



# Growing the best and brightest

The drivers of research excellence

A REPORT FOR THE DEPARTMENT FOR BUSINESS, INNOVATION AND SKILLS

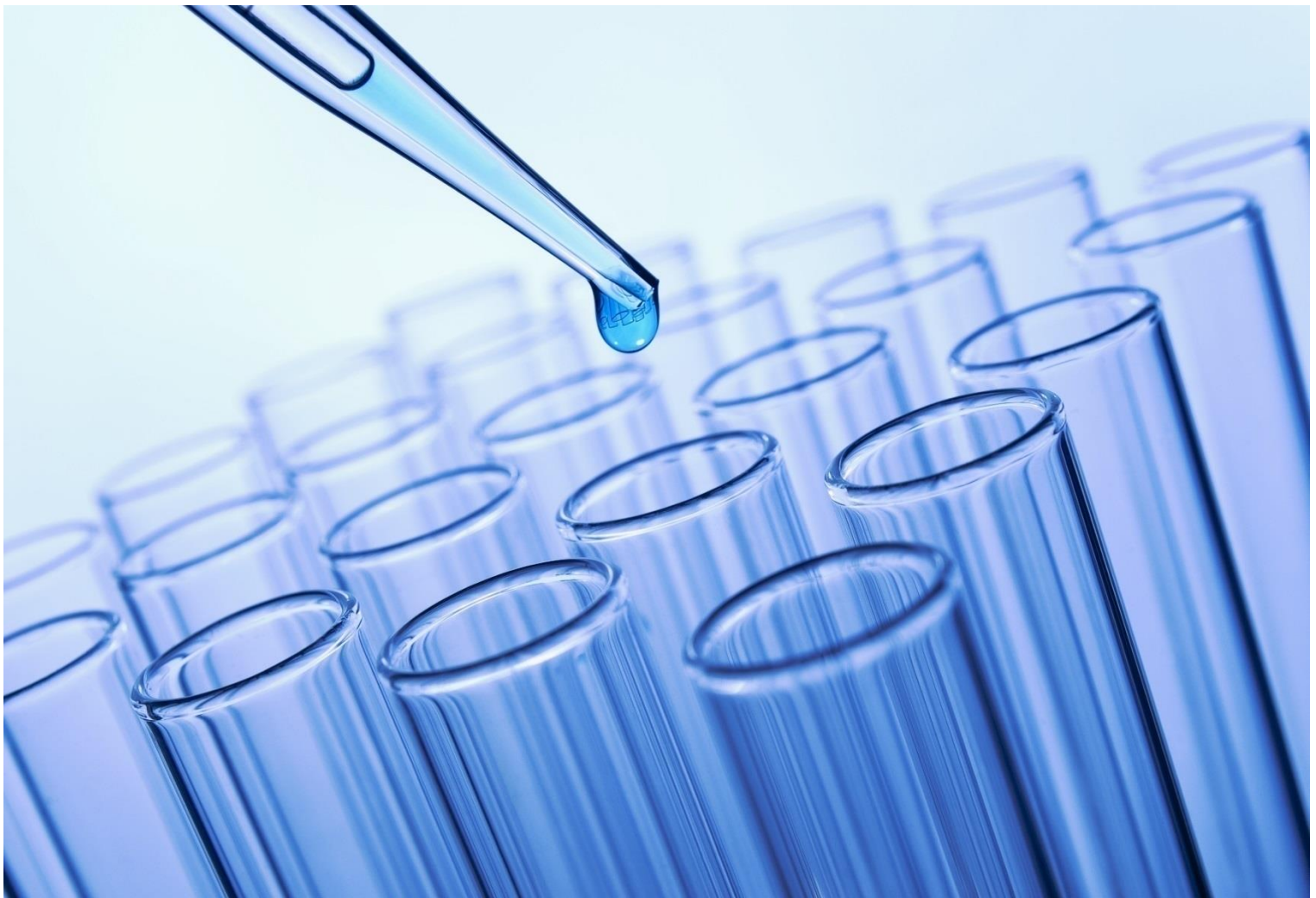
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## Document contents

<b>1. Summary .....</b>	<b>4</b>
1.1. Background and objectives	5
1.2. Our approach and methodology	5
1.3. Key findings	5
1.4. Conclusions	6
1.5. Report structure	7
1.6. Acknowledgements	7
<b>2. Our approach and methodology.....</b>	<b>8</b>
2.1. Introduction	9
2.2. Our approach	9
2.3. Methodology	10
2.3.1. Stage 1: Literature review .....	10
2.3.2. Stage 2: Semi-structured interviews .....	10
2.3.2.1. Selection of HEIs and subject areas.....	10
2.3.2.2. Interview methodology .....	12
2.3.3. Stage 3: Drawing conclusions .....	12
<b>3. Drivers of research excellence .....</b>	<b>13</b>
3.1. Overview	14
3.2. Recruitment practices	15
3.2.1. Overview.....	15
3.2.2. Evidence from the existing literature.....	15
3.2.3. Evidence from the interviews.....	17
3.2.3.1. Identifying the need to hire a researcher.....	17
3.2.3.2. Advertising and encouraging researchers to apply.....	18
3.2.3.3. Evaluating potential candidates .....	19
3.2.3.4. Making an offer to a preferred candidate.....	21
3.2.3.5. Integrating new recruits.....	21
3.2.4. Conclusion.....	21
3.3. Developing and motivating researchers	23
3.3.1. Overview.....	23
3.3.2. Evidence from the existing literature.....	23
3.3.3. Evidence from the interviews.....	24
3.3.3.1. Mentoring, appraisal and leadership.....	24
3.3.3.2. Training.....	28
3.3.3.3. Incentives .....	28
3.3.3.4. Research environment and culture.....	29
3.3.4. Conclusion.....	29

3.4. Collaborating with others	30
3.4.1. Overview.....	30
3.4.2. Evidence from the existing literature.....	30
3.4.3. Evidence from the interviews.....	31
3.4.4. Conclusion.....	35
3.5. Creating and implementing research strategies	36
3.5.1. Overview.....	36
3.5.2. Evidence from the existing literature.....	36
3.5.3. Evidence from the interviews.....	37
3.5.3.1. Creating a strategy.....	37
3.5.3.2. Benefits of institutional research strategy.....	38
3.5.3.3. Departmental strategies.....	38
3.5.4. Conclusion.....	38
3.6. Securing a mix of funding	39
3.6.1. Overview.....	39
3.6.2. Evidence from the existing literature.....	39
3.6.3. Evidence from the interviews.....	39
3.6.4. Conclusion.....	40
3.7. Competitive pressure	41
3.7.1. Overview.....	41
3.7.2. Evidence from the existing literature.....	41
3.7.3. Evidence from the interviews.....	41
<b>4. Key findings, conclusions and further research .....</b>	<b>43</b>
4.1. Summary of key findings	44
4.2. Conclusions	44
4.2.1. Conclusions relating to the drivers of research excellence.....	44
4.2.2. Conclusions relating to the UK's competitive position .....	45
4.3. Potential areas for further research	45
4.3.1. Recruitment practices .....	45
4.3.2. Developing and motivating researchers .....	46
4.3.3. Collaborating with others.....	46
4.3.4. Creating and implementing research strategies .....	46
4.3.5. Securing a mix of funding .....	46
4.3.6. Competitive pressure.....	46
<b>Annexes.....</b>	<b>47</b>
Annex A – Summaries of Existing Literature Reviewed	48
Annex B – Sample Selection	89
Annex C – Discussion Guide	95
<b>Further information .....</b>	<b>101</b>



# 1. Summary

This section sets out a summary of our approach and methodology, key findings and conclusions.

Drawing on a combination of the existing literature and interviews with 51 academics in 12 of the UK's leading institutions we find:

- (i) the activities supporting the **recruitment, development and motivation of researchers** are critical drivers of research excellence;
- (ii) the activities relating to **collaborating with others, creating and implementing research strategies, securing a mix of funding and responding to competitive pressures** are also seen as important by interviewees; and
- (iii) in relation to many of these activities, our research emphasises that the “on-the-ground” or “day-to-day” initiatives by individual researchers can be at least as important as the “high-level strategic” initiatives instigated by institutions.



### 1.1. Background and objectives

The UK research base is among the most efficient in the world. A recent report written by Elsevier for the Department for Business, Innovation and Skills (BIS) shows that the UK accounts for 9.5% of downloads, 11.6% of citations and 15.9% of the world's most highly-cited articles and has overtaken the US to rank 1<sup>st</sup> by field-weighted citation impact. This has been achieved with 0.9% of global population, 3.2% of R&D expenditure, and 4.1% of researchers.<sup>1</sup>

Higher Education Institutions (HEIs) are an important part of the research base and we were asked by BIS to undertake a study to help develop its understanding of the drivers of research excellence in such UK institutions.

Specifically, BIS wanted us to look beyond funding levels and path dependency as drivers of research excellence and instead to focus on the in practice features and practices prevalent in HEIs (e.g. institution autonomy, recruitment practices, culture) that support research excellence.

Put simply, the primary objective of this study is to understand the practical things that UK HEIs do with the resources they have to help create excellent research. This is not to say that the level or organisation of funding is unimportant – clearly it is very important – but it is not the focus of this study.

The results will be used to help BIS decide how it should best deliver its responsibility for maintaining and building on current levels of excellence in research.

### 1.2. Our approach and methodology

We approached this study from the viewpoint of “competitive advantage”. Studying the sources of competitive advantage involves understanding what an organisation does differently to give it a competitive edge over another and, relatedly, how that competitive edge can be maintained where rivals have strong incentives to erode it by “mimicking” or “outdoing”.

The academic literature on competitive advantage identifies two overarching sources of competitive advantage: superior efficiency and differentiation.

To help understand the sources of competitive advantage in HEIs, we did two things.

» In the first stage of this study we undertook a review of the existing literature on the drivers of research excellence. Where relevant, we also considered the existing literature about what firms do “on-the-ground” to create a competitive advantage.

» The second stage of this study involved conducting semi-structured interviews with 51 academics in 12 of the UK's leading universities. The purpose of this stage was to deliver an evidence-based understanding of which of the long-list of drivers identified through the literature review were seen by HEIs as particularly important, and how they work in practice. Our sample of 12 institutions – 7% of the 163 UK HEIs – accounts for:

- £680m (35%) of research grants from Funding Bodies (e.g. HEFCE);
- £600m (40%) of Research Council grants; and
- £2.4bn (37%) of the total £6.4bn of research income.<sup>2</sup>

### 1.3. Key findings

A consistent result across all of our interviews is, unsurprisingly, that the primary driver of research excellence is excellent researchers.

Therefore, the activities supporting the **recruitment, development and motivation of researchers** are highlighted by this research as critical drivers of research excellence.

In particular, the following practices appear to be particularly important as evidenced by the existing literature and the views and efforts of interviewees:

- the evaluation of potential (internal and external) recruits – for example, checks and processes to ensure “plurality” and to avoid the risk of recruiting too many individuals “like us”; and
- informal and formal mentoring and appraisal arrangements – for example, striking the right balance between offering guidance and preserving researcher autonomy, knowing when to encourage a researcher to persevere or re-think and so on.

In addition, the activities relating to **collaborating with others, creating and implementing research strategies, securing a**

<sup>1</sup> BIS (2013), “International Comparative Performance of the UK Research Base – 2013”.

<sup>2</sup> Based on HESA statistics relating to 2011/12. Total research income represents Funding Body grants for research, and research grants and contracts.

***mix of funding and responding to competitive pressures*** were also seen as important by interviewees.

In relation to many of these activities, our research emphasises that the “on-the-ground” or “day-to-day” initiatives by researchers can be at least as important as the “high-level strategic” initiatives instigated by institutions.

For example:

- we heard that the personal relationship researchers forge in the early stages of their career can have a critical effect on their opportunities for collaboration later. These personal relationships are usually forged in the corridors of institutions and at conferences;
- we also heard that one of the benefits of developing an institution level “research strategy” was not the roadmap provided by the strategy itself, but the opportunity to bring together different individuals to share points of view and best practice; and
- that the terms on which different sources of funding are made available had a bearing on research productivity – not just the level of funding. For example, the freedom of research direction, or lack of it, after a grant has been won.

A common practical challenge for any individual researcher seemed to be making time to lay the foundations for conducting excellent research in the future, given the pressure to do excellent research now. This is exacerbated by uncertainty over what activities are worthwhile.

#### 1.4. Conclusions

In line with the key findings of this report, our conclusions are as follows.

- » First, supporting excellence in recruiting, developing and motivating people will contribute to research excellence and productivity. Potential impediments to excellence in these areas are the actual or expected time and effort associated with recruiting individuals that need a visa to work in the UK and a lack of recognition for carrying out mentoring and appraisal activities.
- » Second, efforts to facilitate day-to-day collaboration, particularly early in a researcher’s career are likely to contribute to research excellence, and help support larger scale collaborative initiatives. For example, BIS might be in a good position to bring new

researchers in academia and industry together through a common forum.

- » Third, although the scope of our study has not focused on funding, it indicates that the terms on which funding is made available has a bearing on what/how research is undertaken. Although differences between funding sources in relation to the terms on which funding is made available is not unusual and may be entirely appropriate, this study suggests that better understanding the differences between funding sources, and what works and what doesn’t could further ensure that the limited funds are invested in the right way.
- » Finally, in line with previous research, this study suggests that the UK is well-positioned to remain a research leader in the future and its competitive position vis-à-vis other countries is unlikely to be undermined in the short-term. Of course, continued investment in research is necessary to maintain the UK’s position in the long-term.

Section 4 of this report sets out ideas for further research relating to better understanding:

- the extent to which the recruitment of researchers from outside of the European Union is affected by the actual or expected time and effort associated with acquiring visas;
- the role that middle-career researchers might have in UK research productivity;
- how much excellence in mentoring and appraisal affects key measures of research excellence (e.g. from peer review and bibliometric);
- whether more could be done to help early-career researchers forge personal relationships as the foundation for collaboration later;
- the measures of success used by HEIs when evaluating their research strategies;
- the differences in terms between funding sources and the effect this has on research; and
- benchmarking researchers’ salaries and the extent to which trade-offs are made between salaries and other factors (such as institution reputation).

## 1.5. Report structure

The rest of this report is split into three main sections and a number of annexes.

- » Section 2 sets out our approach and methodology.
- » Section 3 contains the main results of our work and describes the drivers of research excellence based on our review of the existing literature and our interviews with 51 academics across 12 excellent research institutions.
- » Section 4 sets out the key findings and conclusions of our work, including the potential implications for how robust the UK might be to big-push initiatives in other countries.
- » The annexes contain various supporting materials, including further details on how we selected the HEIs and departments to interview and the discussion guide we used to help structure our interviews.

## 1.6. Acknowledgements

We are hugely grateful for the time and openness of the individuals that participated in this study, including: officials at BIS and HEFCE; the 51 senior academics that each gave up a significant amount of time to speak to us; and the excellent individuals who organised the meetings for us.



## 2. Our approach and methodology

This section sets out our approach to, and methodology for, this study. Our approach is shaped by the business and economic concept of “competitive advantage” and semi-structured interviews with academics are at the heart of our methodology.



## 2.1. Introduction

BIS asked Economic Insight to undertake a study to help develop its understanding of the drivers of research excellence in Higher Education Institutions (HEIs) in the UK.

Specifically, BIS wanted us to look beyond funding levels and path dependency as drivers of research excellence and instead to focus on the “on-the-ground” features and practices prevalent in HEIs (e.g. institution autonomy, recruitment practices, culture) that support research excellence.

Put simply, the primary objective of this study is to understand the practical things that UK HEIs do with the resources they have to help create excellent research.

The results will be used to help BIS decide how it should best deliver its responsibility for maintaining and building on current levels of excellence in research.

The remainder of this section sets out our approach to, and methodology for, this study. In particular, it describes how we have sought to meet the objectives of the study set out above. As described further below, our approach is shaped by the business and economic concept of “competitive advantage” and semi-structured interviews with academics are at the heart of our methodology.

## 2.2. Our approach

Studying the sources of competitive advantage involves understanding what an organisation does differently to give it a competitive edge over another and, relatedly, how that competitive edge can be maintained where rivals have strong incentives to erode it by “mimicking” or “outdoing”.

Therefore, although principally developed in the context of analysing firms not HEIs, we think that the concept of competitive advantage is a useful lens through which to look at the drivers of research excellence in HEIs and aligns closely with the research objective set out above.

The academic literature on competitive advantage identifies two overarching sources of

competitive advantage: superior efficiency and differentiation.<sup>3</sup>

In this context, superior efficiency is achieved by finding ways of maximising the quantity and quality of research for a given level of funding (or, similarly, finding ways to minimise cost for a given quantity and quality). Differentiation is achieved by finding ways of creating valuable research that others do not.

This concept immediately helps to frame and raises various practical questions of relevance to this study, such as:

- What does superior efficiency look like?
- How might it vary between disciplines?
- How is it achieved in practice?

Previous work, discussed in more detail in Section 3 of this report, suggests that research institutions adopt various formal and informal strategies to achieve superior efficiency and differentiate themselves. These strategies include but are not limited to:

- facilitating and encouraging various forms of collaboration;
- leading and supporting researchers through various mentoring and appraisal techniques; and
- balancing the competing demands of research, teaching and administration.<sup>4</sup>

But the existing literature tends to contain relatively little information about what each of these strategies look like in practice. Uncovering this is as an important part of this study for two reasons.

- » First, it is likely that most institutions will recognise the importance of, and take steps to deliver (say) a good research environment. To understand what subtle changes make the difference between 'very good' and 'excellent' will require us to develop a richer understanding of the different 'flavours' of a research environment. We note that there may be similarities / differences between the disciplines (e.g. an excellent research environment for an economist might look quite different to the same for a chemist).

<sup>3</sup> For example, see: Porter (1980), “Competitive Strategy”, Free Press.

<sup>4</sup> For example, see: For example, see: Warwick (2002), “The determinants of research group performance”, *Journal of Management Studies*; Schofield (2012), “Critical Success Factors for Knowledge Transfer Collaborations between University and Industry in the Emerging Market Context”; Goodhall (2009), “Highly Cited Leaders and the Performance of Research

*Universities*”, *Research Policy*; Wood (1990), “Factors influencing research performance of university academic staff”, *Higher Education*; Harris (1994), “The determinants of research performance: A study of Australian university economists”, *Higher Education*; Travaille (2010), “What keeps science spiralling? Unravelling the critical success factors of knowledge creation in university research”, *Higher Education*.

- » Second, it is likely that these more subtle differences are not wholly dependent on funding or historic fortune, but rather are affected by the unique skills, capabilities and innovativeness of HEIs undertaking excellent research. Thus, our focus is on these elements, rather than funding or path dependency.

### 2.3. Methodology

To meet the study's objectives, we have adopted a three-stage methodology, as set out below. Throughout, we benefitted from the helpful input of stakeholders from BIS and the Higher Education Funding Council for England (HEFCE).

#### 2.3.1. Stage 1: Literature review

In the first stage of this study we undertook a review of the existing literature on the drivers of research excellence. Where relevant, we also considered the existing literature about what firms do "on-the-ground" to create a competitive advantage. We acknowledge that the research sector is different in certain respects to the commercial sector, but consider there are relevant parallels from which lessons can be learnt for research.

The main objective of this first stage was to develop a "long-list" of drivers that would help us identify the most fruitful lines of investigation with the HEIs and so develop the structured interview questions. We reviewed a total of 37 papers, which are summarised in Annex A to this report. We have not reviewed every relevant paper due to the high volume of publications in this area, but believe we have picked up the most important ones and have accurately represented the current literature base. Our primary method of selecting papers was to use Google Scholar with appropriate search terms, such as "research productivity" and "research collaboration". BIS were also able to suggest various interesting and helpful papers.

#### 2.3.2. Stage 2: Semi-structured interviews

The second stage of this study involved undertaking primary research. The purpose of this stage was to deliver an evidence-based understanding of which of the long-list of drivers identified through the literature review were seen by HEIs as particularly important, and how they work in practice.

We considered two high-level methods of research for this study.

- » The first method would be a quantitative approach. This would involve:
  - gathering data on the quantity, quality and impact of research conducted by different institutions (such as from Elsevier's Scopus dataset or from Thomson Reuters' Web of Science dataset);
  - gathering data on the potential determinants of research excellence (e.g. salaries paid to researchers); and
  - looking for correlations / statistical relationships between the above datasets.
- » The second method would be a more qualitative approach, involving understanding what research institutions do in practice to achieve excellence through semi-structured interviews.

We chose the second method. Although we could see a number of merits in the first approach, our view is that, given the objectives of this project, the second method would yield more useful insights. The main reason for this is that, in order to undertake the first quantitative method, it would be necessary to 'translate' what research institutions do in practice to deliver research into continuous or categorical variables that can be used in a quantitative analysis. Our concern with this approach is that, in doing so, much of the subtlety and richness that is fundamental to the success of this study would be lost in translation.

We then decided how best to choose which HEIs and subject areas to interview and the interview methodology.

##### 2.3.2.1. Selection of HEIs and subject areas

Broadly speaking, we chose HEIs and subject areas within them that would be regarded as excellent on the basis of the Research Assessment Exercise, subject to feedback from BIS related to helping ensure that we got a good mix of locations and subject areas. Annex B sets out how we conducted this exercise in detail.

The table below shows the universities and departments we spoke to. In total, we spoke to 51 academics. The universities we spoke to account for 37% of a total £6.4bn research income in 2011/12.<sup>5</sup> We recognise that due to the nature of the sample we may have heard

<sup>5</sup> Based on HESA statistics relating to 2011/12. Total research income represents Funding Body grants for research, and research grants and contracts.

different opinions compared to the total population of institutions who produce excellent research. For example, the institutions we spoke to may be more supportive of the importance of critical mass due to their (relatively large) size. Furthermore, due to the timing of the research, matters related to the

REF may have been more front of mind than normal.

**Table 1: Institution and department selection**

<i>Institution</i>	<i>Units of assessment</i>
Cardiff University	Communication, Cultural and Media Studies Civil Engineering Law
Institute of Cancer Research	Cancer Studies/Biological Sciences
LSE	History Business and Management Studies Economics and Econometrics
UCL	Other Hospital Based Clinical Subjects Physics Art and Design
University of Cambridge	Computer Science and Informatics Other Hospital Based Clinical Subjects History
University of East Anglia	Biological Sciences Earth Systems and Environmental Sciences Chemistry
University of Edinburgh	Pure Mathematics Social Work and Social Policy & Administration English Language and Literature
University of Essex	History Electrical and Electronic Engineering Computer Science and Informatics
University of Manchester	Cancer Studies Electrical and Electronic Engineering English Language and Literature
University of Oxford	Infection and Immunology Earth Systems and Environmental Sciences Computer Science and Informatics
University of Warwick	Applied Mathematics History Business and Management Studies
University of York	English Language and Literature Computer Science and Informatics Biological Sciences

### 2.3.2.2. Interview methodology

We decided to conduct face-to-face semi-structured interviews with academics. Specifically, in each HEI we usually spoke to the Pro-Vice Chancellor of Research (or equivalent) and a senior researcher within each of the departments we selected. We relied on recommendations from the Pro-Vice Chancellor of Research to identify appropriate senior researchers. Each interview lasted for around one hour. To help guide the interviews, we produced a discussion guide which was circulated to interviewees in advance. The discussion guide is provided in Annex C to this report and was the product of our work and helpful feedback from BIS. As semi-structured interviews, the discussion guide provides the broad themes that we wanted to explore, within which we encouraged interviewees to raise new ideas and focus on the issues they considered particularly important.

There are two main benefits of this methodology.

- » Although the most costly method of conducting research, we considered that face-to-face interviews with a small number of research institutions would allow us to gather high quality / detailed information about the determinants of research excellence and so add to the existing literature. This method also allowed us to probe / explore the hypotheses / emerging findings from the literature in greater detail than would be possible using a large-scale telephone / postal / internet survey.
- » Speaking to researchers from more than one discipline would allow us to understand the similarities / differences in the determinants by discipline, helping to ensure that our conclusions are not unduly distorted by a 'discipline specific' effect and to add further richness the study.

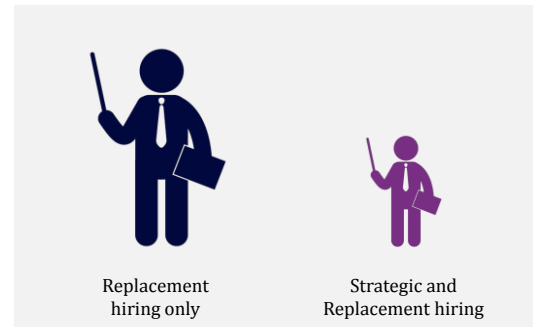
We did not use incentives to recruit interviewees. All of the institutions were willing to participate in the research.

### 2.3.3. Stage 3: Drawing conclusions

The final stage of the project was to collate and draw conclusions from the study, as set out in the next sections of this report. In doing, we have sought to strike an appropriate balance between drawing out some general points made by the interviewees, while recognising the differences between individuals and institutions.

To help readers gauge the frequency with which different views were expressed by interviewees, we sometimes use figures like the

one below. The relative height of the pictures provides an indication of the relative frequency – so, in the example below, approximately twice as many interviewees said that they undertook replacement hiring only, compared to the number of interviewees that said they undertook replacement and strategic hiring.







### 3. Drivers of research excellence

This section contains the main results of our work and describes the drivers of research excellence based on our review of the existing literature and our interviews with 51 academics across 12 excellent research institutions.

### 3.1. Overview

This section contains the main results of our work and describes the drivers of research excellence based on our review of the existing literature and our interviews with 51 academics.

All of our interviews highlighted (and subsequently focused on) the activities HEIs undertake associated with recruiting, developing and motivating people.

The remainder of this section is divided into six parts:

- recruitment practices;
- developing and motivating researchers;
- collaborating with others;

- creating and implementing research strategies;
- securing a mix of funding; and
- competitive pressures.

For each category, we provide an overview of it, summarise some of the relevant existing literature, set out the results of our interviews, and conclude.

A cross-cutting result from all of our interviews is, unsurprisingly, that the primary driver of research excellence is excellent researchers. This is illustrated by the word cloud below, which shows the frequency with which different drivers were mentioned during our interviews with Pro-Vice Chancellors.

Figure 1: Word cloud of drivers mentioned by Pro-Vice Chancellors



Source: Wordle analysis of transcripts of interviews with 9 Pro-Vice Chancellors

## 3.2. Recruitment practices

### 3.2.1. Overview

Without exception, our research shows that recruiting excellent researchers, either individuals or teams, is a critical part of producing excellent research. Indeed, all of our interviewees said that the presence of excellent researchers in an institution has a significant influence on their ability to attract other excellent researchers. Furthermore, BIS (2013)<sup>6</sup> notes that the Pareto Principle holds for the distribution of citations across authors – that is, roughly 20% of authors account for 80% of citations. Strong recruitment practices, therefore, are fundamental to research excellence.

*“Talent is everything.”*

– PVC of Research in a leading HEI

Recruiting researchers includes the following activities:

- identifying the need to hire a researcher;
- advertising for and, more generally, encouraging researchers to apply;
- evaluating potential candidates;
- making an offer to a preferred candidate; and
- integrating new recruits.

Since research is by its nature highly specialised, most of these activities are also highly skilled and involve the time and effort of existing researchers – some of whom may also need to develop the skills and capabilities to be able to make good recruitment decisions. That is, as well as being a critical part of producing excellent research, recruiting researchers involves an investment – namely, the diversion of time and effort away from research activities (in the short-run) to recruitment-related activities. Accordingly, being able to recruit researchers efficiently will contribute to an HEI’s competitive advantage in two ways: directly – through hiring the better researchers; and indirectly – through leaving more time for research.

Moreover, there is scope for one HEI to be better at recruiting researchers than another

HEI. This is because within the rules and guidelines implied by law and best practice, HEIs have significant discretion about how to recruit researchers – both in terms of choosing an overarching recruitment strategy (for example, the extent to which an institution versus individual departments influence the number or type of researchers recruited in a year) and choosing specific options within that strategy (for example, the methods used to evaluate potential candidates). In addition to these choices, recruitment decisions will often call for the good judgement of those responsible for making them – for example, how to choose between two equally good candidates ‘on paper’ – these judgements are often hard to describe or write down, but may be fundamental to recruiting the best researchers.

Finally we note that recruiting researchers closely interacts with the other drivers of research excellence. For example, an HEI’s ability to encourage researchers to apply is influenced by other features of the HEI – such as the work environment and facilities available. These drivers are considered in more detail in subsequent sections.

### 3.2.2. Evidence from the existing literature

The existing literature supports the view that recruitment practices influence research excellence.

For example, papers by Snyder et al (1991) and Harvey (2002), through the use of interviews and surveys, show that **recruitment and retention practices affect research productivity in research environments**.

~

*Snyder et al (1991) studied the “management control systems” that outstanding US universities were using in 1989. The purpose of management control is to ensure that the necessary resources are allocated to meet organisational goals, and so is highly relevant to recruitment practices. The authors examined the management control processes within central research offices, or research divisions, of universities to determine how funded research is encouraged. By conducting 33 telephone interviews, the authors found that the recruitment and retention of outstanding researchers was one of three strategies that increased research productivity (alongside the setting of specific goals and monitoring progress towards objectives using specific external measures).<sup>7</sup>*

<sup>6</sup> BIS (2013), “International Comparative Performance of the UK Research Base”.

<sup>7</sup> Snyder et al (1991), “Factors Contributing to Research Excellence”, Human Sciences Press.

Harvey (2002) explored the drivers of performance of medical and medical-research groups. Case studies were developed from semi-structured interviews which explored the history, structure, strategy, culture, outputs and impacts of the research group. A quantitative survey was also administered which included topics such as: generation of grants; fellowships; publications; contribution to individual career and research group development; and scientific impact. Harvey found that finding, motivating and retaining talent was one of a number of drivers of research excellence (including strong leadership, and strong links between theory and practice).<sup>8</sup>

~

Similarly, papers by Hiltrop (1999) and Horwitz (2003), show that **recruitment practices also affect commercial performance in firms**. Proactive recruitment practices are seen to be particularly important.

~

Hiltrop (1999) explores some of the strategies and techniques that organisations are using to attract and retain talent. HR managers and personnel officers in 115 multinational and 204 domestic companies located in Western Europe were asked to complete a structured questionnaire containing 67 statements about the management policies and practices of their firm. Three groups of company were created to analyse the results: those with high, medium and low ability to attract and retain talent – as considered by a group of seven management and executive search consultants. They find that those with a high ability to attract and retain talent outperform their competitors in terms of the level of teamwork and openness between co-workers, the training and development opportunities they offer to employees, and the degree of pro-activity in HR planning.<sup>9</sup>

Horwitz et al. (2003) explores the most and least effective HR strategies used by knowledge intensive firms for attracting, motivating and retaining workers. The authors administered a questionnaire to firms in Singapore and received 44 usable responses. Based on self-reported success, the most effective strategies for attracting workers included offering a highly

competitive salary, proactive selection and recruitment initiatives, and funded internal staff development.<sup>10</sup>

~

Finally, there is a large recruitment related-literature, which shows that the **characteristics and experiences of individual researchers, influences research productivity**. Papers show that the presence of “stars”, along with a highly cited Head of Department, can raise departmental performance.

~

Dunar and Lewis (1998) examined the factors that contribute to the research productivity of doctoral-granting universities in the US. They studied both individual-level drivers (such as the age and experience of researchers) and faculty-level drivers (such as faculty size). Using data from the National Research Council, the authors found that faculties with more “full professors” and “stars” materially enhanced departmental research performance. They assume that full professors are tenured, experienced and mature senior faculty. To measure the presence of “star” faculty they used a National Research Council constructed Gini coefficient for publications. The Gini coefficient measures the publication concentration on a single or small number of faculty. If each member of staff is producing the same number of papers the coefficient will be low, at the other extreme, if all the papers in a department were being produced by one person the coefficient would be high.<sup>11</sup>

Gonzalez-Brambila and Veloso (2007) considered how researcher age influences research output and impact. Using a dataset of Mexican researchers, they found that a researcher’s publishing peaks at around 53 years old, but overall found that age does not have a substantial influence on research output and impact relative to other factors such as professorial level and subject area.<sup>12</sup>

Similarly to Dunar and Lewis, Witte and Rogge (2010) studied the individual-level drivers of research excellence. Based on the output data on 81 Belgian researchers and researcher interviews, they found that higher research performance is achieved by those who: are female, have a PhD, are affiliated with one or

<sup>8</sup> Harvey (2002), “The determinants of research group performance: towards Mode 2”, *Journal of Management Studies*.

<sup>9</sup> Hiltrop (1999), “The quest for the best: human resource practices to attract and retain”, *European Management Journal*.

<sup>10</sup> Horwitz (2003), “Finders, keepers? Attracting, motivating and retaining knowledge workers”, *Human Resource Management Journal*.

<sup>11</sup> Dunar and Lewis (1998), “Determinants of research productivity in higher education”, *Research in Higher Education*.

<sup>12</sup> Gonzalez-Brambila and Veloso (2007), “The determinants of research output and impact: a study of Mexican researchers”, *Research Policy*.



more other universities, get more satisfaction out of doing research, perceive that timing is a major constraint to improving their research, and rate their ability as a researcher higher.<sup>13</sup>

Chandler et al. (2009) reports on a mixed-method study to evaluate factors affecting motivation, including reasons for varying levels of motivation, amongst clinicians in Tanzania. They observed over 2000 hospital consultations, interviewed clinicians to evaluate job satisfaction and morale, and then designed and implemented a survey instrument to measure work motivation in clinical settings. They found that salary was a clear prerequisite for motivation and that non-salary motivators only had an effect where salary requirements were satisfied.<sup>14</sup>

Goodall et al (2014) explores the association between the personal research output of a department head and the department's subsequent performance. Chairs, or Heads of Departments, manage daily operations, hire faculty and professional staff, and work closely with senior university administrators. Their role is particularly important given the degree of decentralisation and the devolved powers given to departments. The authors find that a longitudinal predictor of a department's future research success is the cumulative number of citations of the incoming chair's own research. They suggest that one of the reasons this relationship may exist is that scholar-leaders may find it easier to recruit and retain other top scholars because of reputational factors, or because a head who is a cited scholar signals to potential recruits that he or she understands how to create the right incentives and work environment for other research-focused academics.<sup>15</sup>

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### 3.2.3. Evidence from the interviews

The existing literature shows that recruitment practices influence research excellence. Every interviewee confirmed this and considered it to be an uncontentionous point. Therefore, we principally used the interviews to help develop a better understanding of what the recruitment practices used by excellent research institutions look like. All of the interviewees were understandably hesitant to over-generalise as each recruit is different to another, but various themes did emerge, which

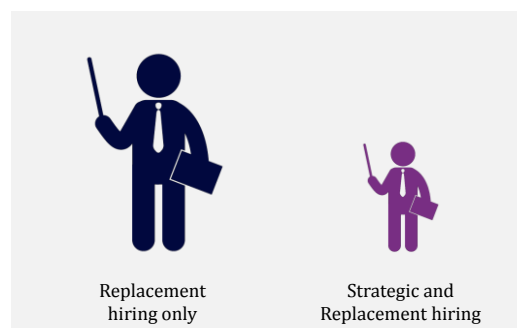
we set out below organised by each of the activities described previously

#### 3.2.3.1. Identifying the need to hire a researcher

Interviewees typically distinguished between two recruitment triggers. The first and most common trigger was the need to replace an existing member of staff, due to retirement, changing jobs, or to maintain staff-student ratios. The second trigger was more strategic and perhaps less common – a departmental or university-wide expansion strategy – which creates new positions to fill. We were told that the “impact agenda” had encouraged demands of this latter type.

The figure below shows that roughly twice as many interviewees said that they undertook replacement hiring only as the number of interviewees compared to the number that said they undertook replacement and strategic hiring.

Figure 2: Recruitment trigger frequency



Source: Interviews with HEIs

In both cases, HEIs give serious consideration to the recruitment need – that is, it is not simply a case of replacing existing or previous staff with individuals with the same background, skills and capabilities.

- » First, consideration is given to whether a hire is needed or whether the development of existing researchers would address the potential recruitment need in the short to medium term.
- » Second, interviewees explained that while actual or potential research ability would be the key consideration, an individual's ability to do and balance the important demands of teaching and administration is also important. Many of them said these demands on new researchers had changed

<sup>13</sup> Witte and Rogge (2010), “To publish or not to publish? On the aggregation and drivers of research performance”, *Scientometrics*.

<sup>14</sup> Chandler et al (2009), “Motivation, money and respect: A mixed-method study of Tanzanian non-physician clinicians”, *Social Science & Medicine*.

<sup>15</sup> Goodall et al (2014), “Do we need highly cited departmental chairs?”, *VoxEU.org*

and increased over time and considered that this trend would continue. Consistent with research ability being an important consideration, interviewees often noted that teaching skills could be learned through training and experience, whereas “raw research talent” could not. Indeed, one interviewee considered that the requirement to be or have the potential to be a good teacher would reduce the pool of potential candidates for any given position.

*“Our only criteria is you’ve got to be world leading or potentially world leading, straight forward, just one criteria.”*

**– PVC of Research in a leading HEI**

- » Third, consideration is also given to how the skills and capabilities of a new recruit would complement existing team members. For example, engineering departments often considered it helpful for researchers to have industry experience. Some interviewees considered it beneficial to ensure that there is a mix of researchers from different PHD programmes, not just their own to help ensure “plurality”. Thought is also given to team balance, one interviewee said that they wanted to make sure there is the right mix of “creatives” and “doers”.

Because of the importance of correctly identifying the recruitment need, significant time and effort is devoted to reaching agreement on it and formal arrangements are set up.

For example, HEIs typically form at least one recruitment committee, often comprising of multiple senior researchers, to debate and agree on the individual specifications. The number and size of committees varied according to the scale and strategic importance of the hires under contemplation. Also, HEIs often require business plans to be written, which formally articulate the need for recruitment based on the costs and benefits it would bring.

Finally, a number of interviewees noted the link between recruitment and the way funding is organised. That is, they felt that the focus on “impact” is distorting or could distort recruitment decisions in favour of researchers (and research) that can be shown to have an impact sooner, and away from “blue-skies” research that could create a larger impact later. Additional research could be undertaken to test

whether recruitment decisions had changed recently.

*“An academic is for life, not just for REF”*

**– PVC of Research in a leading HEI**

### 3.2.3.2. Advertising and encouraging researchers to apply

All interviews made a distinction between competition for funding and competition for talent. They said that their closest competitors for funding were other UK institutions, whereas they competed globally for talent, which is relevant here.

We found differences between disciplines in terms of the geographic scope of competition. For example, researchers in economics and finance related disciplines particularly cited other UK and US institutions as their closest rivals, whereas researchers in English language pointed to other UK and Northern European institutions. Law is seen as a less geographically mobile discipline. But they generally saw the differences as matters of degree and, in many cases, considered that competition could only be meaningfully assessed by considering particular topics of study within a discipline.

Given the intense global competition for talent, the HEIs considered it important to use a range of methods to advertise and alert individuals to positions.

- » Interviewees saw informal methods as particularly effective – that is, researchers using their social and professional networks (such as those developed at conferences) to alert their contacts to opportunities and, where appropriate, encourage them to apply. Intelligence is also gathered through day-to-day reading of journals and other discipline relevant materials. Some academics are invited to present a paper at a seminar. This allows for the assessment of their capabilities, lets them see the institution, and also to establish a relationship with them.
- » Formal methods are also used, including the use of internet (such as the Social Sciences Research Network) and print advertising, as well as recruitment agencies for more senior hires. Opinions on the usefulness of recruitment agencies varied. There were those that had used recruitment agencies in the past, but considered that they added

little value because the pool of potential candidates was relatively small and already known to the departments. Others used recruitment agencies, not as a means of identifying potential candidates, but rather as a way of making contact in a professional and arms-length manner.

- » In some cases, strategic initiatives with other universities are seen as a way of attracting researchers through joint appointments. This, for example, is one of the motivations for the recent Monash-Warwick Alliance and also the alliance between the universities of East Anglia, Essex and Kent.

Of course, the methods used vary according to the discipline area and the seniority of the position. For example, when recruitment agencies are used, they are used for senior hires. The committees noted above consider both the most appropriate advertising medium and more subtle aspects of the advert: what it should say and how it should say it.

The figure below shows that very few interviewees said that they used recruitment agencies in their recruitment process.

Figure 3: Using recruitment agencies



Source: Interviews with HEIs

Reputation – of the HEI, the department and key individuals within it – were seen by interviewees as being the primary determinant as to whether a researcher would choose one HEI over another. Of course, reputation is harder for HEIs to change in the short-run in order to fill a specific position. Nevertheless, HEIs do use their discretion to tailor their offer to attract specific candidates, particularly for senior hires, which is discussed further below in the context of making offers.

Finally, there were factors largely outside of the control of HEIs, which interviewees felt had a significant bearing on their attractiveness to potential candidates. These included:

- a lack of funds available to pay PhD students and the associated effect this has on the mix of students willing to undertake PhDs in the UK<sup>16</sup>;
- the challenges of acquiring visas for non-EU candidates – some considered this to be a material impediment, others did not – there was not a strong pattern by discipline area or location – the figure opposite shows that a significant proportion of interviewees considered that visas made it difficult for them to recruit the best researchers;
- for HEIs in London, the high living costs and associated lifestyle – and, similarly, for HEIs out of London, the inability to offer the London lifestyle; and
- candidate-specific factors, such as encouraging researchers with families to move home, move their children from one school to another, and so on.

Figure 4: Impact of visas



Source: Interviews with HEIs

### 3.2.3.3. Evaluating potential candidates

At a high-level, the HEIs we spoke to follow a fairly typical evaluation process. They invite CVs, examine a candidate's credentials, shortlist and invite them to interview. The interviews themselves can involve a dinner, followed by more formal interview designed to test a candidate's interest in and aptitude for research. These may also involve presentations intended to test a researcher's ability to convey the relevance and results of his/her research to a wider audience, for example at conferences.

Given the importance of evaluating potential candidates to making sound recruitment decisions, we asked interviewees to point to key considerations that they thought meant the quality of their evaluation process was particularly high within the "typical" evaluation process. These are set out in the box overleaf.

<sup>16</sup> For more information on the minimum stipend set by Research Councils see:

<http://www.rcuk.ac.uk/media/news/rcuk-doctoral-stipend-levels-and-indicative-fees-for-2014/>

As mentioned earlier, candidates are evaluated primarily on their research ability, rather than their teaching ability, due to the belief that teaching can be taught.

HEIs described the changes they had made to further improve their evaluation process. They spoke in general terms of an increase in the “professionalism” of the process, linked to the

points outlined above. Others described an increase in evaluation intensity – for example, reading published or working papers in their entirety instead of undertaking a partial review, and seeing recruitment as a continuous process, for example by proactively inviting researchers from other institutions to present work.

### *Some key features of a successful evaluation process*

#### *1. Identifying and focusing on the most important individual characteristics in CVs.*

Specifically, interviewees noted that CVs increasingly contained a lot of information about the skills and capabilities of researchers that, though important, were secondary to whether they would become good researchers. For example, we were told by one senior researcher – a view echoed by others – that having good new research ideas mattered most. The ideas would inevitably need refinement, but demonstrating creativity and direction mattered.

#### *2. Avoiding the risk of recruiting too many individuals “like us”.*

Consistent with the plurality point outlined above, interviewees said that it is important to encourage diversity of opinions and interests within a department. The informal (e.g. corridor discussions) and formal (e.g. conferences) exchange of these opinions and interests contributed to research excellence. This is achieved by ensuring that the evaluation is done by individuals with different backgrounds and interests rather than an individual, and by creating an environment whereby differences of opinion could emerge and be discussed.

#### *3. Spending time at the institution.*

Where appropriate and particularly for more senior hires, encouraging candidates to spend time in the institution. This was seen as a way for both the HEI and the candidate to work out whether each would be a good fit for one another.



### 3.2.3.4. Making an offer to a preferred candidate

We were told that, within constraints, HEIs can flex the following aspects of their offer to attract the best researchers:

- the amount of teaching and administration time a researcher is expected to do;
- internal resources, including funding and equipment;
- the continuity of research time – i.e. the number and duration of periods that research could be undertaken without the interruptions of teaching and administration, including research leave;
- the position offered – for example, one HEI had recently introduced three new lines of Professorships amongst other things so that individuals could demonstrate career progression;
- the amount / quality of office space;
- the creation of part-time posts;
- the amount of time a researcher could spend undertaking external consultancy work;
- relocation payments and spousal employment;
- identifying PhDs that would support an individual's research; and
- salary.

Of these, increasing the amount and continuity of research time is seen as the most important factors to researchers and considered most carefully, although was not always possible within the resources available to departments. In line with the evidence from the existing literature, although a fair salary was seen as an important pre-requisite, it was not the primary factor that would influence a choice of institution. This depended on the reputation of the HEI, the freedom to pursue individual research interests – and the amount and continuity of teaching time was an important part of that.

Interviewees said that, in general, UK HEIs could not compete with some other institutions in Europe and particularly the US in terms of salary. One interviewee noted that although the UK could not compete with some other institutions in Europe on salary, they were more competitive in terms of the amount of autonomy given to researchers.

Finally, interviewees made a distinction between the process of making an offer to junior researchers on the one hand and senior researchers on the other. That is, there was

generally more individual negotiation for senior researchers. Interviewees attributed this to the fact that it was a “buyers’ market” for more junior posts (one interviewee noted that they had recently advertised 1 junior post and received 400 applications for it).

### 3.2.3.5. Integrating new recruits

The integration of new recruits is closely related to the issue of developing and motivating researchers, which is considered below. We note here that the departments we spoke to said that they had not experienced any difficulties associated with integrating new recruits within their existing teams or found that existing research was disrupted. For example, one English literature department said that they had successfully integrated around 18 new researchers over a period of two years, which represented a significant increase in the size of the team. They attribute this to a variety of factors, including:

- first, the success of the activities described above;
- second, picking the right time – interviewees described that there would sometimes be a natural “change-of-the-guard” where existing researchers move on – which provides a good window for change; and
- third, as discussed in the section below, the efforts taken to integrate new researchers into the department. For example, all researchers – often regardless of seniority – are often assigned two mentors – one with on-going responsibility for the overall development and well-being of an individual, the other with a formal appraisal role.

### 3.2.4. Conclusion

The evidence from the existing literature and our interviews confirms that the recruitment practices adopted by UK HEIs is a driver of research excellence and a source of competitive advantage. In particular, the HEIs put in place the formal and informal mechanisms outlined above to ensure that the right recruitment need is identified, that the right individuals are attracted to apply and that they are evaluated properly.

Although all of these activities are important, the efforts HEIs make to ensure that individuals properly integrate and the changes that institutions make to this process, suggest that doing this step well is of particular importance.

### ***Control and effects of staff turnover***

As discussed earlier, being able to attract the right people is a significant driver of research excellence. In a similar fashion, a HEI's ability to retain individuals is also very important. Through our discussions we have found that the factors that contribute to recruitment are very closely aligned with those that affect retention. Researchers are tempted to leave by the prospect of being able to do better work somewhere else, be surrounded by better people, face a new challenge, and in some instances salary.

Personal factors are often a key determinant of why people both may leave, and why they may not leave. Some people wish to have a different life-style (e.g. to move from a city to a rural area, or vice-versa), or to move internationally for the experience, particularly when young. More senior researchers, who are more likely to have started a family, often have more factors keeping them in their current position.

The level turnover in institutions varied, but none of the interviewees saw retention as a problem. Rather, people moving on is seen as a natural process and allows for individuals to move onto positions that they may be better suited to and for new individuals with different skills to move into their old position.

Some individuals use the threat of moving to a different job as a way of gaining leverage to get, for example, the PhD students they want or seed funding for a new project. This practice is however not common.

### 3.3. Developing and motivating researchers

#### 3.3.1. Overview

Our research shows that, having recruited excellent researchers (discussed above), HEIs invest time and effort in developing and motivating them. This investment is seen as a way of encouraging excellent research and, relatedly, staff wellbeing and retention. Indeed, we were told by interviewees that, in general, staff turnover in UK HEIs is relatively low and that this is, in part, attributable to the success of their efforts to develop and motivate researchers. But low staff turnover is also seen as the reason it is needed – that is, ensuring that existing staff continue to develop and remain motivated is particularly important when they comprise a high proportion of an institution’s research capacity. It is a source of competitive advantage.

Of the potential drivers of research excellence we identified, developing and motivating researchers arguably covered the most diverse range of activities. It includes:

- mentoring, appraisal and leadership (formal and informal);
- training (both “on-the-job” and courses);
- incentives (such as giving tenure, giving promotions, reducing workloads, overhead return and increasing salary); and
- the research environment and culture.

This study strongly challenges any possible view that research, even in subject areas where team working is unnecessary, is exclusively an individual endeavour and that researchers have to rely solely on their own initiatives to develop their skills and capabilities and self-motivation to keep going. All of the interviewees said that self-development and motivation are of course very important and useful attributes of excellent researchers, but that others have very important roles to play in terms of the activities outlined above.

Most of the individuals we spoke to had responsibility for the development and motivation of researchers. As well as speaking in general terms about what they do to do this, many were willing to speak to us about their own experiences – when they thought the activities above work well and when they do

not (either as providers or receivers of them). These discussions highlighted that there are differences between HEIs (and, indeed, between individuals) in terms of what they do and these differences contribute to the relative success of one institution compared to another.

#### 3.3.2. Evidence from the existing literature

The existing literature shows that investments in researcher development and motivation contribute to research excellence.

For example, papers by Snyder et al (1991), Ramesh and Singh (1998), Horwitz et al (2003) and Antikainen and Vaataja (2010) **show that mentoring, appraisal and leadership methods affect research performance**. Along with personal attributes, which can be developed, performance can also be influenced for instance by setting goals and challenges, and by recognition.

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*The paper by Snyder et al (1991) noted above also shows that setting specific goals (and supporting those goals with necessary resources) is a driver of research excellence. In the context, specific goals would be set around ‘faculty participation’ (for example communicating funding opportunities, or providing seed money) and ‘research visibility’ (for example the number and size of research grants received).<sup>17</sup>*

*Ramesh and Singh (1998) studied the “personal” and “organisational” attributes that contribute to research productivity. By reviewing the existing literature at the time as well as discussions with researchers, they identified 11 attributes in total. Seven of the factors related to the personal attributes, such as “persistence” and “learning capability”. One of the four organizational attributes was “stimulative leadership”, which was defined by the two statements ‘stimulating and facilitative leadership in the organization’ and ‘urge for excellence’.<sup>18</sup>*

*As discussed in the recruitment section, Horwitz et al. (2003) explores effective HR strategies used by knowledge intensive firms. The most popular and highly effective strategies for motivating knowledge workers were practices allowing freedom to plan work and challenging work.<sup>19</sup>*

*Antikainen and Vaataja (2010) looks at rewards that attract and enhance users’ commitment to participate in online open innovation*

<sup>17</sup> Snyder et al (1991), “Factors contributing to research excellence”, Human Sciences Press.

<sup>18</sup> Ramesh and Singh (1998), “Determinants of research productivity”, *Scientometrics*.

<sup>19</sup> Horwitz et al (2003), “Finders, keepers? Attracting, motivating and retaining knowledge workers”, *Human Resource Management Journal*.

communities. Data was collected through interviews with the community maintainers of three open innovation intermediaries, and by a web survey in the communities maintained by them. In addition, the authors analysed the rewarding mechanisms in 12 open innovation communities. Over half of the respondents stated that some form of recognition, like top ten lists, encourages them to participate in the community. The respondents were also asked to give their opinion on the importance of various forms of public acknowledgement – announcing rewarded members on the website was rated much more important than acknowledging the most active member of the month or introducing active community members on the website.<sup>20</sup>

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There is a significant literature which **shows that the research environment and culture can affect research performance**. Freedom to pursue own interests, along with opportunities to collaborate and share ideas are identified as particularly important.

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In an early paper, Pelz (1956) investigated the relationship between research performance and social environment in a large government research organisation in the US. Research performance was determined by peer review and environment measured by a questionnaire. Pelz found that research performance is higher when: researchers are given freedom to pursue original ideas; that they have a leader who gives neither complete autonomy nor excessive direction and allows for frequent interaction; where researchers have daily contact with several colleagues who have different employment backgrounds, have different values and/or tend to work in different scientific fields; but, at the same time, has frequent contact with one important colleague who has similar professional values. Professional values were measured through three 'science' orientated questionnaire statements (stress on using present abilities or knowledge, freedom to carry out original ideas, and chance to contribute to basic scientific knowledge) and three 'institutional' orientated statements (stress on having an important job, association with high-level persons having important responsibilities, and sense of belonging to an organization with prestige in the lay community). Comparisons

were made between the professional values of the subject and important colleagues with whom they reported that some contact with them is of 'great significance' to their work.<sup>21</sup>

West et al (1998) studied the relationship between "departmental climate" in universities and research excellence. They found that departmental climate (defined as "the ambience of an organisation...various patterns of influence on employee behaviour generated by prevailing environmental conditions in an organisation") may be an outcome of research excellence, rather than a director contributor to it.<sup>22</sup>

Earle (2003) looks at what types of perks are actually valued most by employees, and explores how the physical environment can be aligned to help shape a company's organisational culture and facilitate the communication, teamwork and creativity that are necessary to sustain a culture of continual innovation. The paper cites various examples that demonstrate that the quality of the work environment can have significant effects on job performance. When teams have a dominant organisational component, group spaces must be designed with the furniture and the tools to help teams work effectively. This includes ample and mobile seating and work surfaces, teaming areas, project rooms and other devices that support group work.<sup>23</sup>

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### 3.3.3. Evidence from the interviews

As in the case of recruitment practices, the existing literature shows that developing and motivating researchers contributes to research excellence. Our interviews confirmed that and added to the existing literature by describing some the activities in greater detail.

#### 3.3.3.1. Mentoring, appraisal and leadership

We asked interviewees what role mentoring, appraisal and leadership had in developing and motivating researchers to do excellent research.

Most interviewees started by pointing out that, in general, individual researchers were primarily self-motivated to do excellent research. They spoke about being driven by the satisfaction of answering difficult questions and making new discoveries. One London-based institutions noted that researcher were

<sup>20</sup> Antikainen and Vaataja (2010), "Rewarding in open innovation communities – how to motivate members", *International Journal of Entrepreneurship and Innovation Management*.

<sup>21</sup> Pelz (1956), "Some social factors related to performance in a research organisation", *Administrative Science Quarterly*.

<sup>22</sup> West et al (1998), "Research excellence and departmental climate in British universities", *Journal of Occupational and Organisational Psychology*.

<sup>23</sup> Earle (2003), "Building a workplace of choice: Using the work environment to attract and retain top talent", *Journal of Facilities Management*.

generally quite self-critical – and would have a good sense of whether they were doing well, for example based on whether they won research grants or not. Mentoring, appraisal and leadership were not seen as substitutes for these personal qualities.

However, all the interviewees considered that mentoring, appraisal and leadership could complement these personal qualities. Indeed, some individuals with mentoring and appraisal responsibilities often felt that they would like to invest more time in these activities as it would be beneficial to their researchers. This is consistent with the evidence from the most recent Principal Investigators and Research Leaders Survey (PIRLS) survey, which shows that research leaders consider such activities to be an as important part of their job as advancing their research area (>90%).

**Figure 5: My institution recognises and values the contribution I make to...I think this activity is very important in being a successful PI/research leader**



Source: PIRLS (2013)

Interviewees made a distinction between the nature of mentoring and appraisal:

- “Mentoring” is seen as an inherently forward looking form of guidance – that is, a steer to help a researcher decide what best to do in future to progress his/her research.
- “Appraisal” is seen as a backward looking form of guidance – that is, an assessment of performance to date. It might provide an input in to a mentoring discussion, but would not be the focus of it.

Interviewees also made a distinction between “formal” and “informal” mentoring and appraisal.

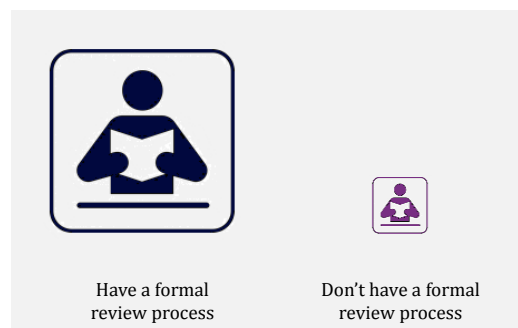
- Formal mentoring and appraisal takes place on a pre-defined timetable, often once or twice a year, and is related to other decisions – such as pay and promotion cycles. All institutions had formal appraisal arrangements and most

(but not all) had formal mentoring arrangements.

- Informal mentoring and appraisal captures a wide range of activities. For example, at one end of the spectrum are meetings with supervisors which are not dissimilar to those that would arise in the context of the formal arrangements above. At the other end of the spectrum are “corridor chats”, passing observations and suggestions that emerge on a day-to-day basis. Informal mentoring and appraisal is pervasive.

In addition, the HEIs encourage and create other opportunities for mentoring and appraisal. For example, most of the HEIs we spoke to have a (formal) “peer review” process for research grant proposals. The figure below shows that most interviewees we spoke to use a formal review process.

**Figure 6: Use of formal review processes**



Source: Interviews with HEIs

The primary objective is to increase the efficiency and likelihood of winning grants. But it is also seen as an important opportunity for receiving feedback on on-going or future research, as described in the box overleaf.



***An example of how a peer review process for grant proposal application can “spill-over” and affect research more widely***

One School of Biology we spoke to described how its internal review panel for BBSRC grant proposal applications worked.

Every proposal has to go through a process and that the process varies according to the experience of the researcher. That is, new researchers have to submit initial outlines for review before progressing, whereas more experienced researchers have to go through a detailed review stage before submission.

The process has roughly doubled their success rate: they submit fewer proposals, but get the same amount of funding, leaving more time for research.

Interestingly, they observed that even experienced researchers have started asking for their proposals to go through the initial stage – they see it as a mechanism to get wider early input on their research ideas, as well as enhancing their proposals.

There were mixed views on the reasons for implementing such a system. A small number of interviewees suggested that the Research Council’s “demand management” had encouraged this practice, whilst others think that it would have been implemented anyway.

Another example is encouraging attendance at conferences, which as well as a networking opportunity, is seen as an important forum for feedback.

Interviewees spoke about common or particularly challenging issues that researchers’ experience and that good mentoring and

appraisal can help address. This helped us identify the features of appraisal and mentoring which seem particularly important to get right; these are set out in the box on the following page below.

Unsurprisingly, the interviews highlighted that, in addition to careful consideration of the above factors, the success of mentoring and appraisal arrangements would often turn on the personalities and management skills of the individuals involved. With this in mind, departments consider what might make good mentor-mentee “matches” based on their experience and judgement. As discussed below, training is often given to those with these management responsibilities. Indeed, the PIRLS survey noted above shows that a significant proportion of Principal Investigators – around 2/5 – considered that they would benefit from additional training in this area.

**Figure 7: Would you benefit from more support/training/development?**



Source: PIRLS (2013)

Finally, specific goals “publish x papers by this point in time”, “bring in £x of funding” were generally not used explicitly, although more than one institution do set such specific goals for some members of staff.

### *Some key features of successful mentoring and appraisal arrangements*

#### *1. Striking the right balance between offering guidance and preserving researcher autonomy.*

Interviewees were careful to highlight that “mentoring” is not the same as “directing”. Generally, interviewees considered that directing researchers to pursue a particular topic / research question / research methodology is unlikely to promote research excellence, even if this is requested by a researcher. The reason interviewees gave for this is it can compromise a researcher’s sense of intellectual ownership and/or interest in work and, in doing so, can reduce commitment to it and productivity.

#### *2. Knowing when to encourage perseverance versus re-thinking.*

As noted above, interviewees said that an inherent quality of excellent researchers is perseverance. By its nature, some research does not yield useful insights or results, some research does not work as planned (e.g. experiments fail), and some research takes longer than anticipated. Interviewees said that, quite naturally, a researcher can become disheartened with his/her work. In these situations we were told that the mentor must know when to encourage a researcher to persevere versus suggesting he/she re-thinks the work. This can be challenging, particularly if the mentor is not sufficiently distant from the researcher’s work (which can be beneficial for other reasons, see below).

#### *3. Ensuring that appraisals are fact based.*

It was generally felt that appraisals should be grounded in fact, including information on grants won, paper citations, time spent on non-research activities (i.e. teaching and administration) and so on. Some institutions had invested in software tools to help appraisers gather and record this information efficiently. Views were mixed among those interviewees we spoke to with appraisal responsibilities: some could see the long-term benefit of such initiatives, but felt that it imposed a short-term burden as they had to invest time to learn the new systems.

#### *4. Allowing distance between the mentor and mentee in terms of field of research.*

Unsurprisingly, we were told that it is generally helpful for mentors to be familiar with their mentees field of research. But, at the same time, interviewees felt that it is best for the mentor and mentee not to be too close in terms of the exact topic under consideration, to avoid the possibility that the guidance would be unduly influenced by a mentor’s view of how things should be done.

#### *5. Managing “middle career” researchers.*

A number of interviewees raised the importance of how best to help so-called “middle career” researchers develop. There is not a clear definition of what a middle career researcher is. What we took from the interviews is that middle career researchers were (or had the potential to be) highly productive individuals that could go further, in some cases reaching “star” status. Indeed, they can represent “good value” to UK HEIs, since they are productive but do not attract the costs associated with recruiting stars. They sometimes present a development challenge because their progress can be slow relative to their expectations and this can become a frustration, particularly since the mentoring and appraisal “solutions” that can help early career researchers are no longer appropriate given their level of experience. A number of the institutions we spoke to think that they might be able to improve the support these individuals receive and, as part of this, whether more explicit “performance management” might be beneficial – such as setting more explicit targets.

### 3.3.3.2. Training

We briefly discussed training with interviewees.

Most interviewees mentioned formal training courses and workshops related to finding and winning research grants, i.e. those skills that early career researchers may not otherwise acquire through their day-to-day work.

Of course, “on-the-job” training was considered particularly important. Interviewees cited early exposure to management responsibilities as being important – for example, leading a small team on one element of a research project. This was seen as a “managed risk”, but a highly valuable one.

As mentioned in the recruitment section, interviewees believed that teaching could be taught, if the researcher didn’t already possess these skills. Along with this, there was a strong commitment to providing support and training to any relevant areas highlighted in a researcher’s annual appraisal or through their mentor.

### 3.3.3.3. Incentives

We discussed to what extent HEIs use “incentives” – rewards or penalties – to encourage research excellence. The incentives we had in mind could be financial or non-financial.

Interviewees often made three high-level points about incentives.

- » First, as noted above, researchers are generally highly self-motivated to produce excellent research. The implication is that any incentives created by the HEI could only ever “reinforce” behaviour that would otherwise emerge, rather than trigger behaviour from scratch. Researchers have an innate desire to conduct excellent research, and in a way compete with themselves to do the best.
- » Second, researchers are primarily motivated by long-term reputation / recognition of their work, rather than short-term financial rewards. No one mentioned the use of annual bonuses. The implication is that incentives used by institutions would tend to be focused on increasing the opportunities for a researcher to develop his/her reputation or recognise his/her performance in a way other than personal remuneration. Of course if researchers perform well, they may get promoted which comes with an associated pay rise.
- » Third, the above does not mean that remuneration is not important to individual

researchers or institutions. Rather it is a relatively “low power” or “blunt” form of incentive. (Many made the point, in any event, the UK could not compete with countries such as the US if salary were the primary driver of excellent research).

With these considerations in mind, HEIs use the following groups of incentives.

#### » **Increasing the amount of (continuous) research time available to researchers.**

This includes: reducing the teaching or admin responsibilities has; giving research leave; and organising the teaching or admin timetable in a way that teaching commitments are “loaded” into one term rather than spread over the year. Interviewees said that the continuity of research time as well as the amount, mattered. Fragmentation of research time created inefficiencies because of the need to start thought or other processes again. It is typical for institutions to reduce the teaching and administration responsibilities of junior researchers.

#### **Mixed views on whether teaching enhances or detracts from research**

We heard interesting points of view in relation to the interaction between research and teaching.

Interviewees considered that teaching time, though very important, displaced research time and so put pressure on research excellence.

Other interviewees considered that teaching, although displacing research time in the short-term, could enhance it in the long-term. They said that teaching undergraduate and postgraduate students positively contributed to research excellence by raising new ideas and challenging existing ones. A few researchers went so far as to say that the best researchers were also the best teachers.

- » **Increasing the amount of resources available to researchers.** This includes: redistributing resources, such as junior staff, lab time etc; providing funds to hire staff; and so on.
- » **Grant overhead return.** This involves a proportion of the part of a research grant that is allocated to the institution for overheads to be returned to the researcher. These extra funds can then be spent on, for example, going to conferences or starting a new project.

- » **Increasing internal recognition.** This can include anything from an email from a more senior member of the department or institution, to promotion. One institution we spoke to had introduced additional professorial positions to facilitate promotion-based recognition.
- » **Creating opportunities for personal development.** This includes facilitating and funding time overseas.

All interviewees discussed the use of rewards, rather than penalties.

#### 3.3.3.4. Research environment and culture

The final aspect of researcher development we discussed related to the environment and culture they worked in. We were interested in the “intangible” aspects of the working environment that contributed to research excellence, rather than the quality of the buildings, facilities and so on.

We heard the full spectrum of views here. All institutions considered that the working environment and culture was conducive to producing excellent research, but for different reasons. Two dimension of “culture” were raised: the extent of competitive pressure and the degree of internal hierarchy.

- » **Extent of competitive pressure.** Some institutions described the research environment as high pressured and competitive. Individuals were resolutely focused on producing excellent research and individuals would sometimes be explicitly or implicitly “pitched” against one another to encourage healthy competition. Other institutions described the environment as being highly collegiate, with little explicit or implicit competition between individuals within it – phrases such as “family atmosphere” were used to describe it. Others described the research environment as being “high pressured” and “relaxed” at the same time – relaxed in the sense that the departments or institution put little day-to-day pressure on individuals to produce research, but pressured in the sense that individuals were self-disciplined to achieve their own short-term research goals.
- » **Degree of internal hierarchy.** All institutions had a “formal” hierarchy, with varying degrees of steepness. As discussed elsewhere, the primary purpose of this is to help coordinate, reconcile competing demands for resources and provide leadership. But without exception, the researchers we spoke to considered that there was a flat “intellectual hierarchy”. That

is to say, that arguments (say in relation to a critical investment in a facility, key strategic collaborations with others) are assessed with respect to their merit, not with respect to the seniority of those who make them. One interviewee balanced this view by noting that one of the “perks” of seniority was that it became easier to be “heard” by decision makers. Further research could be undertaken to understand the views of researchers less senior than those we spoke to.

The type of culture in a department was typically, though not exclusively, attributed to the attitude and approach of the leaders within it.

#### *The pros and cons of internal growth and external recruitment*

Interviewees said that there were pros and cons of “growing a department from within” versus hiring researchers from another institution.

The pros associated with hiring researchers from another institution related to the different skills and capabilities that researchers from another institution bring, as well as their different opinions. Indeed, we were told that some departments actively look for post-docs outside of their PhD program for this reason.

The cons were associated with the time it took to reach a common understanding of what the research aims and culture of the department were. We were told that this could lead to (at least in the short-run) a loss of research productivity.

#### 3.3.4. Conclusion

The evidence from the existing literature and our interviews confirms that researcher development is a driver of research excellence and a source of competitive advantage. In particular, the formal and (perhaps more importantly) informal mentoring and appraisal arrangements, as well as institutional culture, are cited by HEIs as particularly important. Interviewees do, however, think that more can be done in this area, but were concerned that other increasing pressures (from admin and teaching) could divert from these efforts.

### 3.4. Collaborating with others

#### 3.4.1. Overview

Our research shows that collaboration is a driver of research excellence. Even where a specific research task is undertaken under a so-called “sole-researcher” model, collaboration with others is necessary.

A number of studies (from the academic and policy communities) consider the role of collaboration as a driver of research excellence. For example, the Wilson Review (2012) found that there has been a significant change in the quantity and quality of business-university collaboration over the past decade (since the Lambert Review), but that improvements are still needed for the UK to attain world leadership in business-university collaboration.

BIS (2013)<sup>24</sup> shows that the citation impact of collaboration increases with geographical extent. Compared to a single author paper, there is a positive impact on citations if the paper is co-authored within an institution, a greater impact if co-authored within a country, and an even greater impact if co-authored between countries.

In line with the focus on this study, we explored what “on-the-ground” collaborative activities in HEIs contribute to producing excellent research.

Of course, many “on-the-ground” activities happen within (and in response to) funding and other facilitating frameworks created by Government, the Funding Councils and others. For example, Government recognises the role of collaboration in achieving its policy aims.

*“A theme of collaboration runs throughout these allocations of science and research funding. In a period of constrained public finances, we will put increased emphasis on bringing people together to develop creative solutions. Researchers will have access to a wider range of facilities and equipment through a pooling of resources and expertise. This larger pool of capability will be crucial in building the reputation of UK science and research and attracting international investment and talent.”*

– BIS

But collaboration does not happen by accident: a need for collaboration must be identified, opportunities for collaborations explored and understood; agreements reached about the objectives and practicalities of the collaborations – such as the balance of responsibility between the partners; and so on. Again, what do HEIs do in practice to make sure that they collaborate in a way that contributes to research excellence?

Relatedly, HEIs will need to think carefully about striking the right balance between collaboration and competition. There need not be a tension between the two: two partners may bring different skills and capabilities to a collaboration that are necessary to achieve a common objective (and indeed competition could take place between multiple collaborations) – but it is likely that there will be grey areas – for example, where the output of a collaboration could contribute to one partner having a competitive advantage over another in future. What do HEIs do in practice to strike the right balance?

#### 3.4.2. Evidence from the existing literature

The existing literature highlights **collaborating with others as an important driver of research excellence**, as well as the different forms of collaboration.

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*A report by the World Bank (2009) suggests that a high concentration of talent and a critical mass is an important driver of research excellence, particularly in those disciplines which are resource-intensive or where physical proximity of others in their field is important.*<sup>25</sup>

*An article in Higher Education Policy (2012) summarises a series of papers presented at the 2010 conference “Organisation of Science Practices” in Trento. It argues that collaboration and competition are increasingly being seen both within and between research organisations, but that competition can sometimes hinder research productivity.*<sup>26</sup>

*Kenna and Berche (2011) investigated how the number of researchers in a group affects research quality and critical mass. By creating a model using data from the UK Research Assessment Exercise (RAE) 2008, they show that the primary driver of research quality is the quantity of researchers that an individual is able to communicate with. In doing so, they also find*

<sup>24</sup> BIS (2013), “Comparative Benchmarking of European and US Research Collaboration and Researcher Mobility”.

<sup>25</sup> The World Bank (2009), “The Challenge of Establishing World Class Universities”.

<sup>26</sup> Higher Education Policy (2012), “Collaboration and Competition in Research”.



*that the quality of management is a driver of research quality.<sup>27</sup>*

*As noted above, the study by Witte and Rogge (2010) found that higher research performance is achieved by those who, amongst other things, are affiliated with one or more other universities.<sup>28</sup>*

*Through informal semi-structured interviews with researchers from social science, humanities and laboratory science disciplines, Talja (2002) identified four forms of collaboration in information seeking and use: strategic sharing – a conscious strategy of maximising efficiency in a research group; paradigmatic sharing – a means of establishing a novel research approach; directive sharing – between teachers and students; and social sharing – a relationship and community building activity. They conclude that scholars' social networks are often the place where information is sought, interpreted, used, and created.<sup>29</sup>*

~

The literature also highlights that **collaboration between firms is an important driver of economic productivity**, under the right circumstances.

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*Delgado et al (2011) evaluated the role of regional cluster composition in the economic performance of industries, clusters and regions. They find that cluster-based agglomeration is an important driver of regional economic performance.<sup>30</sup>*

*Powell et al (1999) conduct a statistical analysis of over 400 firms in the biotechnology industry. They find that collaboration is a significant determinant of the competitive advantage of individual biotech firms and the performance of the industry as a whole. Their findings suggest that there are, however, limits to the learning that occurs through inter-organisational networks.<sup>31</sup>*

*Hamel et al (1989) studies collaboration between corporates, and specifically between western and Japanese companies. They find that a strategic alliance can strengthen both companies against outsiders even if it weakens*

<sup>27</sup> Kenna and Berche (2011), "Critical mass and the dependency of research quality on group size", *Scientometrics*.

<sup>28</sup> Witte and Rogge (2010), "To publish or not to publish? On the aggregation and drivers of research performance", *Scientometrics*.

<sup>29</sup> Talja (2002), "Information sharing in academic communities: Types and levels of collaboration in information seeking and use", *New Review of Information Behaviour Research*.

*one partner vis-à-vis the other. They identify three conditions under which mutual gain is possible: strategic goals align, whilst competitive goals diverge; size and market power of both partners is modest compared with industry leaders; and each partner believes that it can learn from the other and at the same time limit access to proprietary skills.<sup>32</sup>*

~

### 3.4.3. Evidence from the interviews

In line with previous studies, we were told that there is a spectrum of "collaboration" at play – from high-level strategic alliances with other institutions (of the type set out in the box below) to collaboration that happens on a "day-to-day" basis between individual researchers in the same HEI.

*"Collaborative research tends to be better research. If you are working with really smart people in related fields, you tend to be able to produce better research than if you're working on your own. In some fields it's necessary to even get over a starting line. In other fields, it's increasingly where you get the competitive advantage."*

– PVC of Research in a leading HEI

We were told that the high-level motivation for collaboration was almost always to facilitate research that could not be undertaken without it – or at least not in the same way. The interpretation of this does, however, vary from context to context. For example, we were told about collaborations:

- with a private sector company motivated by access to data, and to understand what is "on the mind" of the company (biotechnology);
- we were told of collaboration with another institution to allow for 24/7 computing time;

<sup>30</sup> Delgado et al (2011), "Clusters, convergence and economic performance".

<sup>31</sup> Powell et al (1999), "Network position and firm performance: organizational returns to collaboration in the biotechnology industry", *Research in the Sociology of Organizations*.

<sup>32</sup> Hamel et al (1989), "Collaborate with your competitors – and win", *Harvard Business Review*.

- we were told of a collaboration with another researcher as it would be enjoyable and encourage a spirit of challenging / reinforcing research ideas; and
- between departments, orchestrated by the personal research agenda of a charismatic researcher interested in solving a specific problem.

Collaborations can be formed between two types of individuals: those that are complementary and those that are substitutes. Partners who are substitutes bring with them a similar set of skills and the value is in the meeting of minds and sharing of ideas, or the need for a critical mass. Collaborations between complements allow different people bring different skills to the group, as is the case with interdisciplinary partnerships. The chart opposite demonstrates the proportion of collaborations which include both complements

and substitutes, and those which are purely complementary.

Figure 8: Mode of collaboration



Source: Interviews with HEIs

### ***Examples of high-level strategic collaborations***

#### **Monash-Warwick Alliance**

The Monash-Warwick Alliance was finalised in December 2011 and aims to create a new type of global university partnership. Both institutions emerged in the 60s and have since performed extremely well. They are now looking to this partnership as a way of continuing their rapid growth, to challenge older institutions and models, and take advantage of globalisation.

Specific areas have been identified that are best placed to take advantage of such a partnership. These are areas that are already performing well at both institutions, and are considered emerging on the world stage.

Joint appointments allow the two institutions to attract world-class individuals and offer them access to people, facilities and funding in two locations. For example, professors will have access to two pools of PhD students, allowing for a greater number of successful matches. They will also be able to apply for funding in the two separate locations, increasing the opportunities to conduct their desired research.

Professors will be primarily based at one of the universities, but will spend a significant time at the other. Positions will be mirrored to ensure that there is a balance of staff across both institutions.

#### **UEA and Norwich Research Park**

Norwich Research Park is a partnership between UEA, the Norfolk and Norwich University Hospital and four independent world-class research institutes: the John Innes Centre, the Institute of Food Research, The Genome Analysis Centre and The Sainsbury Laboratory.

The partnership allows academics from across the park to draw on each other's expertise and collaborate closely. Facilities are also shared across the park. If two institutions have the same machine, there are mechanisms in place to ensure that if one is busy the other one can be used.

This partnership is attractive to potential professors at UEA, and helps recruit and retain top talent.

#### **Rolls-Royce University Technology Centres**

Rolls-Royce has established a global network of University Technology Centres (UTCs), each of which addresses a key technology. These partnerships are funded by Rolls-Royce on a long-term strategic basis, as they keep Rolls-Royce directly connected to cutting edge academic research capability. They also provide access to skilled people and enable recruitment and retention of highly qualified and motivated staff.

Research projects are supported by direct company sponsorship, Research Councils (notably EPSRC in the UK) and international government agencies concerned with developing leading-edge science and technology.

Rolls-Royce has UTCs at many UK universities including Oxford, Cambridge and Manchester.

#### **Exeter and IBM**

IBM is one of the first University of Exeter Strategic Corporate Partners. Projects supported by the partnership include initiatives addressing water management, climate change, sustainability and health. Other areas of collaboration include smart metering, analytics and the management of big data.

"Solving global challenges is only possible through meaningful collaboration and I am delighted that we have been able to formalise our long term partnership with IBM today. Exeter already has excellent links with organisations such as the Met Office, and the potential for further collaboration will bring an added dimension to our work with IBM." - Professor Janice Kay, Deputy Vice-Chancellor (Education) for the University of Exeter.

#### **Regional Strategic Collaborations**

Universities often engage in regional collaborations with each other, for example: the N8 (the eight most research-intensive universities in the North of England); the M5 (a group of research-intensive universities in the Midlands); and the GW4 (four research-intensive universities in the South West and Wales). By working together and sharing resources, they aim to increase the opportunities available to themselves and maximise the impact of their research base.

*Source: collaborators' websites and press releases*

An important point emerging from our interviews was that the day-to-day collaborations can be as important as the high-level strategic alliances above. By day-to-day collaboration, we mean the informal conversations that take place around an HEI between researchers. This could be in a corridor, over a coffee, in a lab and so on. Indeed, some individuals suggested that co-location as well as the arrangement of the buildings, is a driver of research excellence

because of the importance of day-to-day collaboration.

The factors outlined in the box below were cited by interviewees as features of successful collaborations. Interviewees did not explicitly mention knowledge transfer offices, which is consistent with UK-IRC (2013)<sup>33</sup> which finds that the level of contact with knowledge transfer offices is lower among academics from top rated department.

### *Some key features of successful collaborations*

#### *1. Successful collaborations are often forged through personal contacts, developed early in careers and through networking occasions, such as conferences.*

Related to the point about day-to-day collaboration, a number of interviewees noted that the most successful collaborations that they had participated in were developed “from the ground up” rather than being a consequence of a university-wide strategic initiative. This success was attributed to the need for a successful collaboration to be built on trust and a strong understanding of what each partner wants to get out of the relationship. A number of interviewees suggested that sometimes relationships would be forged early in a career, but not used until later, given the pressure to publish single-author articles. This perhaps explains how any tension between “competition” and “collaboration” is managed.

#### *2. Larger scale successful collaborations are characterised by an environment of openness and leadership.*

We were told that it was critical, early on, to encourage those involved in the collaboration to be open about what they wanted, their expectations, concerns, and so on. One approach to this would be to have an early “facilitated” meeting, which a senior individual would chair and encourage a fruitful discussion.

#### *3. The potential for a long-term arrangement.*

We were told that this mattered for a variety of reasons. First, it encouraged each party to invest in the relationship and take it seriously. Second, it allowed for a “take it in turns approach” – a specific example of this is in relation to co-authorship – where one could resolve a “lead author” dilemma in such a manner.

A topic closely related to collaboration is critical mass. Our discussions also highlighted the important distinction between a “critical mass” necessary for undertaking a specific research task or project and a “critical mass” in a department or institution.

» *Critical mass for a specific research task or project.* We were told that many research teams in lab and non-lab settings were often relatively small – usually a number less than

10 and perhaps a figure between 3 to 7 is typical. Of course, teams are sometimes larger and smaller than this. Indeed, a number of interviewees mentioned that they had deliberately kept the research teams smaller than they could have been for three quality-related reasons: first, to retain control over the quality of research undertaken; second, to reduce the burden of management; third, to ensure that responsibility for delivery was clearly

<sup>33</sup> UK-IRC (2013), “The Dual Funding Structure for Research in the UK: Research Council and Funding

Council Allocation Methods and the Pathways to Impact of UK Academics”.

assigned. Relatedly, we were also told that smaller teams led to quicker and more efficient decision making.

- » *Critical mass in a department or institution.* Distinct from the critical mass for a specific research task or project, there was universal agreement that gathering together a “critical mass” of researchers in one place contributed to research excellence. There was a broad definition of “in one place”, which seemed to vary according to the circumstances faced by the interviewees. It could mean in the same region, the same city, or the same building. For example: one English language department attributed the success of another department to the fact that all of its staff could be housed under one roof; whereas researchers in Cambridge said that it was beneficial that they could reach London quickly to meet with colleagues. What mattered was sufficient opportunities to exchange ideas, challenge thinking and so on.

Of course the two forms of critical mass interact with each other – critical mass in a department or institution will contribute to the quality of a research task or project.

#### ***How collaboration and network effects can mitigate the threat of competition***

Many interviewees expressed the view that “success breeds success”. That is, we were often told that excellent researchers were attracted to institutions that contain excellent researchers, in part due to reputation benefits of being associated with such an institution, but also the greater opportunities for “day-to-day” collaboration.

This might be seen as a research version of a “network effect”. That is, the value of an institution for an individual researcher rises as the number of researchers in it increases.

Collaboration and network effects could mitigate the threat of competition to UK institutions – this is because, unless an institution can attract a significant number of researchers at once, the lesser opportunities for “day-to-day” collaboration may mean that it is not in the interest of any individual researcher to move.

masses” one for a specific research project (which may be relatively small) and a larger one for a department / institution.

#### **3.4.4. Conclusion**

The research shows that collaboration is a driver of research excellence, and suggests that the most successful collaborations are built “from the ground up” through personal relationships. There are two relevant “critical



### 3.5. Creating and implementing research strategies

#### 3.5.1. Overview

Through discussions with HEIs and reviewing publicly available information, our research shows that research strategies play a role in the production of excellent research. There were mixed views on the value of formulating and documenting such strategies, and those that were supportive were able to identify a number of benefits. PACEC (2014)<sup>34</sup>, commissioned by HEFCE, discusses strategies in more detail, but we present our findings here.

Within our discussions, our aim was to identify how research strategies are created, how they practically influence on-the-ground research, and what the benefits of having an identifiable strategy are.

A research strategy sets out a vision, and how it is planned to be achieved. We heard about both high-level institutional research strategies, and subject specific departmental strategies. The presence of an institutional research strategy, in many cases, informs and gives direction to departmental strategies.

Many of the institutions that we spoke to have publicly available research strategy documents, or discuss research explicitly in an overall strategy document. Each institution presents their strategy differently, but there are common themes running throughout all, as discussed below.

- » **Excellence.** Each institution aims to achieve research excellence through their strategy.
- » **People.** Institutions recognise that to achieve research excellence they need to attract and retain the very best people on an international scale.
- » **Impact and contribution.** Institutions want to conduct research that has an impact and contributes to society, both nationally and internationally.
- » **Collaboration.** Institutions recognise the value of collaboration. They encourage and foster research across disciplines, institutions, commercial sectors, and international borders.

The degree of specificity in the published research strategies varies between institutions.

For example, some institutions set loose goals that align with their vision e.g. “provide support to staff, especially when newly appointed, and offer an effective administrative support system”. Whilst others are set more measurable goals e.g. “complete Research Staff Handbook and monitor application through e-Prog”, and “undertake a professional marketing exercise to understand factors that attract postdocs”.

#### 3.5.2. Evidence from the existing literature

Although the existing literature relates to commercial entities, parallels can be drawn with the research sector. The literature recognises that **significant resource is invested in creating and developing high-level strategies, and that having an identifiable strategy can positively influence performance.**

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*Paroutis and Pettigrew (2007) investigates the practices of strategy teams in a FTSE-100 company to form a picture of what they do on a daily basis and how they interact with each other. The authors conducted 36 interviews with managers and developed case studies in conjunction with the firm to ensure accuracy. They identify three groups of activities that the strategy teams engage in. Firstly, activities conducted within a single strategy team, where knowledge is generated by the team members and the interactions between them. Secondly, activities involving more than one strategy team, relating to collaboration and coordination. The third area relates to changing the structural and organisational context within which strategy is conducted.*<sup>35</sup>

*Hendry and Kiel (2004) discuss two different roles that a board of directors could play in the development and implementation of a firm's strategy: strategic control and financial control. Strategic control involves the board exerting a continuous process of formal and informal influence over management. Financial control involves the board exerting influence over management at formal board meetings and only at the end of the resource allocation decision process. It also involves the board evaluating management primarily on the financial results of the firm.*<sup>36</sup>

*Bantel and Osborn (1995) uses empirical evidence to assess whether higher performing firms have identifiable strategies as opposed to*

<sup>34</sup> PACEC (2014), “The Impact of QR”.

<sup>35</sup> Paroutis and Pettigrew (2007), “Strategizing in the multi-business firm: strategy teams at multiple levels and over time”, *Human Relations*.

<sup>36</sup> Hendry and Kiel (2004), “The role of the board in firm strategy: integrating agency and organisational control perspectives”, *Corporate Governance*.

*pursuing an unidentifiable strategy, for example a firm that is 'stuck in the middle' as per Porter's definition. The authors surveyed the CEO and human resources vice-president at 200 Midwest banks, which allowed for the identification of 20 strategies. A combination of factor analysis and cluster analysis was then used to segment each bank into one of six strategy type groups – one of which had no identifiable strategy. In terms of the relationship between strategy and performance, the authors only found a positive relationship between measures of short-term performance, such as return to stockholders.<sup>37</sup>*

~

### 3.5.3. Evidence from the interviews

Bantel and Osborn find a positive relationship between having an identifiable strategy and some measures of performance. This is somewhat consistent with the mixed views that we received from interviewees. Some individuals told us that time is spent refining and updating their research strategy, and that it has a positive impact on the standard of research conducted in their institution. Others were more sceptical about the value of a specific research strategy.

*"Our research strategy has significantly contributed to our performance in recent years."*

*"I'm sure we do have a research strategy document. I'm sure it's relatively valueless. Research isn't about top down strategies, beyond the facilitation. It's very much an individual thing and people beyond specific research activities are there to make sure that the institutional structures and support is light enough on its feet to support real brilliance, real innovation, real outstanding excellence and novelty."*

– PVCs of Research in leading HEIs

#### 3.5.3.1. Creating a strategy

The process of creating an institutional level strategy is seen by most as a bottom-up process. That is, such a high-level vision and set of objectives is in effect the sum of strategies at grass roots. It was the view of a number of interviewees that this was the only

way that a strategy would be meaningful and maintain the autonomy of individual researchers. The practical process of creating such an institutional research strategy involves the input of the departments that sit below the overarching entity. These departments typically have research committees that input and review the institutional research strategy iteratively, until an agreed upon document is created.

*"Every department was, to a greater or lesser degree, all acting strategically. They couldn't necessarily point to a single document which was the strategy, something called 'Our Strategy'. But it was very apparent when they sat down and articulated what they believed about the research environment, what they thought the drivers of excellence were, why they were supporting their staff, the type of people they wanted to appoint, the type of facilities they needed, the types of collaboration etc."*

– PVC of Research in a leading HEI

A few respondents believed that an institutional-level research strategy was more top-down. They were of the view that it was the institution's role to guide departments and take a central management role.

The majority of individuals responsible for research in their department said that they had a specific research strategy, set out in a document. Some, however, took the view that simply 'excellence' was their strategy and decisions were made on a more ad hoc basis and judged on their merits with regard to excellence.

There were also mixed views on the impact an institutional strategy had on their departmental strategy. There were individuals who saw the higher-level strategy as guiding their own, whereas others saw little or no connection. If institutional strategies are built bottom-up though, departmental strategies would align with it by definition.

<sup>37</sup> Bantel and Osborn (1995), "The influence of performance, environment and size on the

identifiability of firm strategy", *British Journal of Management*.

### 3.5.3.2. Benefits of institutional research strategy

Despite the varying views of the value of institutional-level strategies, a number of benefits were highlighted to us:

- » *Recruitment.* A documented institutional-level research strategy can signal to potential staff the ambition and professionalism of the institution. A document detailing the vision of the institution and how it aims to achieve their goals can give a sense of the organisation that cannot be attained from speaking to a select few people in the recruitment process.
- » *Sharing best practice.* The process of creating an institution-wide research strategy can provide a mechanism through which departments can learn and exchange views about research excellence.
- » *Resource allocation.* A research strategy sets out the institution's priorities and objectives which can be used as a basis for making resource allocation decisions. With an agreed upon set of goals, making decisions between competing resource requests can be made simpler and more transparent.
- » *Guidance.* An institution-level research strategy can be used by departments as a basis to create their own written document.

### 3.5.3.3. Departmental strategies

Whether departmental research strategies are specifically documented or not, the main way in which they can influence research is through the identification and subsequent focus on specific areas. The degree to which 'cherry-picking' takes place varies by department. Some are actively and constantly looking for the new and interesting areas in which their department could expand into, and others take a more passive approach. The process of identifying these 'up-and-coming', or strategically important areas, typically involves the departmental research committee. As these committees are made up of active researchers in the wider field, they are best placed to identify these new academic avenues to pursue.

The individuals we spoke to described two ways in which the identification of specific areas practically influences the research output of the department.

- » *Hiring.* If an area of interest is identified and the skills or experience are not already present in the department, relevant individuals are hired. This aligns closely with the 'strategic hiring' trigger discussed previously.

- » *Internal funding.* Departments can also make seed funds available for research in particular areas, or given a set of research proposals choose the one which aligns with their strategy.

Along with identifying areas to develop into, departmental research strategy can influence research in other ways. Interviewees often described funds being made available for interdisciplinary research – which as discussed earlier, is a common institutional level strategy. Strategies can also be formulated with regard to the development and motivation of individual researchers, for example standard approaches to reduced loads for early career researchers and the amount of research leave that can be applied for.

#### ***Similarities between the views on research strategy and governance arrangements***

Similar to the views we received on institutional strategy, the opinions on governance and specifically the degree of centralisation were mixed. Indeed, we visited both institutions that would consider themselves relatively centralised and those that consider themselves as very devolved. Centralised institutions spoke of their ability to act as a large entity, enabling collaborations and allocating funds. Devolved institutions spoke of the freedom and ability to make decisions. All institutions we spoke to are highly successful, and as such both governance models are capable of producing excellent research.

### 3.5.4. Conclusion

Whilst most of the institutions that we spoke to have publicly available research strategies, we received varying views as to the value of such a document. Most decisions that influence research directly are made at the lowest effective level, however there are clear benefits to having a documented research strategy that is built bottom-up.

### 3.6. Securing a mix of funding

#### 3.6.1. Overview

The focus of this study is not on the funding of research in the UK, in particular, we abstract from the *level* of funding. However, interviewees raised a number of points related to the *organisation* and *mix* of funding which they considered relevant to this study and which we outline below.

The UK operates a dual funding system for publicly funded research in order to direct funds towards those projects and individuals who are most likely to produce excellent research. HEIs receive funds from a Higher Education Funding Body (e.g. HEFCE) and from Research Councils (e.g. BBSRC, EPSRC and MRC). Funding councils allocate money based on research produced in a previous period and Research Councils allocate funds on a project by project basis, providing grants to undertake a particular piece of research.

HEIs also receive substantial funding from charities, for example the Wellcome Trust, businesses, and philanthropists.

#### 3.6.2. Evidence from the existing literature

The existing literature explores the pros and cons of different funding mechanisms, makes international comparisons and suggests that **a greater mix of funding sources allows institutions to be more flexible and adjust to changing environments.**

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*OECD (2011) discusses publicly funded research and the pros and cons of the different funding mechanisms. Institutional block funding provides research organisations with a stable basis for research activities. This can help them to acquire funding from other sources, provides them with a certain degree of autonomy in the selection of their research, and allows them to build up expertise in new fields. Conversely, a surplus of block funding may de-incentivise organisations and researchers to look for funding from other sources. Project based funding gives funding organisations more control over research. Increasing the share of project funding can be used to make research organisations more responsive to socio-economic needs as these considerations can play an important role in funding decisions.<sup>38</sup>*

<sup>38</sup> OECD (2011), "Issue Brief: Public Sector Research Funding".

<sup>39</sup> 1994 Group (2011), "Mapping research excellence: exploring the links between research excellence and research funding policy".

*1994 Group (2011) explores patterns of national research excellence in a selection of the world's top performing countries: the UK; the USA; China; Japan; Australia; and Germany. It focuses on the funding priorities and mechanisms used by different countries. It notes that the UK takes a widely distributive approach to funding with resources provided across all disciplines, whereas other countries such as China have a particular focus on applied, rather than basic research.<sup>39</sup>*

*Institute for Prospective Technological Studies (2011) looks at the funding EU research institutions receive and how the level of financial autonomy affects the diversification of their budget and the amount of competitive funding they receive. The study covers 200 research-active universities from 33 European Research Area (ERA) countries. The more autonomous a university is, then it should, in principle, be able to better compete in obtaining funds from different sources, such as competitive funds, contracts with private companies, and donations from the non-profit sector. This could make institutions less dependent on one single stream of income and more able to adapt to a changing environment.<sup>40</sup>*

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#### 3.6.3. Evidence from the interviews

Interviewees made a number of observations about the organisation and mix of funding. Specifically, we were told that institutions actively sought to diversify their mix of funding. For example, one incoming Head of School said that one of his objectives was to increase funding from philanthropists.

There were three main motivations for this.

- » The first was to reduce the dependency that an institution has on any given source of funding, in case its ability to get it falls in future.
- » The second was to increase the flexibility with which research could be undertaken. We were told that different funds attract different terms and conditions for their use. For example, interviewees said that Research Council funds had more restrictive requirements attached to them than funds given by companies. The requirements mentioned were related to: the (increasing) size of research project that had to be bid for; the stages at which funds had to be

<sup>40</sup> Joint Research Centre – Institute for Prospective Technological Studies (2011), "European university funding and financial autonomy".

spent; the flexibility around delivery timescales; and the qualifications of staff that could be used to undertake work on the project. The view was that these requirements have a bearing on how research is undertaken. Interviewees made similar observations in relation to the funding of capital projects.

- » The third was associated with the individual and institution wide “signalling benefit” associated with different types of funding. For example, grant funding won after a peer reviewed process was seen as a broader marker of credibility. A fellowship from a respected organisation (such as the Wellcome Trust) was seen as endorsement of an individual’s capability.

With this in mind, the HEIs raised a number of actual or potential challenges:

- the restrictions that come with Research Council funds noted above, including an actual or perceived tendency for Research Council grants to be biased towards larger projects;
- whether UK institutions were as good as they could be in advertising their skills and capabilities to attract international funding; and
- the availability of funding for PhD students.

#### 3.6.4. Conclusion

Both the existing literature and evidence from our interviews highlights the benefits of a mix of funding sources. Receiving funds from a variety of sources allows institutions to be more flexible in the projects they undertake and how they conduct them.

#### *How funding facilities affects research excellence*

Facilities were discussed in two contexts with interviewees. The first was in terms of specialist equipment such as labs or machinery. Subjects such as engineering and physics could not take place without highly specialised equipment, which often requires considerable funds. Subjects such as history and English literature also require specialist facilities – in terms of libraries. One interviewee noted that there was considerable value in there being a copyright library only a short walk from their office. All respondents that highlighted the importance of libraries discussed the concentration in London, and the ‘pull’ that this creates.

For most subject areas, some form of specialist equipment is a prerequisite for producing excellent research. The cost of ensuring access to the required facilities varies hugely depending on the subject area, but the overall consensus among interviewees was that the existing specialist facilities were adequate. Researchers will always welcome more specialist equipment, but the present level of access is not fundamentally holding them back.

The second context facilities were discussed in was related to the estate – the buildings, along with the location of offices. As discussed earlier, collaborations can be formed through informal meetings in corridors. One interviewee told us that people from different departments were located in the same building in order to facilitate interdisciplinary connections. Buildings should also have adequate communal areas in which people can meet and interact with others.

Interviewees expressed the view that periodic and unpredictable allowances for capital funding unduly restricted the type of investments that were made and introduced difficulties in planning for the future.



### 3.7. Competitive pressure

#### 3.7.1. Overview

In line with the objectives of this study, this section focuses on the “on-the-ground” activities in HEIs which contribute to producing excellent research in the UK.

It is, however, important to recognise that many of the “on-the-ground” activities considered in the rest of this section are influenced by the actions of others – external drivers. One example of this is the organisation of dual research funding in the UK, which encourages a form of quality-based competition and clearly contrasts with other ways of distributing funds that would not create the same incentives.

Indeed, one of the external drivers that interviewees frequently mentioned was the competitive pressures.

#### 3.7.2. Evidence from the existing literature

The existing literature, relating specifically to competition in the publicly funded research sector, identifies various forms of competition and discusses the relationship with research performance – which can be both positive and negative.

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*Higher Education Policy (2012) discusses the relationship between collaboration and competition in research. It highlights various forms of competition that can take place within the research sector, namely competition for employment, rankings and funding. It notes that competition can sometimes create adverse incentives. One case study reports that interviewed postdocs are strongly steered by the assumption that tenure depends on the number of own publications, and therefore they prefer single authored publications above co-authored ones. This creates the disincentive to form potentially valuable collaborations.*

*1994 Group (2011) explores patterns of national research excellence in a selection of the world's top performing countries. It notes that the World Bank has linked a competitive environment with research performance, citing “the absolute lack of competition among universities” in Germany as having held them back. In more recent years Germany, along with Japan and China, have moved away from non-competitive block funding to more competitive systems for allocating funds.*

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#### 3.7.3. Evidence from the interviews

Our discussions highlighted that there were at least four relevant interrelated “competitions”, with varying geographic scopes.

» **A competition to attract researchers** – this was typically seen as a competition with other HEIs in the UK and internationally to attract talent. However, some interviewees also mentioned a “regional” scope to competition – potentially recognising that, at least in the short-term, researchers might seek new jobs in institutions close to where they live.

» **A competition to attract funding** – this is primarily seen as a competition with other UK HEIs, particularly those in the Russell Group. A few interviewees mentioned competing with other European institutions to attract European Commission funding.

» **A competition to create excellent research** – this is seen as a competition with an individual's own previous work and other key individuals / teams in the same field of research, and is, to some extent, independent of their geographic location.

» **A competition for internal funds and resources** – this is seen as a competition with others within an HEI. The competition is used as a means to allocate scarce internal resources (echoing the approach to dual funding).

In general, we heard that the HEIs and individual researchers within them were highly competitive and that competition contributed to research excellence.

There were differences between disciplines in terms of their views, although they were not systematic: namely, science-related disciplines sometimes placed greater emphasis on competition than humanities-related disciplines – particularly in terms of attracting funding. One possible explanation for this is that the level of funding required to undertake research in humanities-related disciplines is typically lower than that required for the sciences.

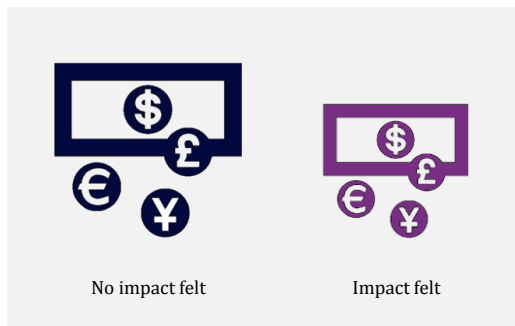
We discussed with individuals specifically which other institutions they saw as their competition. Difference arose in terms of the different types of competition outlined above, but institutions tended to compare themselves to others locally. For example, London-based institutions most commonly referred to others in London, and those with regional alliances, such as the Eastern ARC (the University of East Anglia, the University of Essex and the University of Kent), referred to each other.

*“For pretty much every university in the UK, it is beneficial for us if they are thriving and developing; and that is true of every other university. It is a symbiotic relationship. Whereas, a standard competitive one, you want to stamp on the competition.”*

**- PVC of Research in a leading HEI**

In terms of new competition from abroad, for example from China, interviewees saw countries that are significantly increasing their spend as potential collaborators, rather than competitors. Most interviewees reported that they haven't seen much talent move to these countries, but that their presence will increase over the next decade. Whether the positive view that they present increased opportunities for collaboration will persist over time will be seen in due course.

**Figure 9: Impact of international competition**



*Source: Interviews with HEIs*

Of course, the organisation of funding and other competitive pressures does not mean that an HEI will compete. For this to happen, the incentives created by the competition have to trickle through the different parts of an HEI. This does not happen by accident and so the decisions made in different parts of an HEI will determine: how well they compete for funds; the overall intensity of competition for those funds; and, therefore, the contribution the organisation of funding makes to research excellence.

The quality of these decisions will relate to the activities set out above. Here we note two activities we were told about that are particularly closely related to competition and that contribute to research excellence.

- » **Benchmarking** – HEIs benchmark themselves against other universities in the UK and internationally. Peer groups, such as

the Russell Group, are used. This benchmarking often takes the form of gathering information on citations etc. But can also be gathered from informal discussions between the senior management of an institution and researchers.

- » **Learning** – researchers would learn “best practice” from being seconded to other universities, or through the type of collaborations outlined above. A number of institutions told us that they have been to visit institutions abroad to learn about their institutional practices. Although they consider each other competitors, they are happy to share information with each other as they see it as a win-win action. However, one interviewee told us that they would not consider doing this with other UK institutions because the competition is more direct due to the funding mechanism.



## 4. Key findings, conclusions and further research

This section sets out the key findings and conclusions of our work, as well as areas for further research.

#### 4.1. Summary of key findings

The primary objective of this study is to understand the practical things that UK HEIs do with the resources they have to help create excellent research.

Our research highlights that the activities of recruiting, developing and motivating people are significant drivers of research excellence.

- » In relation to **recruitment**, we found that careful consideration is given to: the need to hire a researcher, advertising for a researcher, evaluating potential candidates, making offers and integrating new researchers. Identifying the right recruitment need and matching individuals to that need are, unsurprisingly, seen as particularly important parts of the process and significant time and effort are invested to get them right. Researchers felt that the focus on “impact” is distorting, or could distort, recruitment decisions in favour of researchers (and research) that can be shown to have an impact sooner, and away from “blue-skies” research that could create a larger impact later. Some researchers also felt that time and effort associated with recruiting individuals that need a visa to work in the UK prevented the UK from attracting the best.
- » We also found that HEIs considered **mentoring and appraisal** to be central parts of bringing on researchers. Most of the HEIs we spoke to have formal (and separate) mentoring and appraisal processes, although those individuals with such responsibilities felt that more time could be invested in them. The evidence suggests that a lack of recognition for these efforts, as well as a lack of time, could explain why more time is not invested in them. That said, many considered that informal feedback – the day-to-day conversations that take place in and around research work – were as important as the formal mentoring and appraisal processes. A number of interviewees considered successfully bringing on “middle-career” researchers as a particular challenge.

Other activities also contributed to research excellence.

- » **Collaboration** was cited as a key feature of research excellence in the institutions we interviewed. Perhaps the main finding from this study is, like mentoring and appraisal, day-to-day collaboration and individual partnerships, which are often forged early in researchers’ careers, were often cited by researchers as the most significant to their work. By their nature, it is easier within

these partnerships to develop a common understanding of the purpose of the collaboration and trust, compared to larger scale initiatives. Relatedly, we found “critical mass” to be important, consistent with previous studies. We found two “types” of critical mass: the critical mass to undertake a given research task or project – which was typically smaller than a more general “critical mass” of researchers in a department or institution.

- » Most institutions we spoke to have an institution-level **research strategy** – a document which captured their research vision and goals. We heard mixed views as to the impact of creating and implementing research strategies. Some felt that the gap between the strategy and the specifics of research in any given discipline meant that such a document could only be of limited use. Others though saw the process of creating a research strategy as important as the outcome – for example, facilitating the sharing of best practice between departments.
- » Securing a **mix of funding** is seen as important, primarily because of the different research activities different funding allows an institution to undertake and the different restrictions different sources have. For example, a number of interviewees considered Research Council grants to be more restrictive than some private sector funding.
- » Finally, although there is a high degree of **competition** in the research sector, institutions see the increase in spend in foreign countries, such as China, as an opportunity for collaboration, rather than a threat.

#### 4.2. Conclusions

##### 4.2.1. Conclusions relating to the drivers of research excellence

We draw the following conclusions from this study.

- » First, supporting excellence in recruiting, developing and motivating people will contribute to research excellence and productivity. One example of such support is The Concordat to Support the Career Development of Researchers and the associated monitoring activities through the Principal Investigators and Research Leaders Survey (PIRLS) and the Careers in Research Online Survey (CROS). Another form of



support could include collating and disseminating examples of best practice from other HEIs and from industry. This could help, for example, to contribute to the “middle-career” researcher challenge.

- » Second, relatedly, impediments to these activities will impede research excellence and productivity.
  - One potential impediment is a possible lack of recognition for undertaking activities associated with developing and motivating people. Increasing recognition could help increase researchers’ willingness to do them within the limited time they have and so contribute to research excellence and productivity in the longer-term. In particular, individual and external recognition, which has currency beyond a researcher’s current department or institution, would seem to be important and may call for institution-wide initiatives. This could be a natural development of the “HR Excellence in Research Award”.
  - Another potential impediment to recruitment is the actual or expected time and effort associated with recruiting individuals that need a visa to work in the UK.
- » Third, efforts to facilitate day-to-day collaboration, particularly early in a researcher’s career is likely to contribute to research excellence, and help support larger scale collaborative initiatives. For example, BIS might be in a good position to bring new researchers in academia and industry together through a common forum.
- » Fourth, although the scope of our study has not focused on funding, it indicates that the terms on which funding is made available has a bearing on what/how research is undertaken. Although differences between funding sources in relation to the terms on which funding is made available is not unusual and may be entirely appropriate, this study suggests that better understanding the differences between funding sources, and what works and what doesn’t could further ensure that the limited funds are invested in the right way.

#### 4.2.2. Conclusions relating to the UK’s competitive position

Based on our findings, and in line with previous research, this study suggests that the UK is well positioned to remain a research leader and its competitive position is unlikely to be undermined in the short-term. In the long-run, the UK’s position will depend on relative

funding levels, and the ability and speed at which other countries can gain a competitive advantage.

One way in which competitive advantage can be gained, or at least the advantage of another reduced, is through mimicking their actions. Such a strategy involves multiple stages. Firstly, one would need to identify others that had a competitive advantage. In the context of the research sector, those that have a competitive advantage, or are at least benefitting from a previous competitive advantage, are easily identified through international league tables and through the research they are publishing. The benefits of a competitive advantage may however take a long time to be realised, and therefore identification of who has a competitive advantage at that point of time be more complex.

Secondly, the identification of the competitive advantage itself would need to take place. As this study shows, the determinants of research excellence are complex and practices vary considerably.

Once a competitive advantage has been identified, the appropriate resources are needed to replicate it. Funding allows for the appropriation of certain resources, however people and reputation cannot easily be bought.

Along with mimicking, institutions and nations can also develop their own competitive advantages, although this tends to take time. Developing ‘home grown’ researchers and individuals to run institutions naturally depends on how individuals learn. We therefore conclude that any changes in relative national performance will be gradual, and take place over years. The degree to which rankings change will depend on funding, and most importantly people.

### 4.3. Potential areas for further research

BIS asked us to suggest various areas for further research. As an exploratory project, almost all of the topics could be studied in further detail. But, in line with the conclusions set out above, our ideas for immediate fruitful research are as follows.

#### 4.3.1. Recruitment practices

**Immigration.** This study suggests that matters relating to immigration could be preventing HEIs from recruiting the best researchers. Further research could explore this hypothesis further. It could involve developing information on how inflows into the UK have changed over time, and case studies around



how the time and effort associated with recruiting individuals from outside of the European Union may have recruitment decisions. Attaining visas is often seen as causing friction in the recruitment process and further research could investigate where the issues lie. For example, the extent to which perceptions of the system limit individuals considering a UK post.

#### 4.3.2. Developing and motivating researchers

**Middle-career researchers.** This study suggests that UK research productivity could increase if HEIs could help middle-career researchers progress faster. Further research could help define and scale this challenge better and, perhaps, indicate the type of help that works – in other HEIs or in research-driven industries.

**Impact of mentoring and appraisal.** This study suggests that good informal and formal mentoring and appraisal arrangements enhance research productivity. Further research could seek to validate this finding. For example, by correlating the results of PIRLS and CROS with the results of the REF exercise or other bibliometric data. A similar exercise might be undertaken to understand how staff turnover is correlated with mentoring and appraisal performance.

#### 4.3.3. Collaborating with others

**Opportunities to forge early-career relationships.** This study suggests that opportunities to forge early-career relationships creates collaboration opportunities later. Further research could be undertaken to understand whether more could be done by Government or HEIs to facilitate early-career relationships.

#### 4.3.4. Creating and implementing research strategies

**Measures of success.** This study suggests that research strategies can influence research productivity. Further research could be undertaken to understand how HEIs (and potentially firms) measure whether different aspects of their strategy have been successful and consider whether this should influence the information that is gathered to benchmark the HEIs in the UK against other countries.

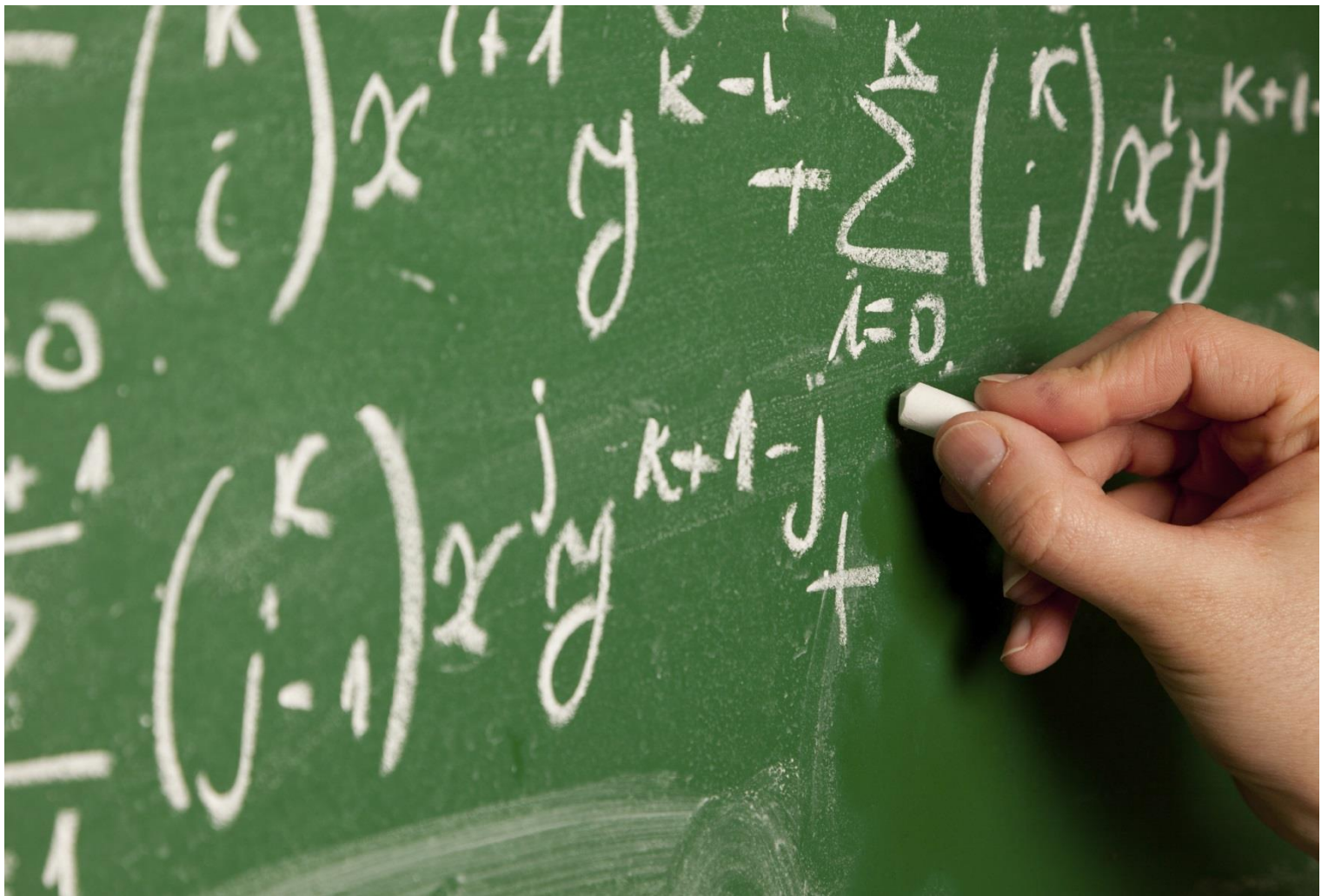
#### 4.3.5. Securing a mix of funding

**Terms attached to funding sources.** This study suggests that the terms attached to different funding sources has a bearing on research excellence. Further research could seek to better understand: what the differences

between funding are, why they exist and the effects they have on research “on-the-ground”.

#### 4.3.6. Competitive pressure

**Salary benchmarking.** This study suggests that researcher salaries in the UK are lower than in the US and other countries. Further research could be undertaken to understand the scale of the differential today and the potential risk of it widening. For example, one could undertake a choice exercise with researchers to understand the extent to which salary is “traded-off” against other factors (such as institution reputation).



## Annexes

## Annex A – Summaries of Existing Literature Reviewed

This annex presents short summaries of each of the papers that we reviewed in full. Each paper is set out on a separate page, and a list of each provided below.

- 1994 Group, 2011, Mapping Research Excellence: exploring the links between research excellence and research funding policy
- Ackers and Gill, 2008, Attracting and Retaining ‘Early Career’ Researchers in English Higher Education Institutions, *Innovation: The European Journal of Social Science Research*
- Antikainen and Väättäjä, 2010, Rewarding in open innovation communities – how to motivate members, *International Journal of Entrepreneurship and Innovation Management*
- Bagdonienė, Kazakevičiūtė and Žilionė, 2012, Innovativeness of knowledge intensive business services as a factor for productivity
- Bantel and Osborn, 1995, The Influence of Performance, Environment and Size on the Identifiability of Firm Strategy, *British Journal of Management*
- Chandler et al. , 2009, Motivation, money and respect: A mixed-method study of Tanzanian non-physician clinicians, *Social Science & Medicine*
- Cherchye and Abeele, 2005, On research efficiency. A micro-analysis of Dutch university research in Economics and Business Management, *Research Policy*
- Delgado, Porter and Stern, 2011, Clusters, Convergence, and Economic Performance,
- Dunar and Lewis, 1998, Determinants of Research Productivity in Higher Education, *Research in Higher Education*
- Earle, 2003, Building a workplace of choice: Using the work environment to attract and retain top talent, *Journal of Facilities Management*
- Forman and Markus, 2005, Research on Collaboration, Business Communication, and Technology: Reflections on an Interdisciplinary Academic Collaboration, *Journal of Business Communication*
- Gonzalez-Brambila and Veloso, 2007, The determinants of research output and impact: A study of Mexican researchers, *Research Policy*
- Hamel, Doz and Prahalad, 1989, Collaborate with Your Competitors – and Win, *Harvard Business Review*
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- Harvey, 2002, The Determinants of Research Group Performance: Towards Mode 2, *Journal of Management Studies*
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- Hiltrop, 1999, The Quest for the Best: Human Resource Practices to Attract and Retain Talent, *European Management Journal*
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- Lambert, 2003, Lambert Review of Business-University Collaboration
- Lindner, 1998, Understanding Employee Motivation, *The Journal of Extension*
- OECD, 2011, Issue Brief: Public Sector Research Funding

- Paroutis and Pettigrew, 2007, Strategizing in the multi-business firm: Strategy teams at multiple levels and over time, *Human Relations*
- Pelz, 1956, Some Social Factors Related to Performance in a Research Organisation, *Administrative Science Quarterly*
- Powell, Koput, Smith-Doerr and Owen-Smith, 1999, Network Position and Firm Performance: Organizational Returns to Collaboration in the Biotechnology Industry, *Research in the Sociology of Organizations*
- Ramesh and Singh, 1998, Determinants of Research Productivity, *Scientometrics*
- Rothaermel, 2008, Competitive Advantage in Technology Intensive Industries, *Technological Innovation: Generating Economic Results Advances in the Study of Entrepreneurship, Innovation and Economic Growth*
- Russell Group, 2012, *Jewels in the crown: The importance and characteristics of the UK's world-class universities*
- Russell Group, *The concentration of research funding in the UK: driving excellence and competing globally*
- Snyder et al, 1991, *Factors Contributing to Research Excellence*, Human Sciences Press
- Talja, 2002, Information sharing in academic communities: Types and levels of collaboration in information seeking and use, *New Review of Information Behaviour Research*
- West, Smith, Feng and Lawthom, 1998, Research excellence and departmental climate in British universities, *Journal of Occupational and Organisational Psychology*
- Wilson, 2012, *A Review of Business–University Collaboration (Wilson Review)*
- Witte and Rogge, 2010, To publish or not to publish? On the aggregation and drivers of research performance, *Scientometrics*
- The World Bank, 2009, *The Challenge of Establishing World Class Universities*
- Zakić, Jovanović and Stamatović, 2008, External and Internal Factors Affecting the Product and Business Process Innovation, *Economics and Organisation*

<b>Title:</b> Mapping Research Excellence: exploring the links between research excellence and research funding policy
<b>Author(s):</b> 1994 Group
<b>Date:</b> 2011
<b>Journal:</b> -
<p><b>Drivers identified:</b></p> <ul style="list-style-type: none"> <li>• Government funding and support</li> <li>• Distribution policies targeting appropriate disciplines</li> <li>• Continued investment</li> <li>• Funding that rewards excellence</li> </ul>
<p><b>Synopsis:</b></p> <p>This report explores patterns of national research excellence in a selection of the world's top performing countries, the UK, the USA, China, Japan, Australia and Germany. It focuses on the funding priorities and mechanisms used by different countries.</p>
<p><b>Main arguments / ideas:</b></p> <p>They identify a number of factors that can affect national research performance:</p> <ul style="list-style-type: none"> <li>• an underlying core of Government funded research and support for higher education;</li> <li>• higher education policies for distributing funding to disciplines and targeting those disciplines appropriate to the country;</li> <li>• continuing investment to support growth; and</li> <li>• a competitive research funding environment which rewards excellence wherever it is found.</li> </ul> <p>The UK has a widely distributive approach to funding research in higher education, with resources provided across all disciplines. This is reflected in the finding that UK research excellence is located within all disciplines. A similar pattern is found in the USA, but is not replicated elsewhere. Australia's research excellence profile demonstrates the effects of a tightly targeted funding policy, mirroring research themes identified nationally. Interestingly, China, which is competing with the USA in size of research output, so far dominates in areas of research excellence which would seem to complement rather than challenge the USA. The USA has a special focus on medical sciences whereas China's competencies are less developed in this discipline. However, this may change in the future, with health identified as one of China's research priorities.</p> <p>Germany has a lower level of competency productivity, but this may be because it is investing in expanding its provision of current areas of research excellence. It may be that certain disciplines have a greater ability to evolve into new discipline areas and therefore have a greater potential to produce new research competencies.</p> <p>China's rapid period of expansion in research and development would seem to have had positive results in research excellence with competencies thriving. However, Chinese success is not guaranteed. There may be drawbacks in the future if 'the academic culture that demands quick results hampers innovative and long term research efforts' (World Bank, 2009, The challenge of establishing world-class universities, p59). China's investment in research and development has concentrated upon applied rather than basic research which may affect China's future success. UNESCO reports that the majority of GERD in China is spent on experimental development with an estimated 5% on basic research. Whilst China is currently performing well and is expanding its research excellence, sustainability issues may emerge.</p> <p>The World Bank has linked a competitive environment with research performance, citing 'the 'absolute lack of competition among universities' in Germany as holding back the performance of its universities. In recent years German funding policy has moved away from the tradition of non-competitive block grant funding by supplementing this with additional funds under the Germany Excellence Initiative in a conscious approach to differentiate its universities. Although targeted allocations under this scheme are based on competition we are yet to see whether long term funding schemes of this nature will produce the necessary competitive environment or whether the scheme will simply concentrate resource without enhancing competition. The same principles can be applied</p>



to Japan and China. Although these countries select institutions to receive concentrated funding through competitive measures these long term competitions and mechanisms may not have the same effect of establishing a natural level of concentration as the policies in the UK, the USA and Australia can be seen to have done.

A competitive funding environment would seem to be linked to successful research intensive institutions by allowing funds to concentrate responsively to institutional excellence. The success of competitive funding policies will depend upon the unique situation within each country and the methods and types of funding used.

Japan has moved to a more competitive system of higher education funding in a period of substantial change in the structure of Japanese higher education. Japanese higher education institutions have been semi-privatised and given higher levels of financial autonomy with the intention of replicating the competitive grant system in the USA. This has been coupled with a decline in Government support. Rather than the greater industry-university collaboration this was intended to foster, it is reported that in fact many national university corporations are now facing financial difficulties, as only a select number of institutions have been able to benefit from more competitive funding arrangements. It is understood that the Japanese Government is now reconsidering the balance between regular and competitive funding. The more competitive system may have been implemented too quickly to allow the sector to respond and for funding to concentrate at a natural level. UNESCO also argues that such policy changes need to be matched to the culture of academe in the country: 'the Government's policy of focusing investment on the nation's top universities may have improved their performance but, at the same time, damaged the research and development capacities of other universities, thereby destroying the domestic networks of researchers along with the diverse capabilities and approaches these have to offer'.

The low presence of social science competencies in Japan, China and Germany may be in part attributable to the role of language. The UK has the benefit of publishing in English, therefore increasing accessibility to articles globally.

**Evidence / data sources:**

The paper draws on a number of different reports and uses Elsevier's measure of excellence.

<b>Title:</b> Attracting and Retaining ‘Early Career’ Researchers in English Higher Education Institutions
<b>Author(s):</b> Ackers and Gill
<b>Date:</b> 2008
<b>Journal:</b> Innovation: The European Journal of Social Science Research
<b>Drivers identified:</b> (a) N/A
<b>Synopsis:</b> This paper discusses the attraction and retention of early career researchers in UK institutions. They discuss mass expansion, an ageing academic demographic, women failing to progress equally, and an increasingly international research labour market.
<b>Main arguments / ideas:</b> The evidence suggests that skills shortages in some disciplines are exacerbated by overall increasing demand (expansion) and demographic trends (retirement). Skills shortages are not evenly distributed but impact differentially at regional and institutional level. These shortages appear to be concentrated in certain disciplines – particularly those that have competitive alternative career paths for graduates. There is evidence of limited progression within the UK system from school through undergraduate study, and continuation rates into research careers are also differentiated. In particular, the very significant flows of girls and young women progressing at a higher rate than their male peers into UK undergraduate study and generally outperforming them during these early careers represents a key but largely untapped source of academic labour. At the present time, the impact of these trends is being significantly mitigated by the recruitment of staff from abroad, especially of early career researchers. International recruitment is absolutely critical to the stability of the system at the present time. Policy should be consistent in promoting a sustainable academic labour force for the future through two balanced approaches: first, developing an adequate and well-trained national supply of graduates; and, second, attracting strong overseas candidates by creating competitive positions, and career paths, comparable to or better than those available in other countries.
<b>Evidence / data sources:</b> This article examines a combination of sources: interviews with key informants; reviews of 15 university human resource strategies; literature reviews; and Higher Education Statistics Agency (HESA) data.

<b>Title:</b> Rewarding in open innovation communities – how to motivate members
<b>Author(s):</b> Antikainen and Väättäjä
<b>Date:</b> 2010
<b>Journal:</b> International Journal of Entrepreneurship and Innovation Management
<b>Drivers identified:</b> <ul style="list-style-type: none"> <li>• Money</li> <li>• Recognition</li> </ul>
<b>Synopsis:</b> <p>This study looks at rewards that attract and enhance users' commitment to participate in online open innovation communities. They found that a combination of monetary and non-monetary rewards are important.</p>
<b>Main arguments / ideas:</b> <p>They identify various potential motives for participation: intrinsic motives (ideology, enjoyment, intellectual stimulation, learning); extrinsic motives (firm recognition, reputation, efficacy, user need, rewards); and social motives (Altruism, friendship, peer recognition).</p> <p>The survey results indicate that monetary rewarding is important, as well as recognition based on the quality of ideas.</p>
<b>Evidence / data sources:</b> <p>The data was collected by interviews with the community maintainers of three open innovation intermediaries and by a web survey in the communities maintained by them. In addition, they analysed the rewarding mechanisms in 12 open innovation communities.</p> <p>The interviews covered questions related to the current rewarding mechanisms and future plans for rewarding and motivating members. In addition, they asked their views on the relationship between rewards and motivation to participate. The web survey was based on the knowledge acquired from the interviews as well as the literature review and an analysis of the rewarding mechanisms used in online open innovation communities. Over half of the respondents stated that some form of recognition, like top ten lists, encourages them to participate in the community. The respondents were also asked to give their opinion on the importance of various forms of public acknowledgement – announcing rewarded members on the website was rated much more important than acknowledging the most active member of the month or introducing active community members on the website.</p>

<b>Title:</b> Innovativeness of knowledge intensive business services as a factor for productivity
<b>Author(s):</b> Bagdonienė, Kazakevičiūtė and Žilionė
<b>Date:</b> 2012
<b>Journal:</b> -
<b>Drivers identified:</b> <ul style="list-style-type: none"><li>• Innovativeness</li></ul>
<b>Synopsis:</b> <p>This paper analyses innovativeness as the factor determining the productivity of knowledge intensive business service organizations.</p>
<b>Main arguments / ideas:</b> <p>Within the variety of factors that influence productivity increase, an important role goes to innovativeness, which is strategically important for knowledge intensive business services. Innovativeness greatly determines how productively the providers of knowledge intensive business services will successfully fulfil their functions of helping business develop their activity and strengthen their competitiveness. Knowledge intensive business services distinguish in innovativeness more than any other groups of services because they have to offer clients unique solutions to their problems.</p> <p>The authors present an integrated model of KIBS productive performance and drivers of innovativeness, in which they distinguish three closely related components: input, service process and productive performance as well as identifying factors influencing innovativeness.</p>
<b>Evidence / data sources:</b> <p>This paper draws on a number of other academic papers.</p>

<b>Title:</b> The Influence of Performance, Environment and Size on the Identifiability of Firm Strategy
<b>Author(s):</b> Bantel and Osborn
<b>Date:</b> 1995
<b>Journal:</b> British Journal of Management
<b>Drivers identified:</b> <ul style="list-style-type: none"> <li>• Strategy</li> </ul>
<b>Synopsis:</b> <p>This paper empirically examines the broadly held assumption that higher performing firms pursue identifiable generic and/or industry-specific strategies, as opposed to pursuing an unidentifiable strategy.</p>
<b>Main arguments / ideas:</b> <p>Firms could follow a generic or industry-specific strategy, or alternatively, not follow any identifiable strategy. Several authors have developed models of generic strategies, for example Porter (1980) identifies three types: cost leadership; differentiation; and focus. Other authors have identified more specific strategies, relating to individual industries. A firm that doesn't follow one of these strategies, this is 'stuck in the middle' as Porter describes it, is labelled as a firm that has an unidentifiable strategy.</p> <p>They find that strategic identifiability could be isolated and was influenced by size and environmental conditions. However, they could only find that measures related to short-term stockholder and senior management interested were positively related to having an identifiable strategy.</p>
<b>Evidence / data sources:</b> <p>The authors use a sample of 200 Midwest banks. A single industry in one geographic region was used to ensure these factors didn't influence the results. Questionnaires were answered by both the CEO and human resources vice-president of each bank, and allowed the identification of 20 strategies. A combination of factor analysis and cluster analysis was then used to segment each bank into one of six strategy type groups – one of which had no identifiable strategy. Three measures of performance were used: return on assets; growth (in income and assets); and return to stockholders.</p>



<b>Title:</b> Motivation, money and respect: A mixed-method study of Tanzanian non-physician clinicians
<b>Author(s):</b> Chandler et al.
<b>Date:</b> 2009
<b>Journal:</b> Social Science & Medicine
<b>Drivers identified:</b> <ul style="list-style-type: none"> <li>• Salary</li> <li>• Non-salary</li> </ul>
<b>Synopsis:</b> <p>This paper reports on a mixed-method study to evaluate factors affecting motivation, including reasons for varying levels of motivation, amongst clinicians in Tanzania.</p>
<b>Main arguments / ideas:</b> <p>Understanding what motivates health workers in their work is essential to provide an empirical base for policy decisions to improve quality of healthcare and poor quality of care is a particular concern in low-income countries.</p> <p>They find that salary was a clear prerequisite for motivation and that therefore non-salary motivators will only have an effect where salary requirements are satisfied.</p>
<b>Evidence / data sources:</b> <p>They observed over 2000 hospital consultations, interviewed clinicians to evaluate job satisfaction and morale, then designed and implemented a survey instrument to measure work motivation in clinical settings. The instrument they created was based on a series of statements relating to two domains, 'internal' and 'environmental' motivation. Internal motivation statements measured job satisfaction, organisational commitment, intention to leave, attitudes towards patients, self-efficacy, work ethic, vocation and attitude to change. Environmental motivation statements related to job security, salary, resource availability, risks from patients, justice within the organisation, management support and policy environment.</p>

<b>Title:</b> On research efficiency. A micro-analysis of Dutch university research in Economics and Business Management
<b>Author(s):</b> Cherchye and Abeele
<b>Date:</b> 2005
<b>Journal:</b> Research Policy
<b>Drivers identified:</b> <ul style="list-style-type: none"><li>• Size of research program</li><li>• Financial support</li></ul>
<b>Synopsis:</b> <p>This paper take an original approach in that it analyses research performance at the individual program level, instead of the department level. It is then able to make interesting observations about differences in performance.</p>
<b>Main arguments / ideas:</b> <p>The authors argue that research performance should be analysed at the individual program level, rather than the department level, to avoid losing important information. They find statistical evidence in support of size effects in several specialization areas; the direction of the relationship between size and productive efficiency seems to depend on the specific category of specialisation. They also obtain strong and persistent corroboration of a positive relationship between efficiency of academic research and the degree of financial support by scientific research funds.</p>
<b>Evidence / data sources:</b> <p>Regression analysis is used to measure the research performance of Dutch universities over the period 1996-2000.</p>

<b>Title:</b> Clusters, Convergence, and Economic Performance
<b>Author(s):</b> Delgado, Porter and Stern
<b>Date:</b> 2011
<b>Journal:</b> N/A
<b>Drivers identified:</b> <ul style="list-style-type: none"> <li>• Clustering</li> </ul>
<b>Synopsis:</b> <p>This paper evaluates the role of regional cluster composition in the economic performance of industries, clusters and regions.</p>
<b>Main arguments / ideas:</b> <p>On the one hand, diminishing returns to specialization in a location can result in a convergence effect: the growth rate of an industry within a region may be declining in the level of activity of that industry. At the same time, positive spillovers across complementary economic activities provide an impetus for agglomeration: the growth rate of an industry within a region may be increasing in the size and “strength” (i.e., relative presence) of related economic sectors.</p> <p>They find that, after controlling for the impact of convergence at the narrowest unit of analysis, there is significant evidence for cluster-driven agglomeration. Industries participating in a strong cluster register higher employment growth as well as higher growth of wages, number of establishments, and patenting. Industry and cluster level growth also increases with the strength of related clusters in the region and with the strength of similar clusters in adjacent regions. Their analysis also suggests that the presence of strong clusters in a region enhances growth opportunities in other industries and clusters. Overall, these findings highlight the important role of cluster-based agglomeration in regional economic performance.</p>
<b>Evidence / data sources:</b> <p>They use a panel dataset developed by the US Cluster Mapping Project (CMP). The CMP identifies 41 “traded” clusters incorporating 589 “traded” industries within the US. Traded industries and clusters are those which concentrate in particular regions and sell products or services across regions and countries, in contrast to local industries serving primarily the local market whose employment is evenly distributed across regions.</p>

<b>Title:</b> Determinants of Research Productivity in Higher Education
<b>Author(s):</b> Dunar and Lewis
<b>Date:</b> 1998
<b>Journal:</b> Research in Higher Education
<p><b>Drivers identified:</b></p> <ul style="list-style-type: none"> <li>• Individual attributes <ul style="list-style-type: none"> <li>○ Innate abilities (i.e. IQ, personality, age, gender)</li> <li>○ Personal environmental influences (i.e. quality and culture of graduate training, culture of employing department)</li> </ul> </li> <li>• Institutional and departmental attributes <ul style="list-style-type: none"> <li>○ Institutional structure and leadership <ul style="list-style-type: none"> <li>• Size of program and faculty</li> <li>• Control by private sector</li> <li>• Amount of university funding</li> <li>• Availability of university funding</li> <li>• Number of books and journals in library</li> </ul> </li> <li>○ Departmental culture and working conditions <ul style="list-style-type: none"> <li>• Workload policies</li> <li>• Availability of leaves, travel, and institutional funds for research</li> <li>• Number of students on research support</li> <li>• Availability of 'star' faculty</li> <li>• Availability of nongovernmental research funds</li> </ul> </li> </ul> </li> </ul>
<p><b>Synopsis:</b></p> <p>The purpose of this paper is to examine factors that contribute to research productivity of doctoral-granting university in the US.</p>
<p><b>Main arguments / ideas:</b></p> <p>The authors investigate the relationship between various individual and faculty factors on research performance. Previous studies have investigated the effects of individual characteristics on research performance. Age and experience have been shown to have mixed effects on performance (Clark and Lewis 1985; Levin and Stephen, 1989) and vary by field. The size of a research organisation has received a lot of attention in relation to performance. Larger departments are better placed to facilitate collaborative research, may be better at attracting high quality researchers, and may have greater amounts of resource available to them. They also identify other institutional factors listed above.</p> <p>They found consistent with some previous studies that academic research productivity is closely associated with program faculty size, but usually at a diminishing rate. Programs will achieve increasing research performance as they increase the number of their program faculty, but at a certain level the marginal product of an additional faculty member will begin to decline. They identified a positive effect of private universities, indicating that public research universities lack something that private ones have. They also found that having more full professors and 'star' faculty materially enhanced departmental research performance. They assume that full professors are tenured, experienced and mature senior faculty. To measure the presence of 'star' faculty they use a National Research Council constructed Gini coefficient for publications. The Gini coefficient measures the publication concentration on a single or small number of faculty. If each member of staff is producing the same number of papers the coefficient will be low, at the other extreme, if all the papers in a department were being produced by one person the coefficient would be high.</p>
<p><b>Evidence / data sources:</b></p> <p>Data in this study come from the 1993 National Research Council (NRC) study on research-doctorate programs in the US. Their sample included a total of 30 program areas within four cluster fields identified as the biological sciences, the physical sciences and mathematics, the social and behavioural sciences, and the field of engineering. The principal dependent variable for research productivity was</p>

## Economic Insight

Growing the best and brightest

the number of journal articles per average faculty member attributed to each of the programs between 1988 and 1992. Independent variables included: number of faculty; student staff ratio; library expenditure; public institution dummy; measure of full professors; and measure of 'star' faculty.



<b>Title:</b> Building a workplace of choice: Using the work environment to attract and retain top talent
<b>Author(s):</b> Earle
<b>Date:</b> 2003
<b>Journal:</b> Journal of Facilities Management
<b>Drivers identified:</b> <ul style="list-style-type: none"><li>• Work environment</li><li>• Buildings and facilities</li></ul>
<b>Synopsis:</b> <p>This paper investigates the role the workplace plays in recruitment and retention and the way in which it can be used to improve an organisation's corporate identity. It then looks at what types of perks are actually valued most by employees, and explores how the physical environment can be aligned to help shape a company's organisational culture and facilitate the communication, teamwork and creativity that are necessary to sustain a culture of continual innovation.</p>
<b>Main arguments / ideas:</b> <p>Second to pay and benefits, various studies have shown that the work environment is an extremely effective tool for attraction and retention. The paper cites various examples that demonstrate that the quality of the work environment can have significant effects on hiring and also job performance.</p> <p>Non-financial benefits can also attract and retain staff, such as flexible working hours and child care.</p> <p>When teams have a dominant organisational component, group spaces must be designed with the furniture and the tools to help teams work effectively. This includes ample and mobile seating and work surfaces, teaming areas, project rooms and other devices that support group work.</p>
<b>Evidence / data sources:</b> <p>This paper drawn on numerous other studies.</p>

<b>Title:</b> Research on Collaboration, Business Communication, and Technology: Reflections on an Interdisciplinary Academic Collaboration
<b>Author(s):</b> Forman and Markus
<b>Date:</b> 2005
<b>Journal:</b> Journal of Business Communication
<b>Drivers identified:</b> <ul style="list-style-type: none"><li>• Collaboration</li></ul>
<b>Synopsis:</b> <p>This paper describes one particular collaboration, particularly in regard to the political pitfalls and personal benefits experienced.</p>
<b>Main arguments / ideas:</b> <p>The authors discuss both incentives and disincentives created by their institution to conduct collaborative research. Funding made available by the institution, and the placement of the two authors within the institution allowed them to conduct the research. However, the authors felt that given they were fairly early on in their careers, more reward is given to single-authored publications. This therefore led to them publishing separate papers in journals from their respective subject areas.</p> <p>Despite the drawbacks, both authors found great benefits from the collaboration. It enriched their work and enabled them to add aspects to their research that otherwise would not have been possible.</p>
<b>Evidence / data sources:</b> <p>The authors discuss their own experience of a collaboration.</p>

<b>Title:</b> The determinants of research output and impact: A study of Mexican researchers
<b>Author(s):</b> Gonzalez-Brambila and Veloso
<b>Date:</b> 2007
<b>Journal:</b> Research Policy
<b>Drivers identified:</b> <ul style="list-style-type: none"><li>• Age</li></ul>
<b>Synopsis:</b> <p>This paper looks at a unique dataset of Mexican researchers to explore the determinants of research output and impact.</p>
<b>Main arguments / ideas:</b> <p>Their findings confirm a quadratic relationship between age and the number of published papers. However, publishing peaks when researchers are approximately 53 years old, 5 or 10 years later than what prior studies have shown. Overall, the results suggest that age does not have a substantial influence on research output and impact, compared to factors such as professorial level and subject area. They also found that reputation matters for the number of citations but not publications. Results also show important heterogeneity across areas of knowledge.</p>
<b>Evidence / data sources:</b> <p>They use data on 14,328 researchers who were part of the Mexican National System of Researchers (SNI), for at least 1 year, from 1991 to 2002.</p>

<b>Title:</b> Collaborate with Your Competitors – and Win
<b>Author(s):</b> Hamel, Doz and Prahalad
<b>Date:</b> 1989
<b>Journal:</b> Harvard Business Review
<b>Drivers identified:</b> <ul style="list-style-type: none"> <li>• Collaboration</li> </ul>
<b>Synopsis:</b> <p>This paper discusses the merits and pitfalls of collaboration between corporates, and specifically draws on ventures between western and Japanese companies.</p>
<b>Main arguments / ideas:</b> <p>A strategic alliance can strengthen both companies against outsiders even as it weakens one partner vis-à-vis the other. In particular, alliances between Asian companies and Western rivals seems to work against the Western partner. Cooperation becomes a low-cost route for the new competitors to gain technology and market access. It takes so much money to develop new products and to penetrate new markets that few companies can go it alone in every situation.</p> <p>The authors stress the point that Western companies are entering in to agreements in a bid to reduce costs, whereas Asian companies want to learn from their counterparts. For this reason, Asian companies tend to get more out of the agreement than the Western company. They set out certain conditions under which mutual gain is possible, at least for a time:</p> <ul style="list-style-type: none"> <li>• <b>Strategic goals align, whilst competitive goals diverge.</b> That is, both companies share the same goals in relation to the outcomes of the partnership, but don't compete in exactly the same market.</li> <li>• <b>Size and market power of both partners is modest compared with industry leaders.</b> This forces each side to accept that mutual dependence may have to continue for many years and not be overly competitive in trying to appropriate skills from the other.</li> <li>• <b>Each partner believes that it can learn from the other and at the same time limit access to proprietary skills.</b> This ensures mutual benefits without sharing important skills.</li> </ul>
<b>Evidence / data sources:</b> <p>This paper draws upon the five year study of the internal workings of 15 strategic alliances between the US and Japan; Europe and Japan; and the US and Europe.</p>

<b>Title:</b> The determinants of research performance: a study of Australian university economists
<b>Author(s):</b> Harris and Kaine
<b>Date:</b> 1994
<b>Journal:</b> Higher Education
<b>Drivers identified:</b> <ul style="list-style-type: none"> <li>• Autonomy around research areas</li> <li>• Involvement in multiple areas</li> <li>• Collaboration</li> <li>• Balance between teaching and research</li> <li>• Environment conducive to research</li> </ul>
<b>Synopsis:</b> <p>This article explores the relationship between individual productivity in research, as measured by an index of publications produced, and their preferences and perceptions about research-related issues.</p>
<b>Main arguments / ideas:</b> <p>The paper conducts cluster and discriminant analysis to uncover the determinants of research performance. They find that higher performance levels are associated with a stronger career orientation in research undertaken, a stronger motivation to undertake research, a higher degree of interaction with other economists, and a work environment assessed to be conducive to research. Pressure as a result of teaching commitments was associated with lower levels of research performance, with average performers experiencing greater pressures than low performers, whereas high performers did not appear to regard teaching commitments as a significant factor constraining their research activities.</p>
<b>Evidence / data sources:</b> <p>A sample of 34 Australian university economists were classified as low, average and high in respect of their publication performance using cluster analysis. Discriminant analysis was then used to see whether membership of these groups was associated with items representing individuals' preferred research approach, their involvement in a range of research-related activities, the things which they felt constrained their research and their perceptions of the benefits of their position which might be conducive to research.</p>

<b>Title:</b> The Determinants of Research Group Performance: Towards Mode 2
<b>Author(s):</b> Harvey
<b>Date:</b> 2002
<b>Journal:</b> Journal of Management Studies
<p><b>Drivers identified:</b></p> <ul style="list-style-type: none"> <li>• Strong leadership</li> <li>• Finding, motivating and retaining talent</li> <li>• Strategies of related diversification</li> <li>• Strong linked theory and practice</li> <li>• Network connectedness</li> </ul>
<p><b>Synopsis:</b></p> <p>This paper explores the determinants of performance of medical and medical-related research groups. It focuses specifically on how best to configure knowledge producers for optimal effectiveness in the research environment.</p>
<p><b>Main arguments / ideas:</b></p> <p>The author discusses the different ‘modes’ of working. Mode 1 is described as driven within disciplinary frameworks. Typically within this mode, progress is linear (proceeding in stages) and research groups tend towards homogeneity in terms of skill and experience. This is contrasted with Mode 2 production which does not cast research problems within a single disciplinary framework, is transdiscipline-driven, and research groups combine heterogeneous skills and experience.</p> <p>Factors identified with high-achievement are: strong leadership; finding, motivating and retaining talent; strategies of related diversification; strongly linked theory and practice and, in particular, network connectedness. They find evidence of Mode 2 working, with increasing use of collaborative strategies and some evidence of a thematic emphasis emerging, although to a lesser extent than the literature suggests, since participants are still working from a strongly disciplinary base.</p>
<p><b>Evidence / data sources:</b></p> <p>The paper is based on both case studies and a quantitative survey of the same set of research groups. Case studies were developed from semi structured interviews which explored: the history, structure, strategy, culture and specific outputs and wider impacts of the research group. Particular issues included: financial and intellectual support and its historical development; human resource policies and practices; inter-disciplinarity; thematic working; theoretical versus empirical research; solo scholars versus collaborations; collaboration versus competition with other research groups; locus of decision-making; research leadership; research dissemination and profiling; and environmental opportunities, impediments and pressures to change. The survey questionnaire asked respondents to supply details concerning grants and fellowships generated from regional sources and their outcomes and impacts in terms of such factors as: generation of subsequent grants and fellowships, publications, contribution to individual career and research group development, and scientific impact.</p> <p>Groups were identified as high profile in their field and had high output in orthodox academic terms (e.g. refereed journal articles, and with recognized and highly visible ‘star’ performers).</p>



<b>Title:</b> The Role of the Board in Firm Strategy: integrating agency and organisational control perspectives
<b>Author(s):</b> Hendry and Kiel
<b>Date:</b> 2004
<b>Journal:</b> Corporate Governance
<b>Drivers identified:</b> N/A
<b>Synopsis:</b> This paper discusses the role of the board of directors in a firm's strategy, and proposes a theoretical perspective to explain the board's role.
<b>Main arguments / ideas:</b>  There are two schools of thought as regard to the board's role. The passive school views boards as rubber stamps or as tools of top management whose only contribution is to satisfy the requirements of company law. The active school sees boards as independent thinkers who shape the strategic direction of their organisations.  The authors categorise a board's approach to strategy according to two constructs: strategic control and financial control. Strategic control involves the board exerting a continuous process of formal and informal influence over management, beginning early in strategy development and involving iterative consultation from development through to implementation and evaluation. It also involves the board evaluating management based on their strategic proposals pre-implementation as well as on the financial results post-implementation.  Financial control involves the board exerting episodic influence over management at formal board meetings and only at the end of the resource allocation decision process. It also involves the board evaluating management primarily on the financial results of the firm.
<b>Evidence / data sources:</b> This paper draws on a number of other academic papers.

<b>Title:</b> Collaboration and Competition in Research
<b>Author(s):</b> Higher Education Policy
<b>Date:</b> 2012
<b>Journal:</b> Higher Education Policy
<b>Drivers identified:</b> <ul style="list-style-type: none"><li>• Collaboration</li><li>• Competition<ul style="list-style-type: none"><li>○ Employment</li><li>○ Rankings</li><li>○ Funding</li></ul></li></ul>
<b>Synopsis:</b> <p>This article discusses the relationship between collaboration and competition in research. It summarises a number of papers that were presented at a conference.</p>
<b>Main arguments / ideas:</b> <p>Collaboration and competition are increasingly being seen both within and between research organisations, leading to interesting questions. Competition can sometimes hinder research productivity. One case study reports that interviewed postdocs strongly steered by the assumption that tenure depends on the number of own publications, and therefore they prefer single authored publications above co-authored ones. Therefore, they are restrictive in setting up collaborations.</p>
<b>Evidence / data sources:</b> <p>The article summaries papers presented at 'Organisation of Science Practices', Trento, 2010.</p>

<b>Title:</b> The Quest for the Best: Human Resource Practices to Attract and Retain Talent
<b>Author(s):</b> Hiltrop
<b>Date:</b> 1999
<b>Journal:</b> European Management Journal
<b>Drivers identified:</b> <ul style="list-style-type: none"> <li>• Teamwork</li> <li>• Openness</li> <li>• Training and development</li> </ul>
<b>Synopsis:</b> <p>This article explores some of the strategies and techniques that organisations are using to attract and retain talent and presents the findings of recent studies that have assessed the effectiveness of these approaches.</p>
<b>Main arguments / ideas:</b> <p>The findings suggest that high performance organisations are consistently outperforming their competitors on a number of human resource factors, including the level of teamwork and openness between co-workers, the training and development opportunities they offer to employees, and the degree of pro-activity in HR planning. Developing this capability begins with the realisation that effective human resource management underpins the competitiveness of organisations.</p>
<b>Evidence / data sources:</b> <p>HR managers and personnel officers in 115 multinational and 204 domestic companies located in Western Europe were asked to complete a structured questionnaire containing 67 statements about the management policies and practices of their firm. A factor analysis of the responses reduced these 67 practices to 11 factors. Three groups of company were created to analyse the results: those with high, medium and low ability to attract and retain talent – as considered by a group of seven management and executive search consultants.</p>

<b>Title:</b> Finders, keepers? Attracting, motivating and retaining knowledge workers
<b>Author(s):</b> Horwitz, Heng and Quazi
<b>Date:</b> 2003
<b>Journal:</b> Human Resource Management Journal
<b>Drivers identified:</b> <ul style="list-style-type: none"> <li>• Salary</li> <li>• Challenging work</li> <li>• Autonomy</li> </ul>
<b>Synopsis:</b> <p>This exploratory study identifies the most and least effective HR strategies used by knowledge intensive firms (KIFs) in Singapore for attracting, motivating and retaining workers.</p>
<b>Main arguments / ideas:</b> <p>Highly effective attraction strategies require a bundle of practices, of which a highly competitive pay package was the top strategy used. Others included proactive recruitment and selection initiatives and funded internal staff development.</p> <p>The most popular and highly effective strategies for motivating knowledge workers were practices allowing freedom to plan work and challenging work.</p> <p>The most effective retention strategies were challenging work, competitive pay and performance related incentives, which also align with the most popular strategies employed.</p>
<b>Evidence / data sources:</b> <p>Based on a literature review and research objectives, a structured questionnaire was designed for gathering data. The survey had five major sections. The first covered organisational profile, including industry sector, firm ownership, number of employees and percentage of knowledge workers. The second section had five definitions that described knowledge workers, requiring two which most aptly describe knowledge workers in their organisations to be chosen. In the third section, the deployment of knowledge workers as full-time employees or as non-core employees was specified. The fourth and main section listed strategies for attracting, motivating and retaining knowledge workers. The last section dealt with voluntary labour turnover, the acceptable and tolerable level of turnover, reasons for turnover and remedial measures taken.</p> <p>Their analysis is based on 44 usable responses. Effectiveness rankings are based on self-reported success of the different strategies.</p>

<b>Title:</b> European university funding and financial autonomy
<b>Author(s):</b> Joint Research Centre - Institute for Prospective Technological Studies
<b>Date:</b> 2011
<b>Journal:</b> -
<b>Drivers identified:</b> <ul style="list-style-type: none"> <li>• Funding</li> <li>• Financial autonomy</li> </ul>
<b>Synopsis:</b> <p>This paper looks at the funding EU research institutions receive and how the level of financial autonomy effects the diversification of their budget and the amount of competitive funding they receive.</p>
<b>Main arguments / ideas:</b> <p>European higher education systems have experienced important changes over recent decades, leading to higher autonomy in most cases. The more autonomous a university is, then it should, in principle, be able to better compete in obtaining funds from different sources, such as competitive funds, contracts with private companies, and donations from the non-profit sector. This could make institutions less dependent on one single stream of income and more able to adapt to a changing environment.</p> <p>They find that:</p> <ul style="list-style-type: none"> <li>• Considering only public funding coming from government (national and regional), on average, about 20 % is assigned on a competitive basis, with UK institutions and, in general, technological universities having the highest shares of competitive funds.</li> <li>• Most institutions with highly diversified budgets are located in the UK.</li> <li>• Institutions that declare to be completely autonomous are the ones that have the most diversified budget.</li> </ul>
<b>Evidence / data sources:</b> <p>The study covers 200 research-active universities from 33 European Research Area (ERA) countries.</p>

<b>Title:</b> Critical mass and the dependency of research quality on group size
<b>Author(s):</b> Kenna and Berche
<b>Date:</b> 2011
<b>Journal:</b> Scientometrics
<b>Drivers identified:</b> <ul style="list-style-type: none"> <li>• Number of researchers in a group</li> </ul>
<b>Synopsis:</b> This paper investigates how the number of researchers in a group affects research quality, and whether there is a critical mass.
<b>Main arguments / ideas:</b> The authors show that research quality is correlated with group size and that there are two significant, related masses, which are discipline dependent. The critical mass marks the size below which a group is vulnerable to extinction and there is also a higher value at which the correlation between research quality and group size reduces. Once critical mass is achieved, a research team has enhanced opportunities for cooperation as well as improved access to more resources.  It is reasonable to expect that both the size and the quality of a research group are affected by a multitude of factors: the calibre of individual researchers, the strength of communication links between them, their teaching and administrative loads, the quality of management, the extent of interdisciplinarity, the equipment used, whether the work is mainly experimental, theoretical or computational, the methodologies and traditions of the field, library facilities, journal access, extramural collaboration, and even previous successes and prestige factors. They show that of all these and other factors, the dominant driver of research quality is the quantity of researchers that an individual is able to communicate with – given by the size of research group.
<b>Evidence / data sources:</b> They create a model using data from the Research Assessment Exercise (RAE) 2008.



<b>Title:</b> Lambert Review of Business-University Collaboration
<b>Author(s):</b> Lambert
<b>Date:</b> 2003
<b>Journal:</b> N/A
<b>Drivers identified:</b> N/A
<b>Synopsis:</b> This paper provides a review of business-university collaborations in the UK, and puts forward several recommendations.
<b>Main arguments / ideas:</b>  <p>The research intensity of UK businesses is below that of many other developed countries, with two important exceptions - pharmaceuticals/biotechnology and aerospace/defence. This has had an adverse impact on the overall productivity of the UK economy. The Review makes a number of proposals for building new networks among research-intensive businesses, and supports existing schemes for business-university collaboration such as LINK and Knowledge Transfer Partnerships. It suggests that the Government should seek ways of directing a higher proportion of its support for business R&amp;D to small and medium-sized enterprises (SMEs).</p> <p>The best forms of knowledge transfer involve human interaction, and the Review makes several recommendations designed to encourage more frequent and easy communications between business people and academics. It suggests that research collaborations might be made easier to agree if model contracts could be developed on a voluntary basis to cover the ownership and exploitation of intellectual property (IP).</p> <p>From a business perspective, the Review suggests that the dual funding system provides disincentives to business-university collaboration. Research departments which are doing work that is of real value to business but which does not rank as world-class will get little support from the dual support system and may find it increasingly difficult to sustain themselves.</p> <p>Business is critical of what it sees as the slow-moving, bureaucratic and risk-averse style of university management. However, there have been significant changes for the better in recent years. Many universities have developed strong executive structures to replace management by committee, and have raised the quality of their decision-making and of their governance. Strategic planning and the process of resource allocation have been improved.</p> <p>Companies are broadly satisfied with the quality of the graduates they recruit, although there are some mismatches between their needs and the courses offered by some universities. Prospective students would benefit from clearer market signals than are now available about what has happened to graduates from particular courses, in terms of their employability and pay.</p>
<b>Evidence / data sources:</b> Universities, businesses, professional bodies, development agencies and government agencies have all contributed to this review.

<b>Title:</b> Understanding Employee Motivation
<b>Author(s):</b> Lindner
<b>Date:</b> 1998
<b>Journal:</b> The Journal of Extension
<b>Drivers identified:</b> <ul style="list-style-type: none"> <li>• Interesting work</li> <li>• Salary</li> <li>• Appreciation</li> </ul>
<b>Synopsis:</b> <p>The study examines the ranked importance of motivational factors of employees at The Ohio State University's Piketon Research and Extension Centre and Enterprise Centre. It considers ten motivating factors in the context of employee motivation theory. Findings suggest interesting work and good pay are key to higher employee motivation.</p>
<b>Main arguments / ideas:</b> <p>Five major approaches led to their understanding of motivation: Maslow's need-hierarchy theory; Herzberg's two-factor theory; Vroom's expectancy theory; Adams' equity theory; and Skinner's reinforcement theory.</p> <p>They tested the ten motivating factors which gave a ranked order of: (a) interesting work, (b) good wages, (c) full appreciation of work done, (d) job security, (e) good working conditions, (f) promotions and growth in the organization, (g) feeling of being in on things, (h) personal loyalty to employees, (i) tactful discipline, and (j) sympathetic help with personal problems.</p>
<b>Evidence / data sources:</b> <p>Data was collected through the use of a written questionnaire. The target population of this study included employees at the Piketon Research and Extension Centre and Enterprise Centre. The sample size included all 23 of a possible 25 employees. The questionnaire asked participants to rank the importance of ten factors that motivated them in doing their work on a scale of 1 to 10.</p>

<b>Title:</b> Issue Brief: Public Sector Research Funding
<b>Author(s):</b> OECD
<b>Date:</b> 2011
<b>Journal:</b> N/A
<b>Drivers identified:</b> <ul style="list-style-type: none"> <li>• Public funding policy</li> </ul>
<b>Synopsis:</b> This note discusses publicly funded research and the current trend to more selective and competitive funding.
<b>Main arguments / ideas:</b> <p>Institutional block funding provides research organisations with a stable basis for research activities. This can help them to acquire funding from other sources, provides them with a certain degree of autonomy in the selection of their research, and allows them to build up expertise in new fields. Conversely, a surplus of block funding may de-incentivise organisations and researchers to look for funding from other sources.</p> <p>Project based funding gives funding organisations more control over research. One rationale for increasing the relative share of competitive funding is that it is expected to yield relatively higher returns in terms of knowledge creation and research output. Increasing the share of project funding can be used further to make research organisations more responsive to socio-economic needs as these considerations can play an important role in funding decisions.</p> <p>One policy used by governments is the use of ‘research priorities’ to allocate separate sources of funding thereby incentivising certain research behaviours and fields. Examples include targeting specific research fields; encouraging collaboration between research and industry; or setting specific growth targets for public research output and graduate numbers. As a result of changes in research policies and the creation of specific research priorities, HEIs have responded by incentivising desirable behaviours on an organisational level. Indeed, organisations may concentrate resources in areas of research that will guarantee the most reward. By aligning their organisational objectives with government research priorities for funding, research organisations and universities produce benefits associated with their reputation and prestige through positive research evaluations. In addition, research organisations offer personal incentives to encourage researcher behaviours that will generate the highest reward from governments in terms of funding and prestige.</p>
<b>Evidence / data sources:</b> The paper draws on numerous academic papers.

<b>Title:</b> Strategizing in the multi-business firm: Strategy teams at multiple levels and over time
<b>Author(s):</b> Paroutis and Pettigrew
<b>Date:</b> 2007
<b>Journal:</b> Human Relations
<b>Drivers identified:</b> N/A
<b>Synopsis:</b> This paper looks at the practices of strategy teams in a FTSE-100 utility company and forms a picture of what they do on a daily basis and how they interact with each other.
<b>Main arguments / ideas:</b> The paper identifies seven activities that individuals in strategy teams engage in: <ul style="list-style-type: none"> <li>• Executing is conceptualized as the set of activities referring to instances when a strategy team undertakes day-to-day, routine activities such as preparing documents and presentations.</li> <li>• Reflecting refers to activities within the strategy team when members reconsider, learn from and modify past ways of conducting strategy.</li> <li>• Initiating refers to activities by strategy teams that initiate or shape new ideas about changes in the established content and process of strategy.</li> <li>• Coordinating occurs when activities by one team directly influence the behaviours of another team or teams towards using a specific set of strategy tools or language.</li> <li>• Supporting occurs when one strategy team provides strategy knowledge and resources to other managers or teams.</li> <li>• Collaborating concerns the development of strategic reports and ideas jointly with other teams across organizational levels.</li> <li>• Shaping context refers to activities taken by a strategy team aimed towards shaping the contextual conditions within which other teams are operating.</li> </ul> <p>The first three activities, executing, reflecting and initiating, refer to activities conducted within the setting of a single strategy team. Here knowledge is generated amongst the inner members of the team and the interactions between them. The next three, coordinating, supporting and collaborating, refer to activities involving more than one strategy team. Accordingly, the settings of these types of practice are mainly meetings, teleconferences, virtual teams, and away days. The final practice, shaping context, refers to activities undertaken by strategy teams that eventually change the structural and organizational context within which strategy is conducted.</p> <p>They find that the strategy teams they followed used both recursive (based on routines) and adaptive (creative and reactive) activities to formulate and refine their strategy.</p>
<b>Evidence / data sources:</b> The authors conducted 36 interviews with managers with strategy related roles (e.g. group strategy director, strategy manager) as well as non-strategy related roles (e.g. marketing director, finance manager, HR director). Interviews were transcribed and then coded. Case studies were also built and reviewed by the company to ensure accuracy.

<b>Title:</b> Some Social Factors Related to Performance in a Research Organisation
<b>Author(s):</b> Pelz
<b>Date:</b> 1956
<b>Journal:</b> Administrative Science Quarterly
<b>Drivers identified:</b> <ul style="list-style-type: none"> <li>• Autonomy</li> <li>• A social environment that provides both similar and dissimilar peers</li> <li>• Support</li> </ul>
<b>Synopsis:</b> <p>This paper investigates the relationship between research performance and social environment in a large government research organisation in the US.</p>
<b>Main arguments / ideas:</b> <p>The author finds that research performance is higher under the following conditions:</p> <ul style="list-style-type: none"> <li>• Having freedom to pursue original ideas</li> <li>• Frequent (daily) contact with several scientific colleagues who on the average have been employed in settings different from one's own, who stress values different from one's own, and who tend to work in scientific fields different from one's own</li> <li>• At the same time, frequent contact with at least one important colleague who has similar professional values</li> <li>• A chief who gives neither complete autonomy nor excessive direction, but who frequently interacts with subordinates and who also gives them the opportunity to make their own decisions</li> </ul>
<b>Evidence / data sources:</b> <p>The research performance of staff was determined by peer review. A panel of investigators was comprised of experienced scientists, nonsupervisory as well as supervisory. Where possible, each subject was evaluated twice, once in comparison with others in his own laboratory or division, and again in comparison with others in the same scientific discipline. The assessors' judgments were assigned numerical scores from 1 to 9 and the scores from different judges were averaged. In order to isolate the effect of environment on an individual's performance, an appropriate constant was added to control for individual factors such as basic ability, quality of training, or type of experience. Data relating to the environment that the subjects worked in were collected via a questionnaire.</p> <p>Professional values were measured through three 'science' orientated questionnaire statements (stress on using present abilities or knowledge, freedom to carry out original ideas, and chance to contribute to basic scientific knowledge) and three 'institutional' orientated statements (stress on having an important job, association with high-level persons having important responsibilities, and sense of belonging to an organization with prestige in the lay community). Comparisons were made between the professional values of the subject and important colleagues with whom they reported that some contact with them is of 'great significance' to their work.</p>

<b>Title:</b> Network Position and Firm Performance: Organizational Returns to Collaboration in the Biotechnology Industry
<b>Author(s):</b> Powell, Koput, Smith-Doerr and Owen-Smith
<b>Date:</b> 1999
<b>Journal:</b> Research in the Sociology of Organizations
<b>Drivers identified:</b> <ul style="list-style-type: none"><li>• Collaboration</li></ul>
<b>Synopsis:</b> <p>This paper investigates the relationship between position in a network of relationships organisational performance.</p>
<b>Main arguments / ideas:</b> <p>Their results highlight the critical role of collaboration in determining the competitive advantage of individual biotech firms and in driving the evolution of the industry. They also find that there are decreasing returns to network experience and diversity, suggesting that there are limits to the learning that occurs through inter-organizational networks.</p>
<b>Evidence / data sources:</b> <p>The paper draws on ten years of observations (1988-1997) for nearly 400 firms in the human biotechnology industry, they utilize three types of panel regressions to unravel the linkages between network structure, patenting, and various firm-level outcome measures.</p>



<b>Title:</b> Determinants of Research Productivity
<b>Author(s):</b> Ramesh and Singh
<b>Date:</b> 1998
<b>Journal:</b> Scientometrics
<b>Drivers identified:</b> <ul style="list-style-type: none"> <li>• Personal           <ul style="list-style-type: none"> <li>○ Persistence</li> <li>○ Initiative</li> <li>○ Intelligence</li> <li>○ Creativity</li> <li>○ Learning capability</li> <li>○ Concern for advancement</li> <li>○ Professional commitment</li> </ul> </li> <li>• Organisational           <ul style="list-style-type: none"> <li>○ Resource adequacy</li> <li>○ Access to literature</li> <li>○ Stimulative leadership</li> <li>○ External orientation</li> </ul> </li> </ul>
<b>Synopsis:</b> <p>This paper, through a number of techniques, breaks down a long list of 200 variables into 11 factors that influence research productivity.</p>
<b>Main arguments / ideas:</b> <p>Among the eleven factors which are identified to have influence on the research productivity, there is a dominance of personal factors over the organizational factors. Seven out of the eleven factors belonged to the personal group. They are: persistence, initiative, intelligence, creativity, learning capability, concern for advancement, and professional commitment. While the rest four factors belonged to the organizational group. They are: resource adequacy, access to literature, stimulative leadership (defined by the two statements 'stimulating and facilitative leadership in the organization' and 'urge for excellence'), and external orientation.</p>
<b>Evidence / data sources:</b> <p>The authors identify nearly 200 variables influencing research productivity from relevant literature, biographies and discussions with scientists. 80 variables were then selected for a Q-sort technique, in which 325 scientists replied. 26 variables were selected for further analysis and principal component analysis resulted in 11 factors.</p>

<b>Title:</b> Competitive Advantage in Technology Intensive Industries
<b>Author(s):</b> Rothaermel
<b>Date:</b> 2008
<b>Journal:</b> Technological Innovation: Generating Economic Results Advances in the Study of Entrepreneurship, Innovation and Economic Growth
<b>Drivers identified:</b> <ul style="list-style-type: none"> <li>• Competitive advantage</li> </ul>
<b>Synopsis:</b> <p>This chapter of a book introduces the meaning of competitive advantage and posits that a firm's strategy is defined as the managers' theory about how to gain and sustain competitive advantage.</p>
<b>Main arguments / ideas:</b> <p>The author demonstrates how a firm creates its competitive advantage by creating more economic value than its rivals, and explains that profitability depends upon value, price, and costs. Examining the interplay of firm resources, capabilities, and competencies, the chapter emphasizes that both must be present to possess core competencies essential to gaining and sustaining competitive advantage through strategy. Next, the chapter describes the value chain by which a firm transforms inputs into outputs, adding value at each stage through the primary activities of research, development, production, marketing and sales, and customer service, which in turn rely upon essential support activities that add value indirectly.</p>
<b>Evidence / data sources:</b> <p>The chapter draws on a number of academic papers, along with Michael Porter's Competitive Advantage</p>

<b>Title:</b> Jewels in the crown: The importance and characteristics of the UK's world-class universities
<b>Author(s):</b> Russell Group
<b>Date:</b> 2012
<b>Journal:</b> N/A
<p><b>Drivers identified:</b></p> <ul style="list-style-type: none"> <li>• Concentration of talent and a critical mass</li> <li>• Sufficient facilities</li> <li>• Effective governance <ul style="list-style-type: none"> <li>○ Autonomy</li> <li>○ Competitive environment</li> <li>○ Leadership</li> <li>○ Culture</li> </ul> </li> </ul>
<p><b>Synopsis:</b></p> <p>This paper by the Russell Group discusses the importance of world-class universities in the UK and the characteristics they exhibit.</p>
<p><b>Main arguments / ideas:</b></p> <p>The paper defines a world-class university as an institution that has a high concentration of excellence, talent and modern infrastructure, that is utilised with vision and creativity to deliver excellent learning and research in order to make a significant contribution to the world's knowledge, health, wealth and well-being.</p> <p>A World Bank report (The challenge of establishing world-class universities, 2009) identifies three distinguishing critical factors, which are discussed in the paper.</p> <ul style="list-style-type: none"> <li>• High concentration of talent and a critical mass. A critical mass threshold is strongest in those disciplines which are resource-intensive (for example, those which require physical infrastructure such as laboratory equipment), or where physical proximity of others in their field is more important.</li> <li>• Sufficient resources to provide a state-of-the-art environment. Universities must be able to fund the environment in which talent can teach, learn and research. Degrees in science, technology, engineering and maths (STEM) subjects, in particular, require access to first-class teaching laboratories and support from expert technical staff. With changes in technology, as the ways in which students learn changes, the associated facilities also need to change.</li> <li>• Favourable and efficient governance. They identify autonomy, competitive environment, leadership and culture as key features of a good governance.</li> </ul>
<p><b>Evidence / data sources:</b></p> <p>This paper draws on a World Bank report and various other academic papers.</p>

<b>Title:</b> The concentration of research funding in the UK: driving excellence and competing globally
<b>Author(s):</b> Russell Group
<b>Date:</b>
<b>Journal:</b> N/A
<b>Drivers identified:</b> <ul style="list-style-type: none"> <li>• Public funding policy <ul style="list-style-type: none"> <li>○ Focus on excellence</li> </ul> </li> <li>• Critical mass</li> </ul>
<b>Synopsis:</b> This document discusses the concentration of UK public research funding on excellent research.
<b>Main arguments / ideas:</b> <p>The paper emphasises the importance of concentrating funds on excellent research. They voice a concern that a reduction in concentration, due to the allocation of 09/10 QR funding (which saw less funding being allocated to Russell Group universities), risks damaging the UK's research base and its sustainability.</p> <p>A report by the Higher Education Policy Unit (The Role of Selectivity and the Characteristics of Excellence, Report to HEFCE, 2000) provides evidence that the increase in the concentration of funding which has occurred with the evolution of the RAE has led to a significant improvement in research performance. Concentrating limited research funding on the highest-quality research ensures the most effective distribution of funding and the greatest returns on investment.</p> <p>Evidence also suggests the importance of a critical mass of research activity in supporting research excellence. Research commissioned by HEFCE (A Review of Volume Indicators, 1999) has found that the highest quality research is performed in institutions where a high proportion of staff are research active. Despite this, QR funding allocations for 2009-10 saw a much wider dispersal of funding across the sector.</p>
<b>Evidence / data sources:</b> The paper draws on numerous academic papers.

<b>Title:</b> Factors Contributing to Research Excellence
<b>Author(s):</b> Snyder et al
<b>Date:</b> 1991
<b>Journal:</b> Human Sciences Press
<b>Drivers identified:</b> <ul style="list-style-type: none"> <li>• Setting goals</li> <li>• Recruitment</li> <li>• Monitoring goals with specific measures</li> </ul>
<b>Synopsis:</b> <p>This paper looks at the management control systems (MCS) that outstanding university research divisions use, and try to identify those practices that appear more successful than others.</p>
<b>Main arguments / ideas:</b> <p>An MCS involves setting goals and objectives. This process is continuous in that success is always being monitored and goals, objectives, and key success factors are necessarily altered as progress is made.</p> <p>The paper defines a framework in which MSCs sit. There are three types of management activity: strategic planning; management control; and operational control. Strategic planning is the process of setting high level goals and objectives, and setting policies relating to the acquisition and distribution of resources. Management control ensures the necessary resources are allocated to meet organisational goals, and operation control ensure specific tasks are completed efficiently. Management activities are then split across a continuum ranging from structured to unstructured. Structured decisions are those that are routine and require little human interaction, whereas unstructured decisions are unique and need individual thought. MSCs fall in the category of unstructured management control decisions.</p> <p>The results of the authors' analysis indicate three strategies to increase research productivity:</p> <ul style="list-style-type: none"> <li>• Setting of specific goals and supporting those goals with necessary resources</li> <li>• Recruit and retain outstanding researchers</li> <li>• Monitor progress towards objectives using specific external measures</li> </ul>
<b>Evidence / data sources:</b> <p>The paper focused on the management control processes within central research offices, or the research divisions of universities, to determine how funded research is encouraged at research institutions. The analysis is based on 33 telephone interviews conducted in 1989 with outstanding research universities in the US. The sample was selected on the basis of change in the 1987 National Science Foundation ranking of Total and Federally Financed R&amp;D Expenditures. A mix of institutions was chosen to represent those that had increased, maintained and decreased in rank.</p> <p>Questions included on the survey fell into four main categories: influential environmental factors; faculty participation; research visibility; and key success strategies and measures. In this context faculty participation and research visibility are considered to be the generic areas from which goals would be formulated, influential environmental factors are considered to be the constraints, either internal or external, that the universities have to work with, and key success factors are those measures that research divisions use to monitor progress toward their objectives.</p>

<b>Title:</b> Information sharing in academic communities: Types and levels of collaboration in information seeking and use
<b>Author(s):</b> Talja
<b>Date:</b> 2002
<b>Journal:</b> New Review of Information Behaviour Research
<b>Drivers identified:</b> <ul style="list-style-type: none"> <li>• Social networks</li> </ul>
<b>Synopsis:</b> <p>This paper investigates the types of information sharing that occur in academic environments and analyses the differences between certain subject areas.</p>
<b>Main arguments / ideas:</b> <p>Scholars can be characterized as super-sharers, sharers, occasional sharers, or non-sharers, according to the extent in which they engage in information sharing and/or collective information seeking. However, individual scholars can simultaneously engage in different kinds and levels of information sharing activities, depending on who they are working with and which tasks.</p> <p>Based on their findings, the authors classify different types of information sharing:</p> <ol style="list-style-type: none"> <li>1. Strategic sharing: information sharing as a conscious strategy of maximizing efficiency in a research group.</li> <li>2. Paradigmatic sharing: information sharing as a means of establishing a novel and distinguishable research approach or area within a discipline or across disciplines.</li> <li>3. Directive sharing: information sharing between teachers and students.</li> <li>4. Social sharing: information sharing as a relationship- and community-building activity.</li> </ol> <p>The authors conclude that scholars' social networks not only affect their choices of information seeking strategies; rather, these networks are often the place where information is sought, interpreted, used, and created.</p>
<b>Evidence / data sources:</b> <p>The data on scholars' information sharing practices were gained by informal semistructured interviews. Four different disciplines, nursing science (a social science), history (a humanistic field), literature and cultural studies (a humanistic field), and ecological environmental science (a laboratory science), were chosen as the objects of study in the project.</p>



<b>Title:</b> Research excellence and departmental climate in British universities
<b>Author(s):</b> West, Smith, Feng and Lawthom
<b>Date:</b> 1998
<b>Journal:</b> Journal of Occupational and Organisational Psychology
<b>Drivers identified:</b> <ul style="list-style-type: none"> <li>• Climate</li> </ul>
<b>Synopsis:</b> This paper empirically tests the relationship between departmental climate in universities, and research excellence.
<b>Main arguments / ideas:</b> Organisational climate refers to the perceptions that organisation members share of fundamental elements of their organisation. Sells & James (1987) define climate as 'the "ambience" of an organization... various patterns of influence on employee (member) behaviour, generated by prevailing environmental conditions in an organization'. It has been proposed by others that climate can influence organisational performance (Payne and Pugh, 1976).  The authors found that departmental ratings of research excellence predicted subsequent departmental climate, particularly in members' descriptions of degree of formalization, support for career development and support for innovation. Dimensions of climate, however, did not predict as strongly subsequent research excellence rating. It appears that climate may be an outcome as much as a cause of research excellence, at least in this context.
<b>Evidence / data sources:</b> A longitudinal design was used which involved gathering climate data from academics in 46 departments in 14 universities in 1992 and again in 1994. Climate measures were related to external Higher Education Funding Council ratings of research excellence made in 1989 and 1992.

<b>Title:</b> A Review of Business–University Collaboration (Wilson Review)
<b>Author(s):</b> Wilson
<b>Date:</b> 2012
<b>Journal:</b> N/A
<b>Drivers identified:</b> N/A
<b>Synopsis:</b> This paper provides an updated review, since the Lambert Review, of business-university collaborations in the UK.
<b>Main arguments / ideas:</b>  <p>Since the Lambert Review (2003) there has been a huge change in both the quantum and the quality of business–university collaboration, however, improvements need to be made in the supply chain to attain the status of world leadership in business–university collaboration.</p> <p>In the context of the university sector as a whole, further clarity of the portfolio of each university’s capability, allied with a referral system, will improve collaboration and, critically, the reputation of the university sector.</p> <p>Given the international mobility of corporate investment in research, sustaining research collaboration through establishing strategic partnerships and long-term investment is critical. Within the small and medium-sized enterprises (SME) sector, growth in innovation will benefit from further specific and targeted government intervention.</p> <p>There is widespread concern that the government’s policies on immigration will damage the UK’s research base. Whether this damage would be caused through perception of regulation or through actual regulation is unclear. This issue needs to be resolved. The UK’s research base is at the heart of its innovative capability; we cannot afford to erode the intellectual capital of our universities through the unintended consequences of our immigration policy.</p> <p>Universities are international organisations, not only in recruiting students from all parts of the world, but also through international research partnerships and joint venture investments overseas, often with the private sector. They are an underutilised resource in terms of inward investment and job creation. UK universities attract significant research sponsorship from international companies and, whilst there are direct and positive benefits through intellectual property and job creation in universities, there is insufficient attention given to the opportunity for additional investments in the UK from these activities.</p>
<b>Evidence / data sources:</b> Universities, businesses, professional bodies, development agencies and government agencies have all contributed to this review.

<b>Title:</b> To publish or not to publish? On the aggregation and drivers of research performance
<b>Author(s):</b> Witte and Rogge
<b>Date:</b> 2010
<b>Journal:</b> Scientometrics
<b>Drivers identified:</b> <ul style="list-style-type: none"> <li>• Researcher affiliation with other universities</li> <li>• Personal satisfaction with conducting research</li> <li>• Confidence in personal ability</li> </ul>
<b>Synopsis:</b> <p>This paper argues that measures of research performance should be multidimensional, rather than based on a single measure alone. They then use their constructed measure to investigate the personal drivers of research performance.</p>
<b>Main arguments / ideas:</b> <p>Their results indicate that higher research performance is achieved by those who:</p> <ul style="list-style-type: none"> <li>• are female</li> <li>• have a PhD</li> <li>• are affiliated with one or more other universities</li> <li>• get more satisfaction out of doing research</li> <li>• perceive that timing is a major constraint to improve their research</li> <li>• rate their ability as a researcher higher</li> </ul> <p>On the other hand, alternative examined background characteristics (i.e., researcher age, retention, research time, salary increase, and collaboration within own department) did not significantly influence performance.</p>
<b>Evidence / data sources:</b> <p>The data set comprises output (research) data on 81 Belgian researchers. They matched this data set with administrative and survey data. The administrative data contains information on age, gender, doctoral degree, tenure, (official) teaching load, and (official) time for research. The data are further enriched with a questionnaire on the researcher's opinions and perceptions on research satisfaction and personal goals.</p>

<b>Title:</b> External and Internal Factors Affecting the Product and Business Process Innovation
<b>Author(s):</b> Zakić, Jovanović and Stamatović
<b>Date:</b> 2008
<b>Journal:</b> Economics and Organisation
<b>Drivers identified:</b> <ul style="list-style-type: none"><li>• Innovativeness</li></ul>
<b>Synopsis:</b> <p>This paper explores the influence of nine external and internal factors on product and business processes innovation.</p>
<b>Main arguments / ideas:</b> <p>The competitive advantage of a company strongly depends on its ability to benefit from innovative activities. Understanding the factors that affect product and process innovation and their effects is necessary for deciding on an innovation strategy. The nine factors that are analysed are as follows: industry maturity; customer needs and expectations; technological opportunities; investment attractiveness; intensity of competition; company size; origin of ownership; and export orientation. They find that technological opportunity is the most important factor for innovativeness.</p>
<b>Evidence / data sources:</b> <p>The authors draw on various theoretical literatures along with several studies.</p>

## Annex B – Sample Selection

### Background and objectives

The objective of interviewing 12 higher education institutions was to deliver an evidence-based understanding of which of a 'long-list' of potential determinants of research excellence are particularly important and how they work in practice. This objective places various requirements on the selection of institutions and departments (and also interviewees, which is not covered here).

- » A minimum requirement was that the higher education institutions we interviewed should be considered 'excellent' according to some relevant and ideally objective measure or measures of research performance. This could have been based on a peer review exercise and/or bibliometrics.
- » A secondary but important requirement was that it would be helpful to get 'good coverage' of higher education institutions and subjects. This would help ensure that we develop a holistic understanding of the determinants of research excellence. In particular, we discussed that it would be helpful to get good coverage of higher education institutions in terms of:
  - amount of public funding received;
  - subject areas;
  - extent of institution specialism (e.g. we compared the Institute of Cancer Research to the University of Cambridge); and
  - location.

While our selection was not intended to be 'representative' in a statistical sense, we agreed that 'good coverage' was desirable, provided that it did not compromise our ability to meet the minimum requirement above (for example, it would not make sense to interview an institution that is not considered excellent to ensure that we include a specific subject area).

### Options and suggestions

This section sets out the options and suggestions we put forward for (a) identifying 'excellent' research institutions and (b) getting good coverage of them. We then discuss the different options for the selection of subject areas.

#### Identification of 'excellent' research institutions

For the purpose of identifying 'excellent' higher education institutions, we suggested using the Research Assessment Exercise 2008 scores (RAE scores), which were used to determine the research funding that institutions receive from the Higher Education Funding Bodies.

- » The advantages of using the RAE scores include: they are based on a well-regarded and credible peer review methodology; as such, they will be well-known to the sector; and finally they are publicly available and therefore verifiable.
- » The potential limitation of the RAE scores is that they will soon be superseded by a new methodology. The significance of this limitation primarily depends on the extent to which those institutions and departments considered to be 'excellent' on the basis of the current methodology will no longer be under the new methodology. We presume that the risk of significant changes is fairly low, but welcomed any views on this.

There were other options for identifying 'excellent' higher education institutions. For example, there are third-party rankings (such as from The Times) which are based on research and other dimensions of institution quality (such as teaching). Also, Elsevier and Thomson Reuters sell bibliometric data that could have been used to measure research excellence. It would have been more appropriate to use these rankings or measures instead of the RAE scores if they were clearly more accurate measures of research excellence. Based on our understanding, it was not clear to us that this is the case:

- » In relation to the third-party rankings, we note that they often depend on the amount of research funding an institution receives – and therefore are partly dependent on the RAE scores (they also rely on bibliometric information, see below). Accordingly, the information in these rankings is, at least to some extent, already captured by the RAE scores.

- » In relation to the bibliometric data and associated measures, it is not clear to us that there is widespread agreement that the bibliometric method is 'better' or 'worse' than the peer review method underpinning the RAE scores. We also note that these data are typically 'paid-for' and so not truly publicly available and verifiable.

We recognise that measuring research excellence is contentious (presumably in part because it is a driver of research funding) and so welcomed views from BIS on the pros and cons of different methods of identifying excellent institutions.

### Getting good coverage of research institutions

To arrive a list of candidate research institutions to interview, we ranked them according to a weighted average RAE score. Specifically, we followed the steps outlined below.

- **Step 1:** In line with the methodology used by HEFCE to allocate funding, we assigned weights of 3 for 4\* research, 1 for 3\* research and 0 for all other research – 3\* and above research is 'excellent' and 4\* is 'world leading'.
- **Step 2:** Using these weights, we then calculated a weighted research score for each 'unit of assessment' (broadly speaking a subject area) for every institution. For example, in the case of research in Civil Engineering at Imperial College London, 40% of its research was graded at 4\* and 55% of its research was graded at 3\*. So, using the above weights, its weighted research score is  $43.75 = \frac{3}{4} * 40 + \frac{1}{4} * 55$ .
- **Step 3:** For each institution, we then calculated the simple average of the weighted research scores across all unit of assessments it received HEFCE funding for to arrive at an overall score for each institution. So, an institution covering two units of assessment with weighted research scores of 40 and 50 would receive an overall score of 45.
- **Step 4:** We then sorted the research institutions from highest to lowest according to their overall score.

The advantages of this method is that the highest ranked institutions:

- first, have to be producing excellent research according to the RAE scores – in line with our attempt to identify excellent research institutions;
- second, could be producing excellent research in few or many subject areas – that is, it allows specialist or smaller institutions to be included in the list – in line with our objective not to unduly limit coverage of institutions; and
- third, could be located anywhere – again, in line with our objective not to unduly limit coverage of institutions.

Within this method, no account is taken of the 'size' of the unit of assessment in terms of the amount of funding it attracts across all universities. On the one hand, this could be seen as a strength of the method in the context of this project – i.e. the method focuses on research excellence, rather than institution / subject funding. On the other hand, it could be seen as a weakness if the subject areas that attract the most funding have the greatest role to play in maintaining / furthering the UK's competitive advantage in research than those that do not. Put simply, it might be less interesting to BIS to understand the determinants of research excellence for subject areas (or institutions) that are 'small' in funding terms. An adjustment for this issue is set out below.

The table below shows the list of institutions identified by our initial approach.

- » The first column of the table shows the top 20 list of institutions (sorted by name) that are identified by the steps set out above. As can be seen from the table, the list seems to provide good coverage in terms: the size of institutions, variation in terms of the degree of specialism and location (although we note that there are none from Wales or Scotland – discussed further below).
- » The second column shows which institutions would be excluded if none of the subject areas in which they excel are 'large' in funding terms. To define 'large' we have included only subject areas that attracted more than 2% of total HEFCE funding in 2013-14. Those subject areas that remain after this account for 60% of total HEFCE funding in 2013-14.<sup>41</sup>

<sup>41</sup> Included: Biological Sciences, Computer Science and Informatics, Physics, Other Hospital Based Clinical Subjects, Business and Management Studies, General Engineering and Mineral & Mining Engineering, Chemistry, Earth Systems and Environmental Sciences, Mechanical, Aeronautical and Manufacturing Engineering, English Language and Literature, Art and Design,

- » As a cross-check, the third column shows which TRAC<sup>42</sup> peer group the institution belongs to. As expected, most belong to peer group A or B (institutions with the highest research intensity as measured by the total research income they receive). The list also includes specialist music / art colleges.

<i>Unfiltered list of top 20</i>	<i>Excluded by size?</i>	<i>TRAC group?</i>
Courtauld Institute of Art	Yes	G
Imperial College London		A
Institute of Cancer Research #		A
Institute of Education	Yes	B
King's College London		A
London Business School #		C
London School of Economics and Political Science #		C
London School of Hygiene & Tropical Medicine #		A
Queen Mary, University of London		A
Royal Academy of Music	Yes	G
Royal College of Art #		G
University College London #		A
University of Cambridge #		A
University of Durham		B
University of Essex #		B
University of Manchester #		A
University of Oxford #		A
University of the Arts London		G
University of Warwick #		A
University of York #		B

Based on this analysis, we suggested that we contact the 17 institutions that remain after excluding those subject areas that are 'not large' in funding terms to arrange interviews, since we anticipated that not all institutions we contacted would be able to participate. If most agreed to participate and we had a choice of institutions to interview, we would have suggested: speaking to at least one 'specialist' institution (such as the Institute of Cancer Research); speaking to no more than one 'arts or music' institution (e.g.

*Electrical and Electronic Engineering, History, Applied Mathematics, Psychology, Pre-clinical and Human Biological Sciences, Cancer Studies, Infection and Immunology, Geography and Environmental Studies.*

<sup>42</sup> TRAC (Transparent Approach to Costing) peer groups were created to benchmark universities. They are determined by turnover and research income levels. <http://www.jcpcg.ac.uk/guidance/revisions/Peergroups10.pdf>



picking only the Royal College of Art); and picking the rest to deliver a good geographic spread (i.e. avoiding a London-centric list). Our ‘first picks’ using this methodology are indicated by a # in the table above.

We noted that the above list does not include any institutions in Wales, Scotland or Northern Ireland. This is because the HEFCE dataset we used only relates to institutions in England. To account for this, we suggested including one or two of the University of Edinburgh, the University of Glasgow, Cardiff University or Queen’s University Belfast (all in TRAC A).

### Getting good coverage of research areas

As well as identifying the research institutions to interview, there was also the question of which subject areas to study. Aligned with the method above and the research objectives, we identified the subject areas in which the institutions achieve their highest weighted research scores. With this in mind, the table below shows (up to) the top three units of assessment for each of the 17 institutions listed above (i.e. after applying the subject area size filter described above). This approach seems to provide a reasonable coverage of subject areas.

<i>List of 17</i>	<i>Top 3 units of assessment</i>
Imperial College London	History Computer Science and Informatics Business and Management Studies
Institute of Cancer Research	Biological Sciences Cancer Studies
King's College London	Business and Management Studies Other Hospital Based Clinical Subjects History
London Business School	Business and Management Studies
London School of Economics and Political Science	History Business and Management Studies
London School of Hygiene & Tropical Medicine	Infection and Immunology
Queen Mary, University of London	English Language and Literature Computer Science and Informatics History
Royal College of Art	Art and Design
University College London	Other Hospital Based Clinical Subjects Computer Science and Informatics History
University of Cambridge	Computer Science and Informatics General Engineering and Mineral & Mining Engineering Earth Systems and Environmental Sciences
University of Durham	English Language and Literature Chemistry Applied Mathematics

University of Essex	History Electrical and Electronic Engineering Computer Science and Informatics
University of Manchester	Cancer Studies Computer Science and Informatics English Language and Literature
University of Oxford	Infection and Immunology Earth Systems and Environmental Sciences Computer Science and Informatics
University of the Arts London	Art and Design
University of Warwick	English Language and Literature History Business and Management Studies
University of York	Computer Science and Informatics Biological Sciences Chemistry

### Final sample

Following feedback from BIS on (a) the method we proposed to identify ‘excellent’ research institutions and (b) relatedly, the shortlist of 17 institutions, we agreed on a set of 12 institutions and subject areas to contact. To ensure a geographic spread of institutions, we included Cardiff University and the University of Edinburgh, along with hand picking institutions across England. Further to that, we used an element of discretion in the selection of subject areas to ensure a ‘balanced’ mix.

A list of the institutions we spoke to, along with the units of assessment (based on RAE 2008) represented by the individuals we spoke to, is set out in the table below.

<i>Institution</i>	<i>Units of assessment</i>
Cardiff University	Communication, Cultural and Media Studies Civil Engineering Law
Institute of Cancer Research	Cancer Studies/Biological Sciences
LSE	History Business and Management Studies Economics and Econometrics
UCL	Other Hospital Based Clinical Subjects Physics Art and Design
University of Cambridge	Computer Science and Informatics Other Hospital Based Clinical Subjects History
University of East Anglia	Biological Sciences Earth Systems and Environmental Sciences Chemistry

University of Edinburgh

Pure Mathematics  
Social Work and Social Policy & Administration  
English Language and Literature

University of Essex

History  
Electrical and Electronic Engineering  
Computer Science and Informatics

University of Manchester

Cancer Studies  
Electrical and Electronic Engineering  
English Language and Literature

University of Oxford

Infection and Immunology  
Earth Systems and Environmental Sciences  
Computer Science and Informatics

University of Warwick

Applied Mathematics  
History  
Business and Management Studies

University of York

English Language and Literature  
Computer Science and Informatics  
Biological Sciences

## Annex C – Discussion Guide

### Background

Economic Insight has been commissioned by the Department of Business, Innovation and Skills (BIS) to conduct a study of the drivers of research excellence in higher education institutions (HEIs). The objective of the study is to determine the factors that drive research excellence in UK institutions, abstracting from the absolute level of funding and ‘historical stocks’.

A key stage in this study is to conduct interviews with HEIs, and specific departments within them, that have been identified as having produced excellent research – as identified by the results of the RAE 2008. The purpose of the interviews is to help **develop a practical understanding** of the levers available to the sector and HEIs to help create excellent research.

### Interview details

The interviews will follow a broad structure that is set out on the following pages, and will be tailored to your specific role. We do not intend to stick rigidly to each question, but rather use them as a guide for our discussion. The purpose of sharing these with you is to enable you to give prior thought to the areas we would like to discuss, to enable the most productive conversation possible.

A previous stage of this project has identified various potential drivers of research excellence. Some of these drivers will be more applicable than others to your specific subject area or role, and the time spent discussing different factors will be tailored in each case.

As noted above, our objective is to develop a practical understanding of the levers available to the sector. With this in mind, we **will encourage and welcome practical examples from your own experience as a researcher and/or your experience of working in an institution. For example, you will see that we ask questions about what factors attract research to an institution. To help answer this, we could discuss a recent recruit and what mattered to him/her and/or how you made your own decisions.**

Each interview will last approximately 45 minutes to 1 hour. Thank you for your participation, we look forward to meeting you.

## Discussion Guide

### Introductory questions for Pro-Vice Chancellors or equivalent

It would be helpful to first gain some background understanding of your current role:

Could you describe what your role involves here?

What decisions do you make and what responsibilities do you have regarding research?

How does your role fit in with the rest of the research teams?

It would also be helpful to get your initial thoughts on the drivers of research excellence:

What can you as an institution do to encourage research excellence? How do you do this and what works best?

What do you think the Government and funding bodies can do to further encourage research excellence in your institution?

What do you see as the upcoming issues with regard to producing excellent research?

Is there anything that can be done to foster research excellence that isn't currently being done? Are we missing anything?

### Introductory questions for research team leaders or equivalent

Before discussing these drivers of excellence, it would be helpful to gain some background understanding:

What research are you managing/involved in?

What attracted you to conducting research here?

How much influence do you have over the environment and facilities?

How much influence do you have over the research of others (e.g. team leader responsibilities)?

It would also be helpful if you could describe, in general terms, what you see as the main factors that help you produce excellent research.

What motivates you or your team to produce excellent research?

What can and does the university do to help?

**Questions relating to specific areas we would like to discuss are presented on the following pages.**

Topic or issue	Primary questions	Secondary questions
<b>Competition</b>	<ol style="list-style-type: none"> <li>1. Who do you see as your closest competitors?</li> <li>2. What are your relative strengths and weaknesses?</li> <li>3. What do you do to stay ahead of the competition?</li> <li>4. What changes have there been in 1-3 in the last 5-10 years?</li> <li>5. Do you expect any changes in 1-3 in the next 5-10 years?</li> </ol> <p style="text-align: center; color: red;">~ Identify and discuss practical examples ~</p>	<p>Which departments, institutions and nations do you see as your closest competitors?</p> <p>Do you do, or offer something unique or different, in terms of attracting, developing and retaining researchers?</p> <p>What do you do to understand your competitive position (e.g. benchmarking)?</p> <p>How do you decide whether, what and when changes are needed to stay ahead of the competition (e.g. recruiting to access best-practice)?</p> <p>What recent changes have worked well and not so well (e.g. in terms of recruitment practices, incentives)?</p> <p>How have the increases in funding in other countries (e.g. China) affected you?</p> <p>Who and what do you see as the main competitive threats in (a) the short-medium term (5-10 years) or (b) the long-term (10+ years)?</p>
<b>Collaboration</b>	<ol style="list-style-type: none"> <li>6. Who do you see as your natural collaborators?</li> <li>7. How do you collaborate?</li> <li>8. How do you complement each other?</li> <li>9. When do collaborations work well and not so well?</li> <li>10. How do you balance competition with collaboration?</li> </ol>	<p>What are the important characteristics of a collaborator (e.g. similar of different set of skills, aligning personalities)?</p> <p>How do you become aware of potential collaborations?</p> <p>Are your collaborators the same as your competitors?</p> <p>What are you looking to gain from a collaboration and what are they looking to gain?</p> <p>How do you decide who is best to collaborate with?</p> <p>Why do others want to collaborate with UK institutions?</p>

	~ Identify and discuss practical examples ~	What would happen to the quality of your research if you weren't able to collaborate?
<b>Recruiting researchers</b>	<p>11. How do you know when to hire new researchers?</p> <p>12. How do you advertise for, and attract the best staff?</p> <p>13. How do you match an individual with the position you have available?</p> <p>14. How do you evaluate candidates?</p> <p>15. What components of a package matter most to candidates?</p>	<p>Is there a preference towards hiring internally or externally? Why? Is one more costly than the other?</p> <p>What is the recruitment process? How long are interviews? What information do you take account of? Do you decide who should be on the panel?</p> <p>Which elements of teaching components are most important? (e.g. who they are teaching, which courses, how many students, how much marking)</p> <p>How important is contract length to researchers? Does this impact the subsequent research that they do?</p> <p>Why do foreign researchers come to the UK? What most attracts them? Why do UK researcher leave the UK?</p> <p>Do you face any difficulties in recruiting?</p>
	~ Identify and discuss practical examples ~	
<b>Developing researchers – performance management and rewards</b>	<p>16. How do you incentivise and reward researchers for producing excellent research?</p> <p>17. How do you identify when a researcher has performed well?</p> <p>18. Do you do anything to enable or enhance the recognition that researchers get?</p> <p>19. Do you set specific goals in terms of research excellence, published papers, or grants received?</p>	<p>What most motivates a researcher? (e.g. salary, promotion, less teaching)</p> <p>What do researchers use as their measure of recognition? (e.g. promotions, speaking at conferences)</p> <p>Who do people want recognition from? Who are their peers? People in the same field?</p> <p>What matters most to you in terms of performance? (e.g. attracting funding, building reputation)</p> <p>How do you track performance? Do you look at papers published, citations, grants received?</p>



	<p style="text-align: center;">~ Identify and discuss practical examples ~</p>	<p>Have you seen better performance in cases where specific goals are set?</p>
<p><b>Retaining researchers</b></p>	<p>20. Is retaining staff an issue for you?</p> <p>21. How do you retain researchers who might be tempted by offers to move elsewhere?</p> <p style="text-align: center;">~ Identify and discuss practical examples ~</p>	<p>What factors are most important to them?</p> <p>Why do researchers leave?</p> <p>Where do people go when they leave? Do they retire or go to another research institution?</p> <p>How do you decide how much effort to put in to retaining a member of staff?</p> <p>Are there examples of where someone's mind has been changed because you have offered them something else or something differ?</p>
<p><b>Work environment, support and leadership</b></p>	<p>22. What degree of autonomy do you give to researchers / are you given?</p> <p>23. What aspects of the environment do you think really matter to your research and why?</p> <p>24. How does the need for Research Integrity affect research excellence in your institution?</p> <p>25. What support and leadership do you offer researchers?</p> <p style="text-align: center;">~ Identify and discuss practical examples ~</p>	<p>How free are you to set research objectives?</p> <p>How much control do you have as to where money is spent or which grant funders you target?</p> <p>Is there a strong team spirit? Is it a relaxed environment? Do you arrange social events within the team? How formal is the work environment?</p> <p>Do you have formal weekly meetings with researchers, or an open door policy, or work closely with them on a day-to-day basis?</p> <p>Do you offer mentors or career guidance?</p> <p>What has happened when different degrees of support have been given?</p>
<p><b>Size and critical mass</b></p>	<p>26. Do you need a certain number of researchers/range of facilities to produce excellent research?</p>	<p>How do you decide on the appropriate size of your departments/schools/research teams?</p>

	<p>27. Do you see evidence of a critical mass to enable recruitment, attraction of funding, or the production of excellent research through the exchange of ideas?</p> <p>28. What mix of staff do you find best? Do you need one 'star' faculty and many other researchers, or many 'stars' working together?</p> <p style="text-align: center;">~ Identify and discuss practical examples ~</p>	<p>Is there a point at which research quality declines with size?</p> <p>How much collaboration is there within a department/school?</p> <p>Do researchers always work in the same groups?</p>
<b>Facilities</b>	<p>29. How important are facilities and equipment to you for producing excellent research?</p> <p>30. How do you ensure that you have the facilities that you need?</p> <p>31. What would happen if you don't have state-of-the-art facilities? What would you do?</p> <p style="text-align: center;">~ Identify and discuss practical examples ~</p>	<p>Do you share facilities with other teams?</p> <p>How is time allocated between different parties that want to use the same equipment?</p> <p>Do you receive adequate funding to run equipment?</p>
<b>Government and funding body drivers</b>	<p>32. What incentives do the funding mechanisms have on the decisions that you make?</p> <p>33. What different incentives does Quality Related (QR) block funding create compared to research grants?</p> <p>34. What other Government or funder (including Research Councils, EU, business or charity) initiatives influence the decisions that you make?</p> <p style="text-align: center;">~ Identify and discuss practical examples ~</p>	<p>Apart from completing the relevant submissions and grant applications, what else do you do to ensure that you secure (QR) research block funding and Research Council grants?</p> <p>Does the level of competition for funding result in higher quality research? Do the incentives created change behaviour?</p>
<b>Others</b>	<p>35. Are there any other factors that we haven't already discussed that you consider critical to ensuring an excellent research environment and outputs?</p>	

## Further information

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