be taken into account when developing strategies, evaluation metrics and narratives to provide recognition and support funding for the entrepreneurial and innovation agenda. In addition, to improve the capacity of the HE system to generate value for the economy and society, Austria should capitalise on the institutional diversity of its higher education system and promote more interdisciplinary programmes and joint research consortia between UAS and public universities. Regional initiatives in education and/or research can facilitate a more structured approach to engagement with industry, businesses and local communities by developing tailored skills and sectorial focus groups to support and guide the entrepreneurship and innovation agenda.

In addition, Austria's higher education system should adopt a clear and shared definition of entrepreneurship, which goes beyond business creation and puts the emphasis on nurturing the entrepreneurial mindset of students and faculty. Some HEIs are reluctant to adopt the paradigm featuring the "entrepreneurial university" and tend to marginalise entrepreneurship teaching and learning, rather than mainstreaming it in all faculties and departments. This is an important issue for different reasons: in the short term, it limits the capacity of HEIs to encourage firm creation and employment; in a longer-term perspective, the lack of an effective strategy may impinge upon skills relevance and skills resilience on the labour market.

There is a need for a broader suite of entrepreneurship education activities. Often, students can access entrepreneurial learning opportunities only in extracurricular, often informal, activities. In the same vein, not all faculty members see entrepreneurship as a possibility for an academic career. These conditions impinge upon the possibility that a large share of the student population – in bachelor's, master's and doctoral programmes – acquires problem-solving and innovation capacities, attitudes towards collaboration and accountability, along with other capabilities that frame 21st Century skills. There are potential complements to the present "low-volume" entrepreneurship courses at bachelor's and master's levels. For instance, HEIs could generate "high-volume" courses by integrating different disciplines.

Finally, there is a need to tailor policies supporting HEI entrepreneurship and innovation to the different types of entrepreneurial ecosystems that characterise regional Austria. Geographic variability in the type of HEI start-up activity in Austria implies that there is no single path towards the entrepreneurial and innovation agenda. As such, there is limited space for replicability of successful cases. In addition, the lack of a single path suggests that the evaluation of HEI entrepreneurial efforts to contribute to local and national competitiveness – needed to justify the public funding allocated to HEIs – is a thorny task and cannot be fully standardised across different ecosystems. Evaluation should take into account enabling conditions and develop narratives, along with indicators, to allow a better understanding of the role a given HEI plays in its own ecosystem.

Chapter 1. An overview of the higher education system and its components

This introductory chapter provides an overview of the higher education system, in Austria. It describes the institutional diversity that characterises the system, and presents the main actors and the funding arrangements for education and research, which represent the framework conditions for the entrepreneurship and innovation agenda. The chapter discusses the reforms Federal authorities have been implementing in the field of higher education and, in particular, to connect higher education institutions with economy and society.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

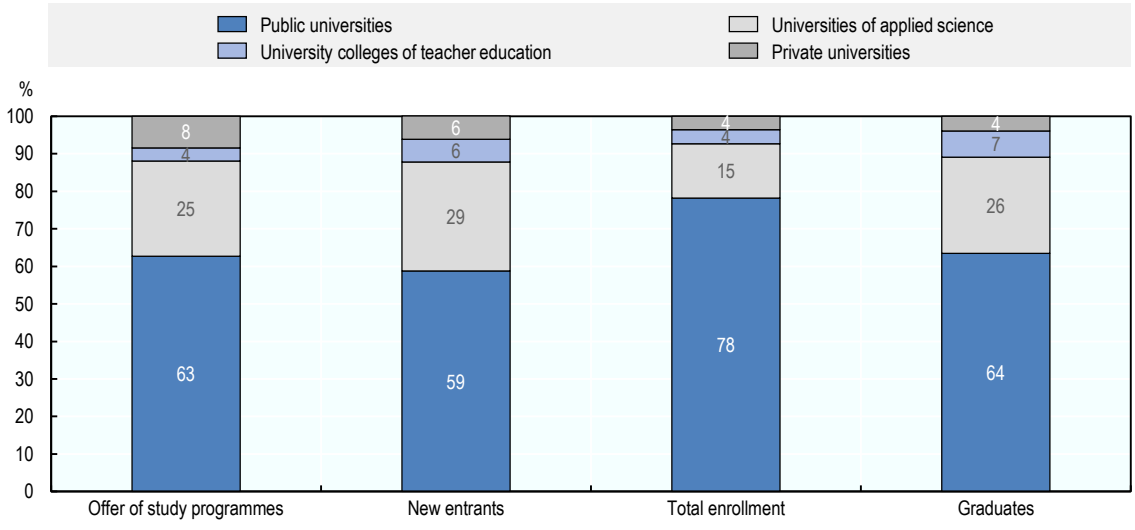
Describing the Austrian higher education system

Austria is home to an important higher education (HE) system that has been evolving to adapt to changing framework conditions. Over the past 25 years, several reforms have triggered a process of institutional differentiation. Among others, reforms have introduced important innovations such as universities of applied sciences (UAS), which focus on vocational-oriented academic training and applied research, and private universities. The reform process is still ongoing and the federal legislator has played a key role by defining rules and financing, and promoting policy dialogue.

The Austrian higher education system consists of four sectors, which are uneven in size. There are 22 public universities, 21 universities of applied sciences (*Fachhochschulen*, UAS), 16 private universities and 14 university colleges for teacher education.[1] Public universities alone represent about 80% of the overall students enrolled in tertiary education. The second largest HE sector is that of UAS. University colleges for teacher education and private education have just a small part of students and offer a small number of programmes (Figure 1.1).

Figure 1.1. Share of new entrance, study programmes, enrolment and graduates across different higher education institutions (HEIs) in Austria

2018 or latest available year



Note: Offer of study programmes: winter semester 2017; New entrants: academic year 2017/18; Enrolment: winter semester 2017; Graduates: academic year 2017/18.
Source: BMBWF unidata, Statistics Austria https://oravm13.noc-science.at/apex/f?p=103:36.

Public universities

Public universities hold more than three-quarters of students enrolled in higher education. Public universities encompass very large actors such as the University of Vienna. Founded in 1365, it is the oldest and largest university in the German-speaking world, counting 91 715 students in 2018. Other important public universities are located in Graz, Innsbruck, Klagenfurt, Linz and Salzburg. There are also several technical universities, medical universities and specialised universities, including the University of Natural Resources and Life Sciences of Vienna, the Vienna University of Economics and Business, and the

University of Veterinary Medicine of Vienna. Universities of arts are other public universities.

Universities of applied sciences

Universities of applied sciences focus on vocational-oriented education and applied research. Austria introduced the University of Applied Sciences Studies Act (*Fachhochschul-Studiengesetz*, FHStG) in 1993. Political reasons to introduce a new professionally oriented sector of tertiary education were to facilitate the diversification of higher education degree programmes and to bridge the gap between academic institutions and the job market. A further intention was to facilitate and enable access to tertiary education to under-represented groups, such as first-in-family or working students. Since its creation, the UAS sector has grown in importance and size. UAS generate new programmes every year, to match the large and diverse demand of highly skilled individuals on the national and international labour markets.

Public or private institutions can obtain accreditation from the Austrian Agency for Quality Assurance and Accreditation (AQ Austria) as a university of applied sciences. Providers can be funded by regions, municipalities or chambers of commerce, etc. The Federal Ministry of Education, Science and Research funds study places within UAS study programmes, not the institutions themselves.

UAS operate in osmosis within their own ecosystems and their study programmes have to reflect the skills needs of their vocational fields. UAS have to undergo accreditation for each study programme as well as initial accreditation for the institution itself. Once approved, curricula of study programmes can evolve to meet the trends and requirements in the relevant vocational fields of activity, based on a permanent dialogue with employers. UAS bachelor curricula include a mandatory internship, forging a strong bond between the UAS and firms/employers. This model is also proving increasingly effective to address the growing demand for lifelong learning.

UAS also offer the possibility to enrol in so-called "dual study programmes" or work-co-operative programmes. These programmes, based on an agreement between UAS and companies, combine academic education at the higher education institution (HEI) and practical training in companies. Students in these programmes spend the first two semesters studying at the UAS. After this period, in most cases from the third semester, the training company hires them and they start to apply in practice what they have learnt in theory. Symmetrically, they project their practical experience in theoretical studies at the UAS. Public authorities have been promoting these co-operative programmes in recent years; in the academic year 2019/20, five Austrian UAS offer seven work-co-operative study programmes.

UAS select their students and, in some cases, ask for tuition fees (Kasparovsky and Wadsack-Köchl, 2015). The number of study places in each programme is limited. Therefore, when there are more applicants than places, there is the legal requirement to set up selective admission procedures. Acceptance of study programmes, however, is not constant. It varies depending on the region and the discipline. Therefore, some UAS have been reporting problems filling all of their available study places.

Private universities

Since their creation in 1999, private universities have been differentiating their offer and have added diversity to the HE system.[2] Today, there are 16 private universities and about

150 programmes ranging from social sciences and economics, law, medicine, psychology, theology, to art and music, etc. Private universities have also PhD programmes. Since 2012, private universities receive their accreditation from AQ Austria, the same body that provides accreditation to the UAS.

Currently representing about 3% of the total number of enrolled students, the sector of private universities has been developing fast over the past 5 years. These institutions have recorded the highest growth rates, showing an average increase of 9.2% in first-time students in 2017/18.

Private universities can receive public funds but there are some restrictions. The share of public funding to private universities amounts to roughly one-third of total funding. Private universities' funding structure is diversified with almost 60% of funding coming from private sources (including tuition fees) and around 10% from competitive third-party funds. Subnational authorities can provide financial support to private universities but the law forbids the federal government from providing funding and subsidies.

University colleges for teacher education

Teacher education in Austria has traditionally been the responsibility of public universities (lower and upper secondary school teachers, e.g. for *Gymnasium*-type schools and higher vocational schools) and colleges for teacher education (teachers for primary and lower secondary compulsory schools).

Recognising the importance of having highly skilled teachers, Austria put in place university colleges for teacher education in 2005. These colleges have replaced the post-secondary colleges for teacher training (*Akademien für Lehrerinnen- und Lehrerbildung*). The Austrian Federal Ministry of Education, Science and Research is also entitled to grant accreditation to private university colleges of teacher education and degree studies supported, for instance, by religious entities. University colleges for teacher education can implement training programmes for primary education independently. They have to co-operate with universities concerning training programmes for secondary school teachers.

Ongoing reforms affecting the structure of the HE system in Austria

Recognising the need to update constantly the HE system to make it able to respond to emerging trends and needs, the government has put in place several reforms. Among others, reform attempts have aimed to achieve a more balanced distribution of students across HE sectors. Examples of these reform attempts are the expansion of the UAS sector and the introduction of admission procedures for public universities in selected study fields. In particular, the federal ministry is aiming to change the distribution of students between the two largest sectors, public universities and UAS. The objective is to have 60% of students enrolled at public universities and 40% enrolled at UAS. According to national authorities, this new distribution should generate a twofold improvement in the system, on the one hand, improving the faculty-student ratio in study fields with high demand and on the other, more students benefitting from the good performance of UAS regarding completion rates, study duration and graduate employability rates.

Based on these, the federal ministry has been putting measures in place to favour the reallocation of students in the HE system. For example, the ministry financed 450 new study places at UAS in the academic year 2018/19. These new places are in science-technology-engineering-mathematics (STEM) subjects related to digital transformation.

Another recent federal initiative promoting a more efficient equilibrium within the HE sector is the Future Higher Education project. The federal ministry launched this project in the spring of 2016, aiming at:

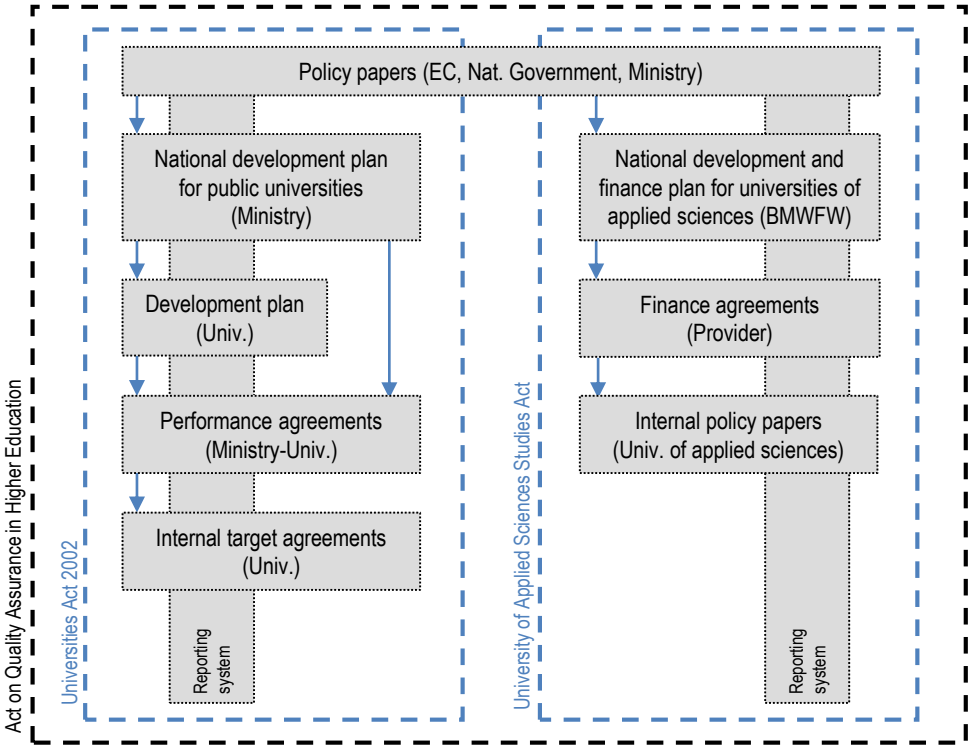
- Emphasising the educational profile of public universities (scientific/artistic education and lifelong learning) and UAS (practice-oriented education at higher education level).
- Structuring and adjusting the range of study programmes on offer.
- Improving the permeability in tertiary education.

The results of the "Future of Higher Education" project were included in the Comprehensive Austrian University Development Plan, the performance agreements 2019-21 with public universities as well as in the development and funding plan for UAS 2018/19-2022/23.

Governance arrangements in different sectors of higher education institutions

The governance of the Austrian HE system reflects both the autonomy of HEIs and the presence of different kinds of sectors and institutions. In particular, due to the sectoral structure and student distribution, the system has developed two kinds of governance arrangements: one for public universities and the other for UAS.

Figure 1.2. Policy instruments for planning and steering Austrian higher education



Source: Ecker, et al. 2017.

The governance of public universities

Concerning governance, public universities are autonomous and negotiate their performance agreements with the federal ministry. This arrangement has evolved over time. Public universities used to be state agencies managed by the federal ministry. In 2002, the University Act introduced autonomy and the adoption of a new public management approach, based on a more managerial, corporate-style approach.

To cope with the governance system, executive decision-making structures have been strengthened at the expense of traditional academic collegial bodies (Pechar and Park, 2017). In particular, a university council (*Universitätsrat*) composed of external experts supervises and controls the rectorate of the university. Members of the university council are appointed in equal shares by the academic senate and the federal government. This governing board appoints the rector from a shortlist of three candidates proposed by the senate. The rector – formerly a *primus inter pares* elected by the academic senate – now acts as the executive manager of a "corporate" university. The rector directly appoints a team of vice-rectors together forming the rectorate as a decision-making entity. In addition, the position of deans as heads of faculties has been strengthened. Academic senates have conserved their powers concerning curricular matters, which remains a relevant responsibility.

The Austrian University Development Plan (GUEP) regulates the relationship between public universities and the federal government/ministry. The GUEP, issued in 2015 and re-drafted in 2017, sets the priorities for the development of public universities and defines a range of planning parameters for teaching (e.g. indicators for enrolment, actively enrolled students, degrees, student/teacher ratios) with the aim to promote transparency.

The federal ministry and public universities negotiate goals and funding based on "institutional strategic plans". In these plans, universities have to formalise their strategic development outlining medium- and long-term strategic goals. These plans serve as benchmarks for the negotiation of "performance agreements". Performance agreements are public contracts between the individual university and the federal ministry, covering a period of three years and detailing specific goals the HEI has to meet regarding personnel, research and teaching. Based on these goals, the federal ministry and the university "agree" on a budget.

HEIs have to report to the federal ministry every year on the state of implementation. HEIs report to the government using a "knowledge scoreboard" (*Wissensbilanz*), which includes both qualitative and quantitative indicators. Based on "knowledge scoreboards", the federal ministry draws up a comprehensive report about the performance of all universities and presents the results to the Austrian Parliament every three years. If HEIs fail to meet the targets defined in the performance agreements, the federal ministry discusses "adequate corrections and consequences" in the following cycle of negotiations.

For example, the last capacity-based university funding, introduced with the performance agreement period 2019-21, has strengthened the steering capacity of performance agreements with the aim to improve their effectiveness. The relation between matching of the objectives defined in the performance agreement and the level funding received from the government has been strengthened.

The governance of universities of applied sciences

UAS enjoy a different governance system than that of public universities.[3] A first important difference, laid down in the UAS Studies Act (Fachhochschul-Studiengesetz, FHStG), is

the possibility for the private sector to participate in the design and delivery of higher education. In fact, UAS are organised as public-private partnerships with the aim of facilitating innovation in study programmes, which reflect the skills needs of the economy.

In some cases, the governance arrangements of UAS can generate conflicts between different functions. Most UAS operate as private companies[4] and, as such, a chief executive officer (CEO) manages the UAS like a private company. However, the CEO is responsible for the "academic leadership" of the UAS, represented by the elected head of a collegial body – the "*Kollegium*" – composed of academics and student representatives.

Unlike public universities, UAS have only to fulfil the requirements stipulated by law to access funding and accreditation. The Ministry of Education, Science and Research funds and allocates UAS study places. Public or private providers in charge of UAS need to apply for initial accreditation as an HEI. In particular, they need to apply to AQ Austria for each study programme they aim to implement.[5] To gain the accreditation of their programme, among other requirements, providers have to illustrate labour market demand (demand and acceptance analysis). In addition, they have to prove having the required staff, facilities and equipment to implement the programme. Finally, providers have to estimate the average cost per study place and generate a financial programme for the duration of the approval. Peer experts evaluate the submitted study programme in a procedure designed in compliance with the European Standards and Guidelines (ESG) for the European Higher Education Area (EHEA).

Finally, the link between UAS and local authorities represents another important difference in the governance system, vis-à-vis public universities. For instance, provincial and municipal governments are closely involved in several UAS governing boards. Their presence in the governing bodies of UAS generates a strong bond between the institutions and their own ecosystems.

The governance of university colleges for teacher education and private universities

University colleges for teacher education follow their own governance arrangements. University colleges are state agencies, subordinated and managed by the federal ministry. However, to facilitate operability, university colleges are equipped with a limited legal capacity, which allows them to conclude certain legal transactions. The management of these institutions responds to performance contracts, signed between the federal ministry and each university college for a period of three years.

Private universities are less dependent on the control of the federal ministry. However, the Private University Act requires that private universities receive accreditation from AQ Austria. To receive this accreditation, private universities have to guarantee, among others, that academics enjoy sufficient autonomy in teaching and research. For the first two consecutive accreditation periods, accreditation is granted to private universities for six years. After the first 2 periods, private universities can receive 12-year accreditation.

Recent reforms in the admission system and impact on funding regimes

There are different systems regulating access to higher education in Austria. The open admission policy that entitled all students with *Matura* – secondary school diploma – to enrol in any programme at any research university was changed in 2005 when the European Court of Justice ruled against Austria's decision to limit open admission to Austrian citizens only.[6] Therefore, federal authorities have introduced access regulations at public universities, with entrance examinations in some disciplines such as medical studies. However, enrolment at universities of the arts traditionally required entrance examinations to prove artistic talent. Likewise, concerning UAS, selection mechanisms were already in place since the 1990s. At both UAS and university colleges for teacher education, student admission depends on the number of available study places. Private universities have been regulating access to their programme since their creation.

Federal authorities have introduced a series of reforms to regulate access to specific fields of study at public research universities over the past decade. For example, in addition to existing access restrictions in medicine, new access regulations were introduced in 2013 in popular fields of study such as architecture, biology, computer science, pharmacy and business. Within this regulatory framework, public universities are free to decide on the implementation of access procedures.

The reform of access regulations to higher education is still evolving and introducing a certain degree of flexibility in the system. Since 2018, for example, access regulations affect fields of study such as education, languages and law. The 2018 reform has enabled public universities to introduce entrance examinations in case there is a high number of applicants for specific study programmes.

Funding mechanisms

Funding mechanisms are different for the various sectors of higher education in Austria. For instance, public universities receive funding based on the outcome of negotiations with the Federal Ministry of Education, Research and Science: a performance agreement. Before 2019, the federal ministry allocated funding to public universities in the form of a lump sum budget. Universities were (and still are) free to use these funds. However, they have to fulfil the objectives agreed upon with the federal ministry in their own performance agreements.

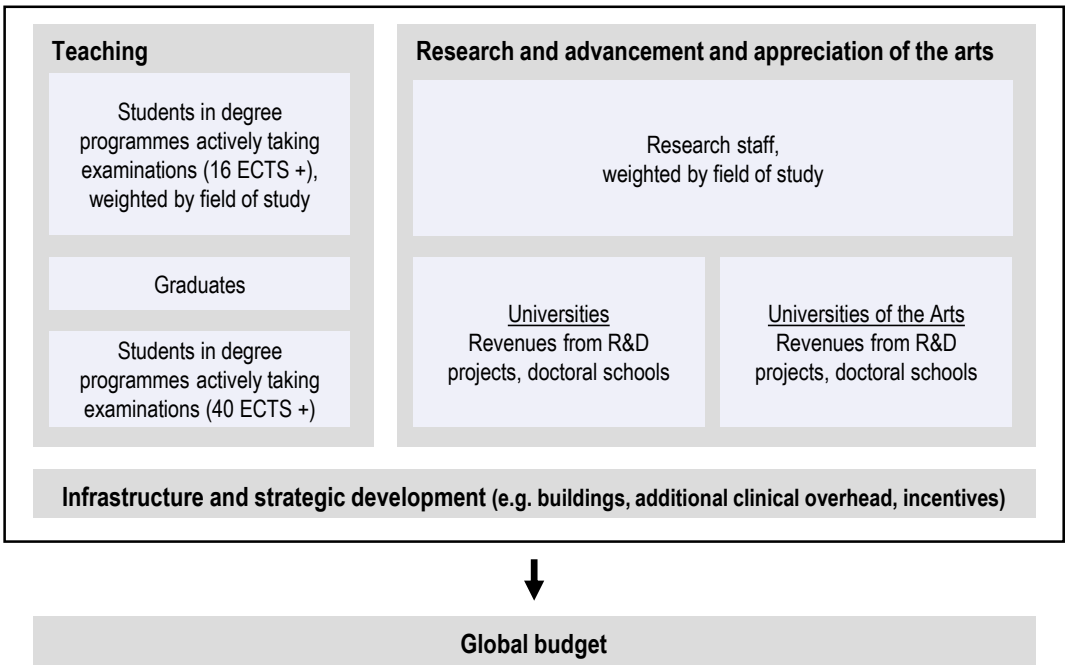
The 2018 reform has introduced a new capacity-based, student-related funding system (see Figure 1.3). In the past, due to the open admission policy, the federal minister did not allocate the lump sum to universities based on student numbers. After several attempts to reorganise the funding scheme in order to take into account the new admission policy, the federal government succeeded in amending the 2002 University Act. The performance agreements of 2019-20 are the first to function with the new funding system.

The federal ministry and public universities negotiate a budget allocation based on three pillars: teaching; research/arts; and infrastructure and strategic development. In particular, the negotiation of the instalment for teaching and research activities takes into account the following indicators:

- number of students in degree programmes actively taking exams
- number of faculty

- specific indicators such as the number of degrees awarded, fast students, third-party funds, structured doctoral studies.

Figure 1.3. The new university funding model



Source: Ecker, *et al.* 2017

The system funding UAS is quite different. For example, the federal ministry and UAS do not negotiate the number of study places. This depends on a development programme and available budget.[7] The government funds a given number of study places and HEIs admit students based on this threshold. The ministry calculates funding rates based on "standard costs". Funding rates cover 90% of the standard operating costs faced by UAS. As of 2019, the annual funding rates for different disciplines at UAS are:

- EUR 8 600 for study places in programmes that have a "technical component" (and then require some specific laboratories/infrastructure) of at least 50%
- EUR 7 420 for study places in courses in which the "technical proportion" is at least 25%
- EUR 6 950 for study places in courses focusing on tourism
- EUR 6 850 for study places in all other courses.

Providers have to co-fund for investing in buildings and other infrastructure. In most cases, co-funding depends on other public authorities, such as subnational authorities, including regions, local governments as well as economic chambers.

The federal government has been increasing the number of study places in UAS over the years. Study places have risen from 43 593 (2013/14) to 48 539 (2017/18). In academic year 2018/19, in line with the federal policy to improve enrolment in STEM disciplines, the government financed a further increase of 450 study places in UAS. In addition, the Future Higher Education project puts in place measures for the sustainable development of

study programmes and UAS locations. The federal government has enacted a new development and funding plan for UAS for academic years 2018/19-2022/23. This plan aims to create 1 450 new study places in UAS by 2025.

Public and private expenditure for higher education

Austria's expenditure on tertiary education amounts to 1.74% of GDP (2015). This puts the country above the OECD average of 1.52% and only slightly below the highest ranked European countries (Estonia 1.77% and UK 1.87%: OECD, 2018). In addition and in line with a national policy promoting science and innovation, Austria's public expenditure for higher education has been increasing in recent years. It totals EUR 4.26 billion (2017), of which EUR 3.52 billion – approximately 82% – funds public universities (Table 1.1). Funding for higher education is almost entirely public. Therefore, Austria is among the countries with the lowest percentage of private expenditures for higher education in the OECD (Figure 1.4).

Table 1.1. Higher education budget, including spending for universities, 2013-17

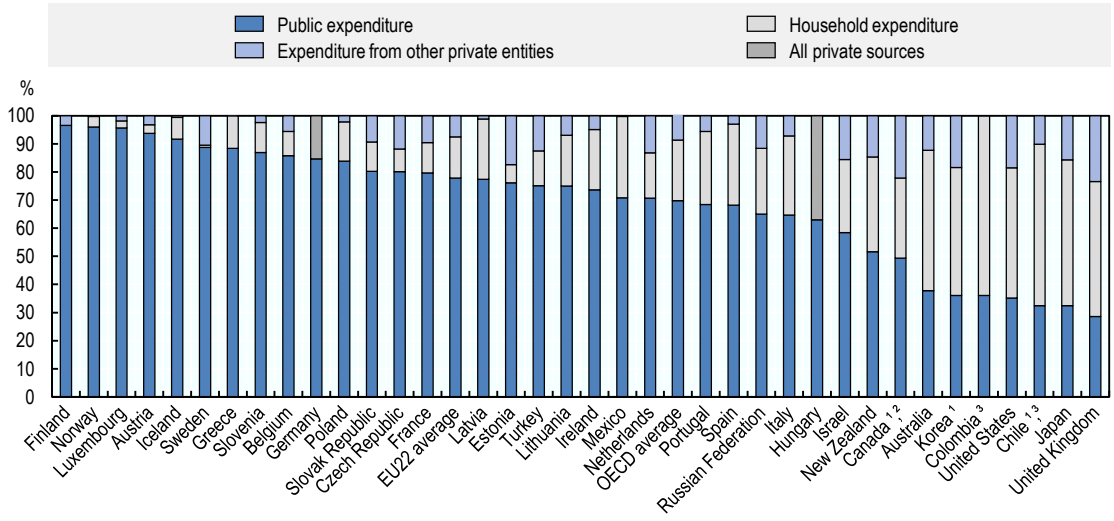
	2013	2014	2015	2016	2017
Higher education budget[1] in EUR million	3 786	3 855	3 981	4 138	4 256
Change 2013 to 2017, 2013=100	100.0	101.8	105.2	109.3	124.1
Nominal change in relation to previous year					
In EUR million	*134*	*68*	*126*	*157*	*118*
In %	*3.7*	*1.8*	*3.3*	*3.9*	*2.9*
Including spending for public universities[2] in EUR million	3 189	3 237	3 303	3 447	3 523
Regular students at public universities[3]	273 280	277 508	280 445	280 783	278 052
Average spending per regular student in EUR million	11 670	11 664	11 777	12 275	12 672
Graduates at public universities[4]	37 312	34 300	34 539	35 864	34 978
Average spending per graduate in EUR	85 476	94 367	95 622	96 102	100 733

1. University budget: UG 31 "Science and Research".
2. Expenditure for the UG 31 "Science and Research".
3. Students each winter semester.
4. Graduates each academic year, e.g. 2017: academic year 2016/17.
Source: Ecker, *et al.* 2017, BMBWF (2019)

Tuition fees

Austria had abolished tuition fees in 1970 but re-introduced those in 2001, before abolishing them again in 2006. To date, only two categories of students pay tuition fees to Austrian public universities: non-EU international students and students exceeding the regular duration of studies by two semesters. UAS may charge tuition (EUR 363 per semester), however, mostly for political reasons; some institutions waive tuition. Colleges for teacher education do not charge any tuition fees. Private universities charge tuition fees: they depend on this source of revenues because they cannot be funded by the federal government. However, about one third of private universities out of 16 are considered "provincial universities" and receive funds from provincial authorities.

Figure 1.4. Distribution of public[1] and private[2] expenditures for tertiary education, 2015



1. Excluding international sources.
2. Primary education includes data from pre-primary and lower secondary education.
3. Year of reference 2016.
Source: OECD (2018a), *Education at a Glance 2018: OECD Indicators*, https://doi.org/10.1787/eag-2018-en.

Third-party-funded research projects at universities

Third party funding to universities has been growing continuously over the past years. For instance – according to the universities' knowledge scoreboards (*Wissensbilanzen*), which provide information on the volume and source of funding at public universities – the share of third-party funding went from EUR 654.4 million in 2015 to EUR 670 million in 2016 and EUR 673.2 million in 2017.

The origin of universities' third-party funds is heterogeneous in terms of both public financiers (e.g. ministries, local authorities, funding agencies) and private donors (e.g. businesses, foundations). In 2017, like in previous years, public funds (mainly provided by the Austrian Science Fund, FWF, and the Austrian Research Promotion Agency, FFG) as well as companies were the main source for third-party funded research projects, contributing more than a quarter of the total research revenues of Austrian universities (EUR 171 million or 25.3%). This also indicates the importance of co-operation between science and industry.

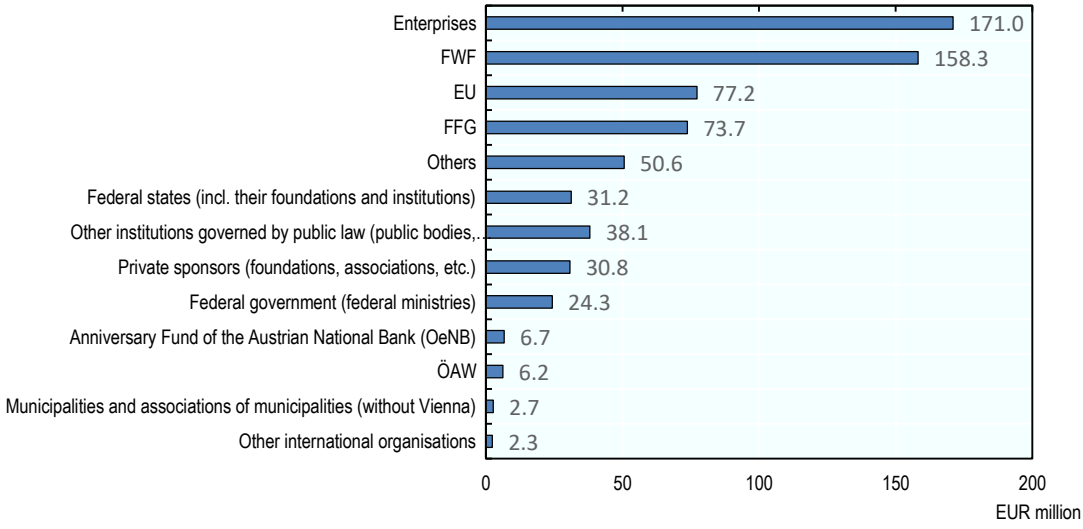
Concerning public research funding for Austrian HEIs, the FWF is responsible for funding basic research (EUR 158.3 million or 23.5% of total funds) while the FFG is the national funding agency for industrial research and development (EUR 73.7 million, 11.0% of total funds). Research funding from the European Union amounted to 77.2 million or 11.5% of total funds in 2017. While the share of funding provided by the FWF and the EU has recently declined in nominal terms, funding from the FFG rose considerably, from EUR 61.1 million in 2015 to EUR 73.7 million in 2017 (approximately 20% increase).

The distribution of third-party revenues varies widely according to the different research areas and disciplines. Overall, third-party funding of Austrian universities amounted to EUR 673.2 million in 2017. HEIs active in natural sciences received the largest share of third-party revenues: 31.9%. Third-party contributions have proved to be particularly important to support research staff at HEIs, particularly temporary assignments (temporary,

fixed-term employment). More than a third of staff at public universities and almost half of the staff at technical universities are employed on the basis of external funding.

Figure 1.5. Third-party funding through research projects at public universities by origin

In million EUR, 2017



Note: Austrian Science Fund (FWF); the Austrian Research Promotion Agency (FFG)
Source: Ecker, *et al.* 2017, BMBWF, unidata https://oravm13.noc-science.at/apex/f?p=103:36:0::NO.

UAS also receive third-party funding as these institutions are legally required to perform applied research, which is conducted in close co-operation with industry, businesses (SMEs) and other employers. In 2015, UAS received a research budget of EUR 104 million and employed 960 full-time equivalent (FTE) researchers (OECD, 2018b; see also Chapter 4 on Leadership and governance).

Reforms in doctoral education and academic careers

In recent years, there has been an ongoing discussion on how to promote career paths and how to improve the framework conditions for (early stage) researchers at Austrian universities. This debate affected the way in which Austrian HEIs organise and implement doctoral programmes. In addition, it affected the academic profession as a whole.

"The new doctorate" at Austrian universities

Doctoral education underwent a far-reaching transformation over the last ten years. The federal government has reformed this sector following the Salzburg principles and other European policy documents (European Commission, 2011).

A key milestone in the reform process is the introduction of the 3-year PhD in 2009. By 2018, all doctoral programmes at Austrian universities conform to the new standards of so-called "structured doctoral programmes". Compared to the old "apprenticeship model" which was characterised by the strong role of the thesis supervisor (see Pechar, Ates and Andres, 2012), in the new model, doctoral candidates are considered early stage researchers. According to the Salzburg principles, they "should be recognised as

professionals – with commensurate rights – who make a key contribution to the creation of new knowledge".

Doctoral training should provide a clear and transparent framework concerning admission, supervision and assessment, entailing clearly outlined milestones.[8] Further, these programmes should help young scholars to get connected and to be active in a research environment from the beginning of their doctoral studies. The challenge of the new model is to strike a balance between providing structures and accountability on the one hand, while at the same time fostering independent research activity and integrating young researchers into the scientific community.

All Austrian public universities have adopted and adapted "structured programmes" over the last ten years. The Austrian federal ministry introduced budgetary leverage to promote structured PhD programmes in the last round of performance agreements. In particular, the government offered conditional funding for structured PhD programmes that conform to the newest standards. These standards include, *inter alia*, team supervision as well as the mandatory personal separation between supervisor and assessor. The number of PhD positions in structured programmes became a "competitive indicator": the more PhD places in these programmes a university can offer, the more funds it would receive.

In addition, a 2017 amendment to the University Act made it possible to restrict access to doctoral programmes by introducing selection criteria on the part of the HEI. Many universities have since introduced "doctoral schools" or "doctoral academies" for specific thematic fields.

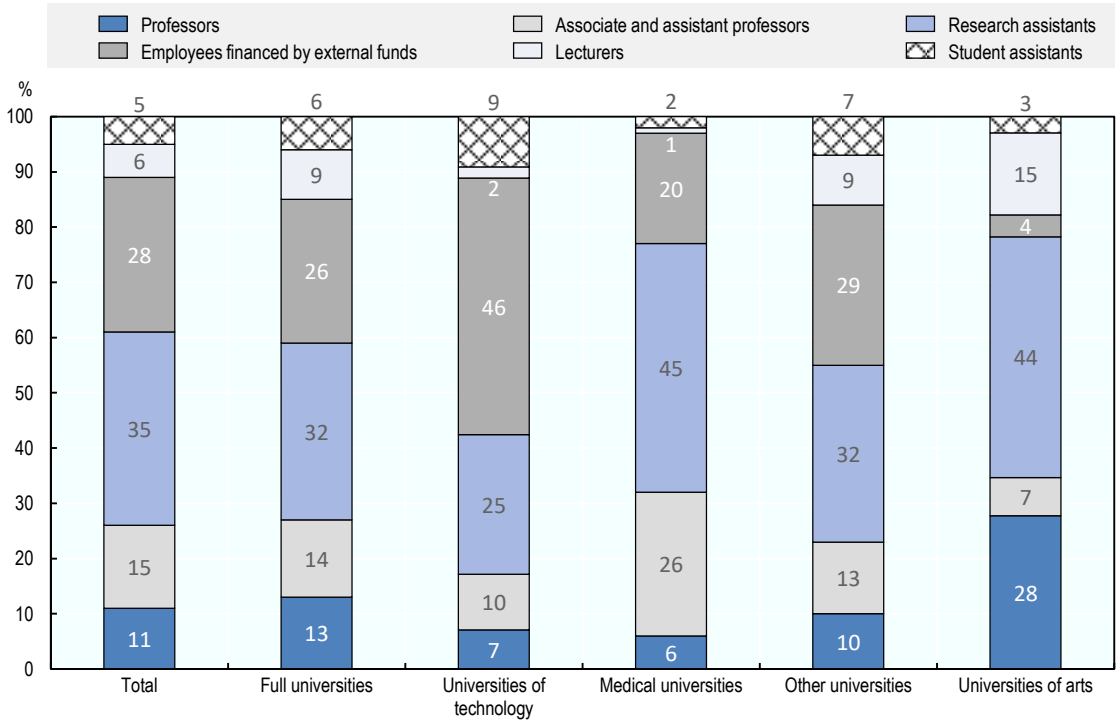
In addition, for UAS, a separate funding line for co-operative doctoral programmes has been recently established which can also be regarded as a first step in the direction of fostering academic careers and research and development (R&D) at UAS.

The academic profession

The terms of academic profession vary among the different sectors of the Austrian HE system. At public universities, faculty members are hired based on private employment contracts.[9] Figure 1.6, below, provides information about the different status of faculty members across public universities.

The University Act of 2002 maintained the traditional German pattern of academic structures (*Habilitation* model) with an "unbridgeable gap" between professors and the rest of the academic staff. However, in 2009, a Collective Agreement for Universities entered into force, adding a new pathway to permanent, tenured employment. These new "tenure track" positions, called *Laufbahnstellen*, are based on so-called "qualification agreements" the candidate has to fulfil to advance into permanent employment as an "associate professor". The qualification criteria laid out in the recruitment process and the evaluation of these positions show strong similarities to the North American tenure track. Until a 2015 amendment of the University Act, the Austrian tenure track did not lead to full professorship, however. Today, "associate professors" who were recruited on a competitive basis are allowed to vote in the status group of ordinary professors.

Figure 1.6. Academic status groups at different types of public universities in FTEs



Source: Ecker *et al* 2017.

The majority of academics employed at public universities, however, are employed in fixed-term positions, including:

- Part-time lecturers: fixed-term, renewable teaching assignments for the duration of one semester.
- Externally funded research positions ("project workers"): fixed-term, for the duration of a research project, both pre- and postdoctoral.
- Student assistants (below master's degree level).

Key actors in the Austrian higher education system

Key actors including federal bodies and HEI institutions

Federal ministries

In Austria, federal, provincial and municipal governments share the responsibility for education. In general, higher education is a federal matter; the provinces, and in some cases municipalities, play a supplementary role in the other education levels. Therefore, the Federal Ministry of Education, Science and Research (*Bundesministerium für Bildung, Wissenschaft und Forschung*, BMBWF) is the key policy actor for what concerns higher education policy.

Regarding the promotion of knowledge transfer the BMBWF in co-operation with the Federal Ministry for Digital and Economic Affairs (*Bundesministerium für Digitalisierung und Wirtschaftsstandort*, BMDW) and the Austrian Ministry for Transport, Innovation and

Technology (*Bundesministerium für Verkehr, Innovation und Technologie*, BMVIT) has set up the NCP-IP, the National Contact Point for Knowledge Transfer and Intellectual Property (*Nationale Kontaktstelle für Wissenstransfer und Geistiges Eigentum*, www.ncp-ip.at), which provides additional support to universities, research institutions and companies, as proposed by the European Commission´s intellectual property (IP) recommendation. For instance, the Intellectual Property Agreement Guide (IPAG) project offers standard sample contracts free of charge on line (www.ipag.at). Furthermore, the BMBWF funds programmes such as Knowledge Transfer Centres and Spin-off Fellowships (see below).

Other federal ministries provide an important contribution to higher education policy. For example, the BMVIT is responsible for applied research and technology development. The BMVIT promotes partnerships with the private sector and encourages companies to invest more in research and technology and co-operate with research institutions through a wide range of funding programmes, mainly administered by the Austrian Research Promotion Agency.

Another important policy actor is the BMDW, which promotes investment in applied research, development and innovation. The BMDW finances programmes, initiatives and networks to strengthen innovative Austrian companies and start-ups and to enhance industry-science linkages and knowledge transfer between academia and the business sector. Important federal actors such as the Austrian Research Promotion Agency (FFG), the Austria *Wirtschaftsservice Gesellschaft mbH* (AWS) and the Christian Doppler Research Association (CDG) administer funding programmes on behalf of the BMDW.

The rectors' conference

Each sector of the Austrian higher education system has its own rectors' conference. University Austria (*Österreichische Universitätenkonferenz*) is the rectors' conference for public universities. The Association of Universities of Applied Sciences (*Österreichische Fachhochschul-Konferenz*) represents all Austrian UAS. The Rectors' Conference of Austrian University Colleges of Teacher Education (*Rektorinnen- und Rektorenkonferenz der österreichischen Pädagogischen Hochschulen*) is the rectors' conference for university colleges for teacher education. Finally, the Conference of Austrian Private Universities (*Österreichische Privatuniversitäten Konferenz*) represents private institutions.

Austrian Higher Education Conference

The Austrian Higher Education Conference plays an important role in a coherent policy. In the period 2015-17, this body issued two recommendations for the further development of Austrian higher education: in June 2015, the Recommendation of the University Conference for Further Development of Doctoral Training in Austria and in December 2015, the Recommendations to Promote Non-traditional Approaches in the Higher Education Sector. The latter represents an important step towards social participation and permeability among the different sectors of higher education.

Student union

The Austrian National Union of Students (*Österreichische HochschülerInnenschaft*) is the legal representative of all students in higher education. It has separate entities for each sector.

Austrian quality assurance agency

The Agency for Quality Assurance and Accreditation Austria (AQ Austria) was established in 2012 by the Act on Quality Assurance in Higher Education (HS-QSG). AQ Austria is responsible for the entire higher education sector in Austria, with the exception of university colleges for teacher education. In carrying out its responsibilities, AQ Austria follows some basic principles:

- HEIs are responsible for the quality of their activities and for quality assurance and improvement.
- AQ Austria understands its procedures as complementary to HEIs' internal evaluation procedures.
- Quality assurance procedures follow international good practices, especially standards and guidelines for quality assurance in the European higher education sector.
- Co-operation with HEIs and other stakeholders is needed to develop standards and evaluation criteria.

Research funding agencies/research institutions with their own funding programmes

The Science Fund (FWF)

The FWF is Austria's central institution for funding basic research. The purpose of the FWF is to support the ongoing development of Austrian science and basic research at a high international level. The FWF aims to strengthen Austria's international performance and capabilities in science and research. The FWF is also actively promoting the attractiveness of Austria as a location for high-level scientific activities. To achieve this result, the Science Fund supports top-quality research projects for individuals and teams and promotes Austria's innovation system and research facilities.

Funding applications to the FWF totalled EUR 948.7 million in 2018, a year-to-year absolute increase of EUR 69.3 million (7.3%) compared to 2017. Accordingly, new funding approvals amounted to EUR 230.8 million, an increase of EUR 13.5 million (5.8%). By applying for the competitive funds provided by the FWF, Austrian science entities have also become quite competitive at the international level. For example, six out of seven 2017 ERC Advanced Grant recipients have a successful FWF track record. The FWF also finances individual researchers with different programmes, including the Schrödinger Fellowships, the doc.funds programme and Young Independent Researcher Groups. Recognising the importance of the Science Fund, the federal government will progressively raise its budget by EUR 110 million between 2018 to 2022.

Austrian Research Promotion Agency (FFG)

The Austrian Research Promotion Agency is the national funding agency for industrial research and development. Therefore, the FFG manages and finances research projects in the business and science sectors, promotes co-operation between science and industry, manages co-operative programmes and projects with the European Union and other European and international partners, and represents Austria's interests at relevant European and international institutions. In addition, the FFG promotes Austria's involvement in European programmes, especially in the EU Framework Programme for Research,

Technology and Innovation and the Framework Programme for Competitiveness and Innovation.

Every year, the FFG awards over EUR 400 million in federal funding to approximately 3 000 applied research and innovation projects, involving more than 5 500 stakeholders. As national contact point for the EU programme Horizon 2020, the FFG provides national organisations with EUR 150 to 200 million in funding every year. The agency also provides professional expertise on tax incentives for research and innovation ("research premium").

Austria Wirtschaftsservice Gesellschaft mbH (AWS)

Established in 2002, the Austria *Wirtschaftsservice Gesellschaft mbH* awards funding and provides financing and consulting services. Grants and funding provided by the AWS are in line with the Guarantees Act and the SME Subsidies Act, fostering innovation and innovation consulting for the benefit of the Austrian economy.

The AWS is particularly active with start-ups. It provides these agents with non-pecuniary support programmes, such as the i2 Business Angels programme, or funds at market conditions that private investors can use for co-financing. The latter includes initiatives such as the AWS Business Angel Fund, the AWS Founder Fund and the AWS *Mittelstandsfonds*. In addition, the Double Equity programme leverages start-up equity.

The AWS provides financial support to about 22% of real assets investments in Austria. Every year, the AWS finances approximately 200 knowledge and research-based start-ups and supports over 600 companies and universities with the aim to improve their intellectual property rights (IPR) strategy.

Austrian Academy of Sciences (OeAW)

The Austrian Academy of Sciences is Austria's main non-academic research and science institution. OeAW was founded in 1847 and its statutory mission is to "promote science in every way". Today the OeAW has over 770 members and 1 600 employees dedicated to basic research, interdisciplinary exchange of knowledge and the dissemination of new insights with the aim of contributing to progress in science and society.

The OeAW manages 28 research institutes in the field of basic research in the arts and humanities and the social and natural sciences. Among these institutes, the most prominent are the following: the Research Center for Molecular Medicine (CeMM), the Institute of Molecular Biotechnology Pioneering (IMBA) and the Gregor Mendel Institute of Molecular Plant Biology (GMI).

Ludwig Boltzmann Gesellschaft (LBG)

The Ludwig Boltzmann Gesellschaft is a public research institution with a thematic focus on medicine, life sciences and humanities, social sciences and cultural studies. Currently, there are 18 Ludwig Boltzmann Institutes, which also focus on the development and testing of new collaboration models between science and non-scientific actors such as companies, the public sector and civil society. For this purpose, LBG created the Lab for Open Innovation in Science in 2016.

The Christian Doppler Research Association (CDG)

The Christian Doppler Research Association promotes co-operation between science and industry. The CDG supports temporary research units implementing application-oriented

basic research. The CDG follows two funding models: the Christian Doppler Laboratories, which support universities and non-university research institutions, and the Josef Ressel Centres, which support universities of applied sciences.

Under the leadership of highly qualified scientists, research groups work closely with business partners on innovative answers to corporate research questions. Over the years, more than 200 CD Laboratories have been funded by the CDG.

Advisory bodies

The Austrian Science Board, the Austrian Council for Research and Technology Development, and the ERA Council Forum Austria are three advisory bodies supporting the federal government in the fields of science and innovation policy. The Austrian Science Board advises the Federal Ministry of Education, Science and Research, universities, and federal and provincial parliaments in matters related to higher education and science policies. The Austrian Council for Research and Technology Development advises the federal government in research, technology and innovation policies with the aim to provide an essential contribution to a future-oriented research, technology and innovation (RTI) policy. The third body, the ERA Council Forum Austria, advises the Austrian ministers responsible for science and research and focuses especially on the connections between European research policy and the national innovation system.

Social partnership and representatives of interests

The "Economic and Social Partnership" is a system of co-operation between the government and the Federal Chamber of Labour, the Austrian Chamber of Agriculture, the Austrian Trade Union Federation, and the Austrian Federal Economic Chamber. This system is not a legal requirement; it is an informal body based on the common will of the participants to promote co-operation. In addition, the Federation of Austrian Industries is the voluntary and independent representation of interests of the Austrian industry. In particular, the Federation of Austrian Industries and the Austrian Economic Chambers have initiated numerous activities, to enhance entrepreneurial learning and teaching as well as industry-science partnerships.

Austrian Patent Office

As legal issues related to IP and the regulation of exploitation rights are important factors for academic spin-offs and start-ups, the Austrian Patent Office represents a central actor in the federal innovation system. Recently, the Patent Office has started to provide a range of new services for start-ups, such as the "patent voucher", "the provisional patent application" (PRI) and the fast online brand registration called "Fast Track".

The social dimension of higher education

The Austrian Higher Education system has been increasingly focusing on the social dimension. In particular, equity in access and the success of previously under-represented groups have gained particular importance in recent years.

National guidelines for equal opportunities and anti-discrimination

The gender performance agreements between universities and the federal ministry prioritise equality and the compatibility of studies with work or care obligations. The University Act of 2002 (BMBWK, 2002) introduced specific institutions – a working group for equality

issues and an arbitration committee – for the reduction of inequalities. For instance, the regulation asks public universities to respect gender parity in university bodies. The University Act also outlined organisational framework conditions for the continuation of equity policies, such as co-ordination centres for gender research. Finally, the University Act spurs universities to adopt their own women's promotion and equality plan.

UAS, which had been created as private companies, underlie a more complex legal regulation. They have to address the demands of the UAS studies act, namely to define measures in the statutes for equality between women and men, and provisions on the promotion of women. Due to their legal form, UAS have to fulfil the demands of the so-called "Equal Treatment Act" (*Gleichbehandlungsgesetz*); accordingly, UAS also report on the proof of fair remuneration for men and women.

National Strategy on the Social Dimension in Higher Education

To mainstream the social dimension in higher education, the federal ministry developed the National Strategy for the Social Dimension in Higher Education in 2016. The social dimension is now referenced in ministerial strategic documents and in university development plans. The process underpinning the creation of this national strategy involved universities, social partners and other key actors in Austrian higher education.

In particular, the strategy, which will be evaluated in 2025, has three main objectives:

- Objective I – promoting integrative access: improve the quality and accessibility of information and counselling services for students. Put in place outreach activities to democratise access to higher education. This includes the recognition and validation of non-formal and informal competencies.
- Objective II – preventing student dropout and improving student success rates. This objective aims above all to make programmes more flexible so that they can be compatible with the other activities students are involved with, including working and parenting. HEIs should develop a "welcoming culture" and enhance the quality of teaching to make it more inclusive and sensible to diversity.
- Objective III – optimising framework conditions and improving the capacity to measure the progress of higher education policy to be more inclusive.

To support the implementation of the strategy by all Austrian public universities, the federal ministry has allocated 0.5% (a total of about EUR 45 millions) of the overall budget to ensure the adoption of measures connected to the social dimension in the performance agreements of all public universities. The allocation of the retained funds will follow a report from the universities by 2020.

The entrepreneurial and innovation agenda in higher education

Austrian federal authorities have put in place several measures to foster the entrepreneurial spirit at public universities. All stakeholders in Austria consider HEIs important players and public authorities have put in place various policies to help connect knowledge generated at universities with entrepreneurial innovation processes (see BMBWF/BMVIT/BMDW, 2019). In particular, federal authorities have put in place a series of policy measures to:

- Integrate the entrepreneurial agenda in the institutional strategy and development plan, also using the HEInnovate tool.

- Increase entrepreneurial competencies and embedding entrepreneurship education in curricula.

The federal ministry has explicitly asked public universities to address and take up the entrepreneurial agenda in their performance agreements. This approach proved to be successful; the performance agreements for 2019-21 focus on entrepreneurship as a strategic issue. Several public universities have created initiatives in the field of teaching and learning or provide support to entrepreneurship through their infrastructure. Knowledge transfer centres are often in charge of activities related to entrepreneurship education.[10] Public universities promote interdisciplinary competencies and/or transferable skills for students and for faculty and staff. Several examples in the fields of entrepreneurship education and support to entrepreneurs are discussed in Chapters 4 and 5 respectively.

Within this context, UAS represent a specific feature of the Austrian "entrepreneurship and innovation agenda". UAS are integrated into their own regional ecosystems and are in a good position to implement the entrepreneurial agenda. Several UAS have embedded entrepreneurship in their programmes. There are several examples of UAS acting as hubs of regional or national networks promoting the co-operation between HEIs and businesses and, more generally, producing value for the economy and society.

Strategic orientation and organisational capacity

Main guiding frameworks and strategies

Three major government programmes frame HEIs' individual strategies, regarding innovation and the entrepreneurial agenda:

- The federal 2011 RTI strategy.
- The Austrian University Development Plan, which focuses on public universities in the years 2019-24.
- The development and funding plans of UAS, the most recent covering the period from 2018/19-2022/23.

Concerning the UAS sector, the general strategic outlines are defined by the ministry in collaboration with the Association of Austrian Universities of Applied Sciences.[11] In October 2017, the association presented a plan promoting the entrepreneurial and innovation agenda at UAS.[12]

Regarding public universities, the GUEP has identified eight systemic goals. One of these, Goal no. 6 focuses on the "expansion of knowledge- and innovation-transfer and locational advantages" and directly addresses the entrepreneurial and innovation agenda. It encompasses some sub-sections and explicitly mentions the "intensification of knowledge and technology transfer as well as the entrepreneurial spirit" and "regional development".[13]

The auxiliary documents for the performance agreements 2019-21 refer to specific measures to develop entrepreneurial spirit at public universities. For example, the agreements refer to the integration of the entrepreneurial agenda in the institutional strategy using the HEInnovate tool, increasing entrepreneurial competencies and embedding entrepreneurship education in curricula.

The 2015 Action Plan for a Competitive Research Area represents another guiding framework for public universities. The action plan drawn up by the former Federal Ministry

of Science, Research and Economy contains measures to promote the co-operation between science and industry; among them, new IPR and strategies to generate value from higher education, the improvement of research infrastructure and "strengthening entrepreneurship and establishing it as a guiding principle for universities".

Austria also implements the smart specialisation strategy. In co-operation with regional policymakers and the private sector, HEIs should act as partners to promote a regional smart specialisation strategy. In 2013, the federal government introduced a new section to the tri-annual performance agreements: the "Lead institutions initiative – Connecting universities with and in their regions". The initiative has encouraged science and research institutions to fulfil their role as regional lead institutions to create societal and economic value. The rationale of the lead institutions initiative is the empowerment of HEIs as sources of strategic capacity, international co-operation hubs and institutions able to create synergies among regional actors (thematic-/location-related approaches).

Governmental strategies on digitalisation

Austria is leveraging on HEIs to promote digital technologies. This is done directly through the General University Development Plan (GUEP), which outlines specific measures for HE with regard to digitalisation, and indirectly through the Digital Roadmap Austria in which HEIs have an indirect role in connection with the RTI strategy, IP strategy and Open Innovation strategy (Box 1.1).

Box 1.1. Open Innovation strategy in Austria

An aspect of digitalisation that plays a comparatively prominent role/position in Austria is the issue of open access, open data and open science. In July 2016, the federal government – as the first member state of the European Union – issued its own Open Innovation strategy. The aim of this strategy is to open up, expand and further develop the innovation system with the purpose of boosting its efficiency and output orientation, and improving the digital literacy of innovation actors.

Source: BMWFW/BMVIT (2016b), *Open Innovation Strategie für Österreich*, http://openinnovation.gv.at/wp-content/uploads/2016/08/Open-Innovation-barrierefrei.pdf.

The issue of "digitalisation" appears in several "system goals". For instance, Austrian authorities intend to reduce teacher-student ratios through "the use of digital possibilities in managing larger groups of students". The digital transformation is also mentioned in the system goal focusing on the "social responsibility of universities". Envisaged measures include, among others, the broadly formulated aim to "develop institutional strategies to be more innovative and transformative with regard to digitalisation as an organisation". As a more concrete example, the strategy names the inclusion of competencies in "computational thinking" into curricula, especially in basic study modules in the humanities and social sciences. The GUEP translates the Open Innovation strategy and the other system goals for universities. The GUEP considers digitalisation as a means to ensure equity in the access to higher education by providing open educational resources or flexible digital learning environments benefitting disadvantaged or non-traditional students.

Programmes fostering knowledge exchange

In Austria, there are a large number of institutions and instruments, with very different scope and funding, supporting innovation and knowledge exchange (Table 1.2). The country has been pioneering policy initiatives to bring HEIs and businesses closer together since the 1980s. Some of these programmes are described in detail below.

Table 1.2. Main policy programmes directed to foster knowledge exchange in Austria (by year of inception)

Research co-operations between HEIs and the business sector	Academic entrepreneurship and academic start-ups	Engagement activities in general (civil society, non-governmental organisations…)
Christian Doppler Laboratories (1988-95) Josef Ressel Centres (2012) https://www.cdg.ac.at/en/	AWS Seedfinancing (1989) https://www.aws.at/foerderungen/seedfinancing	Staatspreis Innovation (1979) www.staatspreis.at
COMET (1998) https://www.ffg.at/en/comet-competence-centers-excellent-technologies	AWS i2 Business Angels (1997) https://i2.aws.at/	Jugend Innovativ (1987/88) www.jugendinnvativ.at
Research Studios Austria (2003) https://www.researchstudio.at/en	AplusB Centres (2002) https://www.ffg.at/en/aplusb-academia-plus-business	University for Kids and Young Adults (2001) https://kinderuni.at/
BRIDGE (2005) https://www.ffg.at/en/bridge	Phönix (Prize for innovative academic start-ups) (2012-19) https://www.aws.at/foerderungen/phoenix/	Long Night of Research *(Lange Nacht der Forschung*) (2005) https://www.langenachtderforschung.at/2018/
Innovation Voucher (2007) https://www.ffg.at/en/innovation-voucher	AWS First (2014) https://www.aws.at/foerderungen/aws-first/	Sparkling Science (2007) https://www.sparklingscience.at/
Laura Bassi Centres of Expertise (2009) https://www.ffg.at/en/laura-bassi-centres-expertise	JumpStart (2015) https://www.aws.at/foerderungen/aws-jumpstart	Red White Red Card for Students and Graduates (2011) https://www.migration.gv.at/en/types-of-immigration/permanent-immigration-red-white-red-card.html
R&D Competences for Industry (2011) https://www.ffg.at/en/rd-competences-industry	AWS AplusB Scale-up (2016) https://www.aws.at/foerderungen/aws-aplusb-scale-up/	Responsible Science and Citizen Science (2015) https://www.responsiblescience.at/
Knowledge Transfer Centres (2014) http://www.wtz.ac.at/wissenstransferzentrum-english/	Spin-off Fellowships (2017) https://www.ffg.at/spin-off-fellowships-programm	Science Slam (2016) http://www.scienceslam.at/
		National strategy on the social dimension (2017) https://bmbwf.gv.at/english/home/studies

Source: Ecker, *et al,* 2017.

CDG – Christian Doppler Research Association

The CDG was founded 1988 as a group instrument of state-owned industries (*Österreichische Industrieholding AG*, ÖIAG) with the major goal of establishing research units (CD Laboratories) to pursue basic research at a high level. The restructuring of the ÖIAG from an industrial group to an investment and privatisation agency in 1993 also brought about a reform of the CDG, opening the association to all Austrian companies in demand for high-level- and application-oriented basic research. In 1995, the CDG was placed under the responsibility of the Federal Ministry of Economic Affairs (now Federal Ministry of Digital and Economic Affairs) and given a new financing basis in the form of

a public-private partnership (PPP) model for research co-operation between science and industry.

Today, the CD Laboratories have an annual budget that ranges between EUR 110 000 and EUR 700 000. Financing takes place through the Federal Ministry for Digital and Economic Affairs, the National Foundation for Research, Technology and Development as public sponsors and by the companies as co-operation partners. In 2017, 148 foreign and domestic enterprises co-operated with Austrian HEIs in 76 CD Laboratories. In 2018, the number of CD Laboratories increased to 85.

In 2012, the CDG acquired an additional area of activity with the management of the Josef Ressel (JR) Centre programme at universities of applied sciences. JR Centres have a budget ranging from EUR 80 000 to EUR 400 000 per year. At the end of 2018, 12 JR Centres were affiliated with universities of applied sciences.

COMET – Competence Centres for Excellent Technologies

Since 1998, 45 competency centres (Kplus, K_ind, and K_net competency centres) were established in Austria, aiming to build up structures for co-operative research. In 2006, the programme was relaunched as the COMET Competence Centre Programme and took over the existing portfolio of centres and networks at the federal level. Their aim was to generate research competencies through co-operation between science and industry and provide a network of hubs offering high-quality research. The Federal Ministry for Transport, Innovation and Technology and the Federal Ministry for Digital and Economic Affairs finance COMET; in addition, the Austrian federal regions provide funding.

The COMET Programme has been implemented in three actions:

1. K2 Centres aim at existing competencies and developing new competencies by collaborating with internationally renowned researchers, scientific partners and companies in a joint strategically oriented research programme at the highest level. K2 Centres are characterised by extremely ambitious research programmes.
2. K1 Centres aim to develop competencies through excellent co-operative research with a medium- to long-term perspective. They conduct research at top international level and stimulate new research ideas in their fields.
3. COMET projects aim to carry out high-quality research in science-industry collaboration. They are characterised by a medium-term perspective and clearly defined topics having the potential for further development.

To improve the capacity to pursue valuable R&D activities at the interface between science and industry, the COMET programme has benefitted from some strategic, conceptual improvements. Recently, programme lines K1 and K2 discussed above were merged and a new programme line, the COMET Module, was introduced. The objective of the COMET Module is to establish promising and emerging fields of research and build up new fields of expertise. Therefore, COMET Modules are characterised by high-risk research activities.

R&D Competences for Industry

The R&D Competences for Industry programme, which was launched in 2011, aims to strengthen the R&D competency of the Austrian industry. This initiative of the Federal Ministry for Digital and Economic Affairs supports company measures for the systematic development and qualification of their research and innovation staff. The programme also promotes the co-operation between companies and HEIs/research institutions. In addition,

R&D Competences for Industry enhances the integration of different research fields that are relevant for industry. The programme focuses particularly on small- and medium-sized enterprises (SMEs) located in Austria.

Knowledge transfer centres

The establishment of three regional knowledge transfer centres (KTCs) and of a thematic knowledge transfer centre in the life sciences field (www.wings4innovation.at) represents the contribution of Austrian universities to intensifying the knowledge transfer from science to business and society, funded by the Federal Ministry for Digital and Economic Affairs and the Federal Ministry of Education, Science and Research.

The regional knowledge transfer centres aim to optimise and extend the management of IP by means of inter-university and multi-centre co-operation projects. Networking should provide business and industry with information, which could improve and accelerate access to innovation, technologies, expertise and knowledge assets. In particular, one of the main targets of KTCs is to simplify searching for university-based co-operation partners and accelerate the launching of research projects. KTCs also aim to transfer knowledge beyond the commercial goal. Accordingly, they pay particular attention to knowledge transfer activities in the area of humanities, social and cultural sciences, and arts. The centres are organised as joint university projects.

In recent years, performance agreements have also been an important instrument to strengthen knowledge and technology transfer. Universities have established and institutionalised strategic knowledge and technology transfer by implementing their IPR and exploitation strategies. In this context, technology transfer offices at universities play an important role.

In the current performance agreements, technology transfer offices are also connected with the framework of knowledge transfer centres. Therefore, the new Impuls Programme for Austrian Knowledge and Technology Transfer offers further incentives to expand the networks of universities and intensify co-operation with schools, universities of applied sciences, kindergartens and companies, especially in the field of STEM. It also provides additional funding for patents and prototypes. Funds of up to EUR 6 million have been awarded to the programme (www.aws.at/wissenstransferzentren, www.aws.at/patentfoerderung, www.aws.at/prototypenfoerderung).

AplusB Centres

The AplusB (Academia plus Business) impulse programme aims to generate a sustainable increase in the number of innovative, technology-oriented spin-offs and start-ups from the academic sector. The programme is based on the evidence that spin-off and start-up activity in Austria is not very dynamic by international standards. This is particularly true for the high-tech sector, which accounts for less than 10% of all new companies. The fact that the number of new companies founded by university graduates and scientists is small is significant.

The programme funds the AplusB Centres that are providing professional support for scientists in the difficult process of turning an idea into a viable business. This involves counselling and assistance during the actual start-up phase and the proof of concept: establishing the idea of entrepreneurship more firmly in academic theory and practice.

The AplusB Centres aim to support different activities and actors:

1. For incubation: scientists from universities, universities of applied sciences, colleges and non-university research institutions, as well as R&D academics from the private sector.
2. For awareness-raising and stimulation activities: young scientists, students and professors.

There are currently seven AplusB Centres in Austria. In previous years, the FFG was responsible for the programme management; since 2017 the AWS has taken over the programme management under the new name "AplusB Scale-up".

Sparkling Science

Sparkling Science is a research programme of the Federal Ministry of Education, Science and Research. The programme started in 2007 and the last projects approved will run until the end of 2019. The initiative's vision has been to break down structural barriers between the education and academic system in Austria. For this purpose, the programme has been facilitating a working environment in which scientists have the possibility to work side by side with young people involved in scientific research projects. Within this context, young colleagues can take an active part and work independently on parts of the research projects. In addition, as junior colleagues, they can introduce important suggestions into the research approach. As of June 2018, the programme has funded almost 300 projects.

The Innovation Foundation for Education

The aim of the Innovation Foundation for Education is to explore new paths in education and to support projects that promote transformation processes in educational institutions (https://innovationsstiftung-bildung.at/). The foundation was established in 2017 and it is endowed with a minimum of EUR 2 million per year. It aims to bring together new players and, in order to do so, supports educational institutions, companies and non-governmental organisations.

Notes

[1] Among the 22 public universities, there are 15 research universities, 6 universities of the arts and 1 university for continuing education. The former medical faculties of the Universities of Vienna, Graz and Innsbruck became "Special" medical universities in 2004. In 2014, a medical faculty was established at the University of Linz.

[2] The procedure for the recognition of private universities is outlined in the Private Universities Act (*Privatuniversitätengesetz*, PUG) of 2011 and in the Act on Quality Assurance in Higher Education (*Hochschul-Qualitätssicherungsgesetz*, HS-QSG*)* of the same year.

[3] Introducing the UAS Studies Act meant introducing a new kind of relationship between state and HEIs in Austria. For the first time, HEIs became autonomous institution, decentralising decision-making processes to foster independence, responsibility and flexibility of HEIs. As a counterbalance, obligatory procedures of external quality assurance (accreditation, audit) conducted by an independent accreditation agency were established.

[4] The UAS Studies Act makes no regulation on the legal status of UAS providers. Although most of them are limited companies, there are other legal entities as well, e.g. associations, private foundations, etc.

[5] As mentioned above, since 2012, AQ Austria is responsible for the accreditation of study programmes and of newly established UAS institutions.

[6] Austrian authorities were trying to limit the influx of German students, who do not fulfil the admission requirements in Germany, enrolling at Austrian universities.

[7] To develop the UAS sector and generate new study places in existing or new programmes, the ministry opens a tender process for providers.

[8] See also https://uniko.ac.at/modules/download.php?key=10897_DE_O&cs=3D3C.

[9] Before 2002, public universities were state agencies and academics with a permanent position had the status of civil servants.

[10] See http://www.wtz.ac.at/wissenstransferzentrum-english/.

[11] The Association of Austrian Universities of Applied Sciences is a private institution representing the interests of its members but has no legal foundation.

[12] See www.fhk.ac.at/index.php?id=111&L=0.

[13] Other system goals are also to be mentioned, such as Goal no. 7, "Increase of internationalisation and transnational mobility", as well as Goal no. 8 "Social responsibility of universities: gender equality, diversity and social inclusion, responsible science, sustainability and digital transformation".

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Chapter 2. Applying the HEInnovate framework to higher education in Austria

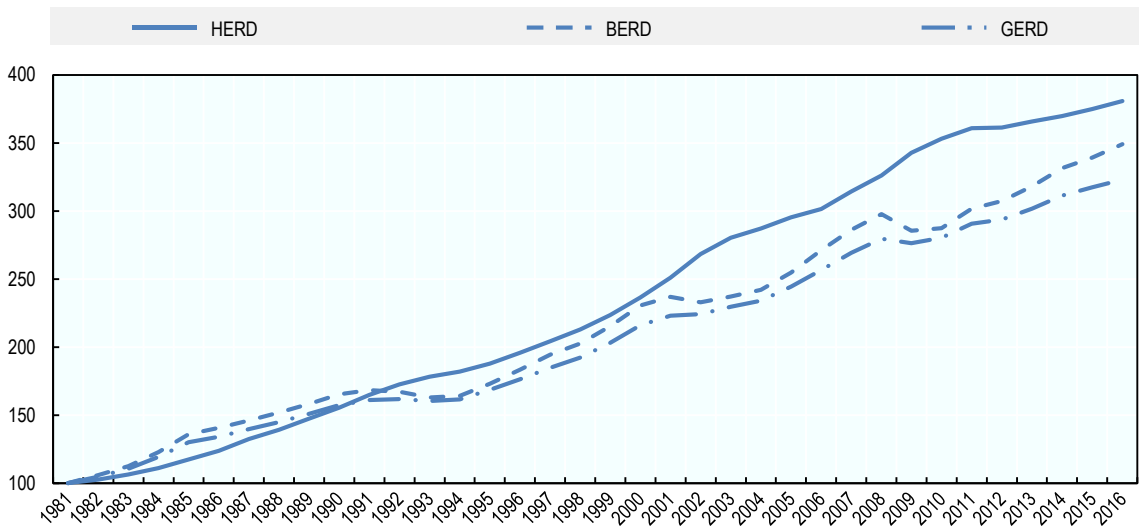
This chapter presents the HEInnovate guiding framework and applies all the dimensions of the HEInnovate framework to Austria's higher education system and to Austrian higher education institutions (HEIs). The aim is to have an all-round discussion of the capacity of HEIs to engage and create value for the economy and society. The chapter illustrates national features and some selected case studies in the eight dimensions of the HEInnovate framework. It displays some relevant results of a leader survey, a questionnaire that was administered to all Austrian HEIs.

The HEInnovate guiding framework

In recent decades, the missions and mandates of higher education institutions have become more complex and their activities have broadened, both in OECD countries and emerging economies. For instance, HEIs have acquired a pivotal role in national innovation systems and have considerably expanded their research and development (R&D) activities since the 1980s, partly at the expense of public research organisations. In the OECD area, as illustrated in Figure 2.1, HEIs' R&D expenditures have increased more rapidly than R&D expenditures in the business and government sectors (OECD 2017).

Figure 2.1. Trend of expenditure on R&D by performing sector in OECD

Base year 1981=100 (Constant USD PPPs)



Note: Higher education expenditure on R&D (HERD); Business enterprise expenditure on R&D (BERD); Gross domestic expenditure on R&D (GERD). The figure shows that HERD has increased more than BERD and GERD, over the past three decades.
Source: OECD Main Science and Technology Indicators Database. https://www.oecd.org/sti/msti.htm.

Moreover, the increasing role of HEIs in national innovation systems and their expected contribution to economic growth, social and cultural development has put an increasing demand on HEIs for knowledge exchange and technology transfer with economic players. This transformation has gone hand in hand with other global trends:

- In many OECD countries and emerging economies, the governance of HEIs has been decentralised. This has often resulted in a greater autonomy of HEIs combined with shifts in funding towards greater emphasis on performance and competition. This has allowed HEIs to autonomously allocate resources, set strategic targets and shape their own profiles in research and education. Research suggests (Aghion et al., 2010) that the shift towards greater autonomy of HEIs has had a positive impact on HEI performance.

  Globalisation has been affecting the way that HEIs interact and compete at the international level. Increasing participation in international science and innovation networks has enabled greater international exchange and mutual learning in research activities and education practices. It is also, however, leading to increased

competition between institutions for attracting and retaining talented students and researchers.

- The changing context for HEIs has put more emphasis on the concepts of the "third mission" and the "entrepreneurial university" (OECD, 2017b; Etzkowitz et al., 2000; Gibb, Coyle and Haskins, 2013). The third mission of HEIs refers to all the activities that go beyond the two core missions of HEIs: teaching and research functions. These activities can be very broad and diversified and take place at different geographical scales (international, national, local). As mentioned above, one of the key third mission activities of HEIs is "knowledge exchange" with business, public organisations and society more broadly (OECD, 2007; Goddard, Kempton and Vallance, 2013; OECD, 2017b). This is also a key feature of what is known as the entrepreneurial university.

To support policymakers and HEI leaders to make the most of these transformations, the OECD and the European Commission have co-developed HEInnovate, a guiding framework for innovative and entrepreneurial HEIs (Box 2.1). The HEInnovate guiding framework is developed around eight dimensions defined, and detailed vis-à-vis Austria, in the next sections of this chapter.

Box 2.1. Components of the HEInnovate guiding framework

The HEInnovate framework includes three main components:

- *The HEInnovate self-assessment tool.* The self-assessment tool was conceived for individual higher education institutions wishing to explore their innovative potential. It guides HEIs through a process of understanding, prioritisation and action planning in eight key dimensions (leadership and governance, organisational capacity: funding people and incentives, entrepreneurial teaching and learning, preparing and supporting entrepreneurs, digital transformation and capability, knowledge exchange and collaboration, the internationalised institution, and measuring impact). HEInnovate also identifies areas of strengths and weaknesses, opens up discussion and debate on the innovative and entrepreneurial nature of individual HEIs and allows for the comparison of trends over time. The self-assessment tool gives instant access to results, learning materials and a pool of experts.
- *The HEInnovate country reviews*. Reviews have been developed to provide a national systemic perspective about innovation in national higher education systems. They complement the HEInnovate tool that targets individual HEIs, by providing a systemic perspective and taking into account the different roles and features of different HEIs in a national system. HEIs do not operate in isolation but collaborate with their community and compete with other HEIs in the same country (and abroad) in a variety of fashions. The country reviews were developed to capture and assess these complex interactions and dynamics. At the time of writing, country reviews had been completed for the following countries: Ireland, Hungary, the Netherlands, Poland and Bulgaria (OECD/EU, 2018; OECD/EU, 2017a; OECD/EU, 2017b; OECD/EU, 2017c; Elliott, 2017).

- *The HEInnovate Policy Learning Network (PLN)*. The PLN was established as a platform of peer learning and policy dialogue among policymakers of the countries participating in HEInnovate country reviews. The participants of the PLN meet regularly and discuss key themes linked to the HEInnovate eight dimensions relevant to their countries. It is a platform to learn from and compare similar experiences across OECD and European Union (EU) countries.

Sources: OECD/EU, 2018; OECD/EU, 2017a; OECD/EU, 2017b; OECD/EU, 2017c; Elliott, 2017.

The HEInnovate eight dimensions in the Austrian context

Austria's science and innovation system ranks very high in the OECD (OECD, 2018). Higher education institutions play an important role in the national innovation system. The OECD HEInnovate Review of Austria, based on the specific request of the Federal Ministry of Education, Science and Research (BMWFW), focuses on three key dimensions, selected among the eight of the HEInnovate framework. These are leadership and governance; entrepreneurship teaching and learning; and preparing and supporting entrepreneurs. The report discusses these three dimensions in detail in Chapters 3, 4 and 5. In addition, the OECD has collected a broader set of information that allows generating some analysis on all the dimensions of the framework. In particular, with the support of the BMWFW, a leader survey was administered to all Austrian HEIs (Box 2.2). The survey's high response rate provides insights to discuss the performance of the higher education system and HEIs in a more holistic way.

Box 2.2. The HEInnovate Leader Survey

The Leader Survey in Austria, 2018

As part of the HEInnovate country reviews, an online survey was administered to Austrian rector's offices, in order to complement the information obtained from the background report and the study visits.

The questionnaire, based on the HEInnovate framework, asked about current and planned practices in: i) the strategic directions of the HEI; ii) management of human and financial resources; iii) the teaching and learning environment; iv) knowledge exchange activities; v) internationalisation; vi) entrepreneurship education; and vii) business start-up support.

The response rate was quite good. A total of 45 Austrian HEIs (approximately. 60% of the total) filled the questionnaire. Respondents were divided into 17 public universities, 4 private universities, 13 universities of applied sciences (UAS) and 11 university colleges of teacher education. Reflecting the selection of case studies (mostly public universities and UAS) the discussion of the data from the Survey focuses especially on these two types of HEIs.

Leadership and governance

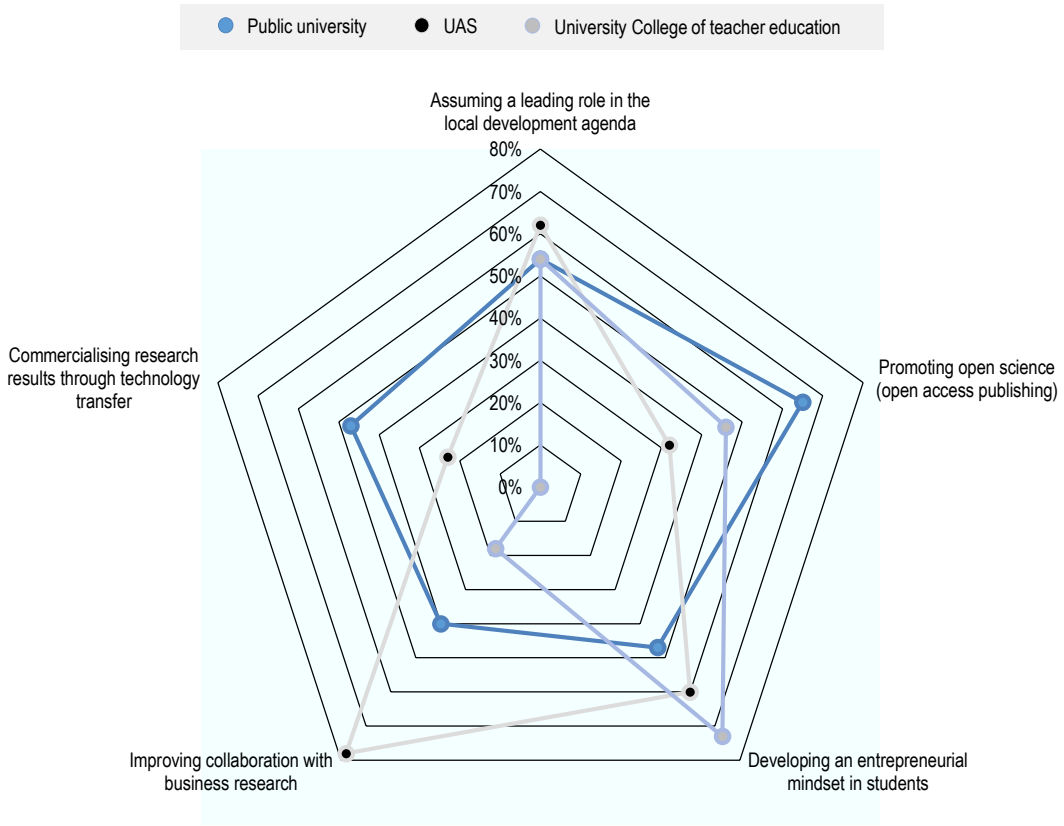
Leadership and governance arrangements are crucial to define the framework of incentives to promote the entrepreneurial and innovation agenda within higher education institutions. Many HEIs across OECD and EU countries include the words "innovation" and "entrepreneurship" in their mission statements but, in an innovative and entrepreneurial institution, this is more than a reference. Entrepreneurship should permeate the strategy of innovative higher education institutions and affect visions, values and missions. For example, an HEI could have a mission statement and written strategy, setting out an entrepreneurial vision for the future of the institution. This strategy could clearly emphasise the importance of entrepreneurship, culturally, socially and economically. In addition to the strategy, it is equally important to articulate a clear implementation plan with clear objectives and define key performance indicators to measure progress.

Austrian HEI leaders can count on an environment conducive to engagement and most HEIs have a strategic approach to engagement activities. Government agencies along with the private sector commit significant resources in support of the entrepreneurial and innovation agenda, in a clear partnership-orientated approach. Within this context, rectorates and senior management are often involved in leading and rolling out their institute's engagement strategy. Entrepreneurship and innovation are embedded in HEI strategies, which, in the case of public universities, become a reference framework for handling eventual tensions between rectorate, senate and university council. For example, if the rectorate of a given public university would like to introduce a new lifelong learning programme in co-operation with the private sector, it will be easier to overcome potential resistance from the senate if such a programme is in line with the university strategy.

The modalities of engagement may change across HEIs. Some Austrian institutions put a particular focus on start-ups and spin-offs. Others have developed a broader engagement agenda, which encompasses social activities. Most common is developing an entrepreneurial mind-set of students. For 60% of the 45 surveyed public universities, universities of applied sciences and university colleges of teacher education this objective ranked among the top three dimensions of the entrepreneurial and innovation agenda, next to assuming a leading role in the local development agenda (56%) and followed by promoting open science through open access publishing (47%), and improving collaboration with business research (45%). Commercialising research results through technology transfer ranked much lower (23%).

A closer look shows that different types of HEIs have developed different foci in their strategies (Figure 2.2). Public universities put emphasis on the development of open science (65%), on commercialising research results through technology transfer (47%), and on mind-set development (47%). Conversely, UAS focus more on improving collaboration with business research (77%) and assuming a leading role in the local development agenda (62%). Commercialising research results through technology transfer is prominent in the strategy of less than 1 in 4 UAS (for 23% of respondent UAS), compared to almost 1 in 2 public universities. 73% of the surveyed university colleges of teacher education point out that they emphasize the development of an entrepreneurial mind-set as a core curriculum and training objective for their students. More than half (55%) stated that they are committed to promoting open science through open access publication and for 43% assuming a leading role in the local development agenda is an important dimension of their "engagement" strategy.

Figure 2.2. Most prominent dimensions in Austrian HEI's strategies for engagement



Note: HEIs responded the following question: "Taking into account the HEInnovate dimensions/components listed below, please indicate the three that are most prominent in your strategy". The total number of responses analysed was 41, of which 17 were from public universities, 13 from universities of applied sciences (UAS), and 11 from university colleges of teacher education. The survey response rates per HEI type are the following: public universities (81%), UAS (62%), university colleges of teacher education (100%). In total, 45 responses were collected. The total number of higher education institutions in Austria is 67.
Source: OECD (2018b) HEInnovate Leader Survey Austria.

The role of the Austrian public authorities, both at the federal and subnational levels, has been prominent to promote HEI engagement. For example, the national innovation strategy (the research, technology and innovation [RTI] strategy of 2011) has put forward the objective of generating stronger linkages between higher education and the economy (OECD, 2017b). In the same vein, the support of national funding agencies (like the FFG and AWS, see Chapter 1) and subnational entities such as regional development agencies, chambers of commerce and industrial associations have spurred entrepreneurship in HEIs' strategies.

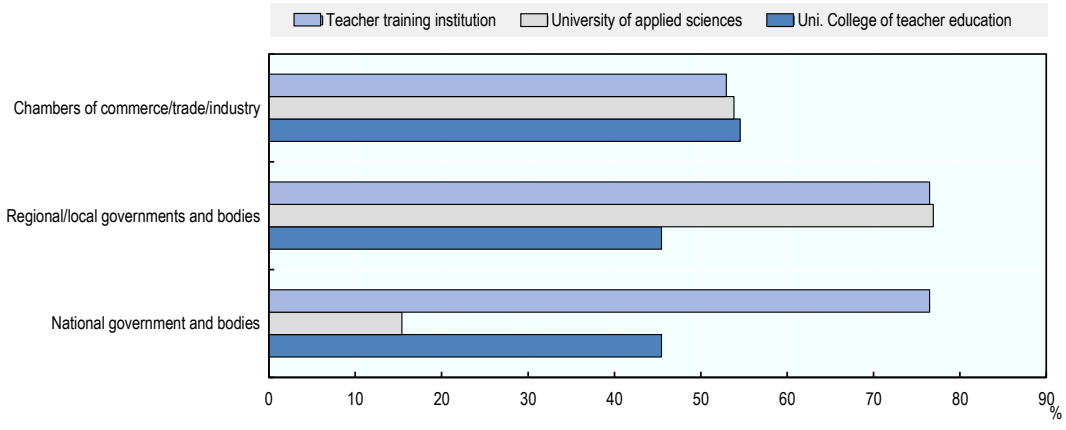
These efforts go in the right direction and could be further improved by developing a common definition of entrepreneurship in the higher education system. The previous performance agreements with public universities (2016-18), for example, suggested the application of the HEI self-assessment tool regarding their entrepreneurial agenda, but it adopted a narrow definition of entrepreneurship closely related to the idea of developing or running a business (see the discussion on "entrepreneurship teaching" in Chapter 4). In recent years, however, Austrian HEIs seem to have developed a broader understanding of

entrepreneurship, which is (informally) defined as an individual's ability to turn ideas into action. This entrepreneurial mindset includes creativity, innovation and risk-taking, as well as the ability to plan and manage projects in order to achieve objectives.

By implementing the entrepreneurial and innovation agenda, Austrian HEIs interact with ecosystems but there are regional differences in terms of firm density and R&D investment from businesses and HEIs. These differences depend on the characteristics of the regional economy, like R&D expenditures performed by the higher education (HE) sector and the business sector or the density of firms. In general, there are several ways in which HEIs can be actively involved in the development and implementation of local, regional and national innovation and entrepreneurship strategies. These include collaborating with the public sector, business partners, direct support of start-ups and established companies, as well as supporting local cultural and artistic activities.

In Austria, HEIs enjoy good collaboration with public authorities and economic chambers, which at the regional level are the private sector's representations in regional ecosystems. More than half of the surveyed HEIs reported collaborating with chambers in supporting entrepreneurship (53%), two-thirds (67%) collaborate with regional and local governments, and 47% with the national government. A closer look by type of surveyed HEI show some differences (Figure 2.3).

Figure 2.3. Main collaboration partners of Austrian HEIs in supporting entrepreneurship



Note: HEI leaders responded to the following question: "With which of the following organisations/ institutions does your HEI collaborate in supporting entrepreneurship?" The total number of responses analysed was 41, of which 17 were from public universities, 13 from universities of applied sciences (UAS), and 11 from teacher training institutions. The survey response rates per HEI type are the following: public universities (81%), UAS (62%), university colleges of teacher education (100%). In total, 45 responses were collected. The total number of higher education institutions in Austria is 67.

Source: OECD (2018b) HEInnovate Leader Survey Austria.

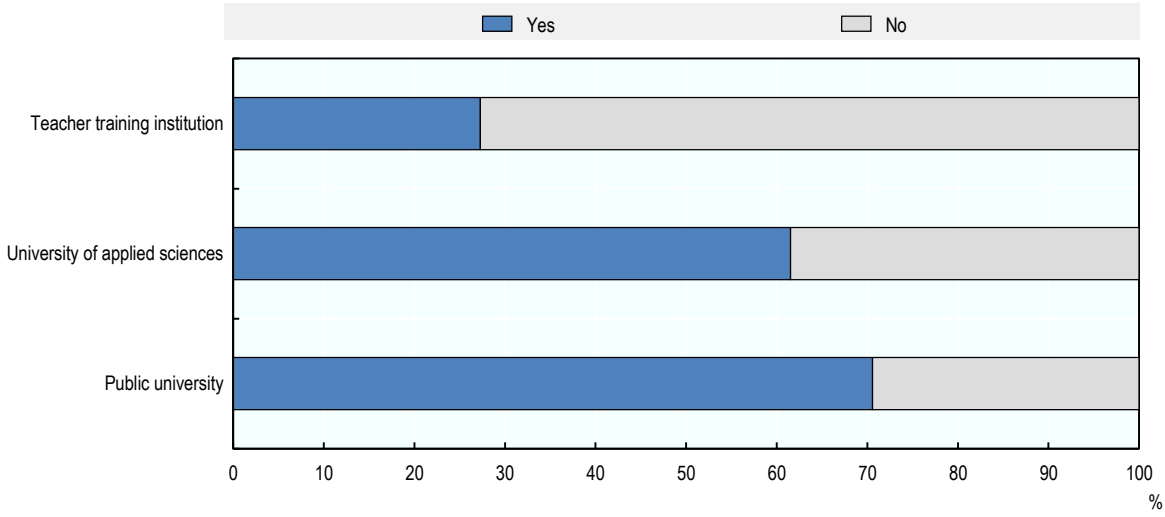
More public universities collaborate with national government and their bodies than universities of applied sciences (76% vs. 15%), and 45% of the surveyed university colleges of teacher education reported to have this kind of collaboration. An important way of collaboration with the national government for public universities are performance agreements (see Chapter 3). Regional and local governments and their bodies collaborate more with public universities and UAS than with teacher training institutions. No differences can be noted for the collaboration with chambers; approximately half of the surveyed HEIs collaborate with them for entrepreneurship support.

Organisational capacity: Funding people and incentives

The organisational capacity of a given HEI affects its ability to implement a strategy. In other words, while important, a strategy alone is not enough to make an institution more capable to engage. An HEI that is committed to carrying out innovative and entrepreneurial activities needs to fund and invest in these areas accordingly and consistently. In this domain success factors include the following: i) a strong alignment between investments in innovative and entrepreneurial activities and the HEI overall financial strategy; ii) a continuous and long-term engagement with funders and investors, also outside the academic world to secure financial resources to deliver strategic objectives; iii) a balanced and diversified range of funding and investment sources, including in-kind contributions; and, finally iv) the possibility to re-invest revenues generated from research, teaching and knowledge exchange activities.

Regarding funding and investment, Austrian HEIs have access to different sources of funding that support their entrepreneurial and innovation agenda. More than half of the surveyed HEIs (53%) responded in the affirmative to the question of whether public authorities – at the national, regional or local level – provide financial support or incentives for the provision of start-up support measures including incubators (Figure 2.4).

Figure 2.4. Funds provided by public authorities to support start-up measures



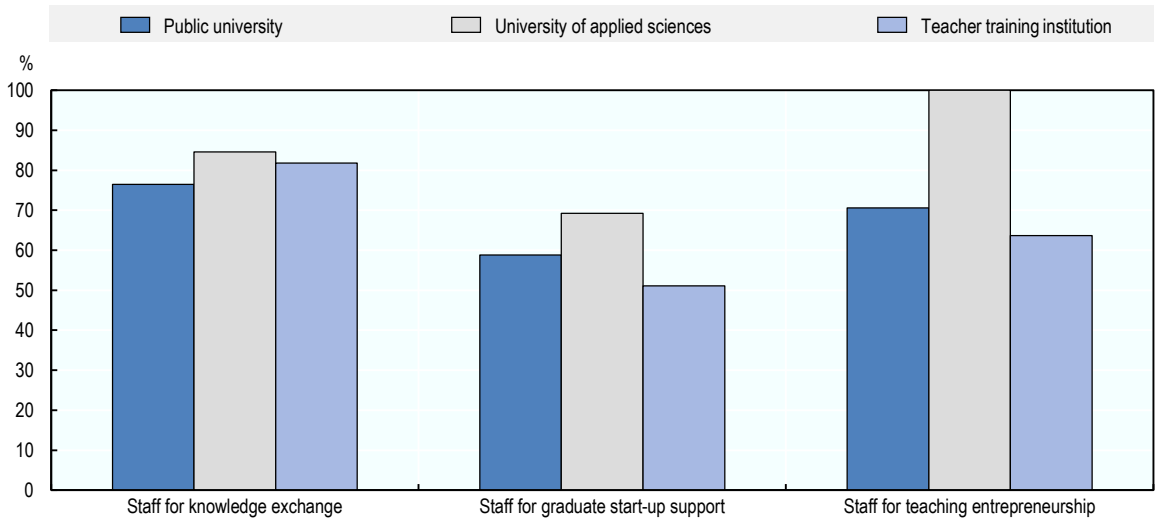
Note: HEI leaders responded to the following question: "Do public authorities – at the national, regional or local level – provide financial support or incentives for the provision of start-up support measures including incubators?" The total number of responses analysed was 45, of which 17 were from public universities, 13 from universities of applied sciences (UAS), and 11 from teacher training institutions. The survey response rates per HEI type are the following: public universities (81%), UAS (62%), university colleges of teacher education (100%). In total, 45 responses were collected. The total number of higher education institutions in Austria is 67.
Source: OECD (2018b) HEInnovate Leader Survey Austria.

Motivated, skilled and committed people are essential to developing the HEI into a more innovative and entrepreneurial organisation. These people need support structures (e.g. centralised office to support engagement activities), training and rewards if their contributions to the entrepreneurial and innovation agenda are going beyond their current tasks.

As discussed in the chapter on leadership and governance, Austrian HEIs can count on different programmes and projects supporting the entrepreneurship agenda. This approach is quite common in OECD countries. There are cases, however, in which the support from the government has been more organic, allowing HEIs to develop a strategic – and long-term – approach to improve their capacity to engage with business and society. For instance, the Netherlands' Valorisation Programme helped HEIs to generate functions and institutions supporting the entrepreneurial agenda. The engagement of HEIs in this direction has been continuing also after the end of the programme (i.e. end of public subsidies to the positions and institutions related to the implementation of the entrepreneurial agenda) (OECD/EU, 2018).

Co-operation with firms can generate funds that can improve the capacity to engage and broaden the range of engagement activities. Supporting academics in their co-operation with firms and other engagement activities is important and widely practised among Austrian HEIs. More than 80% of the surveyed HEIs reported having staff dedicated to knowledge exchange (Figure 2.5). Most (76%) of the surveyed public universities reported that there is an office to co-ordinate knowledge exchange activities; this was less common practice among the surveyed university colleges of teacher education (55%) and universities of applied sciences (46%).

Figure 2.5. Presence of staff dedicated to knowledge exchange



Note: HEI leaders responded to the following question: "Do you have staff dedicated to knowledge exchange?". The total number of responses analysed was 45, of which 17 were from public universities, 13 from universities of applied sciences (UAS), and 11 from teacher training institutions. The survey response rates per HEI type are the following: public universities (81%), UAS (62%), university colleges of teacher education (100%). In total, 45 responses were collected. The total number of higher education institutions in Austria is 67.

Source: OECD (2018b) HEInnovate Leader Survey Austria.

Entrepreneurial teaching and learning

An HEI should explore innovative teaching methods to stimulate entrepreneurial mindsets. Students should learn about entrepreneurship. For instance, starting a new company requires knowledge about tax rules, financial schemes and other private or public policy support, among others. However, entrepreneurship is not only about starting a business. It also means acquiring the skills and competencies associated with the ability to tackle

problems with a variety of methodologies and interdisciplinary approaches. This encompasses soft skills such as communication, management, organisational skills, etc.

As part of the promotion of entrepreneurship education, several Austrian HEIs offer their students the possibility to enrol in interdisciplinary programmes. For example, and as discussed in the chapter 3, assessing leadership and governance, the University of Vienna has put in place "extension curricula" and "alternative extensions" – *Erweiterungscurricula* and *Alternative Erweiterungen* – to give students the possibility to attend classes in different study programmes and faculties. In the same vein, at the University of Innsbruck, some curricula are based on "modules", which can be formed by mixing disciplines/programmes. Data from the Leader Survey illustrate that interdisciplinary programmes are more common among the surveyed public universities (71%) than among the surveyed universities of applied sciences (38%). Within the surveyed public universities, most commonly these interdisciplinary programmes on entrepreneurship are offered in master's programmes (ISCED 7) (41%).

Several HEIs have created tenure for entrepreneurship professors. In UAS, temporary staff with entrepreneurial/technical experiences represents the largest share of faculty. While this potentially gives students access to information about the needs of ecosystems, it also requires quality assurances and co-ordination efforts to combine different courses in terms of their content and teaching styles into a common programme frame.

A better framework of incentives in the higher education system could further develop the numerous practices observed at the HEI level. Encouraging and rewarding innovative and entrepreneurial behaviour in faculty and administrative staff, and students is a key feature of innovative and entrepreneurial HEIs. Well-designed incentive and reward mechanisms should be diverse and differentiated to be able to promote different types of careers and actions depending on the different types of skills of staff. These incentives and rewards mechanisms should be available at an individual level as well as for faculties or departments, extending beyond classic career progression models. Examples of good practices include: adjusting staff teaching and research workloads; providing institutional funds to stimulate innovation and change; allow sabbaticals for staff who seek to enhance their entrepreneurial capacity; develop rewards and incentive mechanisms going beyond traditional research, publications and teaching metrics; making office and laboratory space available for staff and students who pursue entrepreneurial activities; and developing flexible intellectual property (IP) protection models.

In Austria, faculty members that engage with entrepreneurship can benefit from a reduction of their teaching responsibilities. They can even get a sabbatical year to develop their business; for this purpose, the "spin-off fellowship" is offered and is also mentioned in many case-study HEIs as a good practice to raise the interest of young researchers for commercialising the results of their research (Box 2.3). Conversely, students enjoy very limited incentives to approach entrepreneurship while studying.

Box 2.3. Supporting faculty and students creating a company: The Austrian Spin-off Fellowship

The Spin-off Fellowship targets faculty and students interested in founding their own company. The Spin-off Fellowships is a programme of the Federal Ministry of Education, Science and Research (BMBWF) which offers support with the commercialisation of existing and newly developed intellectual property belonging to Austrian universities and research institutions.

By doing that, the programme enables the fellowship project to be followed by a company start-up. The following formal conditions must be fulfilled in order to apply for a fellowship from the FFG:

- The technologies or research results are the property of an organisation which is eligible to apply.
- There is an individual intellectual property commercialisation agreement, based on the spin-off strategy of the relevant university or research institution.
- There is a declaration of support from the host.
- The fellow(s) are in an employment relationship with the university or research institution when the project starts.

Some caveats could be represented by the fact that during the term of the project the fellow(s) (= potential founders) must devote themselves exclusively to the project and may not carry out any teaching or other research assignments during that period.

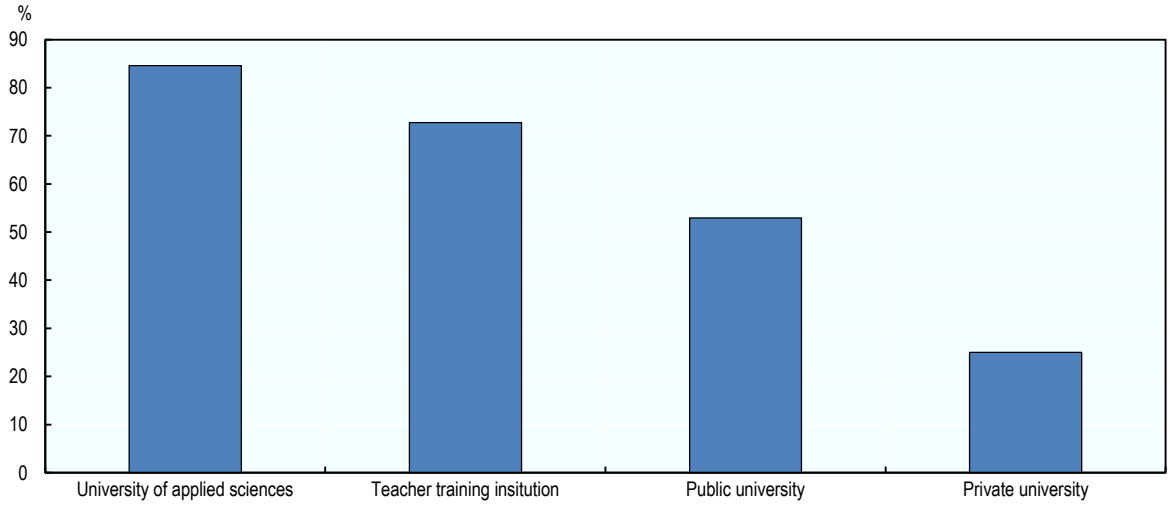
Source: FFG (n.d.), *Spin-off Fellowships*, https://www.ffg.at/en/node/52752 (accessed on 15 April 2019).

Entrepreneurial teaching and learning do not mean necessarily accompanying students starting their own business but rather helping them develop an entrepreneurial mindset and the related skills also necessary to work creatively as an employee. In Austria, many HEIs, including public universities and UAS, have been offering learning opportunities focusing on entrepreneurship.

A large number of Austrian HEIs have developed programmes to provide students with learning opportunities vis-à-vis entrepreneurship. However, these programmes tend to deliver entrepreneurship training to a small number of students. In some cases, classes tend to be centred on financial, legal and regulatory issues. For example, the entrepreneurship programme at the University of Vienna has a relatively narrow focus on financial issues and regulations, which may cause high dropout rates (see Chapter 4).

Similar to the approach of other countries, a wide range of teaching methods is used in entrepreneurship education. Blended learning seems to be more common in UAS and university colleges of teacher education where, of the surveyed institutions, 85% and 73% reported to use blended learning in their entrepreneurship education activities and less practised in public universities (53%) (Figure 2.6).

Figure 2.6. Entrepreneurial teaching and learning: HEIs using "blended learning" teaching methods



Note: HEI leaders responded to the following question: "Which one of these approaches are used by your HEI?" The total number of responses analysed was 45, of which 17 were from public universities, 13 from universities of applied sciences (UAS), and 11 from teacher training institutions. The survey response rates per HEI type are the following: public universities (81%), UAS (62%), university colleges of teacher education (100%). In total, 45 responses were collected. The total number of higher education institutions in Austria is 67.

Source: OECD (2018b) HEInnovate Leader Survey Austria.

Traditionally, UAS have a close collaboration with experts and employers in programme development. UAS were founded with the aim of reflecting the skills needs expressed by the job market, especially by firms operating in their own "ecosystems". For this reason, the participation of representatives from the industry in which the UAS operate is legally binding and supported by specific governance arrangements (see Chapter 3). While academic education should not be affected by short-term skills needs in the labour market, the capacity to take into account the mid- and long-term evolution of skill requirements can improve curricula and offer a better service to stakeholders, including students. Within this context, entrepreneurship education – constantly reviewed and updated – represents, for HEIs, a gateway to the economy and society.

As discussed in Chapters 4 and 5, in Austria, entrepreneurship education is often delivered through extracurricular activities. A greater embedding of entrepreneurship activities into programme curricula can be noted for UAS, reaching approximately 30% of students (Table 2.1). While some extracurricular activities, such as formula student competitions, have formal recognition (the competition awards a prize for innovation for student teams across the world, see Chapter 4), many activities related to entrepreneurship education are informal. This does not represent a negative feature *per se.* Informal (extracurricular) education can be as effective as formal education in developing an entrepreneurial mind-set but it is more difficult to evaluate and also to certificate (i.e. to give the possibility to students to capitalise on their entrepreneurship education when joining the labour market). In general, extracurricular activities are more effective when formally recognised, for examples in exams or other evaluations.

Table 2.1. Students involved in entrepreneurship education in Austrian HEIs

HEI type		What percentage of students are involved?				Total
		Less than 9%	Less than 10%	Between 10% and 30%	More than 30%	
Public university	Count	9	2	3	3	17
	% within HEI type	52.9	11.8	17.6	17.6	100.0
Private university	Count	1	1	1	1	4
	% within HEI type	25.0	25.0	25.0	25.0	100.0
University of applied sciences	Count	1	0	4	8	13
	% within HEI type	7.7	0.0	30.8	61.5	100.0
University college of teacher education	Count	4	4	2	1	11
	% within HEI type	36.4	36.4	18.2	9.1	100.0
Total	Count	15	7	10	13	45
	% within HEI type	33.3	15.6	22.2	28.9	100.0

Note: HEI leaders responded to the following question: "What percentage of students are involved in entrepreneurship education?". The total number of higher education institutions in Austria is 73.

Source: OECD (2018b) HEInnovate Leader Survey Austria.

Some Austrian HEIs have developed "good practices" to review and update entrepreneurship education by integrating the results of research. For example, at the Vienna University of Economics and Business, international research in entrepreneurship affects teaching and connects with the local environment, generating an "intellectual spill-over" in its ecosystem. To achieve this result, the university encourages staff and educators to review the latest research in entrepreneurship education. The Institute for Entrepreneurship and Innovation provides a forum whereby staff and educators can exchange new knowledge and ideas, incorporating the latest research.

Preparing and supporting entrepreneurs

HEIs can help individuals reflect on the commercial, social and environmental or lifestyle objectives related to their entrepreneurial aspirations and intentions. For those who decide to proceed to start a business or any other type of venture, HEIs can offer targeted assistance to generate, evaluate and act upon new ideas, building the skills necessary for successful entrepreneurship and, importantly, find relevant team members and get access to relevant networks (Box 2.4).

In Austria, the support of the government to the entrepreneurial and innovation agenda in HE has positively affected the capacity of HEIs to raise awareness and support entrepreneurship. Over the past decades, Austrian authorities and innovation agencies, as for example the Austrian Research Promotion Agency (FFG), have been implementing policies to promote HEI entrepreneurship. These include the AplusB Centres (2002), the Phönix Prize for innovative academic start-ups (2012) and the Spin-off Fellowship (2017). These initiatives, which are discussed in detail in Chapter 5, have generated development and national good practices; academic entrepreneurship has become popular and helps HEIs engaging with business ventures. However, there are still some conservative environments, especially in public universities, in which faculty members do not see entrepreneurship as a valuable carrier opportunity.

Box 2.4. Supporting entrepreneurs: The I-Corps programme

To transform a scientist into a scientist-entrepreneur, there is a need for appropriate education and training. There are many examples of start-ups producing services or products that fail to meet demand on the market. In some cases, a better definition of the service/product and some market research would have helped transform a failure into a success.

Based on this assumption, the National Science Foundation (NSF) launched the I-Corps programme in 2012. The programme awards principal investigators (PIs) a USD 50 000 NSF grant. PIs, together with an entrepreneurial lead (generally a PhD student and a business mentor), attend a seven-week course in which they are taught to identify business opportunities for their research and ways to exploit these opportunities (Huang-Saad et al., 2017). Academics (students and teachers) who develop a business idea may lack information about the way in which they should successfully implement it.

Through I-Corps, NSF grantees learn to identify valuable product opportunities that can emerge from academic research and gain skills in entrepreneurship through training in customer discovery and guidance from established entrepreneurs.

Sources: NSF (n.d.), *NSF Innovation Corps (I-Corps™)*, https://www.nsf.gov/news/special_reports/i-corps/ (accessed on 15 February 2019); Huang-Saad, A., Fay, J., Sheridan, L. (2017) "Closing the divide: accelerating technology commercialization by catalyzing the university entrepreneurial ecosystem with I-Corps" *The Journal of Technology Transfer* 42 (6), 1466-1486, 2017.

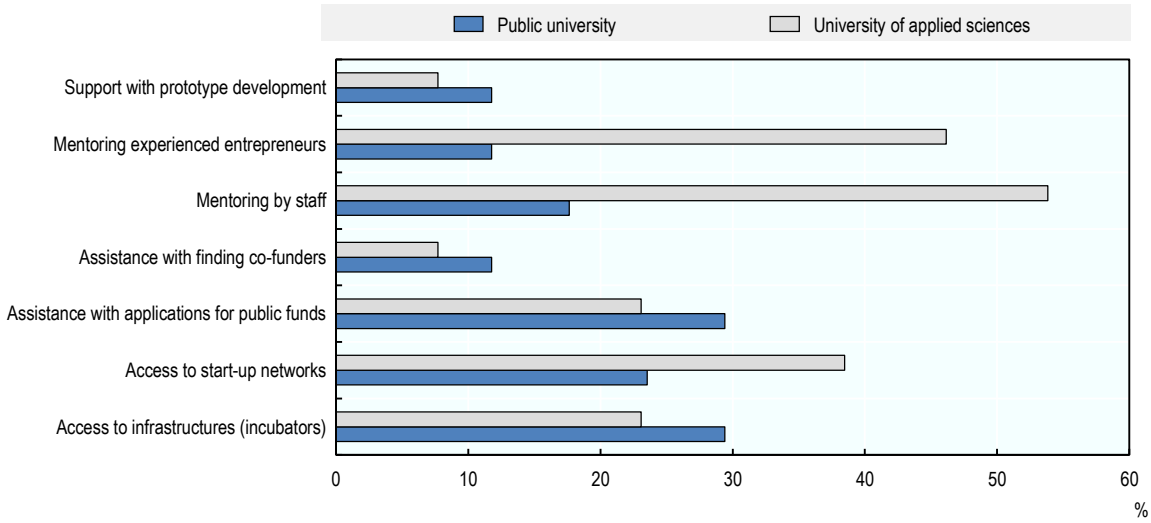
Emotional preparation is as important as the technical aspects (see Chapter 4). Aspects of entrepreneurship, related to soft skills such as dealing with people and building relationships, managing innovation processes, coping with success, stress and risk, and how to restructure or exit, are often not taken into account. The involvement of entrepreneurs and key actors from the entrepreneurship ecosystem is often very useful to offer holistic entrepreneurship training.

Public universities and UAS seem to have different priorities in their start-up support (Figure 2.7). Overall, intramural start-up support appears to be more common for UAS than for public universities. A reason for this could be that public universities rely more on a network approach and refer aspiring entrepreneurs to external organisations that offer specific support. The priority setting in start-up support also points in this direction. Priorities for public universities are offering access to infrastructure, including incubators, assistance with the application to public funding and access to start-up networks, whereas UAS put an emphasis on mentoring by staff and experienced entrepreneurs.

Austria's venture capital sector is relatively small and, despite recent improvements, the country struggles to link excellent research to funding opportunities (OECD, 2017b). External financing can be essential for the success of the initial stages of a new venture. It provides investment for feasibility and market studies, product and prototype development such as proof of concept funding, for initial production or for offering the founders some living income before their first revenues are generated. Public authorities have put in place initiatives, such as the Global Incubator Network (2016), to improve the international linkages of start-ups and SMEs. This network is endowed of EUR 4 million and serves as a platform for international and Austrian start-ups, investors, business angels and start-up agencies. The network's objective is to promote Austria as a start-up hub and improve

international networking for Austrian companies by providing improved access to international incubators and accelerators, international investors and potential international strategic partners. It provides support for entry in international markets, connects to international start-ups and supports firms in handling intellectual property rights (OECD, 2017b).

Figure 2.7. Priorities in the start-up support offer by Austrian public universities and universities of applied sciences



Note: HEI leaders answered the following question: "Please indicate the three most important start-up support measures that are actually in place and used in your HEI". The total number of responses analysed was 30, of which 17 were from public universities, and 13 from universities of applied sciences (UAS). The survey response rates per HEI type are the following: public universities (81%), and UAS (62%). These response rates, however, need to be interpreted with caution as the survey design does not allow for the exclusion of multiple responses per higher education institution. In total, 45 responses were collected. The total number of higher education institutions in Austria is 67.

Source: OECD (2018b) HEInnovate Leader Survey Austria.

There is a large network of HEI incubators and accelerators supporting students, graduates and staff to move from idea generation to business creation. Business incubators provide a range of services such as free or subsidised premises where start-uppers can work on their projects, access laboratories and research facilities, prototyping support, as well as advice on IP matters and financial opportunities. They also offer a visible and accessible location for entrepreneurs to access an integrated package of coaching, mentoring and training. Incubators and accelerators are often developed in co-operation with subnational governments, regional development agencies and chambers of commerce, as in the case of the University of Innsbruck. As in other countries, however, policy support is mostly focusing on technical – hard science – sectors, while social entrepreneurship and other forms of soft science struggle to find their space in incubators.

Digital transformation and capability

Digital transformation and capability were added as the eighth dimension to the HEInnovate guiding framework in June 2018, after the completion of the study visits undertaken as part of this review. The following presents some reflections on the implementation of the multidimensional digital agenda in Austrian HEIs.

The Austrian federal government has elaborated a holistic strategy to promote digitalisation. Policymakers recognise the transformational importance of digitalisation and, through many channels, including higher education, act to accelerate its diffusion. There has been considerable experimentation over decades with varied institutional models to support innovation, and evaluation of innovation policy instruments is a widespread practice. This includes a coherent and shared strategy and action plan allocating resources for digital transformation across the HEI. In particular, a digital roadmap was developed in 2017 to address new opportunities and challenges offered by digitalisation and automation; the newly established Ministry of Digital and Economic Affairs (BMDW) is in charge of developing new Digital Strategy (OECD, 2017b).

As in other European countries, including Austria, HEIs are developing their digital infrastructure to support their vision, mission and strategy. HEIs have been focusing on digital learning activities (online learning platforms). Digital technologies provide opportunities for innovative curriculum design and delivery, new pedagogies, learning processes and assessment methods. For instance, the Institute of Nursing Science and Practice at Paracelsus Medical Private University (Salzburg) has developed a bachelor degree study programme in nursing science on an online basis. The programme is specifically designed to reach out to working students, who can study from home and set their individual time management, limiting the time at university to just one week per study year.

Austria's Open Innovation Strategy provides HEIs with specific support to promote open research, open innovation and accessibility.[1] Open science improves the effectiveness, quality and productivity of a research system, encourages the adoption of new research methodologies and scales up innovation in HEIs (OECD/EU, 2015; Dai, Shin and Smith, 2018). Through open science, the HEI promotes collaborative efforts, faster knowledge exchange and new ways of sharing results (including publications, research data and methodologies) among students, staff and society, with a specific focus – particularly important in the case of Austria – on disadvantaged or non-traditional stakeholders.

Knowledge exchange and collaboration

Innovative and entrepreneurial HEIs do not operate in isolation but are strongly connected to other stakeholders within their ecosystems. Knowledge exchange is an important catalyst for organisational innovation, the advancement of teaching and research and local development. It is a continuous process, which includes the stimulation, direct application and exploitation of knowledge for the benefit of the social, cultural and economic development of society.

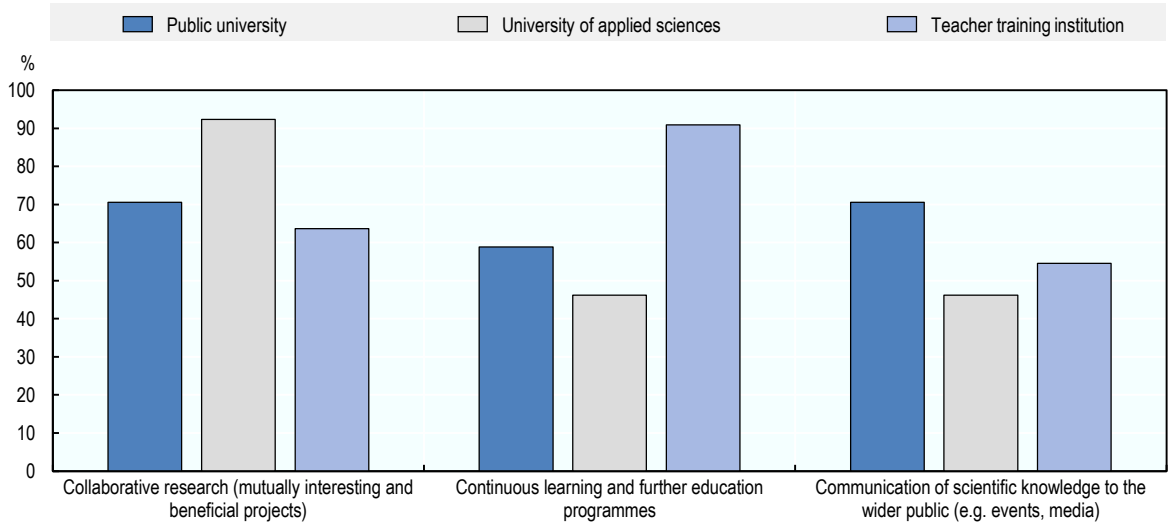
All Austrian HEIs are committed to knowledge exchange and have been developing strategies and modus operandi to engage and collaborate with stakeholders. This situation partly owes to the broad set of instruments to promote science-industry collaboration that has been developed by public authorities with the aim of improving knowledge transfer.[2] There are several examples of collaboration. Among others, the *Angewandte*, the University of Applied Arts in Vienna, has developed a collaboration with a tech company that is developing electronic systems for self-driving cars. The university is helping the company streamline and simplify these systems in order to reduce their vulnerability and increase reliability and resilience.

The capacity of HEIs to engage in knowledge exchange and collaboration activities, however, also depends on the characteristics of the region in which they are located. Although the available data do not allow to affirm this with absolute certainty, it seems that

Austrian HEIs located in areas with a concentration of economic activities tend to be part of denser networks with external stakeholders. This is in line with the idea that HEIs have acquired a "new centrality" in regional innovation ecosystems (EUA, 2019). Also, in Austria, HEIs are experiencing new formats of producing and sharing knowledge, integrated with their traditional roles of educating students and developing research.

The importance of local actors in knowledge exchange and collaboration activities seems to be confirmed by the responses that Austrian HEIs provided to the OECD Leader Survey (2018b). In terms of knowledge exchange, activities very high in the priorities of the surveyed HEIs (public and private universities, UAS and university colleges of teacher education) are: collaborative research, that is, mutually interesting and beneficial projects (71% ranked this as 1 of their 3 most prominently practised); continuous learning and further education programmes (64%); communication of scientific knowledge to the wider public through events and the media (58%) (Figure 2.8).

Figure 2.8. Priorities in the knowledge exchange activities of public universities, universities of applied sciences and university colleges of teacher education in Austrian HEIs



Note: HEI leaders responded to the following question: "Knowledge exchange can take on various forms. The focus can be on teaching, research or any form of strategic collaboration. Which of the following are currently practised at your HEI? Please pick the three most prominent for you". The total number of responses analysed was 41, of which 17 were from public universities, 13 from universities of applied sciences (UAS), and 11 from teacher training institutions. The survey response rates per HEI type are the following: public universities (81%), UAS (62%), university colleges of teacher education (100%). These response rates, however, need to be interpreted with caution as the survey design does not allow for the exclusion of multiple responses per higher education institution. In total, 45 responses were collected. The total number of higher education institutions in Austria is 67.
Source: OECD (2018b) HEInnovate Leader Survey.

A closer look at different HEIs suggests that current priorities for knowledge exchange activities in universities of applied sciences are more directed towards collaborative research (92% said this was 1 of their 3 most prominent practices) than continuous learning and further education programmes (46%) or science communication (46%). The latter was a priority for 71% of the surveyed public universities, together with collaborative research (71%) whereas lifelong learning was a priority for 59%. University colleges of teacher

education have a current focus on lifelong learning (91%), followed by collaborative research (64%) and the communication of scientific knowledge to the wider public (55%).

Good relations with their "ecosystem" have helped Austrian HEIs integrate research, education and knowledge exchange activities. Many Austrian HEIs have established institutions and methodologies to co-operate with ecosystems in a structured fashion. As discussed above, there are several university incubators in the country. These incubators have generated a positive legacy in terms of business creation and support and have become entrepreneurship hubs in their respective ecosystems (see Chapter 5). In addition, Austrian HEIs use internships and collaboration with external stakeholders to help students and staff participating in innovative activities. Both public universities and UAS broadly implement these practices (see Chapters 4 and 5).

An entrepreneurial and innovative HEI engages with the external environment through a variety of activities ranging from informal activities, such as clubs and networking events, to formal initiatives such as internships, collaborative research, industrial PhDs and entrepreneurship projects (Duruflé Hellmann and Wilson, 2018). Austrian public universities have developed specific graduate paths to favour collaboration with external stakeholders. For instance, to pursue a doctoral degree in Austria, students can enrol either in traditional doctoral studies (*Doktoratsstudium*) or structured PhD programmes. The latter apply strict and standardised selection processes, involve a team of supervisors, are based on structured education and course work, and have theses evaluated by external reviewers (BNWF/FWF, 2010). One core objective of structured PhD programmes is to better integrate doctoral students into the scientific community and ensure active monitoring and supervision to guarantee independent and high-quality research (BMWFW and BMVIT, 2016; OECD, 2018).

The internationalised institution

HEIs increasingly compete and operate at the international level. For this reason, they often integrate an international or global dimension into the design and delivery of education, research and knowledge exchange. Internationalisation of HEIs is not an end in itself but a vehicle for change and improvement by learning from peers from other countries. International connections contribute to introduce alternative ways of thinking, questions traditional teaching and research methods, opens up governance and management to external international stakeholder, offer opportunities to exchange knowledge and collaborate with relevant partners (business, academia, public agencies, etc.) abroad. Therefore, it is linked very strongly to innovation and entrepreneurship.

In Austria, all HEIs consider internationalisation as an important dimension in their strategy and a way to improve their capacity to engage with stakeholders. Many participate in the Erasmus+ programme and engage in student mobility programmes to provide students with access to international experiences. There are some examples, such as the FH Upper Austria – a UAS – that is experimenting with a strategy that connects internationalisation and collaboration with businesses. The UAS helps partner firms to connect with HEIs located in countries in which they export their products or have other kinds of business.[3]

International mobility brings in new education and research ideas, develops intercultural connections and long-lasting partnerships (Appelt et al., 2015). In addition to attracting international staff and students, an innovative and entrepreneurial HEI actively encourages and supports the international mobility of its staff and students. It can promote, encourage and reward international mobility through exchange programmes, scholarships, fellowships and internships, for instance through European programmes.

Austrian HEIs are particularly active to support the international mobility of staff and student. Concerning staff, the attractiveness of the higher education system, although improving, could be increased. As highlighted by the OECD Innovation Review of the country (OECD, 2018), compared to countries leading in innovation, Austria's universities lag in major international rankings, undermining their ability to attract talented domestic and foreign researchers.

Austria HEIs contribute to several international research networks. Strategic international research partnerships are an important part of an HEI's entrepreneurial and innovation agenda. In some cases, Austrian institutions represent international research hubs. It is the case of the University of Vienna, the largest in the country and one of the largest universities in Europe. There are however also several smaller – specialised – universities that contribute to international research activities such as the BOKU and the Vienna University of Economics and Business, within the project CASE (Competencies for sustainable socio-economic development), where a variety of national and international co-partners have developed innovative ways of entrepreneurial teaching and learning.

International mobility of students is also a good feature of the national system. The mobility of Austrian students enrolled in tertiary level study programmes is above average among comparator countries (OECD, 2017a). In 2015, Austrian nationals studying abroad constituted 4.6% of all students enrolled in a bachelor's, master's or doctoral programme. Approximately 15% of all tertiary enrolled students in Austria (2015) come from abroad, a share surpassed only by Switzerland. However, a specificity of Austria is a relatively high share of German nationals enrolled in HEIs. This reflects geographic proximity, a shared language, push factors such as admission restrictions in Germany (in some fields such as medicine) and the high quality of life in Vienna and other Austrian university cities (OECD, 2018).

Some Austrian HEIs link their internationalisation strategies with entrepreneurship. For instance, taking advantage of the common language, some HEIs have joined networks with German and Swiss institutions to promote the entrepreneurial and innovation agenda. This is the case of the FH Campus Wien, which is part of the international network of universities of applied sciences, also encompassing UAS from Munich and Zurich. The three institutions have harmonised their curricula and are experimenting together to promote entrepreneurial teaching.[4] Another example is the Medical University of Innsbruck that is collaborating with a German technology transfer partner (a private company) to improve the capacity of the medical school to engage with the private sector and co-operate in research activities with firms. At the post-doctorate level, the University of Innsbruck participates in the Higher Education and Enterprise Alliance P2I-postdocs to innovators project. Besides the University of Innsbruck, this network encompasses the University of Cambridge, the Free University of Berlin, the University of Glasgow and the PSL-Paris University. Private sector partners include large multinational companies in the oil industry as well as other sectors. The aim of this project is to develop the entrepreneurial skills of postdoctoral students in all fields and create an academic and industrial network useful for their careers.

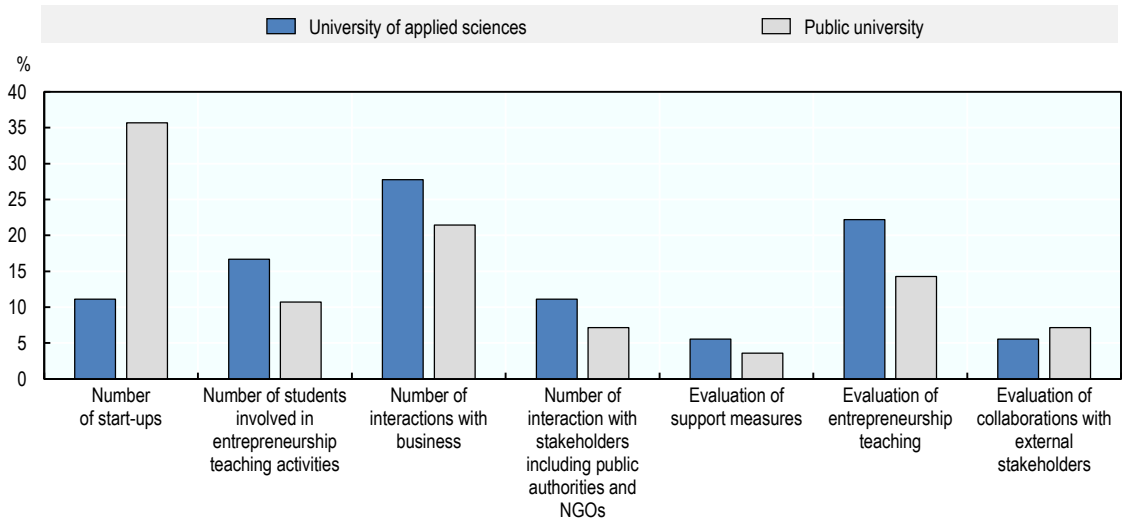
Measuring impact

Measuring impact is a transversal dimension within the HEInnovate framework. Innovative HEIs need to understand the impact of the changes they introduce in their institution and in the wider ecosystem they operate in. Innovative and entrepreneurial HEIs combine institutional self-assessment, external evaluations and evidence-based approaches.

However, impact assessment of innovation and entrepreneurship activities in HEIs remains underdeveloped. This is partly due to the fact that the currently available metrics typically focus on the number of spin-offs, the volume and quality of the intellectual property and of the commercialisation of research results. Such metrics do not take into account important factors such as teaching and learning outcomes, employability of graduates and labour market performance, the contribution to local economic development, graduate entrepreneurship and the impact of the broader entrepreneurial and innovation agenda such as social and cultural dimensions.[5]

Despite these common challenges, evaluation of engagement is gaining importance in Austria. Public authorities have set a system in which Austrian HEIs have to consider entrepreneurship and innovation activities in their strategies (see Chapter 3). Rectors and academic boards support evaluation activities to promote the sustainability of the entrepreneurial and innovation agendas in their respective institutions (legacy). Several HEIs have set indicators and methodologies to measure results and progress in their capacity to generate value for the economy and society. As in most countries, HEIs are challenged by the complexity and variety of engagement activities, as well as by the lack of quantitative indicators for some of these activities. Accordingly, HEIs tend to focus on quantifiable dimensions such as the number of start-ups generated by incubators and the number of interactions with business (Figure 2.9). There are however efforts to generate "narratives" of engagement and to create qualitative indicators assessing, for instance, entrepreneurship teaching.

Figure 2.9. Indicators to measure the impact of engagement



Note: HEI leaders responded to the following question: "What are the indicators that are measured or the dimensions that are assessed?". The total number of responses analysed was 21, of which 12 were from public universities, and 6 from universities of applied sciences (UAS). The survey response rates per HEI type are the following: public universities (81%), UAS (62%), university colleges of teacher education (100%). These response rates, however, need to be interpreted with caution as the survey design does not allow for the exclusion of multiple responses per higher education institution. In total, 45 responses were collected. The total number of higher education institutions in Austria is 67.
Source: OECD (2018b) HEInnovate Leader Survey Austria.

In general, the Austrian system is improving its capacity to assess the impact of engagement but some challenges remain. For example, specific efforts are devoted to monitoring and

evaluating the activities of incubators, including the outreach, take-up and role played by start-up/spin-off support across all faculties and departments. As a result, Austrian incubators are quite efficient and there is plenty of information about their overall performance and about the successful practices they pilot/implement. Conversely, there is no evidence about the evaluation of international activities of HEIs in relation to the entrepreneurial agenda. In the same vein, the evaluation of entrepreneurial teaching and learning activities seems to be limited. It would be important to develop indicators in these areas, also due to the increasing interaction and functions that HEIs are establishing with the specific focus to promote their capacity to engage and generate value for the economy and society in Austria.

Notes

[1] See http://openinnovation.gv.at/wp-content/uploads/2016/08/Open-Innovation-barrierefrei.pdf.

[2] For instance, according to Ecker, Reiner and Gogola (2019), large and long-term programmes, such as COMET and CDG, have played an essential role in promoting collaboration between HEIs and businesses.

[3] Based on information provided by Prof. Dr Andreas Zehetner, Vice President of International Affairs and Professor of Marketing at the FH Upper Austria.

[4] See https://www.fh-campuswien.ac.at/studium/internationales/inuas.html.

[5] The lack of an effective measurement of the impact of engagement activities is that – even in advanced innovation-intensive countries – there is no consensus on the metrics to use to assess many of these initiatives. In addition, due to the wide range of activities, there is no consensus about the timescale to use for measuring such impacts.

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Chapter 3. Leadership and governance in Austrian higher education institutions

This chapter focuses on the "leadership and governance" dimension of the HEInnovate Guiding Framework, as it applies to the case of Austria. This review clearly identified that national and regional authorities, as well as higher education institution (HEI) leaders, have made the entrepreneurial and innovation agenda their priority. Indeed, Austrian higher education institutions play a very active and substantial role in the development of their economic, social and cultural surroundings. Many show clear strengths in terms of their commitment to the entrepreneurial and innovation agenda. However, the review identified a need to introduce more flexible governance mechanisms and specific initiatives to strengthen the organisational capacity of institutions. This should promote their collaboration and engagement activities in the context of advancing the national entrepreneurial and innovation agenda. The chapter assesses all these issues and provides Austrian authorities with some recommendations.

Introduction

The entrepreneurial and innovation agenda facilitates greater interaction between HEIs, state agencies, industry, businesses and regional communities. Being embedded in these regional coalitions, Austrian HEIs generate value in terms of specific skills and knowledge products adding to the productivity and competitiveness of local businesses. Although Austria is a relatively small country, its regional diversity is noteworthy. For example, a high density of manufacturing small- and medium-sized enterprises (SMEs) exists in Tyrol and Upper Austria. These regions together provide a large share of Austria's exports. The region of Styria is the home of the Austrian automotive industry and has different social and economic structures compared with the rest of the country. Other regions are more rural and less connected at an international level. However, due to urban sprawl, some of these regions have been affected by population increases and are gravitating towards the main metropolitan functional regions (OECD, forthcoming).

The Austrian higher education system has consistently recognised the need to become more entrepreneurial and innovative with a view to supporting the economic, social and cultural development of their regions and the country. For example, Austria is an early adopter – and an international benchmark – of universities of applied sciences (UAS), which are providing science-driven, practically oriented higher education and application-oriented research. UAS complement the public universities offering of scientific research and research-oriented education.

The architects of the development of Austrian higher education policy recognise that strong leadership, good governance and adaptive organisational capacity are crucial to developing an entrepreneurial and innovative culture within the higher education system, including in higher education institutions. As a result, the Austrian Federal Ministry of Education, Science and Research agreed to participate in the second round of HEInnovate country reviews and had a particular interest in identifying ways to develop the leadership and governance capacity of HEIs with a view to enhancing their entrepreneurial and innovative capacity.

As discussed in Chapter 1, in recent years, Austria has been implementing a series of reforms in important areas of the higher education system. These include a new university funding model, the performance agreements with public universities and research, development and innovation (RDI) programmes focused on directing and supporting HEIs towards the development of a more entrepreneurial, innovation culture within their organisations (EC, 2018; OECD, 2017).

The Austrian HEInnovate national review seeks to identify systems and approaches to help shape the management and governance model in Austrian higher education institutes with a view to:

- raising awareness of the entrepreneurial and innovation agenda
- strengthening university interactions with businesses and society
- identifying what is required to facilitate the system, to do more in terms of engagement and entrepreneurial activity.

In order to provide recommendations to the national review group, this study employed the statements of the HEInnovate leadership and governance dimension below and described in more detail in Chapter 1, above, as the basis for enquiry.

- Entrepreneurship is a major part of the HEI's strategy.

- There is commitment at a high level to implementing the entrepreneurial agenda.
- There is a model in place for co-ordinating and integrating entrepreneurial activities across the HEI.
- The HEI encourages and supports faculties and units to act entrepreneurially.
- The HEI is a driving force for entrepreneurship and innovation in regional, social and community development.

Along with the above statements, the review process has also investigated some elements of the HEInnovate organisational capacity and impact assessment dimensions as they support and compliment aspects of the leadership and governance dimension. The remainder of this chapter explores the views presented by various stakeholders in relation to the above themes, in the context of examples of good practice and achievements, key challenges, recommendations and learning models for consideration.

Review findings

In terms of delivering on the entrepreneurial and innovation agenda within the Austrian higher education system, this review identified significant existing strengths and achievements in terms of leadership and governance. In particular, national, regional and HEIs stakeholders are implementing remarkable efforts to improve the level of co-operation within the system.

There is interest and support from external stakeholders in developing engaged HEIs

There is clearly an interest from state agencies and industry to have HEIs engaged in the entrepreneurial and innovative agenda. One important strength observed is the commitment of federal ministries, government agencies – such as the Austrian Research Promotion Agency (FFG) and the Austrian federal promotional bank (AWS), among others – and other external stakeholder groups, including business representatives, to the positive development of the entrepreneurial and innovation agenda in Austrian HEIs. Government agencies along with the private sector commit significant resources in support of this endeavour in a clear partnership-oriented approach.

In general, all actors in the higher education system have a positive perception of external agency interaction and industry/business interaction with HEIs. There are several examples of the importance of external agencies to the development of HEIs capacity to respond to local needs. These range from the support received – in particular, by UAS – from chambers of commerce in the development of programmes reflecting regional skills needs to the role of regional development agencies such as in Tyrol in supporting the local HEIs in their innovation activities.

Senior management support the entrepreneurial and innovation agenda

Across the higher education (HE) sector in Austria, the senior management has played an important role in embedding and supporting the entrepreneurial and innovation agenda within HEIs. In all of the HEIs visited, there was a clear understanding among the management teams of the need to deliver on the entrepreneurial and innovation agenda and to embed it in institutional strategies. In several institutions, rectorates were directly involved in leading and rolling out their institute's entrepreneurial and innovation strategy.

The modalities of engagement may change. In some institutions, there is a particular focus on start-ups and spin-offs. In others, the engagement agenda is more diverse and encompasses social activities. In general, however, there are many good practices of what being an entrepreneurial and innovative HEI means in practice.

Rationales behind engagement may also vary. Some of the public universities have responded to the "trigger" of the Federal Ministry of Education, Science and Research in the previous round of performance agreements, which included a first reference to engagement, and specifically to the HEInnovate framework to be used to create and improve institutional processes and organisational capacity to support and sustain the entrepreneurial and innovative agenda.

Several HEIs utilise central support structures to drive the entrepreneurial and innovation agenda closely linked to and often championed by senior management. This allows for institute-wide access spanning all faculties and department boundaries. In other instances, rectorates use their autonomy to: i) provide seed-investment in support of innovative pilot initiatives; ii) create technology transfer offices; and iii) secure partial ownership of incubators.

In other HEIs, very committed individuals have been successful in building boundary-spanning networks that have increased the visibility of and commitment for the entrepreneurial and innovative agenda across faculties (e.g. University of Vienna and BOKU). The University of Innsbruck is an example of how much positive influence the rector can have and, in the case of the Vienna University of Economics and Business, entrepreneurship is widely embedded.

Good practice examples include FH Campus Wien, Graz University of Technology, FH Upper Austria, the University of Innsbruck and the Management Centre Innsbruck. The specific approaches of the University of Innsbruck and the Graz University of Technology are discussed in Box 3.1 below.

Box 3.1. Examples of good strategic planning and senior management support for the entrepreneurial and innovation agenda in Austria

Graz University of Technology

In the Graz University of Technology, overall responsibility for the implementation of one of the university's key strategic projects, the Entrepreneurial University, lies with the rector and is supported by several vice rectors. The focus of the project, which is recognised in their 2016-18 performance agreement with the federal ministry, is on:

- Development of entrepreneurship education activities.
- Development of incentives and support infrastructure to promote the expansion of entrepreneurial and innovation activity in the university.
- Improving awareness and communication of available opportunities, activities and supports in the entrepreneurship and innovation arena.

The project is supported by a dedicated funding stream and has seen some notable new initiatives emerge during the course of its implementation, including:

- The creation of a new Maker Space, the largest in Austria, opened in 2018.

- Setting up the Start-up Garage programme for student entrepreneurs.
- Launching of entrepreneur training programmes with the regional chamber of commerce for students and alumni.
- The development of the Hidden Champions Recruitment Fair promoting employment opportunities in start-ups and SMEs to Graz University of Technology students.
- The creation of the TU Austria Innovation Marathon, at the Graz University of Technology.

University of Innsbruck

With the direct support of the rector, the university has established a *Projekt.service.büro* in 2000. The aim of this office is to support researchers in third-party funding acquisition and classical technology transfer activities (patenting, licencing). In addition, in 2016, the University of Innsbruck also founded the Transfer Centre for Science, Economy and Society, responsible for industry collaboration, knowledge transfer to society, spin-off support, equity management, as well as alumni work and career services. These two departments, located in the same office, work closely together and provide a full-service package regarding third-mission activities to all researchers. The University of Innsbruck is also the owner of a university holding, which has shares in more than 15 commercial spin-offs and provides support to founders as well as the CEOs of already established spin-offs. In 2016, the InnCubator, an entrepreneurship centre run together with the local chamber of commerce, was founded. The InnCubator offers co-working spaces, an incubation programme as well as a large maker's space for easy prototyping.

Examples include:

- Providing seed funding for new "ideas".
- *Found-Her Ideen finden Macherinnen*, a programme to support women who want to become entrepreneurs. This is an important issue in Austria, because women are underrepresented in scientific careers and among entrepreneurs.
- Helping with patenting and Intellectual Property Rights.
- Providing consultancy services to start-ups.

The transfer centre can use some of its revenues as seed funds for new and emerging innovative ideas and projects. This provides the centre with independence from other internal or external funding sources. In addition, both departments offer tailored services to students and staff, responding to needs in quick and flexible ways.

Interdisciplinary approaches in education and research

Technological progress and international competition are among the main drivers affecting economies and labour markets in OECD and non-OECD economies. Within this context, individuals need to develop transversal skills and the capacity to operate in a complex environment, with limited information. In other words, they often need to be creative to solve problems. Entrepreneurial and innovative HEIs can play a pivotal role in providing students with these transversal skills they can acquire in interdisciplinary curricula.

In Austria, all the case-study HEIs recognised this shift in skills development requirements and the need to move away from fragmented, discipline-specific silo structures. Some HEIs have been developing innovative organisation frameworks to facilitate interdisciplinary co-operation and cross-fertilisation. These holistic frameworks tend to counterbalance the forces pushing towards fragmentation.

HEIs have also been promoting interdisciplinary curricula in teaching and researching. The following sections provide some detailed information about the way in which Austrian HEIs have organised themselves to generate multidimensional teaching and research activities, connecting different thematic areas. The aim is to give students the possibility to attend programmes that are more comprehensive. In addition, research can benefit from connecting different scientific areas, including by generating new disciplines.

Interdisciplinary education programmes

Several HEIs have adopted integrated organisation systems in teaching activities. The University of Vienna has put in place "extension curricula" (*Erweiterungscurricula*) and "alternative extensions" (*Alternative Erweiterungen*) to give students the possibility to attend classes in different study programmes and faculties. In the same vein, at the University of Innsbruck, some curricula are based on "modules", which can be formed by mixing disciplines/programmes. The FH Campus Wien enhances interdisciplinary teaching and learning via open lectures in which different faculties collaborate.

These examples illustrate that several Austrian institutions have understood the need to help new graduates develop the way they think between and beyond disciplines, and work with new combinations of interdisciplinary knowledge. Current efforts promoting interdisciplinary teaching activities are focused at the undergraduate level. Box 3.2, below, provides selected examples of these approaches.

Box 3.2. Enhancing interdisciplinary teaching using novel organisational frameworks

University of Vienna

At the University of Vienna, the majority of bachelor's programmes and diploma programmes require students to complete their degree programme, including extension curricula (EC). An extension curriculum is a predefined module group comprising up to 30 ECTS credits. Almost all degree programmes offer extension curricula. This gives students the possibility to choose from a large range of extension curricula, outside of their degree programme.

Beside extension curricula, the University of Vienna provides students with the possibility to engage in alternative extensions (AE). Students have the possibility to complete alternative extensions comprising a maximum of 15 ECTS credits, instead of an extension curriculum (EC). Contrary to an EC, which is predefined, alternative extensions allow students to choose freely which courses or exams they want to complete as part of their degree programme. As a result, students can create their own modules based on their degree programme and other programmes.

University of Natural Resources and Life Sciences, Vienna (BOKU)

BOKU has put in place a mixed curriculum to help scientists develop skills in implementation (engineering) and management (economics). The university sees itself as an education and research institution dedicated to renewable resources with a vision of contributing significantly to the protection of existing natural resources for future generations. Hence, natural sciences, technology and socioeconomics are the three main disciplines delivered at the university. BOKU has a departmental organisational structure (15 departments) and a matrix organisation for study and research programmes with each of the 15 departments providing modules for multiple study and research programmes.

Each programme at bachelor level has four components of equal weight made up of modules from the three main disciplines natural sciences, technical sciences, economics and social sciences and the fourth component of the programme is made up of a mixture of the three main areas. The same philosophy applies to master's programmes, the only difference being in the weighting applied to each component (15% for each main area and 55% for the variable component). This approach makes for a dialogue among the disciplines in terms of programme development and equips graduates with the skills needed to think between and beyond the limits of disciplines and work with new combinations of knowledge.

University of Applied Arts Vienna (*Die Angewandte*)

The University of Applied Arts Vienna (*Die Angewandte*) has organised an interdisciplinary curriculum to offer programmes focusing on complexity, in all its different forms. This programme aims to generate a mix of qualitative and quantitative skills in students and to prepare them to adopt a problem-solving approach to complex societal and economic issues.

Existing organisational mechanisms, national strategies and funding models, however, have not facilitated the creation of graduates with interdisciplinary skills. For example, to implement interdisciplinary approaches in public universities, there is the need for the approval of the academic senate, which may result in a lengthy and difficult development process. Similarly, in UAS, the process of considering the input from business and industry in the development of new programmes can also take a long time due to existing accreditation processes. In addition, UAS develop their programmes in response to "programmatic calls" from the Ministry of Education, Science and Research. The introduction of calls for interdisciplinary programmes may spur interdisciplinary programmes in vocational institutions.

In addition, and as flagged by national stakeholders, a specific kind of interdisciplinary education may involve an approach to better integrate Austrian colleges for higher vocational education (among them *Höhere Technische Lehranstalten*, HTL) with HEIs, to leverage on their capacity to generate entrepreneurial skills. Colleges for higher vocational education are considered short-term tertiary cycles (ISCED 5), but are not considered as higher education by the national system. Emerging international practices illustrate, for example, the possibility of integrating ISCED 5 education with (professional) higher education (ISCED 6), such as UAS, to address regional skills needs (Box 3.3).

Box 3.3. Integrating ISCED 5 professional education with ISCED 6 professional higher education

The experience of the Polytechnic of Turin

The Polytechnic of Turin, an Italian public university, is experimenting the possibility of generating pathways between ISCED level 5 HEIs, called technical higher institutions (*Instituti Tecnici Superiori*, ITS) and the "professional bachelor's degree" (*Laurea professionalizzante*), which is a new degree (ISCED level 6) in universities, introduced in the academic year 2018/19.

The Polytechnic of Turin is an important regional actor. It co-operates with other institutional actors such as the regional government of Piedmont and the City of Turin. Taking advantage of its institutional capital, the polytechnic has been co-ordinating a regional roundtable to discuss the harmonisation of ITS curricula with its new professional bachelor's degree. The round table involves all the regional ITS specialised in manufacturing vocational education and training (VET), regional and local authorities, and other stakeholders, such as the regional branch of the national industrialist association, *Confindustria*.

Regional ITS involved in this policy dialogue should update their curricula to make them modular with the professional bachelor's degree offered by the Polytechnic of Turin. This will allow ITS graduates who want to get a professional bachelor's to attend only one final year at the Polytechnic of Turin.

In addition, the Polytechnic of Turin will co-operate with ITS to give its students access to ITS technical laboratories. Most ITS are equipped with modern laboratories provided by firms co-operating with ITS, to form individuals that are able to plug in immediately in their production processes. To achieve this result, firms have provided ITS with modern machinery tools that the institutions can use to train students. Thus, by co-operating with ITS, the polytechnic gains access to their facilities.

The Italian experience illustrates the possibility of integrating professional education at ISCED 5 and 6. The aim is twofold: streamline educational pathways and provide individuals with the possibility to move from one education ladder to another; generate new skills that will help local firms be more innovative and productive.

Source: OECD (forthcoming), *Supporting Entrepreneurship and Innovation in Higher Education in Italy*, OECD Publishing, Paris.

Interdisciplinary research

Efforts to embrace interdisciplinary approaches also include research activities carried out in Austrian HEIs. There are several examples in which researchers are encouraged to leave the "comfort zone" represented by their own discipline and contribute to research groups encompassing different faculties.

These efforts have generated novel organisational structures within universities. For instance, large universities such as the University of Vienna, have created new "research platforms" that encompass several faculties. Smaller universities, such as BOKU, implement interdisciplinary research by promoting the shared use of scientific equipment. In addition, at BOKU, doctoral students from different disciplines can interact and generate shared research programme. Finally, the interdisciplinary approach is also at the basis of the creation of the Complexity Science Hub Vienna (Box 3.4).

Box 3.4. Enhancing interdisciplinary research activities using novel organisational frameworks

University of Vienna

The rectorate at the Vienna University promotes innovative, interdisciplinary research collaborations through the establishment and funding of "research platforms". The initiative is open for academics and research groups from various disciplines and faculties to submit an interdisciplinary project in response to competitive calls. The calls have no set topic and applications are reviewed by an international panel. These platforms are set up for a duration of four years.

University of Graz

The University of Graz explicitly funds and supports "unconventional research" and interdisciplinary research efforts. Thus, regarding its organisational capacity, University of Graz offers a master's programme in innovation and a number of professorial chairs are dedicated to the innovation topic. This is the case of a new professorial chair for technology and innovation law (the appointment procedure is currently ongoing) or a chair for innovation and transition research or innovative teaching design.

Endowed professorships are a new and important instrument for strengthening Styria's position as a research and business location. The regional government grants funding to outstanding (young) scientists working in highly innovative interdisciplinary research fields and using new teaching concepts. The aim is to create a "Styrian Science Space".

This funding model, which has been piloted in Styria, requires that a second institution acts as a partner, provides a strong incentive for co-operation and has attracted interest throughout Austria. The funding is not restricted to specific subjects and can support all scientific disciplines.

University of Natural Resources and Life Sciences, Vienna (BOKU)

The organisational structure of BOKU, which is set in a development plan, follows an interdisciplinary approach. Research and teaching in the 15 departments are organised according to problems and processes, demanding the creation of interdisciplinary platforms. These platforms depend on solid disciplinary scientific competencies, comprising eight broad "fields of competencies" across BOKU. In general, research and teaching at BOKU follow the "three-pillar-principle", enabling interlinking of natural sciences, engineering and socioeconomics.

The Complexity Science Hub Vienna

Inspired by the Santa Fe Institute in the United States, the Complexity Science Hub Vienna (CSH) was founded in 2015. Founding members of CSH were the Technical Universities of Vienna and Graz, the Medical University of Vienna and the Austrian Institute of Technology AIT. By 2019, the hub has gained four more members: Vienna University of Economics and Business, the International Institute for Applied Systems Analysis (IIASA), the Danube University Krems and the Austrian Chamber of Commerce (WKO).

The idea behind the hub is that by interacting with each other, elements within systems mutate. These interactions change the components and the system. Tools and methods developed by complexity scientists help understand the dynamics of co-evolving complex systems. CSH scientists and affiliates are dedicated to making sense of complexity through data analysis (Big Data) in ways that are valuable for science and society.

The CSH operates within an international network of renowned international complexity science institutions, such as the Santa Fe Institute, the NTU Singapore Complexity Institute, the Arizona State University, and Institute of Advanced Studies Amsterdam. The constant exchange stimulates an optimal flow of ideas and people, who work together on the most pressing questions of our times (www.csh.ac.at).

Despite the good practices, there are still challenges facing HEIs that want to set up interdisciplinary research activities. This is a shared challenge in all academic research systems, not only in Austria. For example, the incentive system supporting research favours specialisation rather than interdisciplinary approaches. Peer reviewing favours the creation of homogenous scientific communities, which represent silo structures. The Complexity Hub is an attempt to overcome this structural challenge. There also remains the problem of the sustainability of funding for this holistic approach to basic research.

Strategic collaboration between higher education institutions and with other entities

In Austria, there are several examples in which HEIs have engaged in strategic collaboration with their peers to promote teaching, research and engagement activities. Significant HEI-HEI collaborations were also observed to exist at a regional level and for the benefit of regional development. There are several examples of these strategic collaborations, including the following:

- The Science Space Styria, which encompasses five public universities, two universities of applied science and two colleges of education into a regional network of HEIs. This regional platform co-ordinates initiatives among HEIs and capitalises on synergies. The aim is to make Styria a location for science and research activities.
- The Vienna Children's University is an important example of collaboration among HEIs focusing on scientific communication. In the Children's University, children can experience the university by attending lectures and workshops, getting in touch with scientists, planning a curriculum and even graduating. Since 2003, several Vienna-based HEIs have opened their doors to more than 4 000 children aged 7 to 12, during 2 summer weeks. To date, the institutions participating in this initiative are the University of Vienna, the Medical University of Vienna, the Technical University of Vienna, the Vienna University of Natural Resources and Life Sciences, the University of Veterinary Medicine, the FH Campus Wien and the Vienna University of Economics and Business.
- Collaboration between the Salzburg-based universities to pool together teaching activities. In particular, students for the Paracelsus Medical University (PMU) can attend some classes, including chemistry, physics and biology at the University of Salzburg. In addition, the PMU and the University of Salzburg (Natural Sciences),

with the support of the University Clinics of the Province, are involved in a strategic programme to promote the regional specialisation in the Life Science Sector.

- The NAWI programme in Graz depends on the collaboration between two Graz-based HEIs, which have joined forces to provide students and researchers with interdisciplinary curricula and programmes. After more than a decade, the two universities have integrated the joint programme into their core budget. The collaboration has spurred a series of research partnerships and other interactions between the two HEIs (Box 3.5).

Box 3.5. Collaboration between HEIs

The NAWI programme in Graz, Austria

In 2004, the Graz Technical University and the University of Graz decided to harmonise their scientific disciplines in both institutions, generating a joint venture. The goal was to place scientific teaching and research at an international level and so NAWI Graz was established, a strategic co-operation in the natural sciences. It covers five subject areas: bioscience; chemistry; earth, space and environmental sciences; mathematics; and physics. Initially with a focus just on teaching, its aims have subsequently broadened significantly to include research. Currently, it involves a significant commitment to co-operation, involving 36 departments at both universities, with 450 research projects per year, third-party revenue in the region of EUR 31 million, 17 jointly appointed professors, and 7 jointly appointed NAWI Graz Fulbright professors.

There are 5 300 students enrolled at bachelor's and master's levels, across 6 bachelor's and 15 master's programmes (of which 7 are in English). Students decide where they want to be enrolled either at the University of Graz or Graz Technical University, often depending on the discipline. It also has allowed for students to design their own individual study programme. Students have been able to approach professors to discuss an area of interest for which a programme does not exist and an individualised curriculum has been developed for them. This form of curricular entrepreneurship means that such a student may be the only person with a degree in this particular area of their interest. Rather than the governance change of merger, NAWI Graz illustrates the opportunities to generate something new through such a structure of co-operation, both for the institutions and for students.

Collaboration also takes place between HEIs and other entities, and in particular local governments, chambers of commerce, regional development agencies and other relevant stakeholders. In particular, Austria has developed specific policies to facilitate the interaction between HEIs and businesses. For instance, Christian Doppler (CD) laboratories are research units within public universities that perform basic research, based on applications received by businesses. In the same vein, Josef Ressel (JR) centres are research units hosted at the UAS and designed to perform application-oriented applied research (CDG, 2018).

Many Austrian stakeholders, including business representatives, consider the development of interdisciplinary programmes of paramount importance for the entrepreneurial and innovation agenda but challenges remain. In particular, the new university funding system is based on discipline-specific costs and it could be difficult to determine the costs, or the

appropriate weighting, of an interdisciplinary programme. Several representatives from specialised universities expressed their concerns about this situation.

Areas for further policy and institutional development

Austria's higher education system is going in the right direction in terms of engagement and value creation; however, certain actions could improve this evolution. This section identifies four strategic areas in which stakeholders could promote further improvements: the funding system (supporting the entrepreneurial agenda); the strategic planning and performance agreement; the governance models; and, finally, the programme development framework.

Funding for the entrepreneurial and innovation agenda

The Austrian Ministry of Education, Science and Research has introduced a new funding model for public universities for the performance agreement 2019-21. The new model puts additional resources into the system (OECD, 2018). In particular, funds are allocated to three pillars: i) teaching; ii) research (for research universities) and advancement and appreciation of the arts (for the universities of art); and iii) infrastructure and strategic development.

- For the first pillar ("teaching"), the basic indicator is the number of active students, i.e. students in degree programmes who actively take exams (student places). In addition, two "competitive indicators" are used to provide specific incentives in each of the two pillars. For teaching, the competitive indicators are the number of graduations in regular bachelor's, master's and diploma programmes and the number of studies actively pursued by students.
- For the second pillar ("research/advancement and appreciation of the arts"), the basic indicator is the number of scientific and artistic personnel. For research, the competitive indicators will be third-party funding revenues and the number of doctoral students in employment. The reference value for these basic indicators of the first and second pillars are agreed upon in the negotiations of the performance agreements. These reference values will determine the indicator-based part of the global budget for each university.
- The third pillar (infrastructure and strategic development) – in addition to payments for buildings, additional clinical cost and funding of special areas such as art galleries etc. – comprises strategic funds for new incentives and direct investment in areas that cannot be unambiguously assigned to one of the first two pillars, e.g. the social dimension or digital initiative.

Although, in general, stakeholders have a positive attitude towards the new funding model, there are some possibilities for improvement. As mentioned in the previous section, discipline-specific HEIs have expressed concerns about the possibility of being penalised by a funding system that takes into account the historic costs. The new system will determine an average unit cost by discipline to be applied across the system, which will then be used in the calculation of the overall budget of an institution. The aim is to increase transparency in funding allocations and to take into account differing costs associated with the delivery of different disciplines.

There is no doubt this approach will work well for multi-discipline universities and will assist in driving new and emerging system strategies. However, in the Austrian system, a number of discipline-specific institutions exist in areas such as economics and the arts. Some institutions and their associated disciplines have most likely the lowest unit costs by discipline and thus act as the base level discipline for comparison purposes in the unit cost model. Hence, their budgetary position will invariably be among the lowest in the system, under the new model. In the case of universities of arts, the number of students who actively take exams is high and the budgetary effect of enhancement may be limited.

The new funding model does not allocate specific additional resources to third-mission activities, these depend on specific programmes and projects (Box 3.6). As noted by Clark (1998), engagement remains a peripheral activity of universities until institutional change within the higher education system provides resources for long-term and stable funding streams.

Box 3.6. Programmes and projects supporting engagement in Austria

PPPs developed by the Christian Doppler Research Association (CDG): CD laboratories and Josef Ressel (JR) centres

The Christian Doppler Research Association (CDG) has developed a public-private partnership model to promote co-operation between business and HEIs. Based on this approach, the CDG created CD laboratories and JR centres, which work respectively in public universities and UAS. The CDG supports the creation of these temporary entities directly within HEIs to avoid the disadvantages of creating new structures and bureaucracies (OECD, 2018). CD laboratories and JR centres have become gateways for businesses to get in contact with basic research or applied research. At the same time, the exposure to the research queries coming from the business community helps HEIs develop their research expertise (FHK, 2018). For example, JR centres can run for up to 5 years with an annual budget of about EUR 400 000. JR centres' specialisation depends on research-applications received from the private sector. JR centres currently operate into two research clusters: i) mathematics, informatics and electronics; and ii) non-metallic materials.

Co-operation with business has generated valuable additional resources for UAS. In 2015, the UAS obtained revenues from R&D co-operation amounting to EUR 40 million (FHK, 2018). The business sector financed R&D at UAS with EUR 13 million (13% of all R&D performed at UAS, compared to 4.8% for universities (Statistics Austria, 2017).

Sources: OECD (2018), *OECD Reviews of Innovation Policy: Austria 2018*, OECD Reviews of Innovation Policy, https://doi.org/10.1787/9789264309470-en; FHK, 2018; Statistics Austria, 2017.

Financing engagement through a parallel funding system based on programmes and projects, as in Austria, is common in OECD countries. There are countries, however, that have put in place a bundle of co-ordinated programmes and projects that have generated a high level of engagement impact. For instance, Ireland has developed the New Frontiers Programme (Enterprise Ireland, 2018) and the Springboard programmes (Higher Education Authority, 2018). Particularly relevant is the Dutch experience with the Valorisation Programme, which represents a systemic effort to promote the engagement agenda in the higher education system of that country (Box 3.7).

Box 3.7. Successful international practices concerning programmes and projects supporting engagement

The Irish approach: New Frontiers and the Springboard programmes

New Frontiers is Ireland's national entrepreneur development programme delivered at the local level by universities/institutes of technology and funded by Enterprise Ireland. The programme started in 2012. It provides help and support to individuals who have developed an innovative business idea and are planning to run their own company. New Frontiers aims to accelerate business development and equip entrepreneurs with skills and contacts they need to succeed in their enterprise. In practice, the programme trains new entrepreneurs, give them access to incubator facilities, mentoring and networks. The programme grants scholarships of up to EUR 15 000.

The Irish government launched the Springboard programme in 2011 as part of the Government's Jobs Initiative. It complements the core state-funded education and training system. In particular, Springboard provides free or 90% funded upskilling and reskilling higher education opportunities in areas of identified skills needs. The programme has broadened its scope since it started. For example, in the beginning, the initiative's primary target group was unemployed people with a previous history of employment. Over recent years, due to the improvements in the labour market, Springboard aims to provide new skills to people in employment.

The Netherlands' Valorisation Programme

Between 2010 and 2018, the Dutch government has provided significant funding to entrepreneurship and innovation activities in HEIs through the so-called Valorisation Programme.

The valorisation – or value creation – agenda has had many benefits. First, it has supported the introduction of new staff profiles and initiatives to broaden career paths for HEI staff (e.g. policy advisors). Second, it supported an increase in collaboration between HEIs, joint initiatives with city and regional governments, and boosted research activities in universities of applied sciences. Third, "valorisation" has also enhanced interdisciplinarity, with further stimulus from the 2016 Dutch Research Agenda. Finally, a key part of the valorisation agenda involves supporting start-ups by staff and students.

Sources: OECD/EU (2018), *Supporting Entrepreneurship and Innovation in Higher Education in The Netherlands*, https://doi.org/10.1787/9789264292048-en; Department of Education & Skills (n.d.), *Upskilling and Reskilling - Higher Education*, https://www.education.ie/en/Learners/Information/Upskilling-and-Training-options/Springboard.html; Enterprise Ireland (2018), *New Frontiers – Support for Irish Startups*, https://www.newfrontiers.ie/. (Accessed on May 2019)

Public investment in research and development (R&D) represents another important source of funding in Austria for the entrepreneurial and innovation agenda. The federal government has actively promoted R&D in the country, since the end of the 1990s. At that time Austria's R&D intensity (aggregate R&D expenditure as a percentage of GDP) was below the OECD average. Since then, Austria's R&D expenditure has increased considerably and much faster than in other OECD countries (OECD, 2018; BMWFW/ BMVIT, 2017).

The increase in R&D investment, however, was not paralleled by a proportional increase in investment in research infrastructure and in basic research. Similar to other countries, during the long economic downturn, capital investment plans in research infrastructure were also postponed in Austria. The economic recession also affected investment in basic research activities.

These unavoidable investment circumstances may have hampered the capacity of Austrian HEIs to capitalise on the national agenda supporting innovation. Given the importance attached by federal authorities to the expansion and development of R&D and innovation capacity and considering the return to a more positive economic outlook, Austrian authorities should consider adopting a more holistic approach to investment in research and innovation. For example, they could review the level of investment required. As part of this review, priority areas, proposed outputs and impacts, and the structure of the associated competitive calls to support any additional investment in research infrastructure could be examined. In a similar vein, it would be important to assess and eventually increase investment in basic research activities, especially in competitive funding of R&D and research infrastructure.

Strategic planning and performance agreements

Austrian public universities negotiate performance agreements with the federal ministry to facilitate the alignment of the individual strategy with the overarching goals of the higher education system. Performance agreements (PAs) are contracts signed between funding authorities and individual universities. PAs are common in many OECD countries.

Performance agreements could support HEIs engagement more efficiently. Austrian public universities develop their strategic plans following a format suggested by the Federal Austrian Ministry of Education, Science and Research within the context of the performance agreements process. This approach facilitates the harmonisation between national and individual strategies, but it also generates a certain degree of "standardisation" in the university strategies, which, in turn, reduces the capacity of a given university to reflect the features of its ecosystem.

To improve the capacity of performance agreements to generate individual HEI strategies, which also deliver on national objectives, Austrian authorities could consider adopting a two-part discussion and including international peers. In the first part of the discussion, Austrian HEIs should be free to develop their own strategic plan – as opposed to following a prescribed template. The strategic plan should also emphasise how the individual strategy will deliver on national objectives. In the second part of the discussion, the parties could discuss financial issues and performance statistics. Both discussion elements would contribute to the final performance agreement between the university and the ministry.

Some international practices could inspire new performance agreements between the federal ministry and HEIs. For instance, the Irish Higher Education System Performance model utilises international peers as part of their process and allows HEIs to develop their own unique strategy (Box 3.8).

Box 3.8. Irish Higher Education System Performance Framework Process

The Irish Higher Education System Performance Framework has six key system objectives:

1. Provide a strong talent pipeline combining knowledge, skills and employability, which responds effectively to the needs of our enterprise, public service and community sectors, both nationally and regionally, and maintains Irish leadership in Europe for skill availability.
2. Create rich opportunities for national and international engagement, which enhances the learning environment and delivers a strong bridge to enterprise and the wider community.
3. Excellent research, development and innovation that has relevance, growing engagement with external partners and impact for the economy and society, and strengthens Ireland's standing to become an innovation leader in Europe.
4. Significantly improve the equality of opportunity through education and training and recruits a student body that reflects the diversity and social mix of Ireland's population.
5. Demonstrate consistent improvement in the quality of the learning environment with a close eye to international best practice through a strong focus on quality and academic excellence.
6. Demonstrate consistent improvement in governance, leadership and operational excellence.

Each system objective has several high-level targets, which the HE system are asked to deliver on through a range of national and regional policy initiatives. The framework process involves the HEIs completing and submitting performance agreement documentation to the Higher Education Authority (HEA) for consideration, discussion and agreement. The HEI submissions are expected to reference their approach to delivering on key system objectives and associated targets in the context of their individual strategic plans developed in association with stakeholders at a regional level. The discussion process with the HEA involves both a strategic discussion involving a panel of international peers drawn from research universities, UAS and HE representative bodies and a budgetary and metrics discussion. The inclusion of a strategic discussion, as opposed to a metrics only discussion, led by international peers, facilitates more open dialogue and a greater understanding of the approach being taken by HEIs to meeting national objectives set in the performance framework.

As in most OECD countries, it is also proving difficult in Austria to account for engagement and value generation when measuring the performance of HEIs. If one considers the kind of documentation that HEIs have to provide and terms of the negotiation, it appears that the performance agreement process focuses on funding issues and statistical metrics collected for system-wide performance purposes.[1] Too often, measurement activities rely upon input indicators, rather than considering outputs.

The evaluation system assessing the performance of Austrian HEIs should take into account both economic and societal variables. The current evaluation system of public universities is based on an accounting tool combining a quantitative metric, comments on the development of indicators and a qualitative report on performance and achievements (*Wissensbilanz*).

It would be possible to improve this measurement approach by adopting more structured evaluation processes, in which evaluators go on field visits and interview stakeholders, including those outside of HEIs. These tailored evaluation processes, financed by the performance agreement process, could generate qualitative indicators and use impact assessment templates to develop narratives related to a specific practice. The results of these evaluation exercises could inform performance agreements as well as government policy and investment decisions. Importantly, intelligible evaluation results, which outline successful practices (explaining the way and the context in which these have been implemented) could inspire other HEIs, thus spreading good practices within the system.

Some national impact monitoring approaches are pointed in the right direction and Austria could also take into account international experiences. The Vienna University of Economics has developed "impact maps" to display its own capacity to generate value. At an international level, several countries have been progressing in this policy agenda. The Netherlands has developed a successful evaluation practice in connection with the Valorisation Programme, discussed above. A multidimensional framework based on qualitative and quantitative indicators guides evaluation activities in research universities and UAS (Box 3.9). Importantly, monitoring and evaluation activities involve a large number of stakeholders and intermediary institutions to generate consensus and co-operation.

Box 3.9. Monitoring and evaluation indicators: Pioneering practices in the Netherlands

In 2010, the Dutch government commissioned research work to develop a list of generic indicators to measure valorisation performance. The indicators had to be applicable in a wide variety of settings, on several levels and for a variety of evaluation goals. The authors soon discovered that there was no ready-made set of indicators that matched the broad definition of valorisation. They were also critical of the use of patent counts as an indicator of valorisation, arguing that the broader societal and economic use of scientific knowledge needs to be taken into account.

Combining quantitative and qualitative indicators, the research proposed a comprehensive four-dimensional framework that could be applied in various situations, including research universities and the UAS. Furthermore, greater attention needs to be paid to the process of valorisation (viewed as a process of interaction during all stages of research rather than just the transfer of knowledge at the end of a research project) when trying to measure valorisation performance, rather than simply considering output indicators.

Since its publication in 2011, the framework has been used in a variety of ways, including for the award of competitive research funding, and has been discussed in parliament. It is credited with having moved valorisation measurement discussions away from focusing only on quantitative indicators of researcher and research organisation performance to a broader, more process-oriented approach that includes other actors as well.

Sources: van Drooge, L., Spaapen, J., (2011), "Introducing "productive interactions" in social impact assessment." *Research Evaluation*, No 20, 211–218; OECD (2014), OECD Reviews of Innovation Policy: the Netherlands, OECD Publishing, Paris.

Governance models

Since 2002, Austrian public universities have a multidimensional governance system based on the senate, the rectorate, and a university council (*Universitätsrat*, see also Chapter 1). The senate governs academic matters, such as authorising and supervising courses and curricula offered by universities. The rectorate and the university council are in charge of strategic decisions. A peculiar feature of the Austrian model is that the rectorate, as a collegial governing body, is on an equal footing with the board/council- and senate-type bodies (Bennetot-Provot, Estermann, 2018).

As the entrepreneurial and innovation agenda requires public universities to become more open to external stimuli, the nature of the relationship between research university management and existing senate structures could be reconsidered. Several stakeholders, including those outside the higher education system, reported that the current senate structures and approaches are too traditional and do not consider current and future national and regional economic, social and cultural needs. For example, the resistance of the senate can hamper the capacity of some Austrian public universities to put in place interdisciplinary curricula or trans-disciplinary research platforms. In some cases, this situation causes that new strategies often progress without the formal engagement of senate members and structures: the management tries to bypass the senate to innovate.

Participation by industry in the governance of HEIs takes different forms and improvements in the speed of response of universities and the development of standard agreements for co-operation are areas requiring further attention. To ensure the continued success of co-operation between HEIs and their regions, consideration should be given to strengthening university and external stakeholder engagement at the regional and national levels.

A more transparent and targeted selection of the members of the university councils could support engagement more effectively. These boards are governing bodies with competencies for strategic decisions, including budget and co-operation, so they have a key impact on the innovation and engagement agenda of HEIs. Several national stakeholders discussed the possibility of improving the selection process of members to provide university councils with expertise and representativeness. In the current system, the university and federal government select board members in equal proportions. However, the selection process does not guarantee that external members have the right competencies to support key HEI functions, including engagement and value creation. Accordingly, a more transparent procedure – e.g. based on a grid of competencies – to select council members appointed by the government could help improve the performance of university councils and their contribution to the entrepreneurship and innovation agenda.

With a view to ensuring that all relevant internal stakeholders engage constructively in developing the entrepreneurial and innovation strategy within universities, it would be important to develop system-wide guidelines and codes of practice for engagement between university management and senate structures. New guidelines and codes of practice should emphasise the need to develop a co-operative approach between management and senate structures. This co-operative approach should support the delivery of an entrepreneurial and innovation strategy. The development of guidelines and codes of practice could be a project co-ordinated by Universities Austria (*uniko*) with support from the federal ministry. There are already some good practices in the Austrian system that the federal minister could capitalise on and extend to all stakeholders. These good practice models for collaboration between management and senate structures were observed as part of this review in the *Angewandte*, the University of Applied Arts in Vienna, the Vienna

University of Economics and Business, the BOKU in Vienna and the University of Vienna. Similar experiences have been implemented in the Vienna University of Economics and Business and in the University of Vienna. In all these cases, there was good co-operation between the senate and management.

Programme development frameworks

Austrian HEIs could pilot and scale-up new approaches to teaching and researching that are relevant to the entrepreneurial and innovation agenda in the HE system. Attention should be paid to a strategic renewal of teaching, integrating the use of digital instruments and strengthening of intersectoral co-operation between UAS and universities. The aim of the higher education system should be to mainstream entrepreneurship and engagement across HEI missions and activities. To achieve this result, HEIs would benefit from the support of federal authorities, which could introduce new competitive cross-sector funding calls focusing on interdisciplinary study programmes and HEI-HEI collaboration, including between public universities and UAS. In addition, regional authorities could support the piloting of regional initiatives.

Austria is already home to good regional experiences, such as the Styrian Science Space discussed above, and stakeholders could consider some successful international practices. For instance, Ireland put in place a Strategic Innovation Fund (SIF) to support reform in higher education. The SIF was a multi-annual fund deployed between 2006 and 2011, which supported innovation, collaboration and reform in higher education. Through SIF, the Irish government supported projects aimed at improving teaching and learning, supporting institutional reform, promoting access and lifelong learning, and the development of fourth-level (postgraduate) education.

In addition, at the subnational level, Ireland has created Regional Skills For a, which facilitate greater interaction between HEIs, other state agencies, industry, businesses and the community in course development and dual learning activities required to meet regional skills needs (Box 3.10).

Improving programme development and accreditation is also important for Austrian UAS. In their case, flexibility and rapidity in programme development and accreditation are essential to delivering on the entrepreneurial and innovation agenda. Currently, UAS have programme rather than discipline accreditation. This can act as a barrier to their ability to respond to industry and business needs. Federal authorities could consider the possibility of granting UAS delegated authority to make awards in specific areas where they have an established “track record” or where there are identifiable industry needs. In addition, promoting collaboration between public universities and UAS in the form of research consortia and collaboration in doctoral education would strengthen the academic and research capacity of UAS and their associated regions.

Programmes for professional vocational education could facilitate the development of a ladder system of qualifications. This would add flexibility to the system and allow individuals to enter and exit from higher education according to their needs – with a positive impact on progression and completion rates – and facilitate lifelong learning.

Box 3.10. The Regional Skills Fora in Ireland

The Network of Regional Skills Fora, which was recently created as part of the Irish Government's National Skills Strategy, provides an opportunity for employers and the education and training system to work together to meet the emerging skills needs of their regions. More structured engagement on the skills agenda and the work of the fora will contribute to better outcomes for learners and support enterprise development.

The fora provides:

- a single contact point in each region to help employers connect with the range of services and supports available across the education and training system
- more robust labour market information and analysis of employer needs to inform programme development
- greater collaboration and utilisation of resources across the education and training system and enhancement of progression routes for learners
- a structure for employers to become more involved in promoting employment roles and opportunities for career progression in their sectors.

The advantages of applying the above learning models in Austria include ensuring stakeholder participation in the development of national and regional strategies, the setting of goals on a collective basis and participation by stakeholders in the delivery and monitoring of progress, thus promoting a partnership approach to national and regional development agenda.

Source: Department of Education and Skills (n.d.), *Regional Skills - Partnership for Skills*, https://www.regionalskills.ie/. (Accessed on May 2019).

As is happening in other OECD countries, there are also some examples of public universities in Austria that have put in place interdisciplinary doctoral programmes going beyond "research-only" practices. These PhD programmes offer geographical/ intersectoral mobility within the framework of international collaborations with other HEIs or business and enterprise partners. The aim is to help students develop transferable skills that can give them the possibility of accessing employment opportunities outside academia. This approach, however, is not generalised, nor developed to its full potential. With a view to assisting in the development of doctoral schools, specific training programmes for PhD supervisors could ensure uniformity in the quality of research supervision across the system and strengthen the capacity of doctoral programmes to affect the entrepreneurial and innovation agenda.

Universities of applied sciences do not award PhDs; however, they have developed a substantial quality and critical mass of output in applied research. Business stakeholders support directly the research activities of UAS, illustrating the importance of demand for applied research in the national productive sector. This arrangement, however, does not guarantee the sustainability of research activities, as budgets allocated to research groups are volatile. Several representatives from UAS met during field visits have flagged their ambition to develop industrial doctorates, in order to engage with business counterparts in applied research activities in a sustainable way and offer students a full range of educational possibilities.

Conclusions and recommendations

Austrian higher education institutions play an active role in the economic, social and cultural development of their regions and country. Many have become more innovative and entrepreneurial in their approaches to education, research and engagement, and show clear strengths.

The capacity (and will) of HEIs to effectively engage with the economy and society, however, still depends on how developed the surrounding economy is in terms of the size and age of firms, the types and amount of business innovation, and the industry structure, as well as the societal challenges to which higher education research can provide solutions. At the same time, the governance arrangements, organisational capacity and the institutional culture of an HEI are key determinants of the entrepreneurial and innovation agenda. Whereas the first set of conditions is boundary setting and largely outside the control of HEIs and change occurs slowly, the second set of conditions is controllable.

Main recommendations

- Provide greater recognition and additional support funding for the entrepreneurial and innovation agenda. This could be achieved by introducing further improvements in the new university funding model, which would provide greater recognition and additional support funding for entrepreneurial, innovation and third-mission activities within the HE system.
- Review the level of available funding for R&D infrastructure and basic research in the context of developing the HE system's entrepreneurial and innovation agenda. This review should consider the level of investment required, priority areas, proposed output and impacts, as well as the structure of the associated competitive calls to support additional investment in research infrastructure and basic research.
- Strategic planning and performance agreement processes need to evolve with a view to allowing for a more entrepreneurial and innovative approach. In this regard, the use of an international peer panel in the performance agreement process could be considered.
- Incentivise collaboration between HEIs in the areas of interdisciplinary programmes, joint research consortia between UAS and research universities, and regional initiatives in education (e.g. lifelong learning) and/or research.
- Generate an impact measurement system for HEIs with both quantitative performance indicators and qualitative analysis methods to help HEIs generate narratives of their impact on their respective ecosystems. Improving impact measurement would generate a platform for good practice and incentivise sustainable investment and support for entrepreneurial activities within the HE system.
- Develop system wide guidelines and codes of practice for engagement between university management and senate structures through a process facilitated by the university representative bodies.
- Introduce greater connectivity in doctoral programmes with the entrepreneurial and innovation agenda by improving the design and implementation of programmes in this area. Introduce training programmes for PhD supervisors. Incentivise the creation of joint research consortia of UAS, public universities and industry and

business partners. These consortia could award PhDs in relevant applied research areas.

- Adopt a more structured approach to engagement with industry, businesses and local communities at the regional level by developing regional skills and industry focus groups to support and guide the entrepreneurship and innovation agenda.
- Introduce additional undergraduate entry programmes (ISCED 5, short cycle HE). Two-year short-cycle higher education programmes could grant access to a bachelor's programme and to a bachelor's degree. This would allow for the development of a ladder system of qualifications. Participants could enter and exit the system on a more flexible basis. This would facilitate lifelong learning. In addition, associated degrees may yield a better skills match in the labour market.

Note

[1] See https://link.springer.com/chapter/10.1007/978-3-319-77407-7_40.

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Chapter 4. Entrepreneurial teaching and learning in Austria

This chapter focuses on the "entrepreneurial teaching and learning" dimension in Austria. Entrepreneurship education is not only about starting a venture or running a business. It is a holistic activity, whose main aim is to provide students with an entrepreneurial mindset (problem-solving capacity, team-working experiences, creativity, capacity to handle complexity, etc.). Importantly, entrepreneurship education gives higher education institutions (HEIs) the opportunity to be more flexible and generate interdisciplinary curricula and engage with external stakeholders, which can provide students with real-life experiences. From this perspective, the chapter assesses the performance of the Austrian higher education system and discuss Austrian case studies. It identifies some challenges and provides some Austrian stakeholders with recommendations.

Introduction

Entrepreneurial teaching and learning top the agenda of the higher education (HE) system in Austria. National stakeholders have selected this dimension – out of the eight listed in the HEInnovate framework – as a focus in this chapter. Field visits confirmed the importance of this dimension at the level of HEIs: all case studies take entrepreneurship seriously. HEIs have integrated entrepreneurship in their development strategy to promote interdisciplinary teaching and research activities, as well as engagement. This is in line with the national strategy to strengthen the linkages between science and industry (OECD, 2018).

Initiatives to encourage entrepreneurial behaviour and action take different forms in different regions and different kinds of HEI. For example, universities of applied sciences appeared to be well equipped to promote the entrepreneurship and innovation agenda. Universities of applied sciences (UAS) are designed to interact with businesses and are more open to these stakeholders, including in teaching activities. In promoting "transversal skills" such as entrepreneurship, UAS are legally required to provide practically oriented higher education. This includes internships as well as study programmes specially designed for working students. UAS absorb 20% of students enrolled in HEIs.

Entrepreneurship education is also becoming more mainstream in public universities. Several among them address the entrepreneurial agenda in their development plans and missions. These institutions have put in place activities in the field of entrepreneurship education, to provide interdisciplinary competencies and transferrable skills to students, faculty and staff (for example the KLUG-Learning Competencies at the University Graz and entrepreneurship education at the University of Vienna) (see Chapter 1).

In addition, Austrian HEIs have acquired an active role in the development of their economic, local, social and cultural environment (ecosystems) and are increasingly aware of their contribution to innovation and value creation. The performance of HEIs in terms of their capacity to engage with entrepreneurial teaching and learning depends also on their regional "ecosystem". HEIs are often supported by regional development agencies and chambers of commerce. For example, local stakeholders in Innsbruck have clearly influenced entrepreneurship learning in HEIs.

There are many start-up schemes, entrepreneurship courses and ecosystem level initiatives in different kind of HEIs, all supporting entrepreneurship and innovation (some of these are discussed in the next chapter: "Preparing and supporting start-ups in Higher education in Austria". Nevertheless, there is an issue regarding the definition of what entrepreneurship means for HEIs and the implications in the development of the entrepreneurial university – which appears to be in an early stage of development in a number of Austrian HEIs. A common and comprehensive definition of "entrepreneurship" would help to implement entrepreneurship education in Austria more effectively.

Within this context, there is still much to do to formulate a sustainable strategy at the HEI level, which clearly shows how to integrate and implement entrepreneurship activities in all parts of a complex university environment (cf. Chapter 2). This is an important issue for different reasons: in the short term, it limits the capacity of HEIs to encourage firm creation and employment; in a longer-term perspective, the lack of an effective strategy may impinge upon skills relevance and also on skills resilience on the labour market.

This chapter is structured as follows. The first section shortly discusses how the entrepreneurship concept could be defined. It focuses on teaching entrepreneurship at the

undergraduate, master's and PhD levels, how research on entrepreneurship could be linked to teaching the subject and also extracurricular, no-credit-based courses in entrepreneurship. The second section discusses whether universities validate entrepreneurial learning outcomes. The section gives examples of learning cases from Austria and other European countries to provide ideas on how to develop new entrepreneurial initiatives. The final section presents some recommendations – or rather suggestions – on actions that national stakeholders could implement to promote the development of entrepreneurial universities in the Austrian context.

Defining entrepreneurship in the context of higher education

Is it possible to teach entrepreneurship?

Before discussing entrepreneurship education in Austria, it is useful to discuss the possibility of teaching/learning entrepreneurial skills. In general, there is a long-lasting debate about whether or not entrepreneurship can be taught. In general, scholars are split into two different schools of thought. One side argues that entrepreneurs are born, not made. The other, conversely, states that entrepreneurship can be learned and that, although culturally and experimentally influenced, it is a skill that can be developed through education and training (Fayolle and Gailly, 2008; Rasmussen and Sørheim, 2006). For example, Drucker (1985) stated that entrepreneurship is a discipline and, like many other disciplines, can be learned.

Once one has taken a side in this dispute, other questions appear. Among others, a key issue concerns the methodology of teaching entrepreneurship. The approach to entrepreneurship education represents another layer of the debate. In particular, there are three different perspectives: teaching "through" entrepreneurship – as a metaphor for economic and organisational change –; teaching "about" entrepreneurship – as a subject area –; and lastly, teaching "for" entrepreneurship – considering the creation of a new business as a possible outcome (Gibb, 1987; Caravan and O'Cinneide, 1994; Klofsten, 2000).

Entrepreneurship education should not be mixed up with teaching general business and economics. Entrepreneurship is about change through creativity and experimentation rather than preserving the status quo and the administration of organisations (Stevenson and Jarillo, 2007; Norrman et al., 2014). Therefore, based on the above, entrepreneurship can be defined as the capacity to transform innovative ideas into sustainable process and products.

Teaching entrepreneurship to improve sustainability and impact

Entrepreneurship is generally perceived as a driver of sustainable development and growth (EC, 2008). Within this context, entrepreneurship education, as a way of increasing the pool of potential entrepreneurs, represents a successful practice (Aronsson, 2004; Lyons and Zhang, 2018).

At the HEI level, entrepreneurship education should aim to develop a mindset and capacity for entrepreneurial activities (Wilson, 2008). Evidence indicates that academically educated entrepreneurs are well suited for working with the development of regional economies, while entrepreneurs with less education tend to be better suited for entrepreneurship on a business-to-business level (Taatila, 2010).[1]

Given their understanding of the economy and society, academically educated entrepreneurs have the opportunity to co-ordinate high-growth firms and thus induce large-

scale job creation (Klofsten and Jones-Evans, 2013). With additional skills, use of new business models and cutting-edge exposure acquired in academic education, these entrepreneurs may find it easier to develop a firm and promote advanced levels of innovation than those with less education (Minniti and Levesque, 2008).

Learning and teaching entrepreneurship in a university context

Main features of the entrepreneurial HEI

An entrepreneurial HEI offers a wide range of opportunities to innovative teaching and learning with the overarching aim to develop an entrepreneurial mindset across all study programmes. To achieve this result, an HEI should:

- Introduce new pedagogies that are student-centred, cross-disciplinary and promote practice-based learning.
- Provide support and training to staff with the objective of creating new curricula related to entrepreneurship.
- Allow students to engage in the evaluation of courses and provide them with the possibility of providing feedback.
- Involve entrepreneurs in classes, so that students can get new perspectives in their formal education.

Approaches to learning and teaching entrepreneurship in HEIs

Entrepreneurship can be supported and taught in HEIs in many different ways. For example, Klofsten (2000; 2008) describes three common approaches that HEIs carry out to deliver entrepreneurial teaching.

- *Mainstreaming entrepreneurship*. This holistic approach features "entrepreneurial universities" that aim to create and promote an entrepreneurial culture across their institution. In this case, entrepreneurship is not distinguished as a specific subject but connects with all the activities of the university concerning undergraduate and graduate courses, research and outreach activities.
- *Teaching entrepreneurship*. In this approach, the HEI organises specific courses in entrepreneurship, where students can learn more about entrepreneurship as a subject in itself. The HEI puts in place different credit-based (European Credit Transfer [ECT] credit) courses of theoretical character at all academic levels. These courses focus, for example, on business creation, legal and regulatory frameworks, business development and financial aspects related to business development.
- *Supporting entrepreneurs*. The HEI can set up specific training programmes for individuals who wish to start their own firms or develop ongoing businesses. These include entrepreneurship programmes, incubator facilities and growth programmes. These activities are more practical than theoretical and are often placed outside the traditional curricula (they are extracurricular) and, therefore, do not give any ECT credit.

Within an entrepreneurial university, all these activities will work together and enrich each other. For example, the development of an entrepreneurial culture in a given HEI and the presence of a variety of courses in entrepreneurship in that HEI will act in parallel and influence students' attitudes in a positive way. As a result, students will act

entrepreneurially in their careers, independently from the fact of actually owning a business. Training entrepreneurs can give valuable contributions to courses in the form of case studies and lectures conducted by entrepreneurs who have participated in previous programmes and gained some experience since.

Formal entrepreneurial teaching and learning in Austrian HEIs

Almost all HEIs in Austria have an understanding of the importance of the entrepreneurial and innovation agenda, as can be seen in the results of the leader survey discussed in Chapter 3. This also reflects the presence of entrepreneurship learning opportunities in many different forms, both curricular and extracurricular, formal and informal.

Entrepreneurship education at the undergraduate and master's levels

Many Austrian HEIs offer a variety of entrepreneurship courses targeting different student groups. Good examples of such undergraduate courses "about entrepreneurship", as discussed above, are VU-Entrepreneurship (University of Innsbruck), Sustainable Entrepreneurship (BOKU) and the interdisciplinary entrepreneurship courses organised at the FH Upper Austria (Campus Hagenberg, Steyr and Wels). At the FH Campus Wien, almost all study programmes have dedicated courses in their modules to improve the entrepreneurial skills of students. The master's degree programme "Health Assisting Engineering" also includes the development of interdisciplinary competencies. Further examples of credit-based entrepreneurship courses at master's level are The Sustainability Challenge and The Garage. The former adopts an inter- and transdisciplinary approach and is based on the co-operation of four universities: BOKU, the Vienna University of Economics and Business, TU Vienna and the University of Vienna. The latter allows students from TU Vienna, the Vienna University of Economics and Business, and BOKU to work together with external stakeholders on their start-up ideas/projects, fostering the ability to communicate across academic cultures. These experiences have benefitted from the experience of the Centre for Global Change and Sustainability at BOKU, which has been a frontrunner in the support of sustainable entrepreneurship and socioecological student initiatives through university courses, networking events and individual coaching.

These courses aim to provide students with the skills needed for an entrepreneurial career, including the development of a business plan as well as an application-oriented approach to starting and running a new business. Most courses are designed not only for students of business administration and management but also for students in all disciplines who want to attend entrepreneurship classes.

Often, experienced entrepreneurs outside the university – who support faculty members and can provide students with role models and inspiration – teach the courses. Participants can generate their own business ideas and it is common that students work in multidisciplinary teams, combining different approaches and perspectives, to get new insights and skills into the business planning process. At the end of the courses, students (mostly in teams) present a business plan and their practical experience.

In general, entrepreneurship education programmes in Austrian universities focus on competencies and skills related to the creation of start-ups. This feature is present in all HEIs selected as case studies for the review process. The result of this approach is that entrepreneurship translates into information and skills that are required to start and run new businesses. Students learn how to write a business plan, analyse new business ideas through the Business Canvas Model, and pitch business models in a lifelike business environment.

Curricular (credit-based) entrepreneurship courses are rare and some entrepreneurship courses offered lack a clear "label" and have differing titles. This situation generates the risk that students do not fully understand the course objective. For example, entrepreneurship courses are often labelled as "business management", "business planning", etc. Among others, this was the case at the TU Graz and the Vienna University of Economics and Business. These institutions offer a wide range of courses and activities to encourage entrepreneurship through experimentation, leadership, specific support, and incentives and rewards. However, as discussed, these are labelled as business management courses or similar; they are not clearly identified as "entrepreneurship" courses.

In other case-study HEIs, credit-based courses are labelled as "creativity" education. These courses encourage students' entrepreneurial mindset and skills. For example, the University of Applied Arts Vienna (*Die Angewandte*) has introduced new formats in cross-disciplinary education and research to prepare people to think and act between and beyond disciplines and manage complexity (Box 4.1).

Despite their declared objective of educating students "about" entrepreneurship across the entire institution, case-study HEIs could reach a larger proportion of students.[2] In addition, entrepreneurship education is not fully integrated into most of the university curricula. For example, entrepreneurship courses are often designed for up to 40 students. Given that some of the case study HEIs have more than 20 000 students, the group of students that can access entrepreneurship education-labelled courses is very small. The current improvements in terms of number of students, although quite generalised, are not sufficient to mainstream entrepreneurship teaching and learning.

Box 4.1. Entrepreneurship education to develop creativity and manage complexity

The case of the University of Applied Arts, Vienna[3]

The University of Applied Arts Vienna has put in place a bachelor's degree programme to develop students' capacity to develop creativity and handle complexity (of globalised societies and economies), with an interdisciplinary approach. The bachelor's "Cross-Disciplinary Strategies. Applied Studies in Art, Science, Philosophy, and Global Challenges" programme provides students with a mix of artistic and scientific skills.

The bachelor's course is designed to provide insights into strategies and methods from a number of areas of knowledge. For instance, basic principles of art, philosophy, natural sciences, engineering and the humanities are an integral part of the curriculum. In addition, the bachelor's specifically focuses on digital technologies, growing automation, artificial intelligence and progress in the area of genome editing. Students will need creativity and entrepreneurial skills to work in these areas.

The study programme offers new teaching and learning methods and action strategies with the aim of generating professionals able to operate in a globalised and interconnected world and who possess the necessary qualifications to handle complex dynamics. The programme promotes collaboration and teamwork, and enables the planning, creation, implementation, analysis and inspired leading of projects.

Creativity/entrepreneurship teaching has generated engagement opportunities for the *Angewandte*. For instance, a Vienna-based company that is currently developing digital technologies for self-driving cars has asked the University of Applied Arts, and in

particular the students of the bachelor's course on "complexity", for help in streamlining (i.e. reducing the complexity of) digital frameworks, in order to improve the reliability of self-driving technologies.

Sources: Bernhard Kernegger; University of Applied Arts Vienna (n.d.), *Cross-Disciplinary Strategies - Applied Studies in Art, Science, Philosophy, and Global Challenges*, https://dieangewandte.at/cds_en (accessed on 20 February 2019).

Concerning the way in which entrepreneurship education is integrated into course curricula, Austrian HEIs have learnt from successful practices on a European level. A general feature of these practices is their capacity to promote entrepreneurship education in connection with different disciplines, to reach out to a large number of students. An example of this interdisciplinary approach is the Conceive, Design, Implement and Operate (CDIO) Entrepreneurship course at Linköping University in Sweden (Box 4.2). Since 2009, over 2 500 students, from a wide range of technical disciplines, have participated in this course. The CDIO Entrepreneurship course provides entrepreneurship education in view of helping students' technology projects, which is at the core of the CDIO procedure. Entrepreneurship education helps the students to understand a technical project from a business viewpoint and improves their capacity to communicate the results of their project (both orally and in writing). With this approach, technology projects benefit from a business perspective and students have both theoretical and practical learning opportunities.

Box 4.2. CDIO Entrepreneurship at Linköping University, Sweden

The CDIO (Conceiving, Designing, Implementing and Operating) Entrepreneurship course deals with how entrepreneurship can be inspired to and integrated within a university curriculum, specifically among science and technology students. This case shows how entrepreneurship can be taught to a large group of students (150 or more) and also how teachers and researchers in entrepreneurship can effectively collaborate with other teachers in different scientific disciplines, sharing common teaching goals and learning outcomes. Therefore, entrepreneurship facilitates interdisciplinary learning and teaching.

The CDIO concept was originally conceived at the Massachusetts Institute of Technology in the late 1990s. CDIO entrepreneurship was launched in 2009. It grants students three credits (ECTS). The course is compulsory for all science and technology students in graduate studies. Since its beginning, the course has seen more than 2 500 students graduate from a variety of technical disciplines such as VLSI design, mixed-signal processing systems, applied mathematics, design and fabrication of sensor chips, automatic control systems and biomedical engineering.

Students learn entrepreneurship and, in parallel, formulate and develop a business idea that has to be connected to their technically oriented projects. They then develop their idea using a Need, Approach, Benefit and Competition (NABC) framework. The course shows the importance of using a practice-based approach since most students have no educational background in business and organisation, development, finance and management. In general, entrepreneurship education should bridge students' attitude gap – convincing them that entrepreneurial skills will be crucial in their future careers, even if they do not develop their own business. For this reason, the CDIO course is mandatory at Linköping University.

Source: Professor Magnus Klofsten, Linköping University, Sweden.

In case-study HEIs, there are several master's courses aiming to promote entrepreneurship but few master's programmes in entrepreneurship. Austria could benefit from international good practices to overcome this situation. Sweden is a good example of a country that was, at the beginning of the millennium, in the same situation that Austria is currently facing. Only a few Swedish universities had started to set up master's programmes in entrepreneurship, often labelled "schools of entrepreneurship". In 2009, the Ministry of Education and Research of Sweden launched a national call for "advanced education in innovation and entrepreneurship", with a specific funding allocation (see Box 4.3). Reacting to this national call, 11 Swedish universities sent applications to the ministry. Two of them received government financing: the Chalmers School of Entrepreneurship and the Master's Programme in Entrepreneurship, Lund University.

Box 4.3. Chalmers School of Entrepreneurship – A master's programme in Sweden

The Chalmers School of Entrepreneurship (CSE) was established in 1997 and consolidated by a subsequent application in 2009.

The original application put forward the following idea to strengthen entrepreneurship education. First, develop an interdisciplinary platform combining innovation, entrepreneurship education and research. Second, attract (or generate through PhD programmes) faculties that are both action-based entrepreneurship educators and transformational leaders within the academy and beyond. Third, increase entrepreneurial capabilities in selected research areas also concerned with innovation and implementation of research.

CSE can be described as a venture creation programme (VCP) (Lackéus and Williams-Middleton, 2015; Ollila and Williams-Middleton, 2011) where "learning through entrepreneurship" (LTE) is central.

The special attributes in the approach at CSE are the following:

- Students are surrogate entrepreneurs. They are put in the drivers' seat to develop early-stage technical ideas provided by the incubator Chalmers Ventures (Lundqvist, 2014).
- The two-year master's programme evolves from providing courses with varying amounts of project work into a one-year thesis. Most of the learning is enabled through teamwork, whereas examinations in the MSc programme are both individual and team-based, focusing on academic reflections and on action learning.
- The main competencies developed within the programme are: entrepreneurial strategy and sales execution; technology and product development; and entrepreneurial mindset and teamwork.
- The school encompasses the six disciplines: entrepreneurial and organisational behaviour; team dynamics; innovation management; strategy; intellectual property management; and entrepreneurial finance. These subjects are mostly taught through project-based interdisciplinary pedagogy.

The CSE programme has been evolving over time. Some of its more notable improvements since it started in 2009 are:

- Implementing a 60 ETC (one-year) master's dissertation into the programme, rather than a normal 30 ETC one. This has allowed students to become more focused on their venture-learning already during the second year of the programme. Along with this change, an adapted "thesis with appended papers" structure has evolved, to capture the different disciplines the programme encompasses (entrepreneurial strategy and sales

execution, technology and product development, and entrepreneurial mindset and teamwork).

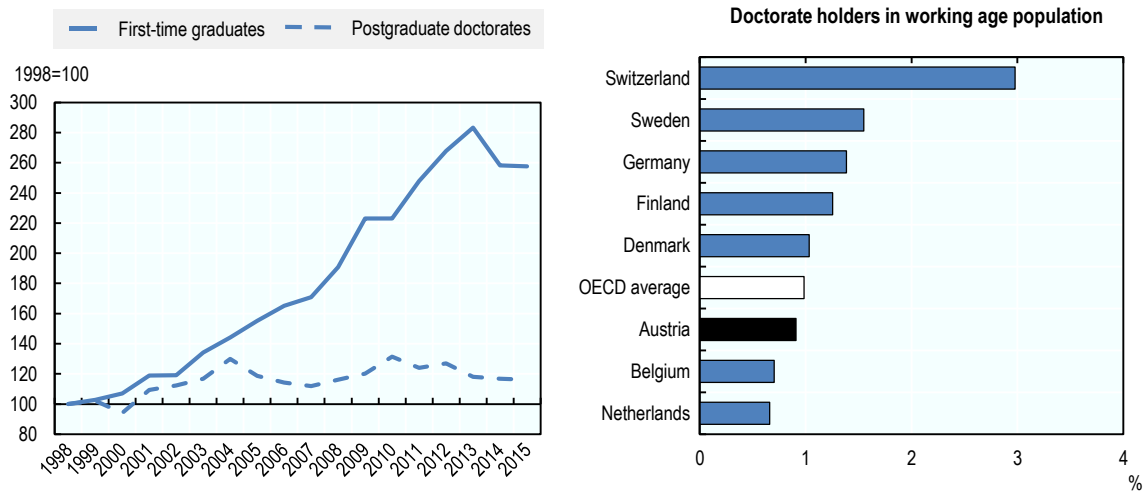
- Running and developing a clinical lab including research, PhD training and international collaboration.
- Going from one faculty to four permanent faculties at the core of the school.
- Starting a corporate entrepreneurship track in 2015, where students are "intrapreneurs" within partners firms.
- The effects of the entrepreneurship programme can be measured on at least three levels:
  - *Long-term effect on students' skills, capacity to handle complexity, and resilience on the labour market.* To assess the long-term impact of the CSE programme, more than 50 alumni who graduated between 1998-2014 were interviewed. The evaluation showed several long-term effects. For example, it found that interdisciplinary team-based learning (which is typical of the entrepreneurship approach) and capacity to handle uncertainty had both affected students' career paths. A majority of graduated declared that they had developed their career based on their capacity to handle uncertainty, often through leading a team. Respondents had capitalised on these skills in both corporate and start-up contexts.
  - *Venture impact (economic, social and environmental sustainability)*. Ventures started at the school are more able to deal with sustainable innovation. Graduates have the specific capacity to generate actionable innovation that ends on the market.
  - *The ability of the school and its student to also bring and grow such innovation on the market* is much higher than alternative tech-transfer models in Sweden (i.e. incubating ventures started by inventor entrepreneurs or doing occasional licensing) (Lundqvist, 2014).

Sources: Professor Mats Lundqvist, Chalmers University, Sweden; Lackéus, M. and K. Williams-Middleton (2015), "Venture creation programs: Bridging entrepreneurship education and technology transfer", *Education+ Training*, Vol. 57(1), pp. 48-73; Ollila, S. and K. Williams-Middleton (2011), "The venture creation approach: Integrating entrepreneurial education and incubation at the university", *International Journal of Entrepreneurship and Innovation Management*, Vol. 13(2), pp. 161-178; Lundqvist, M.A. (2014), "The importance of surrogate entrepreneurship for incubated Swedish technology ventures", *Technovation*, Vol. 34(2), pp. 93-100.

Entrepreneurship education targeting PhD students

In Austria, the percentage of doctorate holders as a share of the working-age population (at 0.9%) is currently somewhat below the OECD average (OECD, 2018) (Figure 4.1). Enrolment in PhD courses is relatively high but the dropout rate is also high, limiting the number of graduates. The relatively low number of PhD workers may generate constraints on the labour market if one considers that the number of R&D-performing companies in Austria has doubled in the past two decades and overall student numbers at lower degree levels have increased substantially. Austria has acknowledged that developing world-class doctoral education is essential and is undertaking efforts in view of reform (OECD, 2018). A further step to improve the attractiveness of PhD courses and their capacity to generate carriers outside of academia would be to develop entrepreneurship education for graduate students.

Figure 4.1. Postgraduate doctorates in Austria 1998-2015 and share of doctorate holders in working-age population, 2015



Source: OECD (2018), *OECD Reviews of Innovation Policy: Austria 2018*, https://doi.org/10.1787/9789264309470-en.

Entrepreneurship education for PhD students is a crucial element for universities to become truly entrepreneurial (Bienkowsk, Klofsten and Rasmussen, 2016). Doctoral students represent one of the larger groups of university academics and play an important role within research groups, which may end up commercialising their research results (Thune, 2009). Many PhD students will make a career as senior researchers whose ambitions and commitments may intensely affect the different forms of scientific production at universities. Postgraduate education can cover a broad range of domains, aims and teaching practices, which do not focus solely on the creation of new businesses as such but also include entrepreneurial attitudes and skills that are valuable in research or teaching (Huyghe and Knockaert, 2015). In addition, due to the increasing number of individuals holding a PhD, job opportunities in academia have been reducing. This requires PhD programmes to provide students with the possibility of finding a job outside the university system (Bienkowska and Klofsten, 2012). Thus, attending a PhD course in entrepreneurship might give graduate students encouragement in an alternative career as a start-up entrepreneur or an entrepreneurial employee within the industry or public sector (Klofsten, 2016).

In several Austrian public universities, there are PhD courses in entrepreneurship or entrepreneurship-related topics, open to all graduate students. These courses provide education in several topics such as technology transfer, commercialisation of research, innovation management (e.g. TU Graz) and courses in intellectual property rights (e.g. Paracelsus University and the University of Natural Resources and Life Sciences Vienna [BOKU]). However, due to the way these courses are designed in most universities, they attract almost exclusively graduate students in fields such as engineering, manufacturing, construction, science, mathematics and computing, and health, which, at first glance, are better related to entrepreneurship or innovation. A more holistic design, promoting an interdisciplinary approach to entrepreneurship could dramatically improve the attractiveness of these PhD courses, helping Austrian institutions mainstream entrepreneurship learning.

Some successful practices exist already and can inspire other Austrian public universities. For example, the interdisciplinary PhD Entrepreneurship course at the University of Innsbruck (Box 4.4). The PhD course of the Innsbruck University provides entrepreneurship education to students and alumni from all faculties. It mixes theory with a practical approach to entrepreneurship education and helps students generate skills that could be useful in their future career, inside or outside the academic system.

Box 4.4. The interdisciplinary PhD Entrepreneurship course at the University of Innsbruck

The PhD Entrepreneurship course at the University of Innsbruck aims to provide doctoral students with skills that help them in an entrepreneurial career. The design of the course requires an interdisciplinary composition in terms of students. So, entrepreneurial education is offered to graduate students from all faculties.

Seminars take students through each stage of launching a new venture and combine theory with workshops run by experienced entrepreneurs. At the end of each seminar, participants present their business plan and first hands-on experiences. All participants in the seminar can present their own business ideas.

The PhD course favours collaboration among students with different backgrounds and skills. For example, an arts student that has generated a business idea and business model can collaborate both with a student in computer science with programming skills and with business students in order to translate this idea into reality.

The course is organised into two parts. The first part is about relevant entrepreneurship topics. Between the first and the second part of the course, students are asked to register on a platform and upload a one-pager with a description of their research and a possible translation into a business idea. Afterwards, students are invited to comment on and discuss each other's ideas in order to prepare for a "hackathon", which will be the focus of the second part of the course.

The hackathon allows students to apply theory in practice. During two days, students work intensively in small groups to prepare a business plan for their idea. At the end of the second day, students present to a jury – composed of potential investors – which will nominate the winner of the hackathon. On completing the course, the participant receives 5 ECTS.

Source: Professor Johann Füller, University of Innsbruck, Austria.

There are also international successful practices that could inspire Austrian stakeholders. For example, the Swedish PhD course Entrepreneurship in Theory and Practice (ETP) has attracted approximately 200 PhD students since 2006. The ETP has involved PhD students from a broad range of research arenas in science and technology ranging from management and engineering, computer and information, to medical and health sciences, comprising a rather mixed group regarding study curricula, organisation and research group association. The course is not mandatory and the "market pull" has been the key force behind recruitment. Many participants are students who would not normally consider a PhD course outside of their research field. The drivers for participation include: individual career goals; capacity to work in groups; and, last but not least, the fact that the PhD course has acquired a positive track record in the local academic community (Box 4.5).

Box 4.5. The PhD course Entrepreneurship in Theory and Practice (ETP), Linköping University

A PhD course called Entrepreneurship in Theory and Practice (ETP) started at Linköping University in 2006. ETP aligns with the university tradition of continual efforts in developing a relevant support structure for students and staff. To date, 12 ETP courses that give 7.5 ECTS have been run with 188 PhD students participating from various disciplines throughout the university. At the end of this course, participants are able to discuss and reflect on the meaning of entrepreneurship in various settings and situations; formulate, develop and present an idea for a new venture, organisation, process or project; co-operate with colleagues in other disciplines and fields of research during idea development as well as understand how an entrepreneurial approach contributes to the development of "me" as a researcher and teacher. The entrepreneurship chair at the university leads the course; a team of eight people, all with extensive practical experience in academic entrepreneurship, coach and assist in workshops. As an extra twist to the course content, participants are offered group coaching by an experienced entrepreneur in connection with the development of new ideas. Previous courses in entrepreneurship for undergraduate students had shown that a practical orientation was useful for scholars who came from fields outside of business and management.

The ETP is an elective course so, to be successful, it has to attract the attention of students who would not normally place entrepreneurship high up on their agenda. Successful recruitment to the course rests on good relations and clear communication channels with the various university research environments. The student's supervisor must approve the course for inclusion in the student's PhD curriculum. So the student as well as the supervisor must be convinced that the ETP is relevant for PhD-level education. Topics include new business development in various contexts, opportunity recognition, team formation, intellectual property rights, and case studies of both successful and failed businesses, to name only a few.

The ETP stimulates students to develop original ideas that have some connection with their doctoral research. At the beginning of the course, participants vote on which of the presented ideas are most interesting. Groups of two to three are formed for each idea, with each group comprising persons from different academic backgrounds, when possible. The groups draw up development plans during workshops and two coaching sessions. At the end of the course, the groups present their ideas in front of a panel of experienced academic entrepreneurs.

Course evaluations show that the participants – in addition to the practical content – highly appreciate the establishment of contact across institutional boundaries, new perspectives on solving problems, and the ways an entrepreneurial attitude benefits future non-academic career. The PhD students who have taken the ETP are a large and diverse group of researchers. In particular, one of these PhD students has played a central role in the founding of more than 20 new spin-off firms.

Source: Professor Magnus Klofsten, Linköping University, Sweden.

Integrating research in entrepreneurial education

For a curriculum to stay up to date and relevant, the entrepreneurial education offer needs to be continuously reviewed and updated. Therefore, HEIs should integrate the results of entrepreneurship research into their entrepreneurial teaching and learning.

The Vienna University of Economics and Business represents a good example of how entrepreneurship research relates to entrepreneurial education. In this university, high international quality entrepreneurship research affects teaching and connects with the local environment. In this case, innovation and entrepreneurship are understood as two sides of the same coin and are widely present in teaching and learning. The university encourages scientific staff to review the latest research in entrepreneurship education.

The Vienna University of Economics and Business's Institute for Entrepreneurship and Innovation provides a forum whereby teaching staff can exchange new knowledge and ideas, incorporating the latest research. The educational offer involves learning "about", "for" and "through" entrepreneurship. The focus is on applying projects in real-world situations (more than 700 projects have been carried out so far), in collaboration with external stakeholders (ranging from start-up companies to multinationals). The institute aims to offer entrepreneurship education at all teaching levels, i.e. bachelor's, master's and PhD, and to label such courses as "entrepreneurship" and not "business planning" (as it is today). The Vienna University of Economics and Business also collaborates with other HEIs (e.g. Technical University Vienna, University of Vienna and University of Natural Resources and Life Sciences Vienna) to networking and sharing good practices. Importantly, the Vienna University of Economics and Business developed the vision that every student should be exposed to the concept of entrepreneurship during his or her time at the university. It would be important to generalise this approach in all sectors of Austrian HE, taking into account the respective specific profile and the range of study fields.

Co-designing and co-delivering entrepreneurial education with the support of external stakeholders

The capacity to collaborate with stakeholders in the design and delivery of entrepreneurship education features in many case-study HEIs. This is a very important characteristic of the Austrian system, which public authorities could strengthen. External stakeholders are often involved in both formal credit-based courses, as well as extracurricular learning activities and support services. Austrian HEIs support several collaborative partnerships with local communities and organisations, local and regional governments, chambers of commerce, industry and HEI alumni.

The capacity to engage with external stakeholders in co-designing and co-delivering entrepreneurial education is particularly developed in Austrian UAS, due to their specific connections with regional ecosystems, which is part of their mission. For example, the FH Campus Wien collaborates extensively with external actors: the institution has a pool of 1 680 part-time staff (external lecturers mainly from the industrial sector) compared to 240 full-time staff. External lecturers represent an important source of expertise to be used in entrepreneurial teaching and learning since the UAS does not have staff active in entrepreneurship research.

Many Austrian UAS consider their capacity to co-operate with external experts and stakeholders from the productive sector as their peculiar trait *vis-à-vis* public universities.[4] For example, regular engagement with external stakeholders encourages long-term

collaborative relationships with the business community. This can provide UAS with useful insights to understand future skills needs, for example.

There are, however, several examples of public universities that have been able to develop strong linkages with external stakeholders, especially in ecosystems where firms and institutions are denser. For example, the Vienna University of Economics and Business has several "competence centres" including one that specifically engages with non-profit organisations, in order to promote education in social entrepreneurship (Box 4.6). The case of the Vienna University of Economics and Business illustrates well that the interaction with external stakeholders generates innovations and a mutual benefit for the HEI and the ecosystem.

Box 4.6. Co-designing and co-delivering entrepreneurial education with the support of external stakeholders

The example of the WU Vienna (Vienna University of Economics and Business)

WU Vienna has seven specific "competence centres" connecting the university with external stakeholders. Competence centres at WU are primarily third-party funded, which ensures a focus on the needs of relevant stakeholders.

The WU Vienna started to look at the non-profit sector over 20 years ago and a group of interested scholars has been studying these issues generating data and evidence. Based on this experience the WU created the NPO SE (Non-Profit Organizations and Social Entrepreneurship) Competence Centre. This centre has 20 staff and receives about 98% of its funds from external sources. The NPR SE Centre focuses on three pillars: applied research, education and networking.

- *Applied research*. WU Vienna started the NPO SE Centre to generate data for non-profit organisations and the public sector. The centre co-operates with the WU Vienna's Institute for Non-profit Management, the Institute for Social Policy, and other WU research bodies. Research focuses on philanthropy (foundations and large organisations), intended as the supply side of the not-for-profit sector, and on the demand side. For example, NPO SE has recently conducted a study on social businesses in Austria, which informed the Federal Ministry of Social Affairs and AWS Austria. Based on research results AWS has allocated EUR 3 million to assess the capability gaps in the social entrepreneurship sector. This is an example of how research can translate into policy initiatives.
- *Education*. The second pillar aims to inform and train practitioners in the non-profit sector and students interested in the subject. Concerning students, the NPO SE Competence Centre often represents a gateway into social entrepreneurship. In addition, by attending NPO SE's programmes, students acquire credits they can transfer into their own study programmes. NPO SE also organises workshops series and training activities. By attending these events, participants learn, for instance, how to develop and submit a social business plan. Ten years ago, the centre founded the Social Impact Award. Over the years, this award became an educational programme, which has been exported to 22 countries.

- Networking. Through its third-pillar activities, the NPO SE develops and manages contacts with non-profit organisations, as well as national and international research networks.

This competence centre's activities show the need for an academic focus on social entrepreneurship internationally, an area that will have increasing significance across developed countries in the coming decades. The non-profit sector and social entrepreneurship will provide scope for co-operation on main social challenges that span disciplinary and national borders.

Evaluating curricular entrepreneurship teaching and learning programmes

Austrian case-study HEIs tend to make limited use of evaluation when it comes to their curricular entrepreneurship teaching and learning programmes and activities. This may depend on the relatively few credits that are associated with entrepreneurial courses and the lack of formal recognition of entrepreneurship as an academic subject. However, based on international evidence, including that gathered by the HEInnovate Guiding Framework, HEIs that value entrepreneurial learning commit to regularly review, validate and update the contents of courses and the learning outcomes across all study programmes.

To improve the validation of entrepreneurial learning outcomes, Austrian authorities could consider the following actions:

- Organise the expected entrepreneurial learning outcomes in relation to knowledge, skills and competencies in all study programmes.
- Ensure that the students understand the entrepreneurial learning outcomes expected and achieved.
- Validate entrepreneurial learning outcomes at the institutional level and acknowledge entrepreneurial learning outcomes in the students' records of accomplishments.

Informal learning opportunities to stimulate the development of an entrepreneurial mindset

Extracurricular learning opportunities are an important complementary part of entrepreneurship teaching and learning provision. An innovative HEI should offer a range of informal learning opportunities for students to inspire individuals to act entrepreneurially. There are different ways to achieve this result including by: supporting access to student enterprise clubs, awards and societies; organising networking events between students and entrepreneurs; engaging students in business idea and business plan competitions as part of their extracurricular opportunities.

Extracurricular learning opportunities are widely used by Austrian HEIs in their efforts to stimulate the development of entrepreneurial mindset and skills. There are some good examples of extracurricular activities like the Start-up Centre at the FH Campus Wien and the Start-up Garage at the Technical University Graz (see the following chapter). These learning opportunities could also generate opportunities for strengthening the linkages between HEIs and their respective ecosystems. For instance, in Rotterdam, the Netherlands, the local UAS, in co-operation with the municipality, has created a laboratory where faculty and students can coach entrepreneurs facing difficulties who are looking for technical support (Box 4.7).

Box 4.7. HEIs providing support to local entrepreneurs: The case of the Rotterdamse Zaak (DRZ)

The Netherlands represents an international good practice in the field of entrepreneurship education and university engagement – or "valorisation" – more generally. There are activities in which HEIs are embedded in their ecosystems and generate concrete and targeted services for the business community. The Rotterdamse Zaak (DRZ) is a good example of this capacity to engage.

The DRZ is aimed at entrepreneurs who are financially unable to find solutions to their problems. The target audience of the DRZ are individuals who have been entrepreneurs for at least 1.5 years and who face financial difficulties. Former entrepreneurs (senior coaches) act as a sounding board for the students of Rotterdam University of Applied Sciences (junior coaches). Students of RUAS help the entrepreneurs learn to give advice on how to improve their business operations – financially and commercially – and help to develop their entrepreneurial skills. The DRZ works with the Regionaal *Bureau Zelfstandigen* (RBZ, a regional bureau for the self-employed) and the *Ondernemershuis Zuid* (OHZ, a meeting place for nascent entrepreneurs) so that students are properly facilitated and get the training they need to master the skills and competencies required for coaching.

The evaluation criteria for access to the DRZ project is set by *Dienst Werk en Inkomen*, the regional governmental agency for employment. They look at the entrepreneur's business plan, their annual statement and credit risk, and decide whether the case should be handed over to the DRZ. One of the criteria for participation in the DRZ, for example, is to have been refused a credit loan by banks. The activities of students who "work for" the DRZ and advise entrepreneurs are peer coached by alumni students who stay on at the DRZ by means of internships. There are peer coaches for financial and commercial activities, as well as junior advisors and assistant junior advisors (from secondary vocational training). There is a weekly briefing at the Chamber of Commerce where students receive training, such as information on entrepreneurship-relevant regulations. The intake interview with the entrepreneur to assess their eligibility for participation in the project is carried out by a senior coach and junior consultant and involves a problem analysis and a plan of approach. Further practical support and guidance are given by the junior consultants but there are also coaching consultations.

De Rotterdamse Zaak (DRZ) started in 2012 with less than 100 entrepreneurs but by 2015 had helped more than 250 entrepreneurs. Since 2013, about 65 students per year have been active as junior coaches. Up to 2016, a total of 905 entrepreneurs had received advice from students. The University of Groningen carried out a study on the effectiveness of the DRZ, based on 100 real cases of entrepreneurs who had received its help. The results show that, in total, the DRZ saved EUR 200 million, which equates to approximately EUR 100 000 per entrepreneur in terms of saved bankruptcy costs, welfare costs, etc. Recently, the DRZ won the prestigious European Enterprise Promotion Award.

Source: OECD/EU (2018), *Supporting Entrepreneurship and Innovation in Higher Education in The Netherlands*, https://doi.org/10.1787/9789264292048-en.

To be effective, however, extracurricular and informal teaching activities need a certain degree of formalisation and recognition. This also to illustrate the importance of entrepreneurship education within the higher education system. Including entrepreneurship education in HEI curricula as well as the formalisation of activities connected to

entrepreneurship education represents an important condition to illustrate the importance of the entrepreneurial and innovation agenda within the higher education system in a country.

The large use of extracurricular and informal entrepreneurship learning represents a specific challenge of the Austrian higher education system, both public universities and UAS. In the majority of the visited Austrian HEIs, some of the extracurricular activities currently adopted in Austrian HEIs could be easily transformed into formal credit-based activities to increase the formal recognition of the importance of entrepreneurial learning; e.g. the "Extension curriculum for entrepreneurship" at the University of Vienna (Box 4.8).

Austrian HEIs could consider integrating the numerous extracurricular activities currently in place into credit-based learning offer or, alternatively, complementing them with formal credit-based entrepreneurship courses. Extracurricular activities should be a complementary part of entrepreneurship teaching and learning. They should not replace entrepreneurship learning and teaching. Otherwise, they will take time away from other formal activities like formal credit-based courses.

In the current situation, only students with a high interest in entrepreneurial activities participate in extracurricular activities. The fact that most of these activities are run in parallel to their study programme exposes them to the risk to delay their studies. In general, the fact that entrepreneurial learning is mostly provided through extracurricular activities indicates a lack of commitment and understanding about the importance of creating an entrepreneurial mindset for all students and not only those who take on extra work.

In the current framework, the Austrian higher education system – encompassing both UAS and public universities – does not mainstream entrepreneurship and engagement. Entrepreneurship education remains a niche opportunity for selected students that are eager to engage with this kind of studies, rather than a possibility for all students that can acquire new, relevant skills.

Box 4.8. The extension curriculum for entrepreneurship at the University of Vienna

The University of Vienna, the largest in the country with about 90 000 enrolled students, has introduced an extension curriculum for entrepreneurship. The idea behind this approach is that bachelor students can take an active role in developing their individual education and advance supplementary skills that are not covered by their study programme.

The practice of the University of Vienna shows how students who "have not earlier been active" in the entrepreneurship field can take a course in entrepreneurship. A self-assessment tool is used to test student entrepreneurial orientation. More than 100 students enter the course every year. However, only an average of 60 students finalise the course. This high dropout rate may depend on the lack of awareness in students concerning the effort it takes to be an entrepreneur. The course has a "traditional" approach to entrepreneurship and subjects are treated with the perspective that students should be able to start a venture and run a business.

The course takes advantage of the institutional framework supporting entrepreneurship in the University of Vienna as a whole. For instance, the course is connected to other start-up initiatives in the Vienna entrepreneurial ecosystem. This gives students the possibility to engage with experienced teachers and mentors, and to visit start-ups and companies connected with the university's ecosystem.

Source: Professor Michaela Schaffhauser-Linzatti, University of Vienna.

There are however some promising developments in the system. Some HEIs are taking action with the aim of mainstreaming entrepreneurship education in their curricula. For instance, the importance of letting every student get in contact with entrepreneurship education was mentioned at the Vienna University of Economics and Business. Individual initiatives of HEIs can have a systemic impact. A similar process, for instance, happened in Sweden in the 2000s; the Chalmers University of Technology's long-term engagement with the Chalmers School of Entrepreneurship generated successful practices that were adopted by the university and then by other HEIs in the country (Box 4.9).

Box 4.9. Integrate research into entrepreneurship in teaching: Chalmers School of Entrepreneurship - Development over time

The Chalmers School of Entrepreneurship (CSE) unites education and research through entrepreneurship, with the aim to generate value for society by developing novel and innovative ideas. The CSE is part of the Chalmers University of Technology, which is situated in Gothenburg, Sweden, and has 10 300 full-time students and 3 100 employees. The CSE played an important role in mainstreaming entrepreneurship first within the Chalmers University and then in the Swedish HE system as a whole.

Since 2009, CSE has evolved in many ways, namely:

- Creating a "clinical lab" around the school allowing unique entrepreneurship and educational research.
- Organising a PhD programme linked to the School of Entrepreneurship, focusing on the clinical lab.
- Attracting external faculty and hired faculty having graduated from its own PhD programme.
- Establishing research and educational collaborations with other venture creation programmes and entrepreneurial education researchers in other universities: Aarhus, Colorado, Leeds, Luleå, Lund, NTNU, etc.
- Adopting the MIT CDIO framework for quality assurance, emphasising learning outcomes that include knowledge, skills and attitude developments.
- Consolidating the School of Entrepreneurship as an autonomous entity, offering entrepreneurial education at all levels of education: primary, secondary and higher education.

Although the CSE remains an advanced venture, operating at the master's level, it has produced positive feedback for the entire University of Chalmers since its inception in 1997. Although it is difficult to measure the overall impact, there are many effects the school has on its university. Its students and ventures are frequently seen in the media, which affects the inner "ecosystem" as well as the way Chalmers is perceived outside the school. Over the years, many university researchers have also been idea providers for the school and gained entrepreneurial experience. Students are expected to gain from having entrepreneurial experience. Thus, CSE has been spreading entrepreneurship through a "value creating" pedagogy, which has now been adopted by the whole university and beyond (Lackéus, 2016).

Sources: Professor Mats Lundqvist, Chalmers University, Sweden; Lackéus, M. (2016), *Value Creation as Educational Practice-Towards a new Educational Philosophy grounded in Entrepreneurship?*, PhD dissertation, Chalmers University of Technology.

Conclusions

Summarising, Austria represents an interesting case study to promote entrepreneurship teaching and learning in higher education. Based on the available information, it is possible to identify some possibilities for improvement. This report puts forward six main recommendations – or rather suggestions – to promote entrepreneurial teaching and learning and engagement in Austrian HEIs. These are:

1. Austrian HEIs need to define what entrepreneurship means in their specific setting. To build a common understanding of how to support entrepreneurship through teaching and learning at HEIs could lead to peer learning and collaborative initiatives between HEIs. As discussed above, there is a need for a wider definition of entrepreneurship compared with the current one, which focuses too much on the importance of new start-ups and business planning. Students and staff need to understand that entrepreneurship education should aim to develop a mindset and capacity for entrepreneurial activities, including social entrepreneurship. Importantly, the definition of entrepreneurship and the strategy will not be the same for every HEI. For example, entrepreneurship has a different meaning in engineering and life science contexts (in which generating spin-offs and start-ups is more common) compared with arts and humanities or teacher education programmes, etc. (where entrepreneurship has a broader meaning and serves different aims).
2. Mainstreaming the entrepreneurial agenda across HEIs. A better – more general – definition of entrepreneurship can help HEIs to raise awareness and develop a strategy that will "percolate" to other parts of the institution, including those that are not engaged in the entrepreneurial agenda, thus mainstreaming the entrepreneurship vision across the entire university context (cf. Chapter 2). Austrian HEIs are on a positive trend and most of them have proved to be aware of the importance of providing students with entrepreneurial capabilities. However, and especially in some public universities, entrepreneurship has not been integrated into teaching and research activities in a sufficient way and entrepreneurship education does not provide credits. This also depends on a systemic problem, as the performance agreements with public universities lack a clear goal for improving their capacity in terms of entrepreneurship, employment and engagement. Specific attention should be given to entrepreneurial learning at the PhD level due to the impact on the labour market and quality of start-ups as well as on academia, as some PhD students will be absorbed by academia.
3. Improving labelling for "entrepreneurship" courses as such, and not as business management or similar. This will help to raise awareness and increase recognition. The Austrian HE system should find a way to recognise and assess the impact of entrepreneurship education on skills, and could be better assessed by graduate tracking/graduate surveys. This would represent an advantage for both graduates and employers.
4. Formalising entrepreneurial education. An increasing number of Austrian students engage in entrepreneurial education delivered in extracurricular activities, which they attend in their own time. This reflects the importance that "soft skills" have acquired overall in the labour market and economy. Parts of these extracurricular activities can be transformed into credit-based (and research-linked) entrepreneurship courses. Generally, to recognise extracurricular activities, it

would be important to introduce learning outcome recognition for entrepreneurship education activities (e.g. diploma supplements). In this way, employers could easily identify individuals who have acquired entrepreneurial skills in their university studies.

5. Including entrepreneurship competencies across bachelor's, master's and doctoral programmes. It is possible to design and implement entrepreneurship education in a variety of ways, depending on the goal of education and on the groups of target students. There is a difference among teaching "about", "for" and "through" entrepreneurship. This will influence the content and pedagogical approach when organising courses in entrepreneurship. There are potential complements to the present "low-volume" entrepreneurship courses at bachelor's and master's levels. For instance, "high-volume" courses could be generated by integrating different courses and subject disciplines.
6. Evaluating entrepreneurial attitudes among the student population to understand whether it is an outcome of selection or treatment. Do entrepreneurial students select into HEIs that promote entrepreneurship or does HEI education create an entrepreneurial attitude? Addressing this question is important because it has implications for curricula development and for understanding how to promote entrepreneurship, among others. One way to address the question is to follow students' attitudes towards entrepreneurship during (and ideally even before) their university education (randomised controlled experiment).

Notes

[1] Taatila (2010) illustrates four case studies in which entrepreneurship education supports the creation of entrepreneurs who contribute to regional development. In particular, while discussing the possibility that entrepreneurial skills can be learned, Taatila puts forward the idea that "entrepreneurship requires numerous skills that are difficult to define as individual atomic subjects, while a specific business requires subject-specific skills in which the heart of entrepreneurial competencey lies within psychological and social skills. […] Since an entrepreneur, by definition, is planning to capitalise on a business idea, she cannot have all the facts available at the moment of decision. […] In this situation, the aim of entrepreneurship education is not "to seek and teach the ultimate blueprint, but […] to secure both long- and short-term goods in future experience. Pragmatism acknowledges that real situations are often "fuzzy or messy" and that all the relevant information is often not even available or is internally incoherent". Within this context, a pedagogic approach towards entrepreneurship needs to be based on the practical development of real-life situations to be the focal point of research.

[2] Generally, data from the leader survey illustrates that the percentage of students involved in entrepreneurship education is higher – more than 30% of overall students involved in entrepreneurship learning opportunities – for UAS compared with public universities – the majority of which reach out to between 10% and 30% of the total number of students.

[3] The University of Applied Arts (Angewandte) self-understands itself as a university in transition that is interested in having a positive impact on society, and in co-influencing the change and transformation process in society. Through the interdisciplinary and transdisciplinary combination and recombination of different disciplines in the arts and sciences across research, teaching and application, the Angewandte supports innovation, but more so the Angewandte creates innovation by new approaches toward education, by combining methods from the arts and different fields of science, and by actively shaping a public discourse on global challenges. With the engagement of faculty, staff, students, and graduates of the Angewandte, in innovation and in processes of innovation, this results in new forms of entrepreneurship, based on social responsibility and a broad

understanding of innovation far beyond technology and economics. *Source*: David F.J. Campbell and Bernhard Kernegger (University of Applied Arts, Vienna, 2019)

[4] The capacity to engage with external experts/stakeholders was mentioned by several Austrian universities of applied sciences when presenting the results of their self-assessment tool exercise to the OECD delegation of experts and peers.

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Chapter 5. Preparing and supporting start-ups in higher education in Austria

This chapter discusses the performance of the Austrian higher education system and higher education institutions (HEI) case-studies in the HEInnovate dimension "preparing and supporting start-ups in higher education". Austria is extremely active in promoting innovation and part of this policy is about start-ups. Over the past decade, the country has put in place a network of incubators and accelerators that support start-uppers in different regional ecosystems. Policy actions are successful. However, students and faculty that engage with entrepreneurship could receive more recognition in the higher education system. The chapter discusses these issues and provides Austrian authorities with some recommendations.

Introduction

Austria actively prepares and supports start-ups. The country has put in place action at the level of the higher education system and also HEIs have been developing their own institutions (including units and organisational frameworks) and infrastructure to accompany students and faculty members in their ventures.

As discussed in Chapter 1, Austria has developed a network of incubators and accelerators at the systemic level, providing valuable support for nascent and growing firms (OECD, 2018b). Within the broader goal to improve its innovation profile (OECD, 2017; OECD, 2018b) and facilitate the commercial use of research, Austria has made significant progress on capitalising on the potential of HEIs to promote entrepreneurship and innovation. For instance, the Austrian Ministry for Transport, Innovation and Technology (BMVIT) funded the AplusB incubation programme, which has a specific focus on promoting HEI start-ups (FFG, 2017) and the Austrian Research Promotion Agency (FFG) has developed the Start-up Initiative to provide early-stage financial support for emerging firms, including those originating from HEIs (OECD, 2018b).

At the HEI level, there are many different initiatives, put in place by both public universities and UAS in different regional ecosystems. Public universities have been engaging with entrepreneurship activities over the last decade. Conversely, in line with their practice-oriented approach to education, universities of applied sciences (UAS) have traditionally pushed entrepreneurship in that they consider it an integral part of their mission. For instance, the Management Centre Innsbruck (a UAS) has integrated "entrepreneurship" in its brand and it is known as the Entrepreneurial School. Both, public universities and UAS, however, play an important role in supporting innovation, entrepreneurs and entrepreneurship ecosystems.

In particular, as the third mission of linking HEI research to commercial outcomes gains importance (Etzkowitz and Leydesdorff, 2000), public universities: i) intensify their efforts to provide entrepreneurship-related student training; ii) follow international practice to start co-operating with UAS (OECD/EU, 2018); and iii) co-operate with regional authorities to establish start-ups locally, thus attracting public resources to promote regional development (e.g. the collaboration between the Regional Development Agency of Tyrol, the Chamber of Commerce of Tyrol and the University of Innsbruck).

Austrian HEIs operate in a country in which the industrial sector is generally strong. This presents both a challenge and an opportunity for entrepreneurship emanating from higher education. On the one hand, it presents a challenge primarily because a thriving industrial sector attracts talent that could otherwise engage (and be successful) in different forms of entrepreneurship. "Loosing" talent to industry may hinder the rate and the impact of entrepreneurship on the economy while making the quantification of the effects of initiatives similar to those mentioned above a thorny task. On the other hand, a strong industrial sector presents an opportunity in large part because it creates the potential for entrepreneurs to collaborate, scale up and exit with resourceful actors. Along the same lines, a strong industrial sector may also indirectly promote high risk and high return entrepreneurship insofar as it can act as a safety net for employment in case of entrepreneurial failure.

This chapter is organised as follows: the next section discusses the importance of preparing and supporting entrepreneurship in higher education, in general. The third focuses on the framework conditions for entrepreneurship that characterise Austria. It presents the policies put in place by national authorities to promote start-ups. The fourth section illustrates

activities and practices at the HEI level, in different ecosystems and by different types of HEIs (public universities and UAS). The last section concludes and provides some recommendations.

The importance of preparing and supporting entrepreneurship in HEIs

After having helped students and faculty to develop their entrepreneurial skills, innovative HEIs should also support them taking advantage of their capabilities. This is important for different reasons. For instance, although not all entrepreneurs hold a tertiary degree, research illustrates that tertiary-educated entrepreneurs are more prone to success and generate innovative firms that grow faster and in a sustainable fashion (Wadhwa, Freeman and Rissing, 2008).[1] In addition, student and alumni entrepreneurs represent an important asset as they create companies and jobs, and as spin-offs may generate significant annual revenues for their HEIs (Graham, 2014).

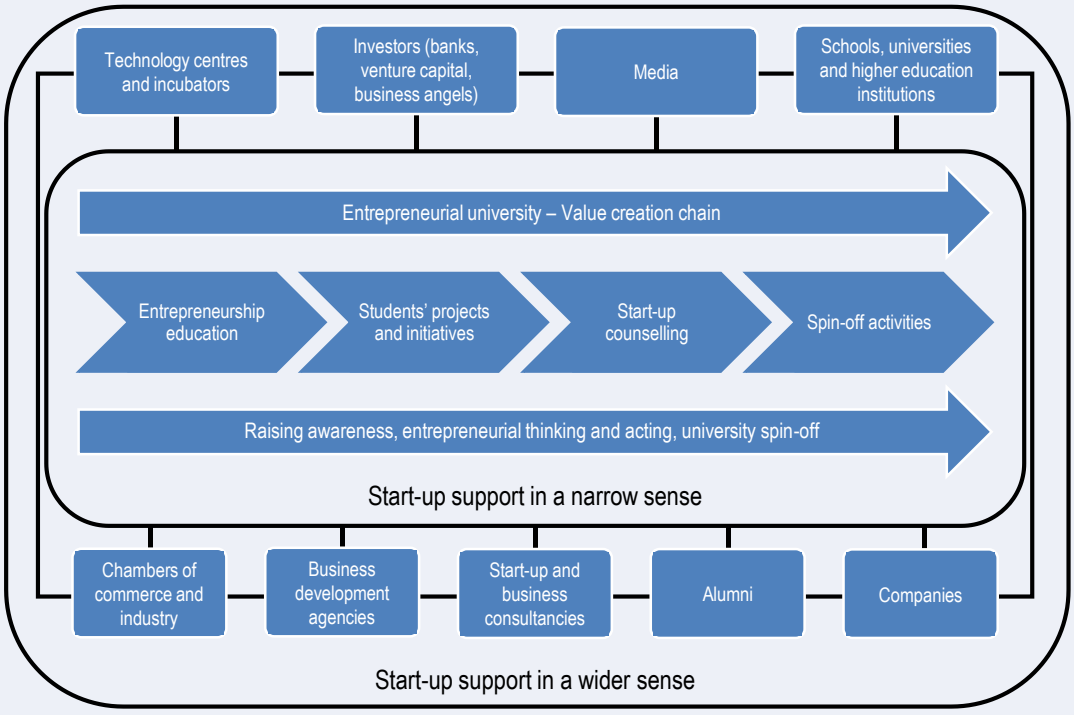
An increasing number of HEIs has put in place specific institutions and functions to accompany students in creating a venture over the past two decades. This wave has brought to campus activities such as incubators, accelerators, co-working hubs and maker spaces (Duruflé, Hellmann and Wilson, 2018). In these places, start-uppers can acquire practical skills that can reduce the learning curve for running a company. These programmes connect young entrepreneurs to real start-up resources that are harder to come by when you are starting out on your own – in some cases, leading to job opportunities and access to funding for student-led projects.

There are several examples of successful programmes supporting entrepreneurship in higher education frameworks in OECD and European countries. A good practice is that of the German EXIST programme (Box 5.1). EXIST is particularly relevant for two main reasons. First, it puts emphasis on establishing a host of different policies and structures, which, by acting in concert, can facilitate entrepreneurship. Second, because it was created at the end of the 1990s and has been running for 20 years, demonstrating that efforts to boost HEI-based entrepreneurial activity need time to develop and mature (Volkmann and Grünhagen, 2014).

Box 5.1. The German EXIST programme to promote HEI-based entrepreneurship

The EXIST – University-based Business Start-ups programme was established in 1998 and run by the German Federal Ministries of Education and Research and later on of Economics and Technology. Its explicit goal was to support and promote start-up creation by students, faculty and graduates of German universities. The underlying rationale for the programme is that entrepreneurship support includes a number of intertwined actors, which are embedded in entrepreneurial ecosystems, and all contribute to start-up creation and growth. The figure below, sourced by Volkmann and Grünhagen (2014), outlines graphically this approach under the Start-up Support in a Wider Sense heading.

The programme included four phases, each meant to gradually strengthen HEI-based entrepreneurship: EXIST I (Model Regions), which ran from 1998 to 2001; EXIST II (Transfer), which ran from 2002 to 2005; EXIST III (Specific Projects), which ran from 2006 to 2011; and EXIST IV (Entrepreneurial Universities), which ran from 2010 to 2018.



EXIST I was a pilot to explore initial support infrastructure for university entrepreneurship in five German regions and included measures that could set the stage for later growth such as the institutionalisation of entrepreneurship chairs at German universities. The goal for EXIST II was to transfer the knowledge from EXIST I regions to other regions and the provision of additional funding support. EXIST III moved to the development of university-based incubators and other entrepreneurship support programmes while EXIST IV implemented interventions to establish an entrepreneurial culture and sustain the structures put in place under EXIST III. These interventions included the sponsoring of entrepreneurship study programmes, among others.

Sources: Volkmann, C. and M. Grünhagen (2014), "Integrated support for university entrepreneurship from entrepreneurial intent towards behaviour: The case of the German 'EXIST' policy programme", in A. Fayolle and D. Redford, *Handbook on the Entrepreneurial University*, Edward Elgar, Cheltenham, pp. 225-247.

Campus activities such as incubators and accelerators contribute to and benefit from regional entrepreneurship ecosystems and national framework conditions. In addition to entrepreneurship teaching and learning (see Chapter 4) and individual characteristics (for example Backes-Gellner and Moog, 2007, highlight that students with a more balanced portfolio of human and social capital are more willing to become entrepreneurs than those with more specialist human and social capital), the actual creation of a new venture by students or recent alumni is strongly influenced by the university context and, especially, the characteristics of the region within which a university is located (Bergman et al., 2015). In general, HEIs located in regions and countries in which economic activities are dense and successful will be more likely to engage with entrepreneurship education and be more successful in supporting students who want to start a venture.

Systemic conditions supporting entrepreneurship in Austria

Austria has improved its capacity to support entrepreneurship but challenges remain. For example, Austria is above the European Union (EU) average in the Innovation Index.[2] It classifies as a "strong" innovator.[3] This position depends largely on innovation among SMEs, the existence of a strong pool of human capital, a strong science base with, for instance, leading scientific publications, and a particularly strong outlay of public funds towards R&D expenditures (OECD/EU, 2018).

The country's performance, however, is not homogenous and there are regional differences. Opportunity-driven entrepreneurship (as opposed to necessity-driven entrepreneurship) falls behind the EU average. Austria also falls behind the EU average in terms of an innovation-friendly business environment including strong digital infrastructure, competition on the markets and efficient allocation of resources. As also highlighted by the recent OECD assessment of Austria's innovation policy (OECD, 2018), while being a manufacturing powerhouse, Austria has a relatively high share of small- and medium-sized enterprises (SMEs) and micro-firms in the business sector, a condition that is likely to hinder technology diffusion (OECD, 2018).

The lack of homogeneity can be better appreciated by considering the different framework conditions supporting entrepreneurship in the country (Figure 5.1). Austria ranks 22nd globally in ease of doing business.[4] The country ranks first in trading across borders, but only 118th in terms of starting a business.[5] Entrepreneurial education at the post-school stage is better developed than at school stage, however, this knowledge should be introduced in an appropriate form at all levels of education. Government entrepreneurship programmes, commercial and legal infrastructure, as well as the physical infrastructure, are all well-developed (Global Entrepreneurship Monitor, 2018).[6] Conversely, the availability of entrepreneurial finance is limited. Risk capital, including business angel funding and formal venture capital, is relatively limited (OECD, 2018b). Venture capital investment in Austria represents about one-eighth of that of Denmark and one-ninth of that of Sweden (Joanneum Research, 2015). Despite the increase of public funding (in particular, Industry 4.0), government support is often too fragmented, lacks critical mass and budgets, and operates over time horizons which are too short (OECD, 2018b).

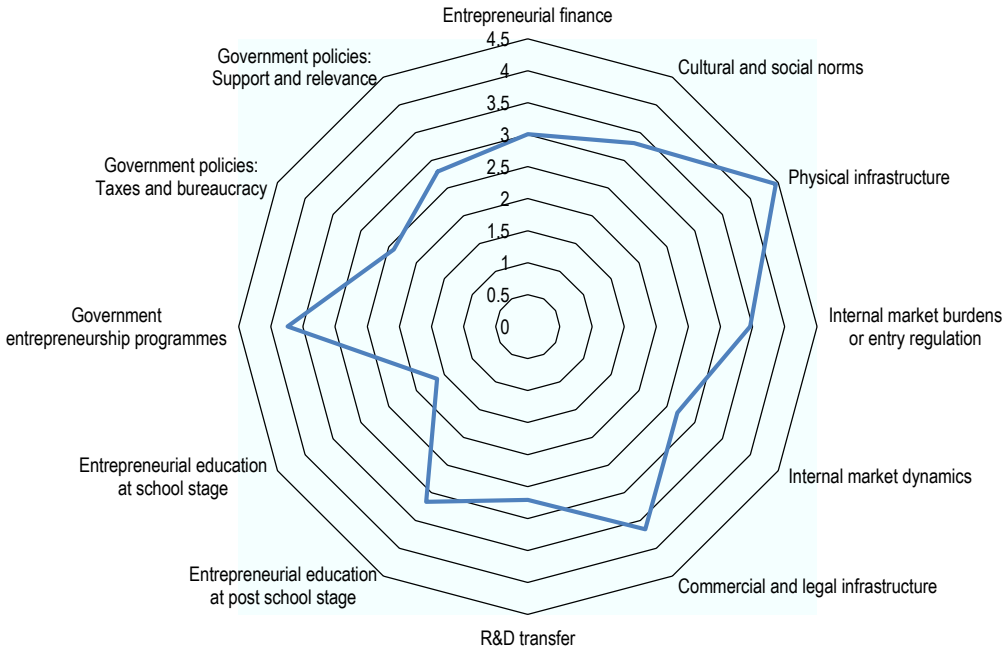
The diversity of conditions also features Austrian HEIs where, in part because of the country's small size, professors of international renown are relatively few and focused on specific subject areas, such as industrial engineering, informatics, mechatronics and biotechnology (OECD, 2018b). Excellence in research influences engagement and entrepreneurship.

Finally, the diversity of conditions supporting entrepreneurship has also a territorial dimension. For example, while the percentage of individuals who consider that they have the skills and knowledge to start a firm is increasing over time, the perception of opportunities to start a firm *locally* decreases.[7]

National averages tend to hide the differences existing at the regional level concerning the organisation of production and support to entrepreneurship. Especially in Tirol and Upper Austria, entrepreneurial ecosystems are dense in SMEs and interconnected institutions, including regional agencies, financial institutions, HEIs and other "intermediate institutions" supporting local economies (Arrighetti and Seravalli, 1999). In Styria, conversely, the productive sector is based on large firms specialised in the automotive industry and local institutions, including HEIs, are connected to these key actors. The metropolitan area of Vienna represents another, different productive ecosystem that

benefits from the presence of international networks and world-class institutions, including some of the leading HEIs in the country.

Figure 5.1. Entrepreneurial framework conditions in Austria



Source: Global Entrepreneurship Consortium, Joanneum Research.

Because of these different "framework conditions", Austrian HEIs have developed different practices to prepare and support entrepreneurship. These practices will be discussed in the next section of this chapter.

Austrian HEIs have developed different approaches to prepare and support entrepreneurship

HEIs have put in place several (extracurricular and informal) activities to support student entrepreneurship

To take full advantage of the potential of HEIs to generate firms and jobs, and also to respond to calls of public accountability, the commercialisation of academic research is receiving increasingly more attention in Austria (OECD/EU, 2018b). Indeed, HEI-based entrepreneurship of various forms (i.e. start-ups, patenting, consulting and the like) is seen not only as a means of commercialisation but also as a way for Austrian HEIs to increase regional and national social welfare.

Against this background, student entrepreneurship is strongly encouraged by the Austrian higher education system and at the level of individual HEIs. A number of programmes provide different types of support ranging from mentoring, networking and ways to seek finance. The national network of incubators, AplusB, represents a good example of a systemic effort to help students and faculty use their capabilities to start a business (Box 5.2). Importantly, the AplusB network delivers entrepreneurship support to different regions in Austria, tailoring initiatives and activities to the features of the local ecosystem.

Box 5.2. The AplusB network of incubators in Austria

The AplusB (Academia plus Business) centres encourage HEI entrepreneurship. AplusB is an initiative of the Austrian Ministry for Transport, Innovation and Technology (BMVIT) starting in 2002. The Austrian Research Promotion Agency (FFG) was in charge of the co-ordination of the integrated network of incubators to support HEI entrepreneurship, in all different regional ecosystems, until 2017. The Austrian federal development and financing bank, the Austria *Wirtschaftsservice* (AWS), is now responsible promoting and funding companies

AplusB centres collaborate in the commercial implementation of academic ideas, both in the pre-seed and seed phases. They support young academics for an eighteen-month period, as they progress from having a good idea to setting up a business. The centres offer in-depth advice and hands-on support by providing infrastructure and capital. In addition, the centres give academic spin-offs and start-ups access to networks from the worlds of science, business and finance. To receive support from the centres, entrepreneurs must have an innovative idea that they intend to develop into a start-up project with growth prospects.

AplusB centres offer an integrated basket of services:

- Advice on business management and professional consultancy and coaching by the centre's project supervisors and external experts (IPR, sales, etc.).
- Provision of infrastructure (laboratories, offices, meeting rooms, etc.).
- Financial support (in the form of grants and/or loans).
- Inclusion in a network of partners from the worlds of science, business and finance.

Source: FFG (2017), *Ideas Become Reality*, https://www.ffg.at/sites/default/files/ffg_startup_folder_en.pdf.

As mentioned, there are also practices at the HEI level. To highlight only a few of these programmes, the FH Campus Wien established the Start-up Centre in 2015 in which, after a selection process, current students and recent graduates with aspirations to start a firm receive office space and mentorship from dedicated personnel. Similar services are available at TU Graz: the Start-Up Garage was founded in 2013 as a joint venture between TU Graz and the University of Graz and, separately, the Science Park is open to potential entrepreneurs who after selection (roughly, one out of seven applicants are admitted) are given access to the incubator. Importantly, students become aware of entrepreneurship (defined not only as the act of setting up a firm but more broadly as the capacity to be creative and implement ideas) as a career path from early on. The curriculum includes courses on entrepreneurship at early stages and there are often visible structures on campus highlighting entrepreneurship.

Another good practice, which is implemented by several Austrian HEIs is that of the Formula Student Competitions. A number of students from different universities, including FH Campus Wien, TU Graz, and the University of Innsbruck, participate, outside their curriculum, in these activities. The competition awards a prize for innovation for student teams across the world building from scratch small-scale formula-style racing cars (Box 5.3).[8] These competitions are well regarded by students and there are real opportunity costs for their participation as some noted their studies are delayed through participation in the competition; they nevertheless regard taking part as worthwhile. Employers, too,

recognise the benefits. Participation in such competitions gives students an overview that would not be possible even in an internship (which might require students to slot into existing activities and thus not give them the bird's eye view of how these different disciplines interact and work together. Institutions and universities may not be able to give students money or explicit academic support as per the rules of these prizes but they can give them space and institutional flexibility to facilitate those participating in such valuable activities and promote the activities of these students.

Most Austrian public universities have started offering entrepreneurship courses but there is a general tendency for these courses to be called "business management", "business administration", or the like, in the curricula (see Chapter 4). For example, this is the case, for instance, at the Vienna University of Economics and Business. Such an approach reduces the visibility of these practices and may also conflict students' view of entrepreneurship and unnecessarily create an image that mistakenly equates business management with entrepreneurship. In the long run, not calling entrepreneurship courses as such may implicitly create a second-rate view of entrepreneurship as a career choice.

In Austrian HEIs, activities to prepare and support entrepreneurship are often extracurricular and informal. These features are not negative per se and may actually help to reach out those students motivated to engage with entrepreneurship and who have the right attitude. This approach, however, impinges upon the possibility of involving a large number of students in entrepreneurship activities. As already discussed in Chapter 4, entrepreneurship is not "mainstreamed" in Austrian HEIs. However, it should be mentioned that the new performance agreements 2019-21 with public universities, which were under negotiation when the site visits took place, include specific measures to integrate entrepreneurship in institutional strategy and development planning (see Chapter 1).

In addition, another issue generated by extracurricular and informal activities is that it proves difficult to evaluate entrepreneurship learning. In the current system, it is virtually impossible to assess whether students' entrepreneurial attitude is a result of university training or whether it is the outcome of inherent entrepreneurial proclivity by the student population. In other terms: are entrepreneurial students in Austria born or made? Addressing this question is important because it has significant implications for curricula development, among others. For instance, if the case is that an entrepreneurial attitude is built, HEIs may adjust their programmes to provide training tailored to specific aspects of entrepreneurship. Similarly, because Austrian industrial actors value an entrepreneurial attitude when seeking employees, if such an attitude is indeed an outcome of training, it directs industry to build stronger ties with HEIs.

Box 5.3. Prizes and student innovation

A significant though often underestimated aspect in the discussion of innovation and entrepreneurship is the matter of creating a culture that fosters such behaviour. While specific course offerings and funding mechanisms are valuable in imparting the skills that are relevant to developing entrepreneurship in students, the role of prizes and participation in competitions cannot be overlooked. They provide an opportunity to gain "real-world" experience in implementing the academic knowledge they have acquired through the course of their studies, and moreover doing so in a motivating and collaborative environment. Participation in prizes move students beyond simply recognition in terms of coursework and credits and adds the extra motivation of peer-group esteem and collaboration, and the challenge of competition.

For some prizes, the focus can be exclusively within one discipline or family of closely-related disciplines. An example of this would be the concrete boatbuilding competitions for civil engineering students in many countries, starting originally in the United States in the 1960s. This idea was brought to Europe by the German Society for Concrete and Cement in the 1980s, establishing the *Betonkanuregatta* in Cologne, with prizes for the fastest, lightest, heaviest; but boat designs must float. "Kanu Reeves" of FH Campus Wien was a recent entry, with a bachelor-level team of civil and building engineering and architecture students. Students design and build a boat with no help from academics, only advice, and learn skills in structural design, team project management, water aesthetics, construction design, etc. With ten weeks from the first meeting to the competition itself, the challenge for students is teamworking and creative thinking, as the kind of solutions necessary emerge from the design process rather than from pre-existing knowledge.

Prizes can also cross many more disciplines, requiring students to work together with many people from different backgrounds. An excellent example of this is the Formula Student competitions, with FS Austria and an FS International competition held annually in the United Kingdom. Student teams from around the world design, build, test and race a small-scale formula-style racing car. Requirements change from year to year (again requiring tailored, situational solutions) with 30% of the parts premade and the remaining 70% of the car put together by the students themselves. Both FH Campus Wien and TU Graz have fielded teams of up to 45 students, who must design and construct a car, based on a business plan. Students do this with no credit recognition, self-select the team and operate a buddy system to organise the entire undertaking. The variety of skills necessary means not just students from engineering but also business and other "non-technological" disciplines are involved.

Vienna-based BOKU has created a student-driven "idea hub" focusing on eco-social projects and businesses. The idea hub won the Austrian edition of the EU-wide business idea competition to combat climate change, ClimateLaunchpad, three years in row. The hub involves students in creative idea generation processes and competency development (team building, storytelling, project management) and fosters students' capacity to implement ideas for sustainable development, enabling them to solve the complex challenges of the 21st century. It offers networking opportunities and project and start-up counselling both to students and external stakeholders (assisted by students, on the model of SME clinics). This student-led approach has proven to be especially effective for early-stage ideas, as students can ask for support from the very beginning of the conceptualisation process.

There are limited rewards for faculty that engages with entrepreneurial activities

While Austrian HEIs facilitate student entrepreneurship, entrepreneurial activities among faculty (i.e. academic entrepreneurship) are, in general terms, neither explicitly recognised nor rewarded. Such activities include patenting, licensing of academic inventions, start-ups, contract research and consulting (Grimaldi et al., 2011). There are some good practices promoting academic spin-offs that are based on research results generated at universities and research institutions, for example, BMBWF's Spin-off Fellowship that supports the commercialisation of existing and newly developed intellectual property belonging to Austrian universities and research institutions, enabling the fellowship project to be followed by a company start-up. This programme also requires that while engaging with entrepreneurship, the faculty cannot carry out any teaching or other research assignments.

Academic entrepreneurship correlates with academic performance (Van Looy et al., 2006; Abramo et al., 2012) and may translate into increased revenue for the host institution (Pitsakis et al., 2015) and improved teaching (Guerrero, et al., 2015). A non-negligible portion of leading research-intensive universities in the United States and elsewhere include entrepreneurial activities in the list of factors that count for promotion and tenure (Sanberg et al., 2014). There are calls for remaining universities to establish similar policies (Sanberg et al., 2014). Box 5.4, below, presents indicative examples of the tenure and promotion language used in the United States when it comes to the commercialisation activities. HEIs in Austria may consider developing similar policies so that entrepreneurship among faculty is explicitly rewarded and, hence, the commercialisation of research and the associated benefits are facilitated.

Box 5.4. Language used to incorporate entrepreneurial activities in tenure and promotion documents at selected universities

There are differences in the language universities adopt to incorporate entrepreneurial activities in their tenure and promotion documents. The table below illustrates some examples.

Auburn University	"Evaluation of Research...Other indicators of research productivity which can supplement one's record include external grants and the creation of intellectual property, copyrights, and patents"
Carnegie Institute of Technology at Carnegie Mellon	"Research: Measures of excellence in this area include the quality, volume, and impact of publications, including papers, monographs, books and research reports; evaluation of research by others; patents; prizes and awards for research; solicited and invited lectures; the amount of financial support; and the contribution of the candidate's work towards the needs of society"
Northeastern University	"...the receipt of patents represents professional recognition of research activities. In some fields, technical, procedural, or practical innovations made clinically or professionally are evidence of productive scholarship"
Pennsylvania State University	"Other evidence of research or creative accomplishments as appropriate (patents, new product development, new art forms, citation index analysis, etc.)
University of Arkansas at Little Rock	"The Scholarship of Integration may result in a traditional academic product such as an article, book or presentation. It also may take the form of a product or patent. As in other areas, appropriate forms of external review must be used to determine the merit of such products"

University of Arizona	"...promotion and tenure reviews, as detailed in the criteria of individual departments and colleges, will recognise original research contributions in peer-reviewed publications as well as integrative and applied forms of scholarship that involve cross-cutting collaborations with business and community partners, including translational research, commercialisation activities, and patents"
University of Wisconsin Madison	"[E]vidence of research performance and of a candidate's standing in a discipline includes …patents or evidence of intellectual property. The case must be made as to the quality and level of contribution of the candidate's present work"
Virginia Tech	"Other kinds of recognition for research may include patents, production or product development contracts, and demonstration of influence through citations, papers, awards, graduate student support, and the ability of the research to attract further funding"

Source: Sanberg, P.R. et al. (2014), "Changing the academic culture: Valuing patents and commercialization toward tenure and career advancement", https://doi.org/10.1073/pnas.1404094111.

Practices to support start-ups vary according to HEIs and regional ecosystems

Different means and enabling factors across different institutions and regions shape entrepreneurial ecosystems that support and maintain start-up activities by students and faculty members in Austria. As mentioned above, Austria's diverse economic geography underpins variability. Although the distinction among different regional support systems is not stark, based on a case study visit, it is possible to identify different types of ecosystems in Austria. For example, Vienna is home to a number of global industrial players and science-based companies. Upper Austria and Tirol host a large number of SMEs, which are often export-oriented. Graz, in Styria, is home to the automotive industry. The variability in support systems and economic geography calls for tailored policies as a one-size-fits-all approach would not do justice to the different needs of each ecosystem. For instance, Public universities co-operate with local AplusB centres that are organised to reflect local industrial specialisations.

In broad strokes, there are three types of start-up support systems in Austria:

1. HEI start-up activities as part of a larger ecosystem with support mechanisms such as entrepreneurial finance and intellectual capital already in place and feeding into each other (Kolympiris, Kalaitzandonakes and Miller, 2011). This kind of ecosystem utilises resources and talent from different industries and disciplines and can support start-up activities across a range of industries. A typical example of such established ecosystem is Vienna where, for instance, students and faculty of the WU Vienna can draw upon the local entrepreneurial infrastructure including, but not limited to, business angel and venture capital financing, legal support for the establishment of new firms and human capital availability from local science-based firms. Indeed, WU Vienna is a good example of how research, teaching and practice of entrepreneurship can feed into each other. The local ecosystem allows for collaboration across HEIs (both public universities and UAS) in Vienna to support start-ups and to integrate with relative ease practice-oriented modules as part of the curricula. At the same time, internationally leading research of entrepreneurship at WU Vienna informs local practice and feeds into teaching activities.
2. The University of Innsbruck exemplifies the second type of start-up support in Austria where local authorities collaborate with HEIs to establish local (small) entrepreneurial ecosystems across industries. A large number of export-oriented

SMEs are located in Upper Austria and Tirol. As a result, the chamber of commerce, as well as other institutions such as the Regional Development Agency of Tirol, are particularly active in promoting entrepreneurship, often in collaboration with local HEIs. For instance, the chamber of commerce established and financed a local InnCubator in collaboration with the University of Innsbruck. The University of Innsbruck is also showing increasing interest towards entrepreneurship per se and it has established a holding company that participates in university start-ups and organises different entrepreneurship events, among others. In cases illustrated by the University of Innsbruck, linking with a regional authority that has enough diversity in terms of the scope of industries it hosts is key to facilitating entrepreneurship across industries. The region of Tirol hosts firms belonging to different industries including tourism, electronics, information technology (IT), biotechnology and renewable energy.

3. HEI start-up activity geared towards a given industry. Several Austrian HEIs have strong links with industry, be it in the form of research contracts, joint research, teaching seminars, grant support and the like. As an example, TU Graz works closely with a number of actors from the automotive industry. As a case in point, TU Graz's AVL-TU Graz Transmission Centre, a research centre focusing on vehicle transmission testing, is in large part funded by the automotive industry. In this situation, the industrial players tap into cutting edge academic knowledge while TU Graz receives research funding, which it could not have secured otherwise. In cases like the above, students and faculty may receive elevated start-up support such as easier network access, if interested in creating a firm in the local industry. If the interest lies in a different sector, however, such support may be somewhat limited, reflecting the focus and experience of the HEI in the dominant industry. This may imply: i) suboptimal local support; ii) seeking support elsewhere; or iii) outright ceasing to seek support or/and abandon the prospect of entering entrepreneurship. A standard solution to such obstacles is to make available support expertise in different fields in part by populating the university department responsible for commercialisation with dedicated personnel per industry. Some HEIs in Styria, such as the FH Campus 02 Graz, have put in place specific activities to stimulate the R&D capacity of local SMEs, with the aim to transform them into restart-ups and generate diversity in the ecosystem (Box 5.5).

Box 5.5. HEIs promoting the innovation capacity of SMEs

The case of the Innolab at the FH Campus 02 Graz

Innolab was a response to an observation of the business environment in Styria, which noted that the region had a gap in the innovation ecosystem in terms of SMEs. It was noted that 50% of all companies and small companies were in a phase where further developments are needed; their business model may have been old, they may have missed trends, and turnover was declining. The key issue was, however, that many SMEs did not have the capacity for their own "in-house" research and development (R&D) as they were too small or not very high tech; they were thus being left behind. Innolab gives these SMEs the opportunity to "restart-up" through a renewal of their existing business and services, or through developing an entirely new business.

The Innolab team comprises eight people, with expertise in business, marketing and R&D, as well as an industrial designer and a sociologist. This team analyses the strengths, weaknesses and core competencies of the business, and discusses the trends and risks as well as opportunities going into the future. The SME and Innolab then jointly develop new ideas up to and including a new business model, going through the various options that promise the most success for the business They offer innovation workshops, supporting the business with contacts and networks and helping SMEs to find the necessary partners to develop and implement their restart-up. Innolab is funded through the Styrian Chamber of Commerce and, as such, is open to Styrian companies and employers (free for the initial early phase), with the goal of making Styria the most innovative restart-up zone in Europe.

It would be important to observe and assess the practices of those HEIs trying to play a more active role in their ecosystems, such as the FH Campus 02 Graz or, on a different level, the University of Innsbruck. There is little evidence supporting the idea that HEIs can morph from "actors" into "drivers" within their ecosystems and orient investment decisions and other local trends. Anecdotal evidence, however, is provided by the University of Strathclyde in Scotland. This practice can be useful to understand how a given HEI (in combination with regional agencies and policy actions) can generate a vision and local institutions that empower its ecosystem (Box 5.6).

Box 5.6. How the entrepreneurial ecosystem of the University of Strathclyde has grown over time

The University of Strathclyde is a public research university located in Glasgow, Scotland and is considered good example in the field of entrepreneurship education and support to entrepreneurs. The University of Strathclyde has achieved these results by a long-term strategy, which supported a process of institutionalisation.

The table below illustrates the main milestones of the process. These include the creation of a Business Venture Group in 1984 when the university formalised its support to spin-off activities based on university research. In 1990, the university opened an incubator. The incubator receives funds from the university and from an enterprise agency, a bank and a venture capital house. The UK government supported the University of Strathclyde in 2000 and provided resources to create mentors for students' ventures. The increasing institutionalisation of activities related to entrepreneurship and entrepreneurship education generates a sort of snowball effect. The pace of milestone events becomes faster and year after year the University of Strathclyde increases its capacity to provide students with a safe environment in which to engage with entrepreneurship learning opportunities. Students have started helping out local businesses in a business clinic connected with the business school. In recent years, the university has created a branch in Dubai – Campus Strathclyde Enterprise Pathway – connected and supported by the Strathclyde Entrepreneurial Network.

1984	Business Ventures Group created as a committee of the university court with a remit to encourage and support spin-off companies based on university research.
1990	Strathclyde opens incubator (Strathclyde University Incubator, SUI) with equal funding from the university, an enterprise agency, a bank and a venture capital house.

1996	Strathclyde Entrepreneurship Initiative (SEI) opens to provide entrepreneurship electives available to all students. Among others, a neighbouring university (in return for teaching provision), regional and city enterprise agencies and a private educational trust provide follow-up funding.
1998	Dedicated university spin-off company development officer post created in the technology transfer office.
1999	Technology Entrepreneurship for Postgraduates training programme starts at SEI, funded by Strathclyde and Glasgow Universities.
2000	SEI renamed Hunter Centre for Entrepreneurship following a GBP 5 million endowment from Sir Tom Hunter, alumnus, entrepreneur and philanthropist; First "entrepreneur-in-residence". Business plan competition launched, managed by entrepreneur-in-residence with GBP 40 000 prize money from an enterprise agency and a bank. Strathclyde, with four other Scottish universities, wins funding for the "Scottish Institute for Enterprise" from UK Government "Science Enterprise Challenge" fund; enables the hiring of student business advisor.
2001	Supercoach Entrepreneurial Training "train the trainers" course runs at Hunter Centre for the first time.
2002	Strathclyde business plan prize money diverted to a "Strathclyde Students into Business" programme with quick grants to fund market research and intellectual property protection. Scottish Enterprise and Royal Society of Edinburgh launch Enterprise Fellowships programme. "Celebration of Entrepreneurship" launched with inspirational events for students, staff, alumni and local people, a joint venture of two academic departments with Careers Office.
2003	Strathclyde 100 (S100) launched: an exclusive invitation-only network of successful alumni and friends of the university, meets 3 or 4 times a year to listen and give feedback to new businesses started by students, staff and alumni; led by Alumni and Development Office, supported by Hunter Centre and tech transfer office (TTO). S100 members volunteer to mentor specific early-stage entrepreneurs in own time (3 years later formalised as Enterprise Partners programme). Some S100 members later invest in showcased businesses.
2004	SEN launched for entrepreneurial students and young alumni – a series of networking events run by TTO staff and a student champion funded by Scottish Institute for Enterprise; SUI launches 'Upstarts' programme to link inexperienced technical start-up entrepreneurs with experienced alumni to strengthen their management teams; Technology Talent Initiative (now Executive Directors Designate Programme) launched; this project funds pre-launch spin-offs, financed by ERDF and city enterprise agency.
2005	GBP 950 000 SEEKIT funding (Scottish Government and ERDF) secured by TTO to grow services to young alumni entrepreneurs (advisors, events and networking) for 3 years, funding renewed for further 3 years in 2008.
2006	Enterprise Matters newsletter launched, funded by SEEKIT (published regularly until 2011).
2007	Four-year undergraduate Business Enterprise pathway launched by Hunter Centre in the BA business degree; Strathclyde Enterprise Awards Dinner launched with first of biennial enterprise challenge awards; Strathclyde Innovation Fund launched; first S100 London meeting.
2008	Strathclyde Innovation Fund closes first round (GBP 4.5 million) of fundraising for spin-offs with Braveheart, a Scottish venture capital company.
2011	Strathclyde Academy of Distinguished Entrepreneurs (a hall of fame) launched; Enterprise Forum monthly administration meetings under chairmanship of senior officer meets monthly to co-ordinate enterprise activities across the university; three-days intensive Enterprise Academy launched for Strathclyde's early-career researchers; Vertically-Integrated Project "Building Strathclyde's Enterprise Community": student-led activities for students interested in entrepreneurship, support the small enterprise support team in TTO, student leaders get credit, participants get official recognition for participation in enterprise skills-building activities. Internally funded enterprise advisor appointed. This replaces the previous externally funded posts.
2012	SUI launches Gabriel Investments, a business angel syndicate to channel start-up funds to high-quality start-ups. University court approves new commercially driven approach to spin-off creation. RKES creates an independently chaired Commercialisation and Investment Advisory Board to oversee strategic developments and recommend individual investments.
2013	Strathclyde 100 launched in Dubai campus Strathclyde Enterprise Pathway launched with separate pathways for students and researchers. Strathclyde Entrepreneurial Network refreshed as a collaborative network that brings together the university's academic and professional services to support enterprise and commercialisation activity at the University. Strathclyde Business School Business Clinic launched: third-year business undergraduates consulting microbusinesses in Glasgow.

Source: Levie, J. (2014), "The university is the classroom: Teaching and learning technology commercialization at a technological university", *The Journal of Technology Transfer*, Vol. 39(5), pp. 793-808.

Austrian universities of applied sciences have experience in facilitating entrepreneurship

The 21 universities of applied sciences (UAS) play an important role in supporting and facilitating entrepreneurship. The first-degree programme out of a UAS went into operation in 1994. UAS focus on application- and practice-oriented education and research and so, by design, they link strongly with industry. As an example of the links between UAS and industrial players, many external lecturers at FH Campus Wien are involved in both the development of study programmes and teaching, many study programmes are specially designed for working professionals (>50%) and involve quite an amount of time dedicated to internships. Furthermore, a number of private companies contribute the amount of money normally given by the federal ministry and provide a grant to students during their education and employ them after graduation.

Since their creation, UAS have traditionally facilitated entrepreneurship primarily among the student population for a number of reasons, including the following:

- First, they provide professionally oriented education and this strengthens a pragmatic mentality among students.
- Second, UAS offer study programmes, which can be combined with ongoing employment (a kind of a part-time study programme that does not prolong study duration because of a specific study organisation). Some UAS also offer dual study programmes, which are co-operative degree programmes combining higher education at HEIs and training on the job at a company to provide a jointly designed education at the university level.
- Third, at a broader level, UAS see promoting entrepreneurship as part of their mission. As a result, they often create an infrastructure to support entrepreneurship (e.g. the FH Upper Austria has set up a separate office for funding academic start-ups, Box 5.7).

Box 5.7. Providing funds to university start-ups: The case of the UAS in Upper Austria

The university of applied sciences in Upper Austria, one of the largest UAS in Austria, has put in place specific actions to facilitate entrepreneurship. Among others, the UAS of Upper Austria has created a fund of EUR 1.5 million that provides seed money to university start-ups. This fund capitalises on the capacity of the UAS of Upper Austria to compete for research funds: every year over 200 research projects generate over EUR 20 million grants.

The fund supporting researchers' start-ups is managed by a separate office. This governance setting has the objective to guarantee autonomy and flexibility to the fund. The creation of the fund reflects the aim to compensate for the lack of venture capital and business angels in the region.

- Fourth, UAS link not only with industrial players directly but also with other actors who also promote entrepreneurship. For instance, as in the case of several public universities, the university of applied sciences in Upper Austria is a shareholder in the local AplusB incubator and the university of applied sciences at Wiener Neustadt co-operates with the AplusB centre "Accent", located in lower Austria in

Wiener Neustadt and Krems, to increase awareness and generate and push ideas towards commercialisation.

The capacity of UAS-like HEIs to affect university-based entrepreneurship is not confined to Austria and there are several successful practices at the international level. In the Netherlands, for instance, UAS are associated with many business experiences and actively support university-based entrepreneurship in their ecosystems (see OECD/EU, 2018, for examples in the Netherlands. Another important example is that of STarmac, an entrepreneurship programme developed by the Swiss Applied Science University of Canton Vaud, part of the University of Applied Science and Arts in Western Switzerland (Box 5.8).

Box 5.8. The STarmac programme at the University of Applied Science and Arts in Western Switzerland

The STarmac programme is a university pre-incubator meant to assist faculty and student with entrepreneurial intentions to start a firm. It provides early-stage coaching, team building services and access to the local entrepreneurial ecosystem.

In the typical scenario, there is some progress on the technological front but lack of progress otherwise. As such, STarmac proceeds sequentially with the assessment of the business idea, the business concept, the business validation and what is called the "start-up innogrant". Projects that reach this latter stage are incubated for one year and receive coaching and financial support so that they can apply for entry to external incubation or acceleration programmes.

Source: Pallotta, V. and D. Campisi (2018), "STarmac: An environment for the stimulation and development of entrepreneurial projects in academic institutions", *Industry and Higher Education*, Vol. 32(4), pp. 269-280.

However, as already discussed above – and also in the case of UAS –, the lack of curricular and formal entrepreneurship education challenges the capacity of Austria higher education system to effectively adopt the entrepreneurial and innovation agenda. The strong focus of UAS on entrepreneurship does not affect the curricula, which do not include student start-up activities. While there is soft recognition among faculty and students for entrepreneurship, there is no formal credit and, as such, students engaging in those activities do so at the expense of their own time.[9] Because entrepreneurship *per se* matters and potential employers tend to value entrepreneurial experience and attitude especially among the student population, Austrian HEIs may consider integrated entrepreneurship activities explicitly in the curricula, as already recommended in the previous chapter.

Conclusions

Exploiting a generally favourable environment towards entrepreneurship and an increasing interest among Austrian HEIs to promote entrepreneurship, students are in an advantageous position to enjoy a wide range of services and opportunities to engage in entrepreneurship, in the form of start-up creation. There is strong infrastructure providing support and guidance both at the national and at the regional levels.

Entrepreneurial training is increasing in Austria, there is a general entrepreneurial attitude in the student population. Different types of entrepreneurial ecosystems are in place and

both public universities and the universities of applied sciences are key actors when it comes to student entrepreneurship. Conversely, entrepreneurial activities implemented by faculty are, in general terms, poorly recognised or rewarded within academia.

For further strengthen such a system, Austrian authorities may consider the following recommendations:

1. Granting formal recognition to entrepreneurship among faculty (i.e. academic entrepreneurship). Entrepreneurial activities should be part of the tenure and promotion criteria. Academic entrepreneurship feeds into research and teaching, and generates revenues for HEIs and local economies. Similar to HEIs in different countries, efforts towards academic entrepreneurship in the form of start-up creation, patenting, consulting and the like should be rewarded because, among other things, academic entrepreneurship can boost local economies (Kolympiris et al., 2015).
2. Promoting entrepreneurship as a viable, and not second-rated, career option. The broader implication arising from Austria being home to a strong industrial sector is that HEIs should concentrate efforts to explicitly recognise and reward entrepreneurship so that not all top talent is directed to industry, despite the fact that employability in the Austrian industry sector offers a number of advantages including job and income security (OECD, 2018b).
3. Allow students to write their dissertation about their start-up experience or business idea. Typically, dissertation topics have an academic focus, however, some programmes are oriented towards applied research projects. Within this framework, students should be given the possibility to connect their experience in entrepreneurship with their dissertation. This would also provide formalisation and visibility to entrepreneurship activities within HEIs.
4. Tailoring policies supporting HEI entrepreneurship to the different types of entrepreneurial ecosystem. Geographic variability in the type of HEI start-up activity in Austria implies that there is no single path towards the entrepreneurial and innovation agenda. As such, there is limited space for replicability of successful cases. In addition, the lack of a single path suggests that the evaluation of HEI entrepreneurial efforts to contribute to local and national competitiveness and, therefore, to partly justify the public funding they receive is a thorny task as it cannot be standardised across the different ecosystems.

Notes

[1] See https://www.forbes.com/sites/ryanrobinson/2018/10/26/is-education-still-relevant-for-millennial-entrepreneurs/#4e569e3a3a64.

[2] See https://www.globalinnovationindex.org/Home.

[3] See europa.eu/rapid/press-release_MEMO-18-4224_en.pdf.

[4] *Doing Business* records all procedures officially required, or commonly done in practice, for an entrepreneur to start up and formally operate an industrial or commercial business, as well as the time and cost to complete these procedures and the paid-in minimum capital requirement. http://www.doingbusiness.org/en/data/exploretopics/starting-a-business/what-measured.

[5] See http://www.doingbusiness.org/en/data/exploreeconomies/austria.

[6] See https://www.gemconsortium.org/country-profile/38.

[7] Idem.

[8] For a discussion about the use of extracurricular learning opportunities in entrepreneurship education in Austria, see the previous chapter in this report.

[9] For example, students struggle to connect their experience related to their start-up with their study programme: the system does not allow them to write their thesis related to their start-up. There are several international examples that illustrate the importance of this approach. For instance, at the University of Mannheim, Business School (Germany), in addition to the classical master's dissertation, students have the opportunity to combine the thesis with a start-up project (master's thesis Inside the Venture) in co-operation with the MCEI (Mannheim Center for Entrepreneurship and Innovation).

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OECD Skills Studies

Supporting Entrepreneurship and Innovation in Higher Education in Austria

The Austrian higher education system has consistently recognised the need to become more entrepreneurial and innovative with a view to supporting the economic, social and cultural development of the country and its regions. Over the past decades, the government has been implementing a broad reform agenda to provide strategic funding, diversify higher education institutions (HEIs) and promote an allocation of students that improves the quality of services and empowers them vis à vis the future of work and society.

This review illustrates policy actions promoting the development of entrepreneurial and innovative activities in the Higher Education System and individual HEIs. In addition, based on information gathered during study visits, the review discusses strategies and practices adopted by Austrian HEIs to innovate, engage, and generate value for their own ecosystems and networks. The review is part of a series of national reports implementing the HEinnovate framework. HEinnovate is a holistic framework that the OECD and the European Commission have developed to promote the "entrepreneurial and innovation agenda" in higher education.

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