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Industrial strategy and the UK regions: sectorally narrow and spatially blind

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The UK government's new Industrial Strategy could have a significant impact on the country's regions and localities. However, this has received little attention to date. The analysis presented here examines the existing location of the sectors targeted by the first phase of the Industrial Strategy Challenge Fund and the location of the R&D laboratories likely to be first in line for funding. In focusing on an extremely narrow range of sectors, the Fund is likely to have limited impact on the UK's persistent regional inequalities. The activities eligible for support account for relatively little of manufacturing or the rest of the economy and the basis of this targeting and its potential distributional consequences are spatially blind. As such, it runs the risk of widening regional divides in prosperity.

Keywords: industrial strategy, manufacturing, employment, R&D, regions, UK

JEL classifications: L52, O25, O32, R11

Introduction

In line with many advanced industrial nations in responding to the challenges posed by “radical and disruptive technologies” (Bailey et al., 2019, 4), the UK government is currently pursuing a new direction in terms of its industrial strategy. This is also in part an overdue response to the recession that followed the 2008 financial crisis, which exposed the UK's reliance on financial and business services. It also aims to address the UK's relatively low level of productivity, seen as a significant contributing factor to the country's sluggish GDP growth (Haldane, 2017). In broader historical terms, it also represents an attempt to revive and modernise domestic manufacturing industry to try

and take advantage of what is being heralded as the ‘Fourth Industrial Revolution,’ “a fusion of technologies across the physical, digital, and biological spheres” (Schwab, 2017, 7). However, for the UK, this will require sustained efforts to overcome a long-term “chronic failure to invest in manufacturing” (Kitson and Michie, 2014, 1).

Indeed, over successive decades, the UK's industrial output has stagnated and its industrial employment has fallen, and to a far greater extent than in most other industrialised nations (Kitson and Michie, 2014; McCann, 2016). Thus, between 1973 and 2007, comparator nations such as France, Germany, Japan and the USA all had average annual growth rates for manufacturing output of above 2%, whereas

the UK's was 0.4% (Kitson and Michie, 2014, 14). The decline in industrial employment has been equally stark, in the UK falling by over 40% over the same period, whereas similar nations mostly experienced falls at less than half that rate (Kitson and Michie, 2014, 15). One consequence has been a vast trade deficit with the rest of the world, forcing the UK economy to become increasingly reliant on a debt-fuelled model of growth (Gamble, 2008). The contrast with Germany, where manufacturing's share of GDP is double that in the UK and where there is neither a trade deficit nor a budget deficit, could not be starker (Roper and Love, 2002; Vogel and Wagner, 2010). Another consequence has been the stagnation of productivity and real wages because manufacturing, rather than services, tends to offer greatest scope for technology to bring increases in output per head that underpin rising national living standards (Mazzucato, 2016).

The re-emergence of industrial policy as a key instrument in delivering macro- and micro-economic policy goals is reflected in support by the World Bank, European Commission and OECD as well as many leading economies (Barca, 2009; Hildreth and Bailey, 2014; Rodrik, 2004). To some extent, the UK is following this trend. Andreoni and Chang (2016) argue that it is inappropriate to see contemporary industrial policy as having either a sectoral or a horizontal focus. Rather, it represents a set of approaches which emphasise factors such as clear and sustained policy vision and commitment, the support to coordinate independent activities, the building of networks between economic agents and incentives to stimulate greater cooperation between hitherto competing firms. Public funding is important but is not the main necessary condition for industrial policies which seek to deliver higher levels of economic growth at a national level. Although contemporary industrial policy is seen by organisations such as the European Commission as being primarily a horizontal policy, as with nearly all such approaches, it will inevitably benefit some sectors

more than others and some places more than others.

This issue is addressed by the European Commission's Barca report (Barca, 2009) and its call for a place-based approach to cohesion policy, and explored in far more detail in Barca et al. (2012) and Hildreth and Bailey (2014). For these authors, place-based approaches meld traditional instruments of regional policy with the need to recognise and support local and regional institutions, capabilities and strengths. To a significant extent, this approach has been embedded in the 2014–20 European Structural and Investment Funds programmes as well as the policy perspectives of states such as Finland and Germany. The place-based approach goes further than analyses of the World Bank (see, for example, Stiglitz et al., 2013) which, while emphasising the national ingredients of industrial policy, do not consider regional policy components. More starkly, Faggio and Overman (2012) suggest that industrial policy should in fact be spatially blind, paying no heed to institutions, opportunities or needs at a local level.

Against this backdrop, this article explores the position and focus of the early phase of the UK's industrial strategy in relation to this question of geographical disparity. We do this through an assessment of the likely spatial implications of the first wave of the Industrial Strategy Challenge Fund (ISCF), and question whether its approach is sufficient to address the deep-seated regional economic imbalances in the UK (Martin et al., 2015). We recognise that the UK may represent an atypical case. On the one hand, it is a country which has an over-representation of the world's leading research, as demonstrated by successive international assessments (Elsevier, 2017). The UK also retains many highly innovative companies in both manufacturing and services. On the other hand, a series of spectres cast a shadow over the UK economy, including large regional variations in economic performance, a long tail of underperforming companies and the disproportionate size of the financial services sector

and its concentration in London. While the immediate and longer-term structural consequences of Brexit add a further complication to these issues, many of the imbalances will be familiar in other parts of the world, for example in eastern Europe. In other words, there are likely to be lessons and pointers from the UK experience for other countries.

The article is structured as follows. In the next section, we set out the UK's industrial strategy as articulated through the Green and White Papers, outline the focus of the first wave of the ISCF and provide an assessment of its aims and priorities against a series of criteria. These provide our conceptual framework for understanding different variants of industrial strategy. We then outline our methodology for our spatial analysis of the first round of the ISCF, but potentially for examining other industrial strategy instruments. The analysis of the ISCF's initial sectoral focus is then presented. Finally, in the conclusion and discussion, we assess the importance of assessing the likely regional and spatial implications of industrial strategy instruments, consider how this analysis may be developed in the future and suggest some alternatives for national industrial policy.

Understanding the UK's industrial strategy

The broad policy debate

Although the UK government never entirely abandoned its support for business and industry, its renewed interest in industrial policy has been widely welcomed, albeit not uncritically (Chapman and Hutton, 2017; Industrial Strategy Commission, 2017). This interest builds on earlier Coalition government policy statements such as the *Plan for Growth* (HM Treasury and Department for Business, Innovation and Skills, 2011) and the subsequent White Paper *Fixing the Foundations* (HM Treasury, 2015). But the big change in orientation, at least in terms of

political profile, came with the publication of a Green Paper and then a White Paper on industrial strategy (HM Government, 2017a, 2017b). Part of this involves a long-term goal of raising the nation's spending on research and development (R&D) from 1.65% of GDP to 2.4% by 2027—just above the current OECD average of 2.3% (HM Government, 2017a). One way of directly stimulating this is the funding provided to specific joint development projects involving businesses and researchers, the ISCF.

The new UK industrial strategy was launched at a particular juncture in UK politics. Three issues are worth highlighting. First, the institutional framework for implementing a national industrial policy, at least in England, has been dramatically overhauled since 2010. The eight regional development agencies in England have been abolished and replaced with 38 Local Enterprise Partnerships (LEPs)—most of which have far fewer resources and capacity to devise and implement policies (Pike et al., 2010). These have been joined in some areas by new Combined Authorities and again in some areas by 'devolution deals' between localities and central government (Pike et al., 2018). Second, the UK has experienced a period of prolonged cuts to public expenditure, many of which have fallen hardest on the poorest parts of the UK (Beatty and Fothergill, 2017). Third, the 2016 referendum in favour of the UK leaving the European Union brought with it a decoupling from the EU's policies and budgets for research and innovation on the one hand, and for regional cohesion on the other, and uncertainty and lack of clarity over what, if anything, might replace them in terms of support for industry.

These three contextual factors matter in understanding not just the formation of industrial policy, but also its likely impact, both nationally and with respect to the less prosperous regions of the UK. There has been a long running debate over the geography of economic policy, of which industrial and regional policies

are intrinsic parts. One view is that it should be ‘spatially blind’ (Coombes et al., 2005; Faggio and Overman, 2012), relying on market processes to spread economic activity and prosperity across the country as a whole. The counterpoint is that it should follow a ‘place-based’ approach (Bailey et al., 2018; Hildreth and Bailey, 2013, 2014) through which governments work with local areas to develop their capabilities to promote economic development. Alternatively, the more ‘traditional’ approach of regional redistribution still retains support.

There has already been considerable commentary on each of these issues, and most recently greatest attention has been on the potential for place-based approaches (Bailey et al., 2015; Berry, 2018; Fai, 2018; Jacobs et al., 2017; Pike et al., 2015). This interest largely follows the Barca report for the European Commission (Barca, 2009). These issues are given even sharper focus by the contemporary fulcrum of latest generation digital and mobile technologies. In the words of the previous *CJRES* Special Issue’s editors, “the increasing advance of such technologies poses real challenges for industrial policy and wider socioeconomic cohesion. With new capital intensive technologies capable of displacing labour, much speculation exists as to whether beneficiaries will reside in more dynamic regions exacerbating and extenuating further socioeconomic and regional divides” (Bailey et al., 2019, 4).

As already stated, a significant focus of policy and political debate around the industrial strategy concerns the UK’s national competitiveness, its perennial problem of low productivity and the goal of increasing the UK’s expenditure on R&D to 2.4% of GDP by 2027. However, as well as addressing national concerns, there is acknowledgement of the need for the policy to reach all parts of the UK economy. This is demonstrated by the then Prime Minister (PM) Theresa May’s speech to a group of leading researchers and industrialists in May 2018:

“And transforming the places where people live and work – the places where ideas and inspiration are born – *by backing businesses and building infrastructure not just in London and the South East but across every part of our country.*” (Emphasis added) (Theresa May, speech on science and modern Industrial Strategy, 21 May 2018, Jodrell Bank Centre for Astrophysics)

The UK government’s industrial strategy appears to be broadly based. In the White Paper published in November 2017 (HM Government, 2017b), the government set out five ‘foundations’ for creating “an economy that boosts productivity and earning power throughout the UK” (10):

1. Ideas: the world’s most innovative economy
2. People: good jobs and greater earning power for all
3. Infrastructure: a major upgrade to the UK’s infrastructure
4. Business environment: the best place to start and grow a business
5. Places: prosperous communities across the UK

As well as the overall ethos, the second and fifth foundations clearly imply that the industrial strategy is intended to support all regions, even if it falls short of directly addressing regional inequalities. However, much of the industrial strategy is not backed by new funding. Indeed, as a UK Parliamentary Select Committee inquiry concluded, “while the government’s rhetoric marks a step change, and the creation of a new Department for Business, Energy and Industrial Strategy (BEIS) has significantly raised expectations, the government’s approach appears to be evolutionary” (Business, Energy and Industrial Strategy Committee, 2017). Their report also highlights shortcomings in terms of closely related issues such as skills, more broad based business support and regional assistance (Fothergill, 2017).

The notable exception in terms of new funding is the first of the government's five foundations—investing in 'ideas', or more precisely, innovations through science, research and technology. This foundation has been backed by substantial additional funding, some of it preceding the formal launch of the strategy. Thus, the Chancellor of the Exchequer's Autumn Statement in November 2016 announced £4.7bn in additional government funding for R&D through until 2020–21, a bigger increase than in any Parliament since 1979 (HM Treasury, 2016). The Spring Budget in March 2017 reaffirmed this commitment (HM Treasury, 2017). This additional spending will add around 0.15 percentage points to the 1.65% of GDP already spent on research and development. This is a significant step towards the government's target of 2.4%, but clearly there will need to be a much bigger increase in public—and more pertinently private—spending on R&D. Furthermore, leaving the European Union would significantly reduce the amount of EU research funding the UK receives, even if the UK remains a participant in any future EU research programmes.

The new R&D funding has begun to take a tangible form. In April 2017, the Business Secretary announced an initial £1bn, to be spent by 2020–21, for a new ISCF, intended to boost growth, create jobs and raise living standards by investing in cutting-edge technologies (Department for Business, Energy and Industrial Strategy, 2017). The first tranche of the ISCF is targeted at six activities or sectors:

- Healthcare and medicine
- Robotics and artificial intelligence
- Batteries for clean and flexible energy storage
- Self-driving vehicles
- Manufacturing and materials for the future
- Satellites and space technology

Two aspects of this list are striking. First, the list of sectors eligible for support is extremely

narrow. At this stage, the government appeared to be placing a huge emphasis on a very small segment of industry. Even if the initial recipients of ISCF funding trigger some wider benefits by working with other companies, universities and public bodies across the whole country, the impact is likely to be very small. There is mixed evidence that public funding of research 'crowds-in' rather than 'crowds-out' private R&D spending (Economic Insights Ltd., 2015; Marino et al., 2016). Factors affecting this include cross-national differences, the type of R&D support, the point in the business cycle, firm size and sector. However, as Marino et al. (2016) note, there is some evidence of crowding-in over the long term. The implication is that the initial impact on sectors and places is likely to be among the most important.

A second striking feature of the first wave of the ISCF is that the choice of activities is actually less to do with supporting specific industrial sectors and more to do with technology. However, what is absent in the discussion are the models and mechanisms by which technology can have the greatest impact on industry. Evidence around innovation systems (Fagerberg, 2018) or specific areas such as university–business interaction, such the role of triple helix models, has so far been absent from the debate (Audretsch et al., 2012; Huggins et al., 2008).

Moreover, the six priority sectors display a strong emphasis on experimental and developmental research rather than on product and process development and the promotion of exports. In the context of limited public resources, the focus on this narrow range of sectors leaves little scope for funding developments across the rest of manufacturing. The assumption appears to be that at some future point, the technologies developed in these sectors will become pervasive and shape the wider economy, but this would seem to leave little margin for error, nor the prospect of widely distributed rewards in the short term.

Dimensions of the industrial strategy

We argue that there are six main dimensions in the debate around industrial policy in general, and the UK's industrial strategy in particular, namely spatial, technological, corporate, institutional, political and social. These dimensions are similar to those articulated by Jacobs et al. (2017), and are helpful for understanding the underpinning rationales for the current direction of UK industrial policy. In this instance, the intention is to use the framework to analyse the government's approach rather than to provide a more normative assessment to redirect policy.

The first dimension is the *spatial* aspect of industrial policy. The location of economic activity and the economic performance of places are long-standing issues in regional studies (Kitson and Michie, 2014; Marshall, 1920), while over the last 20 years, there has been growing interest in industrial policy at the international level (for example, Barca, 2009), at the national scale (for example, Fagerberg, 2018) and at the regional and local level (for example, Bailey et al., 2015). Running through this debate has been whether industrial policy should be spatially blind or whether it should be place-based. As Bailey et al. (2018) note, this debate is as much to do with what the overall aims of economic policy should be: broadly, between increasing national economic output and international competitive performance on the one hand, and on the other with recognising the need for policy aims to be more nuanced, taking into account a range of institutional, contextual and social measures of progress. The latter position lies at the heart of the place-based turn in economic policy (Barca et al., 2012; Rodrik, 2004). This is an issue explored extensively by Hildreth and Bailey (2013), who convincingly argue that spatially blind also means being blind to local historical, institutional and cultural factors which may shape economic development.

The second dimension is *technological*, and in particular is reflected in arguments that a 'Fourth Industrial Revolution' is underway in

which future economic activity and indeed the ordering of society will be shaped by the convergence of technologies in digital, materials science and medicine. Examples include technologies as diverse as artificial intelligence, robotics, nanotechnology and genomic medicine. The clearest policy responses come in proposals such as those from the German federal government to stimulate Industrie 4.0 (Schwab, 2017). Industrial policy has always worked alongside research policy, but the rationale of Schwab is that this current industrial revolution will have profound implications not just on the organisation of the economy but also on other spheres including society. However, there is some debate over whether such changes will occur at the breakneck speed envisaged (see, for example, Edgerton, 2006).

The third strand is a *corporate* one around the organisation of production and consumption. Exponents of the 'Fourth Industrial Revolution' thesis argue that the convergence of technologies will reshape how economic activity is currently organised (Andreoni and Chang, 2016). In the vanguard of such changes have been the Internet and the way it has transformed many economic transactions, as well as newer technologies such as machine learning and robotics. These have in turn been examined in terms of their potential to reshape corporate strategy (Bailey et al., 2018). To a large extent, this is the organisational manifestation of technological change.

The fourth strand is at an *institutional* level. The argument here is that the 'Fourth Industrial Revolution' is underpinned by a range of new and reformed institutions and that these are tied to specific locations, anchoring an array of economic activities (Bailey et al., 2015; Block, 2011). In a related vein, the mix of sectors or skills may allow some places to reap the advantages of specialisation or agglomeration (Foray, 2015; McCann and Ortega-Argiles, 2015; Rodrik, 2004). Examples include the location of hugely expensive research-focused capital

facilities, where the benefits may only be realised over decades.

The fifth dimension is *political*, and in particular the ways in which government seeks to engage in markets. It also involves the role that technology plays in the strategic international positioning of nations. This is not simply about securing a share of international markets but also about controlling certain technologies for strategic benefits (Gamble, 2008). This issue is probably the one least explored in regional studies scholarship (see Martin, 2018 as an exception). From the perspective of political economy, this also reflects ideological positions in terms of the role of government in economic matters. Towards one extreme is libertarianism and Hayek's 'spontaneous order' (Hayek, 1979), as well as the narrow use of market failure to support limited engagement in the provision of public goods. Towards the other is that of a more engaged role in markets reflected in both neo-Keynesian and place-based approaches (Hildreth and Bailey, 2014).

The sixth strand is *social* (and arguably *environmental*) and relates to how industrial strategy may support a range of non-economic benefits. This contains a wide range of approaches, including the need to recognise the foundational economy (Engelen et al., 2017), to develop mechanisms that promote inclusive growth (Lee, 2019) and to ensure the reworking of existing frameworks for social and environmental goals (see, for example, Rodrik, 2014 on a green industrial policy).

Assessing the UK's approach

These six dimensions can help us to understand the shape that UK industrial policy is taking. In terms of the explicit rhetoric within the Green and White Papers, there is a strong emphasis on the *technological* rationale, which perhaps can be supported by a more implicit *political* case around the role of the state in markets and the UK's position in an international economic order: for instance, raising expenditure

on R&D in relation to the OECD average, or the development of strategic technologies for economic and international advantage (such as space technology).

References to the *corporate* and *institutional* rationales are largely through the use of case study examples of positive practices. The lack of reference to any measures to change current structures and practices suggests that the government perceives little that is wrong with these, despite extensive evidence to the contrary (see Jacobs et al., 2017 for a summary). This is reflected in the findings of the BEIS Parliamentary Select Committee (Business, Energy and Industrial Strategy Committee, 2017). This is quite a striking inference by the government given the nature of the UK's productivity problem and laggard firms (Haldane, 2017), the reliance on financial services and markets located overwhelmingly in London, and the wider economic role of the Greater South East in the national economy (Hildreth and Bailey, 2014).

Apart from a desire to "maximise the advantages of the global shift to clean growth" (HM Government, 2017b, 14), the *social* and *environmental* arguments are generally absent from the industrial strategy documents. These appear to be of little concern for central government, with investment in battery development and new materials more a matter of securing competitive advantage. However, it is noticeable that many local bodies (LEPs and local authorities) have sought to explore how their local industrial strategies might be able to support inclusive growth and to recognise the significance of new environmental technologies and markets (Lee, 2019).

Finally, this leaves the *spatial* aspect of the industrial strategy. Although reference is made to place and to the need for rebalancing, as Bailey et al. (2018) find, there is little regard for the need to address issues around capability and institutional capacity at any systemic level. Moreover, the proposed mechanisms for implementing the industrial strategy remain

largely through competitive funding rounds with little attention paid to local capabilities and institutional arrangements (Hildreth and Bailey, 2014), nor to the need for redistribution between regions. Our focus in the rest of this article is to explore these spatial limitations further by tracing the likely spatial consequences of this new set of interventions for the UK.

Methodology

General approach

There is a well-established literature on the diffusion of innovation at a regional, national and international level. While this tends to suggest there is a distance decay in the spread of innovation benefits (Rodríguez-Pose and Crescenzi, 2008), the pattern varies depending on a range of factors, including R&D investment type, regional firm structure and internal-external linkages, and national factors (Crescenzi et al., 2007). Our attention is not with spill-over effects but rather with the likely immediate benefits of the first wave of the ISCF, drawing on a descriptive analysis of key sectors and research establishments. Jacobs et al. (2017) raise concerns at the corporate and institutional level which suggest that the UK has a poorly performing innovation system, at least in terms of bringing broad sectoral and regional benefits. This is largely outside the scope of our approach. The justification of our approach is to test the previous Prime Minister's statement that the benefits of the ICSF will reach every part of the UK.

The first tranche of the UK government's ISCF was at the time of its announcement the largest new spending commitment arising from the industrial strategy. We deploy official and national government statistics on employment to assess the scale and distribution of these ISCF sectors in the context of UK manufacturing and the economy as a whole. This helps to fill a gap given the limited analysis in the Green and White Papers around the scale and significance of the sectors being targeted, especially in relation to other industries.

In terms of the likely regional and local impacts, at the time of our analysis, it was too early to know exactly which companies and organisations will receive ISCF funding and hence where funded activities might be located. However, by looking at the location of the target sectors, it is possible to understand which places across the UK are most likely to benefit from the initial stages of the ISCF initiative. The analysis here draws on employment statistics at a number of geographical scales—namely, local authority districts, sub-regions (such as LEP areas in England), regions and countries. Finally, the location of R&D establishments is considered because, along with universities and R&D functions on production sites, these are in the first instance likely to be the prime beneficiaries of the new government funding. This analysis is indicative, as it was unclear from the contemporary ISCF documentation whether the initial beneficiaries would be businesses, universities or research establishments.

The result of our analysis is essentially an *ex ante* assessment of the likely spatial impacts of first-wave ISCF spending on different parts of the UK. This type of analysis has been lacking to date but it is important if spreading the benefits across the whole of the UK is to be taken seriously as one of the aims of the industrial strategy. Nevertheless, there are limitations to this approach, not least because one of the challenges in examining expenditure on innovation and new technology is that the eventual outcomes can be difficult to pre-determine, for the reasons presented above. The focus of this approach is essentially on inputs (additional expenditure) rather than on exploring how effective the approach may be in different places in terms of innovation processes, technological diffusion (Aydalot and Keeble, 1988; Fagerberg, 2018) and final outcomes.

Measuring the sectors

The first step in assessing the scale and location of the six first-wave ISCF target sectors was to identify the categories under which they

fall in official statistics. This is not straightforward because there tends to be a time lag before new or emerging industries are given their own statistical categories. The match between the six sectors and the government's Standard Industrial Classification (SIC) is therefore imperfect (Table 1).

The numbers in this list refer to categories in the 2007 SIC, the one currently in use and applying to the most recent employment statistics. Two important points should be noted about this match of sectors to statistics. First, it provides a broad, possibly generous, definition of the six target ISCF sectors. There is no separate statistical category for 'self-driving vehicles', for example, so the figures used include all motor vehicle manufacturing, although it could be argued that in the long run the whole of the motor industry might be impacted by driverless technology. Likewise, it is impossible to separate out 'satellites and space technology' from the

rest of the aerospace industry, and 'batteries for clean and flexible energy storage' are mixed in with all other battery manufacture. Within the healthcare sector, the government's initial focus is rather narrowly on pharmaceuticals. The effect on all the figures we present is that they substantially overstate the scale of the sectors directly targeted by the first wave of the ISCF. Similarly, the focus on additional public expenditure does not consider additional investments by companies in particular locations and plants.

Second, there is significant functional overlap between some of the statistical categories. For example, the category 'research and experimental development on natural sciences and engineering' includes many of the labs where new materials for the aerospace and motor industries might be developed. This sort of overlap is just the sort of technological convergence which needs to be supported. Likewise, 'batteries for clean and flexible energy storage' are something that might well be fitted in 'self-driving vehicles'. This suggests that it makes most sense to focus on the scale and location of the six sectors as a whole rather than on individual component parts. These issues are ones which need to be addressed by further research at a fine-grained local level and through robust ex post evaluation of the impacts of the ISCF.

Spatial analysis

National scale of the sectors

Table 2 shows the number of employees in the industries that match up to the sectors targeted by the first wave of the ISCF. The figures here and in all subsequent tables and maps are taken from the government's Business Register and Employment Survey (BRES), which provides the most detailed and reliable breakdown of employment by industry and location. The figures in Table 2 are for Great Britain as a whole in 2017, the most recent year for which BRES data were available at the time of writing. Industry by industry, R&D on natural sciences and engineering accounts for the largest number of

Table 1. *ISCF first-wave sectors mapped to SICs.*

Healthcare and medicine	
21100	Manufacture of basic pharmaceutical products
21200	Manufacture of pharmaceutical preparations
26600	Manufacture of irradiation, electromechanical and electrotherapeutic equipment
32500	Manufacture of medical and dental instruments and supplies
72110	Research and experimental development on biotechnology
Robotics and artificial intelligence	
28990	Manufacture of other special-purpose machinery n. e. c.
Batteries for clean and flexible energy storage	
27200	Manufacture of batteries and accumulators
Self-driving vehicles	
29100	Manufacture of motor vehicles
Manufacturing and materials of the future	
23990	Manufacture of other non-metallic mineral products n. e. c.
72190	Research and experimental development on natural sciences and engineering
Satellites and space technology	
30300	Manufacture of air and spacecraft and related machinery
51220	Space transport

Table 2. *Employment in ISCF first-wave target sectors, GB, 2017*

	Employees
Basic pharmaceutical products	7000
Pharmaceutical preparations	32,000
Irradiation, electromechanical and electrotherapeutic equipment	5000
Medical and dental instruments and supplies	36,000
Research and experimental development on biotechnology	9000
Other special purpose equipment n. e. c.	10,000
Batteries and accumulators	2000
Motor vehicle manufacturing	79,000
Other non-metallic mineral products n. e. c.	6000
R&D on natural sciences and engineering	118,000
Air and spacecraft and related technology	82,000
Space transport	0
Total	386,000
as % of all GB employees	1.3
of which Manufacturing	259,000
as % of GB manufacturing employees	10.8

Source: BRES.

jobs (118,000). These are jobs in free-standing research centres rather than university laboratories, which are counted with the rest of the higher education sector. By way of contrast, at the present time, there are no recorded jobs in Great Britain in space transport.

The more significant figures are in the lower part of the Table, which shows that these industries together account for just over 380,000 jobs, which is only 1.3% of all GB employment. The jobs just in manufacturing (that is, excluding R&D laboratories, which official statistics class as part of the service sector) are fewer still, at just under 260,000, though they account for at just over 10% of all manufacturing jobs. These headline numbers are important because they underline the extent to which the initial focus of the ISCF is narrowly targeted even in terms of manufacturing industry. Looking at the same figures from the opposite direction, they mean that 99% of the economy (by employment) and 90% of manufacturing looks likely to be bypassed as direct beneficiaries of the new funding.

It could be argued that through supply chain linkages and spill-over effects, the ISCF first-wave target sectors are likely to have a wider impact on the economy, for example through a number of innovation diffusion mechanisms. This is a reasonable expectation, although its detailed geography could only be uncovered by means of analysis based on corporate supply chain and related data. It also needs to be remembered that the sectors the government is targeting are much more tightly defined than the statistical categories used here. It is not the whole of motor vehicle manufacturing that would qualify for support, for example, but only driverless vehicles, so these wider effects may be relatively restricted. Similarly, the extent of direct job creation in these activities is rather opaque, and hence the downstream effects are as well. That said, there is evidence that the emergence of new posts in high-tech and digital sectors stimulates lower skilled job creation in the local service sector (see, for example, [Lee and Clarke, 2019](#)), albeit at the expense of average wages and overall purchasing power for such workers.

Geographical location of the target sectors

A central part of our analysis was the geographical distribution of employment in the six target sectors across Great Britain. [Figures 1 and 2](#) show the total number of jobs in these sectors for each local authority district for England and Wales and Scotland, respectively. These reveal a markedly uneven distribution across the three nations, but also a complex pattern. The biggest single concentration of jobs in these sectors is in and around Cambridge, an area which has traditionally not been the centre of UK manufacturing although it is certainly a major centre for R&D. Cambridge itself has 4900 jobs in the six sectors but South Cambridgeshire, which wholly surrounds the city, has a further 14,300—the highest total of any district in Great Britain—bringing the local total to 19,200.

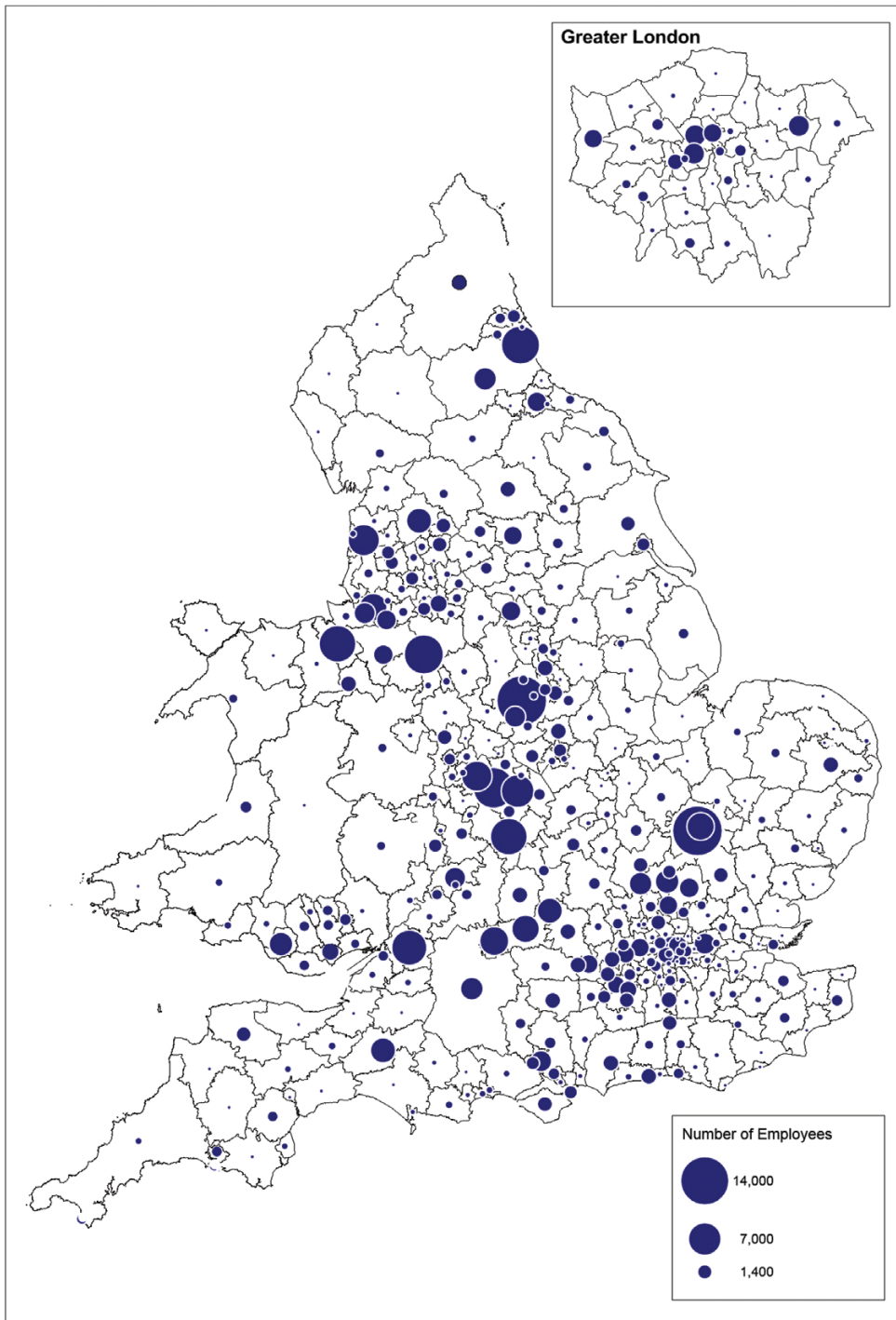


Figure 1. Employment in ISCF first-wave target sectors, by local authority district, England and Wales, 2017.
Source: BRES.

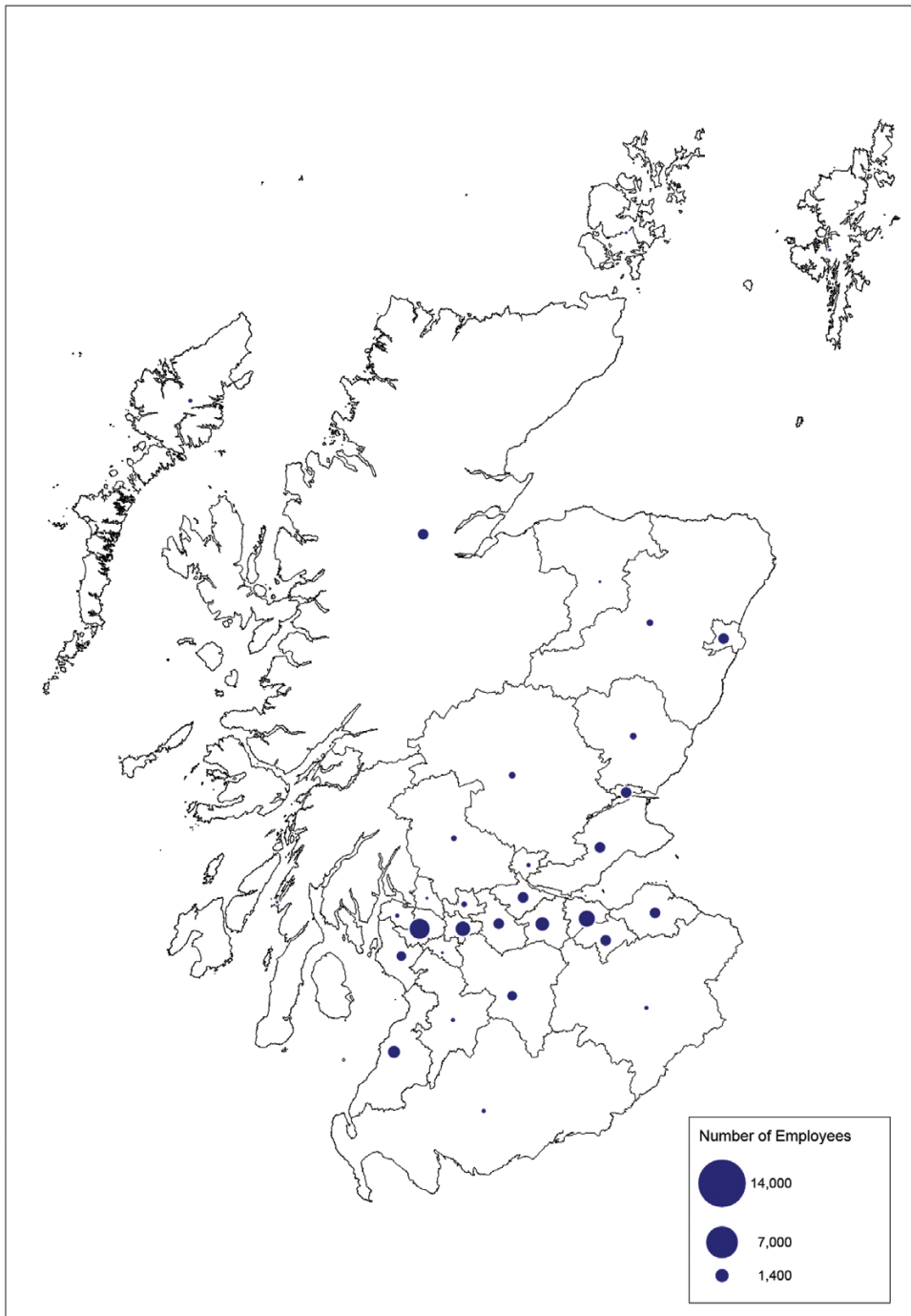


Figure 2. Employment in ISCF first-wave target sectors, by local authority, Scotland, 2017.
Source: BRES.

Most of the other large concentrations of jobs tend to be associated with a single large manufacturing plant in the motor or aerospace industries. Examples include Nissan in Sunderland, BAE Systems in Lancashire, Airbus in Flintshire in North Wales, JLR on Merseyside, Rolls Royce in Derby, a cluster of car plants in and around Birmingham, Airbus (again) near Bristol, further car assembly plants in Oxford and Swindon, engine plants in Dagenham and Bridgend, and Westland helicopters in Somerset. Although the government's intention is to use the new Fund to support the motor and aerospace industries as a whole, the new money that is relevant to these industries is actually being targeted, as we noted, at a very narrow range of technologies—driverless cars, batteries, new materials, robotics and spacecraft. So in practice, not all these car and aerospace plants can be expected to benefit from the work supported by the Fund, certainly not directly or immediately, and perhaps not even in the long run.

At the other end of the spectrum, what is striking is that a large number of local authority districts have barely any jobs in the target sectors: 58 districts across Britain have fewer than 100 jobs in the six targeted sectors; and 149 of the 380 districts across Britain have fewer than 300 jobs in the six targeted sectors. A number of large cities and towns have quite modest numbers too, including Bradford (950 jobs), Leicester (1,250), Middlesbrough (200), Hull (1,200), Nottingham (1,550), Stoke-on-Trent (400) and Swansea (450).

However, the local authority district scale may not be the most appropriate for assessing likely impacts. Because of commuting flows, local labour markets mostly function at a sub-regional scale. In labour market terms, therefore, it may not matter if a local authority district has few if any jobs in the target sectors as long as there are plenty of jobs in these industries in neighbouring areas. To address this issue, [Table 3](#) looks at employment in the target

sectors by sub-region. In England, the sub-regions here are LEP areas. The sub-regions are ranked by the share of all employees in the target sectors. The table also shows the share of manufacturing jobs in the target sectors.

The sub-regional distribution of the sectors highlights three points. First, the share of all employment in sectors targeted by the first wave of the ICSF is nowhere very large. On this measure, Coventry & Warwickshire has the highest concentration at just over 4%. In the vast majority of sub-regions, the ISCF sectors account for less than 2% of all jobs. This underlines the distinctly narrow sectoral focus. Second, there is nevertheless big variation between sub-regions. As a percentage of all jobs, Coventry & Warwickshire at the top of the table has 13 times as much employment in the ISCF sectors as Cornwall at the bottom of the table. Or perhaps more pertinently, Oxfordshire has a five times greater concentration of employment in these sectors than, for example, the Sheffield City Region, one of the country's industrial heartlands. This underlines the extent to which the focus on a narrow range of sector favours some local economies over others. Third, the pattern of variation between sub-regions is complex, and does not reflect a clear North-South divide. Instead, the pattern across the country mostly reflects the location of a number of large car and aerospace plants and concentrations of R&D facilities. Apart from Oxfordshire, the sub-regions covering Cambridgeshire, Wiltshire and Berkshire all have relatively large numbers in the target sectors, but so do Coventry & Warwickshire, North Wales, Lancashire, the Derby and Nottingham area, and Cheshire & Warrington.

The lower part of the Table includes a number of places worth highlighting. At the very bottom, Cornwall & the Isles of Scilly not only has the smallest share of employment in the target sectors but also has the lowest GVA per head of any English NUTS2 area (that is, statistical sub-region). It is hard to see how such

Table 3. Employment in ISCF first-wave target sectors, by sub-region, 2017

	Number of jobs	as % of manufacturing	as % of all employees
Coventry & Warwickshire	18,200	31.4	4.0
North Wales	10,900	24.0	3.9
Oxfordshire	13,000	24.6	3.6
Greater Cambridge & Gr. Peterborough	23,600	7.4	3.0
Lancashire	18,100	18.8	2.9
Derby, Derbyshire, Nottingham & Notts	26,200	17.4	2.8
Cheshire & Warrington	13,300	24.4	2.7
Swindon & Wiltshire	8400	17.2	2.7
Thames Valley Berkshire	10,600	10.1	2.1
Hertfordshire	12,900	15.1	2.0
Liverpool City Region	12,300	19.6	2.0
North East	15,900	14.5	2.0
Gloucestershire	5500	14.0	1.9
Greater Birmingham & Solihull	18,300	18.5	1.9
Solent	9300	16.8	1.8
Cardiff City Region	10,900	13.8	1.7
West of England	10,000	25.5	1.7
Enterprise M3	11,900	16.7	1.6
Tees Valley	3700	2.8	1.4
Buckinghamshire Thames Valley	3000	13.6	1.3
York, North Yorkshire & East Riding	6700	7.1	1.3
Coast to Capital	10,000	17.3	1.2
Heart of the South West	8400	11.6	1.2
Leicester & Leicestershire	5600	3.9	1.2
East of Scotland	8000	5.9	1.1
South East Midlands	10,400	8.3	1.1
Tayside	1900	7.2	1.1
Worcestershire	3100	6.8	1.1
Highlands & Islands	1300	9.8	0.9
Humber	3400	4.8	0.9
West of Scotland	9500	10.1	0.9
New Anglia	5400	4.7	0.8
Stoke-on-Trent & Staffordshire	3500	5.1	0.8
Mid Wales	600	4.5	0.7
Sheffield City Region	5000	4.1	0.7
South East	10,500	5.4	0.7
Dorset	1900	4.2	0.6
Greater Lincolnshire	2600	3.4	0.6
Leeds City Region	8400	3.5	0.6
Greater Manchester	7000	4.0	0.5
London	25,600	8.0	0.5
Swansea City Region	1300	2.8	0.5
The Marches	1500	2.7	0.5
Black Country	2100	3.2	0.4
Cumbria	1000	1.9	0.4
North East Scotland	1400	1.2	0.4
South of Scotland	400	1.5	0.4
Cornwall & Isles of Scilly	700	1.5	0.3
Great Britain	386,000	10.8	1.3

Note: Some LEP areas overlap so the numbers here do not sum to the GB total.

Source: BRES.

a narrowly focussed industrial strategy will do much to address Cornwall's economic problems. Greater Manchester also rests near the foot of the table, despite being the focus of the government's Northern Powerhouse initiative. Across the Pennines, the Leeds and Sheffield City Regions—two of Britain's traditional industrial heartlands—also rank very low in terms of jobs in the first-wave ISCF sectors.

Finally, [Table 4](#) summarises the data at a wider scale for Scotland, Wales and the English regions. This emphasises the point that the distribution of ISCF target sector jobs across the country is not a simple North-South divide, though the South East of England does have the largest absolute numbers. London actually has the smallest share of employment in ISCF sectors, while Yorkshire & the Humber and Scotland also lag rather far behind the rest of Britain.

Location of research and development establishments

In the short-run, the funding the government is channelling into R&D to support its industrial strategy is likely to go to universities, into R&D in companies and into free-standing research and development establishments. The wider sectors that are intended to be the final beneficiaries, such as aerospace and motor vehicle

manufacturing, only stand to benefit further down the line as new products and processes come onstream. It is therefore worth looking more closely at where these R&D establishments are located. Regarding universities, the government notes that 46% of Research Council and Higher Education Funding Council for England (HEFCE) monies are presently spent in Oxford, Cambridge and London ([HM Government, 2017a](#)). Beyond these three locations, a number of other large, older universities are prominent in industrial R&D, and most universities are located in cities. Rural areas, seaside towns and the former coalfields, for example, mostly lack universities of their own and are unlikely therefore to benefit from money flowing into R&D facilities. Regarding R&D attached to manufacturing sites, the places where ISCF sectors are already located (see [Figures 1 and 2](#)) are the most likely to be beneficiaries. Pharmaceutical research by commercial companies, for example, often takes place alongside pharmaceutical manufacture.

The location of free-standing R&D establishments is easier to pin down using official statistics. [Figures 3 and 4](#) show the employment, by local authority district, in establishments carrying out 'research and experimental development on biotechnology, natural sciences and engineering' (that is, SIC classes 72110 and

Table 4. *Employment in ISCF first-wave target sectors, by region and country, 2017*

	Number of jobs	as % of manufacturing	as % of all employees
North East	19,700	12.3	1.9
Wales	23,000	13.9	1.9
East of England	49,200	9.3	1.8
East Midlands	36,800	10.3	1.8
West Midlands	44,200	13.3	1.7
North West	51,800	13.1	1.6
South East	63,100	13.9	1.5
South West	36,300	13.8	1.5
Scotland	22,000	6.7	0.9
Yorkshire & the Humber	16,400	4.0	0.7
London	24,600	8.0	0.5
Great Britain	386,000	10.8	1.3

Source: BRES.

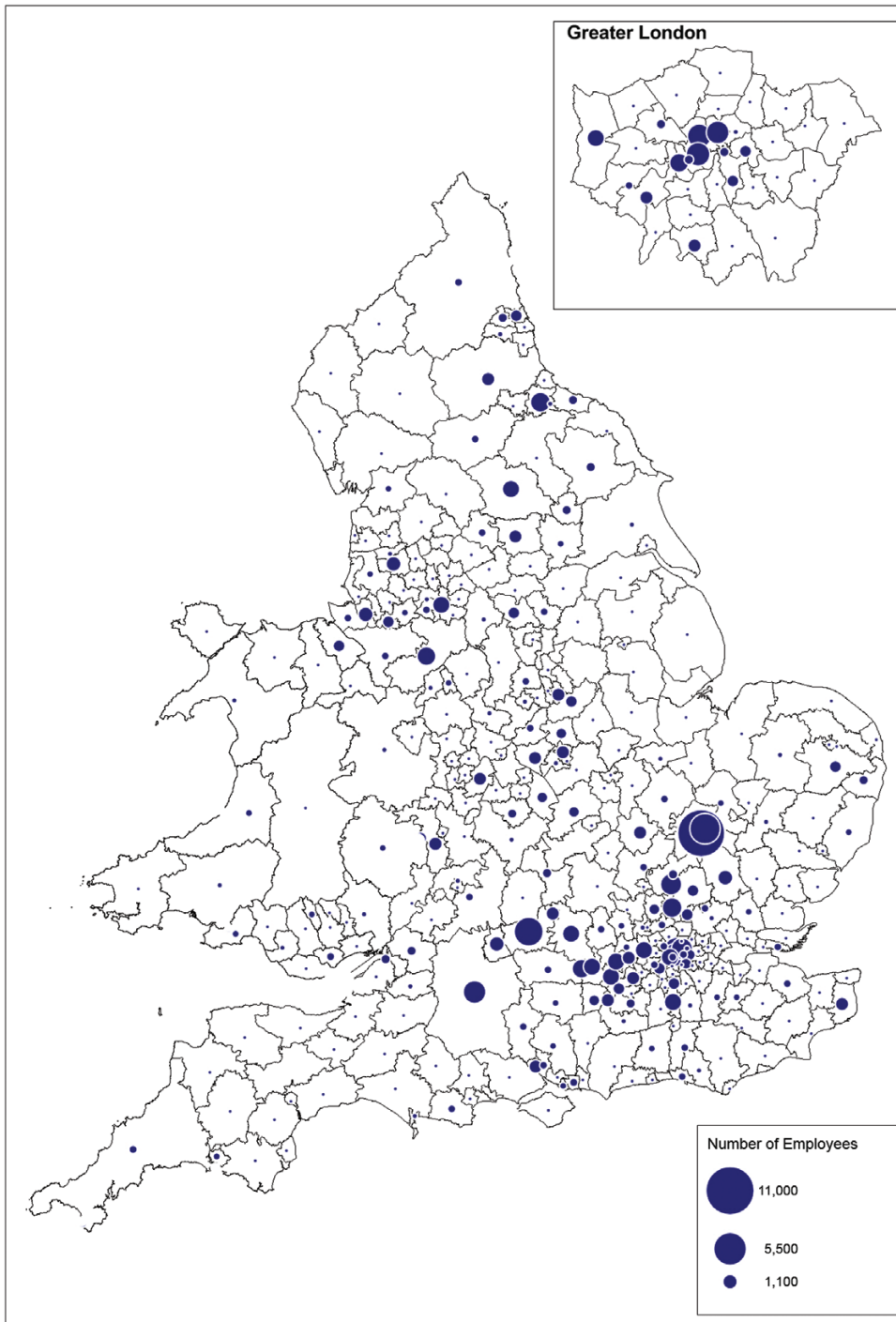


Figure 3. Employment in R&D establishments, by local authority district, England and Wales, 2017
Source: BRES.

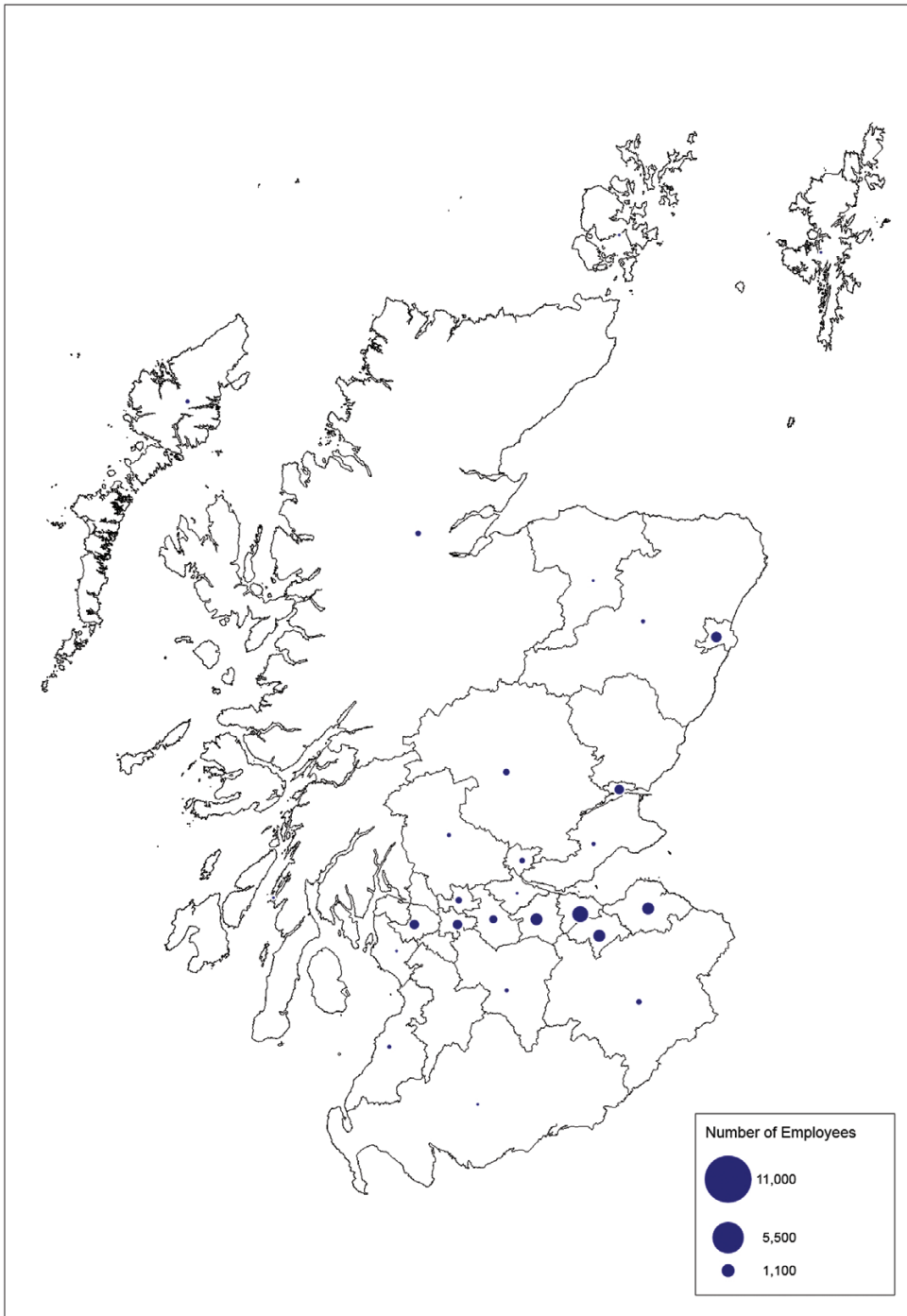


Figure 4. *Employment in R&D establishments, by local authority, Scotland, 2017*
Source: BRES.

72190). This includes free-standing R&D units run by companies, trade associations, charitable foundations and the public sector. Many of these are the establishments most likely to benefit directly and immediately from the increase in government spending on R&D. To underline the locational concentration of R&D of this kind, Table 5 lists the 20 local authority districts across Britain with the largest number of jobs in these establishments. The dominance of the Cambridge area is striking—in total, there are some 15,500 jobs in and around the city. It is important to remember that this excludes R&D in Cambridge University itself. The Cambridge area alone, which has a combined population of just 285,000 (less than 0.5% of the GB total), accounts for 12% of all GB employment in scientific R&D establishments. Looking down the list of the top 20 districts for employment in R&D establishments, it is also noticeable

Table 5. *Employment in R&D establishments,^a top 20 districts in Britain, 2017*

	Number of jobs
South Cambridgeshire	10,700
Cambridge	4800
Vale of White Horse	4400
Camden	2700
Westminster	2600
Wiltshire	2600
Stevenage	2400
Islington	2300
Stockton on Tees	2000
Welwyn Hatfield	2000
Cheshire East	1800
Reading	1800
Bracknell Forest	1600
Edinburgh	1600
Hammersmith & Fulham	1600
South Oxfordshire	1600
Manchester	1600
Windsor & Maidenhead	1600
Hillingdon	1500
Wokingham	1500
Great Britain (total)	127,000

Note: ^aResearch and experimental development on biotechnology, natural sciences and engineering.

Source: BRES.

that industrial areas in the North, Scotland and Wales are few in number. Manchester makes the list but there is no Liverpool, Newcastle, Sheffield or Glasgow, and Stockton on Tees is the only second-tier older industrial town.

The profoundly uneven geography of R&D is underlined by Table 6, which looks at employment by region and country. The three regions in the south east corner of Britain (London, South East and East) have a combined total of 73,000 jobs in R&D establishments, or well over half the GB total. Even within these three regions, the jobs are concentrated in just a few places, as the maps earlier demonstrated. By contrast, the three regions of northern England (North East, North West and Yorkshire and the Humber) can muster a combined total of just 20,000 jobs in R&D establishments of this kind. With over 15,000 jobs, the Cambridge area alone has more jobs in R&D establishments than the whole of the Midlands (14,800); more jobs in R&D establishments than the combined total in Scotland and Wales (13,400); and only 4,500 jobs fewer in R&D establishments than the whole of the North of England, an area with a total population of 15.2 million or 50 times greater than the Cambridge area. The location

Table 6. *Employment in R&D establishments,^a by region and country, 2017*

	Number of jobs
East of England	28,800
South East	28,300
London	15,800
Scotland	9600
North West	9300
South West	7700
East Midlands	7200
Yorkshire & the Humber	5500
North East	5100
West Midlands	4600
Wales	3800
Great Britain	127,000

Note: ^aResearch and experimental development on biotechnology, natural sciences and engineering.

Source: BRES.

of R&D establishments is seldom considered as part of the profound geographic imbalances in the UK economy, but these data reveal it has a distinct pattern which given the focus of the ISCF may only exacerbate regional economic divides.

Conclusions

The focus of this article has been on the likely spatial implications of the first round of funding linked to the UK government's industrial strategy. Two overarching conclusions can be drawn. First, the government's sectoral focus is exceptionally narrow. On a very generous definition that includes, for example, all of aerospace and all of motor manufacturing, these sectors account for only 10% of manufacturing employment and little over 1% of the whole economy. This is an extremely narrow base on which to try to build a revival of British industry. Second, the government's narrow sectoral focus in terms of first-wave ISCF support threatens to widen regional divides. The adoption and diffusion of new technologies may spread over time beyond the sites of their original development, although at present the formal mechanisms through which such applications can be developed remain unclear. However, if the existing location of the target ISCF sectors is a guide to the impact on different parts of Britain, then this is likely to be profoundly uneven and in ways that may widen differences in prosperity.

The strong concentration of R&D activity in and around London and in the Cambridge area provides the clearest example of how an essentially prosperous part of the UK is likely to be a major beneficiary of the new funding. By way of contrast, there appear few opportunities for traditional sectors such as the chemical industry, steel or engineering. Of course, our focus is only on the first tranche of ISCF funding; subsequent waves have brought in additional 'challenge areas' such as food and drink, smart energy and creative industries, and

the nine 'Sector Deals' extend the list to include construction, nuclear and rail transport. This expanded focus is likely to spread the benefits of ISCF expenditure more widely, although this would need to be demonstrated by the sort of fine-grained spatial analysis presented above. Moreover, in financial terms, this first tranche of ISCF funding is significant in that it involves over a fifth of the total allocation of £4.7 billion, and represents a much larger sum than has been made available to either the second or third waves (HM Treasury, 2018).

By implication, for many places, the ISCF appears to offer very little. Most manufacturing does not produce new high-technology products and is removed from exotic leading-edge technologies. However, this does not mean that such types of industry should not be offered support. What matters for these sectors is how technology is adopted and applied, and that industries' position in international markets is maintained and strengthened. This often relies on incremental improvements in products and processes, in selling new products to new markets and in better management practices. That these businesses have survived in the face of globalisation is an indicator that they still have a role to play in a diverse economy.

The conclusion from the analysis is that the first, scene-setting wave of the UK's ISCF has proved to be sectorally narrow and spatially blind, bringing with it the prospect that it will reinforce regional inequalities. This myopia is not just about uneven geographical distributions but also concerns the differences between places, the links between national decisions and local outcomes, and the potential feedback from successful local clusters of businesses to higher national output and productivity.

This analysis is set within a broader framework for understanding different forms of industrial policy. This established that the UK's industrial strategy is strongly guided by what can be seen as *technological* and *political* imperatives, and follows to a large extent spatially

blind approaches informed by new economic geography. Although not explicitly stated, the industrial strategy follows from a dominant model of UK political economy (Martin, 2018), and may reinforce the broad neo-classical approach to economic development pursued in the UK for at least 40 years (Hildreth and Bailey, 2013). Consideration of approaches which may seek to build regional capabilities, which devolve power and build local institutional capacity and which more actively address corporate and regulatory issues, are almost completely absent from the industrial strategy (Berry, 2018; Fai, 2018; Hildreth and Bailey, 2013; Jacobs et al., 2017), save for a few places in receipt of devolved powers (National Audit Office, 2016).

Appraisal of industrial policy has tended to focus on the debate between spatially blind and place-based policies (Bailey et al., 2018). Our evidence brings more clarity and detail to these two sides of the debate. However, we would argue that the place-based debate (following Barca (2009) and taken on by Hildreth and Bailey (2013)) does not go far enough. An example would be the limited attention given to the profound regional implications of austerity for the poorest parts of the UK (Beatty and Fothergill, 2017). Calls for fiscal and political devolution of powers (Jacobs et al., 2017) alone are unlikely to shift entrenched regional inequality. A new national agenda of change to structures of political economy, backed by fiscal transfer and new bolder models of local and regional democracy, are required.

This article is an initial attempt to appraise a significant new stream of government funding, but also an essay in positioning this stream of funding within wider debates around regional policy. Further analysis might introduce some of the intervening variables between new financial inputs and outcomes, such as skills, institutional capacity and absorptive capacity. What is striking in the UK's industrial strategy documentation is how little acknowledgement

is given to innovation systems, to regional policy and to technology diffusion and adoption. However, our fundamental concern is that if the UK government were more intent on reducing regional inequalities, it would not have started with a spatially blind approach. The scale, persistence and growth of regional inequalities (Martin et al., 2015) should be of significant concern to industrial policy makers. Part of the solution to this challenge lies with more spatially sensitive, place-based approaches, but more broadly with the need for more fundamental changes to the political economy of the UK and the spatial inequalities it perpetuates.

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