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).

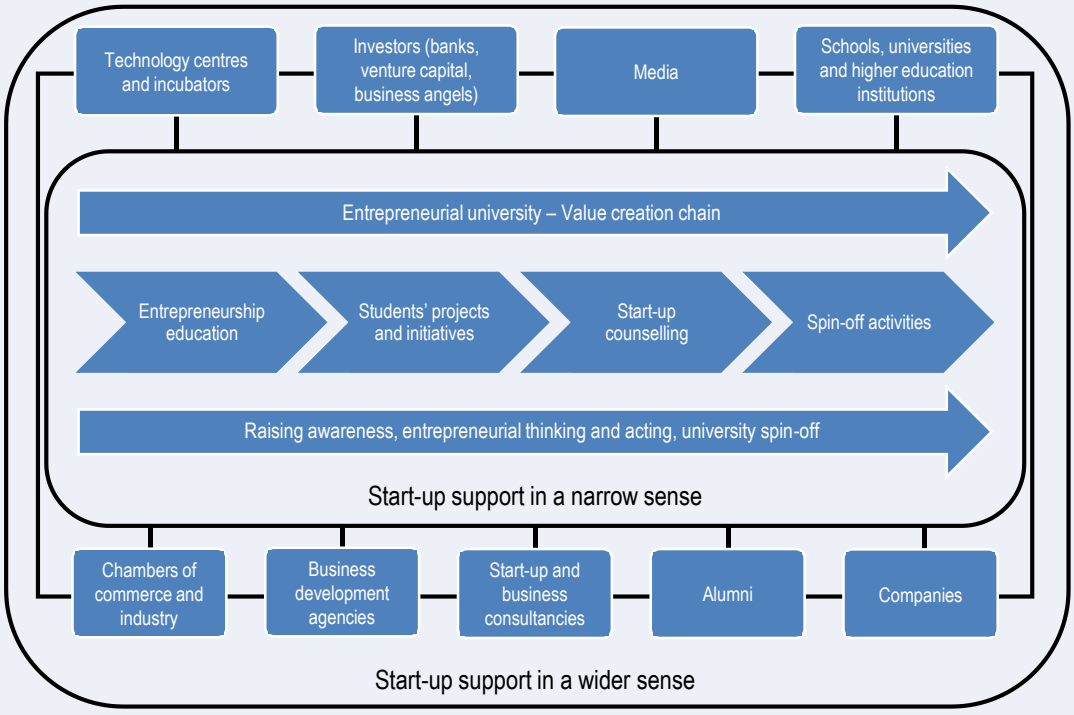
An increasing number of HEIs has put in place specific institutions and functions to accompany students in creating a venture over the past two decades. This wave has brought to campus activities such as incubators, accelerators, co-working hubs and maker spaces (Duruflé, Hellmann and Wilson, 2018). 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).

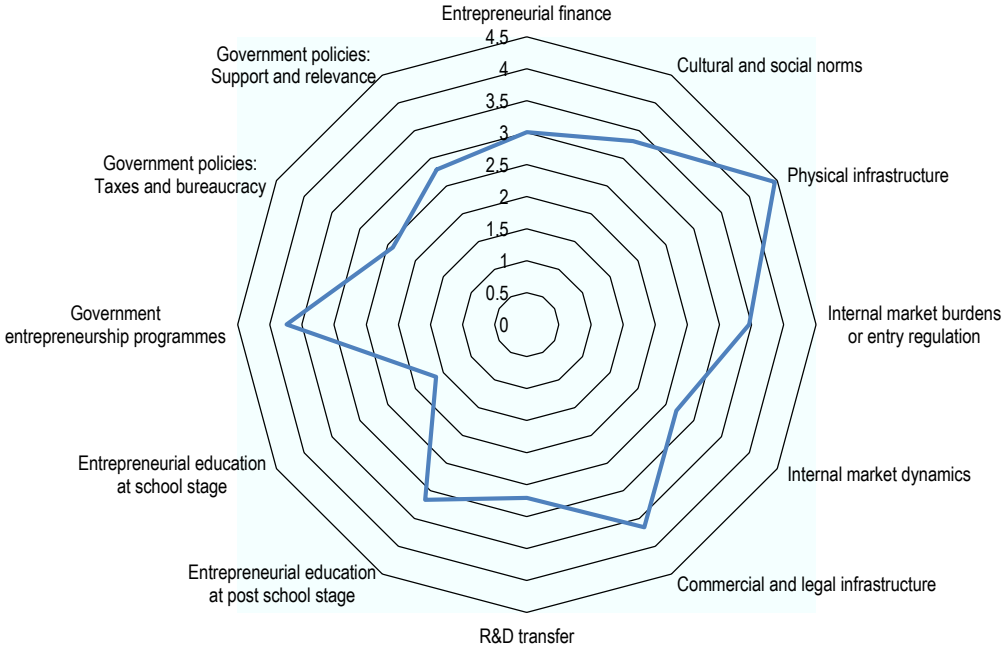
The diversity of conditions also features Austrian HEIs where, in part because of the country's small size, professors of international renown are relatively few and focused on specific subject areas, such as industrial engineering, informatics, mechatronics and biotechnology (OECD, 2018b). Excellence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

References

Abramo, G., et al. (2012), "An individual-level assessment of the relationship between spin-off activities and research performance in universities", *Research and Development Management*, Vol. 42(3), pp. 225-242.

Arrighetti A., Seravalli G. (1999), (eds.) "*Istituzioni intermedie e sviluppo locale*", Donzelli, Rome.

Backes-Gellner, U. and P. Moog (2007), "Who chooses to become an entrepreneur? The jacks-of-all-trades in social and human capital", *University of Zurich Institute for Strategy and Business Economics Working Paper*, No. 76, https://doi.org/10.2139/ssrn.1091089.

Bergman, E.M. et al. (2015), "Effects of learning content in context on knowledge acquisition and recall: A pre test-post test control group design", BMC Medical Education, https://bmcmededuc.biomedcentral.com/articles/10.1186/s12909-015-0416-0.

BMWFW/ BMVIT (2017), *Austrian Research and Technology Report 2017*, https://bmbwf.gv.at/fileadmin/user_upload/forschung/publikationen/FTB_2017_en_WEB.PDF.

Duruflé, G., T. Hellmann and K. Wilson (2018), "Catalysing entrepreneurship in and around universities", Saïd Business School, University of Oxford.

Etzkowitz, H. and L. Leydesdorff (2000), "The dynamics of innovation: From national systems and "Mode 2" to a triple helix of university–industry–government relations", *Research Policy*, Vol. 29(2), pp. 109-123.

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

Global Entrepreneurship Monitor (2018), *Bericht zur Lage des Unternehmertums in Österreich*, file:///C:/Users/Trapasso_R/Downloads/gem-austria-2018-executive-summary-1561109196.pdf (Accessed on January 2019).

Goddard, J.E.H. et al. (eds.) (2006), *The Civic University*, Elgar Publishing.

Government of Portugal (2018), *Short Cycle*, https://www.dges.gov.pt/en/pagina/curso-tecnico-superior-profissional-ctesp.

Graham, R. (2014), *Creating University-based Entrepreneurial Ecosystems: Evidence from Emerging World Leaders*, MIT Skoltech Initiative, http://www.rhgraham.org/resources/MIT:Skoltech-entrepreneurial-ecosystems-report-2014-.pdf.

Grimaldi, R., et al. (2011), "30 years after Bayh–Dole: Reassessing academic entrepreneurship", *Research Policy*, Vol. 40(8), pp. 1045-1057.

Guerrero, M., et al. (2015), "Economic impact of entrepreneurial universities' activities: An exploratory study of the United Kingdom", *Research Policy*, Vol. 44(3), pp. 748-764.

Higher Education Authority (2018), *Springboard+*, https://springboardcourses.ie/.

Joanneum Research (2015), *The Leverage Potential of the European Research Area for Austria's Ambbition to become one of the Innovation Leaders in Europe – A comparative study of Austria, Sweden,* Joanneum Research, Vienna, Austria.

Kolympiris, C., N. Kalaitzandonakes and D. Miller (2011), "Spatial collocation and venture capital in the US biotechnology industry", *Research Policy*, Vol. 40(9), pp. 1188-1199, https://doi.org/10.1016/j.respol.2011.05.022.

Kolympiris, C. et al. (2015), "Location choice of academic entrepreneurs: Evidence from the US biotechnology industry", *Journal of Business Venturing*, Vol. 30(2), pp. 227-254.

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.

OECD (2018a), *OECD Employment Outlook 2018*, OECD Publishing, Paris, https://doi.org/10.1787/empl_outlook-2018-en.

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

OECD (2017), *Education Policy Outlook: Austria*, http://www.oecd.org/education/Education-Policy-Outlook-Country-Profile-Austria.pdf.

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

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.

Pitsakis, K., et al. (2015), "The Peripheral halo effect: Do academic spinoffs influence universities' research income?", *Journal of Management Studies*, Vol. 52(3), pp. 321-353.

Policy, W.P. (2016), *The Knowledge Triangle: Synthesis Report*.

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

Van Looy, B. et al. (2006), "Publication and patent behavior of academic researchers: Conflicting, reinforcing or merely co-existing?", *Research Policy*, Vol. 35(4)596-608.

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.

Wadhwa, V., R. Freeman and B. Rissing (2008), "Education and tech entrepreneurship", Edwin Marion Kauffman Foundation.