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INTERNATIONAL
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GROUP

Creating the Future: A 2020 Vision for Science and Research - Consultation on Proposals for Long-Term Capital Investment in Science & Research

Submission from the Russell Group

1. Summary

- The UK's position as a world-leader in research, and the benefits that flow from this for the economy and society, will only be maintained if our research-intensive universities have the facilities and equipment needed to compete internationally.

- The commitment to increase funding for capital investment and maintain this at around £1.1 billion per year in real terms to 2020-21 is very welcome.

- We recommend that the majority of funding be allocated at the institution and research project level as opposed to large-scale projects, and that funding allocated directly to institutions is at least equal to that allocated to research projects through the Research Councils. **(Scenario 1 in the consultation document.)**

- Capital investment for science and research should be allocated to research-intensive universities and their institutes where there is a critical mass of research excellence. Extending capital investment to research and technology organisations and independent research organisations runs the risk of duplicating existing facilities and equipment rather than building on the UK's research strengths within our universities' centres of excellence.

- The provision of capital funding directly to HEIs by a formula mechanism is extremely valuable as it provides the autonomy and certainty to invest in areas of scientific opportunity identified by our world-leading researchers. The formula approach is also highly efficient as a funding mechanism, compared to costly and time consuming bidding processes.

- A clear commitment from the Government is needed to support the on-going resource costs associated with operating, maintaining and up-grading capital facilities. A resource element separate from project resource should be tied to capital investment to ensure facilities and equipment can operate to full capacity, and to enable vital upgrades and maintenance to ensure the continued competitiveness of facilities in the long-term.

- We welcome the intention to formulate a strategy in relation to the UK's priorities for investment in major national and international projects. In order to choose between priorities identified in the initial round, we recommend further in-depth consultation with key academic research leaders to make a final recommendation on large-scale project funding to Government.

- A proportion of the capital funding budget should remain ring fenced for the future to ensure flexibility to invest in strategic priorities which may not become apparent for years to come. At such time as the Government wishes to allocate the remainder, we strongly recommend that a full consultation be undertaken with the research community to identify strategic priorities for investment.

- The Research Partnership Investment Fund (RPIF) for capital co-investment in university research facilities has been very successful in leveraging funding for capital investment and we would recommend that this be turned into a longer-term, more strategic initiative for the future.

- The majority of research undertaken in the UK relies upon access to small- and medium-scale research infrastructure, much of which is located within leading research-intensive universities. Provision for infrastructure on this scale must be at the heart of the Government's capital investment strategy including through RPIF and as part of Research Council grants.

- Russell Group universities remain committed to increasing productivity and driving efficiency through collaboration with other UK universities and industry through research partnerships to share key scientific facilities and equipment. We urge Government to consider how VAT legislation and guidance can be simplified to avoid hindering collaboration between universities in equipment sharing and other similar activities.

2. Introduction

2.1 The purpose of The Russell Group is to provide strategic direction, policy development and communications for 24 major research-intensive universities in the UK; we aim to ensure that policy development in a wide range of issues relating to higher education is underpinned by a robust evidence base and a commitment to civic responsibility, improving life chances, raising aspirations and contributing to economic prosperity and innovation.

2.2 We welcome this opportunity to contribute to the Government's consultation on proposals for long-term capital investment in science and research, which we understand will feed into the Government's wider Science and Innovation Strategy. The UK's research community, and especially research-intensive universities, are best placed to identify strategic priorities for science and innovation. Russell Group universities undertake the majority of the very best world-leading research carried out in the UK and are highly effective and successful in the commercial exploitation of their research, forming strategic relationships with a range of businesses, international partners and third sector institutions.

2.3 In 2012-13, Russell Group universities accounted for:

- 74% (over £3.5 billion) of UK universities' research grant and contract income
- 75% (over £1.1 billion) of total income from the Research Councils
- 76% (over £0.8 billion) of funding for contract research with businesses
- 82% (over £0.8 billion) of funding for research from UK charities
- 77% (over £0.2 billion) of total income from international (non-EU) research grants and contracts[1]

[1] Higher Education Statistics Agency (HESA) data 2012-13

3. The case for capital investment into research and science

3.1 The UK's universities lead the world in producing excellent research:

- Whilst the UK represents 4% of researchers globally, we produce 16% of the world's most highly-cited articles and rank first in the world by field-weighted citation impact.[2]

3.2 The UK's world-leading position is founded upon a critical mass of research excellence, particularly within our research-intensive universities. Russell Group universities produce an extremely high level of world-leading research - at least two thirds of world-leading research originating from all UK universities.[3]

3.3 Long-term curiosity-driven research undertaken at our universities often delivers significant economic and societal benefits; it endows businesses with competitive advantage, brings new consumer products to market, creates numerous job opportunities, as well as providing better health care, cleaner and more efficient energy sources, improvements to 'quality of life' and much wider cultural benefits. Numerous examples of this can be found in our publications on the significant economic and social impacts of research conducted at Russell Group universities.[4]

3.4 The maintenance of the highest standards of equipment and facilities at our leading universities helps to sustain our world-class research environment, attracting highly sought-after internationally-mobile researchers as well as high levels of international R&D investment:

- The proportion of non-UK nationality academic staff is around 34% at Russell Group universities compared to an average of 20% for other UK HEIs.[5]

- The UK's world-class universities are vital to attracting high levels of foreign R&D: between 2000 and 2011, the most consistent growth in overseas-financed R&D has been in the HE sector, with an average annual increase of nearly 9% over the period.[6]

- Nearly 20% of gross expenditure on R&D conducted in the UK is now financed from abroad (compared to around 4% in Germany and the US) reflecting the quality of the UK science base in being able to attract inward investment[7].

3.5 R&D-intensive businesses place high importance on access to state-of-the-art research facilities and equipment in deciding to undertake collaborative research with a university, use university facilities for contract research, or co-locate business operations. For example, pharmaceutical firms are found to locate their R&D near to world-class rated chemistry departments in UK universities, with the location decision

[2] 'International Comparative Performance of the UK Research Base – 2013: A report prepared by Elsevier for BIS'
[3] Research Assessment Exercise 2008 (for the 24 universities that are now Russell Group members)
[4] See: http://www.russellgroup.ac.uk/uploads/RG_ImpactOfResearch2.pdf and http://russellgroup.org/SocialImpactOfResearch.pdf

[5] HESA, 2012-13
[6] BIS, 'Innovation Report 2014: Innovation, Research And Growth'
[7] OECD Main Science and Technology Indicators, 2013 (GERD financed from abroad)

also related to the presence of science parks.[8] In doing so, they are able to tap into the university's ecosystem, including access to leading-edge academic and industry networks, cutting-edge equipment and facilities, scientific talent and valuable partnering opportunities.

3.6 Access to publicly funded scientific infrastructure is particularly beneficial to SMEs otherwise unable to fund capital investment in the latest equipment.[9] Russell Group universities offer SMEs access to new equipment and facilities, and provide training in new technologies in fields such as additive manufacturing.

3.7 Crucial national research infrastructure is located at many Russell Group universities alongside small- and medium-scale research infrastructure which is vital to attracting leading researchers and businesses. Much of the cutting-edge research infrastructure at our universities is also co-funded by charities, business and international partners.

3.8 A further comparative advantage for the UK's science and research base is derived from high quality research-led teaching in our world-class universities. The training of skilled graduates facilitates transfer of a knowledge base informed by the latest scientific developments and techniques. Companies place particular value on recruiting graduates and postgraduates who have received training on cutting-edge equipment during their degrees, hence continued focus from Russell Group universities to invest in research infrastructure for training students.

3.9 See **Annex A** for examples of research infrastructure located at Russell Group universities and engagement with industrial and international partners to operate and access facilities and equipment for multiple purposes.

3.10 **The UK's position as a world-leader in research, and the benefits that flow from this for the economy and society, will only be maintained if our research-intensive universities have the facilities and equipment needed to compete internationally.**

3.11 Whilst the UK maintains a world-leading position in research excellence, our research base and universities are subject to far lower levels of investment than international competitors, demonstrating how efficient and highly productive the UK's HE system is:

- This year, an international comparison of national HE systems found that the UK's HE sector ranks second out of 50 countries for output but 21st for resource inputs.[10]

3.12 In particular, capital funding for research has been under pressure following Government cuts in previous years. Whilst a flat-cash settlement was introduced for resource funding for science and research within the ring-fence at Spending Review 2010, the baseline science capital funding allocation was initially cut by 46%. Since then, additional allocations of funding have increased the capital budget almost to a flat-cash level. However, when inflation is taken into account, the capital budget has declined significantly in real terms since 2009-10.

3.13 It is therefore increasingly difficult for our institutions to compete with better-resourced institutions internationally. Countries such as China, France, Germany and South

[8] UK-Innovation Research Centre 'The Economic Significance of the UK Science Base: A report for CaSE' (2014)
[9] House of Lords Select Committee on Science and Technology, 'Scientific Infrastructure' (2013)
[10] Universitas21 Ranking of National HE Systems 2014

Korea have invested strategically in a small number of research-intensive universities in order to maintain and enhance their research and learning infrastructures.[11]

3.14 Universities have responded to the challenging funding climate by implementing efficiencies in order to invest in capital. Over the five year period from 2012-13 to 2016-17, Russell Group universities are investing around £9 billion in capital and infrastructure projects primarily from their own resources in order to ensure that they continue to provide world-class facilities for teaching and research. Of the £9 billion of capital investment, over £700 million will be invested in STEM facilities for research and teaching, and over £400 million in medical research infrastructure. This investment is expected to generate £4.89 for the UK economy for every £1 invested.[12]

3.15 We welcome the ongoing commitment from Government to invest in science and research through the provision of capital investment, alongside support for resource. **The commitment to increase funding for capital investment and maintain this at around £1.1 billion per year in real terms to 2020-21 is very welcome.**

4. Achieving the right balance between capital funding streams

The importance of institutional autonomy in allocating research capital investment

4.1 **The provision of capital funding directly to HEIs by a formula mechanism is extremely valuable as it provides the autonomy and certainty to invest in areas of scientific opportunity identified by our world-leading researchers. The formula approach is also highly efficient as a funding mechanism, compared to costly and time consuming bidding processes.** The provision of funding by formula helps to maintain the UK's leading role in excellent research and ensure that we remain internationally competitive.

4.2 Evidence suggests higher financial autonomy within a university budget is associated with higher shares of national public competitive-based funds. This means the more autonomous an institution is, the more effectively it will be able to compete in obtaining funds from different sources, such as competitive funds, contracts with private companies, and donations from the non-profit sector. This also leads to greater

[11] For example:

- Over a decade to 2011, around ¥30 billion (£2.8 billion) was invested in a select few Chinese research-intensive universities to help them achieve world class status. A further ¥10 billion (£950 million) is being invested to create research bases in China's mid-west universities.
- In France, more than €7.7 billion (£6.3 billion) has been allocated to the "Excellence Initiative" (IDEX) since 2010 to create eight campuses bringing together leading institutions to compete with the best universities in the world. In 2014, an additional €2 billion (£1.6 billion) has been announced as the second wave of funding to establish between three and five new IDEX campuses.
- By 2017, a total of €4.6 billion (£3.8 billion) will have been invested in Germany's Excellence Initiative which aims to create 43 clusters of research excellence and 11 excellent universities.
- South Korea is investing £1.2 billion over seven years to 2019 through its BK21 Plus programme to further cultivate a small number of research-intensive universities.

[12] BiGGAR Economics, 'Economic Impact of the Capital Investment Plans of the Russell Group Universities' (2014)

diversification of funding sources, meaning autonomous institutions are better able to adapt to a changing environment and to meet future challenges.[13]

4.3 The provision of institutional autonomy in relation to research through block funding provides research organisations with a stable basis for research activities and allows them autonomy in the selection of research projects, enabling expertise in new fields to be built up.[14]

4.4 Capital funding allocated directly to institutions should continue to be calculated using formula funding methods based on research excellence – in other words, allocated to institutions with an established track record in undertaking world-leading research. These institutions will be most able to leverage impact from the investment in terms of sustaining a critical mass of excellence in the UK, drawing on leading scientific expertise 'in-house' in order to make strategic decisions about when and how best to make investments. This enables strategic investments to be made in priority areas and emerging opportunities to be capitalised on. Conversely, deadlines for research project funding distributed by competition do not necessarily match up to institutional cycles, putting pressure on universities to rush to finalise project proposals. Providing some capital funding directly to institutions allows them to make investments at the most appropriate time.

4.5 The formula method of allocation also means that funding can be distributed with far greater efficiency on the part of universities and Government, as there is no need to prepare or to judge bids for competitions. In addition, autonomy enables institutions to take advantage of opportunities to optimise efficiency of spend through shared facilities within and between institutions, ensuring more widespread access to facilities and equipment and encouraging research collaborations.[15]

4.6 Alongside formula funding, capital funding allocated as part of Research Council grants is also extremely valuable. These investments underpin high quality research in priority areas and ensure universities have the most up to date equipment to remain competitive – helping to finance both small scale equipment for individual projects and more strategic equipment needed for a portfolio of research projects. As with formula funding, Research Council capital grants can also help to facilitate more extensive sharing of equipment and in turn help to support collaborative research.

4.7 Where large scale national facilities (or significant shares in international research infrastructure) are supported by the Government, we urge this to be done following substantial and open consultation with the research base.

4.8 **We recommend that the majority of funding be allocated at the institution and research project level as opposed to large-scale projects, and that funding allocated directly to institutions is at least equal to that allocated to research projects.** This corresponds to scenario 1 in the consultation document.

The role of research-intensive universities in identifying current and future areas of scientific opportunity and in hosting scientific infrastructure

[13] Evidence taken from an analysis of 200 research-active universities from 33 European Research Area (ERA) countries: http://ftp.jrc.es/EURdoc/JRC63682.pdf

[14] OECD Innovation Policy Platform, 'Issue Brief: Public Sector Research Funding' (2011)

[15] For example, the University of Cambridge's Nanoscience Centre provides open access to over 300 researchers from across the University to nanofabrication and characterisation facilities housed in a combination of Clean Rooms and low noise laboratories. See Annex A for examples of partnerships between universities to share access to research infrastructure.

4.9 The location of leading-edge research infrastructure within research-intensive universities is vital in maintaining the international competitiveness of the UK. It ensures access by world-class scientific experts at those institutions, facilitates the development of talented researchers, leading to new scientific discoveries, and an emerging workforce of graduates who have received training in the latest techniques.[16]

4.10 With their strong links to other potential users, investment in universities also enables industry, including SMEs, to access the latest scientific equipment and facilities, thus maximising the effectiveness of investment. In particular, leading-edge infrastructure at UK universities is enhanced by in-house availability of key scientists and consultant engineers to assist with industrial development and experimentation with industry.[17]

4.11 The expertise to understand the major national and international research challenges and opportunities for innovation in science and engineering lies within our research-intensive universities. They are best placed to make strategic decisions within their own institutions about capital investment priorities, to identify emerging opportunities quickly, and to advise Government on priorities for large-scale national and international capital investments.

4.12 **Capital investment for science and research should be allocated to research-intensive universities and their institutes where there is a critical mass of research excellence. Extending capital investment to research and technology organisations and independent research organisations runs the risk of duplicating existing facilities and equipment rather than building on the UK's research strengths within our universities' centres of excellence.**

On-going resource costs

4.13 **We urge Government to give a clear commitment to support the on-going resource costs associated with operating, maintaining and up-grading capital facilities.** The on-going running costs associated with any new capital infrastructure must be met long after the initial funding has run out. Capital investment is only useful where facilities are kept operational and receive upgrades to keep pace with technological change.

4.14 Government cannot rely on universities to continue to use existing resource to fill a gap in the recurring costs of running research infrastructure. Universities are already doing more with less. The implementation of Wakeham efficiency cuts and introduction of policies which are not fully funded, such as open access, are leaving universities to make up shortfalls. It is important not to confuse savings with productive efficiency, where greater output is achieved for the same or less input. In addition, the energy demands of undertaking research in many science subjects are escalating, as are the costs of employing the specialist technical staff needed to operate and maintain increasingly complex equipment.

4.15 Currently, the provision of running costs on a project-by-project basis means that capital expenditure on equipment and facilities is not being used effectively, and

[16] Research infrastructure at our universities is open for use by students as well as researchers and staff. For example, the new South Glasgow Hospitals Campus (SGH) at the University of Glasgow focusing on stratified medicine will include a £25 million learning and teaching facility alongside facilities for clinical trials and research imaging suites.

[17] For example, the University of Southampton Wind Tunnels (part of the national wind tunnel infrastructure) are operated by experienced technical staff and backed by a knowledge base of internationally recognised academic researchers in fundamental and applied aerodynamics. The Tunnels are available for commercial work with consultant engineers on hand.

pieces of equipment (and even whole facilities) are not being kept operational at all times. For example:

(a) ISIS, a world-leading centre for research in the physical and life sciences, includes a suite of neutron and muon instruments to offer unique insights into the properties of materials on the atomic scale. The facility supports a national and international community of more than 3,000 scientists across a broad range of disciplines. However, the facility is running under capacity as insufficient funding has been made available to cover operational costs, with an attendant impact on scientific output. In particular, electricity operating costs have not been sufficiently provided for above the base-line costs of providing the facility.[18]

4.16 In addition to maintenance and running costs, technological advances mean that scientific equipment can become obsolete in a relatively short timescale and require upgrading to maintain a facility's capabilities and competiveness. See **Annex B** for examples.

4.17 As outlined above, the maintenance of cutting-edge research infrastructure within facilities is also imperative in attracting investment from businesses which place a high value on use of the latest research equipment in collaborations, and will wish to recruitment graduates who have been exposed to the latest techniques.

4.18 Last year, the House of Lords Science and Technology Committee argued that:

> There is substantial evidence of a damaging disconnect between capital investment and the funding for operational costs...While we acknowledge the difficulties inherent in meeting varying operational costs, it must be a priority to ensure that facilities are exploited to the full. In essence, provision for operational costs must be budgeted for in conjunction with the decision to allocate capital.[19]

4.19 In order to address the problem, **a resource element separate from project resource should be tied to capital investment to ensure that facilities and equipment can operate to full capacity, and to enable vital upgrades to maintain the continued competitiveness of facilities in the long-term.**

4.20 Furthermore, adequate administrative resource in relation to facilities which will be shared between partners should be included within operational costs alongside technical and maintenance funding. Operationalising access and agreeing charging arrangements is generally a lengthy process, so effective support is required in order to ensure genuine sharing of facilities and the efficiencies that can deliver.

Small- and medium-sized capital infrastructure

4.21 Although investment in some larger-scale facilities and equipment is important in order to ensure that the UK remains globally competitive, support for small- and medium-sized capital needs in universities is critical. **The majority of research undertaken in the UK relies upon access to small- and medium-scale research infrastructure, much of which is located within leading research-intensive universities.**

4.22 The quality of this research infrastructure is an important determinant in the choices made by leading researchers to work in the UK and of business to work with those

[18] Several witnesses drew attention to this in written and oral evidence to the Lords Select Committee on Science and Technology in 2013.
[19] House of Lords Select Committee on Science and Technology, 'Scientific Infrastructure' (2013)

universities. Geographical proximity is critical to ensuring efficient use of medium sized facilities through networked institutions, and is particularly important for SMEs where transportation costs and time-constraints may make accessing infrastructure outside of the region more difficult.

4.23 Furthermore, small- and medium-sized capital facilities located within leading research-intensive universities are used for the education of undergraduate and postgraduate students – they are crucial to student recruitment and also help to boost graduate employability. Such facilities provide the opportunity to enhance enterprise as well as supporting research in core sciences. Access to specialist facilities within institutions stimulates university enterprise activity, such as licensing, spin-outs and business incubation, leading to the development of new technologies. Small to medium-sized facilities also support large-scale facilities in maintaining full operational capacity by training researchers and testing samples. Funding provided by the Research Councils and through formula mechanisms by the Funding Councils is essential to ensuring universities have access to equipment at this scale. **Provision for infrastructure on this scale must be at the heart of the Government's capital investment strategy.**

Identifying the right priorities for the allocation of funding to major projects

4.24 **We welcome the intention to formulate a strategy in relation to the UK's priorities for investment in major national and international projects.** There is a need to plan over the medium and long-term to assess what activity should be led independently by the UK and in what areas strategic collaboration should be made to ensure that our researchers have access to cutting edge facilities.

4.25 It is imperative that infrastructure investment needs are addressed across the full breadth of research excellence in the UK, and that particular interests are not allowed to crowd out academic disciplines where infrastructure perhaps does not take the form of conventional physical 'kit'.

4.26 As outlined above, the expertise to identify priorities for capital investment into national and international research infrastructure lies within the UK's research base, including our leading research-intensive universities. However, it is likely that a variety of suggestions will emerge in relation to which projects should receive funding. **In order to choose between priorities identified in the initial round, we recommend further in-depth consultation with key academic research leaders to make a final recommendation on large-scale project funding to Government.**

4.27 Furthermore, we recommend that BIS, Research Councils and UKTI develop further their coordination of strategic decision-making around major facility funding to ensure that thinking is joined up across Government and that sufficient operational costs are included within the budget for large facilities. A more coordinated approach to the promotion of funding opportunities would also be beneficial to ensure the greatest impact from the investment.

Planning ahead for new opportunities

4.28 **It is important that a proportion of the capital budget is kept aside and ring fenced to ensure flexibility to invest in future strategic priorities which may not become apparent for years to come.** We have previously said that consideration needs to be given not only to what research infrastructure is strategically important for the UK now, but also to how a sustainable funding landscape can accommodate changes in priorities as science evolves. We therefore welcome the Government's

acknowledgement of this and agree that a proportion of the capital funding budget should remain unallocated.

4.29 **We also recommend that, at such time as the Government wishes to allocate the remainder, a full consultation should be undertaken with the research community to identify strategic priorities for investment.**

5. Building on the success of the Research Partnership Investment Fund (RPIF)

5.1 **The Research Partnership Investment Fund (RPIF) for capital co-investment in university research facilities has been very successful in leveraging funding for capital investment[20] and we recommend that this be turned into a longer-term, more strategic initiative for the future.**

5.2 A more strategic approach to RPIF could be achieved with a longer-term and more flexible initiative having either an open-ended time period for putting forward proposals, or at least a clear set of proposal closing dates known well in advance. This would enable universities to plan further ahead, an ability critical to identifying priorities for future capital investment, and to capitalise fully on opportunities to attract globally mobile business investment in research and innovation. International competition is extremely strong and the UK needs to do whatever it can to attract such investment.

5.3 Businesses typically look five or more years ahead in making major capital investments so the longer lead-time universities have to talk to business about potential investments, the better quality of bids that can be put forward, the wider universities will be able to look for partners, and the more likely that they will be of strategic importance. The short deadlines for proposals in previous rounds have meant that projects are more likely to involve partners with a strong existing relationship with the universities rather than new partners.

5.4 Whilst we welcome the ambition to leverage private sector investment, this must be in addition to Government funding and must not be seen as a replacement for it. Government must be wary of over-estimating the capacity of other sectors to fill the funding gap. Unrealistic expectations on the scale of contributions that business, charities and others can deliver could be damaging to relationships between universities and their partners.

5.5 It would also be useful to reconsider the scale of projects eligible for RPIF as many smaller projects (sub £30m) are currently losing out. This would help to leverage capital investment from smaller and medium-sized companies.

6. Our universities are already implementing efficiencies in order to invest in capital

6.1 The changing nature of research in a number of disciplines is driving up cost pressures on research. The cost of some small- and medium-scale equipment has been pushed beyond the means of individual universities, and as outlined above,

[20] £300 million of capital investment is leveraging in more than £800 million of private investment from businesses and charities. See Annex A for examples of Russell Group projects in receipt of funding.

energy and specialist personnel costs are rising whilst public investment in research capital has declined.

6.2 As a result, research-intensive universities are looking to develop more research infrastructure which is shared within and between institutions. This will help to maintain a critical mass of cutting-edge infrastructure to enable UK researchers to continue to compete internationally. Collaborative partnerships between our universities to share access to facilities and equipment realise a number of benefits, including enabling:

- Capital investment to be made and the recruitment of specialist personnel which would not otherwise have been possible.
- Concentration of research activity where collaboration between and within universities and with industry can drive excellence and impact in research.
- Access to facilities and equipment by businesses, ranging from large corporations to SMEs, further leveraging economic and social benefit from the research infrastructure.[21]

6.3 **Russell Group universities remain committed to increasing productivity and driving efficiency through collaboration with other UK universities and industry through research partnerships to share key scientific facilities and equipment.**

6.4 See **Annex A** for examples of such collaborative partnerships.

6.5 Our universities are also extremely successful in leveraging capital investment into research infrastructure through strategic partnerships with businesses. Through RPIF so far, Russell Group universities have received £240 million in capital funding from HEFCE for 17 projects, leveraging double this amount from businesses and other sources.[22]

6.6 Recent interpretation of VAT legislation has hindered equipment sharing between institutions as it requires an institution to levy VAT when charging to another institution's grants, significantly reducing the financial benefits of equipment sharing – unless special arrangements such as cost sharing groups are established. **We urge Government to consider how VAT legislation and guidance can be simplified to avoid hindering collaboration between universities in equipment sharing and other similar activities.**

6.7 In order to incentivise further sharing partnerships to emerge, there is a need for funders to meet the full capital costs of shared facilities rather than expecting institutional contributions as this removes complexities around how such contributions would be allocated in the light of potential benefits (or costs) of hosting the facility, and of different levels of usage between the participants.[23]

July 2014

[21] 'Sharing for Excellence and Growth: Synthesis Report Professor Luke Georghiou on behalf of the N8 Research Partnership'
[22] See: http://www.hefce.ac.uk/whatwedo/rsrch/howfundr/ukrpif/
[23] See footnote 22.

Annex A – examples of collaborative capital investment in science and research at Russell Group universities

- Lloyds Register is major partner in the University of Southampton's Boldrewood Innovation Campus, and will be relocating their R&D division onto the Campus this summer. Capital investment worth over £150 million has been provided by Lloyds Register, HEFCE, RPIF and Wolfson, alongside funding directly from the University. The Campus also provides for other industrial partnerships with companies including Airbus, Rolls Royce UTC, BAE and Qinetiq, and as well for international partnerships. Singaporean partners will be accessing a new 140m towing tank at the Campus.

- The GlaxoSmithKline-sponsored Clinical Imaging Centre at Imperial has created a world-leading facility with state of the art scanning and imaging facilities. GSK initially committed to a £50 million investment in the Centre, alongside parallel investment from Imperial and the MRC. The Centre is a platform for the development of new, more effective, treatment and prevention of diseases. In a unique partnership, the MRC, Imperial, King's College London and UCL have become equal shareholders in a newly created joint venture that assumes responsibility for the facilities and operations at the Centre, creating a framework for collaborative science and driving the centre into new areas and applications of imaging.

- The University of Sheffield's Advanced Manufacturing Research Centre with Boeing is a world-class centre for advanced machining and materials research for aerospace and other high-value manufacturing sectors. Over 60 industrial partners are involved, including Boeing and many smaller companies in the aerospace supply chain. A business park development on the back of this activity is now being planned in order to meet increased industry demand, with its first development 'Factory 2050', a £43 million state-of-the-art research factory to meet the future needs of aerospace and other high-value manufacturing industries. Factory 2050 is receiving a £10 million investment from RPIF and support from manufacturers including Boeing, Airbus, Rolls-Royce, BAE Systems and Spirit AeroSystems.

- Rolls-Royce and the University of Birmingham are developing a £60 million world-leading High Temperature Research Centre for high temperature metallurgy and associated processes for components including turbine blades, with a £20 million investment from RPIF. The Centre will ensure a more effective translation of fundamental research to production and train engineers from apprenticeships to postdoctoral fellows. Focused initially on the key manufacturing areas of investment, the Centre will draw in additional research competencies through wider industry and academic involvement.

- A new Centre for Experimental Medicine is building on Queen's University Belfast's internationally recognised Institute of Health Sciences, including introducing new programmes in diabetes and genomics. The Centre will move to a custom built facility on the Queen's University Health Sciences campus in 2015 and will work collaboratively across QUB and with other universities, the NHS and industry. The project has secured an investment of £10.5 million from RPIF as well as funding from Wellcome and Wolfson.

- The Science and Engineering South Consortium (SES), a partnership between the Universities of Oxford, Cambridge and Southampton, Imperial College London and University College London (UCL), works to optimise shared infrastructure and

training. Major facilities for research in the physical sciences, biosciences and engineering and in High Performance Computing are shared and the Universities engage in the strategic planning of new infrastructure investment. The Consortium's STFC portfolio is worth approximately £150 million; about a third of the national commitment.

- Collaboration to share access to equipment between the genomics centres at UCL and Barts and the London School of Medicine & Dentistry, part of Queen Mary University of London, has avoided duplication of facilities, leading to greater efficiency, and helped the partners to secure capital investment for new equipment. Through the collaboration, UCL and Queen Mary were able to jointly secure funding for a Fluidigm fluidic PCR machine and a higher-capacity autoloader array system and this equipment is now available for shared access.

- The Science City Research Alliance (SCRA) is a strategic union between the University of Birmingham and the University of Warwick. The SCRA has benefited from a multi-million pound capital investment by Advantage West Midlands and the ERDF into advanced materials, energy futures and translational medicine. The investment has funded joint equipment and research infrastructure at both institutions, as well as specialist personnel. The SCRA works in partnership with companies across the UK and internationally including JLR, Johnson Matthey, Ford, Shell, Proctor and Gamble and Unilever, as well as a number of regional SMEs.

- The N8 Research Partnership is a collaboration of eight research-intensive universities in the North of England, including seven Russell Group universities: Durham University, Newcastle University, the Universities of Leeds, Liverpool, Manchester, Sheffield and York, as well as the University of Lancaster. The N8 works to maximise the use of new and existing research assets, including through N8 High Performance Computing, an EPSRC-funded initiative to operate and enable academic and industrial access to Polaris, an SGI HPC cluster which is capable of a peak performance of 110 trillion operations per second – the approximate equivalent to half a million iPads.

- The Centre for Additive Layer Manufacturing at the University of Exeter is an initiative set up by EADS and Rolls Royce with the university to introduce the concept of additive manufacturing (3D printing) to the SME manufacturing base in the South West. The Centre purchased new equipment and facilities and is committed to engaging with 250 SMEs in the region through advice, training and demonstrations.

- ABB International has invested in a £2 million carbon capture pilot plant at Imperial College London which will train 8,000 undergraduates during its 25 year lifespan. The plant will offer a summer school for engineering students; a laboratory for Imperial academics improving technology to capture CO2 emissions; and a location for the energy and chemical engineering sector to train staff.

- The FloWave Ocean Energy Research Facility at the University of Edinburgh allows devices to be tested at scale in a tank enabling research milestones to be achieved in days or weeks, rather than months or years in open water, and will keep the UK at the forefront of marine energy technology and research development. The Facility is available to researchers and industrial partners to develop and refine full-scale devices. This accelerated development should help bring clean energy products to market more quickly and cost-effectively, at lower risk. The £9.5 million Facility was funded by capital investment from EPSRC and the University.

- The University of Nottingham is working with GlaxoSmithKline (GSK) to establish a carbon neutral laboratory for sustainable chemistry. In addition to the philanthropic investment from GSK (£12 million), this landmark project is supported by a £10.3 million award from the UK Research Partnership Investment Fund (UK-RPIF). The GlaxoSmithKline Carbon Neutral Laboratory for Sustainable Chemistry will focus on research of particular relevance to the pharmaceuticals based supply chain and will be the focal point for the delivery of a sustainability-linked EPSRC Centre for Doctoral Training (£5.3 million), training future chemists in cutting-edge 'greener' processes, which are increasingly employed across the chemicals using industry. Reflecting the theme of sustainability, the building is itself a research resource in its own right, demonstrating a carbon neutral footprint over its projected lifetime of 25 years.

- The Centre for Hyperpolarisation in Magnetic Resonance at the University of York uses the latest developments in nuclear magnetic resonance and magnetic resonance imaging to improve the sensitivity of these techniques by several orders of magnitude. The Centre houses the latest hyperpolarisation technologies alongside a suite of NMR spectrometers, pre-clinical MRI scanning and access to the adjacent clinical MRI capability of the York Neuroimaging Centre. The potential benefits of hyperpolarisation include new diagnostic and imaging agents for cardiovascular disease, neurodegenerative conditions and cancer, as well as providing ground breaking advances in analytical chemistry. The £10 million Centre, located on the York Science Park, is co-funded by the University, the Wellcome Trust, the Wolfson Foundation and Bruker Biospin and has strong relationships with pharmaceutical companies including AstraZeneca and GlaxoSmithKline.

- GW4 brings together the universities of Bristol, Exeter, Cardiff and Bath, the four leading research-intensive HEIs in the South West and Wales. GW4 is developing a strategic approach to regional assets, identifying opportunities to develop these, and ensuring efficient procurement and appropriate external use. The GW4 equipment database provides a single source of information on shareable equipment. The database allows effective assessment of need and users across the GW4 prior to investment. It has also enabled a more strategic approach to efficient procurement and use of research infrastructure. This approach is reflected in recent awards to set up UK-leading facilities for NanoESCA spectroscopy (EPSRC £1.8M), and Accelerator Mass Spectrometry (£1.4M NERC, BBSRC) hosted by Bristol on behalf of the GW4 research community.

Annex B – examples of types of equipment and facilities with relatively short life-spans due to technological advances

- **Next generation computing infrastructure** is critical across a broad range of disciplines, enabling researchers to tackle more complex modelling and 'big data' challenges. High performance computers can process data extremely rapidly and model complex systems ranging from galaxies to meteorological systems and DNA, meaning that their use is critical to maintaining competitive advantage in a number of disciplines. Investment in high performance computing is becoming critical as the social sciences increasingly respond to big data challenges through techniques such as text analysis over the next 2-3 years. High performance computing facilities within Universities are also key components of research and institutional e-infrastructure, driving efficiency through improving funding success rates and maintaining continuity of research and mitigating funding gaps. A high performance computer is a large-scale investment requiring significant resource meaning that universities often share access.

- **Magnetic Resonance Imaging (MRI)** technology is constantly improving and upgrades are needed within the research base in order to remain competitive in this field of research. Experimental MRI scanners are able to utilise a much higher magnetic field compared to typical clinical scanners, pushing the boundaries of anatomical imaging and helping to develop MRI as a tool to yield information beyond tissue structure. For example, gated MRI can image the beating heart, diffusion weighted imaging can yield structural information on the cellular level, and arterial spin labelling can quantify cerebral perfusion. These techniques can be used to non-invasively investigate the complex relationship between structure, function, disease processes and therapy.

- Genomics is a rapidly-progressing, resource and data-intensive scientific field, requiring expensive equipment with relatively short useful lifespans. The rapid pace of technological advancement in this field means that older techniques of genome sequencing quickly become obsolete. It is essential for institutions to have access to **next-generation sequencing methods** which drastically cut costs by increasing the rate of sequencing substantially, enabling institutions to undertake large-scale population-based studies and to identify links between specific genomic signatures and particular diseases. Genomic investigations are pertinent in a large number of distinct scientific areas ranging from immunology to ecology.

- In recent years, the price of helium has increased at such a rate that it has become prohibitively expensive to use in scientific experiments without a mechanism to recover helium gas currently being lost through the process. It would be cost effective for facilities such as Rutherford Appleton Laboratory operated by STFC to invest in a **helium liquefier** to ensure that helium gas can be captured and purified after use and used again. However, currently there is no capital investment available for this purpose.