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Exploring UK Academic Attitudes to Collaborating with Industry and Entrepreneurship

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Drawing on a unique set of surveys of academics funded by the Engineering and Physical Sciences Research Council (EPSRC), this report explores changes in the way academics engage with industry in the UK between 2004 and 2009. Although there are new and increasing pressures for academics to engage with industry, the nature and extent of this industry engagement remains an area of choice for individual academics. This report documents how academics' perceive working with industry and explores how academics manage and integrate these activities with their research and teaching efforts. It also examines the entrepreneurial efforts of UK academics. In doing so, it offers lessons for policy. The key findings from the report are:

- Industrial engagement is common among UK academics working in the engineering and physical sciences. The main forms of engagement are conferences and one-off research agreements such as joint research projects and contract research. Most academics engaged in one or two projects (consultancy, funded research or contract research) with industry over the past two years.
- Levels of engagement with industry have increased over the past five years. UK academics appear to use more types of engagement with industry and more frequently than they did five years ago.
- The barriers to engagement with industry remain and are largely concentrated in differences in orientation, including the time scale and nature of research, between academics and industry. In comparison with their industry collaborators, academics perceive few problems in engagement related to Intellectual Property (IP) or university rules and regulations.
- Barriers to engagement appear to be falling over time as academics reported fewer barriers in the 2009 survey than in the 2004 survey. This result contrasts with the results of the industry survey of EPSRC collaborators, which shows an increasing volume of barriers to collaboration over the same period. These differences may reflect a divergence in collaboration experience between academics and industry.
- The main factors the motivate engagement with industry are related to furthering of academics' research activities, including securing additional research funding, and finding interesting and rewarding research problems. Few academics engage with industry for purely financial gain. The importance of these factors has remained relatively constant over time, but the importance of engaging with industry to build networks has increased.
- Most academics feel supported by their department and their university for their engagement efforts with industry. However, few considered this activity as rewarded or valued by their department or university.
- The Research Assessment Exercise (RAE) 2008 appears to have had little negative impact on industry engagement as few academics indicating that the RAE forced them to reduce their engagement efforts. However, the RAE 2008 did lead to a third of academics shifting their publications away from more practitioner-oriented outlets.
- UK academics appear to be highly entrepreneurial. A significant proportion are directly involved in developing new ventures. Respondents to the survey are almost five times more likely to be involved in entrepreneurial efforts than general members of the UK population.
- There are significant differences in the rates of entrepreneurship between academics working in different disciplines.
- The main motivations for starting a new venture among entrepreneurial academics are to develop their research into a practical application and to challenge themselves. The main barrier to entrepreneurship among academics is a lack of time and resources rather than lack of support from colleagues or their university.

Policy lessons arising from the research

- Engagement of academics with industry is widespread, growing and underpinned by strong research. By international comparison, UK academics have relatively high levels of engagement with industry. Therefore, efforts to pressure academics to do more engagement may be based on an illusion that such interactions are uncommon.
- These engagement efforts cover an array of methods and government policy should attempt to support all of these mechanisms rather than favouring single engagement channels, such as starting up new ventures.
- Greater attention needs to be paid to the context that supports engagement by individuals, including the rewards and incentives offered by universities for these activities. Currently, such activities are perceived to be useful for research, but given little or no value by department and universities in their hiring and promotion policies.
- The divergence of opinion between academics and industry about barriers to collaboration raises critical questions about the changing nature of exchange between universities and industry in the UK. It is important to look at both sides of the exchange process, as increasing levels of concern by industry bode ill for the future of such exchanges.
- Despite policy concerns about the lack of entrepreneurial spirit among UK academics, the evidence suggests that entrepreneurial behaviour by academics is fairly common and well above national averages. However, differences between disciplines in rates of entrepreneurship suggest that external factors rather than individual characteristics drive the rate and direction of academic entrepreneurship. This suggests that policy measures need to be taken to create more opportunities for academics working in fields with little entrepreneurial opportunities. Creating more time, resources and support for academics to engage in venture creation, especially in disciplines where such activities are uncommon, may yield the greatest return to policy efforts.

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1 Introduction

In recent years, there has been a surge of interest in the role of universities in shaping economic development. For some, universities are seen as new 'engines of growth', providing the critical infrastructure to enable knowledge-based economic activities to flourish (Etzkowitz, Webster, Gebhardt and Terra, 2000). Others have remained more sceptical of the economic potential of universities, pointing to the historically long delay between university research and industrial application and to the tensions between the many roles of the universities (Mowery, Nelson, Sampat and Ziedonis, 2001; Nelson, 2004). In the midst of this discussion, UK governments have largely followed the former approach, providing funds for universities to increase their engagement with industry and to transfer knowledge. It is not uncommon for UK policymakers to stress the economic value of universities over their other roles in society, and to target funding to disciplines, areas of research or universities, that are seen to be proficient at producing economic benefits.

At the centre of any understanding of the university and its economic impact stands the individual academic, whose teaching and research activities are the core of the university and its many missions. Although considerable effort has been made to shape the university's orientation to industrial engagement and knowledge transfer, we still lack a full appreciation of the nature of individual academics' engagement with industry and how these roles may have changed in recent years, with the upsurge in interest and financial support for knowledge transfer (Rothaermel, Agung and Jiang, 2007). We still do not fully understand how academics have responded to new pressures for engagement and how engagement with industry is linked to their teaching and research activities.

It is clear that academics retain some autonomy in their work. Indeed, one of the core features of academic life is academic freedom, usually taken to mean the ability of an academic to set their own research agenda, methods and outlook (Aghion, Dewatripont and Stein, 2008). At the core of this model of academic freedom is overall understanding that the science system works best when individuals are given some space and time to think independently, one step removed from pressing and immediate problems. Michael Polanyi famously described such freedom as creating a 'republic of science', a separate community where academic researchers would be left to be governed by their own institutions and norms (Polanyi, 1962). However, academic freedom does not imply that academics operate in ivory towers, remote from the problems of practice. In fact, academic research has never been pure, and problems in the world have always acted as a powerful stimulus for researchers (Rosenberg, 1982). Individuals are attracted to academic life not simply for its security and autonomy, but also for the opportunity to work on problems of pressing social, technological and economic needs. Most academics engage with non-academics directly in their research and teaching activities and the university is fully embedded in a layer of overlapping and mutually supporting web of networks that span communities and organisations within and outside the academic sector (Owen-Smith and Powell, 2004).

However, these patterns of engagement differ by discipline. Disciplines, such as civil engineering, require a tight integration between research and practice. In these areas, industrial practice may even be in advance of academic research, which is focused on probing the casual mechanisms that practicing engineers may be less concerned with (Rosenberg, 2002). In other disciplines, the mechanisms of transfer and exchange between research and practice are one step removed as academics are working on problems that may be 6-7 years from potential application (Mansfield, 1991, 1998; Mansfield and Yee, 1996). Patterns of engagement in these more basic research disciplines may be based on 'trickle-through' model, where advances in basic areas of research are passed onto applied research areas, which in turn pass these advances onto areas of practice (Rosenberg and Nelson, 1994).

Applications of seemingly basic research may occur for a variety of reasons that have little to do with the research itself. For example, the transformation of 60 years of sociological research into properties of social networks in social networking sites and communities has little to do with new developments in the original research, but occurred largely due to a new technological opportunity to utilise established network ideas in a new setting.

Academic engagement also requires an absorptive capacity from industry, as university-industry interactions are often a 'two-way' exchange (Meyer-Frahmer and Schmoch, 1998). Academics working in areas with strong local firms may find it much easier to build exchanges than those academic working in rural campuses with little local industry (Laursen, Reichstein and Salter, 2010). Moreover, academics need industrial partners that are willing to work with them in developing new ideas, exploring the commercial potential of existing ones and to help develop and deliver teaching. In the UK, such industrial demand for university engagement has often been found wanting, although research on comparative patterns of engagement between UK industry and universities suggests little or no difference between the UK and other countries in the level of engagement (HM Treasury, 2003).

The purpose of this report is to document the results of a large-scale survey of UK academics to better understand the nature of engagement between academics and industry. The survey was undertaken in 2009 and covers the entire population of academics that were named on grants from the Engineering and Physical Sciences Research Council (EPSRC) since 1999. The survey overlaps with a prior survey of the same population conducted by SPRU – Science and Technology Policy Research in 2004 and allow us to explore how the behaviours and attitudes of academics may have changed in the past five years. We believe that this is the first time it has been possible to map changes in attitudes of academics to engagement over time, helping to overcome the tendency in studies of university-industry engagement to rely on information taken from a single survey.

Our survey covers a wide range of academic behaviours and attitudes. The core questions explore the motivations, levels and barriers faced by academics when engaging with industry. We also examine levels of trust, career motivations, the impact of the Research Assessment Exercise on engagement, and academic entrepreneurial behaviour. Our goal was to cover the wide range of engagements that academics may have with industry.

This survey of academics builds on a larger project that also examines industrial attitudes to engagement with UK universities. This work was undertaken as part of the AIM Innovation and Productivity Grand Challenge, funded by the EPSRC and Economic and Social Research Council. An earlier AIM report summarises the findings of the matching industry survey. Where possible, we will try to explore direct comparisons between industrial and academic attitudes, highlight where these two groups overlap or differ in their attitudes and behaviours.

It must be said that the sample of academics covered in this study are not representative of the wider population of academics working at UK universities. Our sample is drawn from Principal and Co-Investigators on EPSRC funded projects and therefore is older, more likely to be male and concentrated in the main disciplines funded by the EPSRC. We took this approach as we wanted to compare responses to our earlier survey and also because we wanted to create a coherent sample in which to explore changes in behaviours and attitudes of academics towards engagement. Where possible, we have compared our results with the Centre for Business Research census of all academics in the UK in order to calibrate our responses with the wider population of academics (Abreu, Grinevich, Hughes and Kitson, 2009). It must be said, however, that our sample includes some of the leading scientists in the UK, including 114 members of The Royal Society and the Royal Academy of Engineering. It also includes some of the most active engagers with industry among the population of UK researchers and therefore provides some rich insights into the nature of exchange between university and industry in the UK.

2 Method

This research is based on data collected through a questionnaire administered to Principal Investigators (PI) and Co-Investigators in EPSRC funded research projects. Researchers' names, contact details and details of their grants were provided by the EPSRC and double-checked on the web to ensure they were as accurate as possible. The population investigated is composed of 6,106 university researchers affiliated to UK higher education institutions. The scientific disciplines represented are mainly in the physical sciences (aeronautical and aerospace engineering, computing/computer science, mathematics, civil engineering, materials science, chemistry, chemical engineering, physics, electrical and electronic engineering, environmental science, mechanical engineering, statistics) with a small proportion in other disciplines (biology related subjects, medicine, pharmacy, business). The population includes researchers awarded collaborative grants (with an industry partner) and researchers awarded grants without industry involvement.

In order to ensure clean records for the survey, we attempted to clean the data by removing individuals who are no longer active in academia or who have moved abroad. Since the survey population covers the grants period from 1995, many individuals to whom we addressed the survey belonged to one of those groups. In total, we received 150 'return to senders' as the people listed in the EPSRC data had left academia, retired or passed away. We exclude all these 'return to senders' in the calculation of our response rate as we are able to differentiate them from non-responses.

The questionnaire builds upon a past research effort, conducted at SPRU in 2004 and sponsored directly by the EPSRC. The main focus of that survey was on the channels of interaction and on joint publications. Using the funding available from the IPGC programme, we have sought to find possible synergies with this previous work and to extend it. Therefore, a portion of the population surveyed in the present research is composed of researchers that responded to the 2004 questionnaire. The results are broadly comparable between the two populations as we have attempted to repeat many of the questions across the two waves of the survey. We also sought to remove questions of lower interest for this research project than the SPRU project, while we added new sections more tightly related to the creation of academic spin-offs. For example, the past version of the survey focused directly on the nature of co-publications between industry and universities, an issue of concern to the EPSRC at the time of that study. A copy of the surveys can be obtained by contacting the authors.

The survey has main six sections:

- University-industry interactions (section A)
- Your work: structure, interaction style and motives (section B)
- Relationship with industry and support from the university (section C)
- Entrepreneurial orientation and venture creation (section D)
- Commercial ventures (section E)
- Personal background (section F)

Section A (*University-industry interactions*) includes questions taken from the 2004 survey (reasons for involvement in collaboration activities with industry, frequency and forms of interaction, constraints to collaboration) in order to obtain a panel. Using this information, we analyse how the motivations and barriers for collaboration changed over the past five years, and whether the forms of interaction have changed (D'Este and Patel, 2007). It also includes two new elements regarding previous work experience in the private sector and share of the research budget from industry partners (Blumenthal, Causino, Campbell and Louis, 1996). This section identifies which forms of engagement researchers have used and their frequency.

Section B (*Your work: structure, interaction style and motives*) investigates how individual academics allocate their time among their different activities. We also added a question on the individual motivations for being an academic researcher, drawing from a question on the National Science Foundation's Survey of Doctorate Recipients.

Section C (*Relationship with industry and support from the university*) explores the impact of the environment (department and university, industrial partners, research council) on researchers' behaviour. One question is a slight modification of the inter-organisational trust scale developed by Zaheer et al. (1998) and considers the relationship between the academic and his or her industry partner(s). The second question targets the supportiveness of the researcher's department and university of affiliation for industry collaboration. The last question in the section explores the impact of the Research Assessment Exercise (RAE), which was conducted in 2008 by Higher Education Funding Council for England (HEFCE) (Brinn, Jones and Pendlebury, 2001). This question was designed in dialogue with the EPSRC itself. In summary, this section is used to assess the impact of the environment on individual researcher behaviour.

Section D (*Entrepreneurial orientation and venture creation*) explores the entrepreneurial attitudes and activities of academics. The first question in the section focuses on the entrepreneurial orientation of the academic and is derived from a question developed by Nicolaou (2008). Drawing from the Global Entrepreneurship Monitor (GEM) scale for capturing entrepreneurial intent and behaviour, we asked a series of questions about entrepreneurship. The following three questions serve as filters to identify: (a) academics who have already started a business; (b) academics who are planning to start a business; (c) academics who are not interested in starting a business. Individuals in group (c) skip the next section and go directly to the last section of the questionnaire. Individuals in group (a) and group (b) are asked about the factors influencing their decision to start a business (Carter, Gartner, Shaver and Gatewood, 2003) and about the barriers encountered in their attempt to start a new venture. Respondents in group (b) are directed to the last section, while group (a) answers questions in section E (*Commercial ventures*). This section explores in more detail the types of companies created by academic entrepreneurs, asking about the name and year of foundation of the ventures created, the business model and the role of the researcher in the company.

Finally, section F (*Personal background*) collects demographic information: age, gender, academic title, year of the PhD and institution where it was received (this information is used to analyse possible cohort and training effects). The last question in the survey explores the psychological effect of self-monitoring. Research on this issue has typically used multi-item self-reporting measures to identify people high or low in self-monitoring. The most frequently used instruments are the 25-item, true-false, original self-monitoring scale (Snyder, 1974) and the 18-item refinement of this measure (Gangestad and Snyder, 1985; Lennox and Wolfe, 1984; Snyder and Gangestad, 1986). In order to be consistent with most of the established literature, we use the 18-item true-false scale.

The survey was administered exclusively online and was designed using an online tool (LimeSurvey). A few days before the online questionnaire was launched in March 2009, recipients were sent a letter signed by Professor Delpy, Chief Executive of the EPSRC, explaining the purpose of the study and inviting researchers to participate. The researchers then received a personalised email with a link to the survey. After two weeks, a first reminder was sent and a second reminder was sent one week later. These contacts elicited 1,636 responses. In order to improve response rates, we telephoned each contact directly to encourage them to respond. This approach yielded another 448 responses. In total, we received 2084 usable responses from the survey. Given the total population for the survey was 6,106, the response rate was close to 34%. Our approach also generated a rich panel as 756 individuals that responded to both waves of the questionnaire.

Moreover, before the final questionnaire was administered, we conducted a pilot to test that the questions were phrased clearly and to reduce possible ambiguities. We contacted 33 researchers from 11 different departments in Imperial College London (one Professor, one Reader and one Lecturer in each department) and we asked them to respond to the questionnaire. Eight researchers completed the questionnaire, and four partially completed it. We followed up with a telephone call (to both respondents and non respondents) to ask their opinions on the clarity of the survey and the time needed to complete it: no major inconsistencies emerged in this pre-test phase.

In order to check the reliability of our response pool, we undertook some tests of the response population, looking for sources of bias in our sample. In particular, we analysed if there was any difference in the typology of university of affiliation of the respondents compared to the rest of the sample: we performed a non-parametric test (Wilcoxon-Mann-Whitney) and found no significant difference. Unfortunately, we cannot compare respondents and the rest of the sample on demographic characteristics, as this data was collected through the survey.

Regarding the breakdown in terms of university types, the vast majority (around 60%) of the respondents are affiliated with a university of the Russell Group (collaboration of twenty universities that together receive two-thirds of research grant and contract funding in the United Kingdom), while around 20% come from an institution part of the 1994 Group (coalition of 19 top smaller research-intensive universities in the United Kingdom founded in 1994 to defend their interests following the creation of the Russell Group) and only 5% of the researchers interviewed are affiliated with an ex-Polytechnic (institutions of higher education that were given university status in 1992).

In Table 1, we examine the composition of the 2004 and 2009 samples by scientific discipline. Overall, the patterns of responses are similar in terms of disciplines covered. The 2009 sample includes slightly less chemists, general engineers, mathematicians and chemical engineers, but a greater share of computer scientists. We must underline that in the 2004 survey, researchers funded by the EPSRC, but not working in a physical sciences-related discipline, were excluded for the analysis. In the 2009 survey, we have decided to address the whole population of researchers funded by the EPSRC, including academics in life and medical sciences, social sciences and humanities.

Table 1: Discipline breakdown for the two waves of the survey

Discipline	2004	2009
Chemical Engineering	62 (4%)	47 (2%)
Chemistry	271 (18%)	265 (13%)
Civil Engineering	86 (6%)	80 (4%)
Computer Science	162 (10%)	300 (14%)
Electrical and Electronic Engineering	172 (11%)	178 (9%)
General Engineering	116 (8%)	225 (11%)
Mathematics	216 (14%)	244 (12%)
Mechanical, Aerospace and Manufacturing Engineering	179 (11%)	188 (9%)
Metallurgy and Materials	69 (5%)	72 (3%)
Physics	195 (13%)	247 (12%)
Social Sciences	n/a	112 (5%)
Medicine	n/a	56 (3%)
Life and Earth Sciences	n/a	49 (2%)
Humanities	n/a	21 (1%)
Total	**1528**	**2084**

The average age of the academics that answered the questionnaire is 49, while the average academic age (number of years elapsed since the year they were awarded their PhD) is 21. 88% of respondents are male. In Table 2, we analyse the distribution of respondents across academic positions. The majority of academics who participated in the survey are full professors: this is consistent with the fact that we selected people who have been listed as Principal Investigator or Co-Investigator in an EPSRC project, which is more frequent for researchers in advanced stages of their careers. Finally, around 47% of the respondents reported to have had work experience in the private sector.

Table 2: Academic position breakdown for the 2009 survey

Academic position	2009
Professor	1160 (56%)
Reader	309 (15%)
Senior lecturer or senior research fellow	374 (18%)
Lecturer	193 (9%)
Research fellow or research associate	32 (2%)
Unknown	16 (0.8%)
Total	**2084**

In Table 3, we compare the characteristics of our respondents to the average characteristics of the academics in the United Kingdom (HESA data for the years 2007 and 2008) (Higher Education Statistics Agency, 2009). We can observe very different distributions: this is because our population comes mostly from engineering and physical sciences (which according to HESA data represents around 28% of all academics) and, as noted before, researchers in our sample are EPSRC grant holders, therefore they are in a more advanced stage of their career. Given that past research has shown that status and age are correlated to engagement (Landry, Amara and Rherrad, 2006; Link, Siegel and Bozeman, 2007), this may suggest that our sample can be expected to engage with industry to a higher degree than the average academic working in a UK universities.

Table 3: Comparison with HESA data

	HESA	IPGC Survey
Female	43%	12%
Age	44	49
Professor	11%	56%
Reader	17%	15%
Senior Lecturer or Senior Research Fellow	21%	18%
Lecturer	30%	9%
Research Fellow or Research Associate	22%	2%

Sources: HESA data: Staff tables 2009 (accessed 1st March 2010)
www.hesa.ac.uk/index.php/component/option,com_datatables/Itemid,121/task,show_category/catdex,2

3 Analysis

Level of interaction

We begin by exploring the level and nature of interaction between UK academics and industry. Table 4 and Table 5 present the percentage of individuals that indicated they were involved in some form of interaction with industry at least once and at least three times in 2007 and 2008.

The forms of interaction include: creation of new physical facilities with industry funding, joint research agreement, contract research agreement, consultancy agreement, training of company employees, postgraduate training with a company, attendance at conferences with industry and university participation, attendance at industry sponsored meetings. We tested the statistical difference between the two rounds of the survey using a non-parametric test (Wilcoxon-Mann-Whitney). Missing values have been treated in both surveys as equivalent to zero.

Table 4: Degree of engagement across different types of interaction with industry, 2004 and 2009, at least once (over the previous two years)

Types of interaction	2004 At least once	2009 At least once	Difference
Attendance at conferences with industry and university participation	63%	78%	***
Attendance at industry sponsored meetings	48%	59%	***
A new contract research agreement (original research work done by University alone)	47%	54%	***
A new joint research agreement (original research work undertaken by both partners)	44%	53%	***
A new consultancy agreement (provision of advice that requires no original research)	38%	44%	***
Postgraduate training with a company (e.g. joint supervision of PhDs)	34%	44%	***
Training of company employees (through course enrolment or through temporary personnel exchanges)	22%	27%	***
Creation of new physical facilities with industry funding (e.g. new laboratory, other buildings on campus)	12%	15%	**

Notes: p-value +<0.1, *<0.05, **<0.01, ***<0.001

Table 5: Degree of engagement across different types of interaction with industry, 2004 and 2009, at least 3 times (over the previous two years)

Types of interaction	2004 At least three times	2009 At least three times	Difference
Attendance at conferences with industry and university participation	38%	46%	***
Attendance at industry sponsored meetings	17%	24%	***
A new joint research agreement (original research work undertaken by both partners)	11%	15%	***
A new contract research agreement (original research work done by University alone)	13%	13%	=
A new consultancy agreement (provision of advice that requires no original research)	10%	12%	=
Postgraduate training with a company (e.g. joint supervision of PhDs)	8%	11%	**
Training of company employees (through course enrolment or through temporary personnel exchanges)	7%	9%	+
Creation of new physical facilities with industry funding (e.g. new laboratory, other buildings on campus)	1%	3%	*

Notes: p-value +<0.1, *<0.05, **<0.01, ***<0.001

As Tables 4 and 5, the most common form of engagement with industry is attending conferences. Overall, the results suggest increasing levels of engagement between academic and industry over time as all forms of engagement were more common in 2009 than in 2004.

Of the channels of interaction, over 78% of all academics attended a conference with industrial participants in the previous two years, a slight increase from the 2004 survey. Almost half the sample has been to at least three conferences over the previous two years, a significant increase over the 2004 survey. The second most frequent channel of engagement is attending industry sponsored meetings, again more than half the sample had attended such meetings and a quarter did so at least three times in the past two years. These results suggest that personal contacts through conferences and meetings remain the most common means of exchange between industry and academics and such meetings can provide fertile ground for exchange.

Close to half the sample had undertaken at least one new research project, contract research project, or consultancy project with industry over the two previous years. All these mechanisms were more frequently used in the 2009 survey than in the 2004 survey. However, only a small share of academics have undertaken more than three contracts of this type with industry over the previous two years, indicating that although the overall percentage of respondents indicating an industrial-oriented research project has increased, the number of multiple projects has not. This suggests that even engaged academics do not undertaken multiple projects with industry over a two year period, indicating that such engagements are relatively infrequent and episodic rather than common or continuous. One potential reason for this pattern is that working on such projects can be labour intensive and most academics only have the time and attention to work on a small number of these projects at any one time.

In Table 6, we further explore changes over time in frequency of collaboration by looking at responses to the panel, that is those individuals who responded to both the 2004 and 2009 survey. These results are consistent with the overall results for the two waves of the survey. It is clear that for the panel members the level of engagement with industry has increased for all different types of engagement types, with the largest increase recorded for attending conferences and industry-sponsored meetings.

Table 6: Degree of engagement across different types of interaction with industry, 2004 and 2009, at least once, for panel respondents for 2004 and 2009 surveys

Types of interaction	2004	2009	Difference
Attendance at conferences with industry and university participation	64%	79%	***
Attendance at industry sponsored meetings	48%	60%	***
A new contract research agreement (original research work done by University alone)	48%	57%	***
A new joint research agreement (original research work undertaken by both partners)	45%	53%	***
A new consultancy agreement (provision of advice that requires no original research)	38%	48%	***
Postgraduate training with a company (e.g. joint supervision of PhDs)	35%	45%	***
Training of company employees (through course enrolment or through temporary personnel exchanges)	22%	30%	***
Creation of new physical facilities with industry funding (e.g. new laboratory, other buildings on campus)	11%	17%	***

Notes: p-value +<0.1, *<0.05, **<0.01, ***<0.001

Post-graduate training and training of company employees has also increased between the 2004 survey and the 2009 survey, although it remains less common than other forms of engagement. Few academics have undertaken such activities more than three times in the past two years and this finding is consistent across both waves of the survey. Finally, the creation of new physical facilities, as might be expected, is infrequent in 2004 and 2009.

In order to further understand these findings, we compared our data with data obtained through a survey conducted by the Centre for Business Research at University of Cambridge (between 2008 and 2009) (Abreu, Grinevich, Hughes and Kitson, 2009). This survey targeted all researchers in all disciplines in all UK Higher Education Institutions. This effort provided 22,170 answers across all disciplines. Table 7 reports a comparison of our results on different types of engagement and Cambridge results. Overall, the results are fairly consistent across the two samples. But, as expected, the population of EPSRC grant holders appears to have higher levels of engagement than the general population of UK academics. These differences are the result of the different composition of the sample, as Cambridge survey comprises a higher share of researchers in social sciences and humanities and our survey includes mostly older, senior male academics.

Table 7: Degree of engagement across different types of interaction with industry, at least once, IPGC Survey and Cambridge Survey

Types of interaction	Cambridge At least once	IPGC At least once
Attendance at conferences with industry and university participation	87%	78%
Attendance at industry sponsored meetings	n/a	59%
A new contract research agreement (original research work done by University alone)	37%	54%
A new joint research agreement (original research work undertaken by both partners)	42%	53%
A new consultancy agreement (provision of advice that requires no original research)	43%	44%
Postgraduate training with a company (e.g. joint supervision of PhDs)	33%	44%
Training of company employees (through course enrolment or through temporary personnel exchanges)	33%	27%
Creation of new physical facilities with industry funding (e.g. new laboratory, other buildings on campus)	9%	15%

In the survey, we also asked academics to report what percentage of their research budget has come from industry in the year 2007 and 2008. On average, 15.3% of respondents' budget came from industrial partners. There were, however, significant disciplinary differences, with over 28% of research budgets in chemical engineering accounted for by industry funding to just 5% in mathematics.

Table 8 shows an international comparison of the degree of engagement across different types of interaction with industry: UK academics have relatively high levels of engagement with industry, especially if we consider consulting, patenting and the creation of academic ventures. However, we must treat this information very carefully, as these studies are not always directly comparable as the items presented in the questionnaires are phrased in different ways and the sampling techniques employed are not homogeneous.

Table 8: External engagement – Comparison across different studies

	Population	Collaborative research	Consulting	Sponsored research	Contract research	Patenting	Academic entrepreneurship
IPGC (2009)	UK Engineering and Physical Sciences Investigators (N=2084)	53%	44%		54%		25% (based on life-time)
SPRU (2004) (D'Este and Patel, 2007/ D'Este et al., 2005)	UK Engineering and Physical Sciences Investigators (N=1528)	44%	38%		47%	22%	12%
Bird and Allen (1989)	Faculty members of the University of North Carolina (N=171)		71.3%				7.6%
Blumenthal et al. (1996)	US life scientists (N=2052)			28% (industrial support for research)			
Bozeman and Gaughan (2007)	US university scientists (N=1564)	16.7%	18.4%			5.2%	3.1%
Campbell et al. (2000)	US life scientists (N=2366)					8%	4.8%
Coutinho et al. (2003)	Brazilian academic researchers in life sciences (N=150)			26%			
Gulbrandsen and Smeby (2005)	Tenured university professor's in Norway (N=1967)	21%	31%	21%		7%	7%
Klofsten and Jones-Evans (2000)	Academics in Sweden (SE) and Ireland (IE) (N=1857)		51% (SE) 68% (IE)	44% (SE) 68% (IE)	45% (SE) 69% (IE)	12% (SE) 26% (IE)	12% (SE) 19% (IE)
Landry et al. (2006)	Canadian scientists funded by the NSERC (N=1554)	79.7%	23.1%			32.6%	
Louis et al. (1989)	US life scientists (N=778)		10% of salary on average	8% of total research income		19%	7%
Sellenthin (2009)	Academics in Germany (DE) Sweden (SE) (N=801)	64.5% (DE) 63.9% (SE)	45.8% (DE) 43.5% (SE)		61.4% (DE) 51.1% (SE)	27.7% (DE) 23.8% (SE)	

Notes: The figures indicate the percentage of academics involved in specific activities unless otherwise indicated, according to different studies

Factors influencing the decision to interact

On the survey, we asked respondents to indicate the factors that influenced their decision to interact with industry. We included a range of potential factors, some of which were more related to financial incentives, such as securing additional research income, while others were more related to research incentives, such as access to research expertise of industrial researchers or inspiration for new projects. Respondents were asked to rate the importance of each of these factors on a 1 to 5 Likert scale from 'not at all important' to 'crucial'. We tested the statistical difference between the two rounds of the survey using a non-parametric test (Wilcoxon-Mann-Whitney).

Table 9 shows that the most common factor cited as being 'very important' or 'crucial' was securing additional research income (70%), followed by increasing the likelihood of application of research outside academia (67%). More than half the sample also indicated that awareness of problems confronted by industry, building and sustain networks, keeping abreast of research conducted in industry and inspiration for new projects, were very important or crucial to them. These results suggest that Rosenberg (1982) was correct in suggesting that researchers are often motivated to interact with industry in order to gain insights into interesting scientific and technological problems. Few academics indicated that they worked with industry for personal income or gain.

There are some significant differences between 2004 and 2009 surveys. The percentage of respondents turning to industry for additional research income is down over the past five years as well as the likelihood of applying research. However, the importance of networking and keep up with research conducted by industry has increased since, with the largest increase coming for building professional networks. Interestingly, there appears to be no shift toward more short and pecuniary reasons for working with industry. Engagement still appears to be driven by the search for funding, new research ideas and network building.

Table 9: Factors influencing the decision to interact with industry, 2004 and 2009 survey respondent

	2004 % responding 'very important' or 'crucial'	2009 % responding 'very important' or 'crucial'	Difference
Source of additional research income	71	70	***
Increasing the likelihood of application of my research outside academia	74	67	***
Raising awareness of problems that industry confronts	67	59	***
Building and sustaining your professional network	34	53	***
Keeping abreast of research conducted in industry	44	52	***
Getting inspiration for new research projects	n/a	51	
Feedback from industry about viability of research	52	46	***
Access to materials or data necessary for research	40	41	***
Training of postgraduate students	n/a	35	
Helping students to find employment in industry	n/a	33	
Access to research expertise of industry employees	31	30	***
Improving the understanding of foundations of particular phenomena	n/a	24	
Access to state-of-the art equipment, facilities and instruments	22	18	=
Seeking proprietary knowledge (e.g. patents)	11	12	***
Source of personal income	16	11	=

Notes: p-value +<0.1, *<0.05, **<0.01, ***<0.001

In Table 10, we explore the factors influencing the decision to interact with industry for panel respondents. Overall, Table 10 shows a systematic upward trend in the percentage of respondents that report factors influencing interaction as important.

Table 10: Factors influencing the decision to interact with industry, survey panel members

	2004 % responding 'very important' or 'crucial'	2009 % responding 'very important' or 'crucial'	Difference
Source of additional research income	55	67	***
Increasing the likelihood of application of my research outside academia	54	62	***
Raising awareness of problems that industry confronts	48	57	***
Building and sustaining your professional network	23	51	***
Keeping abreast of research conducted in industry	31	50	***
Feedback from industry about viability of research	37	42	+
Access to materials or data necessary for research	30	36	*
Access to research expertise of industry employees	22	29	**
Access to state-of-the art equipment, facilities and instruments	15	16	=
Seeking proprietary knowledge (e.g. patents)	8	11	+
Source of personal income	11	10	=

Notes: p-value +<0.1, *<0.05, **<0.01, ***<0.001

Barriers to interaction

Working across industry can raise many problems for academics. These barriers arise out of the different incentive and institutional regimes operating in the university system compared to industry. These barriers may be related to the orientation of academics, which tends to be longer in terms of its time frame. They may also arise out of transactions associated with industry collaboration, including disputes of Intellectual Property, timing of publication and rules and the regulations of universities. On the survey, we asked academics to rate the importance of a range of different barriers for their relationships with industry. We also tested the statistical difference between the two rounds of the survey using a non-parametric test (Wilcoxon-Mann-Whitney). Like the question above, respondents were asked to rate how much each of these barriers affected their collaboration with industry on a 1 to 5 Likert scale from 'not at all' to 'very much'.

Taken as a whole, the results show that there remain significant barriers to interaction between university and industry (see Table 11). The barriers that were cited as the most important were the short-term orientation of industry research (44%) and the difficulty in finding companies with appropriate profile (40%). The least important perceived barrier to collaboration appears to be conflicts over Intellectual Property (IP), which includes several items on the survey.

Overtime, moreover, it appears that perceived barriers to collaboration are decreasing. This is especially the case for the turnover of staff in industry, lack of mutual understanding about working patterns and the timing of publication. These results contrast strongly with the results for the survey of industrial collaborators in 2008. In that survey, all forms of barriers perceived by industry were significantly higher and especially those items related to the orientation of research and issues concerning IP (Bruneel, Salter, D'Este and Neely, 2008).

There are several potential explanations of these divergences in opinion between industry and academics about the problems of collaboration. First, industrial respondents may face a very different set of issues than individual academics when forming a collaboration agreement as they may have to deal directly with the university research services office or even the Technology Transfer Office. As such, they may be more aware of IP issues than academics, who are one step removed from such negotiations. Second, academics may be unaware of the problems faced by their industrial collaborators and therefore these results may be a signal of a lack of appreciation in the academic sector of the issues and challenges faced by industry. Third, the shift toward Full Economic Costing for research may have had a significant effect on industrial perceptions of university research, whereas for academics this shift may have passed relatively unnoticed. Regardless of the reasons for this divergence of opinion, the results suggest that academics are finding it easier to work with industry; while at the same time experienced industry collaborators are finding it more difficult to work universities. Such a result poses a critical challenge for policy operating in this area.

Table 11: Barriers to interaction with industry, 2004 and 2009

Barriers	2004 % responding 'quite a lot' or 'very much'	2009 % responding 'quite a lot' or 'very much'	Difference
Short term orientation of industry research	46	44	**
Difficulty in finding companies with appropriate profile (e.g. highly innovative partners)	42	40	*
Lack of suitable government funding programmes for university-industry joint research in specific areas	35	33	*
High personnel turnover and lack of continuity in companies' research strategies	29	24	***
The nature of my research is not linked with industry interests or needs	22	20	*
Rules and regulations imposed by university or government funding agencies	19	20	=
Mutual lack of understanding about expectations and working priorities	22	18	***
Industry imposes delays in dissemination of research outcomes and publications	17	14	**
Absence of established procedures for collaboration with industry	14	13	=
Potential conflicts with industry regarding Intellectual Property Rights	12	13	=
Policies adopted by the university's Technology Transfer Office	n/a	13	
University's Technology Transfer Offices have a low profile	15	10	***

Notes: p-value +<0.1, *<0.05, **<0.01, ***<0.001

Table 12 reports the results for the same respondents over the two waves of the survey. Again and as might be expected, the results are generally consistent with the total population of respondents. Overall, panel respondents indicated falling levels of barriers to collaboration. They also indicated they perceived fewer barriers than the general sample of respondents and high declines in the importance of different barriers. One reason for this result may be that panel members are on average older and work in more applied fields than past and newer respondents. However, these results do provide support for the findings above.

Table 12: Barriers to interaction with industry, survey panel members

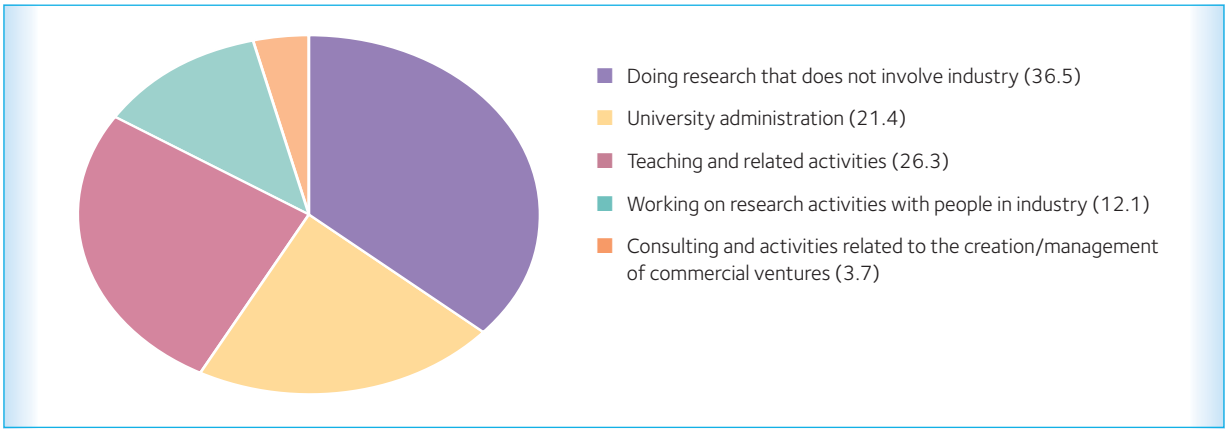
Barriers	2004 % responding 'quite a lot' or 'very much'	2009 % responding 'quite a lot' or 'very much'	Difference
Short term orientation of industry research	47	43	=
Difficulty in finding companies with appropriate profile (e.g. highly innovative partners)	45	38	**
Lack of suitable government funding programmes for university-industry joint research in specific areas	37	30	**
High personnel turnover and lack of continuity in companies' research strategies	29	21	***
Rules and regulations imposed by university or government funding agencies	19	20	=
The nature of my research is not linked with industry interests or needs	21	19	=
Mutual lack of understanding about expectations and working priorities	22	15	**
Policies adopted by the university's Technology Transfer Office	n/a	13	
Industry imposes delays in dissemination of research outcomes and publications	16	13	+
Potential conflicts with industry regarding Intellectual Property Rights	12	12	=
Absence of established procedures for collaboration with industry	12	11	=
University's Technology Transfer Offices have a low profile	15	8	***

Notes: p-value +<0.1, *<0.05, **<0.01, ***<0.001

Time allocation

In order obtain a sense of how academics spend their time – balancing their research, teaching and engagement efforts, we included a question on the survey where we asked academics how they allocate their work time in an average week between different categories of activities. Activities include: doing research that does not involve industry, university administration, teaching and related activities, working on research activities with people in industry (excluding consulting and activities related to the creation/management of commercial ventures), consulting and activities related to the creation/management of commercial ventures. Figure 1 shows that most of the time of senior academics is spent on research that does not involve industry or on administration. 15% of academics' time is spent in activities either related to collaborative activities with industry or to commercialisation efforts and of this, only 3.7% of their time is spent on consulting.

Figure 1: Time allocation in an average week of work



Relationship with industry and support from department and university

One of the questions posed in the survey relates to the level of support for industry collaboration academics felt they received from their department and their universities. Respondents were asked to rank their agreement with a set of statements, going from 'strongly disagree' to 'strongly agree'. Table 13 shows that at least 50% of academics perceive themselves to be actively encouraged or effectively supported for engagement from their department and university. Overall, academics felt they received more support for collaboration from their department rather than their university, indicating the importance of the department level in shaping engagement patterns. However, few academics felt they were rewarded for industry engagement, with only 23% and 19% indicating they felt supported by their department and university respectively.

Table 13: Level of support from department and university

	Department % responding 'agree' or 'strongly agree'	University % responding 'agree' or 'strongly agree'
My department/university actively encourages me to work with industry	51	49
My department/university is very effective in supporting collaboration with industry	59	47
My department/university rewards me for working with industry	23	19
My department/university is an obstacle in the collaboration with industry	7	15

Impact of the Research Assessment Exercise on collaboration activities

At the end of 2008, Research Assessment Exercise (RAE) results were published. The RAE is a government-mandated program to assess the quality of research of all universities and colleges in the UK. The assessment is carried out via disciplinary panels' reviews of the publications, research environment and research esteem of each department. Results are used as the basis for determining the allocation of research funding to universities that is not allocated via competitive bidding for grants. Given these elements, we wanted to analyse if the requirements of RAE had any impact on the level of engagement, as our survey covers the critical period leading up to the final RAE submissions. Although there is considerable concern among academics about the effect of the RAE on industry engagement, there is little direct evidence that the RAE had a positive or negative effect on industry engagement. Therefore, our survey provides some evidence towards this question and may reveal information that is useful in the development of its replacement, the Research Excellence Framework (REF).

In order to get a handle on this area, we asked respondents to indicate their level of agreement with a set of statements about the RAE. Table 14 shows that for most academics the RAE had little or no impact on their engagement efforts. The vast majority of respondents indicated that RAE did not limit their ability to develop new links with industry or that it shifted their attention away from commercial activities. However, more than a third of the sample did indicate that the RAE made them avoid publishing in practice-based journals and quarter of the sample suggested the RAE left them with little time for engagement or commercial activities. The survey makes no attempt to judge the costs of such efforts, but given the time constraints faced by the members of the population; these costs may not be trivial.

Table 14: Impact of the RAE on collaborations with industry

	2009 % responding 'agree' or 'strongly agree'
The requirements of the RAE made me avoid publishing in practice-based journals	34
The requirements of the RAE left with little time to develop new links with industry	27
The requirements of the RAE process limited my time to develop commercial activities, such as starting a new venture	25
The requirements of the RAE left me with little time to sustain my relationships with industry	21
In preparing for the RAE I reduced my work with industry to give more time to research I could publish in basic research/discipline oriented journals	17

Entrepreneurial orientation and venture creation

One new element of this survey was a set of detailed questions on the entrepreneurial attitudes and behaviours of UK academics. We began this part of the survey by focusing on entrepreneurial orientation of academics. In order to do so, we use a set of three questions: respondents were asked to rank their agreement with a set of statements, going from 'strongly disagree' to 'strongly agree'.

Table 15: Entrepreneurial orientation of academic researchers

	2009 % responding 'agree' or 'strongly agree'
I frequently identify opportunities to start-up new businesses (even though I may not pursue them)	26
I frequently identify ideas that can be converted into new product or services (even though I may not pursue them)	41
I am generally not interested in ideas that may materialise into profitable enterprises	22

We were also keen to identify what share of academics has been involved in the creation of a commercial venture. We also sought to understand what share of academics is involved in the process (at the time of the survey or in the future three years) of creating a new venture. In total, we found that a quarter of the sample has been involved in the creation of a new business, whereas 16% are in the process of starting up a new business.

Table 16: Creation of a commercial venture

	2009 % responding 'yes'
You are, alone or with others, currently trying to start a new business, including any self-employment or selling any goods or services to others	16
You are, alone or with others, expecting to start a new business, including any type of self-employment, within the next three years	18
In the past, you have been involved, alone or with others, in the creation of a new business (successful or unsuccessful), including any self-employment or selling any goods or services to others	25

Table 17 illustrates the difference in these rates across different scientific disciplines. It is clear that there are significant differences across disciplines in the levels of entrepreneurial activities. In electrical and electronic engineering, 38% of the sample are involved in developing a new venture, whereas in mathematics only a small share (9%) are involved in a firm. It is interesting to note that also 38% of the humanities faculty are involved in a commercial venture: if we analyse the business model of these firms, we can observe that they are predominantly consultancy-based. In part, the rates of entrepreneurial activity may reflect the general pool of opportunities in the external environment for new firms. In some sectors, there is a readily available pool of capital for new ventures and formal IP is relatively easy to obtain, while in other sectors, there is little or no formal IP and little support. These results suggest that entrepreneurial activities by academics may be largely driven by the specific discipline they operate in rather than their general level of entrepreneurial orientation as the differences between the disciplines in general levels of entrepreneurial orientation is not nearly as large as the difference in entrepreneurial behaviour. Such finding may have significant implications for our understanding of which academics start firms and what are the motivations and incentives for doing so. They suggest greater attention needs to be given to the disciplinary context and how this context shapes the nature of entrepreneurial intent and behaviour.

Table 17: Creation of a commercial venture, breakdown by discipline

	You are, alone or with others, currently trying to start a new business % responding 'yes'	**You are, alone or with others, expecting to start a new business, within the next three years** % responding 'yes'	**In the past, you have been involved, alone or with others, in the creation of a new business (successful or unsuccessful)** % responding 'yes'
Chemical Engineering	30	32	32
Chemistry	14	15	22
Civil engineering	11	13	16
Computer science	17	21	29
Electrical and Electronic Engineering	26	29	38
General Engineering	24	23	35
Mathematics	5	6	9
Mechanical, Aerospace and Manufacturing Engineering	16	19	22
Metallurgy and Materials	14	14	17
Physics	16	16	21
Social Sciences	11	11	22
Medicine	23	27	30
Life and Earth Sciences	10	27	29
Humanities	19	24	38

The advantage of using questions from the Global Entrepreneurship Monitor (GEM) is that we are able to compare our respondents with the general UK population. In Table 18, we directly compare the rates of entrepreneurial behaviour of the respondents to the level of entrepreneurial behaviour among the general UK population, using the UK GEM data. As it can be seen, the level of entrepreneurial activities in our pool of respondents is significantly higher than the average for the UK. In fact, our respondents are between four to five times more likely to engage in entrepreneurship than members of the general UK population. Moreover, since our respondents are highly educated, this result may be not totally unexpected. But it does demonstrate the high levels of entrepreneurial behaviour among EPSRC-funded academics.

Table 18: Creation of a commercial venture, IPGC Survey and GEM data

	2008 GEM % responding 'yes'	**2009 IPGC** % responding 'yes'
You are, alone or with others, currently trying to start a new business, including any self-employment or selling any goods or services to others	2.6	16
You are, alone or with others, expecting to start a new business, including any type of self-employment, within the next three years	4.5	18
In the past, you have been involved, alone or with others, in the creation of a new business (successful or unsuccessful), including any self-employment or selling any goods or services to others	8.8	25

Respondents to our survey have been involved in the creation of 685 different firms. These organisations are not simply consultancies as only 30% of these firms were based on the provision of research-based consultancy. In fact, almost half of the firms were product-based companies, whereas only one fifth was based on the development of intellectual property rights that can be licensed or sold to customers. These results indicate that academic spin-offs founded by EPSRC-funded academics are active in the market for products, rather than the market for ideas. Of these companies, 68% has an academic as director, 35% as a consultant, 9% as a chairman, 12% as a manager and 21% as a member of the scientific advisory board (please note that these values are approximate as academics may cover more than one role in each company and our respondents may be involved in multiple firms).

In the survey, we investigated the motivations and constraints academics face when engaging in entrepreneurial activities. We included a list of factors that could possibly influence researchers' decision to start a business; some related to financial aspects and other related to intellectual challenge and prestige. Respondents were asked to rate the importance of each of these factors on a 1 to 5 Likert scale from 'not at all important' to 'crucial'. Please note that this question was asked only to the people who actually started a business.

It appears that the primary motivation of an individual to start a new firm was to develop a practical application from their research. New ventures also provide an opportunity to fulfil a personal vision and to challenge oneself. In general, the main motivations for entrepreneurship among academics, appears to be related to intrinsic as opposed to extrinsic motivations. However, it must be noted that increased personal income and greater financial security were seen as being important by a significant share of the respondents. The importance of perceptions of others does not appear to play a large role in shaping the decision to start a firm, as few respondents indicating they were trying to set an example or follow the entrepreneurial activities of others.

Table 19: Motivations to start a business

	2009 % responding 'very important' or 'crucial'
To develop practical application for a product from my research	78
To fulfil a personal vision	53
To challenge myself	51
To achieve something and to receive recognition for it	49
To be at the forefront of scientific and technological developments	48
To develop and learn as a person	41
To increase my personal income	41
To achieve greater financial security	36
To lead and motivate others	33
To have more influence in my community	22
To increase my prestige among my colleagues	13
To follow the example of a person I admire	8

We also included a list of factors that could have possibly acted as barriers in the researches' attempts to start a business. Also in this case some factors relate to financial aspects, while some others relate to intellectual challenge and prestige. Respondents were asked to rate the importance of each of these factors on a 1 to 5 Likert scale from 'not at all important' to 'crucial'. Again, this question was asked only to the people who actually started a business.

The main barrier to starting a business was a lack of time and resources. These factors were cited by more than half of the sample. Only a third of academics indicated that they were limited by the structure of the university incentive system or lack of support from the university. In addition, few noted the importance of mentors or colleagues as a barrier to creating a new venture. Fundamentally, it appears that time rather than lack of support (professional or social) is the main barrier to entrepreneurship among UK academics.

Table 20: Barriers to start a business

	2009 % responding 'very important' or 'crucial'
Lack of time	70
Lack of resources	56
Structure of the university incentive system	36
Different career trajectory	33
Lack of support from your university	29
Family pressure	23
Lack of mentors	21
Lack of support from colleagues	18
Limited financial need	16

4 Policy implications

There are several significant policy implications arising from this study. First, although there has been a recent upsurge in interest in the impact of publicly funded research, the motivations and means that academics employ to impact on practice remain often hidden from view. Many of these engagements are of a small-scale and informal nature, and therefore are liable to be ignored by aggregate statistics of formal collaboration between university and industry. The paucity of data often leads to believe that such engagements are rare events and that academics are well removed from the world of practice.

This conclusion in turn leads to the assumption that greater efforts are required to spur academics to ensure their work has impact on communities outside academics. However, this study and a recent survey at Cambridge (Abreu, Grinevich, Hughes and Kitson, 2009), suggest that such a view may be incomplete. The results of this survey suggest that the engagement of academics with industry is widespread, growing and underpinned by strong research. Indeed, by international comparison, UK academics have relatively high levels of engagement with industry. Therefore, efforts to pressure academics to do more engagement may be based on misleading notions of current pattern of interaction.

Second, these engagement efforts of academics cover a wide array of methods and government policy should attempt to support all of these mechanisms rather than favouring single engagement channels, such as starting up new ventures. In particular, greater attention is required to support conferences, consultancy and contract research as a vehicle for deepening ties between academics and industry. Counting university start-ups, patenting and licensing income is of modest value when the vast majority of engagements have little to do with formal intellectual property or venture creation. Moreover, the efforts to privilege some forms of engagement – the most formal and infrequent – may lead university administrators and policy-makers to miss out on opportunities to sustain and enhance the impact of publicly funded research on practice.

Third, greater attention needs to be given to the context that supports engagement by individuals, including the rewards and incentives offered by universities for these activities. Currently, such activities are perceived to be useful for research, but given little or no value by department and universities in their hiring and promotion policies. If universities and governments believe these efforts to be important, they require more clear support, training and profile.

Fourth, the report found a strong divergence of opinion between academics and industry about barriers to collaboration and this raises critical questions about the changing nature of exchange between universities and industry in the UK. It is important to look at both sides of the exchange process as increasing levels of concern by industry bode ill for the future of such exchanges. Contrasting the views of industry and academics about the health and nature of their exchanges remains a critical issue for further research.

Fifth, despite policy concerns about the lack of entrepreneurial spirit among UK academics, the evidence suggests that entrepreneurial behaviour by academics is well above national averages. However, differences between disciplines in rates of entrepreneurship suggest that external factors rather than individual characteristics drive the rate and direction of academic entrepreneurship. This suggests that policy measures need to create more opportunities for academics working in fields with little entrepreneurial opportunities, or where such opportunities are more remote from market. Creating more time, resources and support for academics to engage in venture creation, especially in disciplines where such activities are uncommon, may yield the greatest return to policy efforts.

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6 Background on research projects supporting this report

AIM (Advanced Institute of Management Research)

AIM is a UK leader in the field of management research, bringing academics together with business, public sector and policy thinkers in order to develop and deliver research of a world class standard which has an immediate and significant impact on management practice. We ensure our projects achieve these standards by adhering to four main objectives: conduct research that will identify actions to enhance the UK's international competitiveness; raise the scientific quality and international standing of UK research on management; expand the size and capacity of the active research base for UK research on management; develop the engagement of that capacity with world-class research outside the UK and with practitioners as co-producers of knowledge about management and other users of research within the UK. AIM is sponsored by the Economic and Social Research Council (ESRC) and the Engineering and Physical Sciences Research Council (EPSRC).

Innovation Productivity Grand Challenge

The AIM Innovation Productivity Grand Challenge was an EPSRC and ESRC funded research project that explored the implications of the changing 21st century context of networked, global and increasingly open innovation – a world in which knowledge flows become as important as knowledge creation. It involved a network of five UK universities – Cambridge, Cranfield, Imperial College London, Liverpool and Loughborough – working with the ESRC/EPSRC's Advanced Institute for Management Research (AIM). It addressed four key questions:

- What is the (knowledge) context within which innovation occurs in the UK?
- How do new firms form on the basis of knowledge and its deployment?
- How do established firms access and use knowledge to improve their current activities and generate new directions?
- What technical and organisational infrastructures enable these activities?

A summary of findings of the IPGC project can be found at www.ipgc.ac.uk

UK Innovation Research Centre

The UK Innovation Research Centre (UK~IRC) is a collaborative initiative for cutting-edge research and knowledge hub activity in innovation. It is a joint venture between the Centre for Business Research at the, University of Cambridge, and Imperial College Business School. The Centre is co-funded by Department for Business, Innovation and Skills (BIS), the Economic and Social Research Council (ESRC), the National Endowment for Science, Technology and the Arts (NESTA) and the Technology Strategy Board (TSB). The UK~IRC research programme focuses on open innovation, innovation in services and distributed innovation communities. It actively disseminates its work through its Knowledge Exchange Hub, engaging stakeholders in the public and private sectors.

Innovation Studies Centre

The Innovation Studies Centre, established in 2003 and funded by the EPSRC Innovative Manufacturing Research Centres (IMRC) programme, conducts research on the innovation process from knowledge creation to commercialisation. It seeks to influence policy and practice by working at the inter-face of science, engineering and business management. With over 50 core members, 37 Visiting and Adjunct Professors, and 14 PhD doctoral students, it conducts a range of research projects to develop new knowledge about the process of innovation and venture creation.

Notes

Notes

AIM – The UK's research initiative on management

If you are interested in working with AIM Research,
require further information or to access the following:

- Full UK programme of AIM workshops, conferences and event listings
- Fellows' profiles and full research project details
- AIM quarterly Newsletter and press releases
- Research papers and AIM publications available as downloads
- Information for the media

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www.aimresearch.org

The Advanced Institute of Management Research (AIM) was founded in October 2002. It is a multi council initiative of the UK's Economic and Social Research Council (ESRC) and Engineering and Physical Sciences Research Council (EPSRC) – with activities at over 180 institutions in the UK and overseas.

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