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University Spin-outs: What do we know and what are the policy implications? Evidence from the UK

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Letter from Academia

This letter from academia reviews the academic literature and provides an overview of the trends in spin-outs from universities in the UK. We argue that it is important to develop a more comprehensive ecosystem for academic entrepreneurship that includes a wider range of actors and mechanisms. We outline a framework of such an ecosystem and accompanying research agenda.

1 Introduction

As in many other countries, spin-outs by academic scientists have become a central means of research commercialization by UK universities. In this letter from academia, we argue that in the light of experience with spin-outs by academic faculty, it is important to develop a more comprehensive ecosystem for academic entrepreneurship that includes a wider range of actors and mechanisms.

There is now a considerable number of studies on spin-outs from UK universities (Table 1). Studies have been undertaken at several levels including the university and its TTO, the university department, the spin-out venture and the academic entrepreneurs involved.

These studies reveal a number of important insights regarding the development of academic entrepreneurship. At the university level, the importance of a clear strategy and having the resources and competencies to implement such a strategy are clear. But it is also evident that the most effective strategy is different for different universities, there being dangers in a one-size-fits-all approach. Universities may be able to create spin-outs but vary in their ability to create spin-outs that can attract external funding and subsequently create value.

Table 1. Studies on Academic Entrepreneurship in UK (Source: Adapted and updated based on Siegel and Wright (2015))

Author(s)	Data	Key Results
Franklin, Wright, and Lockett (2001)	Authors' Quantitative Survey of U.K. TTOs	Universities wanting to Launch Successful spin-outs Should Employ a Combination of Academic and Surrogate Entrepreneurship
Lockett, Wright, and Franklin, (2003)	Quantitative and Qualitative Surveys of U.K. TTOs	Universities generating most spinoffs Have elaborated Spin-out Strategies, Strong Expertise in Entrepreneurship, and Vast Social Networks
Nicolaou and Birley (2003)	UK academic entrepreneurs	Different embeddedness of academics in a network of ties external or internal to the university associated with different growth trajectories.
Vohora, Wright and Lockett (2004)	Case studies of UK spin-outs	Spin-outs need to address specific critical junctures if they are to evolve
Druilhe, and Garnsey, 2004	Cambridge University spin-outs	Five distinct types of business activities pursued by academic entrepreneurs; as business models evolve the ventures may enter different types of business activity
Chapple, Lockett, Siegel, and Wright (2005)	U.K.-NUBS/ UNICO Survey-ONS	TTOs Exhibit Decreasing Returns to Scale and Low Levels of Absolute Efficiency; Organizational and Environmental Factors Have Considerable Explanatory Power
Lockett and Wright (2005)	Survey of U.K. TTOs	Rate of spin-out creation Positively Associated with university expenditure on IP Protection, Business Development Capabilities of TTOs, and the Extent to Which its Royalty Distribution Formula Favors Faculty Members
Clarysse, Wright, Lockett, van de Elde and Vohora (2005)	Interviews and descriptive data on TTOs in 50 universities across 7 European countries inc. UK	Of five incubation models identified, only three match resources, activities & objectives: low selective, supportive & incubator, giving rise to different types of spin-outs. Competence deficient and resource deficient types involve mismatches and suggest universities need to adopt different approaches.
Garnsey, and Heffernan (2005)	Cambridge spin-outs	Growing areas of local competence identified based on sectoral distribution of activity over time and on clusters of related activity in the Cambridge area that are related to serial spin-out from the university and local businesses.
Smith and Ho, 2006	Spin-outs from Oxford and Oxford Brookes Universities and government establishments	Number of spin-offs in Oxfordshire increased rapidly over recent years at time of study due to national policy and entrepreneurial culture of the universities and laboratories. Academics in the region entrepreneurial for many decades
Wright, Lockett, Clarysse, and Binks (2006)	Surveys of TTOs and spin-outs	There is a mismatch between the demand and supply side of the market for funding spin-outs. In line with pecking order theory, venture capitalists prefer to invest after the seed stage but in contrast to pecking order theory, TTOs see venture capital as more important than internal funds early in the development phase
Mosey and Wright (2007)	Longitudinal qualitative interviews with UK academic	Nascent academic entrepreneurs frustrated by lack of assistance from TTOs and advice from TTOs less valuable than from other sources. Novice entrepreneurs

	entrepreneurs and TTOs	gave TTO assistance more credence than did nascents. Habitual academic entrepreneurs had mixed views on TTOs but TTO often seen as a barrier regardless of TTO capabilities.
Wright et al. (2008)	Survey, interview and archival data from mid-range universities, TTOs and spin-outs in UK, Sweden and Belgium	Mid-range universities need to focus on developing critical mass in small number of areas of expertise, rather than trying to emulate world class universities across many areas. They need to evolve a portfolio of university-industry linkages reflecting range of activities and firm types with which they interact.
Rasmussen, Mosey and Wright (2009)	Cases of spin-outs in UK and Norway	Spin-out entrepreneurs need to develop opportunity refinement, championing and credibility competences that enable them to interact with resource providers outside the university for the spin-out to grow
Wright, Mosey and Noke (2012)	Cases of postdocs involved in BiotechYes	Support needed to bridge the gap between those interested in starting a venture and those who actual do so as many of the former do not pursue their entrepreneurial intentions.
Mueller, Westhead and Wright (2012)	Survey of UK spin-outs	Spin-outs located outside 'golden triangle' can raise venture capital if can signal venture quality and entrepreneurial expertise
Lockett, Wright and Wild, 2014	Interviews with TTOs and archival survey data in UK	Spin-out activity affected by goals and behavior of different actors involved which may be in conflict
Guerrero, Cunningham and Urbano (2015)	UK data on university impact	Impact of spin-outs greatest for top echelon universities while other universities have greatest impact in other areas
Hewitt-Dundas (2015)	Telephone interviews with 350 university spin-outs	A range of demographics relating to spin-outs and their founders including: few founders commit full-time to the spin-out; only a quarter of spin-outs located at any stage in the University's incubator.
Rasmussen, Mosey and Wright, (2015)	Cases of spin-outs in UK and Norway	To enable spin-outs to grow strong and weak social ties need to change over time.
Bobelyn, Clarysse, and Wright (2015)	VC backed spin-outs and high tech start-ups exiting by trade sale	Patent scope has a negative effect on acquisition return, while patent depth is positively associated with acquisition return. Firms with a limited product portfolio experience higher acquisition returns than those with many products. Those with no products obtain even higher returns. Academic spin-offs were significantly less likely to earn high returns.
Weckowska (2015)	Case studies of 6 UK TTOs	Commercialization involves transactions-focused and relations-focused practice. Both co-evolve in some TTOs while others are predominantly transactions-focused. For the latter the development of a relations-focused approach is difficult, but possible if there is strategic direction and if sources of inertia are removed by TTO directors.

Universities' technology transfer offices (TTOs) vary in their resources and capabilities and in their efficiency in developing spin-outs and other forms for academic

entrepreneurship. The acceptance of a policy to develop spin-outs may also vary across universities (Lockett, Wright and Wild, 2014). Besides reflecting the different objectives of different actors, this may also be an indication that the appropriateness of a policy that focuses on academic spin-outs may differ across universities.

This is illustrated in the cases of mid-range universities in Wright et al (2008) and explored quantitatively in a recent study by Guerrero, Cunningham and Urbano (2015) who show that the economic impact of universities differs between top echelon and 'mid-range' universities. For mid-range universities the most important activities involve research and knowledge transfer through consulting, research contracts and research collaboration. In contrast, for top echelon universities, entrepreneurial spin-off activities have the greatest economic impact.

Regarding the spin-outs themselves, it is clear that they are highly varied in terms of sectors, IP and business models and that they face many challenges if they are to develop beyond the start-up phase. These challenges revolve around gaining access to the resources and capabilities they need to identify and reorient their business models through the various stages of evolution (Druilhe, and Garnsey, 2004; Vohora, Wright and Lockett, 2004). A central issue concerns not just having these resources and capabilities but in having the capabilities to acquire them and in particular to be able to shift to a commercial development trajectory from one determined by the academic context (Rasmussen, Mosey and Wright, 2009). In part, this capability depends on having network ties outside academia but also in being able to adapt the role of these ties as the spin-out venture develops (Rasmussen, Mosey and Wright, 2015).

Some academic entrepreneurs are serial entrepreneurs and have developed these networks with experience but this is not the case with nascent and novice academic entrepreneurs (Mosey and Wright, 2007). TTOs may oftentimes have a limited ability to help nascent and novice entrepreneurs to develop these networks while serial academic entrepreneurs may be able to act as mentors especially in academic departments that are positively disposed towards academic entrepreneurship through spin-outs.

2 Spin-out trends

Using firm-level data collected by the Spinouts UK Survey, it is clear that there has been a downward trend in the number of spin-outs formally recorded (Figure 1). A fuller description of the methods and spin-out trends is presented in Wright and Fu (2015). Classifying universities into quartiles on the basis of their position in the UK University League Tables, we can see that there is a clear link between the quality ranking of a university and the quantity of spin-outs created. Most (71%) spin-outs created in 2000-2012 came from the universities in the top quartile (Figure 1). The drop in spin-out creation among universities in the top quartile is particularly noticeable, declining by a half over the period.

Besides this overall decline, it is also evident that other developments are occurring in spin-out activity. Despite attempts by universities to capture all spin-out activity through their TTOs, a significant number of start-ups by academics continue to bypass this route (Perkmann et al. 2014, 2015).

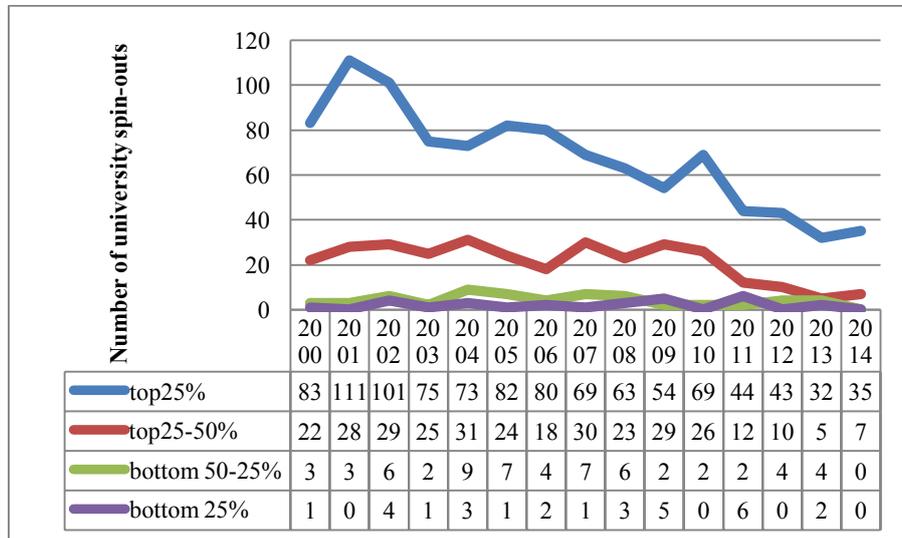
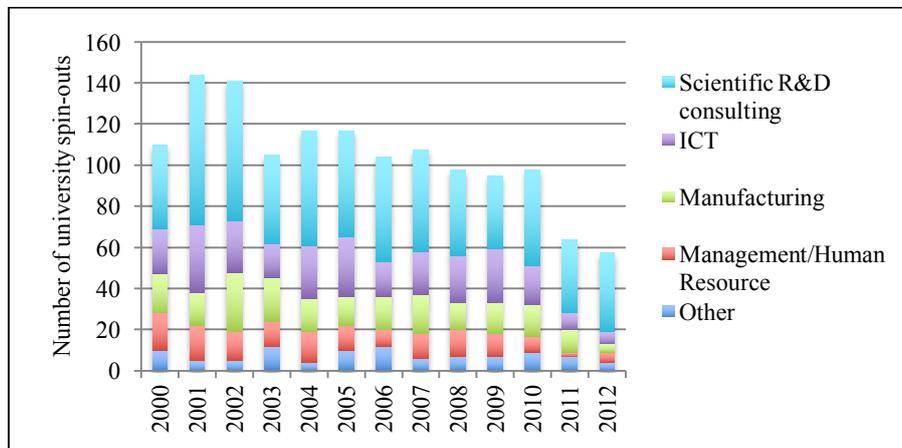


Fig. 1. Quality of Universities and Their Spin-outs Over Time (Source: Authors’ analysis based on Spinouts UK)

Further, while Scientific R&D remains the largest sector for spin-outs, there has been a sharp decline in formally registered spin-outs in ICT (Figure 2). Perhaps surprisingly as they do not attract much attention, spin-outs have also occurred regularly in management and human resources as well as commerce/entertainment.



Note: ‘Other’ includes Material/Energy/Environment sectors; Architectural/Civil Engineering sectors; Commerce/Entertainment sectors; Bio/Pharma sectors

Fig. 2. Sector Distribution of UK Spin-outs from 2000 to 2012 (Source: Authors’ analysis based on Spinouts UK)

We used FAME (<https://fame.bvdinfo.com>) and Zephyr (<https://zephyr.bvdinfo.com>), to obtain data on whether spin-outs had received venture capital (VC) or business angel funding or had undergone a trade sale up to July 2015. VC and even less business angels

play a minority role in funding spin-outs (Figure 3). Some 24% of spin-outs had received VC funding. Universities in the top quartile were somewhat more able to attract finance from this source but other universities in lower quartiles were also able to do so. This is consistent with other evidence from UK spinouts that universities that could signal the quality of their spinouts could attract VC even though they were located outside the so-called golden triangle of Oxford, Cambridge and London (Mueller et al., 2012).

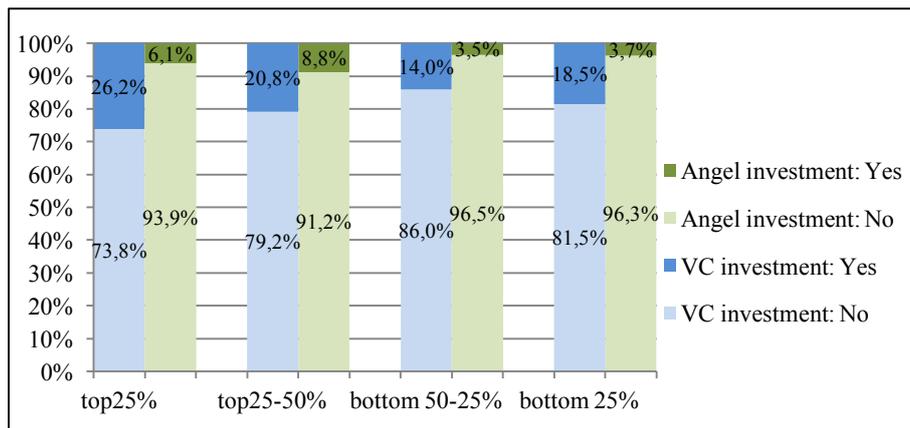


Fig. 3. VC/ Angel-backed Spin-outs across Universities (Source: Authors' analysis based on Spinouts UK)

Business angels, or informal VC typically involves high net worth individuals investing either individually or through a collective arrangements such as a syndicate, or increasingly through crowdfunding (Wright, Hart and Fu, 2015). Only 6.6% of spin-outs had obtained funds from business angels, with quartile two universities being more likely to attract funding from this source.

Although there have been major expectations regarding the financial returns to be generated from spin-outs, the actual overall outcome has been modest, despite a small number of stand-out cases. Under 1% of spin-outs had achieved an IPO by July, 2015 (Figure 4), and these overwhelmingly involved spin-outs from the top two quartiles and those in the Scientific R&D sector.

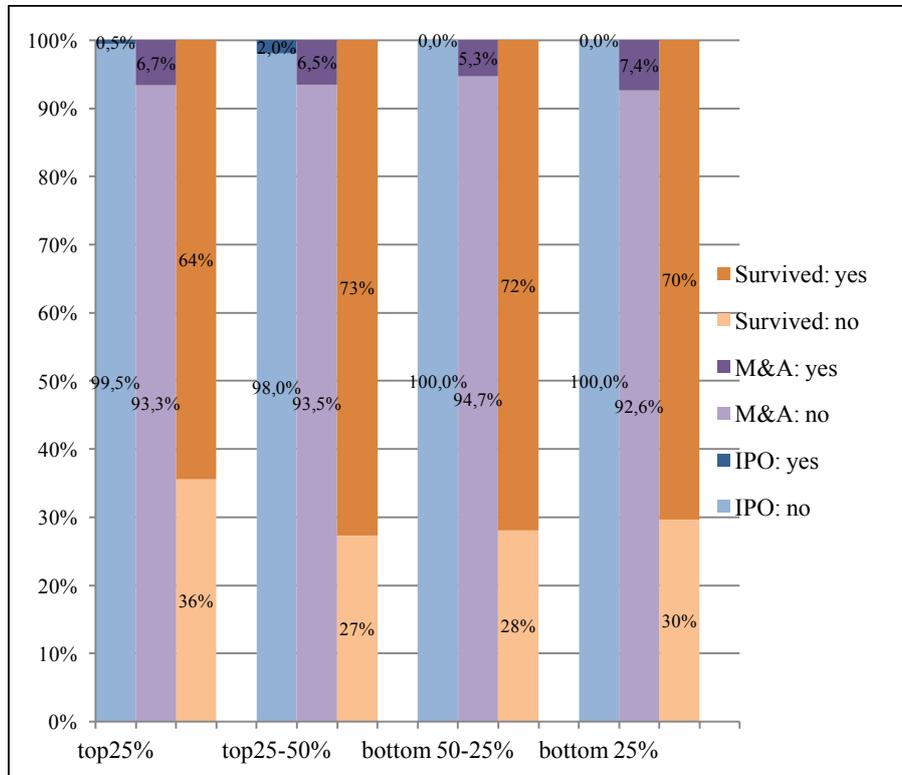


Fig. 4. Exit Routes of Spin-outs across Universities (Source: Authors' analysis based on Spinouts UK)

In contrast, some 6.6% had undergone a trade sale to an existing corporation. Bobelyn et al's., (2015) study in the UK also suggests that academic spin-offs were significantly less likely to earn high returns than other young high tech firms that exit through a trade sale. Spin-outs seem to be more likely to fail than other VC backed firms (Puri and Zarutskie, 2012). Some one third of spin-outs had failed by July, 2015.

3 Discussion and Conclusions

Our review of the literature and recent trends has yielded a number of insights concerning the development of academic entrepreneurship at universities especially in relation to spin-outs by academic faculty. These insights emphasize the heterogeneity of universities and their strategies, as well as the variety of the spin-outs that emerge from them and the challenges they face in accessing the resources and capabilities they need. It is also clear that there are shortcomings in the extent to which TTOs have performed the role of stimulating entrepreneurship and that other actors may also have important roles to play. This evidence also needs to be seen in the context of evolving government policy towards universities in the UK, which is increasingly stressing the

need to take a broader perspective on the economic impact of universities (Wright, 2014; Guerrero et al., 2015). From an academic entrepreneurship perspective this involves consideration of the role of students and alumni in creating ventures as well as that of faculty.

Both the evidence on faculty spin-outs and emerging examples of venture creation by students indicate that support needs to include a wide range of mechanisms that go beyond traditional spin-outs with patents that have a need for large amounts of VC to with potentially worldwide markets to include student ventures with informal IP which may address more local markets and have lower funding needs.

There is fragmentary evidence that universities are developing a variety of mechanisms such as business plan competitions, entrepreneurial garages, pre-accelerators and incubators, to facilitate this broader scope of start-up and spin-out activity. However, as yet we lack a clear framework for analysis of the most effective ecosystems to stimulate this broader range of activities in different universities.

Building on recent research that highlights the variety of contextual factors influencing entrepreneurial ecosystems (Autio et al., 2014), we suggest that one element of the framework concerns the variety of university contexts in terms of scope, research quality ranking, location and local networks, resources, etc. We then envision that universities can develop a continuum of support activities ranging from very early stage support related to formulating opportunities through curricula, pre-accelerators, etc. that can help make embryonic venture ideas ready for the next phase. This phase involves entry into some form of incubator or accelerator that can help shape the business idea and identifies investors and potential markets. This range of support activities we see as being populated by the variety of potential entrepreneurs within universities, a variety of support actors and a variety of investors. Potential entrepreneurs include faculty, support staff, postdocs, students and alumni.

Support actors go beyond TTOs and departmental colleagues to include corporations, public agencies, regional actors, alumni, entrepreneurship centers, adjunct entrepreneurs, etc. Business schools also have a role to play, for example faculty and students can connect with science and engineering faculty and students through business plan and co-working projects. This under-exploited link may be particularly interesting as business schools develop beyond their traditional focus on large corporations (Wright et al., 2009).

Potential investors go beyond VCs, which as we have seen apply to a limited subset of spin-outs from universities to include crowdfunding, accelerators (Clarysse et al., 2015), university seed funds, greater efforts to attract business angels from among alumni, alumni endowments to stimulate entrepreneurial ventures by students, etc.

There is a need for further research to elaborate further the elements of this framework both conceptually and empirically.

In sum, although the last fifteen years have seen considerable progress in research academic entrepreneurship and in particular spin-outs by faculty, in the light of evidence on the impact of this activity and evolving policy towards universities, future research efforts need to turn towards a broader canvass. We hope that the framework sketched out here can provide the basis for this exciting new research agenda.

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