

## The concentration of research funding in the UK: driving excellence and competing globally

### Summary

- Research funding must support real **excellence in research**. This key principle has driven the success of UK research and will continue to be **key to the UK's success in the future** – enabling world-class research to flourish and supporting the UK's leading research base.
- Concentration of research funding, based on excellence, is necessary to **sustain the breadth and depth of the UK's research strength**. The Russell Group is concerned that the recent reduction in concentration of research funding, following the allocation of 2009/10 QR funding, risks damaging the UK's research base and compromising the sustainability of our leading universities.
- **Evidence shows that high concentrations of excellent research have the greatest impact**, generating significant financial returns, as well as broader social and economic benefits; leading to successful partnerships with industry; and supporting international research collaboration.
- The UK faces increasing international competition with unprecedented investment by our competitors in research: it is telling that many of our competitors, such as the US, Australia, China, India and Germany, are increasingly targeting resources towards developing or sustaining leading universities.
- It is important that limited government funds are concentrated on fostering excellence and building on success so that the UK can compete with the best in the world and continue to benefit from world-class research.
- **Sustaining a critical mass of research excellence in our leading universities:**
  - drives up quality – evidence shows that critical mass of research activity can increase the impact of research;
  - supports interdisciplinarity and underpins the research networks and collaboration – drawn from a wide spectrum of research fields – which stimulate knowledge exchange and innovation;
  - ensures a concentration of high-quality research and researchers in one place; offering greater value for money in terms of both infrastructure and impact;
  - ensures sustainable investment in large research infrastructure, supporting and maintaining the UK's leading research base;
  - attracts inward R&D investment from national and international business;
  - provides sustainable and high-quality doctoral education;
  - maintains the world-class research that ensures that the UK is globally competitive and the destination of choice for international collaboration in research.

## 1. Introduction

1. A policy of concentration of research funding, based on excellence, has supported the improvement of UK research since the introduction of the RAE. Evidence suggests 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<sup>1</sup>. Successive research assessment cycles between 1986 and 2001 have driven further enhancement of research “at all grades and across subject areas”<sup>2</sup>. The Russell Group believes that **the level of concentration of research funding prior to the 2008 RAE was about right**, and that this level should continue for the benefit of UK research and the sector as a whole.
2. Concentrating limited research funding on the highest-quality research ensures the most effective distribution of funding and the greatest returns on investment. Funding research excellence sustains the UK’s position as a global leader in research and results in significant social and economic impact. As the **Director-General of the CBI** has recently noted, the UK is well placed to recover from the current global economic downturn because it enjoys “strong comparative advantages. One is our university system, with far more world-class institutions than any country outside the US. Another is the strength of our science base.”<sup>3</sup> Analysis of research and innovation in Europe has noted the importance of fostering peaks of research excellence, which necessarily means supporting a small number of institutions to be the very best because “there is no denying that the high peaks cannot make up a significant proportion of the whole...and Europe needs these peaks.”<sup>4</sup>
3. Evidence also suggests the importance of a critical mass of research activity in supporting research excellence. **Research commissioned by HEFCE has found that the highest quality research is performed in institutions where a high proportion of staff are research active**<sup>5</sup> and an analysis of levels of output and bibliometric impact has suggested that “mass is a significant determinant of achievement”<sup>6</sup>. Indeed, the former Department for Education and Skills noted that: “The best universities contain a critical mass of research groups which can compete globally in a wide range of disciplines.”<sup>7</sup> As large research-intensive institutions, Russell Group universities represent both a critical mass of research activity and a high volume of research excellence. This was demonstrated by the results of the 2008 RAE; on average, twice as much of the research undertaken at Russell Group universities was rated 4\* compared with the rest of the sector.
4. Despite this, QR funding allocations for 2009-10 saw a much wider dispersal of funding across the sector<sup>8</sup>. The Russell Group’s percentage share of total recurrent research funding in England declined from 65 per cent (in 2008-09) to 62 percent,

<sup>1</sup> Higher Education Policy Unit, *The Role of Selectivity and the Characteristics of Excellence*, Report to HEFCE, 2000.

<sup>2</sup> Evidence Ltd, *Impact of selective funding of research in England, and the specific outcomes of HEFCE research funding* (Report to HEFCE and the Department for Education and Skills), 2005.

<sup>3</sup> Richard Lambert, “Reasons to be cheerful?” in *Business Voice*, December / January 2008.

<sup>4</sup> Aghion, P., Dewatripont, M., Hoxby, C., Mas-Coleil, A., and Sapir, A., *Higher Aspirations: an agenda for reforming European universities* (Bruegel Blueprint Series, Volume V, 2008), p.24.

<sup>5</sup> Professor Ewan Page, “A Review of Volume Indicators”, HEFCE, 1999.

<sup>6</sup> HEFCE *Fundamental Review of Research Policy and Funding: Sub-group to consider the role of selectivity and the characteristics of excellence: Final report*, 2000.

<sup>7</sup> DfES, *The future of higher education*, 2005, Chapter 2.

<sup>8</sup> It has not yet been possible to obtain comparative data for institutions in the devolved administrations.

and Russell Group universities accounted for only 23 per cent of the overall uplift in HEFCE recurrent research funding in 2009-10. Furthermore, of the losses to institutions across the sector in England, Russell Group universities accounted for almost half of these (49 per cent of the total losses). A number of Russell Group institutions suffered losses in cash terms varying between 1 and 13 per cent. In real terms<sup>9</sup>, half of Russell Group universities in England saw losses which led to either a flat or a reduced allocation compared to 2008-09. **This means that, despite an increase in QR funding of 5.6 per cent in real terms<sup>10</sup>, only half of Russell Group universities in England benefited from this increase.**

5. Not only does this make the challenge for our leading universities of sustaining world-class research and international competitiveness even greater, it also risks diminishing the rate of return from research funding. Analysis of data from previous RAEs shows that **university research is most cost effective and offers greater value for money when it is done in the departments most highly rated for research**.<sup>11</sup> Now, more than ever, it is vital to maintain the UK's policy of concentrating the majority of research funding on our leading institutions in order to drive up the quality and impact of our research and to maintain our global position at a time of great financial constraint (in contrast to the significant investment from our international competitors – see section 4 below).

## 2. Sustaining world-class universities

6. **A recent World Bank report on world-class universities emphasised the need for continued investment and improvement if universities are to remain world-class.** The report also discussed the vital role of world-class universities in driving economic growth and the development of the global knowledge economy. In recent years a growing number of countries have sought advice from the World Bank on how to develop their universities to become world-class institutions.<sup>12</sup>
7. It is important that we continue to maintain concentrated levels of investment in our leading research-intensive universities. They are key to the sustainability and excellence of UK research in a global context. As UKTI has noted, the UK's success as an international base for R&D (second only to the US) is largely due to the "immediate access to leading research institutions" for companies, with our leading universities "providing the means to tap into global networks on the back of their research excellence"<sup>13</sup>. The leading-edge research conducted in Russell Group universities drives innovation and discovery and which has the capacity to tackle global problems. This is particularly important now that an increasing number of our international competitors are developing a policy of concentrated support for leading universities (see section 4 below).

<sup>9</sup> Using the Treasury's GDP deflator index forecasts.

<sup>10</sup> The increase was 7.7 per cent in cash terms.

<sup>11</sup> Evidence Ltd., *Maintaining Research Excellence and Volume: A report for the Higher Education Funding Councils for England, Scotland and Wales and for Universities UK*, 2002. The analysis considered the results from the 1992 and 1996 RAEs and showed that compared with other departments, 5\* departments produce double the research output for every pound of research funding (Lord Layard, speech in the House of Lords debate on Education and Skills, 24 April 2002; <http://www.publications.parliament.uk/pa/ld200102/ldhansrd/vo020424/text/20424-06.htm>).

<sup>12</sup> Salmi, J., *The Challenge of Establishing World-Class Universities*, 2008.

<sup>13</sup> UKTI, *UK Inward investment 2007-08*, 2008.

8. Evidence shows that the UK's successful international performance on higher education and research, relative to the rest of Europe, owes much to the historical support for our top-performing universities<sup>14</sup>. Recent research into higher education in Europe has noted the importance of promoting world-class, elite universities if Europe is to be at the forefront of innovation and knowledge. In particular, the crucial role of higher education, first-rate research and postgraduate skills in driving leading-edge innovation is highlighted<sup>15</sup>. This suggests that whilst it is desirable to maintain a "good average higher education level", it is imperative that world-class universities are fostered.<sup>16</sup>
9. It is overwhelmingly the leading research-intensive universities that deliver world-class research in the UK:
  - Over 60 per cent of staff in 4\* departments in the 2008 RAE were in Russell Group universities and, on average, twice as much of the research undertaken at Russell Group universities was 4\* rated compared with the rest of the sector.
  - 68.5 per cent of Research Council grant income and of 65.9 per cent of QR funding in 2006-07 was allocated to Russell Group universities (comprising 11 per cent and 13 per cent of the UK and English higher education sector respectively).
  - Russell Group universities account for 55 per cent of the total income from collaborative and contract research income to UK universities.<sup>17</sup>
  - As well as performing high-quality research, Russell Group universities demonstrate a high return on research funding: the HESA 2006-07 Performance Indicators show that on average Russell Group universities awarded more PhDs and received more research grants and contracts than the rest of the sector, per academic staff costs.<sup>18</sup>
  - In total, just twenty Russell Group universities produced 56 per cent of PhDs in the UK in 2006-07. Our world-class universities train and employ high calibre researchers and academics who make up our present and future research workforce.

#### *Selectivity and concentration in funding*

10. Research commissioned by HEFCE on the role of selectivity in research funding (the distribution of funding according to excellence) concluded that the UK's research base has benefited from a concentration of research funding arising from a policy of funding following excellence. Funding models explored in the study found that a less selective distribution of research funding, which failed to reward established excellence so that the country's best research can remain world class, would have "serious disadvantages."<sup>19</sup>

<sup>14</sup> This is noted in Aghion, P. et al, *Higher Aspirations: an agenda for reforming European universities*, 2008.

<sup>15</sup> Aghion et al, *Higher Aspirations: an agenda for reforming European universities*.

<sup>16</sup> Ibid.

<sup>17</sup> Higher Education Funding Council for England, HE-BCI Survey, 2007.

<sup>18</sup> HESA performance indicator data, Share of research output per share of research input, weighted by cost centre, 2006-07.

<sup>19</sup> HEFCE, *Fundamental Review of Research Policy and Funding*, 2000.

11. Indeed, the review concluded that “there seems to be a general relationship between concentration and impact: that is to say, there is a higher relative UK impact compared to the rest of the world in those subjects where activity is more concentrated across institutions.”<sup>20</sup> As Professor David Eastwood, when Chief Executive of the Higher Education Funding Council for England, has said, “research funding should be concentrated...so that our research base remains globally competitive. It should be concentrated because much – though not all – research demands scale and costly kit; and it should be concentrated because there are genuine affordability constraints.”<sup>21</sup>
12. Reducing the current concentration of research funding would mean that the UK would be unable sufficiently to support its current level of research excellence. Our leading universities would no longer be able to sustain world-class research, consequently undermining the strength and success of the UK’s research base as a whole. As the former **Secretary of State for Innovation, Universities and Skills** has emphasised, “our world leading position - and our ability to sustain institutions that are world-class across a wide range of disciplines - depends on an appropriate concentration of research effort.”<sup>22</sup> A recent debate on higher education in the House of Commons discussed the need to concentrate funding on a small number of world-class universities, in order to allow the UK to continue to compete internationally.<sup>23</sup>
13. Whilst the Russell Group believes that the level of concentration prior to March 2009 was broadly at the right level, Professor Paul Wellings’ recent report to the Secretary of State for Innovation, Universities and Skills (as part of the review of higher education) demonstrates a clear rationale for intensification. The report also highlights the highly beneficial impact of funding concentration on the UK research base, arguing that: “Over the next 10-15 years, the cumulative effects of research resource concentration since the RAE began should be exploited to enhance both the basic research platform and the exploitation of novel ideas.”<sup>24</sup> Professor Wellings suggests that this exploitation could include both the Funding Councils and the Research Councils reviewing their funding mechanisms for “universities with larger graduate cohorts in order to generate a more comprehensive suite of training opportunities”<sup>25</sup>.

#### *Doctoral education*

14. In his report for the former Department for Innovation, Universities and Skills, **Professor Wellings has suggested that there should be an even greater concentration of research funding in the UK**, in order to support a small number of graduate schools which would act as regional hubs for postgraduate education

<sup>20</sup> *The Role of Selectivity and the Characteristics of Excellence*, 2000.

<sup>21</sup> Professor David Eastwood, “Quietly flows the Don? Higher Education, turbulence, and timeless verities”, AUA Annual Guest Lecture, 24 October 2007. <http://www.aua.ac.uk/events/annuallecture/tenth/narrative.pdf>

<sup>22</sup> The Secretary of State speaking at the Wellcome Collection Conference Centre in February 2008, launching the debate on a framework for higher education over the next 10 to 15 years.

[http://www.dius.gov.uk/speeches/denham\\_hespeech\\_290208.html](http://www.dius.gov.uk/speeches/denham_hespeech_290208.html)

<sup>23</sup> <http://www.publications.parliament.uk/pa/cm200708/cmhansrd/cm081021/halltext/81021h0001.htm>

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<sup>24</sup> Professor Paul Wellings, *Intellectual Property and Research Benefits*, September 2008.

<sup>25</sup> Ibid.

and research.<sup>26</sup> He notes that thirty-four universities produced 75% of PhD graduates and created 78% of patents<sup>27</sup>. This supports HEFCE's earlier conclusion that "there is a concentration in the distribution of trained researchers and postgraduate researchers in training...the institutions in which these concentrations occur...are also the most frequently associated with high volume and high impact bibliometrics outputs."<sup>28</sup>

15. Other research has demonstrated a clear argument for concentrating postgraduate training and education in leading research-intensive universities<sup>29</sup>. For example, the United States is first in the world for research excellence and concentrates its doctoral training in a relatively small number of universities – 614, or just under 9 per cent, of 7,018 institutions<sup>30</sup>. Such concentration results in a "snowballing process, where an outstanding scientist gets funded to do exciting research, attracts other faculty, then the best students – until a critical mass is formed that has an irresistible appeal to any young person entering the field."<sup>31</sup>
16. Likewise, "Europe needs elite institutions providing excellent training for excellent graduate students"<sup>32</sup> to ensure its future competitiveness and success in research. Given evidence showing that, where research and innovation drive economic prosperity, it is investment in the highest-level skills which has the most impact on growth<sup>33</sup>, it is key that the postgraduate skills are delivered in an environment of the very highest quality. As **Professor Alison Wolf** has argued: "To support research and innovation, countries need a sizeable, but not vast, number of top-class, superbly trained researchers and developers, not a very large number of imperfectly trained ones."<sup>34</sup>
17. The Warrar Review of the economic impact of the Research Councils emphasises the importance of "intellectual capability and creativity" to the UK's success in the global economy, which "is created by having universities that are at the cutting edge of international research and by having a strong stream of graduates and PhD students flowing from these universities into industry and commerce." The report goes on to note that "the output of highly educated people rather than research results is widely regarded as the most effective knowledge transfer mechanism."<sup>35</sup>
18. In recent years, and following the Warrar Review, it can be seen that there is an increasing trend among the Research Councils to award funding for PhD training through mechanisms<sup>36</sup> which reflect the importance of research intensity and well-funded research environments in order to ensure the provision of high-quality support and training for PhD students. The flagship Doctoral Training Centres (funded by the EPSRC, and just launched by the ESRC with a particular focus on

<sup>26</sup> Professor Paul Wellings, Times Higher Education conference: "Making the most of your university's intellectual property", 26 November 2008.

<sup>27</sup> *Intellectual Property and Research Benefits*, 2008.

<sup>28</sup> *The Role of Selectivity and the Characteristics of Excellence*, 2000.

<sup>29</sup> Aghion et al, *Higher Aspirations*.

<sup>30</sup> Ibid.

<sup>31</sup> Mihaly Csikszentmihalyi, *Creativity: Flow and the Psychology of Discovery and Invention*, 1997; cited in Salmi, J.

<sup>32</sup> Aghion et al., *Higher Aspirations*.

<sup>33</sup> Aghion, P., "Growth and the financing and governance of higher education", Universities UK annual conference, 12 November 2008.

<sup>34</sup> Wolf, A., *Does Education Matter?*, Penguin, 2002, p.247.

<sup>35</sup> Warrar, P. *Increasing the economic impact of the Research Councils*, 2006.

<sup>36</sup> For example, a large number of studentships in most Research Councils are awarded in line with research grants received by institutions on a quota basis (most recently, the new Block Grant Partnerships established by the AHRC).

interdisciplinary working) which are awarded competitively to universities also recognise the benefits of cohort training in an environment which offers research intensity. The Wellcome Trust, as another significant funder of PhD studentships, has previously noted the importance of research students being “placed in well-funded research environments where superior facilities, training opportunities and scientific mentoring would be available to them.”<sup>37</sup>

19. The training of highly-skilled researchers in high-quality research environments remains a crucial priority for the UK if we are to sustain our international competitiveness both in research and in industry. The evidence discussed above demonstrates the importance of high-quality PhD training and the benefits for this of the research-intensive environment that results from concentration of funding. It is imperative that we continue to adequately support our leading universities in producing the talented PhD graduates and researchers that will enable the UK to play its full role in the global knowledge economy and sustain a world-class research base.

#### *Sustaining critical mass*

20. Russell Group universities undertake a large amount of highly-rated research across a broad range of disciplines, supporting a critical mass of research activity and excellence. This critical mass allows more effective use of facilities (because of the co-location of research groups and sharing of infrastructure costs) as well as valuable opportunities for inter- and multi-disciplinary working and the exchange of ideas. Additionally, larger groups of research students provide a more supportive atmosphere for research training – the recent initiative by the EPSRC to develop 44 additional Doctoral Training Centres (32 in Russell Group universities) demonstrates an increased focus on training cohorts of doctoral students who will benefit from learning within a supportive and motivated peer group. The World Bank report cited in section 2, above, emphasises “the presence of a critical mass of top students and outstanding faculty” as a determinant of excellence, with “a high concentration of talent” identified as one of the essential characteristics of world-class universities<sup>38</sup>.
21. The HEFCE review discussed above identified a number of reasons as to why critical mass is important to the “achievement of excellence in research”<sup>39</sup>:
  - the intellectual environment created by a larger group of researchers offers peer stimulus, adds to overall vitality and provides the opportunity for researchers to exchange and develop ideas (as well as to be encouraged by visible achievement);
  - large groups allow the simultaneous and parallel development of research themes, which can lead to an overall acceleration of research and contribute to greater diversity of thought and diversity of sub-disciplines – this increases the likelihood of cross-disciplinary working;
  - critical mass means that large groups of research students can be sustained and this provides a more supportive atmosphere for research training;
  - the *per capita* marginal costs of research (administration, clerical support etc) are reduced if a larger research group contributes to infrastructure.

<sup>37</sup> The Wellcome Trust, *Review of Wellcome Trust PhD Research Training: Career Paths of a 1988-1990 Prize Student Cohort*, 2000.

<sup>38</sup> *The Challenge of Establishing World-Class Universities*.

<sup>39</sup> *The Role of Selectivity and the Characteristics of Excellence*.

22. The review also concluded that “mass has some influence on measurable achievement at the institutional level in both the UK and the USA”<sup>40</sup> and that size (critical mass) appeared to have a positive impact on quality for physical, natural and social sciences. In particular, the analysis in the report showed that high volume is crucial for high impact on the clinical and biological sciences, and is important for high impact in engineering and the social sciences (although there was no clear pattern for maths and the arts and humanities).
23. This demonstrates a clear rationale for supporting critical mass in research activity, through concentration of funding based on excellence, in order to maximise the impact of and return from limited public investment, particularly in the current climate of difficult economic circumstances and increased global competition.
24. Critical mass in research activity and excellence is also crucial in supporting the development of research networks, which are becoming more important as discoveries and breakthroughs in research are increasingly achieved by high-achieving multidisciplinary teams<sup>41</sup>. The breadth and depth of research excellence across a wide range of disciplines in Russell Group universities supports such interdisciplinary working, ensuring that leading-edge research at the boundaries of disciplines is flourishing.
25. As the Vice-Chancellor of the University of Auckland has noted: “A critical mass of leading staff and outstanding students in a university, enabled by adequate investment and an international reputation for teaching and research, produces research outputs, an atmosphere of intellectual excitement, and productive relationships with industry that cannot be replicated elsewhere.”<sup>42</sup> Indeed, responses to Australia’s consultation on the proposed Research Quality Framework emphasised the importance of the RQF taking account of the “extent to which the group has an acceptable “critical mass” of researchers to facilitate international-standard research”<sup>43</sup>.
26. An investigation into universities’ management of research identified critical mass as a key requirement for effective management, both in terms of “operational efficiency” and “academic vitality” and emphasised the “unanimous view that the small academic department was no longer sustainable as a primary organisational unit for research in a research-intensive university. There was also a common view that research now required group organisation. Whilst the individual researcher could survive in certain subject areas, they should still be integrated within the wider subject based groups of clusters.”<sup>44</sup>
27. The Scottish Government’s explicit policy of creating and sustaining critical mass through its Research Pooling Initiatives demonstrates an intention to manage

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<sup>40</sup> Ibid.

<sup>41</sup> Abramovsky, L., Harrison, and R., Simpson, H., “University Research and the Location of Business R&D”, *The Economic Journal*, Vol. 117, Issue 519, March 2007.

<sup>42</sup> “Commentary on issues of higher education and research”. Auckland: Office of the Vice-Chancellor, August 2007, Issue 1.

<sup>43</sup> Submission from the University of New South Wales;  
[http://www.dvcresearch.unsw.edu.au/presentations/RQF\\_Prefered\\_Model.pdf](http://www.dvcresearch.unsw.edu.au/presentations/RQF_Prefered_Model.pdf)

<sup>44</sup> Taylor, J., “Managing the Unmanageable: the Management of Research in Research-intensive Universities”, in *Higher Education Management and Policy*, Volume 18, No.2



research investment at a national level to ensure critical mass in strategic research areas. The policy reflects its awareness of the importance of “groupings of significant critical mass well positioned to compete with the best in the world in creating new knowledge as well as in offering enhanced graduate training and making innovative contributions to the economic and cultural life of Scotland.”<sup>45</sup>

28. Given this, the critical mass of research excellence in Russell Group universities can be seen to underpin the UK’s world-class research base and to support the Government’s objective of ensuring the UK is a world leader in research. The high concentration of research excellence in Russell Group universities facilitates the formation of research clusters and collaborations which drive pioneering research, act as hubs of research excellence, and promote inter-university alliances and partnerships with business, as well as international research partnerships. For example:

- The Global Medical Excellence Cluster between the University of Cambridge, Imperial College London, King’s College London, the University of Oxford and University College London aims to connect universities, industry and the NHS to encourage medical innovation and attract higher R&D investment.
- University College London’s Institute of Global Health will develop international research partnerships, in addition to interdisciplinary partnerships, across the university to address global health challenges. UCL’s other ‘Grand Challenges’, drawing on UCL’s strengths as a large research-intensive institution with a broad research base, are employing a similar strategic of promoting interdisciplinary collaborations to address major research challenges.
- Inter-institutional collaborations such as the Science Cities in Birmingham, Bristol, Manchester and Newcastle, the White Rose Consortium (between the Universities of Leeds and Sheffield and the University of York) and the N8 alliance (between the Universities of Leeds, Liverpool, Manchester, Newcastle and Sheffield) aim to combine research strengths and capitalise on joint capacity in order to foster innovation and partnerships with industry.

*Critical mass: supporting business R&D activity*

29. The noted importance of both “institutional quality” and of proximity to markets for economic growth and development<sup>46</sup> has significant implications for how partnerships both between universities and between universities and industry can best be supported. In particular the critical role of leading universities in knowledge clusters<sup>47</sup> and regional technology clusters<sup>48</sup> has been observed; research-intensive universities stimulate productivity and innovation “by serving as a source of knowledge spillovers and producing graduates who disseminate tacit knowledge”<sup>49</sup>. Research for the **European Commission** has found that the returns from R&D

<sup>45</sup> [http://www.sfc.ac.uk/information/information\\_research/strategic\\_research\\_grant.htm](http://www.sfc.ac.uk/information/information_research/strategic_research_grant.htm)

<sup>46</sup> See Crafts, N., “The ‘Death of Distance’: What does it mean for economic development?” in *World Economics*, Volume 6, Number 3. July-September 2005.

<sup>47</sup> As noted in the Council for Industry and Higher Education’s report, *US and UK Competitiveness and the Role of Universities*, 2008.

<sup>48</sup> Rothaermel, F. and Ku, D. “Inter-Cluster Innovation Differentials: The role of research universities”, IEE Transactions on Engineering Management: Special Issue ‘University Technology Transfer’, 2006.

<sup>49</sup> Ibid.

investment are heavily dependent on “the quality of the workforce conducting research” and on “the concentration of R&D centres”, concluding that “geographical concentration of R&D centres and investment may multiply returns...In most cases, an increase in concentration is associated with a rise in the rate of growth. Thus **there is a clear incentive to cluster R&D activities and investment.**”<sup>50</sup>

30. Indeed, an analysis of UK university knowledge transfer activities found that **“high quality research universities have a disproportionately larger effect on cluster formation** than lower quality research universities...[meaning that] high-tech / innovation clusters especially form around large research universities that conduct high quality research”<sup>51</sup>. The analysis considered a sample of twenty universities, thirteen of which were Russell Group universities, and showed that the universities that carry out the highest quality research are also those which achieve the most technology transfer and engender the majority of high quality spin-out companies.
31. The research showed a clear correlation can be identified between the number of R&D companies in the vicinity of a university and the number of postgraduate students, suggesting that Russell Group universities, as leaders in postgraduate education – with 28% of all students and 56% of doctorates – play an important role in attracting R&D investment. In addition, innovation-based companies tend to locate near the UK’s top research universities and R&D companies tend to locate near clusters of innovation-based. It was concluded that “there is an exponential relationship between the quality of research being conducted at a university and both the number of R&D companies and venture-backed companies around these universities.”<sup>52</sup>
32. Similarly, a study using a sample of ten Russell Group Universities showed that all but one were more efficient in venturing activity than two prestigious, research-led US institutions chosen for the same exercise<sup>53</sup>. This was largely due to the health of the UK’s research base which provides “excellent raw material for technology transfer activity”, attracting more investment to develop spin-outs.. The report found that UK universities – which at their best were among the world’s top institutions – had developed highly efficient and effective technology transfer capabilities which enabled them to attract more investment to develop spin-outs.
33. Research also suggests that relationships between universities and industry tend to be more successful where they are “established more intensively by high quality universities”<sup>54</sup>. The link between research excellence and success in knowledge transfer activities was also borne out by the **Wellings review** which found that **universities in the UK with the largest research incomes “tend to be the ones with the strongest performance in research commercialisation and related forms of knowledge transfer.”**<sup>55</sup> Overall, the evidence indicates that a concentration of high quality research stimulates and underpins the most successful

<sup>50</sup> Community and Research Development Information Service, *Benchmarking of National Policies: Public Investment in R&D*, June 2002.

<sup>51</sup> Library House, *An analysis of UK university technology and knowledge transfer activities*, 2007.

<sup>52</sup> Ibid.

<sup>53</sup> Library House, *Spinning out quality: University spin-out companies in the UK*, 2007.

<sup>54</sup> Giuliani, E. and Arza, A., “What drives the formation of ‘valuable’ university-industry linkages? An under-explored question in a hot policy debate”, Science and Technology Policy Research Unit Electronic Working Paper Series, University of Sussex, 2008.

<sup>55</sup> *Intellectual Property and Research Benefits*.

collaboration with business – demonstrated by the significant role of excellent research in attracting business investment to the UK.

34. Research for the Department of Innovation, Universities and Skills shows that the UK is a particularly important location for multinational enterprises that invest in R&D and suggests that is due in large part to the “high availability of researchers” and “access to specialised R&D knowledge and results” provided by our research-intensive universities<sup>56</sup>. Businesses think that UK universities are performing some of the best research and developing some of the best graduates anywhere in the world<sup>57</sup> and evidence demonstrates a strong correlation between the location of business R&D investment and relevant high-quality university research departments in the UK, “confirming the importance of world-class centres of research for attracting increasingly footloose R&D investment.”<sup>58</sup>

#### *Attracting international students*

35. Sustaining world-class universities is vital in ensuring that the UK remains a destination of choice for international students. Evidence suggests the choice of where to study is based predominantly on perceptions of the overall quality of a country’s higher education<sup>59</sup> and department and institutional reputation<sup>60</sup>. The UK’s reputation for high-quality higher education is drawn from its world-class research-intensive universities<sup>61</sup>, who are highly successful in attracting international students – despite comprising just 11 per cent of the UK higher education sector:
36. The financial contribution of international students<sup>62</sup> is becoming increasingly important to the United Kingdom and this vital income stream may be adversely affected by the current economic downturn. Moreover the UK’s market share is

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<sup>56</sup> Department for Innovation, Universities and Skills, *Business Innovation Investment in the UK*, 2008.

<sup>57</sup> Abramovsky, L et al, “University Research and the Location of Business R&D.

<sup>58</sup> Ibid. The correlation was strongest for the pharmaceutical and chemical industries.

<sup>59</sup> See OECD, *Internationalisation and Trade in Higher Education*, Paris, 2004. In addition, MORI research undertaken in two of the EU accession countries (Hungary and the Czech Republic) found that the UK was the most popular choice as a destination for higher education (MORI, ‘Through other eyes: how the world sees the United Kingdom’, 2000). This is a reflection of the high regard for the UK system of HE in terms of the quality of HE and employer recognition of qualifications – the two most important factors in an individual’s choice of an overseas country in which to study. Research has shown that the most important factors for international students in choosing their country of study are quality of higher education and employer recognition of qualifications (Higher Education Policy Institute, *Projecting Demand for UK Higher Education from the Accession Countries*, 2004). This is also corroborated by research undertaken by the British Council identifying the ‘primary attractiveness’ factors for the five major English-speaking destinations for international students. The factors identified as being the most important for the UK were quality of education and employment prospects (British Council / Universities UK / IDP, *Vision 2020: Forecasting international student mobility: a UK perspective*, 2004).

<sup>60</sup> UK Higher Education International Unit, *The UK’s Competitive Advantage: The Market for International Research Students*, July 2008.

<sup>61</sup> See Palfreyman, D., “Sustaining Oxford as world-class” in *International Higher Education*, Number 49, Fall 2007.

<sup>62</sup> Research has found that the total net injection into the economy by overseas (non-EU) students in 2004-05 was around £2.87 billion and suggests that the total impact of direct spending by overseas students in 2004-05 around £4.3 billion (Higher Education Policy Institute, *The Economic Costs and Benefits of International Students*, July 2007. HEPI estimates a multiplier effect of 1.5 for international student’s total input to the UK economy.) In addition, a large proportion of international students who come to the UK stay here to work in universities or elsewhere - research shows that 40 % of postgraduate research students in the UK hope to stay on after they finish their degree (*The UK’s Competitive Advantage: The Market for International Research Students*.) UK business particularly welcomes foreign students in the UK as a source of potential recruits after they finish their studies (Council for Industry and Higher Education, *International Competitiveness, Business Working with UK Universities*, May 2006). This is a major benefit to the research and business sectors of the UK economy; indeed, the International Unit’s report *The UK’s Competitive Advantage* found that international postgraduate research students are essential for the success of the UK economy.

under threat from the increasing global competition for international students, and by the fact that more students are choosing to study in their home country.<sup>63</sup>

### 3. Driving excellence in research

37. The policy of concentrating funds on excellence has enabled the UK to become a world-leader in research:

- Evidence shows that the UK is number one in the G8 of advanced industrial nations for research productivity<sup>64</sup>: UK researchers produce 16 research papers per \$1 million of research funding – compared to 9.9 in the US and 3.6 in Japan.<sup>65</sup> The UK's high level of productivity is a particularly good return given that the UK is ranked seventh in the G8 for public funding for research<sup>66</sup>.
- Furthermore, the UK is second only to the US in research excellence – with 1 per cent of the world's population, we produce 9 per cent of publications and account for 12 per cent of citations. In terms of citation impact the UK is ahead of the US in health, biology, environment and physical sciences<sup>67</sup>.
- On average, UK scientists receive about 10 per cent of internationally recognised science prizes – most of these are conferred on academic staff at Russell Group universities.

38. It is excellent research which has the greatest impact:

- A study of Russell Group research projects has shown that 60 case studies for which financial data was available represented a combined 'value added' to the economy of over £2 billion.
- In addition, these projects represented a significant wider economic and social impact. To gain some insight into the nature of these impacts, we sought to identify major areas where the research might be of benefit to society. All of the innovations we examined have the potential to benefit society through endowing businesses with competitive advantage, bringing new consumer products to market, and often creating numerous job opportunities.
- Over 90% of case studies had the potential to impact on major societal challenges, such as health care, the environment and climate change, or 'quality of life' (improving people's lives through new entertainment, improved communication devices or other services). This includes
  - 39% which have resulted or may result in a new treatment or diagnostic tool
  - 35% which have resulted or may result in other healthcare impacts, such as new medical devices or research tools

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<sup>63</sup> *The UK's Competitive Advantage*

<sup>64</sup> Evidence Ltd / Department for Innovation, Universities and Skills, *International comparative performance of the UK research base*, July 2008.

<sup>65</sup> Universities UK, *Spending Review 2007: Securing the Future*, 2007.

<sup>66</sup> The UK spent 1.82% of GDP on R&D compared to an average of 2.24% according to a study of 21 comparator nations (PSA target metrics for the UK research base, Evidence Ltd / Office of Science and Innovation, 2007).

<sup>67</sup> *International comparative performance of the UK research base*.

- 14% which have the potential to generate significant environmental benefits (for example through energy saving devices or reducing pollution)
- 10% which are associated with technologies which could improve people's quality of life

39. Evidence also shows that there is a positive relationship between the quality of university research and interaction with industry, and that those departments and institutions with more research income tend to engage more frequently with industry.<sup>68</sup> This would suggest that investing in high quality basic research in research-intensive universities promotes university-business interaction and stimulates innovation and knowledge transfer. Research has also shown that institutions with a high critical mass of research activity, such as Russell Group universities, attract the most external research sponsorship<sup>69</sup>.

#### **4. International competition**

40. Recent years have seen countries around the world increasingly investing more resources in their higher education institutions. The reasons for this are two-fold. Countries such as the US and France are investing in higher education as a means to prompt a swift, but sustainable, recovery from recession, recognising that research underpins innovation and long-term economic growth.

41. Other countries, such as China, Japan, Korea, Taiwan, Canada, Denmark, and Germany, have observed the performance of world-class universities (such as those in the UK and US) and the resulting contributions to innovation and productivity growth. These countries are eager to host their own comparable institutions in the hope of reaping the resulting rewards and benefits to international competitiveness. More detail on developments in these countries is given below.

#### ***US and Canada***

42. Under the Obama Presidency the US has substantially increased its investment in research and development to create the conditions for a rapid and sustainable economic recovery. Their rationale is that investing in R&D, the fundamental building blocks of productivity and long-term economic growth, ensures that once economic recovery begins, economic growth will be stronger and more sustainable. The American Recovery and Reinvestment Act (ARRA), enacted in 2009, contained a fiscal stimulus package including \$21.5bn for federal research and development. This included \$11.5bn for basic research in fundamental science and engineering and \$1.5 billion to renovate university research facilities. This funding will primarily be allocated by competitive peer review ensuring that it supports only excellent research. The focussed increased resources for basic research and research infrastructure demonstrates a commitment to the long-term health of the US' research base.

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<sup>68</sup> Noted in Este, P. D., and Patel, P., "University-industry linkages in the UK: What are the factors underlying the variety of interactions with industry?" *Research Policy*, 36 (2007) 1295-1313.

<sup>69</sup> Professor Ewan Page, "A Review of Volume Indicators", HEFCE, 1999.

43. The Government of Canada has announced a commitment to research excellence, providing \$159.1M in September 2009 for 181 Canada Research Chairs in 45 Canadian universities. The programme is designed to attract the best talent from Canada and around the world, helping Canadian universities achieve international research excellence.
44. In addition, leading Canadian universities are calling upon the government to concentrate resources to more effectively support its highly performing universities, and to raise their international standing. The presidents of five of Canada's largest research institutions – Universities of Alberta, British Columbia, Montreal, Toronto and McGill University – have argued that Canada should introduce a 'differentiation' model for higher education that rewards each university's relative strengths, rather than continuing with the existing egalitarian funding environment which works to 'open the peanut-butter jar and spread thinly and evenly'<sup>70</sup>.

## **Europe**

47. The European Commission states that "excellence in research is a prerequisite to its societal spillovers in form of technology development or other innovations... all member states acknowledge the relevance of an excellent research base." Recent examples of activities launched over the last five years to foster the excellence of the public research base include:<sup>71</sup>

- Germany introduced the 'Excellence initiative' to make Germany a more attractive research location, increasing international competitiveness and focussing attention on the outstanding achievements of German universities and the Germany scientific community. Between 2006 and 2011 a total of €1.9bn will fund graduate schools, clusters of excellence to promote top-level research and institutional strategies to promote top-level university research.
- Denmark restructured their public research base in 2006, merging the existing 25 universities and public research institutes into 11 new research institutions. The new restructured system includes three large universities, created to rank amongst the largest in Europe in terms of resources, and aimed at retaining and attracting the most talented students and researchers. It was intended that two thirds of Denmark's public research and university education would take place at these three new universities, and that the three universities will better reap professional synergies, utilise Denmark's research facilities, and achieve a larger share of EU research grants.
- In France, the university system is characterised by a large number of small universities, though resources are largely concentrated. Of 161 establishments, 33 are allocated two-thirds of resources. In 2008 the Government announced a new initiative called 'the Plan Campus' which aimed to develop ten regional centres of excellence in higher education and research, competing at the international level, reorganising 38 universities and research organisations. The Government has significantly increased the number of members of the

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<sup>70</sup> Chronicle of Higher Education, September 4, 2009

<sup>71</sup> ERA-watch country profiles and European Commission, 2009, Trends in R&D policies for a European knowledge-based economy.

Academic Institute of France in order to support the development of high-level research in universities and to enhance interdisciplinarity.

- The French Government announced in December 2009 an additional €35bn spending plan aimed at preparing France for the challenges of the future, and so that France can fully profit from economic recovery. The higher education sector is the centrepiece of the spending plan, and will receive €11bn, with €8bn to create ten campuses that bring together leading institutions. Nicolas Sarkozy said “the aim is quite simple: we want the best universities in the world.”

## **Asia**

45. Major reforms of the science and innovation system have taken place in China since the 1990s, including restructuring of government research institutes through downsizing, and expansion of the higher education sector through more concentrated financial support to the key research intensive universities. R&D expenditure in the higher education sector has experienced rapid growth, and since 2000, more than 50% of S&T and R&D funding has come from the government.
46. Government support aims to promote the advancement of specific Chinese universities with strong research capacity in a few key subjects, in order to create a world-class research environment and performance. Specific initiatives have included Project 211 and Project 985, launched in 1996 and 1999 respectively, which have aimed to enable universities to become world-class institutions. R&D activities are concentrated in a few large universities and focus on a few key disciplines in natural sciences and engineering. In 2005, R&D expenditure by the top 50 universities accounted for 66% of total R&D expenditure in natural sciences and engineering in the higher education sector.<sup>72</sup>
47. In Japan, universities are being encouraged to take a more international stance. Under the “Global 30” Project, thirteen universities were selected in 2009 by the Government to play a major role in the internationalisation of higher education in Japan. The scheme aims to select universities that will function as core schools for receiving and educating international students, and who will play a major role in dramatically boosting the number of international students educated in Japan as well as Japanese students studying abroad.<sup>73</sup>
48. South Korea’s Brain 21 programme is aimed at developing world-class research universities and preparing Korean higher education for the challenges ahead. In 1999, the first phase began with the government deciding to invest 1.4 trillion won (about US\$1.2 billion) into higher education over seven years. The second phase of Brain 21 commenced in 2006. The project operates on principles of selection and concentration, with all universities applying to the project needing to demonstrate collaborative networks among highly skilled university researchers. Each research consortium consists of one leading university and one or more participating universities. The government provides financial resources to selected consortia.

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<sup>72</sup> OECD, 2009, Measuring China’s innovation system: national specificities and international comparisons, OECD Working Paper.

<sup>73</sup> ERA-watch country profile for Japan.

49. Taiwan has significantly increased funding for its Academia Sinica Institution - around 12% of the annual R&D budget in 2009. This is a concerted effort to foster a world-class research institution which can carry out leading research and attract the best staff and students from around the world.



## 5. The global context

50. Excellence in research – leading to groundbreaking discoveries and breakthroughs – will also enable us to tackle the major challenges of the future. It is vital that we continue to support the high-quality research that enables our leading institutions to set the agenda on a global research stage.
51. Research is increasingly conducted on an international basis, with papers resulting from international collaborations more frequently cited and published in higher impact journals than those with UK-only authors.<sup>74</sup> The latest figures on the performance of the UK research base show that UK internationally co-authored papers have risen from 32 per cent in 1998 of total world publications to 45 per cent in 2007.<sup>75</sup> It is therefore essential that the UK's research base is adequately supported and that the UK continues to be the partner of choice for international collaboration to enable us to remain at the forefront of research and discovery.
52. In particular, this means supporting our leading research-intensive universities to engage in leading-edge research collaboration and partnerships; evidence shows that large pre-92 institutions are far more likely than other HE institutions in the UK to engage in international research collaboration<sup>76</sup>.
53. Given that the UK undertakes less than 10 per cent of the world's research, it is also essential that we support our research base and foster international partnerships to ensure that we are able to benefit from the global knowledge pool and to recognise and exploit international developments and breakthroughs.
54. Successful international partnership will help to foster collaborations with other world-class universities, facilitate major global research initiatives and build higher education or research capacity in developing countries. World-class universities, with a high concentration of research excellence, have the potential to tackle major global issues such as climate change, the security of food and energy supply, and global health problems.

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<sup>74</sup> Professor Sir Gareth Roberts, *International Partnerships of Research Excellence: UK-USA Academic Collaboration*, April 2006.

<sup>75</sup> *International comparative performance of the UK research base*.

<sup>76</sup> Evidence Ltd / Department for Innovation, Universities and Skills, *International Research Collaboration in UK Higher Education Institutions*, 2008.