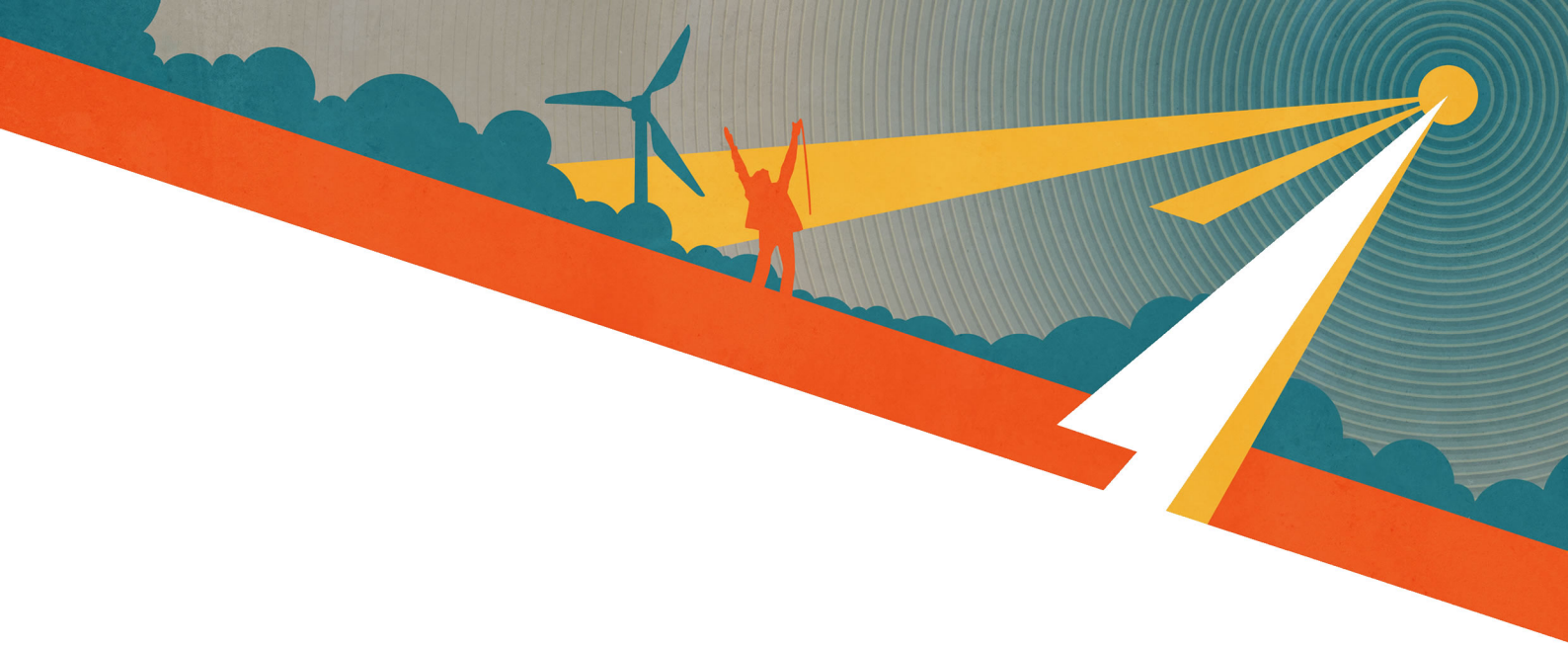

Innovation in the public sector: from static and subscale to dynamic and bold

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Rethinking Public & Private Risks and Rewards

About

This is one of a series of policy briefs and papers produced to inform discussion at the *Mission-Oriented Finance for Innovation Conference: Rethinking Public & Private Risks and Rewards* (London, 22-24 July 2014).

The role of the state in modern capitalism has gone beyond fixing 'market failures'. Those regions and countries that have succeeded in achieving 'smart' innovation-led growth have benefited from long-term visionary 'mission-oriented' policies — from 'putting a man on the moon' to tackling societal challenges such as climate change and the well-being of an ageing population. In addressing these missions, public sector agencies have led the way, investing along the entire innovation chain and courageously defining new high-risk directions. Traditional cost-benefit analysis and market failure justifications would have halted these investments from the start. No internet, no biotech, no nanotech. And today no clean-tech.

To fulfil this mission-oriented function, state agencies — from DARPA in the US to Brazil's BNDES and the China Development Bank — have been willing to welcome failure and tackle extreme uncertainty. How do they do it? What are the challenges ahead? Should government step back, or step up? And how can we socialize both risks and rewards so that economic growth is not only 'smart' but also 'inclusive'?

Such investments would not lead to commercialization without a private sector that is able and willing to engage along the innovation chain. Is financialization putting such engagement under threat? If so, how can innovation policy also promote de-financialization?

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Innovation and the public sector: from static and subscale to dynamic and bold

Tera Allas

Abstract

Knowledge based economies' future prosperity depends on vibrant innovation. Yet the UK's overall innovation performance is worryingly mediocre. Some of this can be attributed to the private sector. However, the public sector has a critical role in enabling, encouraging and actively leading innovation. The UK government could do a lot better in this respect by being bolder, more coherent, more strategic and more dynamic. Part of the current ineffectiveness can be traced back to the limitations of the "market failure" framework – or more precisely, to how it is applied in practice. To genuinely improve economic prospects, a fundamental shift in governments' approach to innovation is required.

The author

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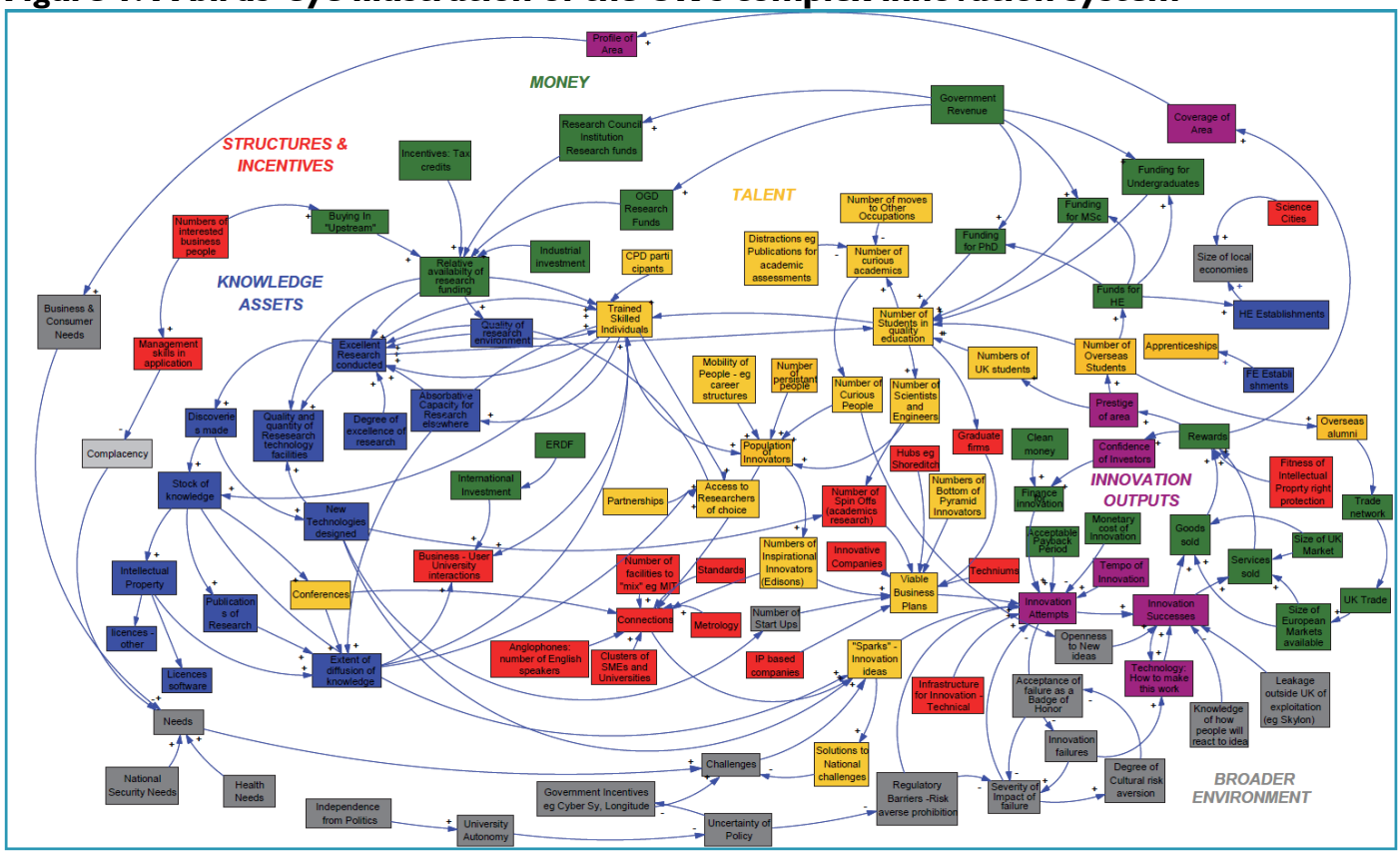
1. Introduction

Innovation is at the heart of economic growth and prosperity. Productivity growth depends crucially on new and creative ways of combining the – increasingly scarce or expensive – resources available[1]. Moreover, most developed economies' performance relies disproportionately on sectors that are research and innovation intensive[2].

However, the UK's innovation performance is only mediocre and worryingly static. There is no one cause for this: innovation outcomes are the result of complex and interconnected systems that incorporate investment, human capital, institutional structures, market and policy incentives, and the broader business and regulatory environment[3] (Figure 1).

In order to enhance prospects for the future, it is therefore necessary to think about all aspects of the system. This paper focuses on the role of the public sector and the way in which the government's approach shapes innovation outcomes. Although the examples are drawn primarily from the UK, the broad evidence is applicable internationally.

Figure 1: A birds-eye illustration of the UK's complex innovation system



Note: The intention of this figure is *to illustrate the complexity and interconnected nature* of the system, not to shed light on the individual elements. For a full-sized version, please see link[4].
Source: BIS (2014)

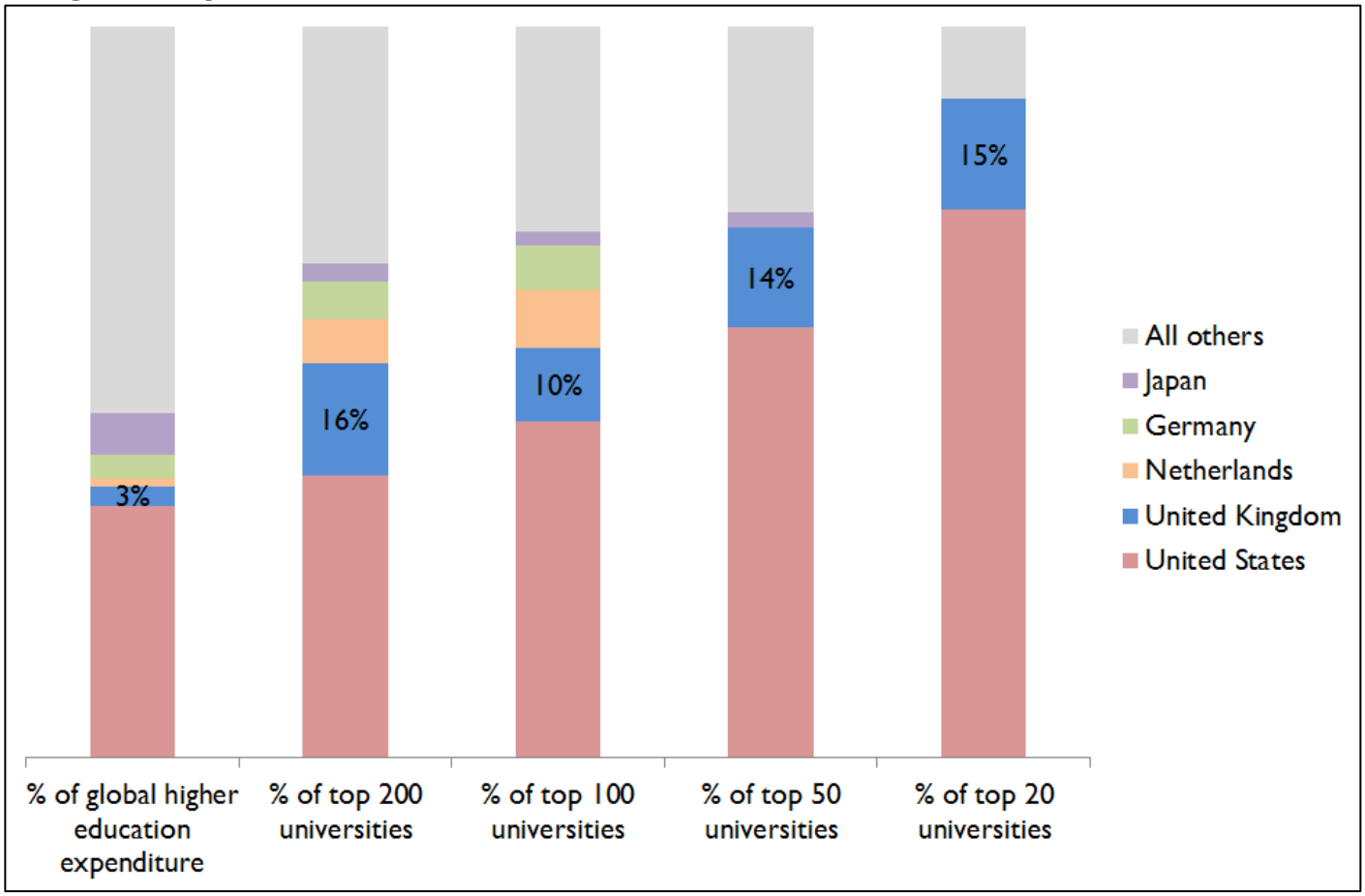
[1] BIS (2011); Hodges (2010); Criscuolo (2009)
[2] See for example page 10, BIS (2014)
[3] Freeman (1995)
[4] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/277044/science-and-innovation-systems-map.jpg

2. The UK's overall innovation performance is worryingly mediocre

The received wisdom about the UK's innovation performance is that it is good at generating world-class knowledge but poor at commercialising it. While this is inevitably a huge generalisation, the recent detailed benchmarking exercise by the Department for Business, Innovation and Skills broadly supports this view[5].

Indeed, the UK benefits from some impressive world-class assets. Even though its share of global expenditure on higher education is less than 3%, it is home to 10 of the world's top 100 universities (Figure 2). Its academic research productivity is second to none: with only 3% of the world's research expenditure, the UK generates 6% of global journal articles, 11% of citations, and 15% of the world's most highly-cited articles[6]. After Israel and Ireland, the UK attracts the highest proportion of foreign funding for its business sector R&D[7]. On some measures, the UK also exhibits vibrant entrepreneurial activity[8].

Figure 2: Selected countries' share of global expenditure on higher education in 2010 and global top universities in 2013-14



Source: Times (2013); higher education expenditure estimated from OECD, World Bank and UNESCO data

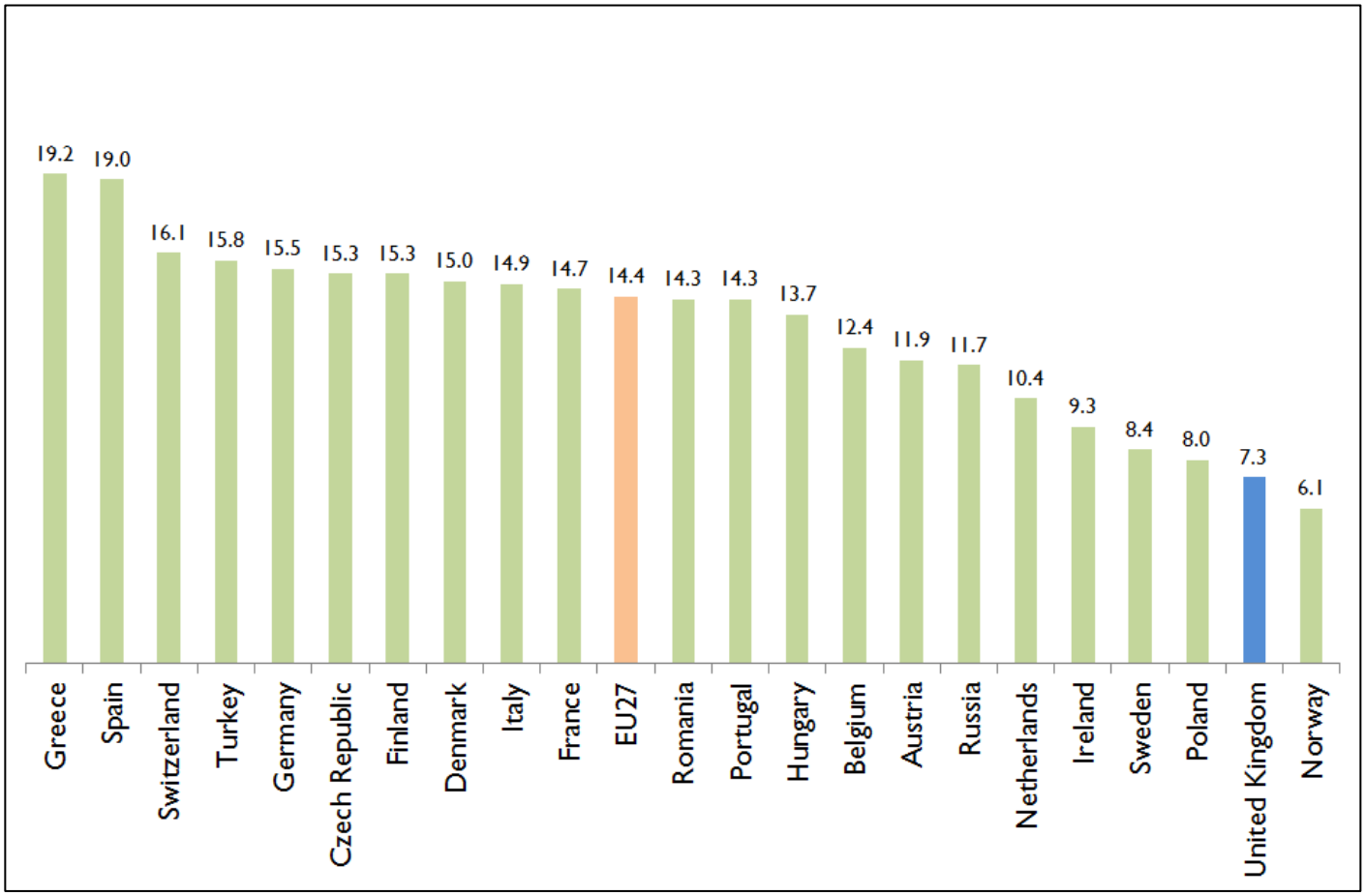
[5] BIS (2014); for a summary table of strengths and weaknesses, see Table 1 on page 7 of the main document
[6] Elsevier (2013); note that some commentators think this position is vulnerable due to its relatively concentrated nature (as opposed to a more distributed set of centres of excellence)
[7] In 2010, funding from abroad accounted for 22% of business enterprise R&D in the UK, while the average for the EU28 was 10%; OECD (2013)
[8] See for example page 88, BIS (2014b), and World Bank (2014)

However, set against these considerable strengths are concerning and apparently pervasive weaknesses. At the level of the overall economy, the UK's comparatively poor productivity performance is well documented[9] and the UK's share of global exports has fallen steadily over time[10]. The financial crisis and the resulting poor credit conditions have exacerbated this by slowing the reallocation of capital to more productive firms[11].

Moreover, the underlying dynamism of the UK's firm population is questionable on a number of fronts. For example, only around 20% of small and medium sized enterprises (SMEs) have significant ambitions to grow[12]; fewer than one in 5 SMEs engage in exports (as compared to one in 4 among EU countries on average)[13]; and an even smaller proportion of entrepreneurs are internationally oriented[14].

Most worrying of all, UK firms are simply not very innovative: innovations account for only 7% of UK firms' turnover – half that of the average for all EU countries (Figure 3).

Figure 3: Percentage of businesses' turnover derived from new to market and new to firm innovations in 2010 – selected countries



Source: European Commission (2014)

[9] See for example ONS (2014)
[10] CBI (2013)
[11] Barnett et al (2014)
[12] BIS (2013); BIS (2013b)
[13] CBI (2011); BIS (2013)
[14] In 2013, 17% of UK entrepreneurs indicated that at least 25% of their customers were from other countries; the equivalent figure for the OECD average was also 17%; Global Entrepreneurship Monitor (2014)

While available evidence on firm-level innovation is highly imperfect, from what we know, it appears that there is an element of polarisation into a relatively small number of competitive, innovation intensive and often export-oriented businesses; and less aspiring, more static, often domestically oriented firms. The aggregate effect is a lack of dynamism – and arguably resilience – in the UK economy.

3. Aspects of the disappointing performance can be attributed to the private sector

Of course, the UK corporate sector exhibits many enviable strengths. For example, it ranks 9th in the world on business sophistication, is known for strong creative skills, marketing flair and value added services[15] and is able to attract talent globally. Paradoxically, these might sound like precisely the kinds of attributes that are conducive to innovation. And they are – but it takes more than this to create and capture economic value.

The main element missing (at least in the context of this short paper) can be summarised as a significant under-investment in innovative, growth-generating activities; driven partly by availability of finance. Compared to an EU27 average of 53%, only 45% of UK businesses record innovation activity[16]. The vast majority of this consists of acquisition of computer software and hardware; fewer than 15% say they engage in any other type of innovation[17].

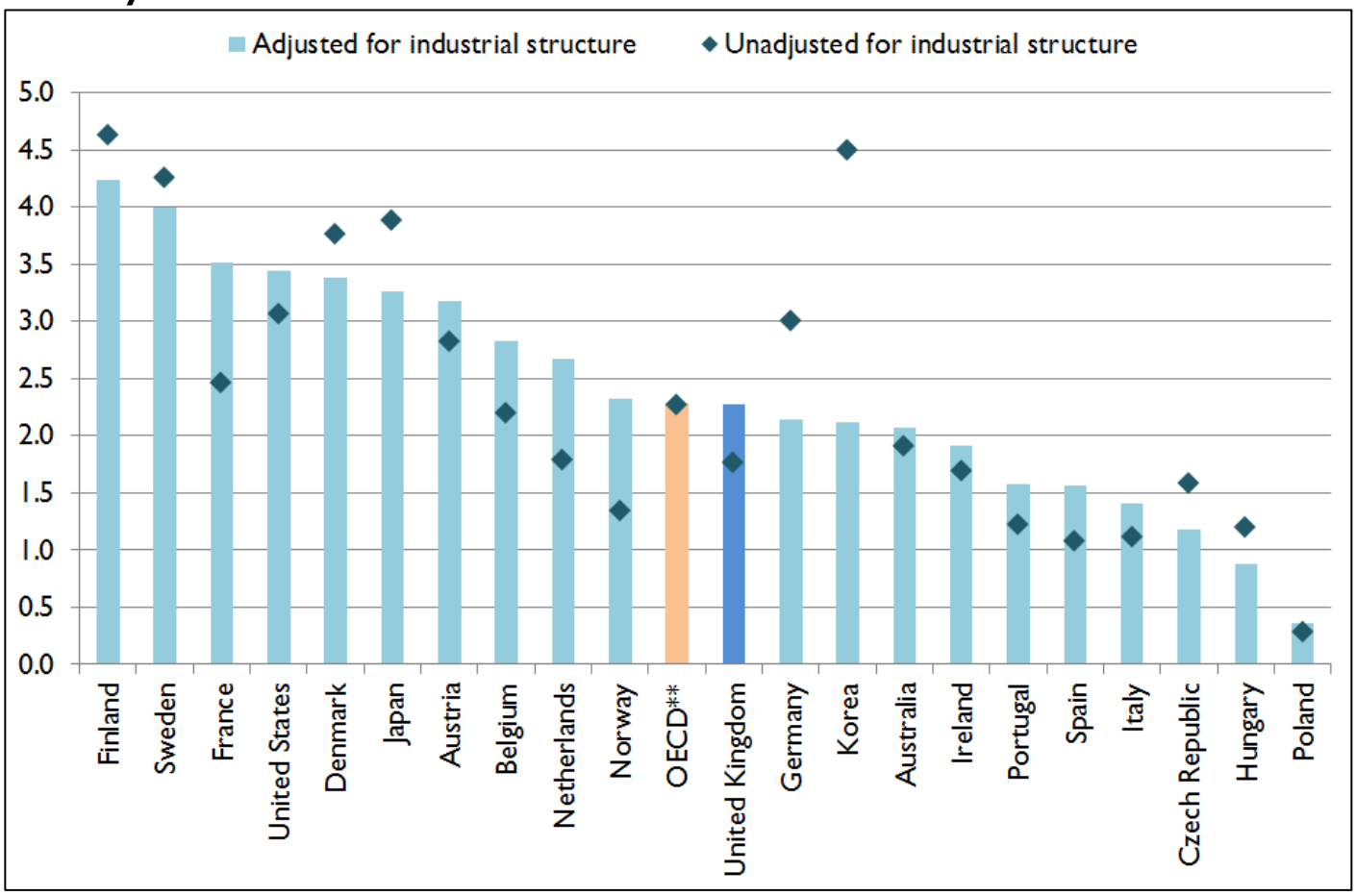
The under-investment applies in particular to internal and external R&D, acquisition of external knowledge and innovation-relevant training. For example, while 62% of the workforce received and 66% of employers provided training in 2013, the figures drop dramatically when health and safety, induction and IT training are excluded[18]. Training for innovative activities was provided by 14% of firms[19].

As for R&D, the UK picture is also one of significant under-performance. Arguably, the most important output from any particular firm's R&D expenditure is not new knowledge but absorptive capacity: the ability to exploit knowledge generated elsewhere[20]. Evidence shows that this has historically been a weak spot for the UK[21]. This might be expected, given the low levels of private sector R&D in the UK relative to leading innovation nations (Figure 4). Moreover, R&D is highly concentrated: out of a total of almost 5 million firms in the UK, the largest 50 spenders (0.001%) accounted for more than 50% of all business R&D in 2009[22].

So what are the causes of this pervasive under-investment? Contributory factors no doubt include low ambition[23], cognitive biases[24], and mediocre management practices[25]. For R&D, the investment levels are partly explained by the underlying sectoral structure of the UK economy (Figure 4). However, after adjusting for this, the UK's private sector expenditure on R&D is still only 2.3% of industry value added – the average of OECD countries, rather than leading the pack.

[15] World Economic Forum (2013)
[16] Eurostat (2013); BIS (2014c)
[17] BIS (2014c) Figure 1
[18] UKCES (2014); for types of training provided, see Figure 4.3
[19] BIS (2014c) Figure 1
[20] A good discussion of this is provided in Allott (2006); see also Griffith et al (2004) and Hughes et al (2012)
[21] Eaton et al (1999)
[22] Hughes et al (2012b)
[23] BIS (2013); BIS (2013b)
[24] Koller et al (2011)
[25] Bloom et al (2012)

Figure 4: Business R&D intensity* adjusted for underlying sectoral structure of the economy in 2010 – selected countries



Notes: * Business R&D intensity is business enterprise expenditure on R&D (BERD) as a percentage of value added in industry; industry excludes real estate; public administration and defence; social security and education; health and social work; and households; ** Average of 24 countries
Source: OECD (2013)

The final – and possibly the most consequential – underlying cause of low investment is the serious difficulty of obtaining finance for innovative growth. Larger firms with the internal cash flows to fund innovation appear poor at reallocating capital to growth businesses[26]; and the short-termism and risk-aversion of the financial markets leads to lower-than-optimal financing of innovative firms[27]. There is some evidence that the UK has a particular problem effectively financing the fast scale-up of emerging growth businesses[28].

The combination of lack of innovative firms, on one hand, and lack of appropriate finance for innovation, on the other[29], appear to result in a kind of "low innovation equilibrium": more finance could only be attracted if there were more investment opportunities; and more opportunities would likely emerge if finance was more accessible. Achieving higher levels of innovative activity is therefore going to require a

[26] Hall et al (2012)
[27] Kay (2012); Lee et al (2013)
[28] Lerner et al (2011); CBI (2011); note that this statement is relative to the US – the access to finance picture is more complex relative to, for example, other EU countries
[29] BVCA (2009)

holistic, system-wide view – and is likely to involve policy changes, funding and active leadership from the government[30].

4. The public sector's role is critical in enabling, encouraging and actively leading innovation

The private sector is always going to be central to innovation. But government policy has a substantial impact on the factors that make successful innovation either more or less likely. This can be thought of on four levels:

1. At the broadest level, government sets the taxation and corporate governance framework, planning regime and other regulations – such as antitrust and intellectual property protection – that govern private sector firms' behaviour and incentives.

2. Government is a major economic actor in its own right. For example, in the UK in 2012-13, government expenditure accounted for 43% GDP[31]. The way it goes about procurement and delivery therefore affects the system as a whole.

3. Many of the critical inputs into the innovation system – such as education and skills, scientific research and infrastructure – are partly or even predominantly funded by the government.

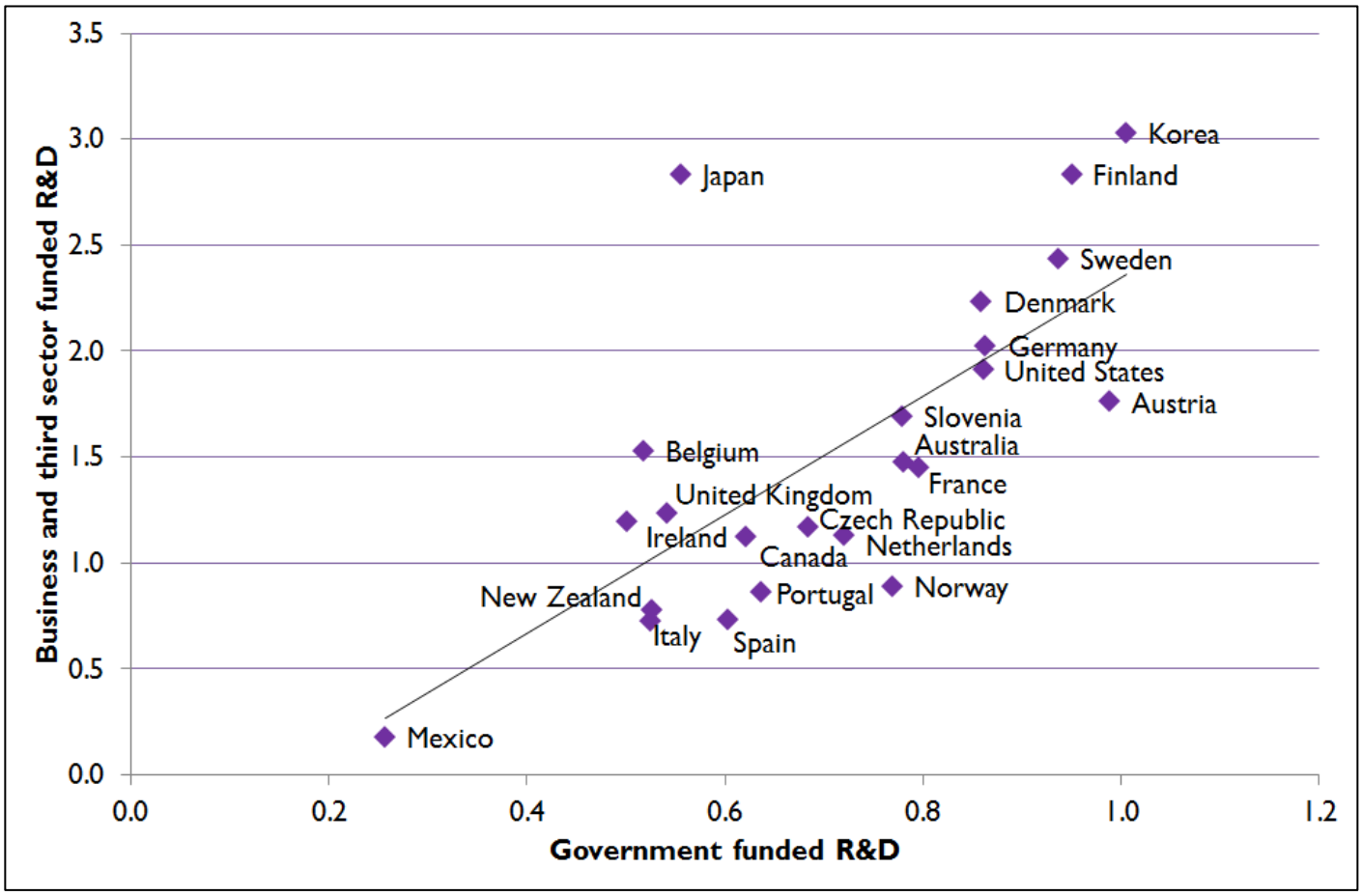
4. A vast array of policies – including standards, regional and local policy, export promotion, enterprise schemes and, indeed, innovation support[32] – are targeted at enhancing economic growth and as such directly impact on innovation.

Given the systems-nature of innovation, the private and public sectors have mutually reinforcing roles[33]. For example, it is likely that there is some causality, and not just correlation, between government and private sector expenditure on R&D[34] (Figure 5). This complicates decision making: it is no longer safe to assume that public expenditure exhibits diminishing returns[35].

Furthermore, the centrality of innovation to future productivity growth means that the policy aims of enhancing prosperity and growth quickly become synonymous with encouraging and rewarding innovation. It is therefore critical not to think of innovation policy narrowly but to think of innovation as a meta-strategy: how can everything the government does be harnessed to drive innovation?

[30] A full discussion is outside the scope of this paper, but critical elements of a system-wide view would include higher education, enterprise, industrial and trade and investment policy, as well as science and innovation.
[31] HM Treasury (2014); this has increased from a recent low of around 36% in 1999-00 and the current government projects this figure to come down to around 38% in 2018-19
[32] A comprehensive typology of innovation policy measures can be found In Table 1 in MIoIR (2013)
[33] BIS (2014)
[34] This argument is discussed in detail in BIS (2014b); see for example Box A in Annex D
[35] For an explanation on diminishing and increasing returns, and their significance, see footnote 45 in section 5

Figure 5: Public and private sector funded R&D as a percentage of GDP in 2011 – selected countries



Note: Business and third sector (private sector) funded R&D has been calculated as total expenditure on R&D minus government funded R&D; the figures are not adjusted for industrial structure
Source: BIS (2014)

Such explicitly interventionist, and ambitious, language often meets with strong resistance on at least three grounds: ideological, economic and pragmatic. Ideologically, commentators argue that the government should do the minimum possible and get out of the way of the private sector. Economic arguments centre on avoiding "picking winners" and the risk of displacing private sector activity. And, at a pragmatic level, many are critical of the government's track record in implementing "big" policy effectively.

All of these criticisms have merit. They also share a fundamental flaw: they ignore the fact that government already "intervenes" in a large number of ways. The starting point is not a clean sheet, but a plethora of existing activities. For example, it is estimated that the UK government spends around £12bn p.a. on growth initiatives[36]. As of July 2014, there were 809 business support schemes available in the UK[37]. The Technology Strategy Board (TSB), the UK's innovation agency, alone administers at least 15 different major programmes.

The real options, then, might be characterised as either to drop all these schemes and hence avoid "picking winners"; or to admit that the government has an active role in driving innovation and that it should do it

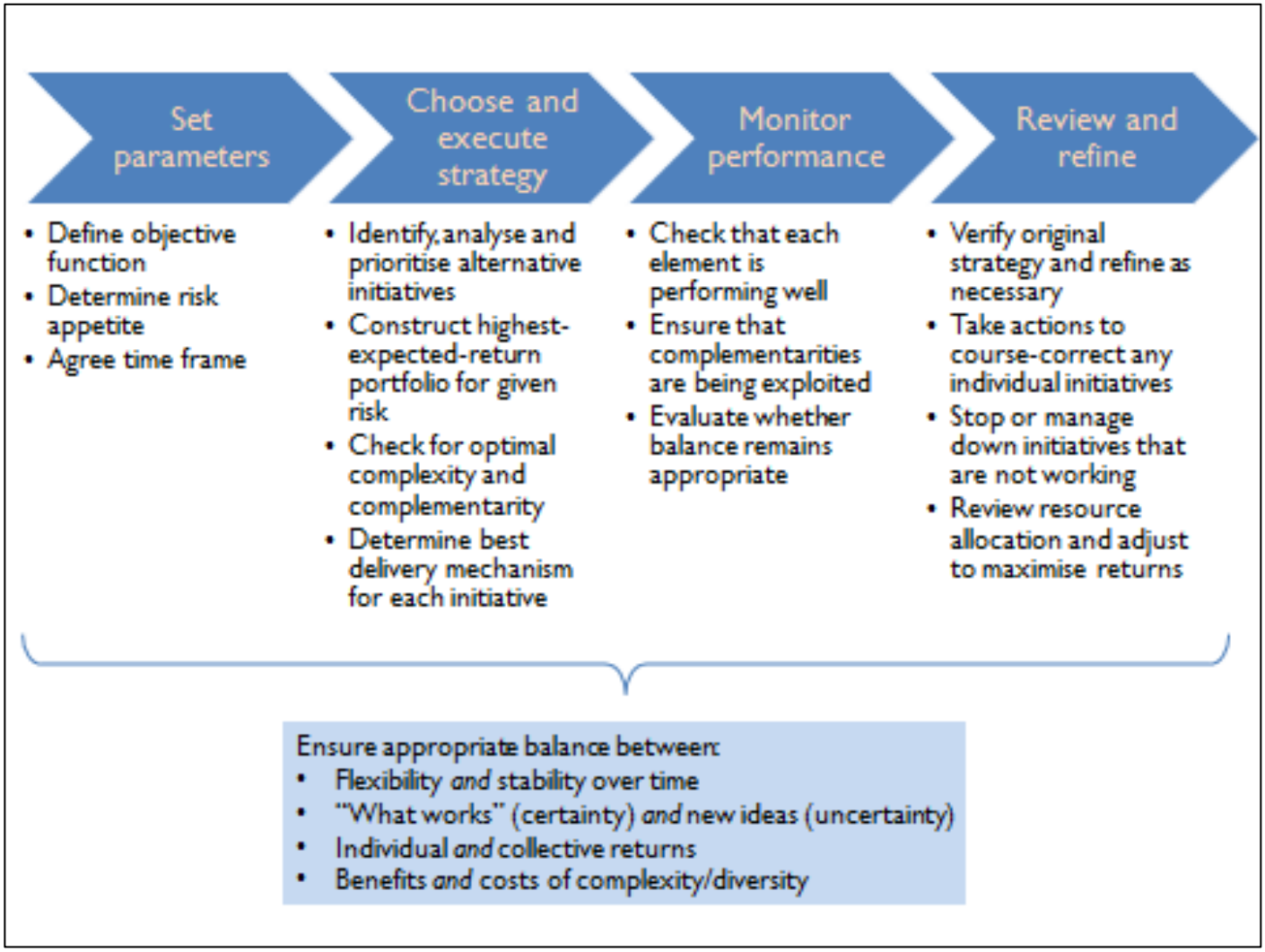
[36] Heseltine (2012); around £1bn is directly innovation related; £6bn is on skills and employment; and £5bn on infrastructure; note that these figures exclude Research Council and higher education funding
[37] https://www.gov.uk/business-finance-support-finder/search

as strategically and effectively as possible[38]. The latter inevitably involves some "picking" and, if this is the case, "picking winners" is surely better than "picking losers"[39].

5. The government's approach could be bolder, more coherent, more strategic and more dynamic

If one accepts the reality of government presence in innovation support, the question then becomes on one of "how": how to maximise the effectiveness of the effort and expenditure. The answer is no doubt not that different from how to run a successful enterprise – but recognising the breadth and complexity of this particular "enterprise" is key. It is therefore perhaps more appropriate to think of it as a portfolio of initiatives. Figure 6 shows some of the principles for managing dynamic portfolios effectively.

Figure 6: Principles for managing dynamic portfolios of initiatives effectively



In this context, the UK has recently been moving in a positive direction. There has been an attempt at greater alignment and prioritisation through the explicit choices made in the Industrial Strategy[40] and Eight

[38] This juxtaposition is intentionally an exaggeration. The point is merely that pretending not to intervene while doing so ineffectively is the worst of both worlds, especially in the presence of potential increasing returns. For an explanation on diminishing and increasing returns, and their significance, see footnote 45 in section 5.
[39] Admittedly, the language of "picking winners" or "picking losers" is unhelpful, but has been used here in the absence of a well-established alternative.
[40] See https://www.gov.uk/government/policies/using-industrial-strategy-to-help-the-uk-economy-and-business-compete-and-grow

Great Technologies[41]. More resources have been dedicated by universities, the Research Councils and the government to turning some of the UK's world class research into economic gains. The connectivity of the science and innovation system has been strengthened to improve the flow of knowledge, ideas and talent between the different key actors. And the delivery organisations have become increasingly professional, with the right technological as well as commercial capabilities.

However, the UK public sector's approach to innovation still suffers from a number of impediments – built up over several years, if not decades, of rather incremental and sometimes superficial policy practices. While there is no strong evidence that the existing portfolio is seriously out of balance[42], a comparison against "best practice" suggests a number of ways in which the UK could do better:

1. **More material**: Not only is the UK government's investment in innovation support lower than many other leading countries[43], it is also spread across 7 departments or delivery bodies and more than 30 major initiatives (Figure 7). As a result, specific initiatives are below efficient scale[44] and any increasing returns[45] – such as critical mass effects and cluster benefits – are not fully exploited.

   For example, in Germany, the network of Fraunhofer Institutes has an annual research budget of £1.7bn (€2.0bn) and 23,000 staff across 67 units[46], whereas the UK equivalent comprises 7 Catapult centres with an annual total budget of around £330m[47]. As a further example, the £3m per annum spent by the UK Centre for Defence Enterprise, however expertly managed, is unlikely to make a material difference to the UK's overall economic growth. Similarly, one has to wonder whether the fixed costs are outweighed by realised benefits for schemes such as TSB LaunchPad competitions which appear to be in the order of magnitude of £1m each.

[41] https://www.gov.uk/government/speeches/eight-great-technologies
[42] BIS (2014)
[43] BIS (2014)
[44] Mazzucato (2014)
[45] Arthur (1994); Increasing returns occur when the ratio of outputs to inputs increases as more inputs are utilised; it is in direct contrast to diminishing returns, the standard assumption in conventional economics. The terminology is often applied to economic returns, implying that the rate of return on an investment increases as its size increases. This can be due to, for example, economies of scale or network effects. Increasing returns are particularly prevalent for knowledge-based products, services, firms, markets and economies. For a simple description on why increasing returns alter the optimal portfolio composition, see Allas (2014).
[46] Fraunhofer Institute website at: http://www.fraunhofer.de/en/about-fraunhofer/facts-and-figures.html
[47] This has been estimated as follows: roughly 25% (£110m) the Technology Strategy Board £440m annual budget is for Catapults; and government support for Catapults is expected to comprise 1/3rd of their funding (the other 2/3rds coming from business and academia); their total budget is therefore expected to be £330m.

Figure 7: List of selected UK government innovation support schemes by department or delivery body

Department	Innovation support schemes
HM Treasury	Patent Box • R&D Tax Credits (Large and Small company schemes)
Department for Business, Innovation and Skills	*Technology Strategy Board:* Catalysts • Catapult centres • Collaborative R&D • Demonstrators • Eurostars • Feasibility studies • IC Tomorrow • Innovate UK • Innovation and Knowledge Centres • Innovation Platforms • Innovation Vouchers • Knolwedge Transfer Networks • Knowledge Transfer Partnerships • Launchpad • Missions • Small Business Research Initiative • Smart • *National Physical Laboratory:* Technology Innovation Fund
Department of Energy and Climate Change	Low Carbon Innovation funding • Office for Low Emission Vehicles (OLEV) • Energy Technologies Institute
Department of Health	Health Innovation Challenge Fund • Innovation, Excellence and Strategic Development Fund • *National Institute for Health Research:* Invention for Innovation (i4i) Programme
Ministry of Defence	Centre for Defence Enterprise • Defence Science & Technology Laboratory
Research Councils	Rainbow Seed Fund • Follow-On Fund • Funding for applied and collaborative research • Collaborative training
Other related initiatives	Devolved Administrations' schemes • Local schemes • University Enterprise Zones • Higher Education funding bodies' support (incl. Higher Education Innovation Funding, UK Research Partnership Investment Fund) • Government enterprise support schemes (e.g., Regional Growth Fund, Growth Accelerator, Manufacturing Advice Service) • UK Trade & Investment services (e.g., Export Marketing Research Scheme) • Various other departmental initiatives

Source: gov.uk; Witty (2013); Heseltine (2012); departmental websites

2. **More coherent**: It may well be that each of the schemes in Figure 7 is relatively effective in its own right. However, there are no systematic checks and balances against costly complexity[48]. Nor is there a mechanism for anyone to ensure that the initiatives form a coherent, mutually reinforcing portfolio. Indeed, anecdotal evidence suggests significant gaps, some overlaps, some inconsistency[49] and a lack of customer-oriented design. Most businesses are either not aware of, or are confused by, what is on offer[50].

   For example, it is not clear how firms funded by the Research Councils' Rainbow Seed Fund gain access to further support from the Technology Strategy Board; nor how firms funded by TSB benefit from enterprise support aimed at building their management and leadership capabilities, such as the Growth Accelerator. Yet, innovation agencies in some other countries are increasingly moving towards a "one-stop-shop" model, in recognition of the fact that funding for R&D or demonstration is only one of the many prerequisites for successful commercialisation and growth[51].

[48] For an excellent discussion of the hidden costs of complexity, see Simplicity (2011); the UK government's approach to managing innovation policy exhibits many of the costly behaviours on pages 18-19.
[49] For example, the definition of a "high growth company" varies from one scheme to the next.
[50] RBS (2013)
[51] Roine et al (2010); This more integrated and co-ordinated model of business support does require the "picking" of eligible firms, which are then offered the full menu of support – ranging from funding for R&D and innovation activities to mentoring, marketing and management skills, export support and personal links to potential customers and potential future funders. The co-ordinated nature of the support means that the likelihood that that a particular firm is successful (the main path towards jobs,

3. **More strategic:** The picture that emerges from the two points above is one of a set of policy initiatives that operate primarily on a "bottom up" basis. Each grant application or loan or service is assessed on its own merits, within the context of the specific scheme – whether it be Innovation Vouchers or Growth Accelerator or Manufacturing Advice Service. The same appears to be broadly speaking true for Research Councils' funding decisions. This clearly has some benefits, not least making the system potentially more diversified and responsive.

   However, there are many problems with a *purely* "bottom up" system of innovation support[52]. Fundamentally, it fails to take a forward-looking view and channel effort systematically into areas of the economic system that are most likely to need it. And it is susceptible to a lot of wasted effort, because it intentionally avoids making big choices at the national level. Yet, a more strategic, mission-oriented approach is much more likely to deliver transformative innovation in the longer term[53] and to set the right framework for more dynamic and proactive portfolio management. Clearly, a balance of more strategic "top down" and more organic "bottom up" is needed.

4. **More dynamic**: While commentators often complain about the frequent changes to the science and innovation policy landscape, one needs to distinguish between words and action. Yes, there has been on average at least one science and innovation strategy published every two years; and each Autumn Statement and Budget has contained related announcements. However, looking at the evolution of the landscape, many of these changes have been marginal; some even just re-naming or repackaging existing schemes[54]. The overall shape of funding allocations has remained essentially static (Figure 8).

   This may reflect the good returns from previous investments, the relatively well-functioning institutions involved in government support for research and innovation, or the genuine difficulty of making robust evidence-based trade-offs between different areas of support. But it may also be due to inertia or lack of ambition or courage to maximise expected returns from the overall science and innovation portfolio[55].

profits and economic growth) is maximised. This in turn provides better returns to *each* of the different support mechanisms as compared to a more fragmented approach.

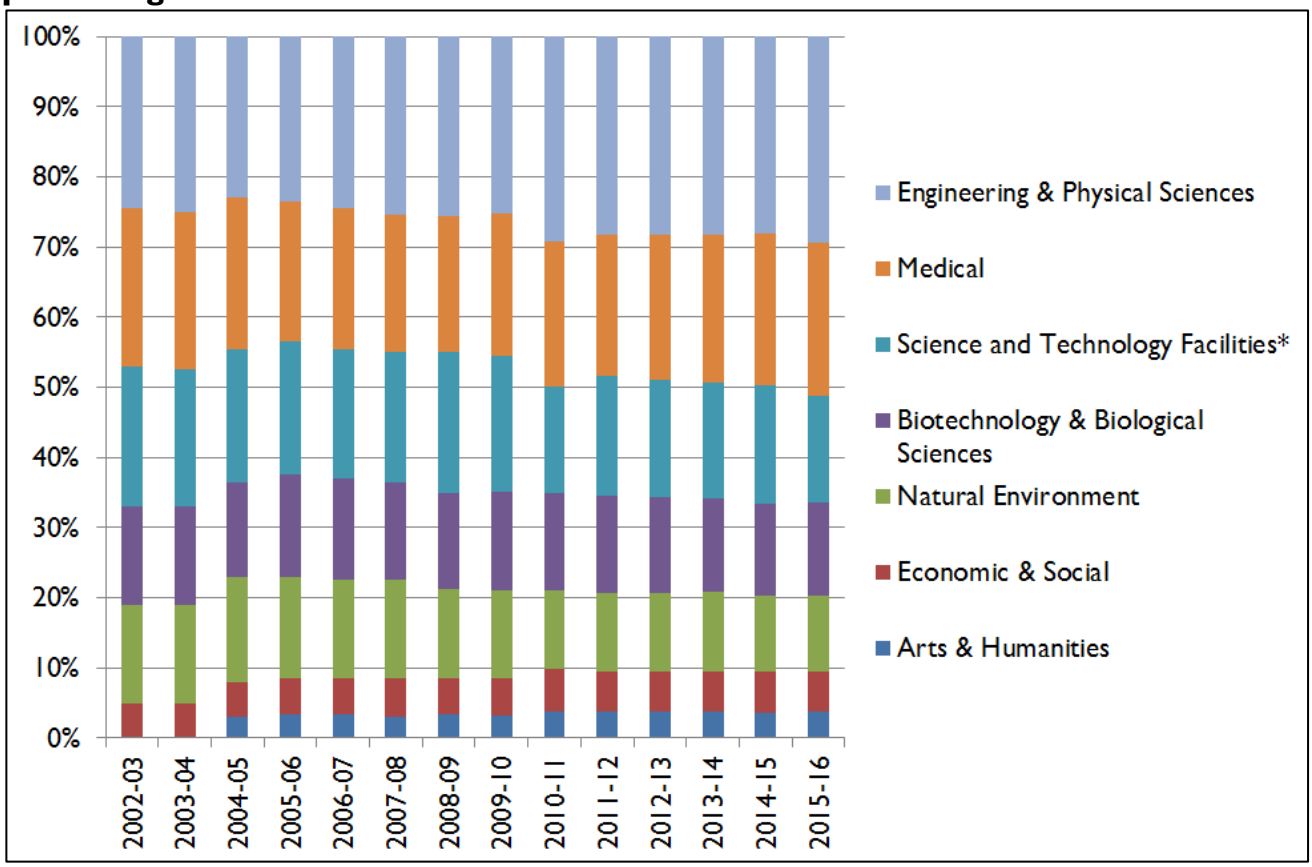
[52] As already discussed, it is highly unlikely to approximate optimum complementarity and complexity; and is likely to be subscale, failing to deliver material economic benefits in *any* particular area.

[53] Foray et al (2012); Mazzucato (2013)

[54] For example, the Catapult centres used to be called Technology Innovation Centres.

[55] Governments can also find it difficult to reallocate funding away from initiatives or projects when such a move might be seen as admitting to a "mistake" – i.e., that those initiatives or projects should not have been funded in the first place. The public or the media are often not receptive to the idea that, in a portfolio of initiatives, some are going to "fail" and that this does not constitute "failure" at the portfolio level. In fact, it is healthy, and over time allocations should change dynamically reflecting the best view of future returns.

Figure 8: Government resource funding allocations to Research Councils as a percentage of total from 2002-03 to 2015-16



Note: * For comparability, the figures include the STFC allocation that was reallocated to capital (from resource) in the 2010 Spending Review; does not include innovation funding due to data availability
Source: BIS (2010); STC (2010); BIS (2014d); BIS (2014e); Research Council Annual Reports

While some complexity is necessary to address the different areas of the system where government support is appropriate, the current approach adds up to a confusing, disjointed and often bureaucratic[56] picture for businesses.

6. The way the "market failure" framework is implemented limits the effectiveness of innovation policy

Since the shortcomings above are not new, it is instructive to look at the underlying causes that contribute to these problems. At a highest level, the fact that innovation policy is delivered through multiple departments and independent bodies (such as universities and Research Councils) without an explicit mechanism for forging alignment and ensuring coherence is clearly an issue. Moreover, the lack of robust and comparable monitoring and evaluation to identify "what works" means that the government doesn't have the tools to re-prioritise and improve the effectiveness of the portfolio over time.

However, there is one other driver that is particularly pervasive that leads to fragmentation, subscale decisions and static resource allocations: the "market failure" framework that underpins decisions about government interventions[57]. Very sensibly, the framework – outlined in the so called Green Book[58] – starts off by requiring policy makers to identify the rationale for any intervention[59]; and then goes through a

[56] Uyarra et al (2014)
[57] Mazzucato (2013)
[58] https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent
[59] Interventions here refer to both government expenditure and regulatory changes

series of tests to ensure the benefits of the intervention outweigh its costs. As taxpayers and citizens bearing the costs of policy changes, we should be pleased that these hurdles exist.

Indeed, theoretically the approach is fundamentally sound: the government should only intervene when it can make things better; and this tends to be when the outcomes delivered by free agents in the market are not in the interest of society as a whole. The default option – to "do nothing" – is borne out of decades of empirical observation that shows how difficult it is to withdraw something once it has been introduced[60]. Hence, making "type 2" errors seems worth it in order to avoid "type 1" errors that might then be a drag on resources for a long time[61].

However, there are real problems with how this "market failure" approach to policy making is framed and implemented in practice. These include the following issues which are discussed in more detail below:

A. **Unintended anchoring**: the pull of the "do nothing" default

B. **Unrealistic assumptions**: narrow theory vs. the real world

C. **Poor framing of options**: lack of portfolio analysis

A. Unintended anchoring: the pull of the "do nothing" default

In theory, the following two approaches should result in exactly the same decisions:

(a) Start by assuming you should do nothing, and then identify those things that are worth doing; OR

(b) Start by assuming you should do everything, and then identify those things that are not worth doing.

However, as is now well documented[62], the cognitive bias called "anchoring" means that most individuals and organisations will end up doing many fewer things under (a) than (b)[63].

Yet, we are not primarily concerned here about the government doing too few things: an uncoordinated plethora of interventions can be just as ineffective as doing nothing. Given the political imperative to show that some action is being taken about any perceived problems, such a bias may in fact be beneficial. What is concerning, though, is the pattern of subscale initiatives – a tendency that exists due to the anchoring pull of the "do nothing" default.

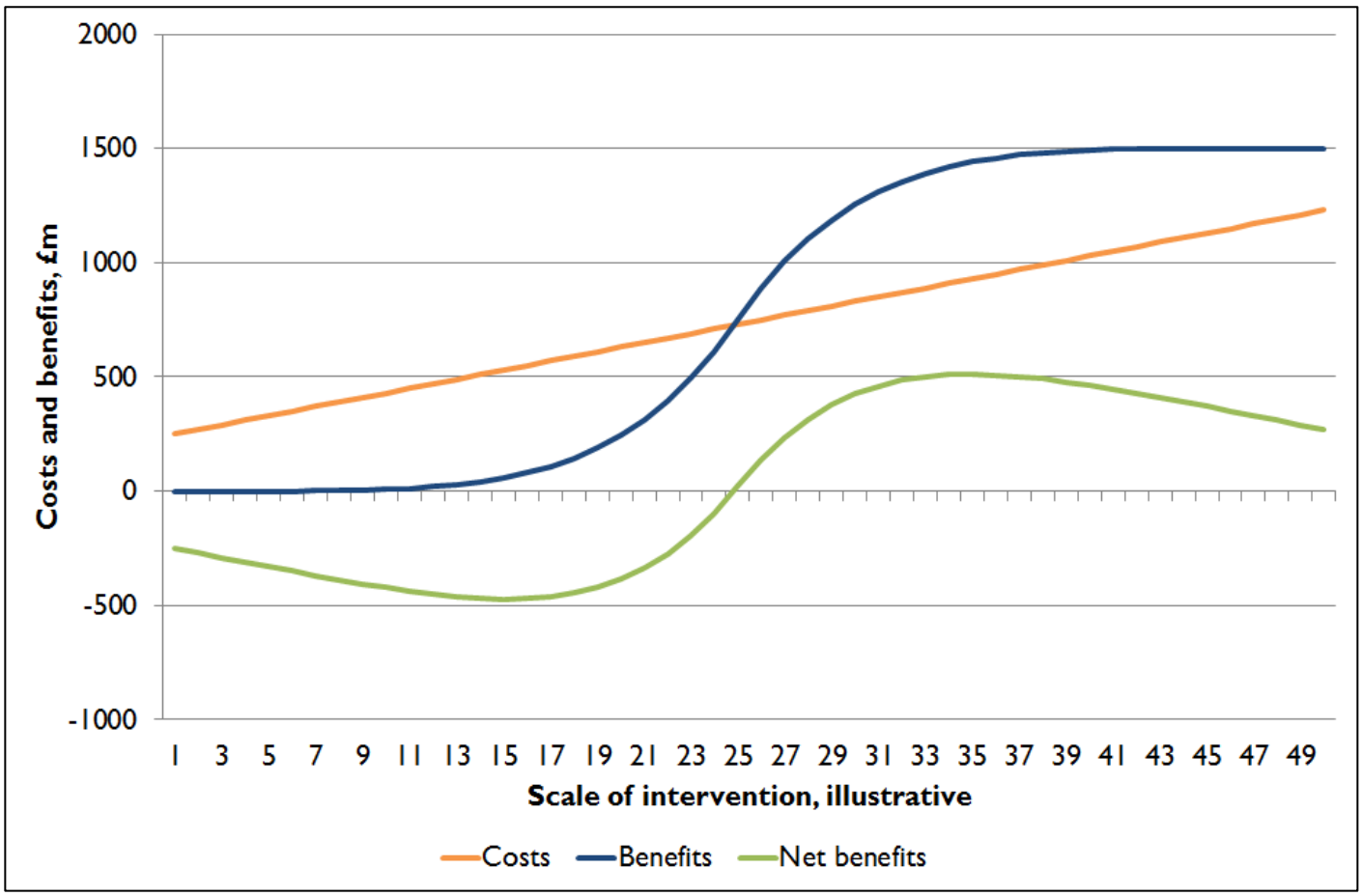
This is what too often happens. A minister wants to address a problem that has been identified (e.g., by stakeholders). Policy officials suggest that "doing nothing" should be the starting point – after all, there is no undisputed evidence of a market failure and budgets are tight. Moreover, other ministers may not see the initiative as priority, or may see it as risky, so gaining agreement may be difficult[64]. The minister still feels that action is preferable to inaction. In response, policy officials work up the best available option that is sufficiently innocuous to be deliverable. The subscale initiative is born.

It should be obvious that just because the *best* option might be to "do nothing", this doesn't mean that the *second best* option is to do as little as possible. There are often fixed costs that need to be covered which

[60] Another reason for the "do nothing" assumption is the government's poor track record in implementation
[61] In this case, a "type 1" error would be to intervene when the government shouldn't (e.g., where it is unnecessary or counterproductive); and a "type 2" error is not to intervene when the government should
[62] See for example Kahneman (2011)
[63] To arrive at something approaching the "correct answer", one should arguably do the analysis both ways
[64] It is these kinds of political constraints that are an additional cause of non-strategic, marginal initiatives. The government rarely has the degrees of freedom to be genuinely strategic and bold – but it should still try.

mean that initiatives have a minimum efficient scale. In fact, if there were no diminishing returns, there would be no optimum level of intervention: more would always be better. Figure 9 illustrates the most likely scenario: some fixed costs, some economies of scale and some diminishing returns. The common sense interpretation is this: *if* you have decided to do something, then you might as well do it properly.

Figure 9: Illustrative costs, benefits and net benefits of a government initiative as a function of scale



B. Unrealistic assumptions: narrow theory vs. the real world

The "market failure" framework states that the government should only intervene where the market on its own does not deliver the socially optimal outcome. However, there is a significant gulf between the (narrow neoclassical) "theory" and real-world "practice" of the underlying reasons for "market failures"[65]. The framework gives little guidance about how to deal with the latter – which in turn leads to inconsistent implementation and often poorly optimised interventions.

(a) The main "*theoretical*" reasons for market failures include: existence of public goods, positive or negative externalities, information asymmetry and market power.

(b) The main "*practical*" reasons for market failure include: coordination failures, search and transaction costs and cognitive biases (such as risk aversion or short-termism)

[65] For the purposes of this discussion, the words "theory" and "practice" are defined here in a very specific way: "theory" applies to the approach and assumptions taken in neoclassical economics; "practice" applies to the main patterns observed in "the real world" of business, innovation and policy making. The latter have also been covered in the "theoretical" systems literature (e.g., Freeman (1995)), so the distinction made here is not entirely accurate but reflects a pragmatic choice of terminology appropriate for this paper.

Even if the failures in category (a) above don't exist, it is highly unlikely that any market will deliver a socially optimal outcome: market failures of type (b) are everywhere – they are a fact of life. So what should policy makers do? Do type (b) failures warrant intervention? How should they be taken into account? Are they equally important as type (a) failures? Lack of agreed parameters on these questions lead to at least the following problems:

1. **Over-intervention**: If full attention is given to type (b) failures, *everything* becomes a target for government intervention. The check lists in the Green Book help weed out the worst ideas. However, unlike private sector decision making frameworks, government seems to lack (or fail to apply) one fundamental criterion: materiality. For example, out of the 133 measures[66] analysed in the 2014 Budget[67], a total of 4 had impacts larger than 0.1% of GDP by 2018-19[68]. This tendency – reinforced by the natural desire to shape policy based on stakeholders' representations – contributes to the fragmentation and subscale nature of the government's innovation policy.

2. **Ineffective intervention**: In situations where the "theoretical" market failures justify action, if the more "practical" issues are ignored, the scale and design of the intervention is highly unlikely to deliver socially optimal results. In other words, if the policy assumes perfect foresight, perfect rationality, no transaction costs and seamless coordination – on the basis that the government should try to minimise its involvement – the scope of the intervention is likely to be unrealistically small and any returns on tax payers' investment are likely to be lower than optimal.

   For example, while the government recently increased capital funding for science, it at the same time confirmed that the resource budget would remain flat in cash terms[69]. However, the UK already has one of the highest capital-to-resource funding ratios for R&D in the OECD[70] – so extra capital without the associated resource funding is likely to be sub-optimal[71]. The government also frequently under-invests in marketing (perhaps implicitly assuming perfect information and/or zero search costs): for example, in a survey of businesses' awareness of start-up support available from government, 40% of respondents had heard of *none* of the main 19 schemes[72].

3. **Inaccurate prioritisation**: Because the inclusion of the more "practical" market failure considerations is essentially arbitrary, there is a large element of randomness in the choice of interventions. Different departments apply different conventions, resulting in lack of comparability. While HM Treasury do scrutinise spending proposals for consistency, they also tend to focus on the "theoretical" market failures. For example, because the theory states that private sector businesses *should* find it profitable to invest in some innovation without government support, the conclusion is drawn that such support would not be good value-for-money. The correct approach would be to prioritise initiatives based on quantifying both the "theoretical" and "practical" failures that *actually* exist.

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[66] Table 2.1: Budget 2014 policy decisions and Table 2.2: Measures announced at Autumn Statement 2013 or earlier which take effect from April 2014 or later

[67] HM Treasury (2014b)

[68] GDP in 2018-19 has been assumed to be around £1760bn based on GDP of £1560bn in 2012 and OBR's growth projections for the following years. The cut-off of £1.8bn has therefore been used in this analysis. The impacts on public finances have been taken as a proxy of impact on the economy.

[69] HM Treasury (2013)

[70] See for example https://twitter.com/TeraPauliina/status/481361100781654016 based on UNESCO data

[71] Indeed, stakeholders have frequently called for higher complementary resource funding levels to ensure that the infrastructure delivered by capital investment is in fact well used and maintained.

[72] RBS (2013)

C. Poor framing of options: lack of portfolio analysis

The Green Book contains excellent guidance on ways in which options should be generated in order to consider portfolio benefits and to avoid fragmentation[73]. Unfortunately, in practice, policy and spending options are often framed in an incremental way, without much consideration of the whole system or the complementarities between different policies. There are, of course, practical reasons why every proposal cannot consider the entire universe of options available – but more weight should be given to portfolio effects[74].

The following three considerations in framing policy options are particularly important in order to ensure materiality, cohesion and dynamism – and are often ignored in practice:

1. **Optimise scale and scope**:

   (a) Compare any new schemes to the alternative of significantly scaling up or expanding the scope of existing initiatives – avoids fragmentation

   (b) Compare any initial options to ones that are several times larger in scale or scope – improves dynamism and allows increasing returns to be captured

   (c) Set a minimum materiality threshold (in terms of net economic benefit) for any new schemes or initiatives – avoids subscale initiatives

2. **Include all costs required for success:**

   (a) Explicitly include costs of complexity (e.g., costs for businesses to navigate the landscape) – improves coherence and avoids superficial policies

   (b) Design options such that all the costs and activities necessary to *deliver economic benefits* from the scheme are included – reduces wasted effort and resource

   – For example, to deliver material benefit from the Small Business Research Initiative, there must be a proportion of projects that lead to actual contracts – ideally ones that can be used by the business to both refine its product/service and to promote its credibility to third party customers

   – As another example, it may be necessary to allocate more funds towards awareness building or towards more "hands on" administration and support to businesses, to deliver benefits rather than just projects or schemes

3. **Make it work for real customers**:

   (a) Design options that explicitly take into account the time-poor, risk-averse and short-term nature of most businesses and the well-documented short-comings in many firms' vision setting and management capabilities[75] – improves materiality

[73] HM Treasury (2014); see page 17 onwards
[74] MIoIR (2013b)
[75] Bloom et al (2012); BIS (2013)

(b) Include options that minimise search, transaction and coordination costs and risks to the customers involved (despite costing more, this may well improve the cost-benefit ratio and overall net benefits of any scheme) – improves materiality

(c) In the longer-term, redesign the policy and delivery landscape from a customer perspective, removing discontinuities and bureaucracy, and building an explicitly complementarity portfolio of schemes – improves coherence and dynamism

While it is clear that not every grant, loan, guarantee, contract or project will lead to a successful economic outcome – and that they should be seen as part of a wider portfolio – much more could be done to maximise the chances.

7. A fundamental shift in governments' approach to innovation is required

Given the resources dedicated by governments to supporting innovation, they cannot afford to do it ineffectively. Governments need to think big in terms of scale and scope to stop effort on immaterial activities; prioritise much more ruthlessly to minimise costly complexity and ensure implementation effectiveness; have a clear strategy, with a portfolio of complementary initiatives, and co-ordinate across boundaries to capture increasing returns; take an end-to-end customer perspective to realise the actual economic benefits of any support schemes; and re-allocate more dynamically to optimise returns over time. ■

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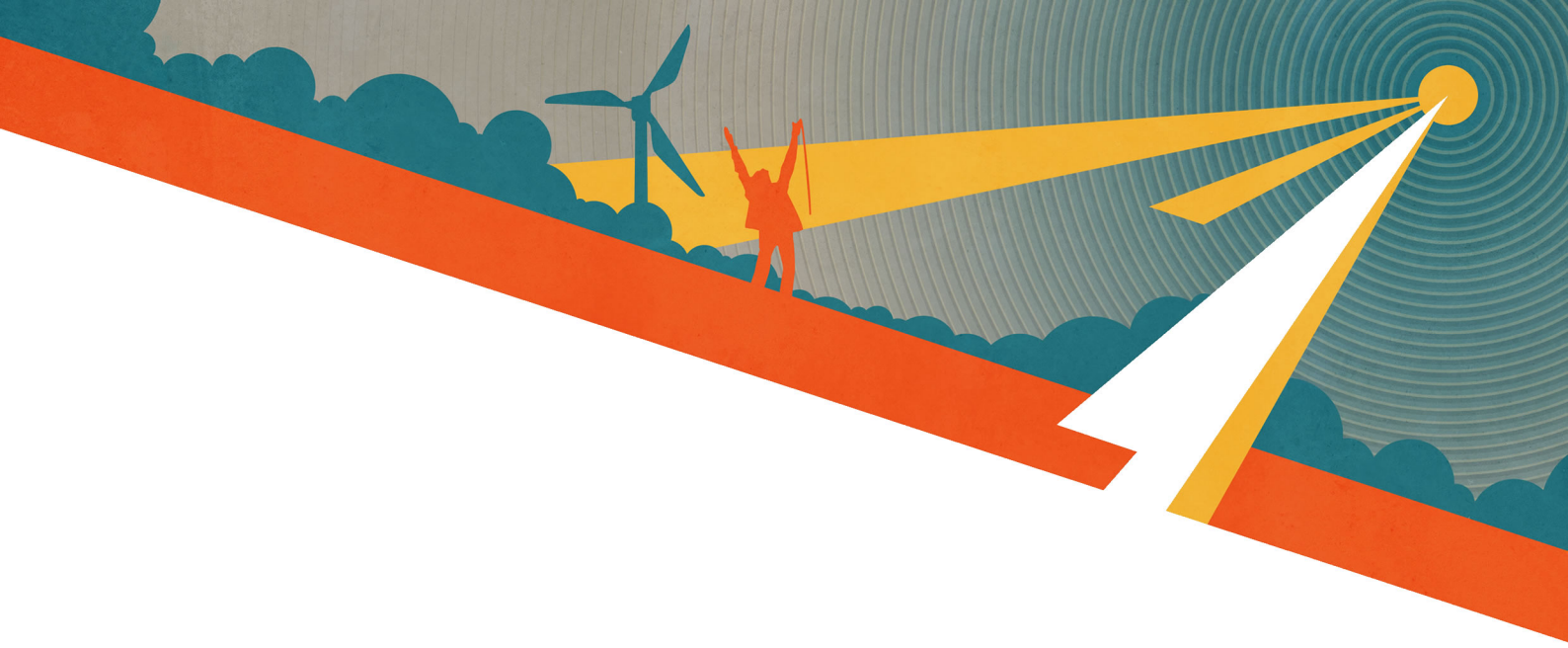

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