

Entrepreneurial-university ecosystem

An overview of key concepts

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Abstract

This working paper is intended to provide an overview of the key concepts associated with an entrepreneurial-university ecosystem. It also briefly discusses the entrepreneurial-university ecosystem around London (UK) and potential data sources to analyse such an ecosystem. The main research method used for the working paper is a simplified form of literature review aimed at quickly understanding the concepts at a high-level. The intended audience is those interested in: a) how universities can function entrepreneurially and b) getting an overview of the relevant literature.

Keywords: Entrepreneurial university; Technology transfer; University spin-outs; London entrepreneurial-university ecosystem

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Abbreviations

EU	European Union
GDP	Gross Domestic Product
LCIF	London Co-Investment Fund
LSE	London School of Economics
MIT	Massachusetts Institute of Technology
R&D	Research & Development
UCL	University College London
UK	United Kingdom
USA	United States of America

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1. Background

In the wake of the economic downturn caused by the financial crisis in 2008 (Guerrero et al. 2016), governments in high-income countries have increasingly sought a role for universities to stimulate regional economic development (Cohen, Nelson, and Walsh 2002). As a consequence, there is a growing role for modern-day universities to be drivers of both innovation and entrepreneurship to precipitate increased regional competitiveness, and economic growth (Audretsch 2014; Urbano and Guerrero 2013). Governments across the world (particularly in high-income countries) are looking to technology innovation as a driver for national economic growth, and to universities as the incubators of this national capacity (Graham 2014). From this perspective, operating at a critical intersection of education, research, and transfer of knowledge, universities are seen as key agents of change in commercialising innovation and creating companies (Rothaermel, Agung, and Jiang 2007). The term ‘entrepreneurial-university ecosystem’, is often used in this context to describe universities acting entrepreneurially to contribute to economic development (Cohen, Nelson, and Walsh 2002; Guerrero et al. 2016).

There is wide-ranging literature available, often adopting innovation ecosystem and entrepreneurship ecosystem perspectives (Rothaermel, Agung, and Jiang 2007) to explore the transition of universities from closed innovation systems (i.e. ones focussed on academic peer-reviewed outputs) to open innovation systems (i.e. ones interfacing with industry and the third sector aimed at identifying applications of the research outside academia) (Chesbrough 2003) producing entrepreneurial outcomes. However, such ecosystems differ significantly depending on factors such as technology, network intensity (i.e. the extent to which a network of academic, industry, public sector, and third sector organisations exists), organisational variety (i.e. the different type of organisations in the ecosystem), and the prevailing legal framework (Hayter et al. 2018). For example, Rothaermel, Agung, and Jiang (2007) highlight that since the 1980s the United States of America (US)-based universities have operated under a legal framework that incentivises universities to patent scientific breakthroughs achieved via government funding. This has resulted in high-levels of sustained entrepreneurial activity by US universities. In contrast, European universities in Germany, Italy, Sweden, and the United Kingdom, though successful in producing innovation and developing technology, operate under a different legal system and thus are seen to be less efficient in technology transfer to the industry (Rothaermel, Agung, and Jiang 2007). This suggests that operational effectiveness of entrepreneurial-university ecosystems is highly dependent on temporal and spatial factors, and dependent on strategic and policy decision-making (Autio et al. 2014).

Universities such as Stanford and Massachusetts Institute of Technology (MIT) which operate within established technology-driven innovation hubs such as the Silicon Valley and Kendall Square in the US are often cited as models for success for universities operating entrepreneurially. However, there are, as

yet, limited examples of universities achieving entrepreneurial success on such scales elsewhere (Graham 2014). Most studies have tended to focus on universities in the US and selected European countries and thus do not necessarily enable a comparison of university commercialisation approaches across other countries (Roberts and Malonet 1996; Jones Evans et al. 1999; Collins and Wakoh 2000; Etzkowitz et al. 2000; Klofsten and Jones-Evans 2000; Owen-Smith et al. 2002; Goldfarb and Henrekson 2003; Mowery and Sampat 2004). An organisational perspective on entrepreneurial activity by universities is still an emerging area of study. This is despite the existence of a well-established discourse and analysis of innovation, entrepreneurial activity, and knowledge transfer in an institutional context for businesses or industries (Rothaermel, Agung, and Jiang 2007). Collins and Wakoh (2000) have hypothesised that local institutional and cultural factors and prior patterns of regional economic development need to be taken into consideration to design the incentives and policy levers for each university system to become more entrepreneurial.

This position was also echoed by the McMillan Review of good practice in technology transfer, published in 2016, which highlighted that the most successful US ecosystem cases do not necessarily translate effectively for United Kingdom (UK)-based universities aiming to achieve similar entrepreneurial outcomes (HEFCE 2016). However, the UK government, having set a target of 2.4% Gross Domestic Product (GDP) to be invested in Research & Development (R&D) by 2027 (Department for Business, Energy & Industrial Strategy and UK Research and Innovation 2018), sees a critical role for universities as drivers of economic growth by expanding their entrepreneurial activity. In consequence, the UK universities will likely need to accelerate the success rate at which they form companies based on academic research, and encourage graduate entrepreneurship contributing to growth of R&D intensive firms. In particular, although London is often cited as one of the premier start-up hubs of Europe, has a sizeable venture capital activity, and is seen to attract global talent (Jennings 2017), the role of London-based universities and the extent to which these act as engines of entrepreneurial activity in London, needs to be understood better in the broader policy context of entrepreneurial-university ecosystems.

In such a context, in this working paper, we explore key concepts related to an entrepreneurial-university ecosystem. Drawing on the insights of the McMillan review (HEFCE 2016), we adopt the acting hypothesis that London can potentially be considered an example of a well-formed entrepreneurial-university ecosystem. We identify data sources relevant to understanding the entrepreneurial-university ecosystem in and around London. The aim is to provide an overview of the London ecosystem rather than analyse it in detail. The next section discusses the research methods used to identify the evidence.

2. Methods

Since this working paper is focussed on providing an overview of the entrepreneurial-university ecosystem concept and identifying key elements of the London ecosystem, we used a time- and resource-efficient approach to literature reviews i.e. a quick scan of evidence.

Quick scans offer a concise, targeted way to effectively identify and summarise the general characteristics, issues, data, and knowledge gaps surrounding a research question. These scans depend on screening peer-reviewed and grey literature identified on the basis of desk research and refined through insights and information from key informants.¹ A quick scan of evidence thus aims to identify a limited number of key resources to review, that enable researchers to concentrate on the most relevant sources.

As part of the quick scan, initial desk research was done using a combination of the search terms identified in Table 2.1. The searches were conducted on Google Scholar and Google. In each instance, we focussed on the first 50 results which were then screened for relevance on the basis of the abstract of the articles. As part of this process, high-quality, peer-reviewed articles were prioritised for selection.

Table 2.1 Search terms used

Category	Example search terms
University-related	University OR academ* OR facult* OR HEI OR "higher education"
Entrepreneurial capability-related	Entrepreneur* OR commercializ* OR commercialis* OR spinoff OR spin-off OR startup OR start-up OR spinout OR spin-out
Ecosystem-related	Ecosystem OR Support OR Assistance OR Service* OR Technology transfer office OR TTO OR Accelerator OR Incubator OR Venture* OR Infrastructure OR Environment* OR Model OR Framework
London-related	London OR Shoreditch OR silicon roundabout

Source: RAND Europe

In addition to the quick scan for articles, we also used an initial list of key literature suggested by Tomas Coates-Ulrichsen to understand the key themes. Box 1 provides a complete list of the articles suggested by Coates-Ulrichsen.

¹ The inputs were provided by Tomas Coates-Ulrichsen, Research Associate at the University of Cambridge's Centre for Science, Technology and Innovation policy (CSTI).

Box 1 Initial list of key literature

Autio, Erkki, Martin Kenney, Philippe Mustar, Don Siegel, and Mike Wright. 2014. "Entrepreneurial Innovation: The Importance of Context." *Research Policy* 43 (7): 1097–1108. <https://doi.org/10.1016/j.respol.2014.01.015>.

Bozeman, Barry, Heather Rimes, and Jan Youtie. 2015. "The Evolving State-of-the-Art in Technology Transfer Research: Revisiting the Contingent Effectiveness Model." *Research Policy* 44 (1): 34–49. <https://doi.org/10.1016/j.respol.2014.06.008>.

Graham, Ruth. 2014. "Creating University-Based Entrepreneurial Ecosystems Evidence from Emerging World Leaders." *MIT Skoltech Initiative*, June. <http://www.rhgraham.org/resources/MIT:Skoltech-entrepreneurial-ecosystems-report-2014-.pdf>.

Guerrero, Maribel, David Urbano, Alain Fayolle, Magnus Klofsten, and Sarfraz Mian. 2016. "Entrepreneurial Universities: Emerging Models in the New Social and Economic Landscape." *Small Business Economics* 47 (3): 551–63. <https://doi.org/10.1007/s11187-016-9755-4>.

Hayter, Christopher S., Andrew J. Nelson, Stephanie Zayed, and Alan C. O'Connor. 2018. "Conceptualizing Academic Entrepreneurship Ecosystems: A Review, Analysis and Extension of the Literature." *The Journal of Technology Transfer* 43 (4): 1039–82. <https://doi.org/10.1007/s10961-018-9657-5>.

PACEC Ltd. 2015. "Research to Estimate the Annual Value of Student Start-Ups," March. https://dera.ioe.ac.uk/22402/1/2015_student_start-ups.pdf.

Philpott, Kevin, Lawrence Dooley, Caroline O'Reilly, and Gary Lupton. 2011. "The Entrepreneurial University: Examining the Underlying Academic Tensions." *Technovation, Managing Technology*, 31 (4): 161–70. <https://doi.org/10.1016/j.technovation.2010.12.003>.

Rothaermel, Frank T., Shanti D. Agung, and Lin Jiang. 2007. "University Entrepreneurship: A Taxonomy of the Literature." *Industrial and Corporate Change* 16 (4): 691–791. <https://doi.org/10.1093/icc/dtm023>.

RSM PACEC Ltd. 2018. "Research into Issues around the Commercialisation of University IP." https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/699441/university-ip-commercialisation-research.pdf.

Shane, Scott. 2004. *Academic Entrepreneurship: University Spinoffs and Wealth Creation*. Cheltenham: Edward Elgar Publishing Ltd.

Vohora, Ajay, Mike Wright, and Andy Lockett. 2004. "Critical Junctures in the Development of University High-Tech Spinout Companies." *Research Policy* 33 (1): 147–75. [https://doi.org/10.1016/S0048-7333\(03\)00107-0](https://doi.org/10.1016/S0048-7333(03)00107-0).

Source: Tomas Coates-Ulrichsen

In addition to the quick scan and the initial list of literature, we also used snowballing² to identify additional relevant articles and ensure a sufficiently rounded coverage of the key themes related to the entrepreneurial-university ecosystem. The next section presents a concise discussion of the findings.

² Snowballing is a process of gathering, searching, scanning and aggregating references as part of a literature review. Depending on the scope of the literature review, snowballing can be done in a continuous, recursive manner. See <http://hlwiki.slais.ubc.ca/index.php/Snowballing> for more details.

3. The findings

In this section we provide a concise a description of the findings based on the quick scan of evidence. We identify the meaning of the term entrepreneurial-university ecosystem, key components of what constitutes an entrepreneurial university, and provide a high-level discussion on the London entrepreneurial-university ecosystem.

3.1. Meaning of the term entrepreneurial-university ecosystem

The term ‘entrepreneurial-university ecosystem’ broadly refers to the idea of universities acting as entrepreneurs to contribute to regional and national economic development (Cohen, Nelson, and Walsh 2002; Guerrero et al. 2016). The entrepreneurial activity by universities can potentially cover a broad range of activities such as patenting and licensing, creating incubators, science parks, and university spin-outs, and investing equity in start-ups, among other indicators (Mowery et al. 2015; Siegel 2006). As a consequence, there is often a lack of consensus on not only what constitutes an entrepreneurial-university ecosystem but also the pathways through which such an ecosystem could be effectively functionalised and would thrive. In consequence, Hayter et al. (2018) argue that in order to understand university entrepreneurship and the resulting ecosystem, micro-level phenomena related to individuals, university, and firm-level activities needs to be ‘vertically connected’ to macro-level outcomes in terms of regional, national economic development, R&D intensity, and social benefits. This requires recognising and understanding academic entrepreneurship beyond the prevalent focus on linear, patent-focussed technology transfer processes (Bradley, Hayter, and Link 2013a, 2013b). For the sake of brevity, we focus on four areas that are considered to co-create an entrepreneurial-university ecosystem (Rothaermel, Agung, and Jiang 2007): entrepreneurial university, technology transfer offices, university spin-outs, and the environmental context of the universities.

3.2. Entrepreneurial university

This involves universities expanding their traditional roles beyond teaching, research, and governance of faculty and students. Members (faculty, students, and staff) of an entrepreneurial university engage with the non-academic community and businesses in the region as an innovation driver (Clarke 2001; Klofsten and Jones-Evans 2000). Acting entrepreneurially, universities thus create organisational structures that can enhance the commercialisation of university inventions through incentive structures, support for patenting and licensing activity through technology transfer offices, as well as providing leadership to

support entrepreneurial thinking, actions, institutions and entrepreneurial capital (Gibb and Hannon 2006).

3.3. Technology transfer offices

Technology transfer offices generally cover activities such as legal advice and decision-making in relation to intellectual property and transfer agreements to industry, licensing agreements and licensing revenues (Bray and Lee 2000; Bercovitz et al. 2001; Jensen, Thursby, and Thursby 2003), sponsored research agreements, and invention disclosures (Thursby and Thursby 2002; Chapple et al. 2005).

Although the available literature often discusses technology transfer as one of the main outcomes of an entrepreneurial university, there is insufficient consensus on the role a technology transfer office at a university plays in the ecosystem and the extent to which the performance of the technology transfer office matters (Rothaermel, Agung, and Jiang 2007). To effectively understand the role of technology transfer in universities' entrepreneurial outreach, Bozeman, Rimes, and Youtie (2015) suggest the performance of technology transfer outcomes need to be understood over long term in the form of costs accrued and benefits delivered.

3.4. University spin-outs

University spin-outs refer to the creation of new firms based on innovation and research from university faculty and students. In contrast to technology transfer, new firm creation offers more quantifiable measures of success factors. The resultant entrepreneurial activity can be measured in terms of the quantity of new firms created, their performance on parameters such as venture capital funding, possibility of stock-market listing, survival/failure outcomes, revenues, and growth rates (Rothaermel, Agung, and Jiang 2007). Additionally the timing and location, rate of establishment, types, and founding team characteristics of the spin-offs can also help clarify and establish a university's contributions to regional and economic growth (Rothaermel, Agung, and Jiang 2007). The university's contributions to the ecosystem can go beyond technology innovation, patents, or licensing to include key personnel and the ways in which the personnel contributed to the spin-off (e.g. management or technical capabilities) (Carayannis et al. 1998; Nicolaou and Birley 2003).

Although the factors that could lead to a successful spin-off are widely discussed in the literature, longitudinal studies tracking the outcomes of university ventures are somewhat limited (Rothaermel, Agung, and Jiang 2007; Rothaermel and Thursby 2005a, 2005b). Vohora, Wright, and Lockett (2004) highlight that new high-tech ventures face several challenges in evolving ideas from non-commercial environment to competitive rent-generating firms including, lack of resources, academic entrepreneurs lacking commercial skills, and potentially conflicting objectives of stakeholders such as university and venture capital funders.

3.5. Environmental context in which the universities operate

The role of technology transfer offices and the extent to which universities are able to successfully spin-out companies depends on the social, political, economic, and regional environment in which the universities operate (Rothaermel, Agung, and Jiang 2007). In addition to the geographical location of the universities, their presence in a regional innovation cluster or science park can be crucial to sustaining an entrepreneurial-university ecosystem in a region. This is because being in this location can help them scale up specific entrepreneurial capabilities. The location can also contribute to different aspects of the ecosystem (such as infrastructure resources, technical and managerial capability, or access to funding) (Audretsch and Stephan 1996).

Research suggests that a university being embedded in an innovation network, science park, or regional innovation cluster plays a critical role in the performance of university-driven entrepreneurship, growth and productivity of the spin-out firms, human and social capital, R&D and differential performance of the new firms compared to start-up activity in other regions (Adams, Chiang, and Starkey 2001; Zucker and Darby 2001; Zucker, Darby, and Armstrong 2002; Murray 2004; Löfsten and Lindelöf 2005; Medda, Piga, and Siegel 2004). Whether science parks effectively contribute to higher economic performance of member firms in the local/regional innovation network is however unclear based on available evidence (Westhead and Storey 1995; Löfsten and Lindelöf 2002; Lindelöf and Löfsten 2003). There is however some evidence that science parks enable founders of the member firms better networking opportunities with the universities (Westhead and Storey 1995; Lindelöf and Löfsten 2003; Löfsten and Lindelöf 2005).³ A similar role is argued to be played by a university's support to technology business incubators which are aimed at providing better access to funding, strategic support for commercialisation, and thus highlight the role of the environmental context (Rothaermel, Agung, and Jiang 2007).

3.6. The London entrepreneurial-university ecosystem

Estrin (2018) suggests that although the UK excels in disruptive, radical innovation and technological solutions and entrepreneurial opportunities, it lags behind in broader commercialisation of its research. This 'weakness' has also been echoed by other research which has identified that the UK faces systemic challenges in scaling up businesses beyond the start-up phase (Bannerjee, Bielli, and Haley 2016; Coteau 2014). Thus in comparison the other European Union (EU) countries, the UK has a comparatively strong but regionally unbalanced entrepreneurial ecosystem (Estrin 2018). A 2017 study for the British Business Bank and the UK Business Angel Association to which RAND Europe provided policy inputs also offered similar observations suggesting that the financial investments, availability of talent, and infrastructure support in London outpaces other UK regions significantly (IFF Research and RAND Europe 2017). Anecdotal evidence suggests that one of causes of this could be that instead of a singular cohesive

³ A notable example of the role of the science park is the relative success of the entrepreneurial ecosystem around the University of Cambridge in the UK. See Graham (2014).

ecosystem, London has pockets of entrepreneurial activity spurred by world-leading universities such as University College London (UCL), Imperial, and London School of Economics (LSE), and presence of venture capital funders which has resulted in areas with high concentrations of start-up activity and university spin-offs such as the Silicon Roundabout (Farr 2013), South Kensington, Shoreditch, Clerkenwell, Spitalfields, and Canary Wharf (London & Partners 2018). Evidence also suggests that the Mayor of London’s Co-Investment Fund (LCIF) and the Green Light programme are also key catalysts in London being a hub for entrepreneurial, start-up activity (Jennings 2017).

A key challenge is understanding the role played by the entrepreneurial-university ecosystem in this start-up, spin-out activity. Understanding key features of the London entrepreneurial-university ecosystem would require analysing available Venture Capital (VC) funding data in public domain on London’s Entrepreneurial ecosystem (Jennings, n.d.a) and correlating it with the London’s academic landscape for deep technological expertise (Jennings, n.d.b). The following table indicates additional secondary sources of potential data that could provide baseline indicators of London’s entrepreneurial-university ecosystem.

Table 3.1 Data sources to understand London’s entrepreneurial-university ecosystem

Data source	Description	Web link⁴
Higher Education Business & Community Interaction (HE-BCI) survey	Provides university-level data on the scale of spin-off activity	https://re.ukri.org/knowledge-exchange/the-he-bci-survey/
Higher Education Statistics Agency (HESA)	Provides baseline characteristics of specific HEIs in terms of scale, research portfolios, student populations	https://www.hesa.ac.uk/data-and-analysis
Beauhurst	Provides data on high growth businesses, some of which comes from universities. ⁵	https://about.beauhurst.com/data/
Spinouts UK	Provides coverage of UK university spinouts. ⁶	http://www.spinoutsuk.co.uk/
Gateway to Research	Includes listing of spinouts (based on Research Fish outcomes data) linked to Research Council research	https://gtr.ukri.org/
The Office of National Statistics	Provides data on economic activity on London such as Investment in start-up and scale-up in the tech sector(see the web link)	https://data.london.gov.uk/dataset/investment-in-start-up-and-scale-up-in-tech-sector
VC funding data on	Provides details of start-up hubs and VCs	https://docs.google.com/spreadsheets/d/1iv

⁴ Links valid as of December 2019.

⁵ This data is not available in the public domain and requires payment to access.

⁶ Beauhurst has acquired Spinouts UK. This data is not available in the public domain and requires payment to access.

Data source	Description	Web link⁴
London's Entrepreneurial ecosystem	active in London	Qog6VplziYlkF3YoVII9JsTaiDKjoRwxERpMZNjac/edit?usp=sharing
London's academic landscape for deep technological expertise	Provides details of academics, academic organisations and the courses they offer, and entrepreneur societies in London	https://docs.google.com/spreadsheets/d/1BO3MQkP17kAKkRp8jcBBDLWPx1G0e7PbXoJNCKhx9vM/edit?usp=sharing

Sources: Tomas Coates-Ulrichsen, Jennings (n.d.a; n.d.b), and RAND Europe

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