

The entrepreneurial university as driver for economic growth and social change - key strategic challenges

Magnus Klofsten^{a)}, Alain Fayolle^{b)}, Maribel Guerrero^{c)}, Sarfraz Mian^{d)}, David Urbano^{e)}, & Mike Wright^{g)}

Corresponding author:
Magnus Klofsten
Magnus.klofsten@liu.se

- a) Linköping University, PIE/Helix Competence Centre, Linköping, Sweden
- b) EM Lyon Business School, Lyon, France
- c) Newcastle Business School at Northumbria University, UK
- d) State University of New York, New York, USA
- e) University Autonomus of Barcelona, Spain
- f) Imperial College London, London, UK

Key words

Internal & external factors, entrepreneurial learning, pathways for entrepreneurship, and impact measures

Highlights

- Leadership challenges of the entrepreneurial university
- The meaning of entrepreneurship within an academic context
- The university as a complex system for strategic decision making

Abstract

The sparse or total lack of research on the various leadership and strategic issues facing universities seeking to become more entrepreneurial has led this special issue to focus on the management, development, and implementation of this vision. We have solicited original research on the strategic challenges that these universities currently encounter. Researchers in management and related disciplines have contributed to this field of inquiry, which is having growing implications for our universities and stakeholders in the social and economic spheres. We begin by tracing an overarching framework, to which we add brief descriptions of the contributing papers in this special issue. To conclude, we outline future research goals and discuss how, around the world, academic actors involved in university development – such as university managers and policy makers – could view the ideas presented here.

Introduction

The idea that universities could (or should) be entrepreneurial entities was introduced in the early 1980s, and debates on how higher education institutions could be involved in social change and economic growth began to appear more prominently in the literature (Etzkowitz, 1983; Clark, 1998; Klofsten and Jones-Evans, 2000; Gibb & Hannon, 2006; Perkmann et al 2013; Guerrero et al. 2016). In carrying out their role of a catalyst for development through attracting well-educated people, facilitating knowledge transfer, and contributing to the creation of new ventures, as well as to maintaining the competitiveness of established firms and organisations, universities have attracted growing attention from researchers exploring the impact of higher education institutions on regional finances and culture (Saxenian, 1994; Etzkowitz and Klofsten, 2005). The issues that have been studied include how universities pursue their entrepreneurial ambitions via patent applications, idea spin-offs into new firms,

industrial research collaborations, and entrepreneurial training of highly skilled individuals and incubators (Slaughter and Leslie, 1997; Shane, 2004; Somsuk and Laosirihongthong, 2014). An understanding of the roles of present-day entrepreneurial universities is a prerequisite for appreciating how, as key enablers in technology, innovation, and economic development, they act as change agents in current competitive society. With support from state and private sector partners, these centres of learning create and disseminate new knowledge, organize multidisciplinary and boundary spanning activities, and facilitate novel partnership arrangements; researchers are highly interested in the strategic mechanisms of these activities. Through regional interaction, entrepreneurial universities promote change that benefits the entire region (Wright et al. 2004; Guerrero et al. 2018).

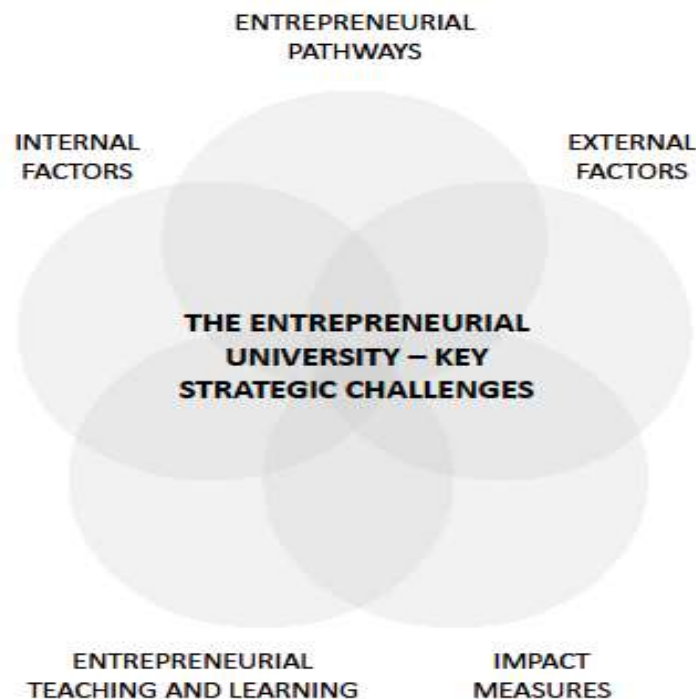
University leaders currently find themselves with expanded roles. Besides their former tasks of dealing with internal issues, they must now manage relationships with external stakeholders in the private and public sectors (Etzkowitz, 2016). The nature of inter-university competition has also changed, extending onto the global arena (Bouncken, 2018). With resource constraints, universities must continue to find new ways of proving their value to society and their entitlement to available resources (Gibb and Hannon 2006). Other emergent challenges are integrating entrepreneurship in the university curriculum, skills development of students for the global market (Leitch, 2006); the “massification” of higher education and its management (Smith, 1999; Shattock, 2000), including through the recent trend of online programs (MOOCs); external expectations for guidance in social and economic issues (Charles, 2003; Arbo and Benneworth, 2007); and internal demands for future funding and autonomy (Darling et al. 1989; Armbruster, 2008). Universities are thus facing both new challenges and old ones with new levels of urgency. Survival and future development will depend on how well universities adapt to unpredictable environments that are becoming global, instead of isolationist; international, instead of domestic; and competitive, instead of regulated, something like OECD and the European Commission has focused on through organising and running different schemes in order to stimulate entrepreneurial development at European universities through i.e. HEInnovate community (Gibb et al. 2013; OECD/EU, 2018). Entrepreneurial skills of individuals may possibly be increasingly indispensable for navigating such environments (Aparicio et al. 2016) along with adaptability and flexibility, strong leadership, and an environment conducive to entrepreneurial processes (Gibb and Hannon, 2006).

The scope of the special issue

In the last quarter of a century, and especially in the last 10 years, “the entrepreneurial university” and “academic entrepreneurship” have become prevalent research topics. Much of the research has approached these areas on an operational level, by studying technology transfer offices (TTOs), teaching and training activities, stakeholder collaboration, innovation support, development of new spin-off firms, and incubators and science parks. Although more pertinent, the areas of leadership, governance, and the broader design issues of contextual fit with the environment have been largely ignored (Siegel and Leih, 2018; Rinaldi et al. 2018; Siegel and Wright, 2015). Designing relevant entrepreneurial higher education and research, however, depends on many challenging factors. In complex, unpredictable times, leadership needs to be nimble and exude confidence if their organization is to succeed and survive. When an institution has a shared culture and vision, continually produces new ideas, and is provided with a certain degree of freedom to operate independently of its stakeholders, innovation will have favourable conditions. Similarly, changing environmental and contextual regional elements have required innovation in organizational design in order to sustain growth.

These strategic challenging tasks of university leaders, governance, and institutional design populate the emerging forefront of the new, societal focus on entrepreneurship. Higher education institutions are not immune to this shift. The ways that higher education institutions can choose to pursue entrepreneurship – for example, in the management of various internal and external factors, in the development of teaching and learning schemes, and in their support of varying entrepreneurial pathways – must be chosen to fit the institution, and adapted according to results from measurements of their impact on the entrepreneurial agenda (see figure 1).

Figure 1. The entrepreneurial university - key strategic challenges



This lead paper begins by discussing these topics in more detail, illustrating how universities can act strategically to become effective economic and societal change agents. We then summarize the papers in the special issue. The final section discusses the implications of these new strategies for policymakers, university leaders, and other academic stakeholders concerned with university development, wherever in the world the university may be located. This section also lays out an agenda for future research.

Internal factors – strategic challenges

In the current socio-economic landscape, entrepreneurial universities are facing great pressures to make their core activities more affordable, more effective and more sustainable (Guerrero et al. 2016). An entrepreneurial approach will help university leaders to identify and deal with certain challenges related to formulating a strategy, and determine what capabilities they need to face and achieve stakeholders' goals related with the university internal factors (Holstein et al. 2018; Siegel and Leih, 2018; Teece, 2018). Although a considerable body of academic research has recognized these strategic aspects, few studies have explored the internal factors of entrepreneurial universities with a strategic focus (Siegel

and Leih, 2018) by analysing their links with strategic decisions, the building of dynamic organizational capabilities, and the achievement of a sustainable performance.

Regarding strategic choices, the academic debate of internal factors has been related with at least three strategic decisions. First, internal factors related with an entrepreneurial orientation across units and departments to build an amphometer and culture characterized by proactiveness, innovativeness and risk-taking (Todorovic et al. 2011). Adopting an entrepreneurial orientation, internal stakeholders (administration, academic faculties, staff, students, alumni) are more likely to share a common vision, commitments, achievements and a key role in supporting the university entrepreneurial agenda. Second, are internal factors relating to an internationalization strategy (Cattaneo et al. 2015; Minola et al. 2016). Adopting an internationalization orientation, entrepreneurial universities are more proactive in terms of attracting and retaining talent with entrepreneurial mindsets and behaviours; capturing balanced and diversified funds for ensuring long-term investment in entrepreneurial and innovative activities; and building strategic partnerships with key agents with a strong entrepreneurial innovation presence and recognition across the globe. Third, are internal factors relating to a diversified strategic orientation (McAdam et al. 2017; Abdelkafi et al. 2018; Madichie and Gbadamosi, 2017). By adopting a diversified strategic orientation, entrepreneurial universities looking for the achievement of multiple stakeholders' goals and long-term survival by focusing on value creation and hybrid business models in the delivery and support of entrepreneurial and innovative initiatives.

The success of strategic entrepreneurial universities' decisions depends on the investment and transformation process of traditional into dynamic organizational capabilities (leadership, talent people, financial bases, new organizational structures, incentives and rewards systems, and other resources) required for the delivery of the entrepreneurial agenda (Guerrero and Urbano, 2012). Regarding the investment in and transformation of leadership capabilities, studies have confirmed that university leadership that marries strategic thinking and capabilities development enhances the likelihood of a university's competitive fitness to support entrepreneurial and innovative objectives over the long-term (Leih and Teece, 2016). The process of building dynamic entrepreneurial and innovative capabilities requires time, trust, engagement and commitment among internal and external members of innovation and entrepreneurship ecosystems (Miller and Acs, 2017; Huang-Saad et al. 2018; Herrera et al. 2018; Yuan et al. 2018). Therefore, leadership is a key dynamic organizational capability in the delivery of an entrepreneurial agenda.

Concerning the investment in and transformation of human capabilities, the literature has explored how the university: promotes entrepreneurial synergies between administration, academics and staff; designs novel career progression models according the academics' profiles; explores (non)financial incentives or rewards for supporting university members that are actively seeking opportunities aligned with the strategic objectives; and engages as well as recruits human capital with entrepreneurial and innovative mindsets and behaviours (Fini et al. 2009; Philpott et al. 2011; Leih and Teece, 2016). These HR practices are relevant for reducing tensions, motivating and engaging diversified collectives with the propensity to be successful in generating entrepreneurial initiatives and obtaining excellence in research and teaching. However, there is still little evidence about strategies for managing conflicts, opportunistic behaviours and constraints for adopting a dual way of acting as both an academic and an entrepreneurial organization (Philpott et al. 2011; Gianiodis et al. 2016). Therefore, the investment in the development of human entrepreneurial and innovative capabilities, as well as, the design of incentives and rewards to the community who actively

support the entrepreneurial agenda are key components of entrepreneurial university organizational capabilities. Regarding the investment in and transformation of innovation and entrepreneurship capabilities, there is a mature analysis about the infrastructures developed by the university to support innovation and entrepreneurship; particularly, the literature about technology transfer offices, incubators, scientific parks and business creation offices (Siegel et al. 2007). Innovation and entrepreneurship capabilities are internal factors that are necessary to provide specific support for the entrepreneurial and innovative university community (potential and new entrepreneurs). A successful integration of internal factors through investing in the transformation of organizational capabilities are the key antecedents of a sustainable entrepreneurial university performance. Nowadays, there is little evidence about the link between strategic university challenges and long-term sustainability of an entrepreneurial and innovative agenda, as well as the effects of strategic and dynamic internal factors on the effectiveness of entrepreneurial university agendas and their impacts of entrepreneurial outcomes in the society (Rasmussen et al. 2011; Guerrero et al. 2015; Fini et al. 2018; Hayter and Cahoy, 2018). Similarly, an emergent academic debate is the growing complexity of university's leaders for sensing shifts, seizing opportunities, transforming and operating in more digital competitive environments (Teece, 2018). For instance, to respond to digital challenges and achieve stakeholders' goals, entrepreneurial university's leaders should transform their internal factors into digital technologies (e.g. artefacts, platforms, infrastructures) for conducting entrepreneurial and innovative initiatives (Nambisan, 2017; Rippa and Giustina, 2018; Nambisan et al. 2018). This means working on fostering strategic organizational capabilities such as digital human capital, a digital culture, digital support infrastructure, digital teaching and research practices, as well as a dynamic digital presence.

External or environmental factors – strategic challenges

When we talk about strategic aspects related to external or environmental factors that affect entrepreneurial universities, we usually refer to stakeholders, partnerships and alliances (Gibb and Hannon 2006; Clauss et al. 2018). For example, the entrepreneurial university framework of the European Commission-OECD (2012) considers that external relationships for knowledge exchange and internationalization are some of the most relevant external strategic aspects for universities. Knowledge exchange and collaboration support organisational innovation, teaching and research, and local development, creating value for higher education and society in general. Internationalisation integrates an international or global dimension into the design and delivery of education, research, and knowledge exchange relationships, supporting change and improvement (EC-OCDE, 2012). Despite this, there is a lot of literature (Kirby et al. 2011; Guerrero and Urbano, 2012) that highlights the importance of the institutional environment that condition the creation and development of entrepreneurial universities.

Concerning the institutional environmental factors, North (1990; 2005) defined institutions as “the rules of the game in a society, or more formally, institutions are the constraints that shape human interaction” (North, 1990, p. 3). Institutions can be either formal (such as constitutions, regulations or contracts), or informal (such as attitudes, values, norms of behaviour and conventions). The dynamic relationship between these two types of institutions affects economic and social development. Applying North's framework to the field of entrepreneurship, the institutional matrix can foster or inhibit the development of entrepreneurial universities. In this context, formal factors are the development and implementation of entrepreneurial courses for students (Lee and Win, 2004), the university support for technology transfer and start-ups, and the existence of efficient incubators and science parks (Link and Scott, 2005), the flexible organizational structures and leadership

(Clark, 1998), and effective interaction among university, industry, and government (Etzkowitz and Klofsten, 2005). Informal factors are favourable attitudes of students and faculty toward entrepreneurship (Liñán et al. 2011), adequate ways of teaching (Kirby (2005), the presence of entrepreneurial role models (Venkataraman, 2004), and appropriate reward system for being an (academic) entrepreneur (Landry et al. 2006). A challenge for academic leaders at all levels is to create synergetic combinations of these environmental factors that make them contribute to a university becoming more entrepreneurial and consequently, to develop and generate more entrepreneurial societies with important repercussions on social and economic progress.

Teaching and learning entrepreneurship – strategic challenges

Entrepreneurship education is an important topic for individuals, organizations and societies. Universities as a particular type of organization play an essential role in diffusing entrepreneurial culture, promoting entrepreneurship as a desirable and feasible human behaviour and facilitating/supporting entrepreneurial behaviours from their students, researchers and other categories of employees. Moreover, universities are research-based organisations that set-up virtuous circles linking knowledge production (research activities) to knowledge diffusion (teaching/learning activities). We would like here to develop two main challenges in relation to entrepreneurship education and the strategies to deal with.

Very often, the implicit model linking entrepreneurship education (learning useful knowledge and developing ad hoc competences) to entrepreneurship (applying entrepreneurial knowledge and competences in a real-life situation) emphasizes the positive outcomes of entrepreneurship. However, universities could also show the negative outcomes of entrepreneurship such as failure, psychological stress, financial losses, health concerns and so forth. Entrepreneurship education research is key to help us getting a better understanding of the positive and negative outcomes of entrepreneurship as Gartner claims: “The really interesting questions and insights in the field of entrepreneurship are coming from scholars focusing on entrepreneurship education. When we explore issues in entrepreneurship education we are delving into fundamental concerns about the knowledge, skills and activities that are essential for spurring entrepreneurial activity“ (Fayolle, 2018, from the book cover page). Consequently, the first challenge for entrepreneurship education is to move from a (too often) practice-based orientation to a research-based orientation. Universities’ strategies to deal with this challenge could turn around dedicating PhD seminars, dedicating research teams, encouraging students to choose entrepreneurship education as a topical domain for their doctoral studies, designing and offering research-based seminars and workshops for entrepreneurship educators and trainers. Entrepreneurship education should also be strengthened by integrating evidence-based research results in entrepreneurship and entrepreneurship education (see for example, Bae et al, 2014; Schlaegel and Koenig, 2013; Martin et al, 2012; Nabi et al. 2017; Wang and Chugh, 2014).

A second set of challenges and issues relate to the assessment and evaluation of entrepreneurship education (Nabi et al. 2017). For example, entrepreneurship education literature shows contradictory results concerning the impact of entrepreneurship education, the need to define assessment and impact indicators at individual, organization and society levels, the necessity to sophisticate research design and methods to study evaluation issues (for example longitudinal design, experimental research design, mediating and moderating effects) and the need to apply in entrepreneurship education, concepts, constructs, theories and methods from the field of education. Teaching and learning entrepreneurship in the context of universities should be based on entrepreneurship education having been thought

through in order to answer basic questions such as: Is it relevant (regarding the needs from all stakeholders)? Is it coherent (is there an alignment between the objectives and the other teaching model components)? Is it efficacious (is there an impact in relation to the assessment indicators)? Is it efficient (is there an impact optimizing the resources)? The assessment of entrepreneurship education would also gain legitimacy by examining the impact at the four Kirkpatrick's levels: reaction (level of participants' satisfaction), learning (acquisition of knowledge and competences), behaviours (transfer of knowledge and competences to professional (entrepreneurial) situations) and results (benefits for individuals, organizations and societies) (Kirkpatrick, 1996). Alternatively, the basic model from Baldwin and Ford (1988; 2017) could be applied. This process-based model differently from the Kirkpatrick goal-based model distinguishes the inputs: participants' characteristics, training characteristics, and organizational context or environmental characteristics; the outputs: learning and retention processes (personal changes that a learning context might enhance; possession of knowledge or abilities) and the Outcomes: maintenance of what people have learned over time.

These two challenges have to be understood from an entrepreneurial university point of view. Being (or becoming) an entrepreneurial university raises important questions in relation to teaching and learning activities. Among them, how to integrate entrepreneurship education at the whole university and how to define entrepreneurship (and consequently entrepreneurship education) appear quite fundamental and strategic. If universities want to reach a bigger audience than start-up entrepreneurs they need to design and implement entrepreneurship education in a way including the diversity of entrepreneurial situations, processes and behaviours. This could also be done by emphasizing the role of context (for example, in relation to the core topics of university faculties and disciplines) and taking it into consideration in dedicated entrepreneurship courses through contextualised case studies and entrepreneur talks. Finally, we believe it is possible to teach entrepreneurship and develop student's entrepreneurial mindset at the whole university, through transversal approaches using 'enterprising' pedagogical initiatives. Such initiatives strive to facilitate learning that is empowering, experiential, cooperative and reflective.

Supporting different entrepreneurial pathways – strategic challenges

The emergence of the entrepreneurial university model over recent decades is motivated by the increasing importance of knowledge-based entrepreneurship as a strategy where regions and nations that acquire better understanding in creating and managing innovation spaces around universities by strategically building and managing their outreach capacity for gaining competitiveness and economic development (Mian, 2011; Svensson et al. 2012). In the prevailing environment of resource constraints and lingering debates about fears of threat to traditional academic values there are continuing expectations from entrepreneurially oriented universities of delivering on the coveted role of fostering knowledge economy through their pro-active support of innovation and entrepreneurship. For this university leaders must make strategic decisions on an optimal mix of out-of-the box non-traditional activities and boundary spanning characteristics that have been duly identified (Tornatzky et al. 2014). To review the strategic choices of these activities and characteristics is in terms of the benefits and services they offer to their university community (students, faculty, and staff) and beyond, the academic literature has come up with different functional pathways to demonstrate university leadership's commitment for direct involvement in supporting innovative entrepreneurship (OECD, 2012).

First, the university raises awareness of the value and importance of developing entrepreneurial abilities amongst its members. Developing entrepreneurs is often focused on the provision of opportunities and facilities prior to the inspiration and motivation that is necessary for individuals to move forward with their entrepreneurial intentions (Hornsby et al. 2018). Creating widespread awareness amongst students, faculty and staff of the importance of developing a range of entrepreneurial abilities and skills is therefore an important function of an entrepreneurial university. Thus, by instilling characteristics of an enabling entrepreneurial culture, through new projects and providing supportive work environment is not only a critical function but is being increasingly emphasized through innovative programmatic activities (Guerrero, et al. 2016).

Second, the motivated individuals look for the nuts and bolts of a business start-up. This typically comprises a venture idea, finding a team if applicable, and preparing a business plan and connecting to an enabling internal and external network for support and refinements (Klofsten, 2005). It is about developing an enterprise game plan for creating value in many different areas of society. This is not just about the abilities which support new business ideas but also those which can support employability and career development in the entrepreneurial arena. This key function is on the rise to promote start-ups on various university campuses. Third, targeted training is provided in some of the skills and competences to initiate, operate and grow their start-ups. Training in critical functions of legal and regulatory issues, technical, fund raising, management, marketing, and soft emotional issues is provided. A host of training courses, practicums in venture labs, internships, extra and co-curricular activities serve to prepare participants for entrepreneurial action (Lundqvist, 2014; Hornsby et al. 2018; Rydehell et al. 2018). Therefore, there is an increasing trend on entrepreneurially-oriented campuses to impart such skills.

Fourth, mentoring and coaching is equally critical for the success of a novice entrepreneur in identifying and solving problems as they arise. Through this function institutions often provide valuable longer-term support in the form of tacit knowledge, and social capital. They include alumni entrepreneurs, experienced volunteers, and professors with prior academic entrepreneurship experience. This function is often coordinated by intermediaries such as university-related innovation and incubation centres and has potential for growth. Fifth, financial support for venture or piece-meal funding and in-kind support and grants, and awards are essential for the development and success of most academic entrepreneurial initiatives. Interactions with funding entities also provide necessary feedback for business plan refinement and risk reduction of new ventures. With traditionally limited direct university involvement in this area, arms-length support through university-related centres is expected to grow (Mian et al. 2016). More importantly innovative crowdfunding platforms offer new avenues for funding technology-oriented ventures (Wu et al. 2017).

Finally, most prominent entrepreneurial universities either have their own or provide access to various types of business incubators, accelerators, science park and other incubation support facilities as part of their enterprise development mission (Bergek and Norrman, 2008; Mian et al. 2016; Albahari, et al. 2017; Pauwels et al. 2016; Bank et al. 2017; Wright and Drori, 2018). These facilities offer a visible and accessible space/location and serve as focal points for experiential training of academic and other regional entrepreneurs. More comprehensive university-related incubation facilities serve as hubs for providing most of the above entrepreneurial support functions under the same roof. More and more ambitious university/college programs are expected to offer such facilities in coming years. Lastly, in terms of the university-industry partnership function generating entrepreneurial opportunities,

a number of entrepreneurially-oriented research-intensive universities, particularly the land grants institutions in the US along with industrial research labs and hybrid organizations in Europe and elsewhere are engaged in transferring and commercialization of their research results. They also allow university-industry interactions for industrial problem solving and student and faculty training (Tornatzky 20014; Corona et al. 2006). For this purpose, science parks, technology transfer offices, industrial liaison offices, and modern catapults have been established. More vivid cases of these university led models have emerged as regional hubs providing successful exemplars of ecosystems driving innovative entrepreneurship.

Impact measures of the entrepreneurial university – strategic challenges

There is considerable variation in the number of academic start-ups and spin-offs created by universities but the raw number of start-ups created says little about their economic, financial and social impact. Many start-ups do not generate revenue from products as they are based on relatively embryonic technologies, which are far from ready for the market. Findings across different countries are consistent in showing that the majority of academic start-ups are small, low growth enterprises but that they have a relatively high survival rate. Universities may be inefficient in liquidating these ventures if they are measured on the basis of the percentage of start-ups created that have survived and may also be reluctant to liquidate start-ups created by star scientists who may otherwise move to another institution perceived as more supportive (Wright et al. 2007).

Performance of academic start-ups by faculty is generally below that for other forms of start-ups. Based on a large dataset of entrepreneurial firms in Sweden, Wennberg, et al. (2011) showed that Corporate Start-ups (CSOs), especially those involving university graduates who had gone on to gain industrial experience, perform better than university start-ups, in terms of survival as well as growth. U.S. evidence indicates that students are a far more important source of university entrepreneurship than current or former faculty, and student companies do not seem to be of lower quality than those of current or former university employees (Åstebro et al. 2012). Various strategic factors influence the impact of entrepreneurial universities. Universities that have been most successful in generating the largest numbers of start-ups have clear, well-defined strategies regarding the formation and management of spin-outs (Lockett, Wright and Franklin, 2003), as well as appropriate resources and capabilities (Lockett and Wright, 2005). Universities generating significant numbers of start-ups typically have the most favourable policies regarding surrogate (external) entrepreneurs who have the commercial expertise that academic entrepreneurs do not. Many universities aiming to develop academic spinoffs do not invest in sufficient resources and capabilities to match their aspirations (Clarysse et al. 2005), underestimating what is required to take innovations from the lab to market.

However, the nature and extent of start-up creation and development at a particular university has been influenced by the various actors involved in academic entrepreneurship such as technology transfer officers seeking to shape this activity to meet their own goals, which may be at variance with the strategies of senior university management (Lockett et al. 2014). Attitudes and strategies towards entrepreneurship can vary substantially between departments and disciplines even whether the university is favourably disposed or not (Rasmussen et al. 2014). There is some debate as to whether the impact of strategies to promote entrepreneurship in universities is consistent or not with strategies regarding the development of basic science research. For example, Kleinman (2003) argues that commercial factors are having deep-rooted systematic, pervasive, and indirect effects on contemporary academic practice which may be detrimental to the public good. On the other hand, evidence relating

basic research effort to invention disclosures suggests that pressures and mechanisms aimed at commercializing university research have not diverted faculty from basic research to research with more commercial potential (Grimaldi et al. 2011). Rather, both basic and applied research appear to be greater when faculty can benefit from commercialization of their research effort, in other words the two are not mutually exclusive. Science quality at the university from which the venture is spun-off and the intellectual human capital and networks of the academic entrepreneurs involved have a positive effect on start-up growth but commercial orientation of research appears to have a negative effect (Colombo et al. 2010). University start-ups benefit most from a broad scope of technology from the parent university in term of subsequent growth, as this allows them to change market application if the first applications they pursue turn out to be a dead end, while CSOs benefit most from a specific narrow scope technology that is sufficiently distinct from the parent (Clarysse, et al. 2011).

Comparing leading international universities with ‘mid-range’ regionally based universities shows marked differences in the extent and nature of entrepreneurship (Wright et al. 2008). While teaching, research and entrepreneurial activities have a significant economic impact, for universities outside the top echelon, the most important activities relate to research and knowledge transfer through consulting, research contracts and research collaboration (Guerrero, Cunningham and Urbano, 2015). In contrast, for universities in the top echelon, entrepreneurial start-up activities have the greatest economic impact. Universities may be able to benefit financially from start-ups as a result of the indirect effect on enhanced reputation they engender (Pitsakis et al. 2015). Developing a reputation for social impact via spinoffs may have positive revenue spill-overs for the core university activity of research, especially for high-status universities. Another key dimension of the impact of entrepreneurial universities is the historical trajectory and culture of a university. Some universities have a teaching focus, while others are focused on research and yet others have a strong economic development and community outreach mission. However, even universities within the same strategic group may differ in how they view their role in promoting the development of entrepreneurial activities by faculty and students. This role may be anchored in the past and constrain how and to what extent a particular university develops its strategy for academic entrepreneurship (Holstein et al. 2018).

The indirect impact of entrepreneurial universities is also important with there being large variations across universities in terms of graduates’ propensities to enter entrepreneurship (Daghbashyan and Hårsman, 2014). In turn this also depends to a great extent on the geographical location of the university. Swedish data shows that students graduating in a metropolitan area, and in a region with a strong presence of university peer entrepreneurs and family members, are much more likely than other graduates to locate their business in the region of graduation (Larson et al. 2017). The metropolitan effects are consistent with the importance of local opportunities, while the presence of peer entrepreneurs and family highlight the importance of social embeddedness. There is however a major debate about what and how to measure the contribution of academic entrepreneurship. Impact measured in terms of officially identified start-ups understate the extent of venture creation activity by academics by a substantial margin (Perkmann et al. 2014). Academics create start-ups that do not depend on formal IP and which may not pass through the TTO. This has caused some debate about the dangers of IP going out the back door (Markman et al. 2005), although there may be personal and wider social impacts. Besides counting the number and value of spin-offs by faculty as well as start-ups by students and alumni, entrepreneurial universities might also consider more qualitative measures to assess their impact. Universities need to set out clear objectives along the different dimensions of entrepreneurship and assess outcomes

against these objectives. For example, universities could assess how personnel and resources support its entrepreneurial agenda, assess entrepreneurial teaching and learning across the institution, assess the impact of start-up support, assess knowledge exchange and collaboration, and assess the institution's international activities in relation to its entrepreneurial agenda. Given the nature of these dimensions, universities would also need to set out mechanisms to collect appropriate data and also to set down what different levels of outcome success might mean.

Summary of the papers in the special issue

From the 32 papers submitted, we chose the following eight for publication in our special issue after a formal review process. Summaries of these contributions are presented below and in table 1.

In the first study, Etzkowitz and his colleagues focus on Stanford University, a role model for universities with entrepreneurial aspirations. The institution was founded on a cattle ranch and imbued with not only scholarly but also entrepreneurial goals. Based in an agricultural region, Stanford benefitted from industrial stakeholders who contributed to its technical development; in return, the university was pivotal in the industrial development of the region.

Internationally, developing the entrepreneurial ambitions of universities has emerged as a center of attention in academia and government policy. The paper uses a longitudinal model to explore the evolution of Stanford University into an entrepreneurial university and the future policy objectives of the institution. In particular, when the university found itself in a state of inaction brought on by previous successes, the paper shows that Stanford adopted bottom-up initiatives to push through its “paradox of success”. For universities considering a transition to an entrepreneurial mindset, the Stanford experience and the model evolved since the institution’s founding may be helpful.

The systematic review by Centobelli et al, traces the various paths that universities have used to develop an entrepreneurial outlook. The researchers then complement a conceptual framework with a research agenda. One finding is that exploration and exploitation are critical to developing an entrepreneurial model, but these are under-researched at the present time. This paper applies the idea of organizational ambidexterity to universities in the analysis of entrepreneurial development paths. Exploration and exploitation are learning processes, but they may not need to occur simultaneously. The idea of balance over time, as discussed in papers on ambidexterity in other areas, also applies to these two learning processes, and alternating between periods of exploitation and periods of exploration might be more advantageous than simultaneity in the development of ambidexterity. The review proposes an integrated conceptual framework comprising six constructs: the external and the internal organizational environments, university exploration and exploitation, university ambidexterity, and entrepreneurial university performance.

/insert Table 1 here/

Wakkee et al study explores the under-researched topic of how universities with an entrepreneurial profile in developing countries use their role as change agents to drive a sustainable regional economic development. Regions with endemic pollution and adverse poverty can motivate universities to adopt a sustainability vision, which then drives institutional change. This study inductively investigates how a business school in northern India takes the vision of sustainable development and seeks to plant it in its surroundings. Qualitative inquiry and numerous observations of the many complex processes allow theory

building. The researchers define how factors such as campus leadership, holistic teaching, student involvement, and research programs may in the short term create significant local effects. However, smallness has liabilities, and any sustainable impact of significant proportion on the local environment is difficult to achieve. Instead, a scaling up of promising initiatives usually occurs on site at the main campus. Thus, local or extension campuses could be characterized as incubators. This study finds that universities, through education and outreach, can be agents for sustainable change. This work also shows how, besides being risky, a separate space for testing new ideas of sustainable development, which are then moved to a larger location, can be advantageous.

The Sanchez Barrioluengo and Benneworth study investigates the extent to which internal institutional configurations affect the production of regional benefits on the UK Higher Education sector. The study was conceived due to increasing interest in the mechanism's universities use to maximize the creation of regional benefits that are over and above traditional teaching and research goals. An understanding of these mechanisms, specifically via third mission outputs, is deemed necessary due to the heterogeneity of educational institutions. Data from the Higher Education Business and Community Interaction Survey (HE-BCI), an annual survey maintained by the Higher Education Statistics Agency (HESA) and administered throughout the UK since a 2001 pilot, form the empirical basis of this study. The researchers focus on four common elements – steering core, administrative machinery, internal coupling, and academic heartland – of two university models: the entrepreneurial university and the (regional) engaged university model.

Fuster et al, discuss how universities play strategic roles as drivers of regional economic growth. University spin-off (USO) companies are a vital mechanism for the transfer of knowledge and the generation of entrepreneurial university ecosystems. Policymakers increasingly fund universities on the belief that successful entrepreneurial university ecosystems will engender business ecosystems to the benefit of the region. The researchers explore this idea of USO benefits and the benefits of an entrepreneurial university ecosystem to regional economic well-being in the Andalusian region of Spain. Using a mixed-methods approach and in-depth interviews, the study identified main actors of the Andalusian entrepreneurial university ecosystem and also ecosystem mechanisms; these include a wave effect generated through a social network approach that allows knowledge spill-over to reach businesses outside the entrepreneurial university ecosystem. The study found USOs to be the main actors in the entrepreneurial university ecosystem. The study also expands the emergent ecosystem approach in the field of entrepreneurship.

Rivezzo et al, explore academic entrepreneurship (spin-offs) and knowledge transfer (patents) to understand how entrepreneurial orientation among university departments determines entrepreneurial performance. The study also investigates the interaction of internal and external contextual variables in the relationship between orientation and performance. Survey data from 294 heads of university departments in four European countries (Italy, Spain, UK, and Portugal), supported a finding of a positive relation between the number of spin-offs and entrepreneurial orientation. Other findings include the positive roles of department age and size, country GDP per capita, and R&D expenditure in this relation. A surprising outcome is the negative association between number of patents and entrepreneurial orientation. A final area of discussion is the moderating role of contextual variables.

The case study by Donghui Meng et al investigates how academic entrepreneurs from this group learned to successfully commercialize their Anti-Lock Braking System and Automated

Mechanical Transmission technologies through their interaction with industry. The study illustrates how three distinct sources of industry–university (I–U) knowledge transfer are vital for university researchers engaging in commercialization: personal experiences in industry, commercialization partner firms, and leading customers. Each of these knowledge transfer mechanisms are important in their own way, transferring a unique sort of knowledge that is crucial for a specific phase of academic entrepreneurship. This paper synthesizes literature on I–U knowledge transfer and extends knowledge on the dynamics of AE from an ecosystem-based perspective.

Finally, the Soetanto & van Geenhuizen study focuses on the relationship between universities and their spin-offs, with a special focus on post-incubation processes. The data set includes a sample of 100 spin-offs from two European universities. The researchers develop several hypotheses for predicting why spin-offs tend to maintain proximity to universities; they also investigate the impact of distance to their university on performance. The findings suggest that factors such as research orientation, entrepreneurial orientation, and market hostility encourage spin-offs to remain near their universities. The study found, however, that spin-offs which rely overly much on proximity experience a restriction in commercial activities and lower returns in performance. Spin-offs that are highly oriented entrepreneurially perform well if they are able to balance their need to remain close to their university with market considerations. In the current discussion on how universities best support entrepreneurial activities, this study inputs new ideas for supporting the long-term growth of spin-offs, which also account for entrepreneurial orientation as well as flexibility.

Discussion and conclusions

This special issue succeeded in attracting a group of papers that in various ways reflect the challenges that entrepreneurial universities face in their efforts to become an important agent in society for economic growth and social change. The authors are based in Europe, Asia, and the United States, which indicates that regardless of where you find yourself, entrepreneurial universities are a complex phenomenon, comprising varying academic traditions, decision-making levels, research values, and sub-organization cultures.

A major conclusion from the articles in the special issue is that the concept of the entrepreneurial university can have many different meanings depending on the academic context. The local academic environment could have a strong impact on both attitudes towards entrepreneurship and choice of external partners for research collaboration. This situation, regardless of whether it involves junior or senior researchers, is highly challenging strategically for university leaders; for the implementation and coordination of entrepreneurial activities; and for activities that are internal as well as external to the university. An academic's willingness and ability to interact with society depends to varying degrees on the resources, the norms, and the management strategies of the faculty and the school where the academic resides (Bienkowska et al. 2016). Furthermore, it is important that university leaders are able to internally define, visualize, and communicate the true meaning of an entrepreneurial university – that *entrepreneurial* is not merely the starting of new ventures but rather an attitude or behavior in the daily academic life for all members within the academic community. From the viewpoint of the university, becoming entrepreneurial not only presupposes knowledge transfer of a sort – from university research into the industrial world – but knowledge exchange: that also industry and the environment have much which universities can learn and benefit from.

Finally, the diversity of organizational cultures and abilities must not be overlooked, but in future, comprise a focus of careful consideration in the design of new studies. Explanations of variations in university performance and the special contexts that entrepreneurial universities face must be explained through empirical evidence and the building of theory. Theoretical models focusing on university strategies should be tested against internal and external contexts. Assumptions of passivity on the part of universities and homogeneity in the environment are risky. Rather, future studies must approach the exploration of how universities are developing with an entirely new mindset, understanding that a single university – or group of universities – may be unique concerning organizational performance, social impact, and surrounding environment, and that these are less certain and more dynamic than previous observations have supposed.

In Table 2 we set out a number of questions for a potential future research agenda built around the five sets of challenges developed in Figure 1.

/Insert table 2 here/

It is our hope that this special issue will provide new insight, even new ideas, for avenues of future research. New construct models should be tested across various countries, simultaneously as an effort to define the nature of underlying mechanisms and variations in performance outcomes. We are also hopeful that this issue will contribute to a proliferation of academic debate on the strategic issues that universities currently and in the near future will meet – and in one way or another, must deal with. New research in these areas would fulfill the goals of this special issue.

References

- Abdelkafi, N., Hilbig, R., & Laudien, S. M. (2018). Business models of entrepreneurial universities in the area of vocational education—an exploratory analysis. *International Journal of Technology Management*, 77(1-3), 86-108.
- Albahari, A., Pérez-Canto, S., Barge-Gil, A., & Modrego, A. (2017). Technology Parks versus Science Parks: Does the university make the difference? *Technological Forecasting and Social Change*, 116, 13–28.
- Aparicio, S., Urbano, D., & Audretsch, D. (2016). Institutional factors, opportunity entrepreneurship and economic growth: Panel data evidence. *Technological Forecasting and Social Change*, 102, 45-61.
- Arbo, P., & Benneworth, P. (2007). Understanding the regional contribution of higher education institutions: A literature review, OECD, Paris.
- Armbruster, C. (2008). Research universities: Autonomy and self-reliance after the entrepreneurial university, *Policy Futures in Education*, 6(4), 372-389.
- Bae, T.J., Qian, S., Miao, C., Fiet, J.O. (2014). The relationship between entrepreneurship education and entrepreneurial intentions: A meta-analytic review. *Entrepreneurship Theory and Practice*, 38(2), 217)-254.
- Bank, N., Fichter, K., & Klofsten, M. (2017). Sustainability-profiled incubators and securing the inflow of tenants—The case of Green Garage Berlin. *Journal of Cleaner Production*, 157, 76–83.
- Baldwin, T. T., and Ford, J. K. (1988). Transfer of training: A review and directions for future research. *Personnel Psychology*, 41(1), 63-105.

- Baldwin, T. T., Kevin Ford, J., and Blume, B. D. (2017). The State of Transfer of Training Research: Moving Toward More Consumer-Centric Inquiry. *Human Resource Development Quarterly*, 28(1), 17-28.
- Bergek, A., & Norrman, C. (2008). Incubator best practice: A framework. *Technovation*, 28(1-2), 20-28.
- Bienkowska, D., Klofsten, M., & Rasmussen, E. (2016). PhD Students in the Entrepreneurial University-Perceived Support for Academic Entrepreneurship. *European Journal of Education*, 51(1), 56-72.
- Bouncken, R. B. (2018). University coworking-spaces: Mechanisms, examples, and suggestions for entrepreneurial universities. *International Journal of Technology Management*, 77(1-3), 38-56.
- Cattaneo, M., Meoli, M., & Vismara, S. (2015). Cross-border M&As of biotech firms affiliated with internationalized universities. *The Journal of Technology Transfer*, 40(3), 409-433.
- Charles, D. (2003). Universities and territorial development: Reshaping the regional role of UK universities, *Local Economy*, 18(1), 7-20.
- Clark, B. R. (1998). The entrepreneurial university: Demand and response. *Tertiary Education and Management*, 4(1), 5-16.
- Clarysse, B., Wright, M. and Van de Velde, E. 2011. Entrepreneurial Origin, Technology Endowments and the Growth of Startup Companies, *Journal of Management Studies*, 48: 1420-1442.
- Clarysse, B., Wright, M., Lockett, A., van de Velde, E. & Vohora, A. 2005. Spinning Off New Ventures: A Typology of Facilitating Services. *Journal of Business Venturing*, 20, 183-216.
- Clauss, T., Moussa, A., & Kesting, T. (2018). Entrepreneurial university: a stakeholder-based conceptualization of the current state and an agenda for future research. *International Journal of Technology Management*, 77(1-3), 109-144.
- Colombo, M., D'adda, D. and Piva, E. 2010. The contribution of university research to the growth of academic start-ups: an empirical analysis. *Journal of Technology Transfer*, 35, 113-140.
- Corona, L, J. Doutriaux, S. Mian. (2006). Building Knowledge Regions in North America: Emerging Technology Innovation Poles”, Edward Elgar Publishing, Massachusetts, March 2006.
- Daghbashyan, Z., & Hårsmann, B., 2014. University choice and entrepreneurship. *Small Business Economics* 42, 729-746.
- Darling, A.L., England, M.D., Lang., & D.W. Lopers-Sweetman. (1989). Autonomy and control: A university funding formula as an instrument of public policy, *Higher Education Management*, 18, pp. 559-583.
- Etzkowitz, H. (1983). Entrepreneurial scientists and entrepreneurial universities in American academic science. *Minerva*, 21(2-3), 198-233.
- Etzkowitz, H., & Klofsten, M. (2005). The innovating region: toward a theory of knowledge-based regional development. *R&D Management*, 35(3), 243-255.
- Etzkowitz, H. (2016). The entrepreneurial university: vision and metrics. *Industry and Higher Education*, 30(2), 83-97.
- Fayolle, A. (2018). A Research Agenda for Entrepreneurship Education, Cheltenham (UK): Edward Elgar Publishing
- Fini, R., Rasmussen, E., Siegel, D., & Wiklund, J. (2018). Rethinking the Commercialization of Public Science: From Entrepreneurial Outcomes to Societal Impacts. *Academy of Management Perspectives*, 32(1), 4-20.
- Gianiodis, P. T., Markman, G. D., & Panagopoulos, A. (2016). Entrepreneurial universities and overt opportunism. *Small Business Economics*, 47(3), 609-631.

- Gibb, A., & Hannon, P. (2006). Towards the entrepreneurial university. *International Journal of Entrepreneurship Education*, 4(1), 73-110.
- Gibb, A. A., Hofer, A. R., & Klofsten, M. (2013). The entrepreneurial higher education institution: a review of the concept and its relevance today. Retrieved from: https://heinnovate.eu/sites/default/files/heinnovate_concept_note_june_2014.pdf
- Grimaldi, R., Kenney, M., Siegel, D.S., Wright, M., 2011. 30 years after Bayh–Dole: Reassessing academic entrepreneurship. *Research Policy* 40, 1045-1057.
- Guerrero, M., & Urbano, D. (2012). The development of an entrepreneurial university. *The journal of technology transfer*, 37(1), 43-74.
- Guerrero, M., Urbano, D., Fayolle, A., Klofsten, M., & Mian, S. (2016). Entrepreneurial universities: emerging models in the new social and economic landscape. *Small Business Economics*, 47(3), 551-563.
- Guerrero, M., Cunningham, J. and Urbano, D. 2015. Economic impact of entrepreneurial universities' activities: An exploratory study of the United Kingdom. *Research Policy*,44, 748–764.
- Guerrero, M., Urbano, D., Cunningham, J. A., & Gajón, E. (2018). Determinants of Graduates' Start-Ups Creation across a Multi-Campus Entrepreneurial University: The Case of Monterrey Institute of Technology and Higher Education. *Journal of Small Business Management*, 56(1), 150-178.
- Hayter, C. S., & Cahoy, D. R. (2018). Toward a strategic view of higher education social responsibilities: A dynamic capabilities approach. *Strategic Organization*, 16(1), 12–34.
- Herrera, F., Guerrero, M., & Urbano, D. (2018). Entrepreneurship and Innovation Ecosystem's Drivers: The Role of Higher Education Organizations. In *Entrepreneurial, Innovative and Sustainable Ecosystems* (109–128). Springer, Cham.
- Holstein, J., Starkey, K., & Wright, M. (2018). Strategy and narrative in higher education. *Strategic Organization*, 16(1), 61-91.
- Hornsby, J. Messersmith, J., Rutherford, M, and Simmons, S. (2018). Entrepreneurship Everywhere: Across Campus, Across Communities, and Across Borders, *Journal of Small Business Management* 56(1), 4-10.
- 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.
- Kirby, D. A. (2005). Creating entrepreneurial universities in the UK: Applying entrepreneurship theory to practice. *Journal of Technology Transfer*, 31(5), 599–603.
- Kirby, D. A., Guerrero, M., & Urbano, D. (2011). The theoretical and empirical side of entrepreneurial universities: An institutional approach. *Canadian Journal of Administrative Sciences*, 28(3), 302–316.
- Kirkpatrick, D.L. (1996). Great ideas revisited. *Training & Development*, 50(1), 54-57.
- Kleinman, D. L. 2003. *Impure Cultures: University Biology and the World of Commerce*. Madison: University of Wisconsin Press.
- Klofsten, M. (2005). New venture ideas: an analysis of their origin and early development. *Technology Analysis and Strategic Management*, 17(1), 105–119.
- Klofsten, M., & Jones-Evans, D. (2000). Comparing academic entrepreneurship in Europe—the case of Sweden and Ireland. *Small Business Economics*, 14(4), 299-309.
- Klofsten, M., & Lundmark, E. (2016). Supporting new spin-off ventures—experiences from a university start-up program, in S. de Cleyn, G. Festel (eds), 93-107, *Academic spin-offs and technology transfer in Europe: Best practices and breakthrough models*, Cheltenham, Edward Elgar, 2016.

- Landry, E., Amara, N., & Rherrand, I. (2006). Why are some university researchers more likely to create spin-offs than others? Evidence from Canadian universities. *Research Policy*, 35(10), 1599–1615.
- Larson, J., Wennberg, K., Wiklund, J. & Wright, M. 2017. Location choices of graduate entrepreneurs. *Research Policy*, 46, 490–150.
- Lee, J., & Win, H. N. (2004). Technology transfer between university research centers and industry in Singapore. *Technovation*, 24, 433–442.
- Leih, S., & Teece, D. (2016). Campus leadership and the entrepreneurial university: A dynamic capabilities perspective. *Academy of Management Perspectives*, 30(2), 182–210
- Leitch, S. (2006). Prosperity for all in the global economy-world class skills, HMSO Norwich, UK.
- Link, A., & Scott, J. (2005). Opening the ivory tower's door: An analysis of the determinants of the formation of U.S. university spin-off companies. *Research Policy*, 34, 1106–1112.
- Liñán, F., Urbano, D., & Guerrero, M. (2011). Regional variations in entrepreneurial cognitions: Start-up intentions of university students in Spain. *Entrepreneurship and Regional Development*, 23(3), 187–215.
- Lockett, A., Wright, M. and Franklin, S. 2003. Technology Transfer and Universities' Spin-out Strategies. *Small Business Economics*, 20: 185-201.
- Lockett, A. and Wright, M.2005. Resources, Capabilities, Risk Capital and the Creation of University Spin-Out Companies. *Research Policy*, 34(7): 1043-1057.
- Lockett, A., Wright, M. and Wild, A. (2015). The institutionalization of third-stream activities in U.K. higher education: the role of discourse and metrics. *British Journal of Management*, DOI: 10.1111/1467-8551.12069.
- Lundqvist, M. A. (2014). The importance of surrogate entrepreneurship for incubated Swedish technology ventures. *Technovation*, 34(2), 93–100.
- Madichie, N. O., & Gbadamosi, A. (2017). The entrepreneurial university: an exploration of “value-creation” in a non-management department. *Journal of Management Development*, 36(2), 196-216.
- Markman, G.D., Gianiodis, P.T., Phan, H.P. & Balkin, D.B. 2005. Innovation speed: Transferring university technology to market. *Research Policy*, 34: 1058–1075.
- Martin, B.C., McNally, J.J. and Kay, M.J. (2013). Examining the formation of human capital in entrepreneurship: a meta-analysis of entrepreneurship education outcomes. *Journal of Business Venturing*, 28(2), 211-224.
- McAdam, M., Miller, K., & McAdam, R. (2017). University business models in disequilibrium—engaging industry and end users within university technology transfer processes. *R&D Management*, 47(3), 458-472.
- Mian, S. (2011). Introduction: Science and Technology-Based Regional Entrepreneurship, (Ed by Mian, S), Edward Elgar, 1-15.
- Mian, S., Lamine, W. and Fayolle, A. (2016). Technology Business Incubation: An Overview of the State of Knowledge. *Technovation*. Vol 50-51, 1–12.
- Miller, D. J., & Acs, Z. J. (2017). The campus as entrepreneurial ecosystem: The University of Chicago. *Small Business Economics*, 49(1), 75-95.
- Minola, T., Donina, D., & Meoli, M. (2016). Students climbing the entrepreneurial ladder: Does university internationalization pay off?. *Small Business Economics*, 47(3), 565–58.
- Nabi, G., Linan, P., Fayolle, A., Krueger, N. and Walmsley, A. (2017). The impact of entrepreneurship education in higher education: A systematic review and research agenda. *Academy of Management Learning & Education*, 16(2), 1-23.
- Nambisan, S. (2017). Digital entrepreneurship: Toward a digital technology perspective of entrepreneurship. *Entrepreneurship Theory and Practice*, 41(6), 1029-1055.

- Nambisan, S., Siegel, D., & Kenney, M. (2018). On Open Innovation, Platforms, and Entrepreneurship. *Strategic Entrepreneurship, Journal* <https://doi.org/10.1002/sej.1300>.
- North, D. C. (1990). *Institutions, institutional change and economic performance*. Cambridge: Cambridge University Press.
- North, D. C. (2005). *Understanding the process of economic change*. Princeton NJ: Princeton University Press.
- OECD (2012), A Guiding Framework for Entrepreneurial Universities.
- OECD/EU (2018), Supporting Entrepreneurship and Innovation in Higher Education in the Netherlands, OECD Skills Studies, OECD Publishing, Paris/EU, Brussels.
<http://dx.doi.org/10.1787/9789264292048-en>
- Pauwels, C., Clarysse, B., Wright, M. & Van Hove, J. (2016). Understanding a new generation incubation model: The accelerator. *Technovation*, *50–51*, 13–24.
- Philpott, K., Dooley, L., O'Reilly, C., & Lupton, G. (2011). The entrepreneurial university: Examining the underlying academic tensions. *Technovation*, *31(4)*, 161–170.
- Perkmann, M., Tartari, V., McKelvey, M., Autio, E., Broström, A., D'Este, P., ... & Krabel, S. (2013). Academic engagement and commercialisation: A review of the literature on university–industry relations. *Research Policy*, *42(2)*, 423–442.
- Perkmann M., Fini R., Ross J., Salter A., Silvestri C., Tartari V., 2014. “Accounting for Impact at Imperial College London. A report on the activities and outputs by Imperial academics relevant for economic and social impact” Technical report, Department of Innovation and Entrepreneurship, Imperial College Business School, UK.
- Pitsakis K, Souitaris, V. and Nicolaou, N. (2015), The Peripheral Halo Effect: Do Academic Spinoffs Influence Universities' Research Income? *Journal of Management Studies*, *52(3)*, 321–353.
- Rasmussen, E., Mosey, S., & Wright, M. (2011). The evolution of entrepreneurial competencies: A longitudinal study of university spin-off venture emergence. *Journal of Management Studies*, *48(6)*, 1314–1345.
- Rasmussen, E., Mosey, S. and Wright, M. (2014). The Influence of University Departments on the Evolution of Entrepreneurial Competencies in Startup Ventures. *Research Policy*, *43*:92–106.
- Rinaldi, C., Cavicchi, A., Spigarelli, F., Lacchè, L., & Rubens, A. (2018). Universities and smart specialisation strategy: From third mission to sustainable development co-creation. *International Journal of Sustainability in Higher Education*, *19(1)*, 67–84.
- Rippa, P., & Secundo, G. (2018). Digital academic entrepreneurship: The potential of digital technologies on academic entrepreneurship. *Technological Forecasting and Social Change*. <https://doi.org/10.1016/j.techfore.2018.07.013>.
- Rydehell, H., Isaksson, A., & Löfsten, H. (2018). Business networks and localization effects for new Swedish technology-based firms' innovation performance. *The Journal of Technology Transfer*, 1–30.
- Saxenian, A. (1994). Regional networks: industrial adaptation in Silicon Valley and route 128.
- Shane, S. A. (2004). *Academic entrepreneurship: University spinoffs and wealth creation*. Edward Elgar Publishing.
- Schlaegel, C. and Koenig, M. (2014). Determinants of entrepreneurial intent: A meta-analytic test and integration of competing models. *Entrepreneurship Theory & Practice*, *38(2)*, 291–332.
- Shattock, M. (2000). Strategic management in European universities in an age of increasing self-reliance, *Tertiary Education and Management*, *6*, pp. 93–104.
- Siegel, D. S., & Leih, S. (2018). Strategic management theory and universities: An overview of the Special Issue. *Strategic Organization*, *16(1)*, 6–11.

- Siegel, D. & Wright, M. (2015). Academic Entrepreneurship: Time for a rethink? *British Journal of Management*, 26(4), 582-595
- Smith, D. (1999). Changing the idea of a university, in Smith and Langslow (eds.), *The idea of a university*, Higher education policy series 51, Jessica Kingsley Publishers London and Philadelphia.
- Slaughter, S., & Leslie, L. L. (1997). *Academic capitalism: Politics, policies, and the entrepreneurial university*. The Johns Hopkins University Press, 2715 North Charles Street, Baltimore, MD 21218-4319.
- Somsuk, N., & Laosirihongthong, T. (2014). A fuzzy AHP to prioritize enabling factors for strategic management of university business incubators: Resource-based view. *Technological Forecasting and Social Change*, 85, 198-210.
- Svensson, P., Klofsten, M., & Etzkowitz, H. (2012). An entrepreneurial university strategy for renewing a declining industrial city: The Norrköping way. *European Planning Studies*, 20(4), 505–525.
- Teece, D. J. (2018). Managing the university: Why “organized anarchy” is unacceptable in the age of massive open online courses. *Strategic Organization*, 16(1), 92–102.
- Todorovic, Z. W., McNaughton, R. B., & Guild, P. (2011). ENTRE-U: An entrepreneurial orientation scale for universities. *Technovation*, 31(2–3), 128–137.
- Tornatzky, L. and Rideout, E. (2014). *Innovation U 2.0: Reinventing University Roles in Knowledge Economy*, Southern Technology Council, North Carolina.
- Wang, C.L. and Chugh, H. (2014). Entrepreneurial learning: Past research and future challenges. *International Journal of Management Reviews*, 16, 24-61.
- Venkataraman, S. (2004). Regional Transformation through Technological Entrepreneurship. *Journal of Business Venturing*, 19, 153–167.
- Wennberg, K., Wiklund, J., Wright, M., 2011. The effectiveness of university knowledge spillovers: Performance differences between university spinoffs and corporate spinoffs. *Research Policy* 40, 1128-1143.
- Wright, M., Birley, S., & Mosey, S. (2004). Entrepreneurship and university technology transfer. *The Journal of Technology Transfer*, 29(3-4), 235-246.
- Wright, M., Clarysse, B., Mustar, P. and Lockett, A. 2007. *Academic Entrepreneurship in Europe*. Cheltenham Edward Elgar.
- Wright, M., Clarysse, B., Lockett, A., Knockaert, M., 2008. Mid-range universities’ linkages with industry: Knowledge types and the role of intermediaries. *Research Policy* 37, 1205–1223.
- Wright, M. & Drori, I. (2018). *Accelerators*. Cheltenham: Edward Elgar.
- Wu, J.J., Atkinson, R.D. (2017). *How Technology Based Start-ups Support U.S. Economic Growth*, Information Technology & Innovation Foundation (ITIF), retrieved from <http://www2.itif.org/2017-technology-based-start-ups.pdf>.
- Åstebro, T., Bazzazian, N., & Braguinsky, S. 2012. Startups by recent university graduates and their faculty: Implications for university entrepreneurship policy. *Research Policy*, 41(4), 663–677.

Table 1: Summary of papers in the special issue

Authors	Focus of the study	Method	Principal results/conclusions
Etzkowitz, Germain-Alamartine, Keel, Kumar, Nelson Smith, and Albats	Stanford University, as a role model for universities with entrepreneurial aspirations is explored	Longitudinal case study of Stanford University	An innovation gap opened up between Stanford University and Silicon Valley, due to an implicit assumption of innovation as a laissez-faire phenomenon. Translational and innovation support mechanisms were created to fill the gap, encouraging to explore the commercial implications of research findings.
Centobelli, Cerchione, Esposito, and Kashav	The various paths that universities have used to develop an entrepreneurial outlook	Conceptual, systematic literature review of entrepreneurial universities	Exploration and exploitation are critical to developing an entrepreneurial model, but these are under-researched at the present time. The authors apply the idea of organizational ambidexterity to universities in the analysis of entrepreneurial development paths.
Wakkee, van der Sijde, Vaupell, and Ghuman	How universities with an entrepreneurial profile use their role as change agents to drive a sustainable regional economic development	Longitudinal qualitative case study of a business school in India	Universities, through education and outreach, can be agents for sustainable change. It is shown how, besides being risky, a separate space for testing new ideas of sustainable development, which are then moved to a larger location, can be advantageous.
Sanchez Barrioluengo and Benneworth	The extent to which internal institutional configurations affect the production of regional benefits on the UK Higher Education sector	Survey study (HE-BCI), data on the individual university knowledge exchange in the UK	The study highlights the increased interest in the mechanism's universities use to maximize the creation of regional benefits that are over and above traditional teaching and research goals. The authors state that it is necessary to create an understanding of these mechanisms, specifically via third mission outputs, is deemed necessary due to the heterogeneity of educational institutions.
Fuster, Padilla-Meléndez, Lockett, and del-Águila-Obra	The strategic role that universities could have as drivers of regional economic growth	Mixed-methods approach based on quantitative SNA (network relationship indexes) and in-depth interviews with key actors in a Spanish university ecosystem	The study identifies the main actors an entrepreneurial university ecosystem and also ecosystem mechanisms; these include a wave effect generated through a social network approach that allows knowledge spill-over to reach businesses outside the specific ecosystem.
Riviezzo, Santos, Liñán, Napolitano, and Fusco	How entrepreneurial orientation among university departments determines entrepreneurial performance	Survey study, data from university departments in four European countries	The study found a positive relation between the number of spin-offs and entrepreneurial orientation. Other findings include the positive roles of department age and size, country GDP per capita, and R&D expenditure in this relation. It was also found that there is a negative relationship between number of patents and entrepreneurial orientation.
Donghui Meng, Xianjun Li, and Ke Rong	How academics could learn from external collaboration	Case study of Automotive Dynamics & Control Group, affiliated with Tsinghua University in China	The study show that academic entrepreneurs successfully could learn from interaction with industry. Authors 'show how three distinct sources of knowledge transfer are vital for university researchers engaging in outreach activities such as; personal experiences in industry, commercialization partner firms, and leading customers.

Soetanto and van Geenhuizen	The relationship between universities and their spin-offs, with a special focus on post-incubation processes	Survey study, data on university spin-offs in the Netherlands and Norway	It is found that spin-offs which rely overly much on proximity experience a restriction in commercial activities and lower returns in performance. Spin-offs that are highly oriented entrepreneurially perform well if they are able to balance their need to remain close to their university with market considerations.
-----------------------------	--	--	---

Table 2: Questions for a future research agenda

Internal	External	Entrepreneurial Pathways	Teaching and Learning	Impact Measurement
What support do universities and other institutional actors provide their spin-offs over the long term?	How can we explore the relationships between ecosystems of the entrepreneurial university and the business sector?	How should universities balance exploration and exploitation in their evolutionary path toward an entrepreneurial mode?	What role do students play in the interactions of the entrepreneurial university with its environment or in its ecosystem?	How can we develop measures of the impact of entrepreneurial universities that take account of the influence of university inputs post-graduation?
What post-incubation mechanism most effectively supports the scaling up process of spin-offs?	What are the mechanisms of bi-directional knowledge transfer, that is, university to industry and industry to university?	How can the experience of good practice entrepreneurial pathways in one university be transferred to universities with different academic traditions and regional conditions?	What impact do the interactions of the entrepreneurial university have on the education task?	How does a regional-based economic situation affect the measurement of the relationship between entrepreneurial orientation and entrepreneurial performance of university departments?
Are other models emerging outside of the one-size-fits-all entrepreneurial university model? What are the dimensions of the contextual conditions that influence these differences?	What are the coevolution processes during knowledge transfer and the coordination patterns of this transfer?	What are the core entrepreneurial pathways that apply in any university context? Can we systematically identify which additional pathways apply in different types of context?	How can bottom up and top down teaching and learning initiatives be developed and integrated?	How can impact measurement be developed that enables analysis of the relationships between outputs and inputs in terms of personnel and resources, entrepreneurial teaching and learning across the institution, start-up support, and knowledge exchange and collaboration?
How can we more precisely characterize the various missions of universities and their relationships to the core university knowledge processes?	How do entrepreneurial ecosystems in universities evolve? What are the constraints on this evolution and how can they be resolved?	How can entrepreneurial pathways be developed that match requisite resources with activities in order to achieve effectiveness?	What are the most effective experiential learning models for promoting entrepreneurship among faculty, postdocs, masters and undergraduate students?	How can the international impact of entrepreneurial universities be measured?
What governance mechanisms and leadership configurations fit with different entrepreneurial university models?	How do variations in the configuration formal and informal institutional context affect the extent and nature of entrepreneurial activity by universities?	What are the most effective forms of accelerators, incubators and innovation parks to support the range of entrepreneurial activities in different types of entrepreneurial university?	What is the appropriate balance between entrepreneurial teaching and learning approaches based within universities and those that reach out to the local or regional community?	How can appropriate data collection methods be implemented across a university to be able to measure entrepreneurial impact?