At the frontier

The geography of the UK’s new economy

Guilherme Rodrigues, Olivia Vera, Paul Swinney
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About the authors

Guilherme Rodrigues, Analyst g.rodrigues@centreforcities.org
Olivia Vera, Researcher o.vera@centreforcities.org
Paul Swinney, Director of Policy and Research p.swinney@centreforcities.org

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The development of the new economy is central to the development of the national economy

The 'new economy' encompasses emerging knowledge-intensive sectors like FinTech and advanced manufacturing that are at the forefront of new technologies and innovations. It is important for improving the UK's productivity and prosperity and a central pillar for the future success of the whole economy.

The new economy is made up of manufacturing and services activities

This report contains two main findings that are relevant for policy. The first is that the new economy – defined as 47 technologically advanced sectors – is made up of both services and manufacturing businesses. As well as robotics and autonomous vehicles, it includes Internet of Things, telecommunications and gaming to name but a few. This is important because much of the thrust of innovation policy designed to foster such activities has focused on product innovation (goods) to a much greater degree than process innovation, which applies more to ways of working and services.

The new economy clusters in cities

The second finding is that while the new economy is located across the country, it is disproportionately based in cities, and city centres in particular. In fact, 59 per cent of firms cluster in the 9 per cent of land covered by the 63 largest cities and towns.

The further a location is from the centre of a city, the less popular it tends to be. City centres are at the heart of this clustering; despite accounting for just 0.1 per cent of land, they are home to 13 per cent of new economy firms. While this holds for both services and non-services, it is particularly true for activities such
as FinTech and Software as a Service. In contrast, deep rural areas (defined as those beyond a commutable distance to a city) account for 52.9 per cent of land, but accommodate just 8.6 per cent of new economy businesses.

Clustering also occurs on business parks in the suburbs of cities, but these are much less popular outside of cities. They play a different role to city centres, and this is reflected in the types of businesses they attract. While the city centre new economy is dominated by services companies, these parks have a higher share of non-services activities, in particular those specialising in sensors and advanced materials.

This happens because of the inherent benefits an urban location offers innovative new economy businesses. Cities provide access to large numbers of skilled workers and a network of similar companies with which to share information and knowledge. This does come at a cost – businesses pay a premium to get access to these benefits through the higher price of commercial space. For those focused on services, access to these two benefits in city centres is particularly important. For non-services companies, the greater relative preference for a suburban location suggests that while access to knowledge is slightly less important to them (although again this varies – it is more important for AI than net zero companies), access to lots of skilled workers still means they mainly locate in cities.

Cities in the Greater South East have more new economy firms than those elsewhere, with large cities in particular punching below their weight

This makes cities very important for the success of the UK economy, even with recent increases in remote working. The challenge for policy is that some cities offer these benefits much more effectively than others. Those in the Greater South East – most notably London but places like Milton Keynes and Reading too – provide plenty of access to skilled workers and knowledge, which has proven attractive to both services and non-services new economy businesses. Most cities elsewhere, particularly large cities outside London, such as Birmingham, Glasgow and Manchester, cannot do this to the same extent, which impacts the size of the new economy within them. The analysis in this report shows that while they are undoubtedly centres of new economic activity, they have fewer new economy businesses than our modelling suggests they should. This is likely to be a key reason why they have lower levels of productivity than their European peers.

Policy has focused too much on specific sectors and too little on place

Rarely is this geography acknowledged in policy designed to support and commercialise innovation, particularly by the new economy. Most policies have been national in focus even if they have played out differently across the country.
One example is public funding for research and development (R&D) – it has been driven by assessments of the quality of universities’ research, but the geography of the best performing institutions means that it has concentrated funding in the Greater South East.

Recent Government policy has looked to take a much greater spatial approach, which is welcome. February’s Levelling Up White Paper committed to increase R&D investment outside the Greater South East by 40 per cent, and was deliberately selective in choosing Birmingham, Manchester and Glasgow as the sites for three new Innovation Accelerators. There is, however, no clear plan for how and where this extra investment will be spent – a strategy setting this out was cancelled – nor a clear sense of what the Innovation Accelerators will do.

Policy has also focused too much on particular sectors. It is right that, where possible, it encourages the development of businesses at the frontier of the economy, but being overly specific ignores the clustering of related industries in certain places. It also leaves it inflexible to supporting the growth of new activities when they emerge.

While some sectors may have specific needs, the barriers holding back one are likely to affect others. For this reason, industrial policy should support the ever-changing new economy and make sure places are offering what this cohort of businesses requires, for example through R&D tax credits, competition policy and intellectual property rights, rather than being too narrowly defined.

**What needs to change**

After the introduction of the CHIPS and Science Act in the USA, which states that $10 billion will be spent to increase innovation in 20 places, the UK should follow its recent decision to prioritise Birmingham, Glasgow and Manchester by going much further. It should create a **£14.5 billion growth package for these three cities over 10 years** to help achieve the Levelling Up White Paper’s ambition of making them internationally competitive. This should include:

- Allocating a total of £1 billion of the annual £7 billion R&D uplift the Government has promised to spend outside of the Greater South East to be shared amongst the leading university in each of these cities.
- A £500 million investment in each place to improve how attractive their city centres are to new economy and other high productivity businesses, funded from the Strategic Programmes budget.
- Extending the City Region Sustainable Transport Settlement beyond 2026/27 for a further five years for Greater Manchester and the West Midlands (an additional £1 billion each), plus a similar commitment to Greater Glasgow, and giving all three places Transport for London-style powers so they have more control over services and can invest revenues
The Scottish Government establishing and working with a new Greater Glasgow combined authority to provide a single departmental-style spending settlement for the city region in the way the UK Government has committed to explore for Greater Manchester and the West Midlands. Legislation should be amended to allow all areas to introduce local taxes, such as a tourist tax.

To support the new economy in other places the Government should also:

- Set out a spatial strategy for how the remaining uplift in public R&D will be spent. It should be driven by the geography of the new economy, with a particular focus on improving innovative activities in places that are lagging behind their potential.
- Extend the Strength in Places Fund to maintain specific support for innovative activities across the country, with funding continuing to come from the Strategic Programmes budget.

A lot of policy has focused on the low levels of public R&D spending relative to other countries, but this has been concentrated on factors that influence mainly product innovation in manufacturing. However, the UK has a much broader business investment problem. To address this, policy should increase R&D spending while encouraging investment in other areas by:

- Increasing the R&D target from 2.4 per cent of GDP to at least the OECD average of 2.7 per cent, by 2027.
- Expanding the R&D tax credits to expenditures associated with innovative services. Including data and cloud computing in the R&D definition in 2021 was a step in the right direction, but the Government should broaden this to cover innovative services activities that depend on software and other intangibles.
- Reversing the cuts to public skills spending seen over the past 12 years and setting a target to increase spending from 5 per cent to 7 per cent of GDP, as is currently the case in Sweden.
- Introducing a human capital tax credit to match the R&D tax credit, which would attempt to reverse the decline in business investment for training.
- Designing future changes to the apprenticeship levy to encourage further business investment in skills.

Finally, to address the UK’s skills problems and to reflect the role that a diverse workforce plays in companies that innovate, the Government should expand the period of the ‘graduate visa’ from two to five years and guarantee the policy will not be reverted in the next decade. This would make the post-work visa more competitive compared to international peers like Australia.
Sustainable growth in developed economies is brought on by the application of ideas and innovation in new areas of the economy. During the Industrial Revolution, this included the production of machine tools and locomotives. In the 1930s, it was chemicals and automobiles. Then, post-war, it was aerospace activities and electronics. The new economy, however it is defined at different stages of history, is important for the performance and development of the economy overall.

Often, policy has been focused on encouraging the growth of the new economy of its day. For example, both national and local governments have been very explicit about identifying specific sectors to support, for example in the industrial strategy set out under the May Government, or through a plethora of local economic strategies. And policies that encourage research and development (R&D) have been popular in the UK in recent decades, with the hope being that this will lead to new breakthroughs that, when commercialised, can grow the economy.

In recent years R&D investment has been at the centre of discussions and policy developments, with the geographical dispersal of public money being a particular bone of contention. In particular, the concentration of these monies in the so-called golden triangle between London, Oxford and Cambridge has been blamed for the poor economic performance of other parts of the UK.

The Government has recognised this. Not only has it set out its intention to raise R&D spending to 2.4 per cent of GDP by 2027, it has committed in the Levelling Up White Paper to increase domestic public investment in R&D outside the Greater South East by at least 40 per cent.

What is less clear is where this money should be spent to have maximum impact. And without this, it becomes very difficult to guide how exactly the Government

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1 Swinney P (2010), Cities, Private Sector Jobs & the Coalition, London: Centre for Cities
2 See, for example, Forth T and Jones RAL (2020), The Missing £4 billion: Making R&D work for the whole UK, London: Nesta
should go about spending it.

International evidence suggests that innovation – a spur of new economic activity – disproportionately occurs in cities. For example, in the USA patents and research papers are more likely to be produced in cities, while in Germany work has shown that innovative firms are much more likely to be based in cities than elsewhere. However, to date, there is very little to show how this plays out in the UK.

This paper focuses on the UK, showing what the geography of today’s new economy looks like using a novel dataset that identifies businesses operating in emerging sectors.

It considers where the new economy firms are located in different types of places, sets out variations across cities, analyses the drivers behind location decisions, and looks at past and current policies designed to foster new economic activity. Finally, it makes policy recommendations to increase the size of the new economy across the country.

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**Box 1: Methodology**

**Definition of a city**

Centre for Cities’ research focuses on the UK’s 63 largest towns and cities. Unless otherwise stated, cities and large towns are defined as Primary Urban Areas (PUAs), using a measure of the built-up area of a large city or town, which sometimes spans beyond the core local authority. Full methodology is available at centreforcities.org/puas

**Defining city centres, suburbs, hinterlands and rural areas**

The analysis in this report splits the UK into four areas. Cities are divided into two areas – city centres and suburbs – as are non-urban areas (hinterlands and deep rural).

**City centres** are defined based on all the postcodes within a circle from the pre-determined city centre point. The radius depends on the size of the residential population:

- London: radius of 2 miles;
- Large cities (more than 550,000 residents): radius of 0.8 miles;
- Medium and small cities (less than 550,000 residents): radius of 0.5 miles

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3 Andrews MJ and Whaley A (2022), 150 years of the geography of innovation, Regional Science and Urban Economics vol. 94 (C)
4 Balland PA, Jara-Figueroa C, Petralic S, Stejna M, Rigbye D and Hidalgo CA (2018), Complex Economic Activities Concentrate in Large Cities, Rochester: SSRN
5 Kinne J and Lenz D (2019), Predicting innovative firms using web mining and deep learning, Mannheim: ZEW
miles.

**Suburbs** are determined based on the postcodes that fall within the rest of a city (defined as PUAs above).

**Hinterlands** are non-urban areas that are considered to be within the travel-to-work area of cities. This varies from place to place and is determined by the average distance that a worker living outside of a city travels to their job within it, defined using Census 2011 data. For example, the travel catchment for London is 63km, but for Worthing it is 20km.

The **deep rural** areas make up the remaining part of the physical landmass of Britain and fall outside of the travel catchment of cities.

To identify **business parks**, the research uses the 2011 workplace-based area classification from the Office for National Statistics (ONS), defining them as the sub-categories of regional business centres, industrial units, science and business parks and business parks.

**Defining new economy activities**

New economy firms, and their activities, are identified by the Data City, which uses ‘web-scraping’ of words from company websites. This data is then matched with Companies House records to verify businesses and their registered addresses.⁶

This enables emerging sectors to be identified in a way that is impossible to do thorough Standard Industrial Codes (how statistics agencies define sectors). The Data City has developed Real Time Industrial Classifications (RTICs) as an alternative to the standard measure and, to date, has identified 48 upper level RTICS, such as FinTech and wearables.⁷

Centre for Cities uses 47 RTICS to define the new economy (dropping business support services – see Appendix 1 for more information). This provides a dataset of 88,162 new economy businesses, which is around 3.2 per cent of all those reported by the ONS in 2021.

The RTICS are grouped into three categories:

- New economy services: businesses where the majority of RTICs (in cases where a firm is allocated more than one) are in services activities such as FinTech, AdTech, or both.
- New economy non-services: businesses where most activities are

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⁷ There are more than 300 sub-sectors under the 48 upper level RTICS. For further details, visit [https://thedatacity.com/real-time-industrial-classifications/](https://thedatacity.com/real-time-industrial-classifications/)
defined as non-services, such as AgriTech, modular construction or both.

- New economy hybrid businesses: those with an equal number of services and non-services RTICs. For example, a business that is classified as both AgriTech and digital creative.

Within this dataset, 60.6 per cent of businesses are classified as services and 34.5 are non-services. The remaining 4.9 per cent are hybrid businesses but given the small number, these are excluded from the analysis.

These firms are then allocated to places depending on the location of their registered address.

**Potential limitations**

There are two principal limitations with this dataset. The first is that by using registered addresses, it assumes that all innovative activity happens at that site. Sixty per cent of the businesses in the dataset have only one address. Given the absence of an identifiable second address, this assumption seems reasonable. It is more of a problem where a registered address is not where the business operates (because it is registered at an accountancy firm, for example) or where there are activities that occur in other branches. In cases where more than 500 businesses were registered to one address, this was manually checked to see whether it was the location of an accountant and, if so, a secondary address was used instead.

To test the sensitivity of the results to this limitation, two steps were taken. The first was to cross check business counts in the Data City dataset to those in the ONS data across the four geographies set out above. This test suggested the Data City data may be underplaying the role of cities, which means the results presented in this report are conservative estimates. The second was to run the analysis using single address businesses only. The key findings presented in this report did not change during this sensitivity testing.

A second issue is that counting firms rather than employees does not factor in business size. Previous work by Centre for Cities has shown that larger companies tend to locate in cities and city centres. Again, this means this dataset is likely to offer a conservative estimate of the trends shown in this report.

It is important to note that while the dataset is not perfect, it is the best that is currently available to understand and provide valuable insight into the geography of the new economy in the UK.

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Other data used for this research

This paper uses the Data City data with several publicly available datasets from the ONS. These include the total number of companies from UK Business Counts, the number of workers within a commutable distance according to the 2011 Census, productivity data at the local authority level from the [sub-regional productivity in the UK](#), the number of jobs from the Business Register and Employment Survey, and data on skills from the Annual Population Survey.
The new economy is urban focused

The geography of new economy businesses suggests that innovation in the UK happens in very specific places. Figure 1 shows new economy density (firms per km²) differs across Britain and indicates the concentration and location of these companies. Central London is by far the most popular place for such activities but beyond the capital there is a great deal of variation, with other large cities clearly visible.

**Figure 1: The new economy clusters in specific locations**
Previous work by Centre for Cities has long shown that the economy generally clusters in cities and large towns. As Figure 2 indicates, they account for 8.7 per cent of the land but accommodate 53.6 per cent of all UK businesses. This is even more acute for the new economy – 58.7 per cent of these businesses are based in cities.

Taking this further and splitting the UK into four broad areas – city centres, suburbs, hinterlands and deep rural areas (see Box 1) – shows how these businesses cluster in city centres, in particular. Around 13 per cent of the UK’s new economy firms are in city centres, which account for 0.1 per cent of land. This is almost twice the share of businesses located in these places overall.

Box 2 looks at the location of the new economy within Manchester to illustrate how this plays out across one city.

**Figure 2: New economy businesses cluster in cities and city centres more than other types of firms**

The geography of new economy firms

[Diagram showing the distribution of new economy businesses across different areas of the UK]

Source: The Data City, Census (2011); ONS (2021); Centre for Cities’ own calculations.

The further an area is from a city centre, the less popular it is among this cohort of businesses. Hinterlands – places within an easily commutable distance from cities – accommodate around a third of all new economy businesses, but this falls to 8.6 per cent in deep rural areas. Both have a lower share of new economy businesses than companies overall, suggesting these areas hold even less appeal for firms at the frontier of the economy. For example, deep rural areas cover more than half of the UK’s land but are home to just 11.6 per cent of all businesses and 9.2 per cent of new economy firms.
Box 2: The new economy in Manchester

Reflecting the patterns shown in Figure 2, the new economy in Manchester is concentrated in its city centre (see Figure 3).

Around 14.7 per cent of its new economy firms are registered there, despite the centre accounting for just 0.2 per cent of land. There are other areas of clustering, including Salford Quays, Stockport, Altrincham, Bury and Bolton. Clusters in or around the city centre tend to have higher shares of new economy services companies than those further out.

Figure 3: The geography of the new economy in Manchester

These location patterns apply to both the services and non-services parts of the new economy

Services companies show an even stronger preference for city locations (Figure 4) – 62 per cent are registered in cities and 16 per cent are in city centres. Non-services activities (mostly manufacturing) are slightly more prevalent in hinterlands, with the share of this type of business in these areas higher than their share of all companies. That said, most firms in both groups prefer an urban location, with more than half of the non-services new economy urban-based.
Figure 4: New economy services are more prevalent in urban areas than non-services

The location of service and non-service new economy firms

There is even greater variation when looking at the sectoral breakdown in finer detail. Figure 5 shows that AdTech companies, which provide online platforms and analytics for advertising, have the strongest preference for a city centre location, with almost half based there. Meanwhile, modular construction is least likely to be sited in an urban area, with around half of businesses either in hinterlands (37.9 per cent) or deep rural areas (15.2 per cent).

Figure 5: AdTech, cryptocurrency and FinTech companies are most likely to be based in cities

Source: The Data City. Centre for Cities’ calculations.

Note: Businesses can be classified into more than one RTIC, which means the same firm can be counted in two different categories.
Most urban new economy activities typically cluster in city centres. Of the five new economy services that are most prevalent in urban locations, four have at least a third of businesses in a city centre. At the other end of the scale, those sectors that are less concentrated in urban areas have fewer than one tenth of their businesses located in city centres (although this is still much higher than the 0.1 per cent of land these centres cover).

**Business and technology parks are a popular location in cities, but less so outside of them**

Business and technology parks are also popular locations for the new economy but where they are located depends on their popularity. Suburban parks (small clusters of commercial space in mainly residential areas) have proved attractive – they account for 0.5 per cent of all land, 4.4 per cent of UK businesses and 6.2 per cent of all new economy firms. However, this changes the further they are from cities – parks in hinterlands are less attractive than suburban ones, and those in deep rural areas are even less popular (see Figure 6).

**Figure 6: Suburban business parks, science parks and industrial units are popular locations for new economy businesses**

These parks are particularly attractive to non-services new economy businesses. For instance, around 15 per cent of all firms specialising in sensors and advanced materials are based in these locations (Figure 7), compared to less than 6.5 per cent of companies in digital creative industries and omics (life sciences that include genomics and metabolomics). Instead, these tend to cluster in city centres (see Figure 5). Within business parks in deep rural areas, energy management firms are the most prevalent new economy sector, yet these places
accommodate just 0.7 per cent of the whole sector (overall, 11 per cent are on business parks).

**Figure 7:** The popularity of technology and business parks depends strongly on the type of new economy firm

The new economy distribution within business parks

Source: The Data City; Census (2011); ONS (2021). Park-related areas based on 2011 workplace-based area classification from the ONS. It includes business parks, industrial units, science and business parks or regional businesses centres.

The geography of the new economy is driven by the benefits that places offer

The observed patterns result from the very different roles that distinct parts of the country play because of the inherent benefits they offer to businesses. Cities (and especially their centres) typically offer benefits known as agglomeration.\(^9\) These are:

1. Matching workers with employers.
2. Sharing inputs like infrastructure and supply chains.
3. Accessing tacit knowledge that requires face-to-face interactions, unlike codified knowledge (e.g., written down in books and other sources).

These benefits are felt over varying distances. For example, access to workers will apply over the distance that workers are willing to commute.\(^10\) Meanwhile, access to tacit knowledge plays out over much smaller geographies in dense city centres.

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in particular. For instance, ‘knowledge spillovers’ in the advertising sector in Manhattan operate within distances of around 750 metres, while in other sectors the effects are estimated to be seen over a distance of a mile.

This explains why new economy businesses often have a strong preference for urban locations. The data above shows that this is particularly acute for services firms that typically innovate by adapting and improving existing products and processes, which is highly dependent on knowledge spillovers.

Non-services businesses do not have as strong a preference for city centre locations, which suggests face-to-face interaction with other companies is less important for them. This could be a problem for some firms that need to patent their innovations and explains, for example, why pharma is less concentrated in city centres than FinTech. However, the strong clustering of these businesses in and around cities implies that access to workers is an important determinant of where they choose to be based.

The location of innovative new economy businesses suggests they are willing to pay a premium to get the access that an urban location offers them. In the UK, on average, city centres are most expensive in terms of rents and congestion. In contrast, deep rural areas provide access to lots of land at a cheaper cost, but not the access to knowledge and workers that cities can offer. Where firms locate depends on how they balance the trade-off between these factors. This may change over time; as an industry matures and its activities become more routine, evidence suggests that it has less need to access knowledge and so relocates.

This is in line with international findings that show more innovative and complex activities are likely to happen in large cities and in very concentrated areas.

- Evidence from several developed countries supports the idea that innovation is fostered by agglomeration, especially between different sectors. For instance, research among German firms shows that city

13 Graham D (2006), Investigating the link between productivity and agglomeration for UK industries, London: Centre for Transport Studies
16 Balland PA, Jara-Figueroa C, Petraliac S, Stejinla M, Rigbye D and Hidalgo CA (2018), Complex Economic Activities Concentrate in Large Cities, Rochester: SSRN

Berkes and Gaetani (2021) highlight the specific importance of high-density areas – such as city centres that concentrate economic activity – promoting ‘informal interactions’ that are particularly relevant to ‘help knowledge flows between distant fields.’ This is a particularly relevant feature for new economy services, where innovation is more likely to be driven by the transmission of knowledge informally, by adapting and adopting existing technologies.
districts exhibit higher shares of product innovator firms.\textsuperscript{18}

- Experience in the USA indicates that firms in the innovation sector have a strong tendency to cluster, in small geographies, by research field.\textsuperscript{19}

- Analysis of USA patent data filed between 1971 and 2007 found that inventors improved the number and quality of patents produced when they moved to a city with a larger cluster in their respective field (e.g., from Raleigh-Durham-Cary to the Boston-Worcester-Manchester area for biology and chemistry inventors).\textsuperscript{20}

**The demand for access to these benefits is unlikely to fundamentally change post-Covid**

There is a question around how sustainable these benefits will be because of the rise in remote working caused by Covid-19 lockdowns. To date, evidence on this is mixed.\textsuperscript{21} At the time of writing, data suggests that among those who are able to work remotely, hybrid rather than fully remote working is more prevalent. Meanwhile, Transport for London (TfL) statistics on ridership into office-dominated central London locations, such as Bank station, show a strong recovery in journeys, although it is not yet back to pre-Covid levels.\textsuperscript{22, 23} This would suggest that face-to-face interactions, which the analysis above suggests are particularly crucial for new economy businesses, will remain important even if they do not happen five days a week.

\textsuperscript{18} Innovation defined as the ‘introduction of a new or significantly improved product or process’.

\textsuperscript{19} Carlino G and Kerr W (2015), Agglomeration and Innovation, Helsinki: Bank of Finland Financial Market and Macroeconomics discussion papers

\textsuperscript{20} Moretti E (2021); The Effect of High-Tech Clusters on the Productivity of Top Inventors, Pittsburgh: American Economic Review


\textsuperscript{22} Source: ONS, Opinions and Lifestyle Survey

\textsuperscript{23} See TfL Network Demand dashboard: \url{http://ow.ly/A4rF5OLXGQr}
The analysis above treats cities as one group, but there is a great deal of difference between them. This section looks at the nature and scale of that variation.

Cities with the largest new economies are in the Greater South East

While patterns have shown there is an urban preference among new economy companies, there is still enormous variation across cities. As shown in Figure 8, those with the largest new economies tend to be in the Greater South East, with seven of the top 10 located in this part of the country. Cambridge, Milton Keynes, Oxford and London rank the highest with more than 30 new economy businesses per 10,000 working-age residents. Meanwhile, those with the fewest – Sunderland, Barnsley and Wigan – have three times fewer firms per working-age population. Box 3 shows how this pattern is also reflected across hinterland locations.
Figure 8: New economy businesses cluster in cities in the Greater South East

Box 3: The new economy in hinterland locations is also skewed towards the Greater South East

As is the case for the largest cities and towns, there is variation across non-urban areas in terms of their share of the new economy. Reflecting the geography seen in urban areas, hinterlands in the Greater South East perform more strongly than elsewhere (see Figure 9), accommodating 14.2 per cent of all businesses but 14.8 per cent of new economy firms. This pattern is far less obvious for deep rural areas; irrespective of their location in the country, their share of new economy businesses is smaller than businesses overall.
Figure 9: As is the case with urban areas, hinterlands in the Greater South East perform better than elsewhere in the country

Number of firms by non-urban areas, as a share of total firms in the UK

Source: The Data City; Census (2011); ONS (2021); Centre for Cities’ own calculations.

New economy businesses mostly locate in productive cities

Innovation is strongly associated with high income and productivity levels. According to the IMF, there is a positive relationship between per capita GDP and innovation in both OECD and non-OECD countries.24 Using the new economy as a proxy for innovation, Figure 10 suggests this is seen at the sub-national level too – cities and large towns with greater numbers of new economy businesses have higher productivity levels.

Figure 10: Cities with more new economy businesses tend to have higher productivity

The relationship between new economy businesses and productivity

Source: The Data City; ONS; Centre for Cities' own calculations.

Large cities are underperforming, impacting their productivity

In many western European economies and the USA, the productivity of cities increases as they grow because of agglomeration benefits. But this does not happen in the UK, with large cities (after London) punching well below their weight. Centre for Cities’ research has estimated that the eight largest underperformers accounted for a £47.4 billion productivity gap in 2018 alone.25

Given the link between innovation and productivity, it is not surprising that Figure 11 shows very little relationship between the size of the city and its new economy. In particular, the three largest cities after London – Manchester, Birmingham and Glasgow – have new economy businesses per 10,000 population that are similar to much smaller cities. This implies they are not fully providing the benefits of agglomeration. As new economy businesses are likely to be at the forefront of innovation, this suggests these cities are underperforming on innovation as well as productivity, with the former impacting the latter.

As previously shown in Figure 1, these cities are home to large concentrations of these businesses. However, they should accommodate many more given the agglomeration benefits they should offer to these types of activities.

25 Swinney P and Enenkel K (2020), Why big cities are crucial to ‘levelling up’, London: Centre for Cities
Figure 11: Manchester, Birmingham and Glasgow have fewer new economy businesses than expected, which suggests the agglomeration benefits they offer are not as strong as they should be.

The relationship between new economy businesses per 10,000 population and working age population within commuteable distance

Source: The Data City; Census 2011; Centre for Cities’ own calculations. Data for commuters is logged.

Strongly performing cities attract both services and non-services new economy firms

Cities either appeal to new economy businesses or they do not. While the analysis above indicates services and non-services activities have slightly different preferences when it comes to location, Figure 12 shows cities like Milton Keynes that are attractive to one type of new economy business, are usually attractive to the other. Those in quadrant D, such as Liverpool, Dundee and Bradford, have low numbers of each, while those in quadrant A, like Milton Keynes and Reading, have many of both.

It is not surprising, therefore, that average productivity in quadrant A cities is much higher than in quadrant D. What is more surprising is that productivity in the handful of cities in quadrant C, which lack services but do well in terms of non-services, is slightly worse than quadrant D. In contrast, quadrant B cities (those with above average numbers of services but a much smaller non-services sector) perform well.

The implication is that not only do services companies make up a significant chunk of the new economy, they are especially important for productivity in a city.
Figure 12: Cities with a competitive advantage in new economy services tend to be more productive

Relationship between services and non-services new economy firms across cities

Source: The Data City, ONS; Centre for Cities’ own calculations.
While agglomeration drives broad location patterns, the wide variation in performance between urban areas points to cities not always providing the benefits of agglomeration that both theory and practice suggest they should. This section looks at the extent to which cities and large towns offer access to workers and knowledge, and how this is likely to affect the number of new economy businesses located within them.

**Agglomeration factors: New economy businesses need access to high-skilled workers**

Skills appear to be a significant factor in the location decisions of new economy businesses, both within cities and outside of them. Cities and non-urban areas in the Greater South East, where the proportion of new economy firms is comparatively high, typically have large shares of high-skilled residents. As shown in Figure 13, a city like Cambridge, or non-urban areas such as Windsor and Maidenhead, have a highly skilled population and a large number of new economy businesses. Meanwhile, cities like Hull and Burnley are at the opposite end of the spectrum.

Because of their non-urban nature, the hinterlands of the Greater South East are unlikely to offer access to knowledge as a key locational benefit. Given this, access to skilled workers is likely to be the main reason why they perform more strongly than those elsewhere.²⁶

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²⁶ Supporting this finding, skill levels of residents have been shown to be a good predictor of the diffusion of personal computers between 1980 and 2000 in the USA. See Beaudry P, Doms M and Lewis E, Should the personal computer be considered a technological revolution? Evidence from US metropolitan areas, Journal of Political Economy Vol. 118 No. 5 (October 2010), pp. 988-1036
Providing access to skilled workers is not just dependent on the workers themselves, it requires sufficient transport connections to link them to employment opportunities. Previous Centre for Cities’ research shows that poor transport connectivity in the UK is a particular issue in many large cities, but less of a problem elsewhere. For large cities, the combination of a limited transport network and low density suburbs makes it more difficult to get potential workers into the centres in a reasonable time, so reducing their ‘effective size’. For example, while 2.5 million people live in Manchester, only 20 per cent can commute into the city centre within 30 minutes by public transport. This means these places offer ‘matching’ benefit of agglomeration benefits similar to those of a much smaller city. Addressing both transport and housing density in tandem will be required to help increase the size of the worker pool that innovative companies have access to in these large cities.

**Agglomeration factors: Being located close to other knowledge-based activities appears to be important for the new economy**

Knowledge spillovers should be higher in city centres with more jobs, as this increases the potential for people to exchange knowledge. Figure 14 supports this idea by showing a strong relationship between knowledge-intensive job

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27 Jeffrey S and Enenkel K (2020), Getting moving: Where can transport investment level up growth?, London: Centre for Cities
density in city centres and the presence of new economy firms. The centres of Manchester, Bristol and Brighton appear to be enabling knowledge spillovers to a far greater extent than the centres of Derby and Barnsley.

**Figure 14: The size of the new economy in city centres increases with density of jobs and rents are higher**

The relationship between the density of knowledge jobs and the size of the new economy in city centres

![Graph](image_url)

Source: The Data City; ONS; Valuation Office Agency. All data is logged.


31 For Manchester and Birmingham in particular, this data suggests their city centres are offering access to knowledge spillovers despite the underperformance of the wider city. But their city centres are undersized, so they are not making the outsized contribution they should be toward the wider performance of their city economies. See Swinney P (2021), So you want to level up? London: Centre for Cities.
Figure 14 also shows that city centres with the most new economy firms tend to have more expensive rents. Once again, this shows that, on average, new economy businesses are willing to pay a premium to get access to the benefits that successful city centres offer. Being a low-cost location is not an advantage when it comes to attracting these companies.

Other factors: Strengths in general manufacturing do not translate into strengths in cutting-edge manufacturing

Frequently, calls to promote sectors like advanced manufacturing are based on the premise that manufacturing mostly takes place in the North and Midlands and that places should build on their existing strengths. However, as Figure 15 shows, there is no relationship between share of employment in manufacturing as a whole and the amount of non-services new economy businesses in a city. A number of cities with small manufacturing sectors overall (and no strong manufacturing legacy), such as Milton Keynes, Cambridge, and Aldershot, have large non-services new economy sectors.

Figure 15: Cities with high levels of manufacturing employment tend to have low levels of non-service new economy firms

The location of general manufacturing and non-service new economy businesses

![Graph showing manufacturing jobs as a share of total jobs, 2021 (%)](Source: The Data City; ONS.)

This is likely to be because lower and higher-skilled manufacturing are looking for different things. Higher-skilled activities require access to high-skilled workers (as shown above). Lower-skilled activities still need access to lots of workers (which is why manufacturing in general tends to locate in or around cities), and also

32 For example, see SQW (2016), The Northern Powerhouse Independent Economic Review, Manchester: Transport for the North
looks for lower-cost land (see Figure 16) – there is no point in paying a premium to be near high-skilled workers or knowledge if a firm has little need for these.33

As a result, cities and large towns with cheaper land, such as Barnsley and Burnley, have proved attractive to this type of manufacturing, but less so to more innovative parts of the sector.

**Figure 16:** Non-services new economy firms pay a premium to access skills and knowledge, while more routine manufacturing does the opposite

Manufacturing, non-service new economy businesses and costs of space

Source: The Data City; ONS; Valuations Office Agency.

Note: Rateable values are used as a proxy for commercial space rents.

Other factors: It is unclear whether access to finance is an issue

According to the British Business Bank, there is very little difference in the supply of most types of finance across the country. However, this is clearly not the case for equity financing – since 2011, 58 per cent of equity deals have taken place in 20 local authorities. While these authorities were mostly in London, the list also includes Manchester, Bristol, Newcastle, Leeds, Cardiff and Glasgow.34 Meanwhile, 61 per cent of the equity deals have been done between investors and investees that are located within one hour of each other.35

This is potentially an issue for new economy businesses in particular because equity finance is more likely to fund innovation and growth.36 What is not clear is whether the issue is a lack of supply or lack of demand. Analysis for the Department for Business, Energy and Industrial Strategy found there was an equity gap in every part of the country. But when factoring in firm characteristics, in absolute terms this gap was the highest in London (£1.9 billion to £3.6 billion), followed by the South East (£1 billion to £1.8 billion). In Northern Ireland it was £0.06 billion to £0.16 billion. Added together, the equity gap in the Greater South East was larger than the rest of the UK combined.37

This analysis suggests that greater access to equity finance would be helpful for encouraging growth of the new economy across the country, and taking steps to address this by changing the tax system so it does not preference debt over equity would be welcome.38 But it does not appear to be driving the geography of the new economy.

Other factors: Research suggests that universities have a local innovation impact, but the mechanisms to make this happen are unclear

There are a number of research papers using international evidence that suggest universities have a local innovation impact.39 Many of these find that the impact tends to play out in sectors that are related to the university’s specialisms, and is more evident where they are research-intensive institutions and in higher-skilled areas. The principal purpose of universities – to educate students – clearly has a central role too, with the size of the local impact dependent on how many

graduates are retained or attracted from elsewhere.

What is less clear is what the mechanism is to make this happen and what the impact of universities is on wider innovation, because most studies use patent rates as their measure of innovation. This causes a problem for policy because it is not apparent what the prescription should be. An evidence base is needed and, to build this, the Government should evaluate the impact of the proposed increase in public R&D spending outside of the Greater South East to get a better understanding of what works.
While the analysis above shows the new economy is highly concentrated in certain locations across the UK, and that services play a big role within this, the past two decades of UK policy have not reflected these realities. Box 4 features a timeline of innovation policies since 2000 and this section provides a critique of the approach taken by successive governments.
Box 4: A timeline of innovation policies and plans

While not exhaustive, the list below sets out policies and plans designed to boost innovation.

Policy targeted at the frontier of the economy has typically focused on specific sectors

In recent years, a popular framing of policy both at the national and local level has been to focus on certain sectors. For example, the 2017 industrial strategy had specific sector deals for areas such as aerospace, AI and the automotive industry. And a number of local economic strategies over the years have also been keen to identify ‘key’ sectors.40

The principle is understandable – to give support to potential growth sectors at the frontier of the economy. But the execution is challenging for a number of reasons. Firstly, it is not clear what the ability of policy makers is to predict the growth industries of the future. Secondly, it misses the reality of many different new economy sectors clustering together, and the activity this creates. FinTech is a good example of two separate industries combining to form a new one.

This clustering happens for at least one of two reasons. The first is that there is a clear purpose for two businesses to be located close to one another, for example collaboration. The second is that while at the margins a particular industry may have a specific requirement that policy could assist with, most new economy activities have very similar needs. The analysis above shows that those places that can offer access to skilled workers and knowledge are able to attract a number of components of the new economy.

The recent approach of policy does not reflect the realities of the new economy. A modern approach would be one that takes a broader look through the lens of place, complemented by national interventions such as R&D tax credits, competition policy and the protection of intellectual property (IP) rights, rather than a tightly bounded focus on a handful of specific sectors.

**Innovation policy in particular has largely ignored geography**

Geography has been largely absent from policy over the past 20 years. Some interventions, like R&D tax credits and the patent box tax regime, are rightly national even if they will play out differently across the country. But there has been a lack of policies that are explicitly spatial in their approach (or at least an explicit spatial strategy in terms of how public money to support innovation is spent).

The most contentious example of this has been the allocation of public R&D investment. In 2018, London and the South East region were awarded 49 per cent of the Government and UKRI’s R&D spending. This has not been a deliberate spatial strategy – it has been place-blind in that it has been driven by assessments of the quality of research of universities (known as the Research Excellence Framework). However, the geography of the best performing institutions means that this has concentrated funding in the Greater South East. This illustrates how national policies can have very particular sub-national implications.

Many have pointed to this being a reason why innovative activity in the UK is skewed towards this part of the country. In response, the Government has made a commitment to increase public R&D spending outside of the Greater South East by at least 40 per cent.

As yet there is no clear strategy as to how this money will be spent. The Government had initially promised to change this with the publication of its R&D and place strategy, which would set out its approach across the country. But this did not happen. Instead, the Government decided it had been superseded by the Levelling Up White Paper. Unfortunately, it does not set out any clear spatial strategy about how place should influence how R&D funding is allocated.

Spatially focused policies have not been totally absent from the long list of interventions and two stand out in particular. The first is the Catapult Centres, which were introduced in 2011 by Innovate UK and are intended to be hubs for research and industry to commercialise and disseminate new innovations. Each centre has one of nine specialisms across 40 different locations in the UK. The second is the Strength in Places Fund announced in 2017. To date, it has

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41 Onward (2020), Levelling Up, London: Onward
42 For example, see Forth T and Jones RAL, The missing £4 billion - Making R&D work for the whole UK, London: Nesta
allocated £314 million to 12 full-stage projects through a competitive bidding process.\textsuperscript{44}

Added to this is the recent announcement of Innovation Accelerators in Birmingham, Glasgow and Manchester. While the £100 million allocated to them is very small in the context of what is spent on R&D in the UK, the Government has made an explicit spatial choice and focused on the places where productivity is the biggest challenge for the UK economy, and this is very welcome. The detail on what exactly the accelerators will do is still to be set out, but the evidence in this paper suggests they should base their plans on a good understanding of where innovation happens in their areas and use this to influence how they attempt to foster more. The same applies to the very recently repurposed investment zones that will aim to support the creation of ‘highest potential knowledge-intensive growth clusters’ around universities.

The UK has long struggled to hit its R&D targets despite a great deal of policy focus

Despite the large role services play in the new economy, many of the policies in Box 4 have concentrated on product innovation by manufacturing companies, with the focus on R&D the most significant (around £22 billion was spent by the Government in 2020).\textsuperscript{45} However, the UK seemingly has a long history of not hitting its R&D spending targets.

The current Government has committed to increasing R&D spending to 2.4 per cent of GDP. But not only is this less ambitious than the previous 2.5 per cent of GDP set in 2004, the UK systematically failed to achieve it. As Figure 17 shows, spending was well below this level in 2014 (the target date set by the original policy) and was not much better in 2019.

The ONS has very recently revised the public R&D figures that these government targets were based on, which has aligned them more closely with the figures HMRC collects from R&D tax credit data. This revision brings UK spending much closer to the original 2.5 per cent target, but even if these figures stand, the UK still trails behind the likes of Germany, South Korea and the USA in both R&D spending and broader productivity performance.\textsuperscript{46} Given this, the Government should raise its ambition for R&D spending.

\textsuperscript{44} Another £2 million allocated to ‘seedcorn funding’ for 40 projects
\textsuperscript{46} While some of the countries analysed have a larger manufacturing base than the UK, this is not universally the case. For instance, manufacturing as a share of GDP is similar in France
Figure 17: UK R&D spending is below the OECD average

R&D spending across selected developed economies

Source: OECD; ONS.

Innovation policy has been too narrowly focused on ‘tangible’ product innovation

R&D is a very narrow definition of innovation. While it is a particularly good tool for the development of new high-technology products, work by Nesta showed that innovation in services rarely depends on such investment and that policy has been designed for advanced manufacturing with a lack of focus on service-based innovation. This is typically associated with more ‘intangible’ innovation such as the integration and diffusion of existing technologies, the improvement of services, and the expansion to new markets and people, which all fall outside the R&D definition.

Last year, the activities that fall under the R&D tax credits scheme were broadened slightly to include cloud computing and data. While welcome, this still misses out a great deal of intangible investment. For example, it does not cover skills (as is the case in Singapore), software investment or developments in social sciences, so does little to encourage investment from services new economy businesses. This needs to change, either by expanding the definition of R&D or by increasing spending in other areas to encourage other forms of innovation.

49 See www.iras.gov.sg/taxes/corporate-income-tax/specific-topics/productivity-innovation-credit-(pic)-scheme
50 Bakhshi H (2022), The Art of R&D, London: Creative Industries Policy and Evidence Centre
The UK has a business investment problem much broader than R&D

Unfortunately, the UK does not merely have a narrow R&D investment problem, despite the focus by successive governments. It has an investment problem full stop.

UK business investment since 2008 has been very weak. It took more than six years for total business investment to recover from the global financial crisis, finally surpassing its 2008 peak in 2014. Just two years later, it flatlined after the EU referendum and when Covid-19 struck, it plunged. It is hard to see how this cumulated loss of investment over the past 14 years has not restricted the supply side of the economy.

Looking at specific aspects of this business investment that are directly related to services innovation paints a similarly bleak picture. According to the OECD, the UK has comparatively low levels of investment in things like IP products and computer software and databases, as shown in Figure 18. A similar relationship is found in total ICT investment, where the UK spend is around 1.8 per cent of GDP (2017), below the Netherlands (4.2 per cent), France (3.6 per cent) and the United States (3.4 per cent).

**Figure 18: The UK is behind several developed nations when it comes to intangible investment**

Investment in IP products and computer software and databases combined as a share of GDP

Source: OECD. OECD average unavailable as data is not available for all members.

There has been a slide in business skills investment as well. Per employee, it has steadily declined since the onset of the global financial crisis, and by 2019 it

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was 28 per cent lower than in 2007. UK businesses have spent half the amount on training per employee than the EU average, and the proportion of employees receiving training in the UK is lower now than in 2004.52

This has been coupled with a cut in public spending on training. Between 2010/11 and 2019/20, the total spent by the state fell by more than 15 per cent, taking it to 2005/06 levels. In terms of a share of GDP, this was a level last seen in the late 1990s.53

In addition, both trends have occurred alongside a tightening of immigration over the past decade. In 2012, the Government set an annual cap for Tier 2 (skilled workers) visas, and the graduate visa was ended (then reintroduced in 2021). Meanwhile, Brexit has stopped free movement of EU nationals.

The implications of this for innovation are likely to go beyond a restriction in the volume of workers; a number of studies suggest that skilled migrants have a disproportionate effect on innovation. Findings from the USA highlight that immigrants are more likely to file patents than the native population.54 Cross-country research shows migrants playing a disproportionally important role in innovation in English-speaking and European countries.55 And research in London found companies with more diverse boards were more likely to introduce new innovations.56

Across the UK, these effects are likely to have been predominantly felt in the cities with the most new economy firms. Figure 19 shows the greater the number of new economy businesses in a city, the larger the amount of National Insurance Number Online (NINO) applications from regions of the world where migrants have, on average, the highest level of skills.57

Focusing on improving R&D investment is a noble goal, but the shortfall is only part of the problem for the UK. The Government needs a set of policies to encourage investment in other areas that influence innovation, coupled with an increase in public and business investment in skills.

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52 Evans S (2022), Raising the bar: Increasing employer investment in skills, Leicester: Learning and Work Institute
55 Coda-Zabetta M, Chacua C, Lissoni F, Miguelez E, Raffo J and Yin D (2021), The missing link: international migration in global clusters of innovation
Also, https://blogs.lse.ac.uk/gild/2021/06/01/the-hidden-link-migration-and-innovation-in-global-clusters/
57 Regions used as a proxy for highly skilled labour are the following: ‘North America & Oceania’; ‘India’; and ‘EU 14’. Selected because they have more than 40 per cent of workers in occupations classified as ‘high skilled’ in 2020. For further details, see: https://migrationobservatory.ox.ac.uk/resources/briefings/migrants-in-the-uk-labour-market-an-overview/
**Figure 19:** Cities with large new economies more likely to compete for foreign talent

The relationship between the new economy and National Insurance registrations by foreign nationals

Source: The Data City, ONS; Department for Work and Pensions
Creating the conditions for new economy firms to start and grow – both in manufacturing and services – is central for the success of a UK economy that has seen investment and productivity flatline in recent years. While there has been a long list of policies designed to encourage innovation, many of these have been poorly designed, with the focus too narrow in terms of sectors and approaches to innovation. They have also largely ignored the role of place.

Cities are where the UK’s new economy is concentrated. This is because of the benefits they offer to emerging sectors – namely access to large pools of skilled workers and tacit knowledge through face-to-face interactions. But a number of large cities outside London are not offering the benefits they should to new economy businesses. Given this, policy needs to have a much greater focus on making them, and their city centres in particular, more attractive places to do business to encourage the creation and exchange of knowledge. The aim should be to get skilled people to interact and share this knowledge.

Given the limited public funding available, the Government should build on its selection of Birmingham, Manchester and Glasgow as the Innovation Accelerators by focusing on improving the performance of these three places. Following the approach of the CHIPS and Science Act, which will allocate $10 billion to increase innovation in 20 places, the UK should create a £14.5 billion growth package for these three cities over 10 years. This would help achieve the Levelling Up White Paper’s ambition of making them internationally competitive and should include:

- Allocating £1 billion from the proposed £7 billion increase in annual R&D spend outside the Greater South East to these cities. The money should be used to increase funding for research in the highest-performing university in each city, so continuing to back excellence – the leading

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58 This package is much less ambitious than the $100 billion over 10 years called for in the Brookings Institution research that informed it. See Atkinson RD, Muro M and Whiton J (2019), The case for growth centers – How to spread tech innovation across America, Washington DC: Brookings Institution
universities are all in the top 15 in the 2021 rankings of the research excellence framework. It would also build capacity to help increase the flow of knowledge from the universities to the private sector. Given the lack of understanding about how these mechanisms work to boost new economic activity, evaluation should be incorporated into this policy from the beginning.

• A £500 million package of support to expand the amount of commercial space in these cities’ centres, funded from the Strategic Programmes budget (previously the National Productivity Investment Fund). This should be used to overcome market failures that have prevented the private sector from developing this space, so unlocking private investment.

• Giving all three places TfL-style powers so they have greater control over services and the ability to use revenues to invest in improving their transport systems.

• For Greater Manchester and the West Midlands, extending the City Region Sustainable Transport Settlement beyond 2026/27 for a further five years (an additional £1 billion each), plus a similar commitment to Greater Glasgow. This should be combined with money to bring forward development of brownfield land to increase residential densities and support the viability of public transport networks.

• Beginning negotiations on creating a similar combined authority structure in the Greater Glasgow area, headed up by a metro provost.

• The Scottish Government should work with this new Greater Glasgow combined authority to set out a single departmental-style spending settlement for the city region, in the way the UK Government has committed to explore for Greater Manchester and the West Midlands. Legislation should also be amended to allow all areas to introduce local taxes, such as a tourist tax. If introduced, evidence should be collected on these changes with a view to rolling them out across other areas if they are successful.

To support the new economy in these cities and elsewhere, the Government should also:

1. **Increase both public and private investment in skills spending, and ease restrictions on skilled immigration, by:**
   - Reversing the cuts to public skills spending seen over the past 12 years and setting a target, as has long been on with R&D spending, to increase skills spending from 5 per cent of GDP to 7 per cent, as is currently the case in Sweden.
   - Introducing a human capital tax credit to match the well-
established R&D Tax Credit, which would attempt to reverse declining business investment in training.

- Designing future changes to the apprenticeship levy to encourage further business investment in skills. This should include introducing greater flexibility for reskilling as well as upskilling, spending on pre-apprenticeship training and reducing administration for SMEs.

- Expanding the period of the ‘graduate visa’ from two to five years and guaranteeing the policy will not be reverted in the next decade. This would make the post-work visa more competitive compared to international peers like Australia (up to four years).

2. **Deliver its commitments to increase R&D spending, and set out a spatial strategy to guide this, by:**

   - Increasing its R&D target from 2.4 per cent of GDP to the OECD average of 2.7 per cent by 2027.

   - Setting out a strategy for where and how it will spend the remainder of the increased R&D money outside of the Greater South East.

   - Extending the Strength in Places Fund to continue providing specific support for innovative activities across the country, with funding continuing to come from the Strategic Programmes budget.

3. **Expand the R&D-style tax credits to expenditures associated with innovative services.** The inclusion of data and cloud computing in the R&D definition in 2021 was a step in the right direction. However, the Government should broaden this definition to include innovative service activities that depend on software and other intangibles.
This paper considers a firm to be part of the new economy if it falls within at least one of the 47 sectors defined below. Each new economy activity is considered either a service or a non-service.

- AdTech (services)
- Advanced manufacturing (non-services)
- Advanced materials (non-services)
- Agency market (services)
- AgriTech (non-services)
- Artificial intelligence (non-services)
- Automation and robotics (non-services)
- Autonomous vehicles (non-services)
- CleanTech (non-services)
- Computer hardware (non-services)
- Cryptocurrency economy (services)
- Cyber (services)
- Data infrastructure (services)
- Data landscape (services)
- Design and modelling technologies (non-services)
- Digital creative industries (services)
- E-commerce (services)
- EdTech (services)
- Electronics manufacturing (non-services)
• Energy generation (non-services)
• Energy management (non-services)
• Energy storage (non-services)
• FinTech (services)
• Food Tech (non-services)
• Gaming (services)
• Geospatial economy (services)
• Immersive technologies (services)
• Internet of Things (services)
• Land remediation (non-services)
• Li-ion battery supply chain (non-services)
• Media and publishing (services)
• MedTech (non-services)
• Modular construction (non-services)
• Net zero (non-services)
• Omics (non-services)
• Pharma (non-services)
• Photonics (non-services)
• Quantum economy (non-services)
• Rehabilitation (services)
• Research and consulting (services)
• Physical sciences and engineering (non-services)
• Sensors (non-services)
• Software as a Service (services)
• Space economy (non-services)
• Streaming economy (services)
• Supply chain logistics (services)
• Telecommunications (services)
• Wearables and quantified self (services)