R&D, Innovation and Technology Working Group

Meeting Summaries

June 2025

Disclaimer

These notes were originally circulated in September 2024 to provide an overview of the ongoing British Academy Policy Programme on Economic Strategy. They are intended to serve as a summary of discussions and reflections within the Working Group up to this point, but do not represent any final conclusions or analyses. The notes do not reflect any formal policy positions of the Academy nor individual members of the Working Group. Individual assertions or evidence claims have not been peer reviewed, but have been made in the context of Working Group discussions with the aim of contributing to the research and policy debate and discussion.

The British Academy

Contents

R&D, Innovation and Technology Working Group 1

Overview of the R&D, innovation and technology Working Group 3
Members and meetings 4
1. Meeting 1 Summary Note (Tues 5 Mar): Scoping Session 5

1.1 Background 5
1.2 Main discussion 6
1.3 Scope and approaches to key questions 7
1.4 Ways of working 7
1.5 Next steps 7

2. Meeting 2 Summary Note (Fri 26 Apr): Learning from the past – historical understandings of R&D 9

2.1 The relationship between R&D and growth at both global and national levels, and the implications of this relationship for policy (Professor David Edgerton) 9
2.2 Discussion 11
2.3 Do the UK's political institutions undermine successful innovation policy?" (Professor Jane Gingrich) 12
2.4 Discussion 14
2.5 Challenges of assessing the effects of innovation policy (Professor Ammon Salter) 15
2.6 Discussion 16

3. Meeting 3 Summary Note (Tues 18th June): Key technologies 20

3.1 Creative Industries & the technology needs of the future (Professor Katy Shaw) 20
3.2 The technology we want and the technology we need (Dr Jack Stilgoe) 23
3.3 Discussion 24
3.4 Should we pick winners and what does that mean? (Professor Jonathan Michie) 26
3.5 Discussion 28

4. Meeting 4 Summary Note (Weds 17 July): Implementation or the 'how to' 30

4.1 R&D, Productivity, and Innovation: What we can (and can't) learn from other countries (Professor Neil Lee) 30
4.2 Implementation of mission-oriented policies (Professor Elvira Uyarra) 31
4.3 What's needed to implement an economic strategy? (Professor Dame Diane Coyle) 32
4.4 Discussion 33

5. Meeting 5 Summary Note (Tues 22 Oct): Output reflections 37

5.1 Output feedback 37
5.2 Policy impacts and opportunities 39

Resource List 39

Overview of the R&D, innovation and technology Working Group

This Working Group focused on R&D, the drivers of innovation and its diffusion, technological change, universities and other related topics identified by the Working Group. It considered a range of specific sub-questions, including, but not limited to:

- What balance should a future UK economic strategy strike between operating at the technology frontier and adopting innovations developed elsewhere?
- How can a future economic strategy take full advantage of the UK's sector and technological strengths in order to drive long-term growth?
- How can government encourage the adoption of technologies and innovative working practices at firm level? Is addressing the 'long-tail' of low productivity SMEs important to encouraging such adoption or can policies be more targeted? W
- Which technologies (both emerging and established) present the most significant opportunities and challenges for the UK economy over the coming decades?

There were five meetings of the group (including an initial scoping session). These covered areas including lessons from the past; the role of the UK's political institutions in innovation policy measures of success; createch; and the potential processes (and pitfalls) of picking winners.

Several cross-cutting themes emerged:

First, UK policy needs to be clear on the national goals for R&D and innovation within a global context, so that policy decisions can be clear in their focus on issues of adoption and diffusion; appetite and capacity for frontier R&D; talent and skills etc. Though activity at the frontier can contribute to capacity for adoption and diffusion, this is not a guarantee and is impacted by skills development and appetite for investment from SMEs as well as larger organisations.

Second, we need to be realistic about the role of R&D and innovation within the context of the UK economy's size and understand existing areas of advantage, including areas like the creative industries. This will mean balancing existing capability with long term ambition in areas of strategic advantage, and for government learn from – without necessarily duplicating – the approaches that other countries have taken to use investment in R&D to drive growth. This is not a quick fix approach and understanding how to effectively measure success (or failure) will be critical.

The systems and structures of R&D and innovation, such as political institutions, funders, industry and universities, need to be carefully constructed and operated according to the goals of the system. Stability within the ecosystem is essential, as is an awareness of where barriers exist and a transparent assessment of political appetite to address them. A national R&D, innovation, technology or industrial strategy will require clear communication of the structures and systems required to achieve long term ambition.

The group was also working on questions of implementation of policy measures, including the datasets and evidence needed to successfully implement innovation policy alongside how to implement areas of innovation policy in a way that does not exacerbate inequalities and that does not simply replicate successful R&D and innovation policy from elsewhere, in the fashion of the 'cargo cult'.

Members and meetings

The Working Group was originally co-chaired by Dr Anna Valero and Professor Paul Nightingale. Dr Anna Valero stepped down in summer 2024 due to a new role on the Economic Advisory Council. All contributions to this project took place prior to Dr Valero's role in HM Treasury. Dr Molly Morgan Jones took over as co-chair in summer 2024.

Member	Role
Dr Anna Valero (co-chair)	Distinguished Policy Fellow, Centre for Economic Performance, LSE
Professor Paul Nightingale (co-chair)	Professor of Strategy at Science Policy Research Unit (SPRU), University of Sussex
Dr Molly Morgan Jones (co-chair)	Director of Policy, the British Academy
Professor Ammon Salter	Professor of Technology and Innovation Management, Warwick Business School
Professor Dan Breznitz	Professor of Innovation, Munk Chair of Innovation Studies, University of Toronto, and Program Director, CIFAR
Professor Dame Diane Coyle	Bennett Professor of Public Policy and Co-Director of the Bennett Institute for Public Policy, University of Cambridge
Professor David Edgerton FBA	Hans Rausing Professor of the History of Science and Technology and Professor of Modern British History, KCL
Professor Elvira Uyarra	Professor of Innovation Studies, Alliance Manchester Business School and Executive Director of the Manchester Institute of Innovation Research
Professor Hasan Bakhshi	Director, Creative Industries Policy and Evidence Centre, PEC
Professor Henry Overman FBA	Professor of Economic Geography, LSE, and Research Director of Centre for Economic Performance
Professor Jack Stilgoe	Professor of Science and Technology Studies, UCL
Professor Jane Gingrich	Professor of Social Policy at University of Oxford and Program Co-Director, CIFAR

Professor Jonathan Michie	Pro-Vice-Chancellor, Professor of Innovation & Knowledge Exchange, Kellogg College President, Oxford University
Professor Katy Shaw	Director of UKRI/AHRC Creative Communities programme and Professor of writing and publishing
Professor Neil Lee	Professor of Economic Geography, LSE

The first, introductory meeting of this Working Group was held on Tuesday 5 March 2024. Subsequent working group meetings were held on

- **Meeting 2: Friday 26th April (12:00 – 14:00)**
- **Meeting 3: Tuesday 18th June (12:00 – 14:00)**
- **Meeting 4: Wednesday 17th July (13:00 – 14:30)**
- **Meeting 5: Wednesday 22nd October (11:30 – 13:30)**

Please see below summary notes of these meetings:

1. Meeting 1 Summary Note (Tues 5 Mar): Scoping Session

On Tuesday 5th March 2024 the British Academy convened the first meeting of the Economic Strategy R&D, technology and innovation Working Group, chaired by Dr Anna Valero and Professor Paul Nightingale. Members engaged in a wide-ranging discussion and offered valuable reflections on the key themes that the group could explore in the work going forward.

1.1 Background

Dr Molly Morgan Jones introduced the broad context of the programme of work. The Academy was initially approached by the Department for Business and Trade (DBT) and His Majesty's Treasury (HMT) in 2023 to help the departments come closer together on issues like economic growth. The Academy held a three-hour seminar in September 2023 and this programme of work is about carrying on that conversation, developing a depth of understanding while constantly joining up across the four themes of sustainability and social value; international trade and geo-politics; skills; and R&D, technology and innovation.

It was flagged that all Working Groups had now had their first meetings, with each tackling the brief in a variety of ways. The overall aim is to convene a variety of experts across a range of disciplines to look in-depth at different elements of these core issues and how they affect a long-term economic strategy for the UK. It was also noted that this programme is being taken forward independently by the Academy, and the purpose is not to answer specific questions from government departments, but to raise issues and think about how these themes tie together. It is about building long term perspectives to change and challenge embedded thinking, and as much about the 'journey' as a final output.

1.2 Main discussion

Data, capacity, and capabilities

It was initially raised that the UK needs improved **capacity to monitor and measure technological innovation**. Standard Industrial Classification codes are no longer fit for this exercise and while there are other techniques to use (e.g. classifications based on web-based information on firms), there is no broad consensus. To understand what we do well in terms of technology and innovation, granular data on innovation and firm activities is important. This links to understanding the **organisational capacities and capabilities** needed to implement new technologies, particularly as there is a widening gap between firms that are active in adoption and those who are inactive. There are questions around what makes firms capable of innovating themselves or adopting new technologies invented by others, and what the barriers are to successful implementation.

The Group also discussed how issues around capacity and capabilities dove tail into other areas affected by short-termism, including **skills development**. There are also issues on the **supporting infrastructure that facilitates diffusion**, with a disconnect between grandiose ambitions on net zero and end-user experience. For example, people may be keen to adopt electric vehicles and heat pumps but there has not been appropriate infrastructural development to make this possible. On innovation, and more broadly, a strategy needs to last and requires a range of actors, including different government departments, and levels of government (national, devolved and regional) to coordinate effectively.

Frontier and diffusion

The Group discussed investments in frontier innovation and on the adoption and diffusion of frontier innovations from elsewhere at length, concluding that a key message is that these cannot be set up in opposition to one another, rather they **go hand in hand**. We must recognise that the current size of the UK's economy – alongside its performance – means we have to be effective at the adoption and diffusion of R&D created in the UK and elsewhere. However, this adoption and diffusion is often predicated on having an effective frontier R&D base in the UK. An example is current inward investment in AI, which is due to the strength of UK science base in this area. In other areas of R&D, the UK is less advanced and will likely need to rely on successful adoption of ideas developed elsewhere. Here it is critical that the UK still seeks to stay close to the frontier in order to understand and shape the technologies which are then diffused into the UK. Members raised that this may be a context where picking winners can be positive approach, but this approach requires significant collaboration with industry, universities and research centres.

Industrial Policy histories and scope

It is important that this group clearly determine its scope, which was suggested as being either 'innovation policy' or, the broader business environment that shapes business investment decisions, including those in innovation. Defining the scope may require deepening understandings of the **history of industrial and innovation policy**. Over the last 40 years, one strand of industrial strategy has tended to focus on innovation and entrepreneurship, but these policies have existed alongside **stagnating productivity**. Improving the commercialisation of research, including via improving university-business collaboration has been an area of focus – with 13 reports in 15 years on this topic. There are unlikely to be substantive improvements to be made on this beyond those that garner marginal gains. The Group discussed opportunities to step back to look at the evidence and gain clarity on **what works and challenge assumptions**. One area to consider are places that have successfully created arms-length bodies for R&D and innovation that are insulated from the political day-to-day and can adopt a long-term approach; it was noted that this has

not been successful in the UK, but it may be possible to look at places where this has been successful and consider lessons for the UK. In terms of industrial strategy, it will be important to engage **with shifts in the wider geopolitical environment** with security concerns interacting with innovation.

1.3 Scope and approaches to key questions

The Group also discussed how they want to position themselves, and it was agreed that in the timeframe we can most effectively answer the **'how can' questions**. This could include, for example, how can we think about innovation in relation to an economic strategy? A key question was raised around scope due to the breadth of R&D and innovation policy. Does the group see itself as considering the challenge from the macro-, meso-, or micro- perspective?

Alongside scope and positioning of this work, the Group discussed target audience. The main audience would be civil servants working with an elected government, with HMT seeing this as a way to challenge entrenched thinking over the last 10 years of a current government, which may well play into the agenda of an incoming government without being party-political. However, civil servant activity will be shaped by the political rationale of a new government. It was also raised that this programme can seek to inform **ways of working between government departments**, with an understanding of the politics behind decision making – i.e. how do we find a compromised position that acknowledges different approaches between HMT and other government departments. It may also be worth approaching HMT to ask them about the barriers they experience to working other departments – it would be useful to understand how HMT thinks about these questions, how do they diagnose issues and where do they disagree.

The issues raised above were linked back to contextualising this framework alongside a historical view. It will be important to think about how to bring the narrative together and articulate some of the trade-offs between policy objectives. The Group should be thinking about **strategies for implementation** across a range of departments with intersecting systems/systems thinking. The focus should be on policy goals and options that are strongly supported by the evidence with frameworks that can appeal to both sides.

1.4 Ways of working

Members with specific expertise will be invited to give structured, in-depth presentations would create the opportunity to delve into the expertise of Members and deepen discussion around key themes. Additionally, the Group was broadly happy to compile a resource list to create a shared understanding on key points and way of thinking, with the inclusion of short summaries. Members were invited to send 1-2 key outputs to the British Academy team. It was also noted that HMT/DBT officials would likely join future meetings so the Group would be able to engage with them in their discussions.

1.5 Next steps

The topics for the next four meetings have been agreed on by the Co-Chairs based on the initial discussion. The aim is for one or two Members of the Working Group to lead an in-depth presentation and discussion of the topic. Please see below for more information on the key questions that will guide these meetings:

- **Lessons from the past**: What has and has not worked in R&D policy in the UK and elsewhere? How much do we know about why policy has or has not worked?

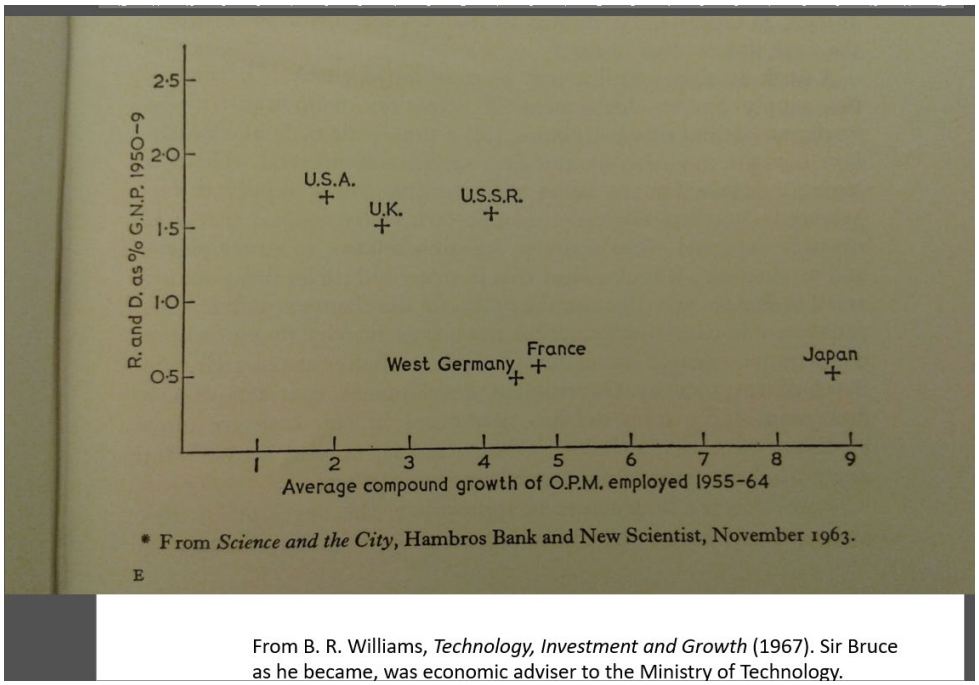
- What is the **role of institutions** (within and outside government) in R&D policy? How can they work together more effectively? What are the barriers to cross-departmental collaboration?
- Developing a framework through the question of '**how can'** – what are the data needs, analysis and evidence base needed to determine the strategic focus of the framework? How should a framework articulate key trade-offs in policy construction?
- What are the **key technology areas** that we know will be strategically important for the UK? This could include clean technologies for net zero, AI, life sciences, defense, and others (e.g. those relevant for areas of UK comparative advantage such as the creative industries).

The project team will be compiling a live reading list containing recommended reading provided by the Working Group. Additions to this list are actively welcomed.

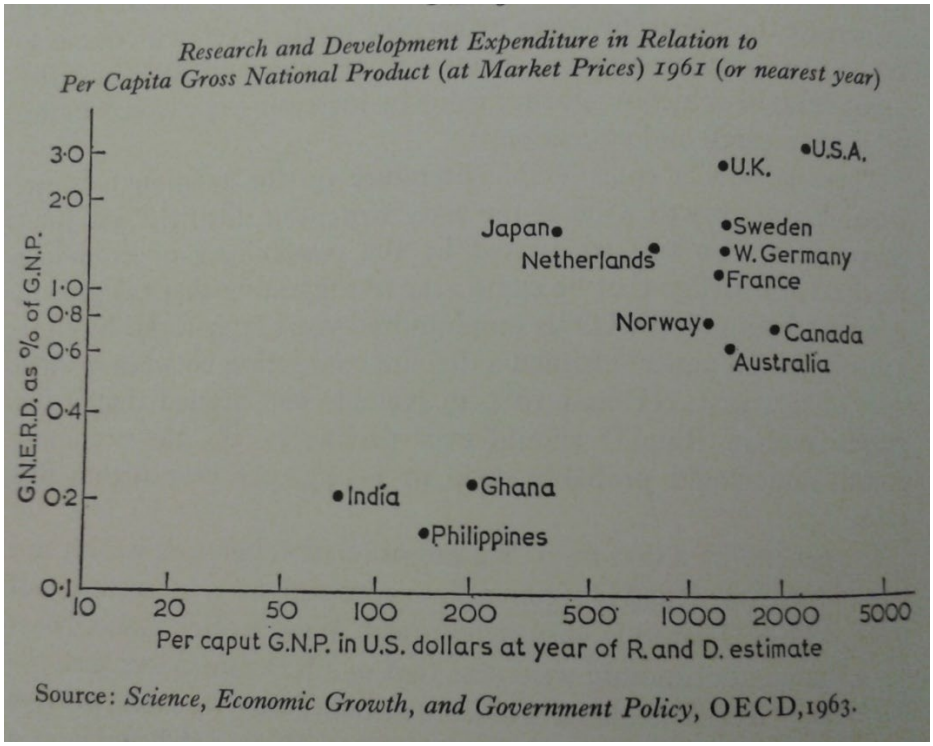
2. Meeting 2 Summary Note (Fri 26 Apr): Learning from the past – historical understandings of R&D

2.1 The relationship between R&D and growth at both global and national levels, and the implications of this relationship for policy (Professor David Edgerton)

Professor Edgerton presented a challenge to the assumption that R&D leads to economic growth. UK governments historically have worked on the premise that low growth is due to low investment in or misallocation of R&D. There is a powerful argument in historical literature that we should always expect a positive relation between national R&D and national growth. The argument is so powerful that challenges have largely been ignored; this includes the British paradox of the 1960s, in which low growth and high R&D was the exception that proved the rule.



From B. R. Williams, *Technology, Investment and Growth* (1967). Sir Bruce as he became, was economic adviser to the Ministry of Technology.



R&D and factors in economic growth

Though R&D is clearly an important factor in growth, this connection should not be conflated, as it usually is, with the argument that national R&D is the main determinant of differential national growth, or even a significant source of this difference. These are two very different issues, and this conflation points to a more fundamental problem in analysis of R&D policy. In his 1967 book *Technology, Investment and Growth*, Bruce Williams created the first comparative R&D analysis as growth figures were becoming available. There is essentially an inverse correlation between national R&D spend and national rates of economic growth, or output per person employed – i.e. poor countries grow fast, and rich countries grow slow. The British figures included defence and other prestige projects, resulting in the British paradox of high R&D and low growth, but the problem in Britain was the misallocation of R&D compared to Germany and Japan in particularly. The implication being that, if you only took industrially funded R&D, this paradox would disappear because there was lower spending on industrially funded R&D. However, the UK's trajectory might as well be exception, and generally speaking, R&D does increase with GDP per capita across countries over time, as they have been getting rich over time.

R&D and innovation within a global context

Another way of thinking about this is that most techniques adopted anywhere in the world come from outside of that country, with the exception of the US in the 20th century, which accounted for 50% of the global economy and 50% of world's R&D. In other words, global R&D may determine national rates of growth more than national R&D does.

Though it is often asserted that developing economies need to do R&D – which may be true for certain areas of R&D, such as defence – on the whole most technologies are shared across national boundaries. For example, in the car industry, multinational actors have created the flow of new techniques throughout the world. It is vital that the relationship between the national and global is taken into account in order to generate sensible national R&D policy. Too often, R&D policy is liable to see nations as the world in miniature, when we should take other countries seriously and have a realistic view of what the UK can offer that is novel.

2.2 **Discussion**

Complexity in relationship between R&D and growth

It was noted by Working Group members that while economists routinely argue for importing the benefits of R&D, this argument is seen as controversial by certain stakeholders of the R&D system. The Group discussed the relationship between R&D and innovation and their collective contribution to a broader sense of public good – is there a way to think about contributing to a global public good through the growth of our own and other nations? It was flagged, for instance, that the AstraZeneca vaccine had more impact globally than in the UK, as the UK was a net importer of COVID-19 vaccines – while the effects may not be felt nationally, British R&D is contributing to a global pool of R&D and new products.

This raised the question of what happens to the correlation between growth and R&D once controlling for more aspects, such as similar sized/shaped economies, human capital etc? You can see this correlation at firm level in the success of innovative firms and spillover effects. In response, Professor Edgerton noted that controlling for similarities in the economy and human capital reduces the link between R&D and growth even further as there are so many sources of growth. It has been suggested that it is also likely to be due to the fact that human capital is a key input into R&D and innovation. It is also possible to generate an inverted argument with firm data on R&D – more successful firms conduct more R&D. The main point is that, at national level, the relationship between R&D and growth is complicated and this needs to be recognised in the science policy community.

Policy implications?

The Group discussed what, if the provocation is accepted, this would mean for policymakers and the policy levers pulled. It may be that no changes are needed, that the same policy levers are pulled, even if the reasons are different, e.g. putting more money into universities. In policy terms, we may be doing the right things for the wrong reasons, and would this evidence actually suggest that we do anything different? Or be widely accepted? It was noted, however, that this argument, if accepted, could prompt change by calling for thinking differently about where and how the government invests, requiring policymakers to return to first principles.

The Group also discussed challenges in measuring firm-level innovation, which national statistics aggregate, and which are obscured by complex systems which make it hard to measure innovation. It was flagged that there are long-run trends in measurement and distortion in the macro-picture. The Group questioned if aggregating at a national level is useful, particularly when some of this R&D is competitive with one another. It might instead be better to confront the conceptual problem that measures of R&D stem from the economically nationalist era of Thatcher. Members discussed issues with an R&D system stacked towards tax credits, and the resulting fraud problems this creates, and Goodheart's Law.[1] It was suggested that there is too great a focus on the metric as driving the 'inputs', rather than on the mechanisms which lead to innovation and growth as the desired 'outcomes'. This raises the question - would our policies be better if the terminology 'R&D' and the resulting focus of expenditure as a measurement of success had not been invented to begin with? Why is it measured as a ratio of GDP? Would 'D&R' shift our understanding and investment?

[1] When a measure becomes a target, it ceases to become a good measure.

2.3 Do the UK's political institutions undermine successful innovation policy?" (Professor Jane Gingrich)

Professor Gingrich framed her discussion with the provocation that the volume of resources going into R&D is not the issue, but instead querying why the structure of spending has not been effective in the UK. It was noted that two critical problems emerge out of the literature: first is the political churn creating a lack of consistency of policies and personnel, and second is a question about the effectiveness of particular forms of R&D, e.g. public R&D, in terms of leading to positive outcomes. These outcomes may be growth, dispersed prosperity, good jobs and so on. This leads to the question of what are the institutions that might solve some of these issues, particularly in creating more consistency over time, and potentially, in terms of the regional focus of R&D spending, that would allow for more broadly distributed and consistent R&D policy? The discussion focused on a set of trade-offs and political institutions in the UK.

Goldilocks institutions

New institutions and agencies dedicated to providing consistency to a broader industrial strategy would need credible commitments from the state to create positive spillovers which benefit the economy. Structures to coordinate different forms of R&D spending – such as bureaucratic structures and agencies within the state –need a 'Goldilocks' approach that carefully balances insulation and intervention. This includes balancing its relationship with industry: if state institutions are too insulated from businesses, there is a risk that bureaucrats can run R&D policy from the centre without listening to the needs of productive actors in the economy. On the other hand, where there is too close a connection between institutions and industry, this can lead to corruption and rent-seeking. Similar is true of insulation from the political process – if there is too much political insulation, bureaucrats and other actors are not linked to the demands of democratically elected politicians, which can lead to misaligned goals or a lack of advocates. But if there is too little insulation from the vagaries of everyday politics, one ends up with the short-termism and churn that much of the literature discusses.

This issue is linked to the question of transparency. While transparency may seem positive to reduce corruption and waste, literature on the effectiveness of the state suggests benefits of opacity – you need spaces where people can make decisions and concessions without being entirely directed by their underlying constituencies. The same balance could be put forward on centralisation. As such, UK institutions have a mixed record on producing these kinds of Goldilocks outcomes, in part because while the political institutions of the country have been historically good at rapid response policy, there are few veto points and few constraints on the state, meaning that maintaining balance can be difficult.

First-past-the-post systems

If we are to create Goldilocks agencies or other kinds of new actors, we need to articulate the problems that we are trying to solve and how they fit with the political system. On the latter, evidence suggests that first-past-the-post electoral systems have a slightly stronger incentive to provide geographically targeted subsides. There are also stronger incentives for politicians to break international agreements in strategic/geographically concentrated sectors (see Professor Stephanie Rickard). An example of this comes from the USA in the tariffs and subsidies to the steel industry, located in geographic regions considered crucial in elections for both parties, like Ohio and Pennsylvania. This is less applicable to the UK, but there are still areas that incentivise the targeting of funding and resources to areas that have high political payoff, as has been seen in the levelling up funding (see *Financial Times*).

Unlike other countries with first-past-the-post systems, the UK has fewer countervailing institutions such as strong judicial oversight. Additionally, compared to continental Europe

where you have tripartite councils between the state, business and labour, the UK does not have strong corporate institutions. This context creates a double institutional problem for the UK as a low veto-point environment, with an electoral system that leads to regionally targeted spending that is not consistent over time.

Contemporary voting patterns

These institutional challenges take on a particular form in our contemporary political moment, particularly when we look at voting patterns. First, there has been some realignment in recent British politics – while in 1997, those who were more reliant on state benefits or 'transfer payments' were more likely to vote Labour, over the last two decades this relationship weakened or even reversed, particularly since the Brexit referendum. This poses a double-edged sword for the questions of regional distribution of R&D and other kinds of incentives. A positive take is that both parties now have constituents across the country and from different social groups, which may result in more even forms of spending. But realistically this results in a lack of interest in distributive policies across the political spectrum and can lead to the problematic churn in British policymaking.

When expanding the political dynamics, though the electoral system has protected UK politics from the rise of populism seen in continental Europe, there have been populist challengers in the British context as well. Much like in Europe, populist voting seems to be most prevalent in places that have ostensibly lost out from the transition to the knowledge economy or are not benefiting from a growth model. However, if you look at composite scores of voting for populist parties and the share of local populations with a university or higher degree, you can see that the gradients are identical between those in the South East and London (including the commuter belt) and the rest of the country. So, access to the high growth model of the South East is not necessarily insulating places politically from the populist backlash.

Aims of innovation policy

This points to a set of questions not only about UK institutions and the incentives they create, but also about the aims of innovation policies put in place. This links to the work of Professor Neil Lee and Professor Dan Breznitz on equity and innovation – what should be the aims of innovation institutions in terms of the targets of innovation? If we think about forms of investment and innovation that could share the gains of growth more broadly, or that could deal with questions we might have in terms of the green transition, it is important to question the institutional structures that would produce equitable outcomes and consider how to create a credible process in a more diversified sense across the country as a whole?

To return to institutional design, if we go back to the first problem about stability and credible commitments, we may think about effective models that insulate institutions politically – such as the Office for Budget Responsibility and Bank of England – that have mandated independent roles and have been a stabilising force in the domains they are responsible for. But this raises a question about the aims of innovation policy and what a political installation means for a more complex mandate that requires adaption to local goals. What would it mean to think about political independence and credible commitments in that context? And is there a trade-off between credibility of policy direction and credibility of access to public funding from the central state? Innovation agencies can be structured with different goals (Breznitz), and the question becomes: what is the mix between innovation goals and institutions that would be most effective for this? What are the trade-offs between political insulation and long-term credibility, alongside getting the local buy-in and effectiveness on the ground? Are these ultimately the same goals, or are there trade-offs?

2.4 **Discussion**

What has R&D ever done for us?

Members discussed wider public understanding of science and innovation (which currently is not well-represented in polls about public trust in 'science'), and people's engagement or alienation with science and innovation policy as it applies to their own lives, picking up on Richard Jones's blog 'What has R&D policy ever done for Barnsley?'. Though many in the group have worked with politicians, the fundamental problem for innovation policy is 'why would anyone vote for this?'. Few successful campaigns that have been run on this as a voter issue. Although surveys of the public suggest that government spending is popular, when they are pushed on trade-offs, middle class voters prefer investment-style policies, especially education spending, while working class voters prefer 'consumption policies' like pensions and unemployment insurance. The problem with this is that it cuts right through industrial policy, which balances investment (in education) with consumption (subsides, tariffs etc).

The broader question is, should an institution like this appeal to voters or be more insulated from the day-to-day mix of politics? If governments are going to be punished by the electorate for failures around policies, then governments are less likely to take risks. Innovation policy spending will always compete with other forms of spending, and the more immediate gains for voters are much more visible, salient, and pressing non-science and technology policies. If you want to create a degree of insulation from this, it is less linked to courting public opinion, and more to do with courting legitimacy of institutions that could be semi-insulated from the day to day demands of public opinion or the political elite. Would a more insulated structure like an independent agency be able to deliver on that? Would it have the degree of trust and political legitimacy that would allow it to outlast whatever incumbent politicians are in place?

Singapore poses an interesting example, caveated with their policy stability, in terms the state-led model and its success in digital technology (challenging the pervasive idea that state-led models restrict the development of innovative entrepreneurship), which could be instructive to the questions raised today. Members also discussed the relationship between legitimacy and bottom-up approaches in different international contexts, such as Canada, which can work particularly well in urban areas. How can researchers encourage policymakers to take bottom-up approaches and link innovation policy to more transformative agendas like grand challenges? Do we need more experimental approaches to align with wider innovation goals?

Relationship between electorate and innovation-regions

The Working Group discussed how the politics of technology transfers has changed, i.e of productive regions like the South East redistributing to less productive regions via transfers. Those changes are 95% compositional, in that there has been a realignment partly on age grounds, partly on educational grounds, partly on the mix of age and education. This has produced different distributions of voters across the country, but those different distributions of voters create geographical incentives for the political elites. The question is how such incentives emerge when facing competing demands on spending. Switzerland is an example of where competing demands have occurred, but where aspects of R&D spending, such as universities have been relatively well insulated, allowing science and technology policy in Switzerland to be relatively consensual and cross-party. This raises the question of what kinds of institutions generate political consensus? There is a lot of complexity in transferring insights from one context to the UK, but it is a starting point to thinking through how building consensus around political structures would allow business and other actors to coordinate.

The Working Group discussed the relationship between education level and populism: a paper on economic impact of universities found that people living in places with more universities tended to be more supportive of democracy, even when controlling for education level. Exploring this further, at a national and local level, would help to better understand that relationship and its mechanisms. This raises questions about the mix of contextual effects that lead to political engagement, including the political spillover effects of proximity to universities on the views of the electorate.

2.5 Challenges of assessing the effects of innovation policy (Professor Ammon Salter)

What are the challenges in the evidence-base?

Compelling causal evidence about the effectiveness of innovation policy instruments is currently lacking. There are many reasons for this, including the broad mix of policies active in innovation policy, the different agencies in the landscape, the activity of private companies being outside the purview of observation, and the difficulty of altering company behaviour. Additionally, the policy outcomes desired actually require additional investment (often much greater than the initial policy investment), either by firms or other parties; for instance, an R&D grant may encourage a company to spend money on an R&D project, but the commercialisation of the product may require investment ten times greater than the original grant, and is also dependant on activities that make it difficult to trace impact back to the original policy intervention.

The challenge of causal evidence is also found in the administrative systems for delivering R&D policies across different countries – there is no, one process for R&D tax credits across all countries, and it depends on the rule of depreciation of various activities. As such, a single policy can vary significantly in different contexts as it is dependent on implementation and administration. Innovation policies focused on building absorptive capacity in countries also operate in international systems. So, while there is general, broad evidence that investment in various kinds of innovation has a positive effect on private innovation investment, and that public investment tends to crowd-in private investment, there is a lack of compelling evidence about which instruments work well, which administrative structures are more appropriate, and which policy mixes are primarily better for others. All of which poses a large challenge to innovation researchers.

Innovation policy is often developed in a highly ad hoc and isomorphic way; that is, policies are developed on the basis of limited evidence, copying what has been done in other jurisdictions. There is also the tendency to rely on the ‘cargo cult model’ of innovation policies; coined by Alan Hughes, the cargo cult refers to the practice of looking at what seems to be successful in other organisations and simply importing policy instruments from other jurisdictions and adding them to the mix and/or exporting policy instruments. There is a degree of significant ambiguity about which factors have generated positive outcomes for these jurisdictions. Over the last 30 to 40 years, the OECD has operated on the system of picking out features of successful innovation systems and copying them to their own jurisdictions. For example, the UK copied the pre-competitive R&D collaborations from the Japanese which led to the Horizon Programme. There has also been investment in catapults in the UK, as well as investment in AI research to build competency in this area.

Problems in the scope of evidence

The evaluation of innovation policy relies on both qualitative and quantitative evidence, but direct measures of the policies themselves are lacking. Many of the measures used, including R&D statistics and patents, have a huge amount of measurement error in respect to understanding outcomes. There are some methods to identify the causal effects of specific

policy instruments and programmes, but there are potential issues. First, outcomes depend on specific contexts, including the design architecture of the programme, its administrative procedures, the difference between places etc. There is also very poor capture of innovation failure. Alongside this, novel innovation often takes time to be appreciated, so short-term evaluations can be unreliable.

Potentially the most notable issue is that evaluations and linked data (especially in the UK) are controlled and managed by funders and governments, which limits the scope of research and assessment. There has also been a rise in the last 30 years of a consultancy industry which provides evaluation and assessment for government under contract, meaning researchers in this area must negotiate access to data, often generating compromises to the research process. There may be quid pro quo arrangements between researchers and agencies to obtain access to information, but this also implicates researchers in the status quo.

Looking more broadly beyond the UK, the institutionalisation of the OECD model for innovation policy, linked to its monitoring and reporting activities for different countries, has led to the fine-tuning of the policy mix of different countries. While this has the potential positive impact of speeding up policy learning across countries, it has also led to a degree of conformity between various countries. However, individual country innovation systems demonstrate a large amount of variety within the activities, programmes, and policies, both at country level and within innovation agencies. These contexts make it difficult to generalise and a lack of compelling evidence generates confusion about what constitutes ‘good’ innovation policy.

Challenges for researchers

It is a challenge for researchers working in this area to make strong statements. This is often combined with a diminishing expertise within the civil service, which sees a lot of churn in departments and results in a loss of organisational memory in the UK government. This churn means that researchers are often starting from ground zero in every meeting with the Department for Science, Innovation & Technology and other relevant government departments in terms of officials’ knowledge of previous efforts, reports and evidence gathering. Due to this, policy entrepreneurs and ‘influencers’ often drive the development of new policies. This may include visiting ‘star scientists’, often from the USA, who promote a particular instrument based on limited evidence. This creates cycles of hyperbole followed by disappointment, such as the UK as a ‘science superpower’. The question becomes how do we undo the Gordian Knot so that we are not in the same state several months before a Comprehensive Spending Review (CSR)? This is an area where there is frustration with the core learning in government due to civil service churn and the poor evidence base that we often have, and the challenges academics face in contributing to this space.

2.6 **Discussion**

Perspective on the ‘centre’

The Group discussed how a certain account of the history of policy is often central to the mindset of the people who shape it, whether politicians, civil services, or scientists. As in the case of defence policy or health policy, there is a perspective in innovation policy that there is one centre in government, be it the Department for Defence in the USA or the Ministry of Health. Though there are many different centres of innovation policy in practice, it is the research councils that largely get the attention and publicity, yet they contribute a tiny part of investment in R&D, even at state level. There is a kind of category error in a systematic way that does not lead to a helpful discourse around innovation.

This has also led to a path dependency on research councils, which has led to flawed institutional fixes to policy questions, such as ARIA, without enough thought about who such an institution services or how it will function. There also remains the question over whether the incorporation of all state research funding agencies under UK Research & Innovation (UKRI) is a benefit for the system? Did Innovate UK benefit when it stood slightly separately and had more autonomy? Within the UKRI, some research councils, such as the Arts & Humanities Research Council (AHRC), have been airbrushed out of discussion documents, while there are hidden evolutions of activity – such as claims that the Engineering & Physical Sciences Research Council (EPSRC) is funding more social science research than the Economic & Social Research Council (ESRC). An additional path dependency for UKRI includes their routes into communities: while UKRI has a culture of reaching out to the community when they are undertaking new activity, this outward reach tends to be with scholars they have funded, which creates a lock into the status quo. Picking up on the point about access to organisational data, at UKRI there can also be a lack of organisational piping for evaluation activity to feed into future decision making.

Engaging with policymakers

Members recognised the issues in engaging policymakers with the different aspects of innovation policy. When approached by different officials in government, it is hard to know the context in which the approach is made, such as whether they are speaking to other researchers, or asking other related questions to the topic? There are three processes by which researchers tend to be approached, one is the process through which officials put business cases together for new investments and their use of the Green Book. This can involve a targeted piece of research to inform business cases, but often it is not clear if other academics are working on it. The second area is evaluation: when advising as part of a peer review group or as an evaluation expert, there is often a lack of network or of formal join-up between researchers across the piece. Finally, Science Advisory Councils often ask for advice on key policy issues, but again there is little formal join-up. Can researchers be more effective in advice to government by joining up how we individually liaise with policymakers and officials?

There was shared frustration that the churn of government departments means that advice and recommendations are not taken up following evaluation procedures, and that there is a need to continually start over again with new faces. Alongside this issue, there is a need to better understand the tools besides the implications of implementing them. There is a tendency to adopt OECD instruments without full consideration of the integration of new tools alongside existing policies, of the effect on the policy mix, and of how these tools may be sequenced. This is a symptom of siloed thinking in innovation policy but also a lack of time resource. There is also a lack of long-term implementation to understand the (often more long-term) effects of new policy instruments.

R&D, innovation the UK research base

As a more general point of discussion, Dr Valero asked the Group whether there is general agreement that the UK has a strong internationally rated research base, though there is room for improvement? This impacts whether the question concerns what the UK can be doing better, or whether the Group needs to focus on the science base itself. It may be that the Group focuses on the translation of the existing strength of the science research base into growth. Finding this area of consensus will help the Group get to the policy implications of the questions raised in the discussion so far.

Members flagged that the UK's strong research base is a great source of export earnings in terms of services – there is also cross-subsidy from international students due to the strength of the research base. As a side note, the importance of international students in terms of

maintaining the university infrastructure for research alongside the cost of maintaining domestic students is a vital part of cross-subsidy in higher education. The UK has done very well on inward investment in terms of foreign R&D, which now accounts for the majority of UK R&D. In terms of lessons for policy, there has been a tendency to the view that the UK is good at science and that our problem is that we do not have enough transfer of technology from the research base. However, it is not clear whether the UK is bad at technology transfer, for instance, because there is a lack of demand on the industry side, rather than in the supply of scientific knowledge? Is there an institutional problem? Until there is clarity on where the problem in the knowledge chain lies, it is unclear as to what the right mechanisms are to promote technology transfer. For instance, catapults are an attempt to solve a gap between universities and industry as transfer institutions that sit between these actors. But there is still a lack of evidence on what the core problems are and what might be done in this space.

Another issue around the quality of UK research is that outcomes are very sensitive to measurement methods, and the UK government has historically chosen measures which make the UK look very good. Different measures highlight a variation in performance across different jurisdictions; for instance, there are single institutions in the USA which outperform the UK in areas that the UK is ostensibly very strong in, according to some measures. So, though the UK does have an impressive performance in this area, there is a complexity to the picture.

Measuring the impact of the science base?

The question is a broader version of Richard Jones's provocation, which is 'what has all of this ever done for people?'. Alongside the challenges data poses to evidentiary conclusions, the outcomes are also poorly measured. Notably, GDP is poorly measured, particularly in the context of new innovations; as an example, the economic growth of Covid-19 vaccines could be tracked to produce a figure, but price indices would not capture the other ways in which people's lives were impacted by this innovation. This impact on lives may well be much greater than the figure associated with GDP growth.[2] This is part of the challenge in thinking through the task of the Working Group.

Innovativeness is also often measured by the strength of the science base, yet the science base should not be expected to be innovative at all. If the goal is to compare innovation across jurisdictions, it is more fruitful to start with industrially funded R&D or innovation outcomes, such as patenting and high growth firms, rather than the science base. There is a tendency to follow the model of start-ups and Silicon Valley, but this is likely inappropriate for the UK context. There is often the cliché that the UK is good at inventing and bad at developing, but the opposite may be well be true. Though this is contested and the picture is complicated.[3] The upshot is that we need to stop thinking in clichés and look seriously at long-held assumptions about innovation.

A potential contribution of this Group could be to come up with new measures or ways of determining success while recognising those barriers to reflection and learning. Embedded assumptions need to be confronted in order to find better measures that recognise the areas of the system that conspire against such measures.

Common ground?

Professor Nightingale also posed a provocation reflecting on the difficulty of getting to good evidence alongside the organisational issues that Professor Gingrich raised around the

[2] This may link to discussions taking place in the social value and sustainability working group.

[3] Coyle, D., and Chung Mei, J. (2022), *Diagnosing the UK productivity slowdown: which sectors matter and why?*, The Bennett Institute [Accessed June 2024].

structure of the UK state: the UK has a particularly odd decision-making structure because of this context, which creates a tendency to default to the clichés highlighted above. There is an endless cycle of pushing the boulder uphill only to have it roll down at the end of the two-year policy cycles. It was noted that other countries see similar patterns – the UK has been an innovator in many policy domains, there is also a good relationship between the policy and research communities (though it may be messy and unstructured). Despite the problems raised, there is good common ground to build on. The challenge is how to develop policy that is experimental and evidence-based, and that creates a compelling story for policymakers. At the end of the day, if it is impact case studies that are bringing home the importance of innovation to ministers, that is a failure on our part as a research community because policymakers did not need us for that. There is a linked issue that the UK has not invested a lot in data infrastructure – it is not enough to do it once, we must systematically collect data to give us the evidence needed for policy insight.

It will be important to set out areas of consensus in terms of what actually does work and the evidence to back that up,[4] and where there are gaps because of evaluation and data challenges as we move into thinking about outputs from this Working Group. Setting out what works in the system and what does not could be a helpful starting point. So, there's a challenge for us to place this discussion within the broader economic framework that this Group sits within – what is the learning for those overarching questions? We will also want to be thinking about how this Group interfaces with other Working Groups, particularly on skills but also the international business and trade environment innovation is a part of, especially when we are talking about technology transfer.

[4] Please see What Works Centre for Local Economic Growth, (2022) 'Evidence topic: Innovation' [Accessed June 2024] and Bloom, N., Van Reenan, J., Williams, H. (2019), 'A toolkit of policies to promote innovation', *Journal of Economic Perspectives* 33(3), pp.163-84.

3. Meeting 3 Summary Note (Tues 18th June): Key technologies

3.1 Creative Industries & the technology needs of the future (Professor Katy Shaw)

What do we mean by the creative industries and how are they performing?

The 'creative industries' has become a buzz word recently. Also known as the cultural and creative industries (CCI) or sectors (CIS), they have been subject to increasing policy interest due to their growth. The previous chancellor named the creative industries as one of the top 3 growth sectors, which generated immediate intervention by policymakers, including a dedicated creative industries team at the Darlington campus of HM Treasury (HMT).

This interest reflects the extraordinary growth figures of the creative industries. Between 2010 and 2019, GVA from the creative industries increased by 43.6% in real terms to £115.9bn in 2019 (accounting for 5.9% of UK GVA). Despite being more greatly impacted by the pandemic in comparison with other industries, the CCI sector continued to grow during this time. For example, publishing, which was growing at around 10-15% pre-pandemic, continued to grow throughout the pandemic and beyond, with the UK as the largest global exporter of books. There were other benefits witnessed during the pandemic, as many CCI businesses had to upskill and use technology in new ways, seeing shifts in business models or the embedding of new technologies that have since persevered. This ability to innovate was crystalised in the Department for Culture, Media and Sport's (DCMS) *Creative Industry Sector Vision* (2023), which looks forward to 2030.

Relationship between creative technologies and skills

The phrase 'createch' is in increasing use, and among its definitions includes thinking about the commercial and cultural possibilities of technology and providing the skills to allow young people to be creative with content. To enable the use of emerging technology to facilitate new creative work, such skills development needs to happen at every level of education, including higher education and through to graduate and freelance technology roles.

However, it should be noted that this is not a static workforce, as AI is shifting the skillsets required in the creative industries. The workforce is going to need more people, possibly from aligned sectors and skillsets, with firms investing in the ongoing processes of CPD and retraining. In employment, it is likely that that we are going to increasingly see createch facilitating cross-sector collaborations, bringing people together from different academic areas and professions to collaborate on specific projects.

The UK is in a strong position to do so, due in part to large market shares in the developing areas of immersive technology and virtual reality (VR), which are being rolled out in aligned sectors. For example, there is a currently a large-scale partnership project between video game designers and the Northumbria police through the National Police Apprenticeship scheme, using VR headsets to help train officers in scenarios like fights in bars and domestic abuse situations. Overall, the VR market is expected to grow despite the current economic climate, reaching a value of £62.5bn by 2030. There is potential to create more opportunities for growth through strategic investments in this area.

Areas of innovation

One example of an area of innovation is the potential for createch to help us 'green' the creative industries, many of which - film sets, theatre productions and music festivals and tours - are carbon heavy. There are several large projects underway which demonstrate how technology can help to 'green the screen':

- The recent production of *Nye*, starring Michael Sheen, used a co-development process to deliver a sustainability plan for the production with the National Theatre, resulting in the smallest possible carbon footprint they could create.[5] The production took place across two sites, the National Theatre in London and the Wales Millenium Centre, Cardiff and best practice was transferred between the two policy contexts (notably the *Well-being of Future Generations Act* in Wales), demonstrating that devolution was not a barrier.
- Historic England are conducting a large pilot using app data from heritage sites to understand who can and cannot access these sites and what they can do when they are there.
- In music, while we are seeing fewer tours, those which do take place are increasingly large, global tours. Alongside this shift in touring patterns, the technology element is proving vital as the streaming of tours is changing how we share and listen to artists. But it also raises questions of just transitions in the music sector, as technology cannot be the preserve of the privileged. We also have to encourage freelancers and smaller organisations to make the most of the opportunities garnered by createch.
- Fulwell73 – the production company who make *Keeping Up with the Kardashians* and the *Late Late Show* – have been granted planning permission to build one of the world's largest film studios on the banks of the Wier in Sunderland. This is a major creative industries investment and a test-bed for new R&D and technology, including an underwater studio to facilitate underwater filming and technology. This has been possible because of the devolution deal for the new mayoral combined authority and is an example of how different actors can collaborate to create a landmark investment generating the opportunity for clustering effects.

Challenges

There are significant challenges to createch, including how we maintain copyright and IP for creatives in the early period of AI use; how we certify the work of creatives; how we think about the roles of creativity and digital literacy and teach those skills to students and staff. Much skills development in the CIS focuses on graduate and post-graduate talent, but we need to create opportunities for established freelancers to develop skills in new areas. A significant barrier to this is the organisation of government and the divergence between funding and application: currently createch sits between funders and government departments (e.g. between the Department for Science, Innovation & Technology (DSIT) and DCMS, both of which are removed from education and skills).

Future

Part of skills development and the future of the CIS will be capturing AI to free workers from menial tasks and generate space for creativity, with technology as an enabling force. As we look to the future, what does 2030 look like? What technology has become obsolete and what is the technology that we would like to be adopted and diffused in our society? What are the actions we need to take, is it possible to cluster mission teams to generate effective investment and enable growth? And how can we make sure that createch is inclusive and how can we enable inclusive innovation? In the North East of England, we have the lowest levels of digital literacy in the country, and many do not have access to the internet, let alone tablets or createch software. So how do we make sure that, as we move forward with new technologies and innovations, that we include everybody? A failure to do so would ultimately mean that we move forward without a diversity of expertise, without the knowledge, learning

[5] National Theatre (2024), 'Environmental Impact Report: *Nye*', *Theatre Green Book* [Accessed July 2024].

and experience that will help us understand the application of technology in different contexts.

Discussion

The discussion focussed on the skills needed for createch and the CIS, beginning with a question on the impact of Brexit and subsequent restrictions on movement and trade, Some of these impacts can be relatively hidden - such as the international changes to royalties – while others are well known. The issues with . freedom of movement, which impact many industries, have raised a question of how to attract freelancers (who are vital to the CIS) to the UK. Such considerations are partly a product of the UK being in a reactive mode in recent years, when what is needed is more foundational work to facilitate relationships with our neighbours and consider the UK's economic place in the world.

The counter to international mobility is domestic skills development, which the Group noted needed greater porosity with a focus on interdisciplinary skills in teaching at all levels, including higher education. Those in the CIS favour humanities graduates, and feel that universities would do well to focus on the benefit of teaching transferable and interdisciplinary skills, and better articulate the value of these skillsets to students to ensure supply. We know that future generations are likely to have varied careers, meaning that subject siloes are problematic for future skills needs.

These transferable and broad skills also support working life within a career or sector; in the CIS, many endeavours are project based, or exist within project ecologies, meaning that the industry values freelancers who can learn on the job, build teams, networks and reputation. It was noted that the Academy is working with the Unit for Future Skills (UFS) within the Department for Education (DfE) on the development of a new skills classification for the UK, and that work is ongoing to embed understandings of transferable skills in government thinking. This is particularly important because the current coding of the CIS is incredibly unhelpful, often hiding jobs, or incorrectly including/excluding areas incorrectly. This clarity is important in terms of how the future workforce and skills need are seen to map onto the sector.

Members discussion the need for a distinction between using technique and innovation, which the discussion around createch ca conflate. The UK has a strong CIS, but these strengths often lie in the imitation and diffusion of technology imported from other countries; in the attraction of the heritage and GLAM sector to tourists; and in the global renown of performing arts. It is the creativity that is the source of the UK's strengths not its technological advancement. Focusing policy and/or funding therefore, on technological advancement in the sector may risk undermining the foundation on which it is built. Members discussed that if a 30-year strategy for the CIS were being written, it might be pertinent to focus on generating home grown technology and methods for international collaboration to build on this creativity.

The economic context of the CIS is becoming more devolved; while there have been successful projects taking place because of devolution in Northern Ireland, Scotland, and Northumbria, there is still a large focus of funding in the South East. DSIT has been tasked with getting R&D spending out of the South East, and the community needs to be helping them understand how to do this. Members also noted the difficulty of capturing CIS R&D within the UK's current tax levers and measures of R&D. We need to make sure that survey instruments like the Business Expenditure on R&D (BERD) survey accurately capture R&D investments in the CIS in order to support the important technological experimentation and innovation in these sectors.

Finally, the Group covered the potential benefits and pitfalls of AI and Large Language Models (LLM), especially in terms of IP, as this is often presented in very polarised terms. It was noted the CIS encompass a large group of sectors, and that this means that there are differences in the perceived benefits and potential threats of AI. Some groups are excited about the potential generative opportunities, particularly if AI can free up labour for them, while for others, particularly publishing, there is a real concern about how to protect IP in the world of AI. It was noted that the CIS should also be upskilling young creatives to navigate AI and IP, while creating robust boundaries around their creative work in an often-predatory market. It is important to have clear understandings of creativity and creative thinking, alongside their constituent components, because technology has different implications for different component parts. For instance, creatives often rely on generative AI in the generation of new ideas and which emerging evidence strongly suggests is impacting on the fluency of ideas that is needed in innovation processes. Yet when it comes to the critical component of evaluation, particularly of cultural content and services, humans are more important.

3.2 The technology we want and the technology we need (Dr Jack Stilgoe)

Political churn

Over the last decade, political churn has posed a problem for technology policy.[6] As a quick run through, in 2012, under David Willets, we saw the identification of eight 'great' technologies and a lean towards, if not picking winners, then at least picking races. In the significant political churn since, we saw changes to these priorities year on year, including the addition of quantum technologies. Between 2015 and 2016, Sajid Javid's opposition to industrial strategy is reflected in a lack of technology policy during this period. Yet in 2017, there was a move towards identifying technology policy through the lens of challenges or missions, rather than picking technologies themselves.

Yet political churn is not the only issue with technology policy; even in 2012, the technologies identified were out-of-date and there were notable errors in the mission-led lens of 2017. For example, AI was used as a challenge or 'mission', yet it is not a problem at which we might direct technologies, but a technology in and of itself. This is also a field that is rapidly changing, the previous Government's technology policy identified nanotechnology as a subcategory of advanced materials, indicating how a technology perceived to be of great future importance can effectively become a footnote.

Underlying much of these issues is a confusion between supply and demand. This is a perennial question for technology policy: can demand be a part of technology policy, when the aims derive from where technology is already pushing us?

Economic opportunities and narratives

An absence of key sectors - like the CIS – in technology policy suggests a disconnect between the technologies that government would like to be at the frontier, and the existing advantages in the UK economy. Alongside this disconnect is a misunderstanding of the nature of invention: it is often presumed that a where the UK has a technology frontier which produces inventions, their adoption and diffusion are guaranteed. This misunderstanding plays out in graphene. Despite the UK government's interest in graphene and massive growth in graphene patenting, British patents accounted for an extremely small proportion. This should not be surprising considering the shape of the British economy, but it disputes a well-rehearsed narrative about the economic opportunities of brand-new technologies.

[6] Jones, R. (2024), 'The shifting sands of UK Government technology prioritisation', *Soft Machines* [Accessed June 2024]

Despite the hyperbole, particularly from tech startups, the 'hype' of emerging technologies very rarely lives up the reality. Sam Altman poses the challenge that it is possible to create a Moore's Law for everything,[7] and instead it is imperative that governments make long-term decisions about technology policy based on reality.

Technologies, inequalities and trust

Another myth which prevails is the idea that innovation and technology offer progressive disruption to power structures and are ruthlessly meritocratic. Yet the evidence suggests the opposite. If the story of invention is that it can and should be done by everybody, then the reality is the children of the 1% bring out the most patents.[8] The issue about whether technology enforces a meritocracy (or not) brings us to the question of social contracts: the Edelman Trust Barometer tells us about low public faith in government to manage technologies in the public interest (45% of the public distrust the government to tell the truth about new innovations and technologies).[9] This antipathy to the government's ability to understand and govern emerging technologies is particularly bad in the UK.[10] The public's alienation with what they regard as 'the system' stems from a growing sense that innovation no longer serves ordinary people. And, despite calls for the complexity of technology to be left to the tech sector, this poses profound questions for policymakers: who does know about technologies and how they can serve the public within government? Who should we be calling on to make decisions about new technologies based on public interest?

Government R&D

This provocation ended with a call for government to rebuild its own capacity for R&D activity. Since the end of the Cold War, we have seen massive reductions in the UK Government's expenditure on departmental R&D. We might consider that during the same timeframe, we have seen corresponding increases in the amount of public money channelled through research councils to external actors. This may exacerbate a problem of expecting more from university R&D than the sector is currently set up to deliver, while the ability within government to make effective and informed decisions about future technology has collapsed.

3.3 **Discussion**

Prioritisation and picking races

Members kicked of the discussion but raising the disconnect between technology priorities historically identified in industrial strategies, and the reality of investing in areas of technology innovation that the UK could actually excel in. A realistic process of picking winners would result in a list of technologies that very few people had heard of. There is little within the industrial strategies of the last 14 years that broaches the practicalities of picking winters, including re-prioritisation of funds from others. In order to pick races to invest in, let alone pick the winners of these races, requires identifying different priorities across countries, regions and universities. Instead, the fact that everyone's technological priorities are the same suggests that though technology policy claims to be industrial strategy, it is instead operating as a signalling device that this government is in the same race as everyone else, but the race is effectively an imaginary one.

As part of the discussion of prioritisation, members also made the point that R&D policy requires government to reprioritise funds appropriately when projects are not delivering and to find a way to enforce that. Yet is also very difficult to shift existing practices once they are

7 Altman, S. (2021), *Moore's Law for Everything* [Accessed June 2024]
8 Bell, A., Chetty, R., Jaravel, X., Petkova, N., and Van Reenan, J. (2019), 'Who becomes an inventor in America? The importance of exposure to innovation?', *Quarterly Journal of Economics* 132(2) pp 647-713.
9 Edelman Trust Institute (2024) *2024 Edelman Trust Barometer* [Accessed June 2024].
10 It was noted that the results of the Edelman Barometer need to be taken with a pinch of salt due to the framing of questions around certain technologies like genetically modified crops and AI.

established – a Member cited the example of the Ministry of Defence's introduction of a 'fail fast' policy on emerging technologies, yet have thus far not failed a single technology. So institutional culture and politics can get in the way of societal need. The Group discussed issues with top-down investment or picking winners – i.e. in graphene – that have caused damage. As an example, Members discussed the investment of £100m by UKRI in the Isambard 3 supercomputer at the University of Bristol and the 'field of dreams' model at work in this technology investment, with little attempt to assess the economic or social benefits of the investment, instead operating with an assumption that such benefits will automatically arise out of the technology investment.

There are different approaches to picking winners which offer lessons. While technology assessment is a very old-fashioned phrase, if government outsources the ability to innovate, then the need for technology assessment becomes greater. As an example, the former US Office for Technology Assessment (OTA) ran from the 1970s until the mid-1990s and was designed to give nonpartisan analysis on science and technology to congress, asking the difficult questions of technology investment not often interrogated by tech enthusiasts (or those with vested interests). There is an argument for capacity within government to assess technology effectively in order to have the competency and ability to make prioritisation decisions.

However, it was also noted that the OTA existed in a particular time and place, during a period of US global leadership in these areas of technology and science. This is not the situation that the UK finds itself in today (nor is it the situation the US finds itself in). It was also noted that there is good technology strategy work being done in government, but it is not necessarily in the areas of government that you would expect. T the governance of technology may be trying to answer a question that really hasn't been relevant since the 1980s, and instead the organisational shift in response to changing patterns of global technology development is to be expected.

Similarly, there are good examples of where the public sector is able to assess technology need. The NHS has the governance structures in place to enable healthcare providers to make decisions about technology investment and they able to articulate the demand side of innovation policy in a way that is not seen in other areas of government. But this is also indicative of the scale of capacity required to make these sorts of decisions. Is it possible to turn similar capacity to other technologies, for instance a clinical trial system for AI, or the users of AI to be involved in areas of decision-making along the value chain? It would take this kind of capacity to govern AI seriously. Instead of getting stuck in the game of pushing a piece of string in discussions of what we need from technology policy, we need to articulate the particularly societal ends of technology policy.

The role of industrial strategy and technology policy

A Member asked whether there needs to be a differentiation between technology policy, industrial strategy, and R&D and innovation policy? While there are similar calls across these areas, it might be useful to better understand the different terminology, purposes and goals that really make a substantial difference to what we're ultimately aiming for. Similarly, which investments can lead to the growth of different industries in a way that works for the UK's ambitions. This may require less exciting approaches, such as adopting technologies from elsewhere and creating diffusion to increase social value. Getting the most value out of technologies requires a different set of policies than investing in technology.

This prompted a discussion of the perennial question is whether there is such a thing as 'technology policy'? And whether approaches to technology policy in government should be threaded across different departments, in the same way that we approach climate policy?

This is less about being prescriptive about what counts as technology policy, but more about recognising the plurality of things that impact the shaping of technology.

However, Members also raised the issue within the current system on solutions chasing after problems, rather than an embedded ability to make strategic decisions. This creates a negative cycle, where the strategic ability to create policy has hollowed out, which in turn creates more problems down the line that then need to be chased. This results in high levels of waste, especially monetarily – more than would have been spent on the capability to make strategic decisions. While it is possible to focus on challenges like health or climate without a specific technology policy, the question becomes how you would get government to undertake forward-looking strategic thinking around technology investment if it focused on missions or challenges. Some progress has been made in thinking strategically about such foci: Patrick Vallance created Areas of Research Interest (ARI) for government departments because it was felt that UKRI was not able to be responsive to government need.

It was also added that when there is no formal assessment of the economic benefits of technological investment, government has no incentive to ensure beneficial outcomes and accountability. How can the academic community persuade government to embed downstream outcomes and assessment before large scale technology investments? It is not ideal to have investments of this kind largely at random, as it means that governments are able to pull the plug on funding later down the line, especially if subsequent governments question the economic and social benefits of such investments. Though there are issues across the technology private sector of ill-advised or poorly evidenced investment, the state has more fiduciary responsibility for its money. We therefore need some check points in the process of technology investment which allow for more disciplined thinking around funding, so that the success of projects is understood and assessable further down the line.

3.4 Should we pick winners and what does that mean? (Professor Jonathan Michie)

Considerations for picking winners

The practice of ‘picking winners’ can refer to picking specific technologies that you expect to be critical in the coming years - such as space technologies – or key sectors - such as defence - or via companies, either creating new companies or supporting existing ones. There are key links between these categories, and often picking winners requires support across technologies, sectors and companies. However, the ‘winners’ will represent a minority of technologies, sectors and firms, and it is vital that other areas remain important and are not written off in the process.

Alongside this caveat, there are three key considerations for the process of picking winners:

1. There is a need to establish an effective process by which to pick winners, which takes into account supply and demand, the country’s particular capabilities, and one that involves the right actors.
2. Understanding the process not so much as picking winners, but as creating winners, and fostering, nurturing and developing them, rather than setting them up to fail with high expectation but low support.
3. Alongside technologies picked as ‘winners’, technology policy should still bolster and nurture other technologies, sectors and companies. We have to focus on the big issue of how to develop and sustain technologies, sectors and companies across the board, not just win the few chosen areas.

While obvious winners in the current climate could be technologies for achieving net zero; machine learning, robotics and artificial intelligence; and life sciences, the question remains: how do you decide whether they are the right choices? This is partly reliant on a proper process to identify potential strengths in the country's technological and economic capabilities. But we also need to create the conditions that enable and support the development and growth of new technologies and sectors, rather than picking them and seeing what happens.

Creating the conditions to create winners – government structures

In order to create the conditions to support and grow new technologies and sectors, the foundation of government and industrial structures is to, in the first instance, do no harm, and if possible, support new sectors. Yet, historically, we can see the negative impact that shifts in government funding and support have on UK innovation and 'winners'. In the 1960s, Britain was world-leading, alongside the US, in machine learning, robotics and AI. However, the Lighthill Report in 1973 argued that there was no future in research on AI and robotics, and effectively ended government funding of AI research.[11] The 1960s and 70s saw crises in oil and energy security that generated innovations in green technologies – this period saw the emergence of interest in alternative energy, with the 1968 formation of the Club of Rome and the publication of the *Limits of Growth* in 1972. Additionally, the engineer Steven Salter invented Salter's Ducks or Edinburgh Ducks in the 1970s, which aimed to harness renewable energy from the North Sea. There is very strong evidence that this could and should have been rolled out on a massive scale in the 1970s, and we would have had mass renewable energy. It was scuppered by the withdrawal of government funding based on research by the nuclear industry. So, we had potential world leadership in sectors and in technologies that remain key today, but the private and public sectors failed to support and develop them.

Creating the conditions to create winners – principles and approaches

There are a range of approaches that would need consideration in order to foster growth and development in key technologies, sectors and companies. Those outlined below, in no particular order, are all key to making a success of any new technology or sector of the economy:

- Creating and maintaining efficient, effective and productive infrastructure, including transport, energy, broadband, research & development, and creating absorptive capacity in government and companies.

- Providing long-term, patient financing, particularly for SMEs, is vital to tackle the short-termism which incentivises owners and managers to focus on short-term profitability. This is a long-standing and well-known problem in the British economy but has not been successfully tackled.

- Fostering university-business collaboration, not only through successful company spinouts, but through generating skills capability. This includes part-time degrees which engage employers both in the research that can tackle grand challenges and in creating a skilled workforce with the capabilities to make the most of new innovations. It is sometimes assumed that new innovations and technologies will significantly improve productivity, but evidence shows that the impact on productivity is largely unknown until such innovations are in the hands of the people who are going to be working with them. So, skills capabilities within the workforce are required to make the most of new innovations when they emerge.

[11] Agar, J. (2020) 'What is science for? The Lighthill report on artificial intelligence reinterpreted', *The British Journal for the History of Science* 53(3) pp.289-310.

- Creating high commitment work systems that use progressive management approaches – involving consultation, representation, engagement, education and training – to boost commitment, motivation, productivity and innovation.

- Using local, city and regional economic development to create regional balance and avoid regions being left behind. This includes learning partnerships between companies and other employers, universities and colleges, elected local and city authorities to deliver lifelong learning, including apprenticeships, part-time degrees etc.

- Creating industrial districts and creative clusters that are capable of profiting from the next important technology waves and that can replace the priority sectors defined today..

- Creating companies with a purpose where stewarding assets is the goal, rather than focussing on high profits.

- Generating a good degree of corporate diversity by picking appropriate corporate structures depending on the purpose of the company or organisation, including employee ownership and hybrid mutuals with employees, customers and communities as members.

- Finally, avoiding losing key companies and potential winners to hostile foreign mergers and acquisitions from overseas – at the moment there is very little protection against this activity.

It is vital that we do not fall into a mantra about economic growth without questioning what it means and who it benefits – we need a better degree of regional balance and regeneration, including lifelong learning and a good mix of disciplinary education. A new approach to economic growth is not just about picking winners, but creating and sustaining winners in terms of technologies, sectors and enterprises, with the benefits of jobs, social, and environmental sustainability at its core.

3.5 **Discussion**

Lobbying

The Group discussed the issue that potential winners have failed in the UK for a range of reasons, which means that there often is not a single, ‘silver bullet’ answer to better supporting technology innovation. As a barrier to government and parliament understanding to better support technology innovation, Members discussed the issue of priorities being set by lobbying activity. It was noted that the nuclear industry has set research priorities for many decades, and there are powerful lobbyists arguing for carbon capture and hydrogen technology despite the mixed picture of evidence. However, Members also discussed that debates on carbon capture have shifted due to the emergence of more nuanced research that avoid using the process as a way to prolong fossil fuel extraction.[12] Either way however, it is difficult for politicians to navigate the money spent on lobbying, as well as the number of lobbyists – who outnumber politicians and civil servants. There is potential merit in reinstating Statutory Industrial Strategy Councils to create more transparent frameworks for understanding policy areas and for determining appropriate policy support. This could operate as an independent institution, mitigating the vulnerability of government to lobbying activity. While there was a broad agreement in the Group with the idea of Statutory Industrial

[12] Serin, E., Valero, A., Lane, A., Powis, O., Haszeldine, S. (2021) *Siezing sustainable growth opportunities from carbon capture, usage and storage (CCUS) in the UK* [Accessed July 2024].

Strategy Councils, there was also a call to look to the future and new thinking, rather than replicating the past or, indeed, the present.

Assessment for picking winners

Alongside potential challenges to understanding the evidence, there is concern that there is a lack of capability to conduct the type of assessment needed to effectively pick winners. The group discussed whether comparative advantage is an appropriate measure; though this is a comparative rather than absolute measure of capability, comparative measures consider volume as well as specialisation and can act as an anchor point in contextualising technological capability on an internationally comparable basis. It was raised that analysis on comparative advantage this should also be supplemented with other analysis, and it was also noted that comparative advantage does need to be taken with a pinch of salt – it is often said that if Japan had abided by that, they would still be focused on rice production. As another example, in the 1970s South Korea invested in their shipping industry following evidence suggesting that this was a growth area, and, despite not having a ship building industry in the 1960s, they now have the second largest shipping industry in the world. It was noted that the long-term perspective of South Korea's civil service was an important component of their success in this area, alongside having appropriate measures in place to withdraw funding from areas that were not successful and try new approaches.

Political implications

It is, however, worth acknowledging the issue that picking winners can quickly become a very ideological. There is a problem with cherry-picking the evidence to support particular views. There have been successes and failures – though Salter's Duck did not get funding, we have been successful in our investment of off-shore wind – so, it is about better understanding why failures happen and where successes through industrial policy come from and how they are beneficial. The UK has not been successful in accepting losses in order to build an industry up over time. There needs to be a new approach to industrial policy that thinks through the costs as well as the opportunities, and thinks in terms of public interest, rather than private interest.

This prompted a reflection among Members that technology firms draw from a wide range of disciplines, including the arts, social sciences and humanities, and that this diversity is also present in science-based industries associated with specific disciplines, such as biotech and life sciences. It takes a diverse and lively scientific village to support innovation. Innovation requires the support of all disciplines, not only because human welfare, social wellbeing, culture, health and democracy are all important to the world of work, but also because the world of work and innovation requires imaginative thinking – the capabilities discussed throughout the meeting require the contribution of all disciplines.

4. Meeting 4 Summary Note (Weds 17 July): Implementation or the 'how to'

4.1 R&D, Productivity, and Innovation: What we can (and can't) learn from other countries (Professor Neil Lee)

It is very difficult to learn directly from other countries due to a range of issues but predicated on policy not being specific to the UK economy as it is now. Learning from elsewhere can lead to problems of implementation including fast policy, institutional incompatibility and chasing a small number of models in terms of success, and this approach can lead to a lack of attention to domestic reality and the specificities of our own context and economy. However, it is possible – when being careful – to take lessons from others and there are three good examples in Austria, Switzerland and Singapore. Though each have a specific set of reasons as to why their approaches to R&D and innovation were successful, all three approached R&D and innovation policy with a) pragmatism and realism about the policies that would work for them, b) place specific research and identification of opportunities for adaption, rather than revolution c) clear attention to fundamentals, and d) political stability and consistency, which we have lacked in the UK recently.

Austria

Austria has had the largest increase in R&D spend in the OECD between 1980 and 2020 except for South Korea. While there is a problem in using R&D spend as a measure (businesses can game tax credits in a way that skews the data), we can see that the Austrian economy has benefits from the success of focusing R&D spend on low-R&D intensive sectors. The area of Styria had the same industrial composition as Wales in the 1970s, and while Wales has lagged in terms of GDP per capita since this period, Styria has seen a considerable increase. What can we learn from this growth? Styria did not take a Silicon Valley model but instead focused on building on the existing institutional and industrial strengths of the region, upgrading locally appropriate research infrastructure linked to the local business base, and were able to integrate what they were doing into global supply chains. A key element of this success was opportunity and being at the right place at the right time, but also in exploiting this opportunity.

Singapore

While Singapore is often a cliched example of an innovation success story in policy and research circles, digital technology was an area in which it had not seen success until relatively recently. However, policymakers in Singapore have acted to tackle this question and we have seen some very successful domestic digital technology firms in Singapore, such as Sea, Grab and Acronis. As a starting point to approaching digital innovation, policymakers were extremely level-headed and realistic about what Singapore could and could not achieve, and built their policy on a strong basis of realism. They did this not only by learning from what they saw elsewhere, including the Silicon Valley model, but adapting it to a Singaporean context and specific advantages. They had a strong policy focus on innovation over a sustained period of time and recognised an opportunity to attract and develop successful regional firms. They built on the comparative strengths of Singapore regionally, such as its public services, rule of law etc, and were able to sell Singapore as a base that offered this stability while providing access to markets and operations across South East Asia, including Indonesia, Malaysia and the Philippines.

Switzerland

While Austria focused on innovation in areas like steel and car production, and Singapore focused on digital tech, Switzerland offers an example of doing both these things well.

Switzerland had the highest score in the 2023 Global Innovation Index rankings – which is scored through patents – and is seen as highly innovative. Switzerland has the largest R&D offices for Google outside of the USA, firms in pharmaceutical and chemical sectors, and smaller firms working as hidden champions. Part of this success is in getting the fundamentals right. Some of these firms started in the 1500s, but this provided a foundation of knowledge in what Switzerland could be successful in comparatively: these firms were not competing on price or quantity with German chemical companies, so instead focused on niche products and moving up the value chain. Notably, policymakers were completely uninterested in fads, ruthless in their realism, and clear about local responsibilities – this includes withholding or removing funding on the basis of ineffective ideas or lack of local skills alignment.

While all three of these examples are predicated on a strong dose of luck and some historical dependence, they also all built successful innovation on the foundation of locally tailored policy and pragmatism about local comparative advantage. There are key lessons for UK policymakers here, particularly in terms of building on cold, hard realism.

4.2 Implementation of mission-oriented policies (Professor Elvira Uyarra)

Innovation studies do not pay enough attention to implementation, particularly in terms of implementation approaches and failures. The traditional view of policymaking follows an idealised, linear progression: agenda setting, options, decision-making, implementation and evaluation. However, we know this model does not work. In fact, the implementation of policies on the ground has a much bigger impact on policy success than the sophistication of policy tools, and should have a much stronger focus in policymaking.

Approaches to implementation

Approaches to implementation can affect policy outcomes. Top-down policy implementation focus on clear goals, appropriate communication routes, incentives and resources, while bottom-up approaches start from the understanding that policy on-the-ground is messy and negotiated, and that policy implementation will need to be tailored to different contexts. The outside-in is also important, as the targets of policymaking are not passive – their behaviour can change, and they can be unpredictable. It is also important to consider policy legacies and the impact of a new policy on the existing policy mix.

Tools for implementation: mixed impacts

There have been EU-wide policy tools that have had mixed impacts in different settings, highlighting the issue that the ability of policies to have positive implementation is dependent on context, including existing strengths and policy histories. Some policy instruments that seem simple, such as Innovation Vouchers, actually vary widely in their implementation depending on contextual factors. Meanwhile, public procurement of innovation has a compelling evidence-base and is theoretically transformative, but has so far largely had disappointing results because implementation requires changes to institutions and systems. However, we have seen success in the public procurement of innovation in Galicia, Spain, where implementation was taken over the long-term – over ten years – through cross-party consensus that allowed for institutional change, the leveraging resources and the building consensus alongside technical work, skills development, and cultural change. Finally surveys of EU member states on the EU's Five Missions found that is it very difficult to embed missions-led policy suddenly across institutions, particularly due to coordination challenges.

There is often an issue in policy design that implementation is not put at the heart of policymaking. Recognising the agency of local actors is crucial to understanding how policy will play out on the ground, and we must foster an adaptive approach to implementation and

evaluation. Often, implementation requires a long-term and coordinated approach, with the collaboration of (and leveraging of) local actors through a strong vision.

4.3 What's needed to implement an economic strategy? (Professor Dame Diane Coyle)

In terms of an initial context, we are seeing a real shift in expectations in terms of government industrial policy or strategy across the OECD. We are also operating in the context of two major transformations, digital and AI, and energy – which are so transformative that having no strategy is a strategy, as change will take place regardless. However, the purpose of a strategic framework is to approach these transformations more intentional way, creating the coordination needed to make such transformations effective and create returns on public investment. This is particularly needed in the UK, where we have seen low productivity growth, stagnant wages, worsening public services alongside the well-known issues of political churn and a complex institutional landscape. Despite work on relative comparative advantage, the UK is starting from a weak position – areas of potential strength are not that strong and our high value sectors, such as finance and advanced manufacturing, are the major contributors to the post-2008 productivity slow-down.

Data gap

This context means that industrial policies are back in fashion, but there are gaps in our data that may limit our ability to implement such policies well. There are major issues with data and knowledge gaps for policymakers and our data gaps are seen across multiple areas that impact economic policy. As an example, we did not have data on Regional Economic Growth until 2015, so it is not until relatively recently that we have started to get a good understanding of regional economic growth – before then we did not have data on the divergence of growth across regions. Areas that continue to have clear gaps that should be addressed include:

- *Sector knowledge*: the sectors outlined in industrial strategies are always the same, but they are too broad brushed; we cannot be at the frontier across all areas of a sector (let alone all areas of multiple sectors). Instead, we need to approach the frontier with more granularity, focused on our strengths in particular areas, such as optics or materials. Our focus on sectors also creates a gap in our knowledge regarding extended global supply chains which intersect sectors – there is a need to look beyond sectors in some areas.
- *Skills*: while it is known that there is a substantial skills gap at the mid-technician level, we lack data on what skills are required for the future of work. While we know anecdotally that young people are undertaking post-education courses to enhance their digital skills, this means that skills data is largely being held by private-sector education specialists, limiting access to government analysis and understanding.
- *Digital use*: linked to the point above, our production, business models, consumption and time have all been transformed by the digital since 2007, yet our data on this activity is no better now than it was then, limiting our understanding of digital use and skills.
- *Price data*: growth data does not tell us about people's standard of living as it entirely theoretical and based off price indices. Understanding people's actual experience – whether their lives are improving – should be much more linked to factors like public services and local amenities (and the erosion of public and private sector provision locally is going to impact people's sense of how well off they are).

It is a risk for government to underinvest in data collection and construction at a time when the private sector is massively scaling up its investment. At the moment, large scale projects are not doing enough to close this gap; for example, the integrated data service is ultimately re-packaging existing data in a way that is not intuitive, rather than creating and collecting new types of data.

Analysis gap

Most economic tools are only suitable in the context of incremental change, rather than transformational change. Standard tools could include cost benefit analysis or competition analysis of a set of markets, but they cannot answer questions about innovation and dynamics, or where markets are going to tip etc. Though there are tools for markets whose boundaries can be clearly defined, there are not standardised tools for the international context in which economies function. At the moment, we simply do not have the economic tools to think about economic transformation.

Economic strategies are also poorly constructed. For instance, we have had a lot of broad-brushed statements from government on getting to Net Zero, but they lack the granularity of focal length that is needed to actually bring about change. If you want to bring about transformational change that pulls us into multiple positive feedback loops (or 'equilibria') you need to think seriously about strategic complementarities or mutually reinforcing policy actions that can increase the rate of return on investment. This includes policy join up, creating and accelerating tipping points in markets, and understanding the coordination needs and failures that government needs to be addressing. It has to be understood that outcomes are endogenous, and that the policy choices we make now affect whether we get into a positive or negative equilibria.

Alongside economic strategies, other elements, such as political economy and institutional design, feed positive feedback loops – we need to get politicians out of the trap of being accused of U-turns, instead creating a learning economy, in which institutions and institutional mechanisms create an environment in which policymakers can try approaches with the expectation that impacts will be felt over time, while also creating space to change course if approaches are not having appropriate impacts. Economic strategy is about enacting decades-long changes, and asking the private sector, and individuals, to make long term investments. There is also the need for coordinating devices, particularly around devolution and place-based policy. A generous view of the Government's missions is that they can create policy alignment, but they lack granularity and miss the point that knowledge is place-based and that coordination is easier at a local level.

4.4 Discussion

Political structures for innovation

Across all three presentations, there was a shared sense that the architecture of the UK's political economy creates a limitation to government machinery within our system: to what extent can the current political architecture of the UK facilitate long-termism and consensus? Across all three presentations, themes of devolution and long-termism were drawn out in reference to implementation of innovation policy, and the lack of political polarisation around innovation policy may create room for cross-party consensus in this area. It was flagged that innovation policy seems to work well in either very big or very small countries, while as a medium sized economy the UK finds itself somewhere in the middle. This has none of the political benefits of being small or the scale advantages of being large, and so may require a different approach.

The role of devolution is important to implementation, providing the opportunity to mobilise unrecognised assets and create a joined-up approach across various elements of policy. The Group discussed whether the UK has to be at the forefront of big frontier technologies, or whether investment and policy focus is better spent on adoption and diffusion of technologies developed elsewhere. Part of this issue is that we largely know what we should be doing in terms of innovation policy, but political barriers mean these lessons and approaches are not always taken on board by government. This could be a question of politics or of expertise – we need to look more deeply at our system to understand what could be changed in order to allow policy innovations to happen. It was noted, for example, that innovation policy in Singapore was not just innovation policy in a narrow sense of simply looking at R&D investments or technology policy – it took a systems view and included visas, legal services, education, infrastructure – with essentially the whole structure of the state being pushed to achieve their innovation policy goals. There is an element of policy coordination across multiple areas that the UK could learn from. The current S&T Framework is a good example of an effort to do this which could be made more of from a policy perspective.

However, there are also trade-offs to consider with approaches like devolution, including complexity in coordination and gaps in regional capabilities. Members raised the issue that the current UK Government's focus on mission-led approaches potentially risks an increase in centralisation. While such missions can create a coordination imperative across different government departments, there is a risk that coordination creates more complexity that needs to be managed. It will be important for government to consider how place contributes to over-arching missions or whether there is a need to create micro-missions that consider different economic geographies and issues of scale.

Place can have an important role in delivery, but it needs to be recognised as such. It is vital to create positive feedback loops within a decentralised system, which create accountability at the local as well as national level. For example, in Japan, information collected from officials in regions is passed up to central government and comes back down again in a feedback loop. Alongside positive feedback loops, we need structures and funding to effectively support areas of decentralisation, for example the Combined Mayoral Authorities, which have the potential to be incredibly impactful. Such approaches are needed to avoid negative effects associated with decentralisation.

As a case study of where long-termism and decentralisation has been successful, Spain has strong cross-party consensus on the importance of R&D and innovation. It was noted that this consensus arose out of a specific context, with the economic crisis of the 1980s and aims to join the EU generating consensus around industrial policy. The economic crisis also led to a lot of policy being devolved, not just innovation, but also infrastructure, transport and education. In Galicia, long-term approaches to innovation policy implementation were created out of existing political and institutional stability alongside a cross-party agreement on the importance of innovation policy, with implementation of industrial policy continuing despite government change. It was understood by policymakers in the region that though they did not have strengths in the invention of technology, they could adopt new technologies effectively. It was raised again that strong emphases on place and pragmatism about existing strengths were important to innovation policy success.

The role of policymakers

This raises the question of the role of policymakers and civil servants in creating, implementing and sustaining successful innovation policy. The Group discussed the approach of policymakers in the examples of Austria, Switzerland and Singapore. Policymakers across these examples also have deep expertise over a long time period and a clear sense of their position in the regional market. While there have been critiques of

Singapore's model of migrants founding firms in Singapore in order to reach nearby markets, policymakers in Singapore have flagged that this is essentially the Silicon Valley model. Policymakers in Singapore were acutely aware of where they stood in the region and knew that they were offering access to a very fair, legally rule bound financial system. Across all three examples, policymakers ask specific and detailed questions about what is working and current activity in other nations, highlighting both an in-depth knowledge and a desire to take appropriate lessons from areas of success.

Members raised whether there has been a proliferation of 'new' R&D strategies, innovation policies and integrated reviews, and whether we should be looking at introducing new policies or focusing on continuation. There is an element across this programme of work that is less about the machinery of government, but instead the machinery of governance and coordination across government. This question is less interested in the economics (in the traditional sense) but more in how government works to deliver an economic strategy. It was noted that the disfunction of 'newism' is not just a British challenge and is partly driven by the fundamentals of technological changes, geopolitics and economic shocks.

The Group also discussed the challenges of joining up academic insight and policy change. Economic tools and theories developed in academia are not necessarily built for such a rapidly changing world. Economists are incentivised by the structures and systems of academic rigour, meaning that activity is incremental, building upon existing bodies of knowledge. A shift for economics would not necessarily mean going back to the drawing board or rewriting the basics of economics, but rather translating what we know, for example in terms of information and the failures of first and second welfare systems, in a different way in order to inform policy and policymakers.

Funding models and cultures

Alongside the importance of political structures and the role of policymakers in implementing innovation, the Group discussed the role of research funding in innovation policy implementation. In terms of national research funding, it was noted that the Swiss National Science Foundation is an innovator in and of itself, experimenting to find better ways of structuring the funding system to fill gaps, and giving researchers access to data to explore these efforts and link them to policymaking. Switzerland's, success in innovation is not just about the big STEM blockbusters like CERN, but in innovative funding structures that generates applied innovation that is locally focused at Canton level. There is also a culture of valuing the contributions of applied universities in Switzerland, which subsequently has an impact on skills development. Alongside this funding system, there is a much clearer distinction between the cutting edge of innovation and the diffusion and adoption of innovation within the Swiss model. However, it was noted that there are issues with the system, particularly in terms of pressures on researchers to be producing world-class innovations, and there are also challenges in replicating it, as many of the structures and firms began or were embedded 500 years ago. To this end, initiatives like the UK's new metascience funding calls, and before that the areas of research known as 'research on research' or 'science of science' could be more supported to build evidence bases at system levels.

The Group also discussed different funding models and what should be enacted at national and regional levels. At the moment, research is funded at the national level by UK Research & Innovation (UKRI) but there is a live question about devolved research funding if we continue to devolve power to combined authorities (though this remains a contentious issue within science policy). It was noted that in the US, most scientific funding is for nine months of the year, with the final three months of funding covered by local industry. This model hugely increases the level of engagement between academics and industry. In the UK, the UKRI

model effectively buys out world-class research and stops research projects from interacting with local industry. It was noted that the Swiss model also creates different incentives for universities and institution types, including those who do not fit the traditional ‘world leading’ model.

Members discussed the potential trade-offs associated with the different research systems of Austria and Switzerland. Austria has a more traditional closed model, which has international implications, while Switzerland operates with a more open model and has a very international research system with lots of migrants from around the world. Swiss universities in particular are very proactive in pulling in talent from overseas. This may be relevant for the UK which has traditionally been open like the Swiss model but is potentially heading to a more Austrian closed model. The new Government’s policies on partnerships are going to be important to this space, particularly in terms of how successful they can be in implementing partnerships with bigger countries with less of a history of co-operative relations.

5. Meeting 5 Summary Note (Tues 22 Oct): Output reflections

Those who attended the conference thought that it successfully provided an opportunity for working groups to highlight specific areas of discussion arising out of working group meetings, with Members noting that it was a useful opportunity to debunk myths and challenge certain taken-for-granted understandings of the political economy. The Group reflected that the R&D sessions did not cover the demand side of R&D and innovation, and this needs to be raised more clearly within the output.

There was a discussion prompted by the reflection that other working groups had more specific policy statements and asks – this working group has so far not presented specific recommendations on policy levers, but this may be in part due to the complexity of the innovation process and a lack of data compared to research areas like education. The Academy team noted that officials have given very positive feedback on the day, and that HM Treasury (HMT) and the Department for Business & Trade (DBT) are circulating and engaging with the discussion papers. The Academy team also noted that each Working Group had given varying levels of policy recommendations and insights in their papers and this was part of the appeal across the groups for officials, so we should not try to over-engineer a specific set of recommendations simply for uniformity.

5.1 **Output feedback**

Strategic advantage and architectures of coordination

There was a shared view that the output is currently too user focused. Instead, the output could showcase that innovation policy is not just about supporting the private sector, but about enabling adoption and diffusion across society to meet social and economic needs. The UK has specific strengths that make it a good test-bed for innovation. The UK has been a home/vehicle for firms to do R&D, and while this is less appealing since Brexit, there is a possibility to sell the unique features of the UK and comparative advantages that still make it an appealing place for new entrants, including that: the UK population is good at adoption, it is still a good bridge into the EU, it has a diverse, tolerant and highly skilled population, and a regulatory environment that supports competition and consumers, rather than producers.

There are also elements of existing funding structures and architecture that are working well for the R&D and innovation ecosystem. In terms of the R&D system, there is good news to flag. The UK Business Enterprise R&D (BERD) survey shows that UK business expenditure on R&D is up from £19.9 billion to 2014 to £49.9 billion in 2022.[1] At the same time, "in constant prices (adjusted for inflation), total civil net expenditure on R&D and knowledge transfer activities increased by 32.6% over the long term, from £10.4 billion in 2011 to £13.7 billion in 2022".[2] This demonstrates that public investment has 'crowded in' private investment into the UK system.

The Group noted that openness is an important strength of the current UK research ecosystem – in comparison to many of our nearest neighbours in Europe, the UK research system has a huge benefit in being able to pull in skilled, international researchers: 18% of UK academics are EU nations and 30% of all UK academics are foreign-born. They are great contributors to the UK science system and studies indicate that UK nationals benefit from spending part of the careers abroad, as this enhances their national and international engagement with non-academic actors. The UK's openness allows us to gain knowledge and skilled labour which benefits our science system and wider economy, providing a culmination of skills and experience, which creates the opportunity to create capabilities.

Social contracts

There is more to say on the direction of innovation in the output, including cross-sector collaboration needed to create directionality – at the moment implicit but needs to be brought to the fore. Framing the paper by looking at both the demand side as well as the supply chain issues, and highlighting that R&D and innovation supports social and economic needs, provides an alternative justification for investing in the science base without getting into the trap of 'divide and rule' approaches to spending or concentrating on the valley of death. Instead, it tells a story of national comparative advantage underpinned by a social contract and justifications for investment which links to other working group discussions across the Economic Strategy programme.

Members noted that there is an opportunity to present the rationale for R&D spend in a more compelling way than conventional arguments. For example, we could focus on societal need and how R&D can make this happen – there are better reasons for doing R&D than are commonly presented by the science base. The main point here is that we need to move away from conventional arguments about economic growth and the link to R&D. R&D and innovation should not just be about producing more and more stuff; neither should economic growth.

One way the paper could do this is to outline what has happened in science/industrial policy over the last 40 years or so – people interested in policy will have a core story of what has happened, but we need to look at what science policy has actually been (for example, the importance of Foreign Direct Investment (FDI)). This paper can be ambitious in reflecting on the collective knowledge of the Group. David Edgerton has sent specific comments on this point so we reflect this arc of history.

Regional architecture

The paper needs to do more to draw out the differences between global, national, and regional innovation policy contexts (and the different approaches in these different contexts). Many of the issues associated with R&D and innovation policy are broadly out of the government's control, so distinctions need to be made between different geographies and how these differences shift policy questions and needs.

Members noted that at a regional level, Mayoral Combined Authority (MCA) level 4 trailblazer deals include R&D and innovation, with plans to further devolve power over skills. The trailblazer deals that MCA are putting together are asking for single, long-term budget settlements, which means regions are going to be a test bed for innovation, including policy innovation – from creative industries to intelligent transport and green ports. We are also starting to see money devolved out of UKRI and FDI is chasing devolution. The benefits of devolution goes back to what we want to get out of R&D, and provide an opportunity to think through R&D and innovation in a more concrete and targeted way.

Alongside regional and devolution innovation policy, the Group discussed current interest in pan-regional approaches. Though MCAs may be too small to coordinate some forms of policy, a pan-regional body (at the level of the North) may be able to coordinate more funding. While the White Rose Pact and the West Midlands and Manchester combined authorities' Memorandum of Understanding highlight examples of pan-regional activity, MCAs are still competing for R&D finance. How this competition element interacts with pan-regional agreements has not yet been thought through.

Capability development

The Group discussed lessons that may be learnt from the devolution and subsequent re-centralisation of health policy. The Group agreed that people and capacity are a vital part of

approaches to devolution – there is a need to back-fill people and skills (including getting civil servants and R&D out of London), otherwise there is a risk that consultants quickly suck up budgets. However, building appropriate innovation policy capacity in new devolved entities poses a challenge for the UK – most countries have strong regional/local innovation activities due to federal structures and a local set of skilled policymakers and actors. This issue can be chicken-and-egg, and there should be an opportunity to experiment, so starting small and building capacity, institutions, evaluation processes, etc. We should note, though, that there is often push-back on trial-and-error approaches because they are expensive.

Other coordinating bodies may offer lessons to learn. The Department for Science, Innovation & Technology could see itself as an enabler of mutual learning between local actors, such as the Directorate-General Research of the European Commission tried to do through its Mutual Learning instrument. Members noted that there can be challenges related to institutions where minor changes to institutional structures can have big effects; ARIA for example may not have an impact, but it has affected UKRI.

Talent as well as technology

This paper could do more to draw out the skills and talent side of research and innovation investment. Research investment is an investment in developing highly skilled people that assume various roles in society. The talent is not just a technology and the benefits of those people and skills to wider society. This also impacts view of R&D and innovation – not only non-linear, but also rooted in an understanding that outputs depend entirely on the people working with technologies (and their capabilities). The paper could build a stronger element on education, including lifelong learning, building capabilities to make the most of new technologies, breadth of education. This is also linked to thinking beyond GDP and high living standards as markers of successful outcomes.

Diffusion and innovation

There is an issue with the conflation of innovation with successful diffusion (within the document and more broadly across current discourse on innovation). While innovation and diffusion are connected, they are not the same thing, and the standard definition that innovation is equivalent to successful diffusion/commercialisation hides important components to fully understanding innovation and the policies that support it. There are clear, analytical distinctions between R&D, innovation and diffusion which are important to be clear about

5.2 Policy impacts and opportunities

The Academy team noted that officials at HMT and DBT are enthusiastically reading the conference materials, and that we've been asked to flag if there are likely to be significant changes to the working group discussion paper. The Academy is currently deciding how to feed into the Industrial Strategy, as well as other areas of policy, such as the Economic Diplomacy Review, R&D mission boards and Skills England. The Academy team are very happy to hear from Members about areas of policy they may effectively feed messages from working group discussions and the final output into.

Resource List

Innovation policy (and gaps)

Bloom, N., Van Reenan, J., and Williams, H. (2019) 'A Toolkit of Policies to Promote Innovation', *Journal of Economic Perspectives*, 33 (3), pp 163-84. [April 2024]

Jansen, A., and Breznitz, D. (2024) 'Effectively financing private sector innovation? Toward a conceptual policy framework', *Science and Public Policy* (00) pp.1-13. [PDF in sharepoint folder]

Business investment

Brandily, P., Distefano, M., Shah, K., Thwaites, G., and Valero, A. (2023), 'Beyond Boosterism: Realigning the policy ecosystem to unleash private investment for sustainable growth', *The Economy 2030 Inquiry,* Resolution Foundation [April 2024]

Universities

GovGrant (2021), 'The University Spinout Report 2021: which UK universities top the rankings for turning innovation into commercial success', *Source Advisors* [April 2024]

Regional innovation

Breznitz, D. (2021), 'Looking for Better Options: The science of innovation policies and agencies in a globally fragmented world', *Innovation in Real Places: Strategies for prosperity in an unforgiving world*, Oxford Academic, pp.116-136. [PDF in sharepoint folder]

Institutions

Valero, A., and van Ark, B. (2023) 'A new UK policy institution for growth and productivity – a blueprint', *Productivity Insights Paper* (027), The Productivity Institute [April 2024]

Informing a strategic approach to growth

Curran, B., Martin, R., Muller, S., Nguyen-Tien, V., Oliveira-Cunha, J., Serin, E., Shah, A., Valero, A., and Verhoeven, D. (2022) 'Growing Clean: Identifying and investing in sustainable growth opportunities across the UK', *The Economy 2030 Inquiry*, Resolution Foundation [April 2024]

De Lyon, J., Martin, R., Oliveira-Cunha, J., Shah, A., Shah, K., Thwaites, G and Valero, A. (2022), 'Enduring Strengths: Analysing the UK's current and potential economic strengths, and what they mean for its economic strategy, at the start of the divisive decade', *The Economy 2030 Inquiry,* Resolution Foundation [April 2024]

Edgerton, D. (2023), 'Industry strategy or foundational economy approach?', *Progressive Review* (30) 3, pp.208-213 [April 2024]

Learning from the past

Edgerton, D. (2017), 'The Political Economy of Science: Prospects and retrospects', *The Routledge Handbook of the Political Economy of Science*, eds Tyfield, D., Lave, R., Randalls, S., Thorpe, C. pp.21-31. [PDF in sharepoint folder]

---. (2019), 'What has British science policy really been?', *Lessons from the History of UK Science Policy*, eds Flanagan, K., Clarke, S., Agar, J., Edgerton, D., and Craig, C. pp.31-39. [PDF in sharepoint folder]

Edgerton, D. and Pickstone, J. (2020) 'The United Kingdom', *The Cambridge History of Science*, eds Slotten, H., Numbers, R., Livingstone, D. pp.151-191. [[PDF in sharepoint folder]

Kesley, T. (2023), 'The Retreat from "High Technology" in Post-War Britain', *The English Historical Review*, cead183, [April 2024]

Growth and skills

Costa, R., Liu, Z., McNally, S., Murphy, L., Pissarides, C., Rohenkohl, B., Valero, A., and Ventura, G. (2023) 'Learning to Grow: How to situate a skills strategy in an economic strategy', *The Economy 2030 Inquiry*, Resolution Foundation, [April 2024]

Growth and Net Zero

Valero, A. (2024) 'Mais lecture – a serious approach for sustainable and inclusive growth', *LSE Economy and Society* [April 2024]

Van Reenen, J. (2023) 'Embedding green industrial policy in a growth strategy for the UK', *Progressive Review* (30)3, pp.175-183. [April 2024]

Zenghelis, D., Serin, E., Stern, N., Valero, A., Van Reenen, J., and Ward, B. (2024), *Boosting growth and productivity in the United Kingdom through investments in the sustainable economy*, Grantham Research Institute [April 2024]

Zenghelis, D., and Valero, A. (2024) *Sustainable investment is good macroeconomics and fiscally prudent for the UK*, Grantham Research Institute [April 2024]