COUNCIL FOR SCIENCE AND TECHNOLOGY

10 Victoria Street
London SW1H 0NB

Prime Minister
10 Downing Street
London SW1A 2AA

24 September 2020

Dear Prime Minister

LEVELLING UP: THE ROLE OF SCIENCE AND TECHNOLOGY IN ADDRESSING REGIONAL DISPARITIES AND PROMOTING EQUALITY OF OPPORTUNITY

When you met with the Council in March you asked us to consider the contribution science and technology could make to 'levelling up' across the country; to help address economic disparities across the UK and to promote equality of access to opportunity.

Levelling up is particularly challenging in the UK's current context. In terms of economic productivity, the UK has some of the widest regional disparities of the OECD countries[1] and addressing this is just one dimension of levelling up; there are also significant inequalities in health, education and employment opportunities across our society[2], which intersect in multiple ways and often in close geographical proximity. The Covid-19 pandemic has shone a light on - and in many cases compounded - existing inequalities, with diverging health, economic, and social impacts in different groups and communities[3]. Levelling up needs **investment in people as well as in places**.

Across the UK there is a considerable **regional imbalance in research and innovation activity**. While there are excellent research and innovation capabilities across the breadth of the UK, official figures show that over half of gross domestic expenditure on R&D is concentrated in London, the South East and East of England[4]. Regional levels of R&D funding correlate with regional productivity[5], although it is important to note that the nature of this association may have several facets, and that regional analyses may hide substantial intra-regional differences. Achieving the goal of 2.4% of GDP invested in R&D presents opportunities for driving R&D activity in regions outside of the South East, though actions beyond investment in R&D will be required for levelling up of prosperity and productivity. We set out in this letter recommendations to help achieve this, guided by two points of principle:

[1] Gal, P. and J. Egeland (2018), "Reducing regional disparities in productivity in the United Kingdom", *OECD Economics Department Working Papers*, No. 1456, OECD Publishing, Paris, https://doi.org/10.1787/54293958-en.
[2] ONS (2020) "Labour market in the regions of the UK: September 2020"; Education Endowment Foundation (2018) "The Attainment Gap"; The King's Fund (2020) "What are health inequalities"
[3] Institute for Fiscal Studies (2020), "The Geography of the COVID-19 crisis in England"
[4] ONS (2020) 'Gross Domestic Expenditure on research and development by region, UK' - most recent figures for 2018; UKRI 'Regional distribution of funding for research and business'
[5] Nesta (2020) "The missing £4 billion: Making R&D work for the whole of the UK". R&D figures are total expenditure, both public and private funding.

i. **A levelling up agenda for R&D should not do anything to diminish the success of the outstanding knowledge based economies that we have in some parts of the UK**; the goal should be to build elements of this success elsewhere in the UK. The solution is not simply to distribute the spending differently. The Government's commitment to increasing investment in R&D offers a rare opportunity to leverage R&D investment for regional growth. Incentivising partnerships across regional boundaries, between stronger and weaker regions, will be essential.

ii. **The success of place-based R&D investments in driving local growth relies on structural investment**; research and innovation does not operate in isolation and the path from R&D and innovation to improved productivity is not predictable. Impact from R&D investment depends on several inter-connected factors, including the availability and access to a skilled workforce; social and connective infrastructure; and strong local leadership[6].

In a globalised world, high earning jobs in high income countries rely upon innovation, productivity, and an advantageous position within global value chains. Innovative activity is a critical factor in attracting investment and the creation of such jobs. The **co-location** of universities, research, innovation and technology centres, knowledge-intensive businesses, skilled people and investment opportunities provides an enabling environment for collaboration and the pooling and exchange of knowledge, ideas and research infrastructure. This can drive innovation and growth[7], with 'spillover' benefits for the local economy[8].

This **clustering and agglomeration of knowledge-intensive activity** increases business innovation[9] and underpins the some of the most successful local economies in the UK, for example the Cambridge life sciences cluster[10]. Indeed, the tendency for these activities to be mutually reinforcing within clusters is precisely why industrial development left to its own devices can create widening gaps rather than convergence in growth. Analysis suggests that across the UK, with the exception of London, major cities are not fully exploiting their agglomeration potential[11]. Taking proper account of the factors which underpin successful innovation clusters[12], investment in research and innovation activity and infrastructure can be an important tool in a wider strategy to level up cities and regions outside of the prosperous South East. Universities and research centres should be the stimuli for agglomeration and local growth, and enablers of opportunity. Support for **collaboration and partnerships** are particularly important for structurally weaker regions to link to partners outside the region with complementary strengths[13].

The approach to levelling up must be strategic and long-term in its focus. Investment decisions on R&D infrastructure can have long lead-in times and an enduring legacy. A piecemeal or short-term approach is likely to result in already prosperous regions - which start from a position of higher absorptive capacity, and greater ability to generate positive returns quickly - continuing to benefit more from policy and funding initiatives than less prosperous regions[14]. A systems approach should be taken to ensure national and local levelling up

[6] Royal Society (2020) "Research and Innovation Clusters", Policy Briefing. See also OCED (2020) "Enhancing productivity in UK core cities: connecting local and regional growth" and Gal, P. and J. Egeland (2018), op cit
[7] The Brookings Institution (2017) "Clusters and Innovation Districts: Lessons from the United States"
[8] BEIS (2014) "An Economic Analysis of Spillovers from Programmes of Technical Innovation Support", Report prepared by ICF GHK"
[9] The Brookings Institution (2017) op cit. Also Carlino, G and Kerr, W R (2014) "Agglomeration and Innovation" NBER Working Paper 20367
[10] Royal Society (2020) "Research and Innovation Clusters" Policy Briefing, pages 16 - 18
[11] OCED (2020) "Enhancing productivity in UK core cities: connecting local and regional growth"
[12] Royal Society (2020) "Research and Innovation Clusters" Policy Briefing
[13] Koschatzky, K (2018) "Innovation-based regional structural change – theoretical reflections, empirical findings and political implications", Fraunhofer ISI
[14] Coyle, D and Mealy, P (2019) *To them that hath: economic complexity and local industrial strategy in the UK* https://www.bennettinstitute.cam.ac.uk/media/uploads/files/working_paper_21_Nov_Penny_Mealy_Diane_Coyle_Bennett_Institute.pdf

strategies are coordinated, mutually reinforcing, and consider both existing and potential future private R&D investment.

A strategy to maximise the contribution of R&D for levelling up should include:

i. Leveraging R&D funding for regional growth by scaling up collaborative funding opportunities to foster and enhance partnerships, within and between regions, where there are research and innovation synergies with the potential to contribute to local growth;
ii. further incentivising the contribution of research, innovation and technology centres to regional growth in funding agreements and in organisational strategies;
iii. enhancing the availability of information on local innovation strengths and needs, for local and national decision makers to inform effective investment strategies and to evaluate outcomes;
iv. supporting wider measures needed for R&D investment to act as a driver for local growth, including measures to support skills and to support local leadership and decision-making.

We have set out our considerations in more detail in an attachment to this letter, including some specific recommendations in these areas. These build upon the Council's previous advice on science and technology for economic benefit across the UK[15] and diffusion of technology for productivity[16]. We would be pleased to provide more detailed advice on any aspect, and to continue to offer advice through the process of implementation of levelling up policies.

We are grateful to Council members for developing this advice, in particular, Professor Julia Black, Professor Jim Hall, Sir Robert Lechler, Dame Ottoline Leyser, Dervilla Mitchell, Professor Fiona Murray, Professor Brooke Rogers and Lord Stern of Brentford. We are also grateful to Professor Richard Jones, Chair in Materials Physics and Innovation Policy at the University of Manchester, and Professor Alan Penn, Chief Scientific Adviser at the Ministry of Housing, Communities and Local Government, for giving their time and expertise to Council discussions on this.

We are copying this letter to the Chancellor of the Exchequer; the Secretary of State for Business, Energy and Industrial Strategy; the Secretary of State for Education; the Secretary of State for Housing, Communities and Local Government; the Chief Secretary to the Treasury; the Minister of State for Universities; the Parliamentary Under Secretary for Science, Research and Innovation; the Parliamentary Under Secretary for the Northern Powerhouse and Local Growth; the Cabinet Secretary and the Permanent Secretaries of HM Treasury, the Department for Business, Energy and Industrial Strategy, the Department for Education, and the Ministry of Housing, Communities and Local Government.

Yours sincerely,

Sir Patrick Vallance
Co-chair

Professor Dame Nancy Rothwell
Co-chair

[15] CST (2017) "Science and Technology for Economic Benefit across the UK", CST letter to the Prime Minister, July 2017
[16] CST (2019) "Diffusion of technology for productivity"; CST letter to the Prime Minister, August 2019

PRIME MINISTER'S COUNCIL FOR SCIENCE AND TECHNOLOGY

ADVICE ON LEVELLING UP: THE ROLE OF SCIENCE AND TECHNOLOGY IN ADDRESSING REGIONAL DISPARITIES AND PROMOTING EQUALITY OF OPPORTUNITY

Leveraging R&D investments for regional growth

Recommendation 1: Public sector R&D funders should review the geographical balance of their funding and the opportunities for wider geographical distribution of R&D funding

1. 'Levelling up' of R&D activity should not subtract from the already very successful regions but should promote wider regional distribution of research and innovation activity and of the benefits to society, productivity and economic growth. The majority of funding from the National Institute for Health Research, for example, is concentrated in the South East[17], while the concentration of patients and incidence of disease, as well as wider research capabilities, are spread across the whole of the UK. The Government's commitment to increasing investment in R&D presents a significant opportunity for increasing regional R&D capability without taking away from currently successful research areas.

Recommendation 2: Collaborative R&D funding mechanisms with an explicit aim of promoting local R&D strengths and hence economic growth should be scaled up. In particular, funding mechanisms which support connections and collaborations between regional partners and with partners across regional boundaries. This could include:

- **Scaling up the Strength in Places Fund**, to support geographical collaborations, building on experience of the first waves of funding.
- **Scaling up funding to support partnerships and collaborations that cross regional boundaries**, building on experience of the Connecting Capability Fund, to enable larger research centres to partner with smaller ones, and to enable partnerships with translational and business partners where there are synergies in research and innovation activity.
- **Establishing a Local Economy Challenge Fund,** administered at local and regional level, to support challenge-led research and to strengthen capacity for research, innovation and knowledge exchange through partnerships.

2. The funding criteria for the UKRI Strength in Places Fund are focused on research excellence as well as impact on local growth. Funded projects bring together businesses, research organisations and local leaders to work collaboratively to boost local research and innovation capacity in order to drive economic growth. This is a relatively new scheme (established following CST advice in 2017) and funding levels are still relatively modest. There may be scope to scale this up, building on experience from first waves of funding, including a review of processes.

3. Local economy challenge funds would support regional specialisation in technology or approach against a common challenge. Systems challenges (e.g. achieving net zero carbon emissions, caring for aging population) require long term solutions and place-based experiments and learning about 'what works', which can be stimuli for growth in less productive areas. A challenge-based approach allows for a diversity of approaches and support for innovation in the broadest sense, guarding against the protection of incumbents against new entrants. Challenges can help achieve dual policy aims: those

which link both net zero and levelling up ambitions, for example, could support the harnessing of natural capital to decarbonise energy supplies while also boosting local investment and opportunity, or jointly address the challenge of local housing shortages with the urgent need for homes to be more energy efficient. A key objective would be to develop knowledge, experience and competence in applied research and innovation activity among local actors on challenges that they have a stake in addressing.

4. Public-sector funders of R&D should also give consideration to how consortia can be more regionally diverse where there are research and innovation synergies, with wider collaborations particularly important for structurally weaker regions[17]. Smaller research centres with excellent specialist capabilities can often miss out on major R&D funding bids because they are too small to stand on their own. Scaling up funding for partnerships, building on experience of the Connecting Capability Fund, should support collaborations and connections across regional boundaries, in particular between larger research, innovation and technology centres and smaller ones, and highly productive areas with those that are less productive.

Incentivising the contribution of research, innovation and technology centres to regional growth

Recommendation 3: Opportunities to further incentivise the contribution of research, innovation and technology centres for regional growth should be considered. In particular:

i. Once the first Knowledge Exchange Framework (KEF) results have been published, BEIS and DfE should consider whether there are **opportunities to further recognise the long-term impacts of research development, deployment and implementation of research** in higher education funding and research evaluation frameworks.
ii. BEIS, and other departmental sponsors of publicly funded research institutes, should consider opportunities to incentivise, and sustainably fund, **initiatives that contribute to local growth and skills in publicly funded research, innovation and technology centres' organisational strategic objectives**.
iii. BEIS, HMT and HMRC should consider whether there are **further opportunities to enhance R&D tax incentives**, building on the success of R&D tax credits in incentivising business R&D; Innovate UK should **identify where public-sector investment could strengthen and extend the positive impact of regionally-based firms and their partners**, by connecting with local areas of lower productivity and skills.

5. **At the city-level, universities can be at the centre of rejuvenation opportunities, driving agglomeration in and around cities**, providing a skilled workforce and acting as a magnet for knowledge-intensive industries. Agglomeration around universities can also drive specialisation, for example Sheffield's Advanced Manufacturing Park, centred around the University's Advanced Manufacturing Research Centre, which has become a hub for knowledge and expertise, linking researchers and academics with industry, attracting business investment and having a transformative impact on the local economy[18]. In South Wales, a world-class Compound Semiconductor cluster has been driven by regional industry, investments in a Compound Semiconductor Applications Catapult and Cardiff University's role in training and research[19].

[17] Koschatzky, K (2018) "Innovation-based regional structural change – theoretical reflections, empirical findings and political implications", Fraunhofer ISI
[18] Breach, A (2019) "Parks and Innovation: Lessons from Sheffield's Advanced Manufacturing Park", Centre for Cities
[19] https://www.gov.uk/government/news/historic-signing-seals-worlds-first-compound-semiconductor-cluster-in-wales

6. Although university funding allocations based on research excellence can help support and drive regional growth where universities have an established and strong research performance, it can be harder for less well established universities to reach the same level of funding, restricting their potential to be a hub for regional growth. Consideration should be given to how far future research assessments, including the Research Excellence Framework (REF), can further recognise and incentivise research development, deployment and implementation of research in the long term, as well as academic research excellence and near term impacts of that research. Impact assessment through the Knowledge Exchange Framework (KEF) should provide detail on the characteristics of different universities relevant to the levelling up agenda.

7. **Outside of cities, specialist research infrastructure and institutes can be hubs for regional growth.** Dame Julia Goodfellow's review of government and research council laboratories on their role in driving local growth[20] and the joint Government Office for Science, HM Treasury report 'Realising our ambition through Science'[21] identifies the role publicly-funded research institutes can have in attracting businesses and skilled workers to an area, and in boosting inspiration, aspiration and skills of the local population. Organisational objectives relating to local growth, including skills development and transfer, could be formalised in organisational remits and business strategies. These activities would need to be funded sustainably to ensure they are not at the expense of research activities. New public research bodies - for example ARPA, and the new National Institute for Health Protection – could similarly be hubs for regional growth, while also bearing in mind the importance of comparative advantage, a skilled workforce, and local infrastructure for agglomeration effects.

8. **Catapult Centres** can also support regional growth objectives, through their regional and national networks and building stronger relationships with universities and businesses, and in collaboration with local innovators in their specialist areas. Regional growth objectives for Catapult Centres, and all research, innovation and technology centres, should remain clearly aligned with core organisational remits.

9. Tax relief for R&D has successfully incentivised business innovations, including a spill-over effect on the innovations of technologically related firms[22]. R&D tax credit claims are heavily concentrated in companies with a registered office in London, the South East or the East of England (although this may not be where all the R&D takes place), and concentrated in a relatively small number of sectors, primarily manufacturing[23]. Further opportunities to enhance R&D tax incentives should be considered, in particular to consider how best to support R&D in services industries. Innovate UK should also consider, for those areas with comparatively higher levels of private sector R&D investment, where public sector investment could strengthen and extend the positive impact from regionally-based firms and their partners by connecting with local areas of lower productivity and skills.

<u>Enhancing the availability of information on local innovation strengths and needs</u>

Recommendation 4: Place-based public R&D investment should build on local comparative advantages; be informed by in-depth knowledge of the strengths and

[20] Currently unpublished
[21] Government Office for Science (2019) "Realising our ambition through science: a review of Government science capability"
[22] Dechezleprêtre, A; Einiö, E; Martin R; Nguyen, K T; and Van Reenen, J "Do Tax Incentives for Research Increase Firm Innovation? An RD design for R&D" revised March 2019
[23] HMRC (2020) "Research and Development Tax Credits Statistics, October 2019"

needs of local innovators; and be guided by a data-driven approach to decision-making and measuring impact.

10. Some public R&D investments should explicitly aim to generate local economic growth. Innovation policies which aim to derive regional development benefits are more likely to be successful in the long term where they build on the existing or emerging strengths of a region[24]. Place-based R&D investment decisions and interventions should seek to strengthen comparative advantages identified through careful and detailed analysis and in-depth knowledge of local R&D and industrial strengths and needs.

11. A detailed mapping of regional capabilities remains imperative to support a targeted approach to R&D funding; raising the profile of areas of regional and local research and innovation strengths, both nationally and internationally, to attract partners and investment. This mapping can also be used to identify 'left behind' areas where regional innovation capability exists, and where there may be a strong local growth case for investing in specific facilities that build on the local area's comparative advantage where this also aligns with wider research or strategic priorities, for example nuclear capabilities in Cumbria, or hydrogen in Teesside.

12. The Science and Innovation Audits[25] provide a basis for understanding regional science and innovation strengths. Complementary initiatives, including Nesta's work on innovation mapping, also provide useful tools to inform decision-mapping at different regional levels, including the development of Local Economic Growth Strategies and how funding to support national Industrial Strategy challenges is implemented.

13. Evaluation of place-based interventions and investments should be outcomes-focussed and look across a broad range of indicators - employment, value-added, sustainability, educational attainment, health physically and mental wellbeing - to give a full picture of the impact of investments on regional economic and population dynamics. What constitutes a good outcome will be different for different places. In terms of productivity, for example, a good outcome may be localised improvements relative to current levels or the UK average, rather than parity across regions. An important issue to resolve will be the level of granularity of data needed to inform successful strategies for levelling up.

14. The Industrial Strategy Council's evidence review of regional economic disparities identified several areas where more granular data would help inform and evaluate decision-making[26]. We note work being undertaken by BEIS, Nesta and the ONS and would be happy to help explore further actions which can be taken to ensure the availability of localised information and data mapping needed for national and local decision-making.

<u>Supporting wider measures needed for R&D investment to act as a driver for local growth</u>

Recommendation 5: Further consideration should be given to opportunities to enhance skills and mobility of talent to help develop regional capabilities and to improve productivity. This should include relationship building and knowledge exchange between universities, research, innovation and technology centres, schools and further education providers, and between businesses and across business supply chains.

[24] Thomas Brenner, Carsten Emmrich and Charlotte Schlump (2013), "Regional effects of a cluster-oriented policy measure – The Case of the InnoRegio program in Germany"
[25] https://www.gov.uk/government/collections/science-and-innovation-audits
[26] Industrial Strategy Council (2020) "Understanding the policy-making processes behind local growth strategies in England"

15. A skilled workforce is crucial for research and innovation in any location. Building long term relationships between universities, research, innovation and technology centres, knowledge-driven industries, schools and further education providers can boost the demand for skills in less productive regions; providing opportunities and driving ambition. These long-term relationships can also help to tailor training provision to respond to changing local industrial needs and provide an infrastructure for life-long learning, including reskilling.

16. Enhancing skills at all levels is essential for levelling up across the UK. Higher skill levels in a local population are associated with higher economic performance[27]. Addressing existing skills mismatches[28] between employment opportunities and employees, and ensuring a pipeline of skills to meet future workforce needs, are essential to ensure economic regeneration is not held back by lack of a local skilled workforce. The Council has separately provided advice to support the implementation of Dr Philip Augar's recommendations on post-18 education which we would be pleased to discuss in more detail. The UK needs an education system that is capable of providing the wide range of skilled people, ideas and innovations necessary for a thriving and inclusive 21st century economy, with equal opportunity and mobility between learning opportunities.

17. Addressing deficiencies in general and specialised skills and training would bring considerable productivity benefits across all regions and sectors of the economy. We considered in previous advice on the diffusion of technology for productivity[29] how the widespread adoption of existing technologies and innovations in business processes, management techniques and analytical methods could lift lagging firms out of the 'long tail' of productivity. We set out ways in which this could be addressed, including establishing a business-focused National Centre for Productivity, which would complement the ESRC-funded Productivity Institute, and provide practical support to businesses and promote knowledge exchange between universities and research, innovation and technology centres and businesses, and across business supply chains. Employers should also be incentivised to invest in training their staff to support the use of new technologies.

18. Mobility of researchers and innovators across research, innovation and technology centres, businesses, and regions, could help seed excellence and knowledge exchange more widely. Consideration should be given to how funding mechanisms can incentivise mobility, for example 'start-up' research grants for talented early-career researchers which explicitly encourage mobility between research institutions and business partners. Enhancing entrepreneurship skills and developing entrepreneurial cultures should be further supported, to support the creation of new businesses from innovative ideas. In addition to skills development in formal education settings, experience working in entrepreneurial environments is a highly effective way to gain entrepreneurship skills[30].

Recommendation 6: Consideration should be given to devolution of powers and localised control over some elements of R&D spending and incentives. This could be in the form of 'innovation deals' recommended by Nesta[31], to give greater local control over R&D spending decisions to places that can demonstrate they have the leadership and capacity to

[27] Gal, P. and J. Egeland (2018), "Reducing regional disparities in productivity in the United Kingdom", *OECD Economics Department Working Papers*, No. 1456, OECD Publishing, Paris, https://doi.org/10.1787/54293958-en; see also Centre for Cities (2017) "Why skills should be the primary focus of any industrial strategy"
[28] Government Office for Science (2017) "Future of skills and lifelong learning" Foresight report, November 2017
[29] CST (2019) "The diffusion of technology for productivity", CST letter to the Prime Minister, August 2019
[30] CST (2016) "Strengthening entrepreneurship education to boost growth, jobs and productivity", CST letter to the Prime Minister, October 2016
[31] Nesta (2020) "The missing £4 billion: Making R&D work for the whole of the UK"

spend funds wisely, and join up R&D investments with other devolved funding streams such as infrastructure and skills.

19. Studies have shown that **strong local leadership**, and the ability to induce action across the system to create long term economic and social value, combined with the availability of sufficient resources, a clear vision, and collaboration, is a core feature of successful regional regeneration[32].

20. Strategies should be coordinated, mutually reinforcing, and consider both existing and potential future private R&D investment. The successful development of the Innovation Districts in Glasgow, for example, are driven by the senior leaders of Strathclyde University and Glasgow University, underpinned by co-ordination and strong partnerships with city leaders, co-located Catapults, Innovation Centres and publicly-funded research centres, and with significant multi-sectoral industry and business participation.

21. Support should also be available to local decision-makers to harness the potential of innovation to help regional economic development, to procure innovative solutions for the delivery of public services, and to build capability where needed in the provision of support and advice on R&D spending decisions and funding opportunities.

22. Place-based interventions should also take into account the social infrastructure needed for local growth and employment benefits to flow from R&D investment. Connective infrastructure for example geographically extends and intensifies the productivity of agglomerations through widening access and enabling collaboration[33]. Connectivity is essential for ensuring people in low-skill areas, especially rural ones, can access high quality education and employment opportunities in their nearest clusters. Connections between schools and students, and businesses and research centres, can boost aspiration and influence future employment prospects[34] emphasising the importance of both outreach and ability to connect.

23. In our advice on a systems approach to achieving net zero carbon emissions we recommended a **National Infrastructure Investment Bank**[35]. This infrastructure investment bank will also be critical for the levelling up agenda, where significant investment is needed. Such a bank would help manage financial risks associated with infrastructure investments, work with the private sector, and bring down the cost of capital. For R&D investments, this will be especially important in areas where research and innovation clusters exist, or are starting to emerge, but lack the wider infrastructure that would enable them to grow.

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[32] Arup (2020) "UK innovation districts and knowledge quarters: Driving more productive growth"; Koschatzky, K (2018) "Innovation-based regional structural change – theoretical reflections, empirical findings and political implications", Fraunhofer ISI
[33] Graham, D. (2018). "Quantifying Wider Economic Impacts of Agglomeration for Transport Appraisal: Existing Evidence and Future Directions"
[34] Education and Employers; key research findings: https://www.educationandemployers.org/research-main/key-findings-from-our-research/
[35] CST (2020) "Achieving net zero carbon emissions through a whole systems approach", CST letter to the Prime Minister, January 2020