

Understanding entrepreneurial academics - how they perceive their environment differently

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academics

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Abstract

Purpose – Academic entrepreneurship is seen as a pathway for universities to create value from their knowledge. However, there has been a lack of clarity about what activities constitute academic entrepreneurship, the different type of entrepreneurial academics and how their perceptions of their environment relate to their engagement.

Design/methodology/approach – Drawing on a large data set of 10,836 responses across 33 countries, the empirical study investigates European academics who undertake four academic entrepreneurship activities (spin-out creation, commercialisation of R&D results, joint R&D and consulting) to determine if they perceive the environment for academic entrepreneurship differently than those who undertake only some of the activities and those undertaking none at all.

Findings – The findings show that less than 1% of academics undertake exclusively spin-offs creation or R&D commercialisation; however, the majority also engage in other entrepreneurial activities such as joint R&D and consulting and even other education and management engagement activities with industry. In addition, entrepreneurial academics in Europe perceive significantly higher motivators and more developed supporting mechanisms for academic entrepreneurship. However, their perceptions of barriers are similar.

Practical implications – At a managerial and policy level, the study results call into question universities prioritising a narrow view of academic entrepreneurship which focusses only on spin-offs creation and R&D commercialisation. Instead, a broader view of academic entrepreneurship is recommended and appropriate mechanisms in place to enable academics to achieve research outcomes from their entrepreneurial activity.

Originality/value – This paper offers an important contribution on how the perception of the environment contributes to the development of entrepreneurial behaviour in individual academics.

Keywords University-industry, Knowledge transfer, Entrepreneurial academic, Academic entrepreneur, Entrepreneurial university, Spin-offs

Paper type Research paper

Introduction

As the entrepreneurial (Etzkowitz, 1983) and engaged (OECD, 1997) university concepts are increasingly embraced by policymakers and universities (Klofsten and Jones-Evans, 2000),

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Corrigendum: The authors of the article Davey, T. and Galan-Muros, V. (2020), “Understanding entrepreneurial academics - how they perceive their environment differently”, published in *Journal of Management Development*, have identified and self-reported that information in Table 5 of the article contained errors. The errors were in the table alone and do not affect the interpretation of results. The online version has since been updated and the correct data for Table 5 is present. The authors sincerely apologise for this.



academics are brought into position to have a more prominent role in the development of the knowledgeable society and economic growth. Long-standing debates exist about the effectiveness of some policies (Mowery and Nelson, 2004), such as the 1981 Bayh–Dohl act, which is designed to facilitate the commercialisation of science (Kenney and Patton, 2009; Link *et al.*, 2007) and there have been ongoing questions about whether this is the role an academic should be playing (Laukkanen, 2003). Despite this, academics have increased their “entrepreneurial” behaviour (D’Este and Perkman, 2011).

This “academic entrepreneurship” (from here *aE*) has resulted in increased patents (Nelson, 2001; Stiglitz and Wallsten, 1999), licensing income (Thursby *et al.*, 2001) and spin-off activity (Shane, 2005). These activities have subsequently created benefits for academics and their universities, whilst contributing to job creation and growth, have driven the competitiveness of local economies and are assisting the interests of society in general (European Commission, 2003, 2006; OECD, 2006).

Extant literature on *aE* has investigated the individual characteristics of academic that are entrepreneurial behaviour (Brandstetter, 1997; Hayter *et al.*, 2018), their motivations (D’Este and Perkman, 2011), intentions (Wright *et al.*, 2006; Gaglio and Katz, 2001), the culture for entrepreneurship where academics work (Hayter *et al.*, 2018; Davey *et al.*, 2016), the top-level managerial commitment in their organisations (Davey *et al.*, 2018), the type of firms they create (Morales-Gualdron *et al.*, 2008) and the mechanisms instituted to support this intention (Klofsten and Jones-Evans, 2000).

However, the concept of academic entrepreneurship in previous quantitative studies is often limited to venture creation. Moreover, these studies investigate factors influencing academic entrepreneurship in isolation or at an institutional level rather than how these factors together shape individual academic behaviour. Additionally, there is a lack of more nuanced understanding of how, how much and why academics engage in *aE* activities and how their environment influences the extent of *aE* they undertake, particularly at an international level.

This paper addresses these shortcomings aiming to contribute to the literature of *aE* internationally and at the same time, provide useful input for policymakers, funding bodies, university managers and knowledge transfer professionals who aim to foster *aE*.

Specifically, the study empirically explores how entrepreneurial academics perceive external factors, such as barriers, motivators and organisational commitment to *aE*. Building on previous research on the academic entrepreneurship and the University-Business Cooperation (UBC), This paper considers four activities underlying academic entrepreneurship, namely (1) spin-off creation, (2) commercialisation of R&D results (3) joint R&D with industry and (4) consulting and draws on a European data set of 10,836 responses from academics across 33 countries.

Results show that most academics do not collaborate with industry; however, results highlight that when academics cooperate in one activity, they cooperate with industry in a number of activities making them highly engaged collaborators. Furthermore, entrepreneurial academics tend to view barriers similar to non-cooperating academics however, perceive a higher development of drivers and support mechanisms.

The paper is structured as follows: it will first explore the literature on motivators, barriers and supporting mechanisms for *aE*, then describe the methodology for the quantitative analysis, display and discuss results before concluding with management and policy implications.

Towards an understanding of academic entrepreneurship

Narrow and broad interpretations of academic entrepreneurship

Called “academic capitalism” (Renault, 2006), “entrepreneurial orientation” (Diáñez-González and Camelo-Ordaz, 2016) or “academic entrepreneurship” (Rothaermel *et al.*, 2007), the entrepreneurial behaviour of academics has been conceptualised in differing ways and generally, within the

context of UBC (Galán-Muros and Davey, 2017). There is some acceptance that the entrepreneurial activity by academics is part of external interaction activities (Abreu and Grinevich, 2013) that can extend to cooperation with industry in management and education (Spaapen and Drooge, 2011; Rossano-Rivero and Wakkee, 2018). Although most authors consider academic entrepreneurs to be those who create spin-offs, patent or license their research results and (Ljungberg, 2011) more recently, other activities have also been included. The literature dedicated to the principal investigator role, for example, points to the necessity for academics in this role to have entrepreneurial skills for managing research (Boehm and Hogan, 2014) and how they have a leading role in commercialising knowledge (Menter, 2016).

Nevertheless, two primary views can be discerned (Göktepe-Hulten and Mahagaonkar, 2010), a narrow and a broad conceptualisation of *aE*. The “narrow” view is mainly defined from an economic standpoint and equates academic entrepreneurship with the creation of new ventures, often referred to as academic spin-offs (Autio, 1997; Cooper, 1971; Shane, 2004; Wright *et al.*, 2007; Shane *et al.*, 2015) and commercial applications through the development of patents, licences and spin-offs (Czarnitzki *et al.*, 2016; Shane *et al.*, 2015). For example, Shane (2004) defined it as founding a firm by an academic to commercially exploit a patented invention or a body of unpatented expertise. This paper refers to academics who fit in this narrow definition as “academic entrepreneurs”.

If entrepreneurial behaviour encompasses the enterprising person and entrepreneurial mindset then being entrepreneurial can equally involve application of these skills in various commercial activities (Miller *et al.*, 2018). However, the narrow view of *aE* excludes many activities undertaken by an academic in which academics apply their entrepreneurial skills and therefore, exclude many academics who undertake them.

A broader understanding of *aE* can originally be found in studies provided by Klofsten and Jones-Evans (2000) suggesting that academic entrepreneurship is “all commercialisation activities outside the normal university duties of basic research and teaching” (Klofsten and Jones-Evans, 2000, p. 299). A number of studies by Tartari *et al.* (2012); Benneworth and Jongbloed (2010) and D’Este and Perkmann (2011) also frame *aE* in this way.

This perspective is embodied in the review of Perkmann *et al.* (2013), which states that proactive behaviour in the form of academic scientists’ engagement with industrial partners also fits into the definition of an *aE*. This view of *aE* broadens the scope by including a more diverse set of “entrepreneurial activities” such as collaborative research, consulting or contract research (Abreu and Grinevich, 2013; Bozeman *et al.*, 2012; Cohen *et al.*, 2002; D’Este and Patel, 2007). In this paper, academics who fit in this broader definition are referred as “entrepreneurial academics”.

This “narrow” and “broad” classification of “academic entrepreneurs” and “entrepreneurial academics”, respectively, is supported by Miller *et al.* (2018) who undertook a systematic review of *aE*-related literature.

Some authors suggest that in practice, the number of academics who commercialise their research and create spin-offs is very limited (Bozeman and Gaughan, 2007; Klofsten and Jones-Evans, 2000; Nikulainen and Tahvanainen, 2013). However, the question of what percentage of academics in Europe who fit in the narrow and broad views of *aE* remains largely unanswered.

Factors influencing academic entrepreneurship

As entrepreneurial activities are discretionary behaviour for academics (D’Este and Perkmann, 2011), and academics are primarily research-oriented, their perception of the institutional environment and the support available for *aE* becomes very important. Individual perceptions of the potential costs and benefits which are related to perceived barriers and drivers for *aE* (Tartari and Breschi, 2012) and the local environment

(Geissler *et al.*, 2010; Mazzarol, 2014) affect the types of entrepreneurial initiatives undertaken and how they are performed.

In highlighting the importance of the environment on the individual, a set of authors emphasised the need to develop the right environment to encourage the UBC which includes *aE* (Galan-Muros *et al.*, 2017; Phan and Siegel, 2006; Stuart and Ding, 2006). Conversely, conflicting results show how university policies and structures (Louis *et al.*, 1989), as well as Technology Transfer Offices (TTOs) (Clarysse *et al.*, 2011) have little effect on entrepreneurship.

Greater insight is required into the perceptions of individual academics and the degree to which the organisational environment is encouraging or inhibiting their *aE* activities. For this reason, this study will examine the perceptions of academics with respect to the institutional environment for *aE*, considering perceived drivers, barriers and supporting mechanism for *aE*.

Motivators

Funding emerges as a common primary driving force (Wood, 2011; D'Este and Perkmann, 2011) relevant for all *aE* activities (Schartinger *et al.*, 2002). Motivations propelling *aE* refer to research outcomes including application of research into practice (Franco and Haase, 2015) and new insights for research (Qian, 2018; Van der Sijde, 2012). Collaboration with industry including joint research, contract research and consulting is strongly informed by research-related motives (D'Este and Perkmann, 2011).

Universities' encouragement, reward and incentive programmes (Grimaldi *et al.*, 2011) which tie the UBC to the promotion and tenure criteria of academics (Siegel *et al.*, 2007; Plewa *et al.*, 2006) stimulate *aE*. Additionally, reputational benefits are also recognized (Pitsakis *et al.*, 2015; Van der Sijde, 2012). The creation of spin-offs was found to contribute significantly to the university's research and teaching missions (Roberts and Malone, 1996), whilst *aE* contributes to the university's mission and to the society generally (D'Este and Perkmann, 2011; Benneworth and Jongbloed, 2010). The motivation to undertake *aE* activities depends on the type of activity (D'Este and Perkmann, 2011) as well as the academic themselves (Lam, 2011), but the perception of drivers seems to be related to their engagement activity (Galan-Muros and Plewa, 2016).

- H1. Entrepreneurial academics perceive motivators differently to those academics who are not or only partly engaged in *aE* activities.

Barriers

Conversely, the lack of funding is regularly nominated as a major barrier to the UBC (Howells *et al.*, 2012; Filippetti and Savona, 2017). Administrative issues such as bureaucracy (Davey *et al.*, 2011; Franco and Haase, 2015) and insufficient work time (Davey *et al.*, 2011, 2018) have also been identified to hinder the UBC, whilst a lack of UBC knowledge has also been found to affect academics with little experience in the UBC (Davey *et al.*, 2018). Organisational culture has been identified as a major barrier to *aE* (Binkauskas, 2012) together with a range of related issues including differing objectives and timelines (Van der Sijde, 2012), language and communication styles (Plewa, 2010).

In determining how academics will respond to barriers, the work of Tartari *et al.* (2012) found that some barriers (Mertonian) pertaining to cultural differences are overcome through the act of undertaking *aE* activities, whilst other (transactional) barriers tend to be less influenced by having engagement experience. The studies of Davey *et al.* (2011) and Galan-Muros and Plewa (2016) found that barriers to the UBC were perceived similarly by academics collaborating at different collaboration levels and showing that those who engaged simply had more motivations to overcome the barriers.

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- H2. Entrepreneurial academics perceive barriers similarly to those academics who are not or only partly engaged in *aE* activities.

Supporting mechanisms

To support *aE* development, universities are adopting strategies (Siegel and Wright, 2015) that support and encourage all university stakeholders specially, academics to have entrepreneurial behaviour (Ambos *et al.*, 2008; Loi and Di Guardo, 2015). While some strategies are related to the official recognition of importance of *aE*, such as UBC's integration in the vision and mission of the university (Clarysse *et al.*, 2005), other strategies are focussed on the implementation, such as the dedication of resources for the UBC (Phan and Siegel, 2006) and incentives, which has been a well-recognised mechanism to support and enhance the UBC (Siegel and Wright, 2015; Lam, 2011).

aE structures include the creation of offices and centres such as the TTO and Knowledge Transfer Offices (Aldridge and Audretsch, 2011), incubators, (Rothaermel and Thursby, 2005) innovation and entrepreneurship centres (O'Shea *et al.*, 2007) and science parks (Fini *et al.*, 2011). The appointment of personnel which could include licensing officers (O'Shea *et al.*, 2007), legal, entrepreneurial and industrial relations supporting staff (Clark, 2001) and UBC activities aimed at academics to interact with businesspeople (Davey *et al.*, 2011) are further examples.

Studies on the mechanisms supporting *aE* report mixed success with studies investigating the role of the TTO (Clarysse *et al.*, 2011) and incentives and management support (Galan-Muros *et al.*, 2017) for *aE*. However, mechanisms cannot be regarded in isolation from each other (Polt *et al.*, 2002) rather, regarded in combination with different mechanisms addressing different activities. As such, it is expected that supporting mechanisms generally play a role in developing *aE* and therefore, will be highly developed or perceived to be more highly developed by those entrepreneurial academics.

- H3. Entrepreneurial academics perceive supporting mechanisms differently from those academics who are not or only partly engaged in *aE* activities.

Methodology

This paper investigates the question: how do academics with different levels of commitment to *aE* perceive the environment for *aE*? A survey on the entrepreneurial activities of academics was designed as an online survey, piloted with 40 academics in three countries and translated into 24 languages. The survey was sent to three managers in each of the over 3,500 registered higher educational institutions (HEIs) in the European Economic Area using a random sampling method. These managers were requested to further distribute the online survey to all academics within their institutions who were the target group for this paper. A total of 10,836 academics from 851 institutions, 24% of all HEIs who received the survey, in 33 countries responded. A weighting system was created to adjust the responses to the number of academics per country in order to ensure a representative sample by the country.

Academics were asked whether and to what extent they undertake four entrepreneurial activities: (1) spin-off creation, (2) commercialisation of R&D results (3) joint R&D with industry and (4) consulting. Academics were also asked how much certain factors motivate them to, or prevent them from undertaking those entrepreneurial activities. In addition, academics evaluated the development of a series of supporting mechanisms in their institutions. The four responses were measured on ten-point Likert scales (1 = not at all, 10 = to a very high extent).

A series of analyses were undertaken using IBM SPSS, 26. First, a set of frequencies show how often academics undertake each of the activities or a combination of them.

Second, bivariate Pearson correlations were undertaken to test the relationships between the extents of engagement in different *aE* activities. Third, respondents were divided into three groups depending on their engagement activities to provide a more granulated picture of academic entrepreneurship, and a series of two-way ANOVA tests were undertaken in order to identify potentially significant differences between the groups. The data were confirmed to meet all the assumptions required for these analyses, i.e. continuous independent variable, independence of cases, normal distribution and homoscedasticity. None of the analyses would allow the research to establish causal links between variables.

Results

Sample description

Table 1 below describes the characteristics of the total sample of the paper which is representative of the European academic population by gender and age and is weighted to be representative by the country. It also shows the sample of entrepreneurial academics, those who undertake the four *aE* activities. This comparison shows that entrepreneurial academics are more likely to be male, 40–60 years old, from mid-size polytechnic or technical universities.

Stage 1: the extent of academic entrepreneurship: individual activities and relationships amongst them

From the 10,836 academics of the sample, 4,707 (43.4%) academics undertake at least one *aE* activity. The activities that are more common are joint R&D (37.6%) and consulting to business (36.2%), while only 25% academics undertake R&D commercialisation and spin-off creation. However, whilst 2,703 (24.9%) of the respondents undertake some form of *aE*, only 62 (0.6%) undertake “spin-off creation” and no other *aE* activity. Similarly, whilst 2,753 (25.4%) of respondents undertake research commercialisation, only 23 (0.2%) undertake R&D commercialisation and no other form of *aE* activity.

These results below Table 2 also highlight the (self-assessed) extent to which European academics undertake *aE* activities. The *aE* activity in which academics are more likely to be engaged at a high level is joint R&D (16%) followed by consulting (12%). On the contrary, academics are very unlikely to undertake “commercialisation of R&D” and “spin-off creation” at a high level (4%).

		Total sample (<i>n</i> = 10,836)	Entrepreneurial academics sample (<i>n</i> = 1876)
Gender	Male	57.0%	66.7%
	Female	43.0%	33.3%
Age	<40 years	29.0%	28.0%
	Between 40 and 49 years	31.0%	33.8%
	Between 50 and 59 years	26.0%	28.6%
	60+ years	14.0%	9.6%
Nature	University(traditional)	64.2%	55.4%
	University of applied science	17.7%	18.9%
	Polytechnic/Technical	9.8%	13.4%
	University		
	Other	8.3%	12.3%
Size	<10,000 students	42.4%	41.4%
	10,000–49,999 students	48.5%	53.2%
	50,000+ students	9.1%	5.7%

Table 1.
Characteristics of the total sample and the entrepreneurial academics sample

A Pearson correlation analysis shows how engagement in the four activities is significantly correlated (Table 3). The highest correlations are between joint R&D and consulting to business (0.692) and “commercialisation of R&D results” (0.668). Spin-off creation has the highest correlation with R&D commercialisation (0.6) (see Table 4).

Considering the two definitions of *aE* explained above, 1,876 (17.3%) of academics fit in the broad definition, that is, they are engaged in some measure of all four *aE* activities at the same time. However, only 13 (0.1%) fit in the view of the narrow *aE* meaning that academics who undertake spin-off creation or R&D commercialisation but no other *aE* activity. This narrow view is so rare in practice because of the significant correlation of these four activities because academics tend to be involved in more than one *aE* activity simultaneously. It must be noted however, that there are fundamental differences in the rate of engagement by academics in the four *aE* activities and that it has been identified that each has its own distinct nature (D’Este and Perkmann, 2011).

These results answer the question posed in the literature review section about numbers of *aEs*. They emphasise the interconnected nature of *aE* activities as well as the multifaceted nature of academic entrepreneurship, even when the level of engagement in each of the individual activities is different. Due to the minimal number of academics who fit only in the narrow view of *aE*, the next stages will focus uniquely on the four activities that compose the broad view.

Stage 2: motivations, barriers and supporting mechanisms

Do academics with different *aE* engagement perceive motivations, barriers and supporting mechanisms differently? Considering that the group representing a narrow view of *aE* was too small (13 individuals), the academic sample is divided into the following three groups:

- (1) Entrepreneurial academics (fully engaged), who undertake all four *aE* activities so fitting in the “broad” notion of *aE* (*n* = 1,876),
- (2) Partly engaged academics, who undertake one, two or three *aE* activities but not the four of them (*n* = 2,832),
- (3) Non-engaged academics, who do not undertake any *aE* activities (*n* = 6,128).

Extent	Joint R&D		Consulting		Commercialisation		Spin-off creation	
	No	%	No	%	No	%	No	%
None	6,760	62%	6,908	64%	8,083	75%	8,133	75%
Low	1,089	10%	1,262	12%	1,374	13%	1,351	12%
Medium	1,210	11%	1,412	13%	914	8%	868	8%
High	1,777	16%	1,254	12%	465	4%	484	4%
	10,836							

Table 2. Extent to which academics undertake *aE* activities (1 = “not at all” to 10 = “to a large extent”. Values were then recalculated into none = 1, low = 2–4, medium = 5–7 and high = 8–10)

<i>aE</i> activities	Joint R&D with industry	Consulting to business	Commercialisation of R&D results
Consulting to business	0.692**		
Commercialisation of R&D results	0.668**	0.596**	
Spin-off creation	0.549**	0.555**	0.600**

Note(s): **Correlation is significant at the 0.01 level (2-tailed)

Table 3. The correlation analysis involving *aE* activities

Table 4.
Perceived development
of motivators, barriers
and mechanisms
supporting the UBC
(1 = “not at all” to
10 = “to a very high
extent”)

Hypothesis	Item	Non- engaged academic mean	Partly engaged academic mean	Entrepreneurial academic mean	Sig	Result
H1: motivators	H1a	5.45	6.98	7.40	0.000**	H1a cannot be rejected
	H1b	3.44	3.76	4.09	0.000**	H1b cannot be rejected
	H1c	4.28	4.63	5.19	0.000**	H1c cannot be rejected
	H1d	6.32	7.56	8.05	0.000**	H1d cannot be rejected
	H1e	6.88	7.74	8.07	0.000**	H1e cannot be rejected
	H1f	6.18	6.29	6.88	0.000**	H1f cannot be rejected
	H1g	6.91	6.92	7.33	0.000**	H1g cannot be rejected
H2: barriers	H2a	6.25	6.65	6.91	0.000**	H2a cannot be rejected
	H2b	6.79	6.24	5.54	0.004*	H2b can be rejected
	H2c	5.36	5.10	5.27	0.071	H2c cannot be rejected
	H2d	6.23	6.09	6.28	0.083	H2d cannot be rejected
	H2e	6.88	6.74	6.63	0.230	H2e cannot be rejected
	H2f	5.29	5.12	5.28	0.235	H2f cannot be rejected
	H2g	5.64	4.13	3.76	0.000**	H2g can be rejected

(continued)

Hypothesis	Item	Non-engaged academic mean	Partly engaged academic mean	Entrepreneurial academic mean	Sig	Result
H3: supporting mechanisms	H3a A university mission, vision, plans and communication embracing the UBC	5.06	5.27	6.15	0.000**	H3a cannot be rejected
	H3b Incentives for the UBC (incl. alignment with work assessment)	3.86	4.15	4.93	0.000**	H3b cannot be rejected
	H3c University resources (e.g. buildings, funding, equipment)	4.34	4.72	5.69	0.000**	H3c cannot be rejected
	H3d Offices and personnel dedicated to the UBC (incl. technology transfer/career office, incubator)	4.07	4.56	5.32	0.000**	H3d cannot be rejected
	H3e UBC activities aimed at academics to interact with businesspeople	3.70	4.29	5.12	0.000**	H3e cannot be rejected

Note(s): ** at 0.1% significance level. * at 0.5% significance level

Table 4.

Results show that all academic groups are at least somewhat *motivated* to engage in *aE* to gain new insights for research and use their research in practice instead of for increasing their chances of promotion. However, partly and non-engaged academics perceive all the seven tested motivations to be significantly lower than entrepreneurial academics, which would in part explain their lower engagement in *aE* activities.

Regarding *barriers*, all academic groups generally share similar perceptions with three exceptions. Whist partly and non-engaged academics find their insufficient work time to be the highest barrier for engagement, entrepreneurial academics perceive bureaucracy as their highest barrier and significantly higher than the other two groups. The three cohorts also perceive their lack of knowledge/experience significantly different, although this is the lowest barrier for both partly and non-engaged cohorts as it has little relevance to them.

In addition, the differing motivations and values between universities and businesses were also significantly different between the groups and less important for entrepreneurial academics. Even considering the three significantly different results, barriers have generally lower relevance than motivators in explaining the engagement in academic entrepreneurship.

In respect to *supporting mechanisms* they are all perceived significantly higher by entrepreneurial academics than by the other two groups and suggesting that there is a role for supporting mechanisms in developing *aE*. All groups nominate “a university mission, vision, plans and communication embracing the UBC” as the most developed mechanism and “incentives for the UBC” as the least developed one.

Stage 3: tendency to undertake other engagement activities

As previous results of this paper revealed that academics tend to undertake more than one *aE* activity, a subsequent query is whether they are also more likely to undertake higher levels of other engagement activities with industry. A set of ANOVA tests show that entrepreneurial academics are significantly more likely to cooperate with industry in all education and management engagement activities than those academics who are not or partly engaged.

Discussion

The results in [Table 2](#) show that less than half of academics in Europe cooperate in at least one *aE* activity but only one in four undertake the most atypical activities associated with *aE* (spin-offs creation and commercialisation of R&D results) (see [Table 1](#)). These results are higher than those reported in previous literature results in which spin-off creation rates were ranging between 3% ([Bozeman and Gaughan, 2007](#)) and 19% for (Irish) academics ([Klofsten and Jones-Evans, 2000](#)), commercialisation rates 15% and 14% in the USA and Finland, respectively ([Nikulainen and Tahvanainen, 2013](#)), and specific patenting/licensing rates were 26% ([Klofsten and Jones-Evans, 2000](#)). This difference might be due to a self-selection sample bias, whereby entrepreneurial academics might be more likely to answer the survey. However, although overall engagement is generally higher, very few academics (4%) do these two activities to a higher degree.

The other two *aE* activities consulting and joint R&D are undertaken by 36% and 38% of academics, respectively. Similar findings have also been made in national studies for the two additional “broad” *aE* activities with consulting rates generally between 17% ([Grimpe and Fier, 2010](#)) and 38% ([D’Este and Perkmann, 2011](#)) and joint R&D rates between 17% ([Bozeman and Gaughan, 2007](#)) and 44% ([D’Este and Perkmann, 2011](#)). The share of academics who undertake consulting and joint R&D to a high level is still low – 12% and 16%, respectively.

The results in Table 3 highlight that when academics engage in one *aE* activity they are more likely to engage in other *aE* activities. A specific analysis identified that less than 1% ($n = 13$) of academics exclusively undertake spin-off creation and R&D commercialization, while 17.3% of respondents undertake all four *aE* activities (“broad” *aE* view). All these results highlight the relevance of conceptualising *aE* more broadly and call for undertaking research in *aE* and not merely considering spin-off creation and R&D commercialisation but also, the possible precursors of these activities: joint R&D and consulting.

The paper demonstrates (Table 5) how entrepreneurial academics also tend to engage at higher rates in education and management activities with industry. It highlights how entrepreneurial academics are in fact highly engaged industry collaborators, beyond just *aE* activities. This is a good justification for considering *aE* within the broader context of the UBC. This result aligns with the increasing prevalence of companies wanting to build relations with academics instead of just purchasing technologies (Davey *et al.*, 2018) as well as the finding that academics need to undertake a wider range of activities to achieve the diverse objectives they have for *aE* (D’Este and Patel, 2007).

This study builds on significant research that has been dedicated to barriers and drivers for the UBC (Galan-Muros and Plewa, 2016; Franco and Haase, 2015; Ferru, 2010; Wu, 2017; Myoken, 2013) and academic entrepreneurship (Davey *et al.*, 2016; Tartari *et al.*, 2012). It shows that whilst entrepreneurial and non-entrepreneurial academics perceive barriers similarly, motivators for *aE* are perceived by entrepreneurial academics to be significantly higher.

An entrepreneurial academic’s motivation to cooperate is to improve their research. They assessed this *aE* motivator significantly higher than those academics with partial or no engagement suggesting that they seek to align *aE* activities with their research interests. In addition, the results show that when academics undertake entrepreneurial activities, they do in effect open up opportunities for greater amounts and different types of activities beyond *aE* activities. This notion is supported by Tartari *et al.* (2012) who identified that experience affects academics perceptions of barriers to *aE* activities and that once an academic “crosses the rubicon” to collaborate, the higher the degree of their cooperation with industry will be.

		Non- engaged academic mean	Partly engaged academic mean	Entrepreneurial academic mean	Sig
Education	Mobility of students	1.20	5.17	6.49	0.000**
	Dual education programmes	1.10	2.99	4.73	0.000**
	Curriculum design including industry	1.08	3.11	4.58	0.000**
	Curriculum delivery including industry	1.11	3.72	5.37	0.000**
	Lifelong learning for businesspeople	1.06	3.12	4.74	0.000**
	Student entrepreneurship	1.03	2.27	4.60	0.000**
	Management	Governance	1.04	2.38	4.45
Shared resources with business		1.03	2.31	4.25	0.000**
Industry support		1.05	2.86	5.02	0.000**

Note(s): **at 0.1% significance level

Table 5. Perceived development of motivators, barriers and mechanisms supporting the UBC (1 = “Not at all” to 10 = “to a very high extent”)

Such entry barriers could include the lack of entrepreneurial skills amongst academics (Laukkanen, 2003), the difficulty in finding the appropriate collaboration partner (Schofeld, 2013; Baba *et al.*, 2010; Gawel, 2014), the importance of existing relations with external actors on a scientist's decision to act entrepreneurially (Aldridge and Audretsch, 2011) and the cultural differences between university and business (Bruneel *et al.*, 2010). The literature on the principal investigator's role shows how researchers who are in this role need to develop skills not unlike an entrepreneur which then places them in a better position than TTO managers to act as boundary spanners (Boehm and Hogan, 2014).

So, what do the results suggest about why academics act entrepreneurially? Academics have to weigh up the cost and benefits of collaborating before deciding to act (Tartari *et al.*, 2012). Whilst academics who undertake *aE* have a similar notion of the barriers as those who do less or do not undertake it at all however, they perceive significantly higher drivers for doing so. It is because entrepreneurial academics perceive higher motivations for *aE* that their cost–benefit ratio evaluation favours *aE*.

The results of *aE* supporting mechanisms show that entrepreneurial academics perceive a higher development of mechanisms supporting their behaviour. The positive aspects of supporting mechanisms have been previously established by previous research to some extent (Canhoto *et al.*, 2016; Galan-Muros *et al.*, 2017; Kaklauskas *et al.*, 2018) or the determinantal effect of a lack of mechanisms in place (O'Kane *et al.*, 2017). Whether or not supporting mechanisms at the entrepreneurial academics' university are more developed and these academics have a higher awareness of the existence of these mechanisms or they have a more positive outlook about their development, it is likely that generally these mechanisms play a role in supporting *aE*.

Management and policy implications

The study informs university managers, knowledge transfer professionals and policymakers to create organisational and policy environments that assist entrepreneurial behaviour at universities and better support individual academic entrepreneurship behaviours. Considering that academics who create spin-offs and commercialise research are often involved in joint R&D and/or consulting as well, management and policy initiatives that address a broader definition of *aE*, in the context of the UBC, seems to offer greater promise in securing economic outcomes for universities. Such an approach would also deliver improved benefits for the academic and university in research, education and management.

Bureaucracy emerges as a large barrier together with the lack of time allocated to engagement activities. Creating an initiative that reduces the highest barriers would be advisable as it could be preventing *aE* activity. However, the entrepreneurial academics in the study are driven by their higher motivations to undertake *aE* activities and, along the way, seemingly overcome any perceived barriers. This suggests that management and policy that prioritises, enables and supports academics to achieve their desired outcomes from *aE* activity with a focus on research outcomes is likely to yield better results than management and policy designed to overcome each of the barriers.

Furthermore, promoting *aE* activities as a way of supporting the research outcomes of academics and a way of getting research into practical use (Wood, 2011) could address the lower motivations of those partly or not engaged academics. Recent research supports this as cooperation with industry creates superior and more authoritative research performance measured through journal citation rate and citation lifetime (Savage, 2017; Jones and Clulow, 2012). The results showed that promoting and supporting *aE* activities could also shift thinking to inspire action to create a broader effect on the university–industry engagement, including education and management activities and on the social contribution of universities (Budyldina, 2018).

The existence of mechanisms supporting *aE* activities and the subsequent awareness by academics of these mechanisms is also important for developing entrepreneurial academics. Specifically, offering programmes to develop more entrepreneurial academics and better promotion of these programmes will help to address the perceived lack of experience, whilst reducing bureaucratic barriers affecting *aE* would assist those already undertaking it. Such programmes should also find ways of bringing academics and industry together to establish relations and build trust because activities such as joint R&D and consulting with industry are built on trusted relations (Galan-Muros and Plewa, 2016).

The results showed that an unexpected benefit of promoting *aE* activity to academics is that they are then more likely to engage with industry in education and management activities. For universities managers and knowledge transfer professionals trying to encourage greater engagement therefore, promoting and supporting *aE* activities will likely have a broader effect on overall industry engagement.

Conclusions, implications, limitations and further research

Based on a survey with over 10,000 academics of 33 countries, the paper identifies that less than half of them undertake at least one *aE* activity and that very few of them undertake those traditionally considered in a narrow version of *aE*, spin-off creation and R&D commercialisation. Those who commercialise their research or create their own ventures almost always undertake joint R&D and/or consulting with industry which are potential precursors. Entrepreneurial academics are also more likely to pursue other cooperation activities with industry in education and management than academics either engaged in only some *aE* activities or not at all.

The study has also concluded that entrepreneurial academics perceive motivators and supporting mechanisms for *aE* significantly higher than those partly or non-engaged in *aE*, while the perceptions of most barriers are similar. This puts the focus on the study of motivations and supporting mechanisms instead of barriers of *aE* most of which seem to be overcome when collaboration is undertaken.

Considered together with other studies that have questioned the profitability of the TTO function (Kenney and Patton, 2009; Breznitz and Feldman, 2010) and identified that earnings from commercialisation is distributed unevenly favouring specific universities (Breznitz and Feldman, 2010), the results of this study bring into question the value of prioritising the “narrow” *aE* activities, spin-offs and R&D commercialisation at the majority of universities.

Instead the study suggests that by considering and supporting a broader concept of *aE* and by increasing the alignment of *aE* activities with research outcomes for academics, universities can achieve better outcomes for all stakeholders. Nevertheless, academics and university management alike should not underestimate the specific nature of and specific support needed for each of the *aE* activities in pursuing a focus on a broader notion of *aE*.

Limitations

The paper has a number of limitations. First, there is not a common understanding of academic entrepreneurship and thus, two clear definitions were provided. There is also a possibility that the sample suffers some self-selection bias, particularly of academics more inclined to engage in *aE*. Moreover, whilst we provided some clear objective differentiation between academics undertaking all, some and no *aE* activities, the assessment of barriers, drivers, the development of supporting mechanisms and their individual extent *aE* activities are subjective assessments sensitive to academics’ own perceptions. Furthermore, this study establishes relationships but not causality related to the environment effect on the academic’s extent of engagement in *aE* which will require further analyses.

Further research

Whilst this research has established the perceived differences of entrepreneurial academic versus those partly or not engaged in *aE*, it has not conclusively identified the factors that influence *aE*. Determining these factors is the subject of further research. Further research should also seek to identify for which institutions is worthwhile pursuing spin-offs and commercialisation of research and a deeper study of the mechanisms supporting academic entrepreneurship or entrepreneurial academics would be highly valuable. This same study could be replicated in new countries to see if results hold.

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