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From investment to outcomes: Capabilities to deliver purposeful public investment in research

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Executive summary

- The renewed focus on research as a driver of Government ambitions provides valuable impetus for clarifying the purpose of public investment in research.
- Publicly-funded research institutions support a breadth of capabilities that form the building blocks of the UK research base.
- The underpinning (and interconnected) characteristics for delivering on purposeful investment are: sustainability; research breadth; cross-disciplinarity; and societal engagement.
- The benefits of research investment should be felt and recognised across the whole UK. This requires shifting emphasis from input mechanisms (the how) to optimising outputs (the what).
- The Government's investment ambitions would benefit from a richer and more data-informed picture of the UK's publicly funded research capabilities.
- Research policy should take greater account of interdependencies in the R&D system to maximise the outcomes from investment.

What is the purpose of public investment in UK research?

> *There is no route to stronger growth in this country, no answer to how we pay our way, or compete with the rest of the world, without science, technology and innovation leading front and centre.* **Liz Kendall, Secretary of State for Science and Innovation**[1]

The benefits of public investment in R&D are well established.[2] Successive governments have placed emphasis on the importance of R&D for economic growth as well as wider prosperity.[3] The Department for Science, Innovation and Technology (DSIT) estimate that £1 of civil public R&D investment generates £8 in net economic benefits for the UK over the long term.[4]

The current Government's 'number one mission' of economic growth includes an *Industrial Strategy* that will see £86 billion of R&D investment in eight key sectors leverage private investment to drive growth.[5] This sits alongside an R&D Missions Programme to address specific challenges relevant to the Government's five national missions.[6] Meanwhile, the specific purpose of the Government's 2025 *Science and Technology Framework* is to 'improve lives for citizens in every part of the UK'.[7]

Research in publicly-funded institutions not only enables the advancement of human knowledge as an end in itself, but also derisks novel areas of research, fuelling the pipeline of innovations and catalysing private sector investment. It generates social benefits such as: improved human and planetary health; technological innovations; and contributions to culture. Additionally, it provides avenues for global engagement, driving international collaborations, supporting science diplomacy and attracting talent and foreign direct investment.

How should public research funding be directed and what research capabilities are needed?

What are the distinctive capabilities of publicly-funded institutions – including universities, research institutes and public sector research establishments – which support these benefits? Science Minister Patrick Vallance has emphasised the importance of maintaining a balance between curiosity-driven research, applied research aligned to the Government's agenda and supporting businesses to scale and invest. These areas have been (inelegantly) labelled as 'three buckets'.

Publicly-funded institutions primarily support the first two types of R&D, with knock-on impacts on the third. The research capabilities they use to deliver this are multifaceted, spanning:

- methodological and disciplinary expertise;
- human capital, including research skills;
- translational capabilities and the networks inherent to them;
- capacity for international collaboration;
- physical and digital infrastructure;
- institutional frameworks that guide the way in which research is undertaken;
- types of research organisations; and
- the research environment and culture.

These capabilities support a host of activities from training the next generation of researchers to enabling cross-disciplinary research and informing public policy. They are the building blocks of the UK research base.[8]

Recently, the Executive Director of UK Research and Innovation, Ian Chapman, set out UKRI's spending plans with emphasis on 'sweating our research assets to their maximum' and 'prioritising with intent' to drive a more purposeful and 'choiceful' funding strategy.[9] This comprises four broad categories:

i. curiosity-driven research;

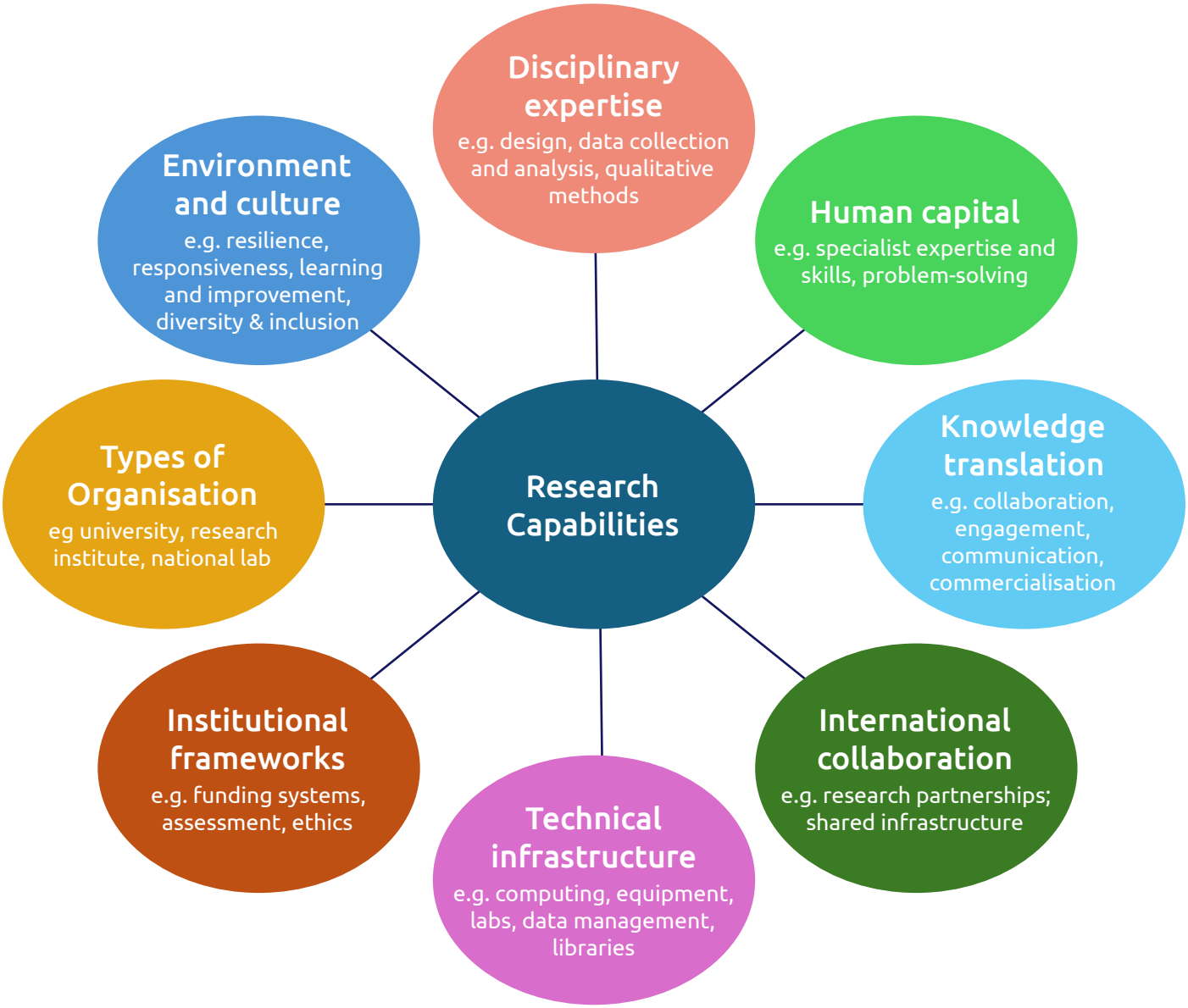
ii. national and societal priorities;

iii. innovative company growth; and

iv. 'foundational' investments in skills, infrastructure and international collaboration.

Capabilities to optimise the outcomes of public investment in research

Broad types of research capabilities



A. Core capabilities

The move towards more purposeful UKRI investment provides an opportunity to address the recent National Audit Office critique that there is no single guiding framework for what public investment in R&D is designed to achieve:

> *Government departments expect UKRI to support the delivery of an extensive range of objectives … These are not consolidated or ranked, meaning that the government does not currently have an overall picture of what it is asking UKRI to do.*[10]

UKRI's recently updated corporate plan sets out a 'refined focus' on the five broad areas of people, places, ideas, innovation, and impacts (alongside maximising operational effectiveness) as it transitions to the new investment approach.[11]

We suggest that to deliver on the intended purpose of public investment, four underpinning characteristics are important: a sustainable research base; a broad research base; strengths in cross-disciplinarity; and wider societal engagement.

i. **A sustainable research base**: The Government has made a clear commitment to investing in R&D. However, long-standing concerns about the sustainability of university research funding (although now acknowledged by UKRI) are yet to be fully addressed.[12] The House of Lords Science and Technology Select Committee has recently warned that the UK is facing a 'crisis point' in terms of its 'inability to retain the economic benefits of its R&D endeavour' due in part to acute funding pressures on universities.[13] Purposeful investment in research becomes somewhat beside the point if much of the research endeavour is teetering on the brink of collapse.

ii. **A broad research base**: Ian Chapman characterises blue-skies research and disciplinary excellence as 'the foundational investment that underpins the UK R&D system'. This foundational investment must also sustain a broad disciplinary research base in blue-skies research. This ensures a breadth of capabilities which can underpin new discoveries and respond to emerging societal needs – many of which are not yet foreseen. Disciplinary breadth in basic research also supports international competitiveness and collaboration, as shown in the Government's most recent comparative assessment of UK research (which uses Elsevier's SciVal database).[14] While much basic research is undertaken in universities, the role of other public-funded research institutes and government research organisations should not be overlooked, as emphasised in the 2023 Nurse review.[15] A long-term strategy to sustain the breadth of blue-skies research across the ecosystem should guide UKRI's investments.

iii. **Strengths in cross-disciplinarity**: The wider societal and political context also requires a greater consideration of further research capabilities – how research responds to societal 'grand challenges'. Harnessing the research base to address complex and systemic problems – what historian Adam Tooze has termed a 'polycrisis' – requires a much greater emphasis on collaboration across disciplines and sectors.[16] As the Royal Society have put it, the UK needs 'a science and innovation ecosystem that is more resilient, more responsive to society's needs, and better aligned with the challenges and opportunities of the decades ahead'.[17] This requires ambitious and concerted efforts to integrate expertise and insights from multiple disciplines, alongside expertise beyond academia in order to develop holistic and cross-cutting solutions.

iv. **Societal engagement**: Maximising the societal benefits of research cannot be achieved by researchers alone. It requires interaction and collaboration with the wider stakeholders who benefit from and deploy research, from business to policymakers to civil society. Key to this are capabilities for research engagement and research use, ranging from responsible engagement practices to knowledge mobilisation and technology transfer, to collaboration and co-design. A growing evidence base points to the importance of strengthening connections between research and communities across the UK, with research suggesting that a majority of people feel disconnected from R&D – only 41% of people feel it is relevant to their lives.[18] This is a striking indictment of the failure to ensure the UK's research base feels relevant to society at large and that public investment in R&D is valued by the public, who fund it.

B. Research assessment and data on the R&D system

Optimising purposeful public investment in UK research will also require smarter assessment and analysis of national needs and how far they are met. This should inform a stable framework for investment within an overarching model for how the system operates.

Assessment of the research system has played a significant role in evaluating and improving UK research capabilities in the context of university research. Established methods such as the REF and peer review are increasingly intertwined with a burgeoning metascience agenda. The Research on Research Institute, headquartered at UCL, the DSIT-UKRI Metascience Unit (which saw its budget trebled in the last Budget) and the introduction of metascience funding calls are embedding a metascientific mentality into UK research.[19] This provides an opportunity for a more agile approach to understanding and evaluating the UK research system.

Data-driven decision making

Evaluation is only as useful as the data on which it depends. The British Academy have observed that there is less high-quality data on R&D and innovation compared to other policy areas, and it argues this is needed 'across all areas of R&D, types of innovation, sectors and geographies' in order to make better policy decisions and improve economic outcomes from R&D.[20]

ESRC Executive Chair Stian Westlake has advocated for the importance of data in informing R&D investment decisions. He has proposed building a 'new analytic capability to provide a timely, detailed source of R&I [Research and Innovation] analytics to inform decision-making, measure impact, and make the R&I system more legible to investors and to the public'.[21] This approach would benefit from integrating data on government funding for R&D with other relevant information, including business investment in R&D.

Unifying the data systems of UKRI's constituent councils has proved challenging, constraining strategic oversight of its grant portfolio. UKRI is overhauling its grants and finance systems to provide better data to support decision making, and in 2024 gained the ability to analyse algorithmically its spending on strategically important areas.[22] In the long term, UKRI expects its updated data systems will improve visibility across the government's entire £20.4 billion R&D portfolio.[23]

C. Operationalising purposeful investment

Systems thinking

The National Audit Office has observed:

> *The UK R&D system is a complex network of organisations involved in the creation, diffusion and use of scientific knowledge as well as the coordination and support of these activities.*

The R&I ecosystem's interface with higher education, healthcare, business and immigration policy creates numerous interdependencies.

The application of policies, funding and other incentives shapes the flow between the inputs and outputs of this system. These are a result of historic decision making and evolution of the system, rather than an optimal design and are affected by wider policy interventions. Systems thinking – taking a holistic perspective that considers the interdependencies between different elements of the R&D system in the context of the system as a whole – offers a more strategic and data-

driven approach. For example, research initiatives to attract global talent need to take account of immigration policies and efforts to strengthen university-business interactions must consider business capacity and appetite for engagement.

Given the impact of science across government policy, the Science and Technology Framework advocates 'an integrated, systems-level approach to science and technology policy across the whole of government'.[24] Consideration should be given to interactions between parts of the system, such as the role of public funding in 'crowding in' private funding and scaling innovation as the House of Lords Committee has emphasised.[25]

Funding mechanisms

In an astute analysis, Ben Johnson, a former Senior Policy Adviser to the Secretary of State for Science, Innovation and Technology, has observed the Government's 'three buckets' approach to public R&D investment needs to act as a governance framework, not just a rhetorical flourish.[26] This would likely require different funding mechanisms to achieve each respective purpose, with different considerations (excellence, capacity-building, innovation potential and so on). Above all, it will need a shift in research funding policy from a focus on the 'how' (what mechanism for which distribution of funding) to the 'what' (the intended purpose and – over time – whether this is being achieved).

One can imagine relevant data about the research system could be combined with key criteria and metrics to guide R&D investment decisions that provide the greatest return in terms of advancing government or sector ambitions. This could also help to inform a better whole-system analysis of the characteristics and capabilities of the R&D ecosystem and of the outcomes of public investment.

Leverage points

A data-driven approach could enable more nuance in investment, with interventions targeted at leverage points: small-scale interventions that leverage large changes in system behaviour. Identifying and acting on leverage points has more potential to meet the critical mass needed for impact – in areas assessed to be of strategic advantage – than taking a uniform approach across the board.

Leverage points may present in the form of opportunities to build capacity for impact or remove constraints that hinder impact – for example, investment in research infrastructure that reaps rewards for many years or seed funding to address the 'valley of death' faced by start-ups falling in the gap between public and private funding or scale-up funding to allow companies to grow.

The unexpected pipeline from inputs to outputs and outcomes

Flows between inputs (investment) and outputs and outcomes of the research system are often indirect, unintuitive or unexpected. As the National Audit Office report points out, 'The impact of R&I activity is not evenly distributed across projects: transformative impact usually comes from a small group of highly successful outliers.'[27] Spillover effects, both specific and indirect, are not well understood or quantified. There is a vast network of impact flows from research conducted in one UK region leading to impacts in others, with considerable variation among UK regions in the extent to which they export research impacts to other regions.[28] Inputs in different locations therefore have different effects on the system in terms of the local and national outcomes.

Maximising impact from research requires an investment approach based on the potential to drive desired outcomes, which may vary in different sectors and regions. As Patrick Vallance told the Science, Innovation and Technology Committee in February 2025:

> *Of course, I would like to get a big budget, but that is an input measure. What we need to ensure is that we have the best possible use of that money to get the maximum effect for the UK.*[29]

In the context of an economic strategy for R&D, the British Academy has proposed working backwards from an economic vision in 15 years' time (outcome) to design the research base and make innovation investments (inputs) that will support that vision. Improved data on the R&D system would support this.

Conclusion: Key questions to address

With a renewed focus on the potential for research to deliver across government and to advance missions, a clear understanding of the research capabilities necessary to maximise intended outcomes for public investment in R&D is needed. We offer three key questions to guide future decision-making.

1. **How can the capabilities of the R&D system be most effectively assessed, in order to drive innovation, improvement and public benefit?**

This will require consideration of the breadth of actors and interactions in the R&D system and ideally integrate data from a range of sources, pragmatically balancing existing data sources with the development of new data capabilities to minimise bureaucracy. Making centralised government or UKRI data accessible to researchers would enable valuable metascientific analysis.

2. **How can research capabilities better address government missions (beyond specific R&D missions programmes) and wider societal needs?**

An assessment of the UK's current research capabilities to deliver against missions and societal ambitions could be combined with an analysis of system interdependencies and leverage points in the context of a transparent framework for investment.

3. **How can the benefits of research be distributed better across the country, and felt by all communities?**

Although addressing societal priorities should not be the only goal of public spending on research, the identification of intended outcomes should engage public perspectives, both regionally and nationally. Investment should maximise outcomes across the country, leveraging interregional connections to export impact across regions. Attention is also needed to build absorptive capacity in regions across the UK to make better use of research knowledge. Universities have a critical role in ensuring that their research is addressing the concerns of the communities in which they are located and across the country.

There is an opportunity to capitalise on the momentum behind purpose-driven R&D investment, advances in data and greater appreciation of systems approaches. Doing so has the potential to boost innovation in the assessment and improvement of UK research capabilities, in order to deliver on the priorities of government, the research sector and communities across the country.

Endnotes

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