BIS Science and Innovation Strategy Survey

University Alliance Response, September 2014

Introduction

1. University Alliance is a non-partisan, non-political organisation working to promote, safeguard and sustain the public benefit delivered by universities.
2. University Alliance brings together the UK's leading innovative and enterprising universities – major institutions combining science, technology and the creative industries with a focus on delivering for the professions, business and the community. Alliance universities are central to the UK's economy, driving growth in new sectors and markets through the delivery of high quality, industry-ready graduates, science and research.
3. Alliance universities have a 'revolving door' approach to business engagement. A key feature of activity is supporting new growth industries and regional development through major partnerships with the likes of Siemens, Hewlett-Packard and GSK, as well as thousands of SMEs. 44% of all turnover from graduate start-ups comes from businesses started by Alliance graduates.
4. Given the success of Alliance universities' engagement with industry and the innovation ecosystem, we are pleased to be able to contribute to this consultation process in the development of the Government's Science and Innovation strategy. We provide examples of Alliance activities throughout the report, and would be pleased to work further with review teams to demonstrate the key role of Higher Education institutions within the Science and Innovation ecosystem.

Summary

5. Universities are central to the UK's science and research ecosystem and the knowledge economy. In the UK's global, knowledge-based economy, where 80% of new jobs are in high-skill areas[1] and new and growth industries take a high-tech, high-skill and innovative approach, universities are playing a critical role in driving the UK's economic future alongside and in partnership with businesses.
6. We **urge long-term certainty on investment** and **real terms increases to the science budget** to bring the UK's investment in line with international R&D averages. We must prioritise investment in the existing infrastructure if we are to future-proof the vitality and competitiveness of the UK science and research ecosystem.

[1] R. Wilson and A. Green (2001) *Projections of Occupations and Qualifications: 2000/2001: Research in Support of the National Skills Taskforce Department for Education and Employment.*

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7. British science is central to innovation. However, open innovation needs open competition – so a commitment to the principle of seeking and funding research excellence wherever it is found must continue to be an essential priority.

8. The university-business interface is a particular strength in the UK and should be prioritised as a route for increasing the innovation and investment in R&D of private businesses.

9. HEIF is a critical stream of funding for driving SME innovation capacity through universities, and is currently under-resourced. Other financial support would further incentivise business-university collaboration, including making these interactions VAT-free: the 'third mission' should be counted as a 'primary purpose' for universities.

10. Connectivity, collaboration and openness are essential to the future of world-leading science, and therefore need to be embedded within the focus and approach of any science strategy. Efficiency savings, for example those made through asset sharing, are another important benefit of collaboration and University Alliance are undertaking and supporting efforts at the national level to improve the sharing of resources amongst universities and the wider research ecosystem.

What more could be done to improve the innovation performance of UK business and boost business investment in research and development?

Increase investment in science and research to competitive levels

11. The UK science base punches above its weight in terms of efficiency and productivity, and is a major source of economic, social and cultural value for the UK generating substantial returns to public investment – estimated to range between 20% and 50%, but often much higher.[2] Substantial value is placed on the knowledge and expertise generated by the UK's publicly-funded university research and researchers – total knowledge exchange investment has risen by 5% over the last year, from £3.4 billion in 2011-12 to £3.6 billion in 2012-13.[3] Universities carry out 74.3% of publicly-funded Gross Expenditure on Research and Development (GERD) and 26.5% of total GERD – significantly above OECD average.[4]

12. However, the UK's investment in R&D and innovation is also well below average compared to competing nations and significantly lower than OECD and EU averages, at the same time as new and emerging economies are investing heavily in science and research: the UK invests 0.5% of GDP in public funding of research as opposed to an

[2] T. Allas (2014). *Insights from international benchmarking of the UK science and innovation system* (BIS); European Commission (2014). *Innovation Union Scoreboard 2014*.
[3] HE-BCI data.
[4] UUK (2014). *Higher Education in Focus 2014: Research and postgraduate research training. London: UUK*, pp. 6-7.

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OECD average of 0.8%.[5] Areas of our overall innovation performance also lag behind many of our key competitors, as outlined below.

13. To achieve economic prosperity by means of the knowledge economy, research and innovation activities need sufficient and sustained funding. **This requires both protection of the science budget and commitment to inflation in real terms**. This will be essential for the science base to maintain its vitality and excellence, allowing it to drive economic growth, respond to business needs, solve tomorrow's problems today and remain the primary choice for partners from across the globe.

14. In a tight fiscal environment, investments must be certain to reap maximum public benefit. The leverage of private investment through our world-class Higher Education system is the best route. There is strong evidence that increasing public investment also increases private investment in R&D (where the UK is weak) – for every £1 spent by the government on R&D, private sector R&D output rises by 20p per year in perpetuity.[6] By failing to invest sufficiently, we are not maximizing the leverage of private investment.

University-business collaboration is strong in the UK and should be used to drive innovation and raise private investment in R&D

15. Many international comparators show the UK is successful at innovation and connectivity. It is ranked third behind Switzerland and Sweden in the 2013 Global Innovation Index, and performs particularly well on business-university collaboration indicators, ranking second for university-business collaboration in the annual Global Innovation Index for the last two years.[7] Business-university collaboration is critical to a joined-up system, across a range of activities. Amongst others these include the commercialisation of research, the sharing of science infrastructure, the collaborative development and improvement of technical and business processes, and the creation of new graduate spin outs, as well as ensuring a pipeline of highly skilled workers to meet the needs of our future economy.

16. In other parts of the innovation system, the UK performs less well comparatively. Whilst the Innovation Union Scoreboard shows that the UK is performing well (and is growing) in terms of the research base and research-business interfaces, there are challenges on the business innovation side. Indicators measuring 'innovators' (high rates of firms involved in innovation activities, ranking 21st), 'intellectual assets' (ranked twelfth) and 'firm investments' (seventh) demonstrated relatively weak performance. There were declines in growth amongst 'sales share of new innovations' and 'SMEs with product

[5] T. Allas (2014). *Insights from international benchmarking of the UK science and innovation system* (BIS); European Commission (2014). *Innovation Union Scoreboard 2014*.
[6] J. Haskel, A. Hughes and E. Bascavusoglu-Moreau (2014). *The Economic Significance of the UK Science Base*. CaSE.
[7] http://www.globalinnovationindex.org/

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and/or process innovations'. UK SMEs under-invest in R&D compared to international comparators.

17. The UK needs to play to its strengths, therefore, and use our leading university-business interface to drive the innovation capacity of the private sector, and inward investment from overseas. Universities have a key role to play, especially with SMEs who typically underperform in this area, and by increasing the domestic talent supply of graduates and research postgraduates to exploit science and innovation. There are also challenges around recognising co-creation of knowledge activities. We offer recommendations throughout this response for increasing the performance against these indicators, particularly around universities' support of SME innovation, and development of the talent base.

18. According to the World Bank, the UK remains the best place to do business in the EU and the G8. The 2011 European Cities Monitor,[8] where 500 business leaders were surveyed, found that some of the most important features for business location decisions included education, highly skilled labour and technology infrastructure. However, the UK needs to be proactive in maintaining its status as a leading innovative economy. Other countries are making business-university collaboration a priority. A dominant theme emerging from workshops in Vietnam and Indonesia that University Alliance has recently undertaken with the British Council showed that this is a top priority for these emerging economies, both in employability and research agendas. Other developed economies are also making concerted efforts to improve in this area, including Australia, who are looking to the UK to learn lessons.

19. Evidence repeatedly suggests that the human factor is crucial in helping with absorptive capacity and knowledge exchange,[9] and therefore support systems that promote the movement of people between industry and academic environments are to be encouraged. Strong links with business and industry are a central focus of Alliance universities. They have found that the most successful approach is one where business links and engagement are embedded across a range of university activities, not least through their staff who have a powerful combination of industry and academic experience. Alliance universities work closely with employers to provide 48% of in-course work placements and lead over one-third of all UK Knowledge Transfer Partnerships (KTPs). By operating a 'revolving door' attitude towards business, staff and students are encouraged to move between different environments throughout their careers, creating T-shaped employees and relevant, impactful research.

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[8] Cuhman and Wakefield (2011). *European Cities Monitor 2011.*

[9] D. Tzabbar, B. S. Aharonson, and T. L. Amburgey (March 2013). "When Does Tapping External Sources of Knowledge Result in Knowledge Integration?," *Research Policy* 42, no. 2, pp. 481–494; Vitae, RCUK, and CBI, *The Future of the UK Research Base and Implications for the Professional and Career Development of Researchers*; H. Bakhshi, P. Schneider and C. Walker (2008), *Arts and Humanities Research and Innovation*. AHRC and NESTA.

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Universities have a key role in driving SME innovation

20. SMEs are the driving force of innovation in the UK economy. Innovation was responsible for two-thirds of productivity growth between 2000 and 2007. It was the common defining feature of the fastest growing 6% of businesses between 2002 -2008. These businesses generated half of all new jobs created during this time and were predominantly SMEs.[10] The UK's innovation performance showed a marked increase thanks to increases in innovative SMEs collaborating with others during 2009 and 2010.[11]

21. Nevertheless, SME spend on innovation is low. Many organisations lack the capacity or 'organisational slack' for innovation and therefore funding to support undergraduates, graduates and postgraduates into businesses should be available at all levels. **Nottingham Trent University** is placing over 300 graduates into SMEs, some benefitting from financial support through ERDF, but demand is currently outstripping funding.

22. The research base and anchor institutions have an important role to play in increasing the innovative capacity and investment of SME private funds in research and development.[12] The examples cited throughout this response demonstrate how Alliance universities' connectivity and expertise are driving economic growth through increasing local SME innovativeness and investment in R&D. University research helps businesses innovate in processes and services as well as technology and products. Among others, the **University of Salford**'s KTPs provide many examples of this, including innovations in processes at Dyer Environmental Controls, Create Construction and Moneyline; and services innovations at Brook Manchester, Moneyline, and Greater Manchester Fire and Rescue Service.[13]

23. Alliance universities are already ensuring their research and expertise are available and productive for a wider cohort of users, including industry of all sizes. In addition to strategic partnerships with large businesses, they are supporting small and rapidly innovating businesses with research and development. UK SMEs need support to increase R&D investments, which lag behind international comparators by opening up their assets for SME innovation activities. Opening university research and facilities to these businesses is an essential element in the integration of the research and innovation ecosystem and realising the benefits of the UK's world-leading research environment.

    a. For example, **Liverpool John Moores University (LJMU)** are in the process of developing a new £15M 4-metre class robotic telescope ("Liverpool Telescope 2',

[10] S. Shanmugalingam et al (2010). *Rebalancing Act.* NESTA.
[11] European Commission (2014). *Innovation Union Scoreboard*, p. 70.
[12] University Alliance (2011). *Growing the future: universities leading, changing and creating the regional economy*.
[13] More details can be found at http://www.salford.ac.uk/__data/assets/pdf_file/0008/224999/KTP-Publication-Final.pdf

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LT2) dedicated to time domain science, superseding the existing 2-metre Liverpool Telescope (LT) as the world's largest robotic telescope dedicated solely to scientific work. The time domain is a recognised UK scientific strength, and building on LJMU's capability in this area will maximise the potential for the UK community to take a leading role in big data, robots and advanced materials. It also provides great potential for engagement between the university and industry in the Merseyside region and throughout the UK. LJMU has a strong track record in this area, with the original LT project safeguarding jobs and driving upgrades in skills and machinery for local precision engineering SMEs.

24. University Alliance welcomes the activities of facilitating bodies – in particular new initiatives by Innovate UK and NCUB – to develop brokerage systems which are helping SMEs get the most out of our research and innovation ecosystem, including access to equipment as well as research and business expertise.

Extend SME innovation funding schemes with proven success

25. Certain high-performing programmes are successful at leveraging private funds and encouraging innovation, including by SMEs – in particular, Higher Education Innovation Funding (HEIF) and Knowledge Transfer Partnerships (KTPs). These should be prioritised in any future science and innovation strategy.

Invest more in HEIF to leverage funds and innovative capacity from SMEs

26. Innovation activities are a part of core business for many universities. Nevertheless, if the 'third mission' is to be realised fully, funding to support these activities, especially costly activities with SMEs, needs to be brought more closely into line with that for the other core missions: research and teaching. As Figure 1 shows**, HEIF is currently significantly under-funded and should be increased to £250 million**, as recommended by Sir Andrew Witty.[14]

[14] Sir Andrew Witty (2013). *Encouraging a British Invention Revolution* (Recommendation 4).

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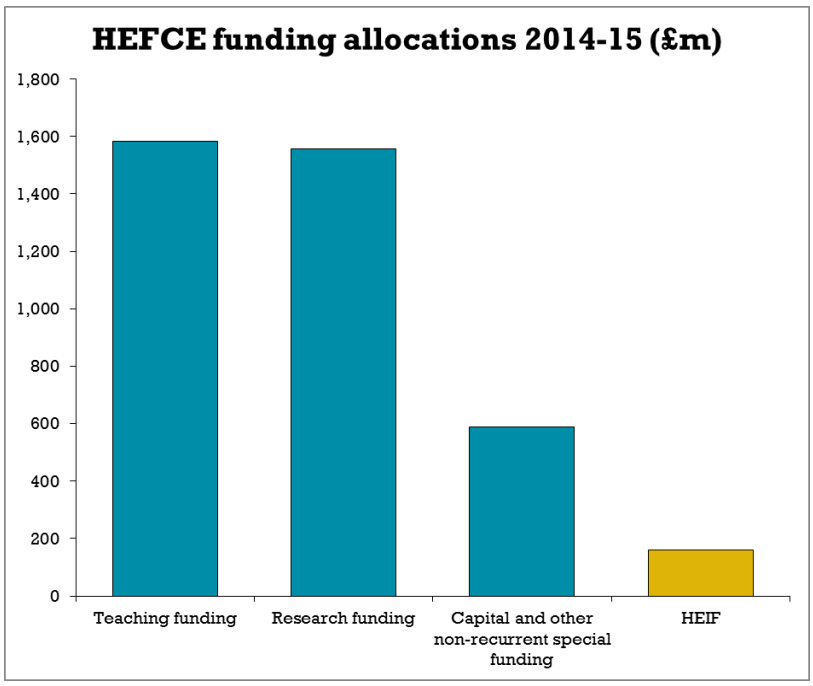

Figure 1. Source: HEFCE Annual Funding Allocations 2014/15

27. At £160 million HEIF is a relatively small – but critical – stream of funding, and its impact far outweighs its size. As the principal dedicated funding stream that allows universities to work innovatively with local SMEs, HEIF has enabled universities to support innovation in growth sectors and it provides an excellent return on government investment – every pound of HEIF gives a gross return of £6.30 in additional Knowledge Exchange (KE) income, a proxy for the impact on the economy.[15] However, this is likely to represent an underestimate of the total economic and social benefits.

28. Alliance universities have a diverse income portfolio and obtain less than 50% of their income from core public funding. HEIF is a critical funding stream for our universities, which are committed to growing income from private sources to achieve significant impact, working in partnership with business to realise important investment and growth. For example:

    a. **Plymouth University** is using HEIF to multiply the impact of their innovative Growth Acceleration and Investment Network (GAIN) platform. In partnership with the public and private sectors the University connects people, ideas and capital to accelerate the growth, and development of knowledge based businesses. GAIN links their research and teaching expertise with more than 500 high growth businesses, encompassing 32,000 staff and a turnover of £2.7billion.

[15] Tomas Coates Ulrichsen (April 2014). *Knowledge Exchange Performance and the Impact of HEIF in the English Higher Education Sector*, Report for HEFCE.

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b. At the **University of Huddersfield**, 50 per cent of their HEIF allocation has been used to establish a series of initiatives to grow the University's KE and commercialisation activities with external bodies. These key collaborative relationships ultimately lead to long term R&D programmes, delivering income generation and gearing for both partners including a £7.6m partnership with Borg Warner with leveraged RGF and inward investment from Borg Warner's US arm, and a £20m partnership with the Rail Safety and Standards Board. Huddersfield is attracting inward investment and upskilling workforce through strategic collaboration.

c. The **University of Portsmouth** has used HEIF funding to open up the testing facilities within the Institute of Marine Sciences and School of Earth and Environmental Sciences, linking these to businesses through the University's Environment Network, UPEN. It also used HEIF funding to establish the cross-faculty Centre for Operational Research and Logistics, bringing together multidisciplinary research expertise on the science of data and the science of decision making and working with different industrial sectors and academic partners. Recent projects include: an EU-funded project to find ways of more efficiently configuring the supply chain of offshore wind farms in order to reduce the per unit electricity generation costs; working with Xyratex (a manufacturer of large scale network storage solutions and High Performance Computers) to develop predictive maintenance systems for their disk drives and storage solutions, which has led to two US patent applications; and the development of a Virtual Engineer – a maintenance and operational management programme for future food packaging with Stork Food and Dairy Systems.

29. Without the steady income stream through HEIF universities would have to scale back this activity, affecting businesses and the economy locally and regionally. Cuts to HEIF would have detrimental effects to SME growth and innovation, new business formation, job creation, commercialisation of research and product to market activity across the UK.

30. To ensure improving returns on HEIF funding, we need to ensure that HEIF allocations are calculated according to its key objectives. The formula for HEIF does not currently recognise the full range of innovation activity. HEIF needs to incentivise universities to continually improve their contribution to innovation and growth, particularly through their work with SMEs.

31. HEIF currently double weights university interactions with SMEs. This weighting should be increased both to incentivise this activity but also to recognise the larger resource required to facilitate interactions with larger numbers of SME partners. High levels of engagement and innovation with SMEs do not necessarily translate into high levels of HE-BCI investment. Some measure of levels of SME engagement in quantity (rather than straight econometrics) and scaling – given that this is a policy priority at all levels – would be extremely useful and a strong indicator of how universities are actively engaging with LEP and local growth agendas.

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32. Reforming the calculation of HEIF to also recognise success in improving returns on HEIF funding, the creation of graduate spin-out companies, and other SME activities with significant local impact, will ensure that universities develop fundamental, long-term and sustainable commitments to driving growth through SMEs. University-led growth will also drive improvement in regions which currently underperform in innovation, and lead to more equally-distributed growth across the UK.

33. Although it is important that healthy returns are realized on public investments, it is important to recognise that some innovation activities are more expensive than others. Engaging with numerous SMEs, for example, uses more resource than fewer collaborations and contracts with large businesses. Nevertheless the impacts of engaging with small businesses (in terms of human resource, percentage increases to profits, etc.) may not equal those on large corporations in purely financial terms. High levels of engagement and innovation with SMEs do not necessarily translate into high levels of income (with implications for HE-BCI results and, subsequently, HEIF). Some measure (and recognition) of levels of SME engagement in quantity, for example number of interactions and/or number of individual SMEs engaged with – given that this is a policy priority at all levels – would be extremely useful and a strong indicator of how universities are actively engaging with LEP and local growth agendas.

Strengthen and develop the key role of Innovate UK and the successful KTP scheme

34. Innovate UK is a well-established and proven support system for securing commercial benefits derived from university research and other activities, with effective mechanisms including innovation vouchers, KTPs and the Catapult Centres. We would strongly recommend that these mechanisms not be replicated in new support systems, rather more be made of Innovate UK by strengthening its funding and ability to support research and innovation by the proposals here.

35. We continue to support the Catapult Centre model of business-university collaboration as it develops and grows. However, in order for Catapult centres to be recognised as a mark of excellence in the UK and to achieve world-leading innovation, they must seek to incorporate the best research and researchers and therefore ensure that any single geographical 'hub' has well-established links with pockets of genuine research excellence across the UK. As part of a national science infrastructure, existing Catapults need to become more open and collaborative so that resources are shared for maximum economic benefit.

36. This includes excellence in working with SMEs. Existing partnerships, capacities and networks based in HEIs should be leveraged by Catapult centres to access SMEs and engage them further with capacity-building. By identifying strengths across the system including in SME engagement, Catapult centres could improve this area of their interaction with business, achieving greater impact in a shorter time than if acting alone.

37. KTPs have a proven track-record in delivering economic growth on the back of Government investment and are widely considered to be effective and productive

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means for knowledge exchange. They have enabled critical business engagement to develop knowledge, commercialise innovation and power new industries. They allow businesses to build capacity and capability to exploit their potential and obtain a return on the investment in publicly funded research.

38. The centrality of research to KTPs is key to their success. However, innovation for many SMEs is not necessarily driven by pure research. A wider recognition and definition of what innovation means, and different forms of research would help more SMEs to engage, as **Teesside University**'s Knowledge Exchange model, supported through ERDF, has shown.[16] More promotion of the KTP model and benefits would help widen its take-up amongst SMEs.

39. Greater flexibility in the scheme would allow universities and business partners to adapt the programme to specific needs, including around researcher development. For example, short KTPs have a very useful place in the scheme – they are an excellent way for students to gain post-graduation commercial experience as well as providing smaller firms with incentives to employ graduates. There should also be an option to lengthen some KTPs to enable a student to both register for and complete a higher degree, preferably a PhD.

40. A framework that enables groups of smaller firms to come together to undertake jointly sponsored KTPs could also increase SME engagement. In the initial phase this could be tested through European funding bids, in light of the Horizon2020 emphasis on SMEs.

Maximise return by using existing SME connectivity within the system

41. Existing capacity, such as exists within Alliance universities (which have strong relationships with SMEs in targeted industries and technologies), should be leveraged to increase engagement with this important constituency and to ensure a joined-up ecosystem of research and innovation activities. These institutions are already proving that partnerships with smaller institutions are possible and that excellent research and strong existing university-business relationships are helping to generate business-led innovation. Alliance universities are committed to improving innovation amongst SMEs and are developing mechanisms for sharing resources and capital with businesses.

    a. For example, as part of the **University of Salford** the major research facility in MediaCity UK connects the BBC and the Digital and Creative Industries sector to international academics and industry research specialists with the aim of generating £25m investment in research over the next eight years. Salford also runs the ERDF Energy Hub, a unique project allowing regional SMEs to engage with leading academics and state-of-the art world class facilities, aiming to support 140 regional SMEs in the development of new technology, products and systems that reduce the carbon emissions from existing properties. ERDF funding has allowed the University

[16] http://www.tees.ac.uk/sections/business/KEI.cfm

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to build a unique facility, Salford Energy House, the world's first and only full size house within a laboratory.

b. The **University of Portsmouth** shares market intelligence with SMEs, and engages in strategic discussions about the big commercial opportunities for innovation and sales and development links to Asia. SMEs also benefit from opportunities to network and present to local business leaders at showcase events around key sector themes such as creative industries, environment, healthcare innovation, high-end manufacturing, infrastructure and logistics, and security.

c. The **University of Plymouth** is harnessing its marine expertise for economic growth through its new Marine Innovation Centre (MarIC), established to optimise the interface between the University and Marine Sector SMEs. The Centre promotes the industrial uptake and commercialisation of the University's research and world-class facilities, links businesses to the Growth Acceleration and Investment Network (GAIN) and improves SME performance by stimulating innovation and the successful exploitation of new ideas. The project has a total cost of £1.97m, of which £880K is ERDF – match-funded by the University – and £200K from industry. The funded period runs from October 2012 to June 2015 by which point the Centre aims to become fully sustainable. MarIC aims to provide 190 business assists over the lifetime of the project and expected results include the creation of 93 new jobs, 41 additional firms involved in business clusters or networks, 37 SMEs launching new or improved products, and 26 gross jobs created in environmental sectors. The project is expected to deliver a gross increase in GVA of £3.726m and a gross safeguarded GVA of £1.674m.

d. **Teesside University's** Centre for Construction Innovation and Research operates as a high level network resource in the Construction sector (one of the 11 key industries in the Industrial Strategy) – a role also recognised by the MD of Niven Architects, a current KTP partner, who cited this as likely to be the most valuable long term benefit of the KTP. The group works with clients involved across all 7 RIBA Plan of Work Stages, and in doing so it is able to foster commercial opportunities and research collaborations between businesses, often acting as the initiator to introduce potential partners.

e. **Coventry University**'s Knowledge Exchange and Enterprise Network (KEEN) is a business improvement programme, part-funded by ERDF, designed to help West Midlands based SMEs increase their profitability and achieve growth. KEEN offers a level of flexibility to companies who are yet to realise their full potential, made possible through the transfer of knowledge into the business via a recent graduate who is recruited to work full-time on a growth project, developed in association with the university, for between 6 to 24 months. Two examples of **Coventry University**'s successes using ERDF funds to help SMEs innovate and raise the innovation capacity

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of their local environment are citied in the recent European University Association report on universities and smart specialisation.[17]

Support co-location of university expertise and business

42. The benefits of co-location of university and business capital (physical and human) are well known. Many universities are already actively involved in the development of Enterprise Zones. Physical proximity encourages the integration of researchers and businesses, developed in harmony with local economic strategy and is incentivised effectively by fiscal means. We welcome the Government's commitment to realising the key role of universities within this by announcing the University Enterprise Zone (UEZ) scheme, which supports capital investment and the development of strong local partnerships between universities, LEPs and other partners. The pilot stage of the scheme is limited with eligibility restricted to the 8 Core Cities. We hope that this will provide an opportunity for the approach to be tested with the potential for it to be extended in the future.

43. Universities have a significant and unique role to play as leaders within their localities. As anchor institutions they are often the only organisations with the scale and local connectedness to drive economic growth and shape the physical environment. LEPs can harness this leadership role by capitalising on individual universities' links and networks with other local players and businesses, and HEIs are heavily involved in LEPs across the country. Our understanding is that 35 out of 39 LEP boards have a VC or equivalent university personnel representing local HEIs (including 9 representatives from Alliance universities). Alliance universities have been in the business of meeting local economic need for over 100 years, many being established during the industrial revolution to meet the demands of the then new industries. They very often have a deep understanding of the industrial and commercial strengths of the region as a result of their close links with business.

44. In their 2012 review of LEP area economies, the LEP Network[18] found that the highest performing and significantly improving LEP areas have high levels of employment and productivity, based on competition, enterprise, innovation, investment and skills. University personnel in some LEPs have been centrally involved in the development of Strategic Economic Plans and ESIF strategies. Alliance universities are reporting high levels of convergence with LEP innovations strategies in Strategic Economic Plans. HEIs should continue to be encouraged to co-develop skills strategies. Universities are also well placed to facilitate LEP collaborations across regional boundaries, enabling businesses and universities construct the infrastructure in which both enterprises can flourish.

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[17] European University Association (2014). *Report on Joint EUA-REGIO/JRC Smart Specialisation Platform Expert Workshop: The Role of Universities in Smart Specialisation Strategies*, pp. 29-30.

[18] www.lepnetwork.org.uk

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a. Both **Oxford Brookes University** and the University of Oxford have been working very closely with the Oxfordshire LEP during negotiations for the Oxford City Deal, the SEP (Strategic Economic Plan) and the ESIF (European Structural Fund) distribution. A key part of the LEP's innovation strategy involves ESF and ERDF money and a board (involving university personnel) will distribute funds once they have been released.

b. The **University of Salford** is heavily involved with the Greater Manchester LEP, and has supported the development of the GM LEP strategy. The University also has representatives sitting on key boards within the LEP, including Low Carbon, which is fundamental in ensuring that the University is engaged and driving the innovation within the GM low carbon and energy sector. The University is also very well connected and works with key organisations that support the LEP, including UKTI Northwest, MIDAS – Greater Manchester's Inward Investment Organisation, Greater Manchester India Steering group and Greater Manchester China Forum. To support this engagement with both the public and private sector organisations, Salford has adopted a key account management approach to ensure that their relationships with the SME community add value and deliver what industry wants, when it wants.

45. Universities are ideally placed as regional hubs for enterprise. While London and the South East are often perceived to be a magnet for businesses and talent, our universities and their student networks are enabling graduates to start and grow their businesses in every region across the UK – drawing on their connections with their local community.

a. The **University of Lincoln**'s £37.5M collaborative venture with Siemens and their supply chain demonstrates the large financial benefits of a university-coordinated strategy with local and industry partners. The partnership resulted in the building of a new Engineering School, generated a wide portfolio of research projects (over £2M since 2010) with immediate commercial benefit, retention of over 1,000 jobs in the UK and further expansion of Siemens' business with the creation of a further 50 jobs. As well as leveraging investment from Siemens, the collaboration brought in £3.2M of public grant, £1.8M ERDF and £1.4M Single Programme funding. The School and the activity around it underpins the Greater Lincolnshire LEP's focus on Engineering as a priority sector for the area. It also provides a critical conduit to draw in TSB funding to businesses throughout the supply chain. Beyond the key strategic partnership with Siemens, the Engineering School has already engaged with over 400 engineering businesses and organisations – undertaking commissioned research (including with Marks & Spencer and Mitsubishi), KTPs, and access to part-time degrees (income totalling £1.6M in the first 3 years and growing rapidly). The school is actively driving local and regional cluster event activities (e.g. IMECHE, IET and the Institutes of Physics and Combustion) and leveraging investment through a portfolio of European-funded projects on aircraft and airport energy technologies.

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What are the gaps in the capability of our people to develop science and deliver innovation in the UK and how should those gaps be addressed?

Good business-university collaboration is producing job ready graduates

46. Despite a persistent and dominant public narrative to the contrary, universities are delivering high-quality job ready graduates for businesses of all sizes. They are achieving this through strong institutional-level partnerships which engage employers and universities across a range of activities. University Alliance's report *Job Ready: Universities, Employers and Students Creating Success* collects compelling evidence from employers' perspectives whose graduate recruits are central to their innovation capability.[19]

47. The hourglass shape of the UK labour market is increasing the need for the attributes and capabilities that graduates bring to the workforce, and economic indicators looking at the levels of graduate saturation have not been exceeded.[20] With 80% of new jobs in high-skill areas it is vital that we have a system that enables all those who have the ambition and ability to succeed at university to do so.

48. It is essential to recognise the importance of enterprise skills. Many of the key jobs of the future do not yet exist, and graduate employees who can adapt to a rapidly changing landscape will be most valuable in this environment. Enterprise culture is embedded across Alliance universities, which have a very strong track record of nurturing graduate entrepreneurialism. **44% of all turnover from graduate start-ups comes from Alliance universities**. We would be pleased to convene best practice workshops in developing graduate and postgraduate entrepreneurialism.

Protecting the future supply of high level skills, postgraduates and future innovators

49. It is essential to ensure that investment in science includes sufficient investment in human capital. This is vital if we are to exploit and progress scientific and innovation developments, not only in historic strength areas but in niche and novel research areas which often require an element of risk and yet could become dominant. This requires a commitment to developing an appropriately-skilled workforce and the researchers and innovators of the future. It also requires a recognition that something must be done to address postgraduate study as the new social mobility frontier. There is a real and worsening narrowing of funding that is restricting, and will continue to restrict, the people who are able to access these higher-level skills, to the detriment of our society and economy.

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[19] University Alliance (2014). *Job Ready: Universities, employers and students creating success,* with further examples at www.unialliance.ac.uk/jobready.

[20] L. Hackett, L. Shutt and N. Maclachlan (2012). *The way we'll work: Labour market trends and preparing for the hourglass*. University Alliance.

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50. High-level skills are a vital component of our future growth but they are also central to the process of innovation and renewal in the key sectors of our knowledge-based economy. Safeguarding the future pipeline of skills is therefore essential to the future success of the UK economy. Yet there has been a steady drop in taught postgraduates (PGT) in the last two years, falling by 11%. The proportion of home PGT students is also falling within this, representing only 64% of the cohort in 2012/13.[21] The sustainability of postgraduate provision is threatened by a combination of the knock on effects of the new undergraduate fee regime (the full extent of which is still to be seen), a lack of fee loan access at PG level, and research funding concentration for postgraduates, particularly through Block Grants and Doctoral Training Centres.

51. Public funding for postgraduate study – both taught and research – is increasingly hard to come by. Alliance universities cross-subsidise in order to invest in the researchers of the future in strategic research areas, but this model is not sustainable or efficient. National funding structures which do not support universities' strategic development of the research base threaten the future strength and depth of the ecosystem. Public funds should support the dynamism of the UK research base by following the principles implicit in the dual funding system: universities must be able to invest strategically in human capital as in other research investment decisions, and funding structures should support them in this.

Taught Postgraduates

52. The future pipeline of research skills is threatened, however, especially for domestic talent supply. Taught postgraduate (PGT) numbers have dropped steadily over the last 4 years, with the numbers enrolling falling by 10% in total. Figure 2 shows how the proportion of home PGT students is also decreasing within this, falling by over 17%, meaning UK students represent only 58% of the first year cohort in 2012/13.[22] These statistics have worrying implications for a 'broken bridge' to postgraduate research from undergraduate, with the majority of PhD candidates now usually required to hold a masters.

[21] HESA, HE Students data.
[22] HESA, HE Students data – First Year postgraduate students.

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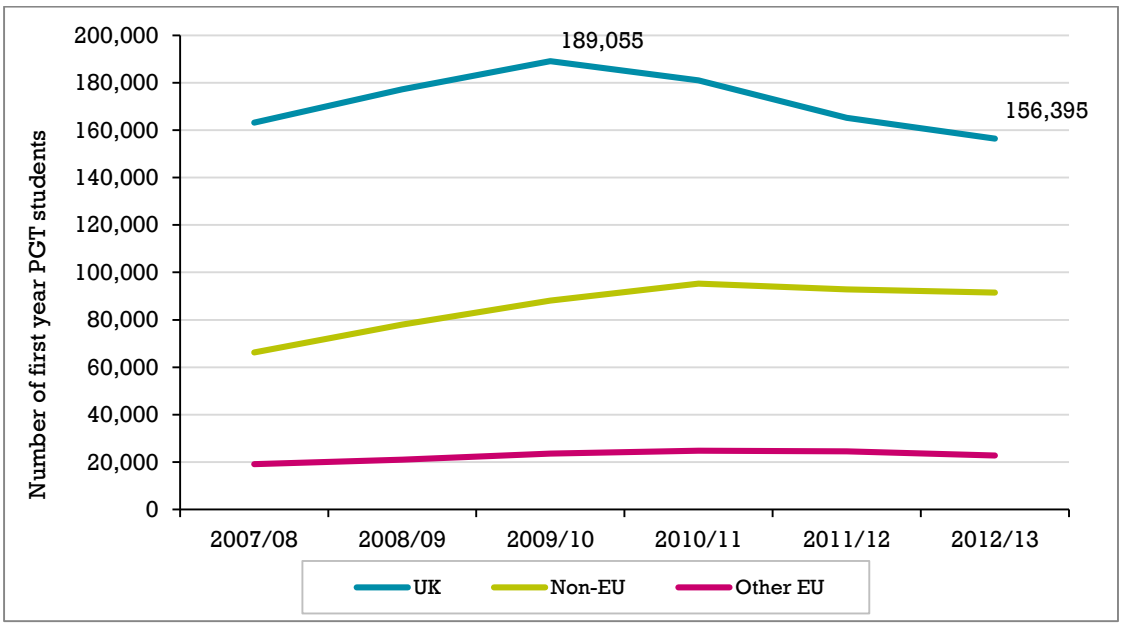

Figure 2. Number of first year PGT students by domicile

53. Funding systems that include access to loans for taught postgraduate students, such as proposed by University Alliance, would provide a more sustainable postgraduate population.[23] In order to encourage more cross-funding for PGT, the narrative around industry involvement in postgraduate support also needs to be changed. Pilot schemes run by three Alliance universities, the **University of Greenwich**, **Nottingham Trent** and **Kingston University**, are innovating around business/professional access, internship models and skills development, as part of Hefce's £25 million 'lifeboat fund'[24]. Theyare examples of efforts to change the paradigm around business involvement in sustaining the supply of highly skilled workers in the UK and investing in the workforce.

Reverse the increasing concentration of funding for research postgraduates

54. The UK also needs to ensure it has a diverse and far-reaching research training system that is flexible and responsive to fast-moving research environments, and world-leading to attract the best talent from across the world. Consideration of how industry-sponsored training programmes might be encouraged should be considered as part of this to ensure that we are supporting a future research base that has the skills to link effectively with business. The House of Lords' Science and Technology Committee 2012 report into higher education in STEM subjects noted the importance of maintaining a diverse complement of training mechanisms, recommending that a variety of PhD delivery models be utilised to ensure that the UK's current breadth of expertise in

[23] University Alliance (2014). *H.E.L.P. UK: A new Higher Education Loan Programme: adding to the debate on funding.*

[24] www.hefce.ac.uk/news/newsarchive/2013/news85254.html#projects

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science and technology is maintained.[25] **Current funding mechanisms which narrow the pool of training centres and supervisors for doctoral students and industrial partners are working against this aim**, however.

55. Research Councils use a variety of different mechanisms and allocation methods to fund postgraduate study. The majority of funding for PhDs is channelled into block grant awards through Doctoral Training Partnerships (DTPs), Centres for Doctoral Training (CDTs – also called Doctoral Training Centres – DTCs) and CASE awards. The introduction of block grants and Doctoral Training Centres, coupled with the removal of PhD researchers as a viable cost in other research grants, has closed off Research Council funding for postgraduate researchers (PGRs) for many university departments, and consequently, for many disciplinary areas where excellent research is undertaken, which threatens the future diversity of the research base. During its last round the EPSRC, the largest funder of DTCs, funded 80 Centres, but these were based at only 28 institutions. Across its three main schemes for postgraduate research, 46 universities are in receipt of postgraduate funding, to the exclusion of excellence in other university departments and disciplinary expertise. Open innovation needs open competition – therefore a commitment to the principle of seeking and funding excellence and developing talent in those same areas must be an essential priority underlying all investments and resulting resources.

56. It is also important to consider wider connectivity in the research and innovation ecosystem – operating a revolving door will ensure that strong, sustainable relationships are maintained between the HE research base and innovators in industry. Changes in public funding for Industrial CASE studentships (iCASE) – which co-fund research postgraduates in partnership with innovative companies – has limited iCASE awards from some research councils to those institutions already in receipt of a Doctoral Training Grant (DTG).[26] This restricts eligible academic partners to 44 HE institutions for the largest funder (EPSRC), disbarring institutions with excellent track records in iCASE studentships and business relationships from the system, and preventing them from delivering the benefits of their strong industry relationships and collaborative research training offering to students and other business partners.

    a. Funding offered by **EDF Energy** for CASE awards in mechanical engineering to **Oxford Brookes University** could not be leveraged after the changes to EPSRC funding ruled this institution outside of public funding mechanisms for postgraduate training. The same effect was felt by several SMEs engaged with the university via Knowledge Transfer Networks.

    b. **Teesside University** were given 'exceptional' dispensation to run an iCASE award from June 2013 with their partner, **TATA Steel**, only after direct intervention by the company, although the university does not hold a DTG. Eligibility for iCASE awards

[25] www.publications.parliament.uk/pa/ld201213/ldselect/ldsctech/37/37.pdf
[26] www.epsrc.ac.uk/skills/students/coll/icase/Pages/intro.aspx

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would allow them to build further on the industry collaboration success that they have achieved in delivering KTP projects (41% of Teesside's KTP projects are graded as 'outstanding', compared with less than 10% nationally).

57. The concentration of funding in these ways limits the diversity of future high level skills. Supporting postgraduates in only a limited number of research institutions narrows the range of the future skills base, excluding many areas of research expertise in institutions outside of these funding mechanisms. It affects the future health of the research ecosystem as universities are being shut out from experiencing, developing and demonstrating capability in these areas. The funnelling effect of both DTGs and iCASE awards also curtails opportunities to involve important strategic business partners in the innovation system – often SMEs – who have strong relationships with those institutions who are currently outside of the DTG system.

58. The concentration of doctoral training, particularly in STEM, into fewer institutions also raises questions about the diversity of PhD supervisors involved in the delivery of training. There are pressures for PhD students to come out fully formed in research and knowledge exchange capabilities, but the existing PhD format – and the restricted number of delivery outlets – may not be optimally designed to help PhD students fulfil their full potential. For example, it is possible that we are not making the most of senior academics – currently outside of the funding system – with relevant expertise and skills(including those from outside of academia), in supervisory roles for PhD students, to act as advocates for the wider skills bases required of doctoral researchers.

59. Vitae's 2013 report *What do Researchers Do?* suggests that 'doctoral degree experience seems to prepare [PhDs] better for employment than for self-employment or entrepreneurship'. Only 5% of doctoral graduates are self-employed three and a half years after graduation, a lower figure than Masters and good first degree holders (8% and 9% respectively). However, 52% have considered self-employment or setting up their own business.[27] Over-concentration channels funding away from universities which may be better placed to develop entrepreneurial and enterprise skills, and fails to address this under-utilised source of innovation within the science base.

Support efforts to increase STEM diversity

60. There is widespread acceptance of a chronic underrepresentation of diversity within STEM subjects and careers, for which the recent CaSE report on improving diversity in STEM offers constructive and welcome recommendations.[28] University Alliance is one of the 176 signatories of the 'Your Life' campaign to encourage diversity including through inspiring more young people to study maths and physics. We will continue to act as Higher Education advisers as the campaign develops, and have recently signed the Women into Technology and Engineering Compact, which aims to support a step-change

[27] Vitae (2013). *What Do Researchers Do? Early Career Progression.*
[28] CaSE (2014). *Improving Diversity in STEM*.

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in how women and girls are encouraged to consider technology and engineering careers and the subject choices or vocational pathways that lead to them. Furthermore 90% of our members are signed up to the Equality Challenge Unit's Athena Swan Charter.[29]

How can we strike the right balance between our investment in curiosity-driven research and investment in solving societal challenges and other forms of applied research? And how can we encourage the interaction between these?

Key challenge: Recognise excellence throughout the system

61. There has been increasing recognition of the diversity and complexity of the role of universities in the UK's research and innovation ecosystem by policy makers, and the emphasis on co-creative activities in an 'open innovation' environment. This more nuanced understanding of the processes and feedback loops that are involved in innovation better appreciates the range of activities involved, including the full spectrum of university research, from basic to applied. As the Government develops its Science and Innovation strategy this more nuanced perspective should help ensure that activities at all stages of the innovation process are incentivised and supported. We support the development and use of more sophisticated indicators that better capture the impact of universities' innovation activities, to augment pure research metrics.

Optimise the existing research and innovation ecosystem with open competition: funding excellence wherever it is found drives quality

62. Universities are the largest research provider in the UK, and research excellence is found throughout the higher education sector. The diversity of our world leading research base (the UK boasts internationally recognised research strength in over 400 fields) sustains and supports our international competitiveness, capitalising on the spread of excellence. Excellence in generating successes in enterprise and entrepreneurialism should also be recognised, since these represent a key part of the research and innovation ecosystem.

63. Open innovation requires open competition, however. The evidence for funding excellence wherever it exists is well established[30] and this principle is an important pillar of the UK's dual funding system for research. The UK should continue its policy of selectively distributing research funding, based on quality, in order to continue to drive the quality and impact of UK research and secure the future health of the UK research base. In a difficult fiscal environment it is essential that these existing principles are

[29] http://www.ecu.ac.uk/equality-charter-marks/athena-swan/

[30] L. Aston and L. Shutt (2009). *Concentration and diversity: understanding the relationship between excellence, concentration and critical mass in UK research;* University Alliance and Evidence Ltd (2011). *Funding research excellence: research group size, critical mass & performance*

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maintained because they have "enabled the Government and funding bodies to maximise the return from the limited public funds available for … research".[31]

64. However, there are examples of public funding streams where these principles are not being followed, particularly around doctoral training - with implications for the future workforce and skills base. Research Council policy to fund 'fewer, larger, longer awards' in response to efficiency pressures has meant that some important funding streams supporting postgraduates and knowledge exchange activities are no longer open to all HE Research Institutions. Concerns and the implications of uncompetitive funding for doctoral students are outlined above.

65. Another example of uncompetitive funding is Impact Acceleration Accounts (IAAs), which some Research Councils have allocated 'based on the size of Research Organisations' recent research funding history'.[32] Calculating eligibility by previous funding allocation within a Research Council context is misleading, as it does not reflect excellence in a diversity of research activities - an open competition for IAAs would recognise excellence throughout the system in realising impact in research.

Dual support and autonomy are essential

66. Maintaining excellence in a broad range of subject areas and research activities will future-proof the UK research/innovation ecosystem in a rapidly changing world. As Government acknowledges, predicting future market changes is an inexact science and we need to make sure we are future proof by allowing growth sectors to thrive – this is why the dual funding system for research, which includes the flexibility for universities to invest in new areas, remains critical to the dynamism and responsiveness of UK research, and has been proven to drive quality. It allows for universities to invest in their areas of strength, across the spectrum of research activities and with a large variety of industrial and other partners.

67. The autonomy of institutions has been shown to have a direct correlation with the quality of a system, with the UK recognised as being distinct in both its level of autonomy and its quality.[33] Autonomy remains key to the approach adopted in Alliance universities allowing them to manage their position within various markets, operate flexibly in response to drivers and opportunities, be responsive to both threats and opportunities and to focus resource on their key strengths within an increasingly dynamic higher education environment.[34]

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[31] www.rae.ac.uk/Pubs/2004/01/rae0401.doc

[32] http://www.esrc.ac.uk/collaboration/knowledge-exchange/opportunities/ImpactAccelerationAccounts.aspx

[33] P. Aghion et al (2008). *Higher aspirations: An agenda for reforming European universities*. Bruegel Blueprint Series, V.

[34] L. Aston & L. Shutt (2010). *Efficiency, leadership & partnership: an approach that delivers shared economic priorities*. University Alliance.

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Changing culture in impact

68. Continued and extended commitment to recognising the social and economic benefits of research is welcomed. Funding streams should reward and invest in those universities who are already doing this well, in order to maximise returns. With a long tradition (over 150 years) of expertise in combining engineering and technology, design and the creative industries together with the professions, Alliance universities promote an environment that fosters innovation with impact. It is clear that impact criteria in the REF and RCUK bids have incentivised changing behaviours more widely in the sector encouraging a closer relationship within the institution between research and enterprise, and amongst researchers who are considering more fully the implications and utility of publicly-funded research when developing research plans.

Increase efficiency and reward strengths throughout the system by facilitating collaborations built on complementary strengths

69. Connectivity, collaboration and openness will be essential to the future of world-leading science – the so-called 'Science 2.0'. Collaboration based on specialised excellence is key to a successful and efficient research ecosystem, bringing cost savings as well as other benefits of collaborative working. Connectivity and collaboration need to be embedded within the focus and approach of nation-level funded projects, which need to be shared and accessible to all in the ecosystem to ensure that complementary strengths across the sector are recognised.

70. Collaboration with industry and with other university partners' complementary strengths is essential to the missions of Alliance universities. Examples of this, and of existing Alliance sharing agreements in specific areas/assets, are outlined in our response to the Government's consultation on proposals for long-term capital investment in science and research (June 2014).

71. Universities have proven that they are keen and willing to work together and to share resources where possible to maximise the national significance of the products of public funds, in all types of all assets (including data and even 'shelved' IP). Good progress is being made towards a more efficient system following the Wakeham and Diamond reviews, although there is still more to be done.[35]

72. A good example of this is through asset sharing agreements, although these are not yet comprehensive, and in many cases Alliance universities report difficulties in accessing existing networks. **University Alliance** is acting collectively to extend these benefits and efficiencies more widely over the next year, to involve universities and businesses across

[35] W. Wakeham (2010), *Financial Sustainability and Efficiency in Full Economic Costing of Research in UK Higher Education Institutions*; I. Diamond (2011). *Efficiency and Effectiveness in Higher Education*.

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the country, which will involve an audit of current capabilities. It may be helpful to extend an audit of current sharing capabilities across the entire sector.

How can we support cross fertilisation of ideas, for example by encouraging interdisciplinary research and innovation? What are the risks and benefits of doing this?

Universities are key to facilitating interdisciplinary research

73. Multi-disciplinary and multi-partner approaches are key to problem-solving and innovation and there is real opportunity for innovation through the constructive tension on the boundaries of disciplines. Connectivity and expertise through people – academics and industry professionals who have experience of both worlds, and graduate placements – is of key importance.

74. The connectivity provided by universities adds value. Universities are principal providers of research and they have a unique offering of scale and internal connectivity, including between disciplines, as well as external connectivity with local, national and international partnerships. Reward and recognition models for individual academic careers are often weighted along disciplinary lines which may act as a disincentive to interdisciplinary working. Universities add value and opportunity to academic interdisciplinary collaborations through system-level partnerships.

75. Internal connectivity is also important, since those from outside need to access all knowledge base easily. Most business challenges need multidisciplinary responses. Wider changes in the relationship between business and academic worlds, moving from transactional to strategic relationships, are helping to realign ambitions. Examples such as the Bristol Robotics Laboratory[36] based at the **University of the West of England** and the work of Innovative Physical Organic Solutions[37] at the **University of Huddersfield** show how important end-user access into research base can be directed through entry points into multi-disciplinary research. Portals and open doors are essential to ensure all sectors have access to world-leading research, an approach which University Alliance institutions have embedded across the university.

76. There are still improvements to be made in incentivising multidisciplinary approaches – this is a challenge about future-proofing the system. There is a role for external structures in supporting collaborative and multidisciplinary research, and a need for timescales that allow commitment to partnerships and collaborations. The Research Councils and Innovate UK have a particularly important role in encouraging multidisciplinary working and have made highly commended interventions through promoting interdisciplinary research centres and problem-led challenges.

[36] http://www.brl.ac.uk/
[37] http://www.hud.ac.uk/research/researchcentres/ipos/

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77. National funds for joined-up big research, around key challenges such as ageing, obesity, environmental sustainability, etc. would further drive and focus interdisciplinary research efforts in some areas. These could be in the form of a No. 10 'Big Challenge' stream, and bids should – as with other large challenge-based schemes, such as Horizon 2020 – require collaborative and multidisciplinary bids.

78. However, where investments are made in national and international projects, these must be neutral and seek to work with – and be accessible by – excellent researchers and research teams throughout the UK's research and innovation ecosystem, wherever this excellence is found. Through this collaborative and excellence-seeking approach, resources will be shared for maximum economic benefit and be able to respond flexibly and innovatively to the great challenges of the day and the future.

79. Disincentives to cross-disciplinary work may be particularly pronounced for younger academics whose career structures are largely discipline-driven (there are not many world class journals operating in interdisciplinary space, for example, and recognition models are disciplinary). There is a need for a system that allows a sufficiently long timescale (and also brings rewards) for early career researchers to commit themselves to building a career profile which involves collaboration with a wider partnership base and multidisciplinary challenges. As outlined above, current funding concentration is not making the most of senior academics with relevant expertise and skills, including those outside of academia, in supervisory roles for PhD students, to act as advocates.

In your view, what are the top 3 priorities for the UK science and innovation system by 2020 and beyond? Which criteria should we use to prioritise technologies for Government support?

Three top priorities

80. **Priority 1. Maximise the UK's leading university-business interface to improve areas of the innovation system with potential to grow.** Recent benchmarking reports (as outlined above) have demonstrated that the UK has real strengths in university-business activities but is underperforming in other areas of investment including private R&D investment and the innovative capacity of SMEs. Universities are anchors and sources of excellence which should be prioritised as agents in driving improvements in these parts of the innovation system through targeted schemes and commitment of more resource to schemes which are demonstrably successful (i.e. HEIF, KTPs).

81. **Priority 2. Ensure excellent science is rewarded throughout the system.** The UK must maintain its position as a world leader in research, both to drive our own knowledge economy and to attract inward investment. To do this, we need to recognise strengths across the system by continuing to fund research according to excellence, wherever it is found. This principle has been shown to drive quality and will future-proof the science and innovation system.

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82. **Priority 3. Ensure the pipeline of future high-level skilled workers and researchers is sustainable.** Policies which narrow the pool of postgraduate students and concentrate funding for doctoral students risk endangering the future health of our science and innovation system in terms of numbers, diversity, and breadth of expertise. In a rapidly changing world, we cannot afford to limit the talent and scope of our future workforce.

Criteria for prioritising technologies

83. Priorities should expand on our existing research strengths, especially in near-to-market research, and build the UK's capacity to exploit large international markets. Priorities which map on to a defined and long-term strategy (i.e. Industrial Strategy and Great Technologies) are useful for research bases to align and complement some of their own resources to achieve national aims.

84. In Annex B2 of its consultation document for capital funding, the Government proposed criteria for prioritisation of projects: affordability, excellence, impact, skills, efficiency and leverage.

85. In tight fiscal environments, affordability is clearly important. When selecting research partners, the guiding principle for prioritising projects must be to invest in excellence, wherever it is found, established by peer review. This involves a balance of projects and range of partners that will achieve responsive short/medium-term impacts as well as 'blue skies'/long-term ones. Our views on skills development are outlined in detail above. Leverage is also key – although a full range of industrial partners of all sizes should be given the opportunity to match their resources to public funds: currently this is not always the case (as with the restriction of iCASE industry partners mentioned above; and the high (£10 million) threshold for the Research Partnership Investment Fund (RPIF)), which demonstrates a missed opportunity.

86. Criteria for national projects should align to long-term transparent priorities such as outlined in the Industrial Strategy and Great Technologies, to allow greater complementarity across the research system. Projects should be prioritised if they are enhancing the UK's existing strengths and if they are building capability to exploit large international markets. Funding should also continue to support niche and experimental research at institutional level.

A joined-up approach to science that plans for the world beyond 2020

87. Economic growth continues to be of critical importance to the UK, and UK science has a central role in delivering the advancements and innovations that will support this growth. National science projects should be prioritised if they are enhancing the UK's existing strengths, and if they are building capability to exploit large international markets. Long-term transparent priorities (such as outlined in a Science Strategy) allow greater complementarity of the research system to these aims. However, funding should also continue to support niche and experimental research at institutional level – abiding

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by the Haldane Principle – since the flexibility of the research system to respond to new opportunities is key to future-proofing in an uncertain and rapidly moving future.

88. Large scale projects in the national interest should aim both to address fundamental weaknesses in the UK's research and innovation ecosystem. Following a recent benchmarking study, it is evident that the UK's capacity to commercialise research needs to improve, as it is currently lagging behind international competitors.[38] Priorities should expand on our existing research strengths, especially in near-to-market research, and build the UK's capacity to exploit large international markets. Priorities which map on to a defined and long-term strategy (i.e. Industrial Strategy and Great Technologies) are useful for research bases to align and complement some of their own resources to achieve national aims.

89. To ensure and to drive quality, all national, large scale capital resources must remain neutral and accessible to the most excellent researchers and innovators within the UK, which will involve a commitment to outreach and autonomy. Furthermore, investments in national capital projects should be balanced with greater funding streams through the funding and research councils, with a more integrated approach to how those resources are shared and made accessible as part of a truly international infrastructure.

Additional comments

Ensure that excellent science is at the heart of government and policy making

90. The UK Government has at its fingertips a world-leading science base to draw upon to inform policy making. We must make the most of this powerful resource to evaluate and develop robust policy decisions that are sound, efficient and cost effective. In the first instance, we urge a commitment to prioritise government departmental R&D budgets – in 2011/12 half of all departments reduced R&D expenditure by over 20% compared with the previous year.[39]

91. There is also a strong case to be made for looking more closely at how government R&D spending is channelled, and whether best use is being made of the excellent research and expertise that – as outlined above – predominantly resides in the UK's universities. Particularly when funding is tight, there is an imperative to ensure that public investment in research returns optimal value, including using existing expertise to ensure efficiency and non-duplication of expenditure. Analysis suggests that use of alternative research providers differs widely between central government departments. It shows, for example, that the Department of Health draws the majority of its research from universities and academics, whilst the Department for Transport draws its research

[38] T. Allas (2014). *Insights from international benchmarking of the UK science and innovation system* (BIS); European Commission (2014). *Innovation Union Scoreboard 2014*.
[39] http://sciencecampaign.org.uk/?p=13593

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primarily from private consultants.[40] Further analysis should be undertaken to investigate these patterns. Issues around procurement, infrastructure, absorptive capacity, advertisement of opportunities and researcher development could form part of this investigation. **University Alliance** is undertaking work in this area and would be pleased to convene further discussions with key stakeholders.

[40] http://blogs.lse.ac.uk/impactofsocialsciences/2014/03/20/open-data-government-commissioned-research/

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