

A fresh case for investing in research and innovation: Summary of two commissioned evidence syntheses

Context

The National Academies recognise the need to better understand the range of benefits that research and innovation (R&I) bring to the UK, the distribution of those benefits across the country and its population, how those benefits are achieved and how best to measure them. The Academies assembled a Steering Group¹ to oversee the commissioning of two evidence syntheses to investigate these questions.

An evidence synthesis is designed to provide policymakers with access to a balanced summary of all available evidence on a topic. The evidence required to address a policy question often comes from a range of disciplines, study designs and sources.

As the UK Government works towards its commitment to increase investment in research and development (R&D) to 2.4 per cent of gross domestic product (GDP) by 2027, there is a need for better evidence to inform decisions about how and where that investment is made.

The commissioned syntheses are a step in developing an evidence base to better describe the conditions needed to ensure the continued excellence of the UK's outstanding research and innovation base and its delivery of benefits, broadly understood, to the UK's people.

Commission one is an evidence synthesis on measuring the distribution of benefits of research and innovation. Commission two considers the conditions needed to translate research and drive innovation. Commission two looks in depth at four different sectors: creative industries, defence, fintech and pharmaceutical and life sciences. This document contains a summary of key findings from both syntheses.

Key findings from commission 1 and 2

Measuring the distribution of benefits of research and innovation

What are the range of benefits of research and innovation?

There are many diverse benefits from R&I. Existing evidence shows significant returns from R&I investment, estimated to be in the region of 20-30%. There is also good evidence that public sector investment crowds in private sector R&D investment, with every £1 invested in publicly funded biomedical and health research being associated with an additional £0.83-1.07 of private sector research investment. Analysis of the contributions of investment in innovation to the UK economy suggests that innovation was responsible for two-thirds of the UK's private-sector labour productivity growth between 2000 and 2007.

The true benefits to society of R&I investment are likely to exceed these economic estimates which likely do not capture fully some of the wide-ranging benefits from research spanning a multitude of areas, including health, culture, public engagement and the environment.

The Impact Index at Figure 1 provides an overview of the areas in which evidence of the benefits of research has been collected, based on analysis of the literature.

A more holistic way of measuring the benefits from investment in R&I would be beneficial, both to better capture and illustrate the ways in which research benefits society, and to facilitate better analysis to make sure investment is targeted towards achieving the full range of these goals, not just those which are most easily measured.

How are the range of benefits of R&I currently assessed or measured in the UK?

Most evaluations of the benefits from R&I are dominated by a few key methods. These include economic analysis based on the total factor productivity model, case studies, and portfolio-specific

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evaluations based on interviews/surveys and case studies (many of which focused primarily on biomedical and health research and health outcomes).

There is a risk that the focus on economic analyses limits the picture of benefits from research to those that can be readily quantified in this way.

How are benefits, economic and beyond, distributed across the UK?

There is limited evidence on the distribution of impacts of R&I by region or population groups and over time. However, there are some interesting examples in specific sectors or fields which could be expanded upon and translated to different contexts. For example, economic analyses in the development sector have explored the impact of R&I on different groups and populations. There are also analyses of regional economic benefits of large infrastructure projects, which provide useful information on jobs directly created, but are not able to fully characterise the range of benefits from these investments. Evidence on commercial benefits of R&I covers geographic distribution, using a range of approaches.

What alternative metrics have been developed in other countries or international contexts?

There are examples of novel practice in the literature, as well as useful and underutilised datasets, including cross-disciplinary ones, which could help develop a more holistic, nuanced picture of the range of benefits of R&I in the UK. For example, the STAR METRICS project in the United States looks at the direct and indirect economic impact of research and innovation spending at universities in terms of employment (both within the university and more widely).

Looking at some of the main datasets available in the UK context, it is particularly notable that there is much more scope to make full use of Researchfish for such analyses. As a unique and relatively longitudinal dataset, there is potential for more interesting and novel use. Researchfish, and other wider datasets (e.g. Gateway to Research, HESA datasets) offer opportunities for more nuanced cross-disciplinary analysis. Better use of existing datasets could give a more comprehensive picture of the range and nature of benefits from R&I.

The conditions needed to translate research and drive innovation

What are the conditions that enable publicly-supported research and innovation to result in a range of benefits?

A number of conditions, and their interaction, are deemed critical to the translation and innovation process across sectors. These include: drivers; input resources; enabling resources; institutional factors; and absorptive capacity.

Drivers are the motivations which spur innovation to occur and are, therefore, a key condition for innovation. The key drivers for innovation will often differ between sectors, depending on the incentives and perceived benefits of innovation within the discipline in question. All the sectors reviewed [pharmaceutical and life sciences, defence, fintech and creative economy] can be characterised as having both supply and demand-side drivers. For example, in the fintech sector, demand-side drivers include a maturing consumer base and a younger demographic more open to mobile banking, whereas supply-side drivers include incumbent financial institutions' desire to cut costs and streamline processes.

Input resources are the primary elements required for an organisation to innovate. These include knowledge assets, talent and capital. Knowledge assets are a primary input into the innovation process across all sectors, although the nature of this knowledge varies across sectors. Talent is an essential component of a functioning innovation system across all of the sectors. The availability of capital is a key enabler of innovative performance across sectors.

Enabling resources, including connectivity and infrastructure, allow actors within the wider innovation system to strengthen their knowledge, talent and capital assets through interaction with other actors and their external environment. Innovation across the four sectors was found to rely on the formation of networks and physical infrastructure, which facilitate the collaboration of multidisciplinary teams. It is apparent that multidisciplinary teams with diverse skills are a key input resource for innovation. For example, a computer game project typically requires producers, game designers, sound engineers, composers and actors.

Two institutional factors that influence the resources in the innovation system are culture and structures (e.g. regulation and standards, but also rules processes and the design of organisations). Culture encourages and incentivises innovation when it is open, trusting, and conducive to risk-taking and learning from failure rather than avoiding it. Risk-averse organisational cultures in the defence and fintech sectors were found to limit the sharing of knowledge and the formation of collaborations. In contrast, the video game industry's ability to adapt and change is considered to be very good; however, due to these rapid innovation patterns, this sector is known to be a 'rollercoaster industry' with no guaranteed success for SMEs.

Absorptive capacity refers to the capacity to build and capitalise on the benefits of new thinking or evidence produced both in the UK and internationally. Some of the findings on talent and institutional readiness to adopt new ideas suggest that there could be constraints on the absorptive capacity of the UK innovation system.

How do such conditions interact in different environments and throughout the lifecycle of research translation and innovation?

In order to understand innovation and the conditions that enable it, the notion of translation or innovation pathways are often used to conceptualise the process through which knowledge and ideas are matured into novel products, processes or services.

Effective translation across all the sectors reviewed requires an interaction between all of the conditions, (i.e. input, enabling and institutional factors, as well as drivers and absorptive capacity) at all stages of the pathway (from research through to adoption and diffusion). For example, many of the successful interventions in the pharmaceutical/life sciences sector stimulate multiple conditions simultaneously, such as building networks, sharing knowledge, bringing together talent and leveraging capital. There is also evidence that an interaction between all of the conditions is needed to support an opportunity across different stages of the translation pathway. However, there are no 'hard' boundaries between these stages and not all innovation relies on formal R&D. Not all sectors are characterised by well-defined translation pathways.

Different policy measures have broadly been effective at addressing the different conditions and stages of translation. Examples of policy interventions used at different stages of translation are presented below.

- Interventions at the early stages often focus on providing capital, developing talent and de-risking R&D. As access to funding at early stages is particularly challenging in the creative sector, there are a number of schemes that either seek to provide access to grant funding or that provide tax reliefs. Innovation vouchers have also been used to promote R&D in creative sector SMEs. Thus, the City of Manchester piloted the Creative Credits scheme, during which 150 SMEs received £4,000 worth of credits to purchase a range of services
- Interventions in the mid-stages often focus on providing enabling resources to promote development and commercialisation. For example, the Defence and Security Accelerator seeks to promote collaboration between industry, government defence and security departments, and academia, to speed up the development of innovative solutions to the most pressing security challenges.
- Interventions in the later stages often focus on promoting cultural change. There are relatively fewer examples of policy interventions that target the later stages of the translation pathway. In the pharmaceutical/life sciences sector, there are several initiatives that aim to address challenges at later stages of the process. For example, Academic Health Science Networks (AHSN), regional networks that connect the NHS, academic organisations, local authorities, the third sector and industry, have developed programmes in partnership with NHS England to identify and drive the adoption and diffusion of innovative ideas and technologies in the NHS.

How has the effectiveness of different levers used to facilitate research translation and innovation been measured?

There are a number of evaluations for policy interventions in the pharmaceutical and life sciences sector; in contrast, few interventions in the defence, fintech or creative sectors have been publicly evaluated. For example, evaluations conclude that the National Institute for Health Research Intervention for Innovation (NIHR i4i), Biomedical Catalyst and Small Business Research Initiative (SBRI) Healthcare programmes fill a crucial gap in the innovation finance system by providing funding at an earlier stage than alternatives such as venture capital.

Evaluation of interventions often use metrics that focus on the economic impacts of the intervention rather than measuring broader social outcomes (e.g. wellbeing or cultural enrichment). Metrics also do not always fully capture all the stages of the translation pathway in all sectors. Where evaluations exist, the methods and metrics for evaluating the impact of policy interventions often do not adequately reflect the full diversity of benefits (beyond economic) from R&I.

Factoring in the timelines for the translation process also has an impact on the design of interventions to steer the process. For instance, the returns on investment are typically much faster in the creative and fintech sectors than for drug discovery or defence. Many evaluations considered in this study focus on the short-term impacts of interventions, with few adopting a longer-term view.

These limitations make it hard to draw evidence-based conclusions as to the effectiveness of policy interventions.

How might these measures be made more robust?

Perhaps the single most important improvement that could be made to understanding the conditions required to translate research into innovation would be to conduct more rigorous, independent evaluations of interventions to ensure robust, evidence-based information on the impacts of policies. Developing more diverse metrics to better capture the full range of benefits from investment in R&I would help to ensure that interventions accurately measure outcomes and progress across sectors. For example, investment in organisational innovation, training and skills, product design, and branding are not recorded as R&D spend, yet are key sources of increased productivity, particularly in the service sector.

What are the barriers to translating research and driving innovation?

Challenges to the translation and innovation process are very context dependent; however, lack of clarity about user needs and stable access to capital throughout the innovation process were commonly identified.

Continuity of funding is important for research translation and innovation and, conversely, the absence of stable funding can be a barrier to translation and innovation. Access to funding, in particular for small and medium-sized enterprises (SMEs), can be a barrier to innovation across sectors. Absorptive capacity is also potentially impacted when there are structural barriers to SMEs being able to access the market, which is notably the case in heavily regulated sectors, such as financial services or the life sciences.

For sectors with relatively defined translation pathways, it is possible to identify the conditions needed at different stages, and therefore design appropriate policies to promote these. The life sciences sector is an example of a sector in which policy interventions were, broadly speaking, more coordinated and found to support conditions across the translation pathway, from idea generation to product development, through to uptake and diffusion. In other sectors, policies are not necessarily coordinated and often do not cover the complete translation pathway. The life sciences sector is also characterised by multiple pathways, which means there is not a one size-fits-all approach to policy interventions. In sectors with no clearly defined pathway, such as the creative sector that has multiple, diverse and dispersed pathways, it is more challenging to design interventions to stimulate innovation.

There are relatively few demand-side measures to stimulate innovation, such as procurement policies or innovation inducement prizes.

Figure 1 – Impact index

