



UNIVERSITY OF  
**BATH**

# Understanding Productivity, R&D, and Innovation in the West of England

IPR Report

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**IPR** Institute for  
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# Contents

Figures .....	2
Executive Summary .....	4
<i>1. Geography and Data Sources</i> .....	<i>5</i>
<i>2. Productivity</i> .....	<i>7</i>
2.1 LEP Level.....	8
2.2 CA Level .....	16
2.3 LA Level.....	20
2.4 ITL3 Level .....	21
2.5 Firm & Industry Level (City of Bristol) .....	23
<i>3. Research and Development (R&amp;D)</i> .....	<i>26</i>
3.1 Business Enterprise R&D .....	26
3.2 UKRI R&D.....	27
<i>4. Innovation</i> .....	<i>30</i>
4.1 Innovation Diffusion .....	31
4.2 Innovation Characteristics.....	36
4.3 Clusters of Innovation .....	39
4.3.1 University-based Innovation.....	39
4.3.2 Industry-based Innovation.....	41
4.4 Innovation Capability Across Industries .....	42
<i>5. Summary &amp; Conclusion</i> .....	<i>48</i>
References.....	49

## Figures

Figure 1. The West of England Mayoral Combined Authority (left) and WoE LEP (right) geographical boundaries.....	6
Figure 2. the West of England Mayoral Combined Authority within the Gloucestershire, Wiltshire and Bath Bristol ITL2-level area. ....	6
Figure 3. The TOP-20 most productive LEPs .....	9
Figure 4. Productivity in the South West region .....	10
Figure 5. Scatterplot of Productivity and Population across LEPs (2021) .....	12
Figure 6. Scatterplot of Productivity and Skills Gap/Shortage across LEPs (2019) .....	13
Figure 7. Scatterplot of Productivity and Level 3 Qualifications or Above across LEPs (2021) .....	15
Figure 8. The CAs across England (Mayoral, Non-Mayoral and GLA). Source: adapted from gov.uk.....	16
Figure 9. Labour Productivity across all CAs (2004-2021) .....	17
Figure 10. Labour Productivity vs Population across all CAs (2004-2021).....	18
Figure 11. Labour Productivity vs Qualifications across all CAs (2004-2021) .....	19
Figure 12. Labour Productivity across LAs of the WoE LEP (2004-2021) .....	20
Figure 13. Productivity at the ITL3 level .....	22
Figure 14. Productivity (GVA per worker) distributions across City Regions in the UK (2017). Source: ONS.....	24
Figure 15. Productivity (GVA per worker) across Industries in the City of Bristol and Great Britain (2017). Source: ONS.....	25
Figure 16. R&D across ITL2 regions (absolute size). Source: ONS .....	26
Figure 17. R&D across ITL2 regions (as a % of GVA and per 1,000 residents). Source: ONS .....	27
Figure 18. UKRI spend across ITL2 regions: total and per person. Source: ONS.....	28
Figure 19. UKRI spend across ITL2 regions: percentage of GVA. Source: ONS .....	29
Figure 20. UKRI spend within Gloucestershire, Wiltshire and Bath/Bristol: total and per person. Source: ONS.....	30
Figure 21. Innovation diffusion across all LEPs .....	32
Figure 22. Innovation diffusion across LEPs (TOP-15) .....	33
Figure 23. Innovation diffusion across LEPs of the South West region.....	34
Figure 24. Innovation types & turnover in innovative businesses – TOP-15 most innovative .....	35
Figure 25. Innovation types & turnover from innovation in the WoE LEP .....	36
Figure 26. Innovation types & turnover in innovative businesses – TOP-15 most innovative LEPs .....	38
Figure 27. Cluster map of the WoE LEP and the West of England Mayoral Combined Authority. Source: Invest Bristol + Bath (bristolandbath.co.uk) .....	41
Figure 28. The eight Great Technologies .....	43
Figure 29. Innovation activity by industry – West of England LEP .....	44
Figure 30. Innovation activity by industry – all LEPs .....	46
Figure 31. Innovation activity by industry groups – all LEPs .....	47

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## ***About the Institute for Policy Research***

The Institute for Policy Research (IPR) was founded in 2013 at the University of Bath. It aims to further the public good through research into issues of significant relevance to policy debate and decision-making. The IPR brings together academics, policymakers, and practitioners from various disciplines and sectors to conduct rigorous and interdisciplinary research on pressing policy challenges. Through its collaborative and interdisciplinary approach, the IPR seeks to bridge the gap between academia and policymaking, contributing to evidence-based policy formulation and societal well-being.

## ***Disclaimer***

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## *Executive Summary*

The West of England Mayoral Combined Authority is responsible for the economic development and strategic planning of the West of England region. To effectively support the region's economic growth and competitiveness, the West of England Mayoral Combined Authority recognises the need to enhance innovation and productivity in its area of jurisdiction. To support this ambition, the current report provides analytical insights on the productivity, Research and Development (R&D) and innovation landscape in the West of England. We hope the report will inform the development of the West of England Mayoral Combined Authority's regional economic strategy and the implementation of its Plan for Innovation.

The West of England Mayoral Combined Authority region contains a diverse ecosystem of businesses, ranging from large enterprises like Rolls Royce and Airbus to a significant proportion of small and medium-sized enterprises (SMEs). However, there is currently a lack of region-specific analysis on business productivity, R&D, and innovation. Therefore, conducting research in this context is crucial to gain a deeper understanding of the local innovation ecosystem and to design targeted programmes and funding initiatives to improve the economic performance in the West of England.

In particular, we aim to answer the following eight research questions:

1. How productive are businesses in the West of England Mayoral Combined Authority?
2. How does productivity in the West of England Mayoral Combined Authority compare to productivity in other authorities?
3. Does the West of England Mayoral Combined Authority punch above or below its weight as determined by its population and skills/qualifications in the regional economy?
4. How widespread is innovation in the West of England Mayoral Combined Authority?
5. What types of innovation are the West of England Mayoral Combined Authority businesses most likely to engage in? Also, how common is it for the West of England Mayoral Combined Authority businesses to engage in R&D activities and form R&D collaborations within their business groups?
6. How does the West of England Mayoral Combined Authority compare to other local and Combined Authorities in terms of innovation?
7. Which industries in the West of England Mayoral Combined Authority exhibit the greatest innovation capability?
8. How does the West of England Mayoral Combined Authority compare to other Combined Authorities in terms of the innovation capability of their industries?

In answering these questions, we use publicly available data published by the Office for National Statistics (ONS) and the Smart Specialisation Hub (SSH). For productivity, we use the subregional productivity data published in the Annual Business Survey (ABS), for innovation we use the UK Community Innovation Survey (UKCIS), for local skills we use the Employer Skills Survey (ESS), for local qualifications and local population we use data from the Census 2021, and for innovation capability we use data from the Smart

Specialisation Hub. However, not all data are available at the Combined Authority level (i.e., the West of England Mayoral Combined Authority). In these cases, we use data at the Local Enterprise Partnership (LEP) level which correspond to a wider geographical area to the West of England Mayoral Combined Authority, i.e., the West of England LEP (henceforth, WoE LEP).

Overall, we show that the West of England Mayoral Combined Authority is the most productive Combined Authority (excluding the London area) and more productive than the LEP which it belongs to (i.e., the WoE LEP). We also show that the WoE LEP is among the 10 most innovative LEPs in England but not among the 10 most productive LEPs which naturally poses the question of how the WoE LEP can effectively use its innovation-capable industry to generate productivity gains. In this respect, the significant UKRI funding in the wider Gloucestershire, Wiltshire and Bath-Bristol area can play an important role. We also find that the West of England Mayoral Combined Authority punches above its population weight in terms of productivity, while the WoE LEP is above its population weight but below its human capital (qualifications) weight.

In an earlier report for the Bath and North East Somerset area, IPR and the Good Economy set out research and policy recommendations for improving the 'foundational' or 'everyday' economy (IPR, 2020). In this report we focus instead on supporting the West of England Mayoral Combined Authority's regional economic strategy and the implementation of its Plan for Innovation. We hope this research will contribute towards better informing regional policy decisions, shaping targeted funding programmes, and facilitating collaborative initiatives that could promote R&D improvements whilst effectively transforming innovation into productivity gains in the region. This, in turn, could lead to job creation and real wage gains, increased competitiveness and economic growth, benefitting not only residents but the wider community.

## *1. Geography and Data Sources*

In the analysis, we have used data that are publicly available. However, not all data correspond to economic activity within the geographical boundaries of the West of England Mayoral Combined Authority, which consists of the Bristol City Council (BCC), South Gloucestershire (SGC), and Bath and North East Somerset (BANES) areas.

For productivity, the data are available at the Combined Authority (CA) level (i.e., for the West of England Mayoral Combined Authority itself) but also at the Local Authority (LA) level (i.e., for each constituent part of the West of England Mayoral Combined Authority). The productivity data are also available at a higher level of aggregation that corresponds to the LEPs with the WoE LEP consisting of the West of England Mayoral Combined Authority and the North Somerset LA.

However, the R&D and innovation data are available only at a higher – than the CA – level of aggregation. The R&D data correspond to the ITL2 level which, in our case, maps to the wider geographical area including Gloucestershire, Wiltshire and the Bath/Bristol area.<sup>1</sup> The innovation data correspond only to the LEP level.

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<sup>1</sup> Since 2018, the UK uses the International Territorial Level (ITL) system which currently maps exactly on the formerly used Nomenclature of Territorial Units for Statistics (NUTS) system. Therefore, the ITL2 level exactly corresponds to the formerly used NUTS2 level for UK geographical territories.

Figure 1 below delineates the geographical boundaries for the West of England Mayoral Combined Authority (CA), its constituent parts (LA), and the wider WoE LEP (LEP). In terms of territory, the WoE LEP comprises of the West of England Mayoral Combined Authority territory while further including the territory of North Somerset. North Somerset is approximately one fifth of the WoE LEP in terms of both residential population (216,728 / 1,171,700 = 18.5%; as per the 2021 Census) and business population (8,940 / 46,270 = 19.3%; as per 2021 ONS statistics). In terms of unemployment, North Somerset and the WoE LEP (in its entirety, i.e., including North Somerset) bear similar unemployment rates [3.0% for North Somerset and 2.7% for the WoE LEP (2021 ONS data)].

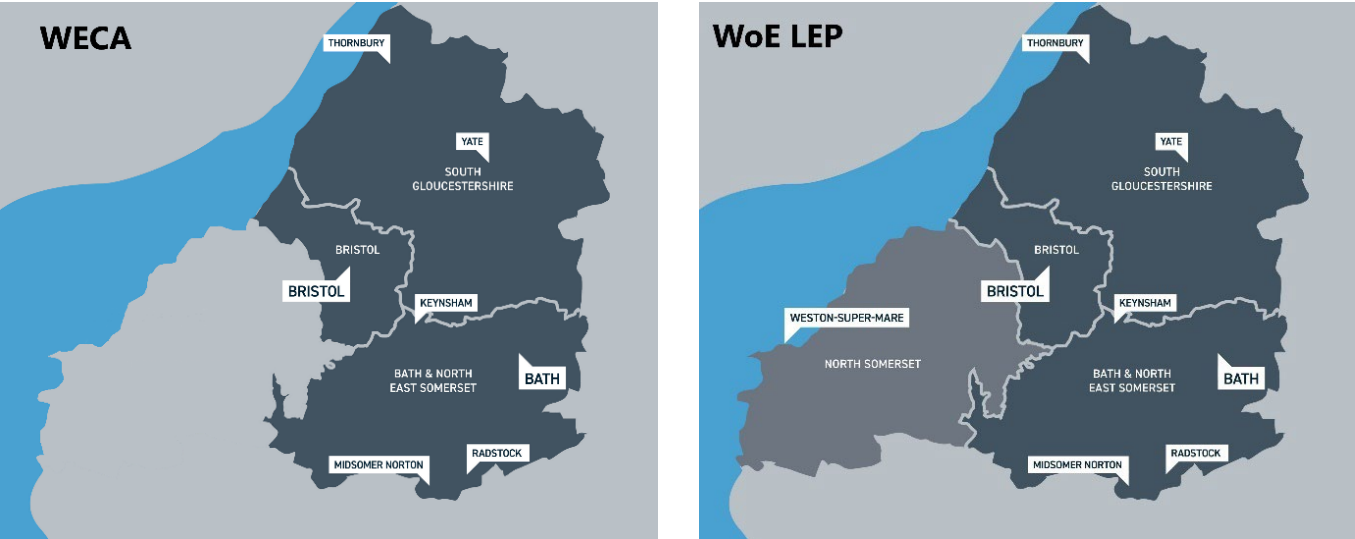


Figure 1. The West of England Mayoral Combined Authority (left) and WoE LEP (right) geographical boundaries.

For statistical purposes, the West of England Mayoral Combined Authority lies within the wider ITL2 level area of Gloucestershire, Wiltshire and Bath/Bristol area. Figure 2 below shows the location of the West of England Mayoral Combined Authority (delineated by the blue border) within its corresponding ITL2 region (delineated by the purple border).

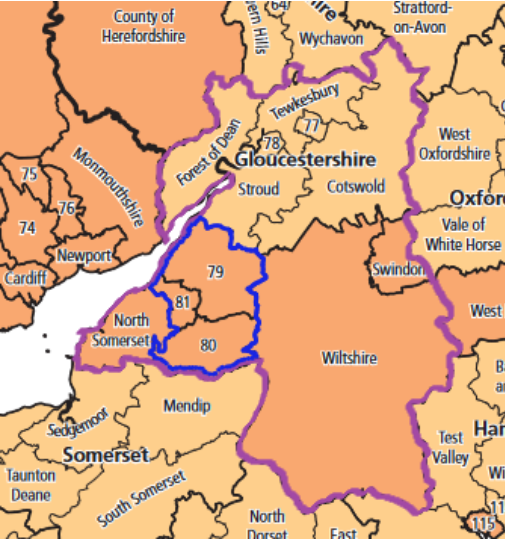


Figure 2. The West of England Mayoral Combined Authority within the Gloucestershire, Wiltshire and Bath Bristol ITL2-level area.

We used publicly available data published by the Office for National Statistics (ONS) and the Smart Specialisation Hub (SSH). For productivity, we used the subregional productivity data published in the Annual Business Survey (ABS) by the ONS. In the most recently published version of the data, the 2004 – 2021 period is covered.

The innovation data were retrieved from the UK Community Innovation Survey (UKCIS) of the ONS which takes place every two years. We used the four most recent waves of the survey. As the survey is biennial and each survey captures innovation activities of the current year and the previous two years, the four most recent waves correspond to the periods 2012-2014, 2014-2016, 2016-2018, and 2018-2020.

We also used regional skills data from the most recent Employer Skills Survey (ESS) of the ONS (2019). To the best of our knowledge, regional data are not publicly available for the Employer Pulse Survey launched in 2021 which is the successor of the ESS.

In understanding innovation activity across industries in the area, we used data on metrics of innovation activity published by the Smart Specialisation Hub. We also used regional population and regional qualifications data retrieved from the Census 2021. Finally, in deflating current GVA prices, we also used GDP deflator data published by the ONS.

## *2. Productivity*

In measuring productivity, we use the labour productivity variant measured as the Gross Value Added (GVA) per hour worked. This widely used measure is available at the LA level, the CA level, the LEP level, and the ITL3 level. We use all four levels in our productivity analysis as each of them offers a distinct perspective.

The CA level provides insights at the desired level (i.e., productivity in the West of England Mayoral Combined Authority) and enables comparisons with other CAs across England. The LA level provides a somewhat wider perspective as it enables comparisons of the WoE LEP (which is the West of England Mayoral Combined Authority plus North Somerset) with all other LEPs across England. As there are only 11 CAs (for the purposes of our analysis we include the regional-tier Greater London Authority in this group), the comparative analysis at the CA level may be somewhat restrictive. In contrast, comparative analysis at the LEP level enables comparisons of the WoE LEP with 36 other LEPs.

By separately investigating productivity across the LAs of the West of England Mayoral Combined Authority, we shed light on the individual contribution of each LA to the overall productivity of the West of England Mayoral Combined Authority. To obtain a better understanding of the productivity in the area that surrounds the West of England Mayoral Combined Authority, we additionally explore all ITL3 regions within the wider Gloucestershire, Wiltshire and Bath/Bristol ITL2 region. In addition, we also explore the distribution of productivity across businesses and sectors (essentially based upon firm-level and industry-level productivity data made available by the ONS).

The available data span from 2004 to 2021. As the published data refer to figures not corrected for inflation, we deflate the GVA values by using the GDP deflator published by the ONS.



## 2.1 LEP Level

LEPs are voluntary partnerships between local authorities and businesses in England. They are designed to promote economic growth and job creation at the regional level. LEPs work closely with businesses, local authorities, educational institutions, and other stakeholders to identify and address economic priorities and opportunities in their respective regions. There are currently 38 LEPs in England. From April 2024, the core functions of LEPs will transfer to local and Combined Authorities.

In Figure 3 below, we present the 20 LEPs with the highest productivity for 2021.<sup>2</sup> Overall, there is a very weak and positive productivity trend over the last 17 years across most of the LEPs which is captured by the generally but very slowly increasing UK average productivity. Indeed, average productivity in the UK was £36.4 of GVA per hour worked for 2004 and only £38.3 for 2021. This slow productivity growth in recent years represents a period of historically weak economic performance, with the UK having a prominent place in the productivity paradox literature (Goodridge et al., 2018; Coyle and Mei, 2023); albeit that a productivity slowdown has been evident in many industrialised nations (Crafts, 2018).

Propelled by their concentration of high-value industries, global connectivity, skilled workforce, and infrastructure among other factors, London and Thames Valley Berkshire are the two most productive LEPs, whereas Enterprise M3 has recorded an impressive increase in its productivity over the last two decades.

The WoE LEP ranks 15<sup>th</sup> in a total of 37 LEPs for year 2021 (red dashed line). There is a weak and positive trend in its productivity levels closely mirroring the UK trend. However, businesses in the WoE LEP are consistently less productive than the UK average. Over the 2004-2021 period, there has been an average 'productivity gap' between the WoE LEP and the UK average of £1.20 of GVA per hour worked. This 'productivity gap' was £1.40 for year 2019 and £1.90 for year 2021, suggesting that the WoE LEP has experienced a somewhat slower recovery in productivity growth rates post-COVID compared to the UK average.

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<sup>2</sup> The data for the 'UK' series correspond to data for the 'UK less extra-regio' series. In other words, excluding economic activity outside the UK landmass (such as oil/gas extraction within the UK's continental shelf). This applies to all Figures in this report where data for the 'UK' are presented.

### TOP-20 MOST PRODUCTIVE LEPs 2004-2021 (2021 prices)

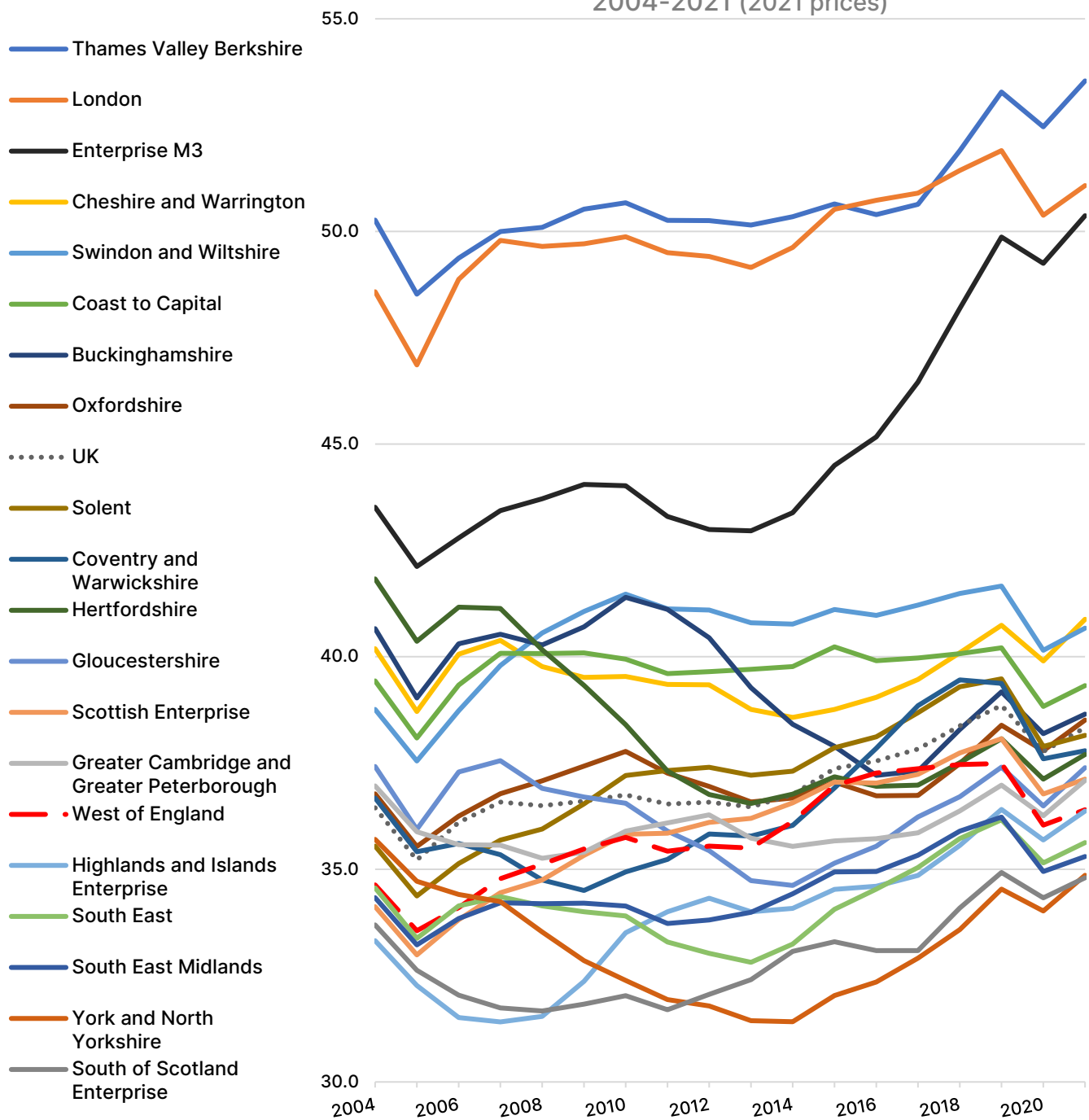


Figure 3. The TOP-20 most productive LEPs

In the South-West region, the WoE LEP belongs to the top half LEPs with the highest productivity. Only two LEPs, namely the Swindon and Wiltshire LEP and the Gloucestershire LEP, had a higher productivity than the WoE LEP in 2021. The WoE LEP and the Swindon and Wiltshire LEP are the only LEPs in the South-West that experienced an increase in productivity over the 2004-2021 period (albeit very weak), with the latter being the only LEP in the South-West with productivity consistently above the UK average. On the other hand, the productivity of Gloucestershire, Dorset, Heart of the

South-West, and Cornwall and Isles of Scilly in 2021 is very similar to their productivity levels in 2004.

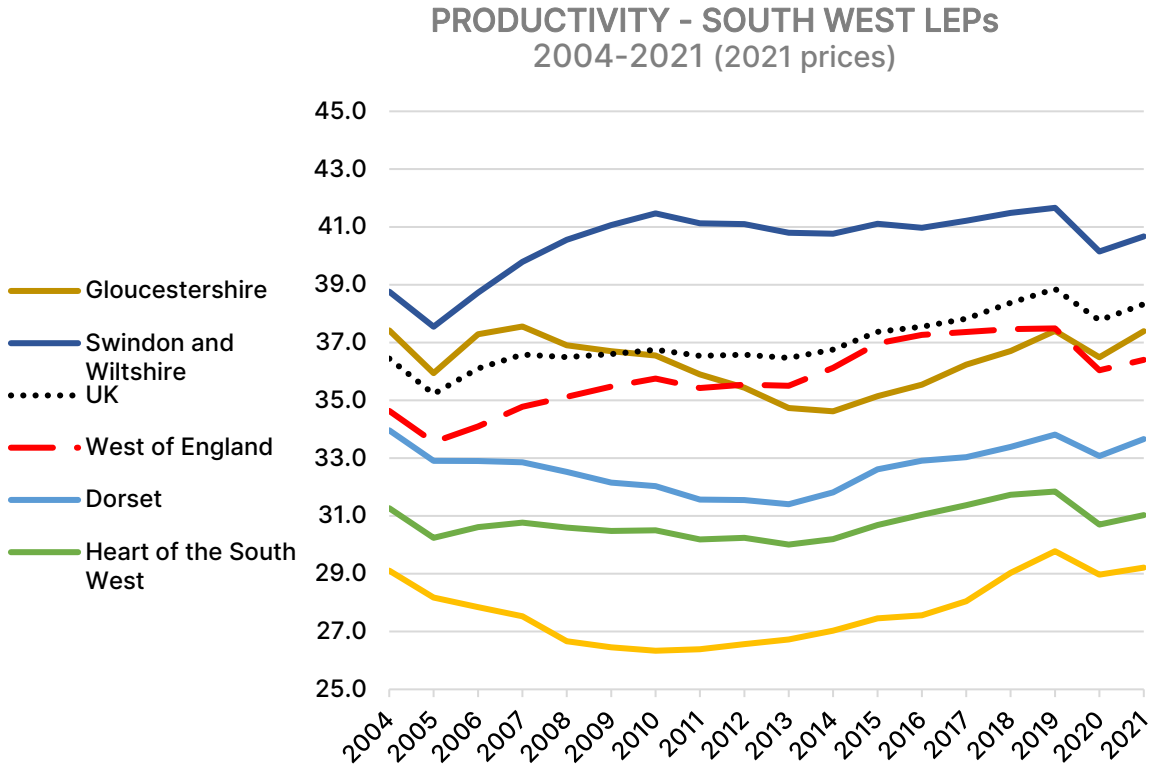


Figure 4. Productivity in the South West region

In understanding how the size of the local population may condition productivity across businesses in the WoE LEP and other LEPs, we plot the productivity rates of all LEPs against their respective population sizes. Figure 5 presents the resulting scatterplot. The WoE LEP lies about in the middle of the main body of data points with a population of 1,171,700 (in 2021) and £36.40 of GVA per hour worked (in 2021). When compared to LEPs with a population in the range of [1,071,700 – 1,271,700], i.e., ±100,000 from the WoE LEP population (1,171,700), the WoE LEP ranks 3<sup>rd</sup> out of 7 similarly populated LEPs. More specifically, the WoE LEP is more productive than Leicester and Leicestershire, Greater Lincolnshire, Stoke-on-Trent and Staffordshire, and the Black Country whereas the WoE LEP is less productive than Hertfordshire and Solent. (All these LEPs are bounded within the two vertical dashed lines of Figure 5.) This leads us to conclude that the WoE LEP does neither punch above nor below its population weight.

When focusing on LEPs with a productivity rate in the range of [34.4 – 38.4], i.e., ±£2 from the WoE LEP productivity rate (£36.40), we observe that the WoE LEP lies closer to the lower end of the population distribution (these LEPs are bounded within the two horizontal dashed lines of Figure 5). In other words, out of LEPs with a similar productivity, the WoE LEP has a relatively smaller population. This may tentatively suggest that if the WoE LEP were to grow in population more than other areas in the near future, it may not experience any negative influences on its productivity due to the population increase per se. Indeed, there are three LEPs with a slightly larger population to the West of England (Hertfordshire, Solent and Sheffield City Region) and slightly higher productivity.

This is further confirmed by the non-existent relationship between LEP population and productivity. When we exclude four LEPs that are obvious outliers (Thames Valley Berkshire, Enterprise M3, London and South East) we only find a very weak correlation (Pearson's  $r = -0.10$ ) between the productivity rate and population size of LEPs.

Next, we investigate the association between the 'skills gap', or skills shortage, as experienced by businesses and productivity. The 'skills gap' in the Employer Skills Survey of the ONS (Office for National Statistics) is measured by asking employers about the skills that their workforce currently possesses and the skills they require for their business operations. The survey collects data on the 'skills gap' at different levels, including job-specific skills, technical skills, and soft skills. Practically, the 'skills gap' is measured by the "percentage of staff that are not fully proficient" (Department for Education, 2020). Figure 6 plots the LEP productivity rates against their 'skills gap' by using information from 2019, which is the last year the Employer Skills Survey was published. (To the best of our knowledge, the ONS has not released more recent relevant data at the LEP level from the successor of the Employer Skills Survey, the Employer Pulse Survey, which was launched in 2021).

Thames Valley Berkshire, London and Enterprise M3 are the three LEPs with the highest productivity rates in 2019. The WoE LEP lies about in the middle of the main body of data points with a 'skills gap' of 14% (in 2019) and £37.50 of GVA per hour worked (in 2019). When compared to LEPs with a 'skills gap' in the range of [13% – 15%], i.e.,  $\pm 1$ pp from the WoE 'skills gap' (14%), the West of England ranks 9<sup>th</sup> – in terms of productivity – out of 22 LEPs with a similar 'skills gap'. Also, out of the nine LEPs with an identical measurement of 'skills gap' (i.e., 14%), the WoE LEP ranks 5<sup>th</sup>. (All these LEPs are bounded within the two vertical dashed lines of Figure 6.) This is an indication that the WoE LEP neither punches above nor below its 'skills weight' in terms of productivity.

When focusing on LEPs with a productivity rate in the range of [35.5 – 39.5], i.e.,  $\pm £2$  from the WoE LEP productivity rate (£37.50), we observe that the WoE LEP lies closer to the lower end of the 'skills gap' distribution, i.e., there are two LEPs with a lower 'skills gap' and six LEPs with a higher 'skills gap' than the WoE LEP (these LEPs are bounded within the two horizontal dashed lines of Figure 6). In other words, out of LEPs with a similar productivity, the WoE LEP has a relatively lower 'skills gap'.

However, we need to be careful when using the 'skills gap' variable, measured as the "percentage of staff that are not fully proficient" (Department for Education, 2020), as it is based on the perception of businesses about the job-specific skills, technical skills, and soft skills of their employees rather than on an objective measurement of the 'skills gap'. This implies that businesses based in areas which are very dynamic, extrovert and attractive to skillful employees, may set the bar high and benchmark themselves against businesses in leading national and international areas.

We find a weakly positive association between the 'skills gap', as experienced by businesses in LEPs, and productivity (Pearson's  $r = 0.23$ , after excluding the Thames Valley Berkshire, London, Enterprise M3 and Swindon and Wiltshire outliers). At first glance, this finding is counterintuitive. However, if we consider that businesses in the most productive areas may indeed set the bar high, then the 'skills gap' measure may be occasionally and partially capturing an element of business ambition.

## Productivity vs Population across LEPs 2021

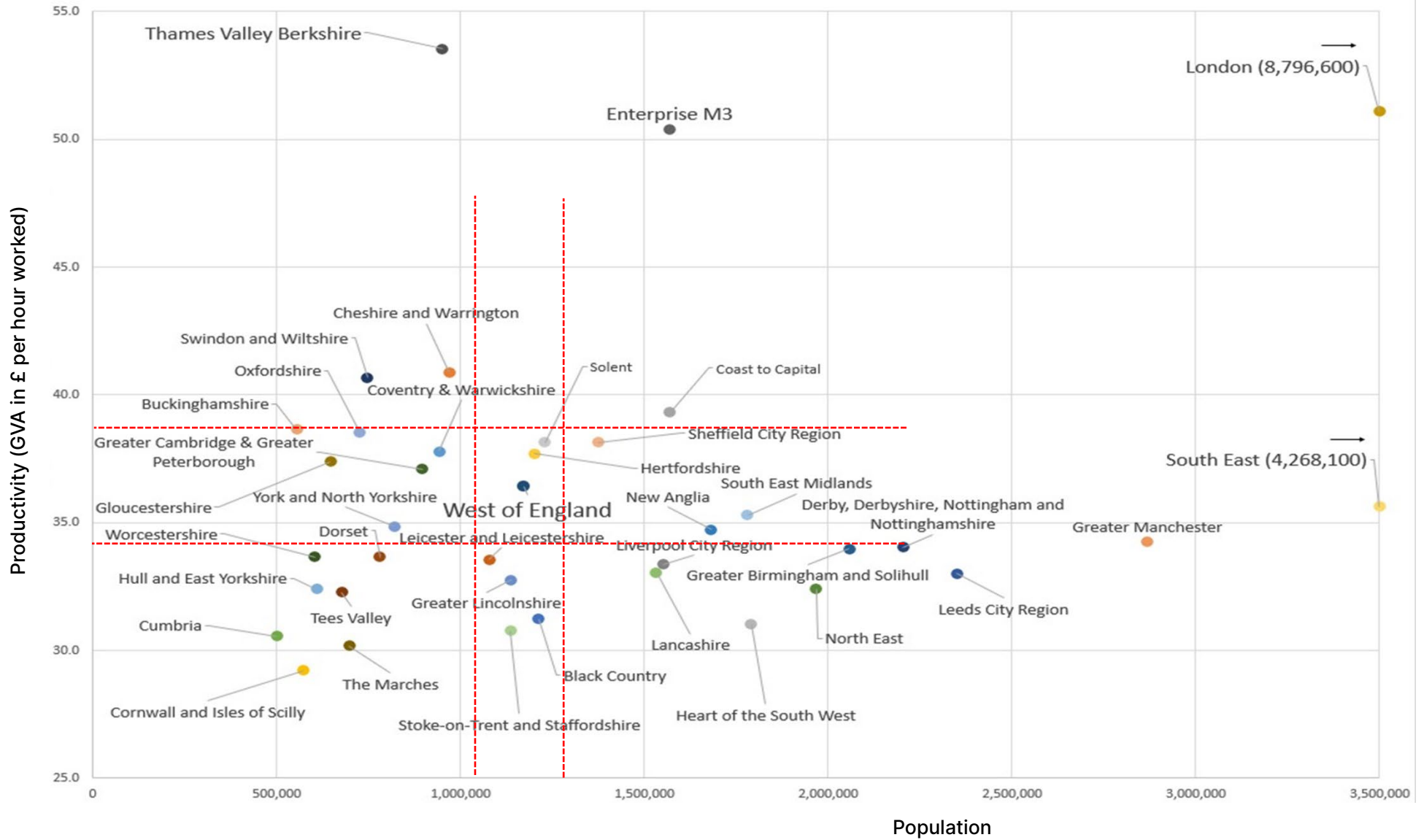


Figure 5. Scatterplot of Productivity and Population across LEPs (2021)

### Productivity vs Skill Gap/Shortage across LEPs 2019

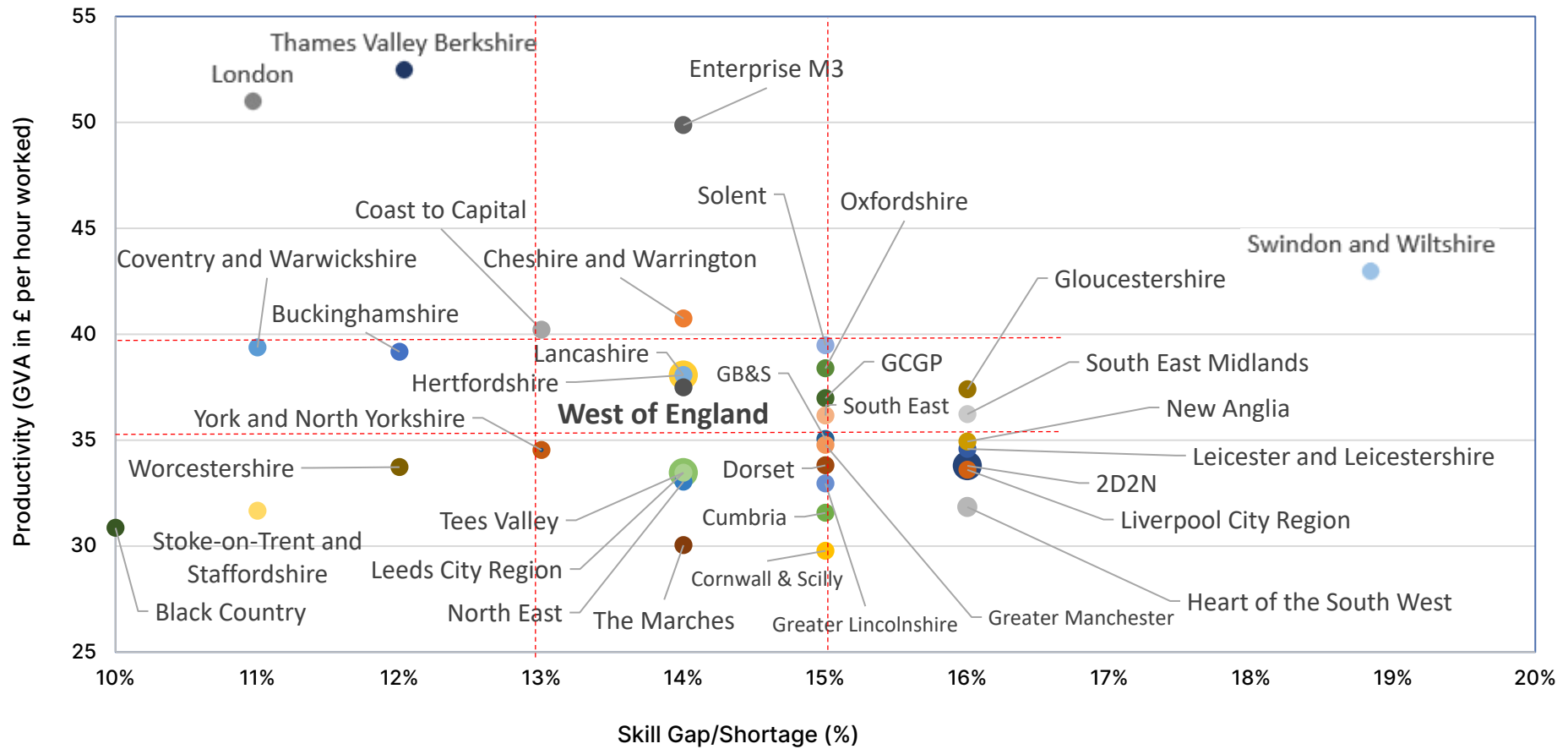


Figure 6. Scatterplot of Productivity and Skills Gap/Shortage across LEPs (2019)

An alternative means of understanding how human capital interacts with productivity is to use the qualifications of individuals. In constructing an indicator of the 'quality' of human capital, we use Level 3 qualifications as the cut-off point and calculate the percentage of the local population with Level 3 qualifications or above. In doing this we use data on the highest level of qualification achieved by the residents of the UK regions based on the 2021 Census and published by the ONS. The Level 3 qualifications correspond to upper secondary or college qualifications, such as A levels and BTEC Nationals, whereas the Level 4 qualifications correspond to qualifications awarded by higher education institutions, i.e., universities, colleges and institutions that provide advanced vocational training cycles or specialised education.<sup>3</sup>

In Figure 7 productivity is plotted against the qualification level across all LEPs for year 2021. The WoE LEP has one of the highest percentages of residents with a Level 3 qualification or higher – 69.2% – with only two LEPs having higher percentages (London – 71.4% and Oxfordshire – 72.9%).

When compared to LEPs with a percentage of Level 3 qualifications or above bounded between 67.2% and 71.2%, i.e.,  $\pm 2$ pp from the WoE LEP respective value (69.2%)<sup>4</sup>, the WoE LEP ranks second – in terms of productivity – out of three LEPs with a similar percentage of Level 3 qualifications or above. (All these LEPs are bounded within the two red vertical dashed lines of Figure 7.) However, when we allow for a wider interval of Level 3 qualifications [66.2% – 72.2%], i.e.,  $\pm 3$ pp from the WoE LEP respective value (69.2%), the WoE LEP ranks fifth out of six LEPs with a similar percentage of Level 3 qualifications or above. (All these LEPs are bounded within the two green vertical dashed lines of Figure 7.) This constitutes a strong indication that the WoE LEP punches below its human capital weight, as measured by level of qualifications, and its productivity is not reflective of its high-quality human capital.

The fact that the WoE LEP productivity is not reflective of its high-quality human capital becomes more important after we reveal a clearly positive relationship between human capital and productivity. The correlation between productivity and qualifications is considerably high, both when we consider all data points (Pearson's  $r = 0.67$ ) and when we exclude the outliers of London, Enterprise M3, Thames Valley Berkshire and Oxfordshire (Pearson's  $r = 0.62$ ).

Another perspective that documents that the WoE LEP punches below its human capital weight in terms of productivity, is by focusing on LEPs with a productivity rate bounded within 35.4 and 37.4, i.e.,  $\pm \pounds 1$  from the WoE LEP productivity rate ( $\pounds 36.4$ ). These LEPs are bounded within the two horizontal dashed lines of Figure 7. Out of 12 LEPs within this area – i.e., with a similar productivity – the WoE LEP has the highest percentage of Level 3 qualifications or above. This implies that the WoE LEP does not sufficiently exploit its highly qualified population in generating productivity gains.

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<sup>3</sup> The ONS defines the Level 3 qualifications and Level 4 qualifications or above as follows. Level 3 qualifications: 2 or more A levels or VCEs, 4 or more AS levels, Higher School Certificate, Progression or Advanced Diploma, NVQ level 3; Advanced GNVQ, City and Guilds Advanced Craft, ONC, OND, BTEC National, and RSA Advanced Diploma. Level 4 qualifications or above: degree (BA, BSc), higher degree (MA, PhD, PGCE), NVQ level 4 to 5, HNC, HND, RSA Higher Diploma, BTEC Higher level, professional qualifications (for example, teaching, nursing, accountancy).

<sup>4</sup> For the narrower interval defined by the 68.2% and 70.2% values, i.e.,  $\pm 1$ pp from the WoE LEP respective value (69.2%), there are no other LEPs apart from the WoE LEP. The area bounded within this interval is denoted by the two blue vertical dashed lines of Figure 7.

### Productivity vs Qualifications across LEPs 2021

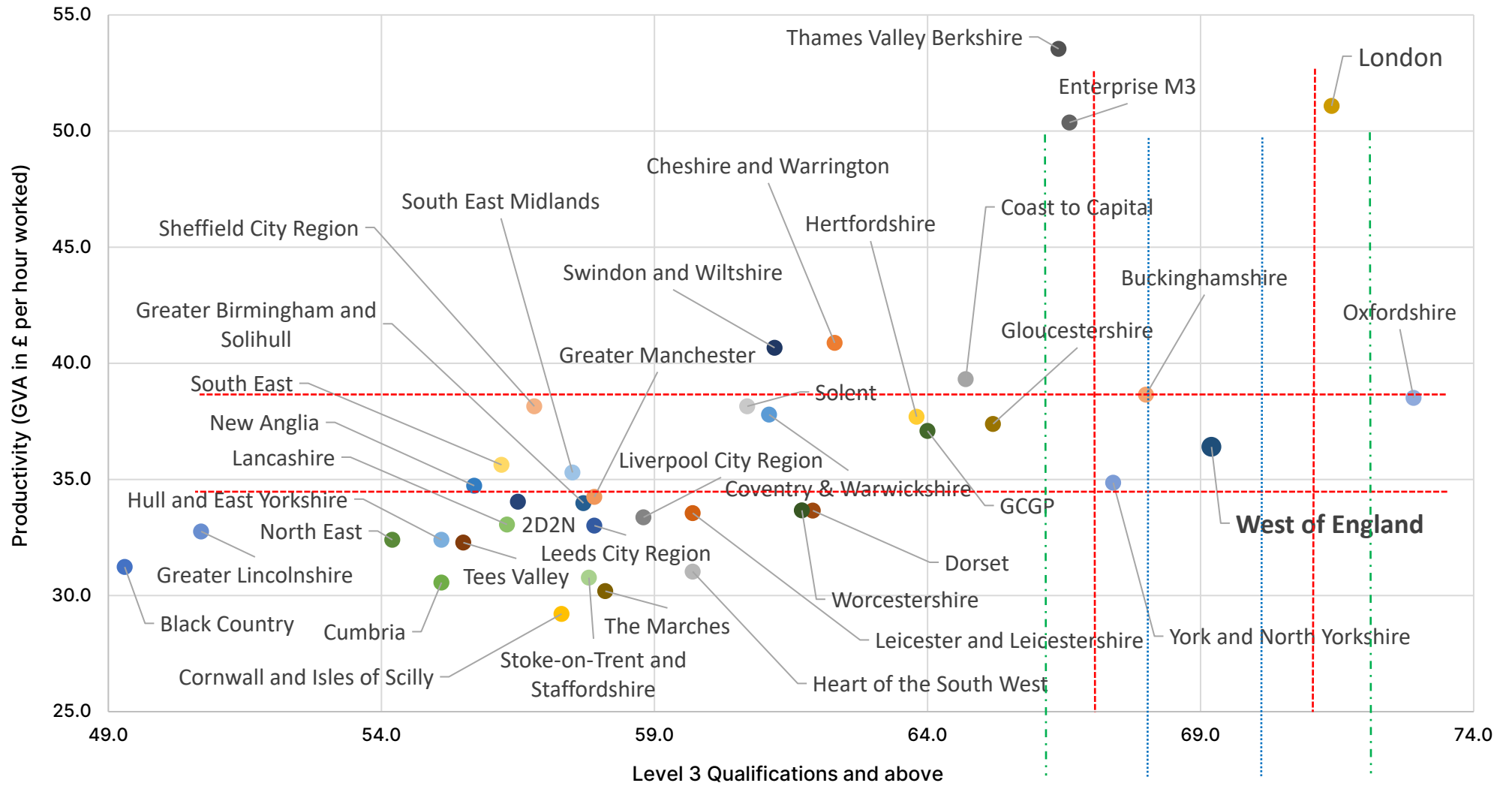


Figure 7. Scatterplot of Productivity and Level 3 Qualifications or Above across LEPs (2021)



## 2.2 CA Level

CAs are a form of sub-regional government in England, established to coordinate and collaborate on key issues such as economic development, transport, and housing. They are typically made up of several local authorities in a specific region, such as district, city, or county councils, working together under a single governance structure. CAs aim to provide a more efficient and effective way of making decisions and delivering services at a regional level. In England, there are nine Mayoral Combined Authorities (MCAs) and one currently non-Mayoral Combined Authority (the North-East Combined Authority). Besides the CAs, we also include in our analysis the Greater London Authority (GLA) as it bears a lot of resemblance to the MCAs and its inclusion serves our comparative purposes, albeit that it is a regional tier of government, not a CA. For simplicity, throughout the report we refer to the GLA as a form of CA. Figure 9 below illustrates the geographical location of the eleven CAs we use in our analysis: the nine MCAs, the one non-Mayoral CA, and the GLA.



Figure 8. The CAs across England (Mayoral, Non-Mayoral and GLA). Source: adapted from [gov.uk](http://gov.uk)

Figure 9 illustrates the labour productivity of all eleven CAs for the 2004-2021 period. The West of England Mayoral Combined Authority exhibits the highest productivity among all the Combined Authorities outside London – the GLA exhibits by far the highest productivity over the whole period. Productivity in the West of England Mayoral Combined Authority very closely mirrors the average productivity level of the UK, in particular after 2010. Also, the West of England Mayoral Combined Authority is consistently more productive than the Cambridgeshire and Peterborough CA, which immediately follows the ranks, after catching up in 2008.

Compared to the productivity level of the WoE LEP, the West of England Mayoral Combined Authority exhibits a higher productivity for both the 2014-2021 period (£36.5 GVA/hour vis-à-vis £35.8 GVA/hour) and for the three most recent years, i.e., 2019-2021

(£37.5 GVA/hour vis-à-vis £36.6 GVA/hour). Therefore, it logically follows that North Somerset (i.e., the area that makes the WoE LEP and the West of England Mayoral Combined Authority to differ) has a lower productivity rate compared to the West of England Mayoral Combined Authority.

In the aftermath of the Great Financial Crisis, there has been some divergence in the productivity rates of the CAs at the lower part of the graph (i.e, lower than the Cambridgeshire and Peterborough CA), only for productivity rates to converge in the most recent years, a process that started around 2013. The only notable exception is the South Yorkshire CA, whose productivity was stagnant across the 2007-2019 period.

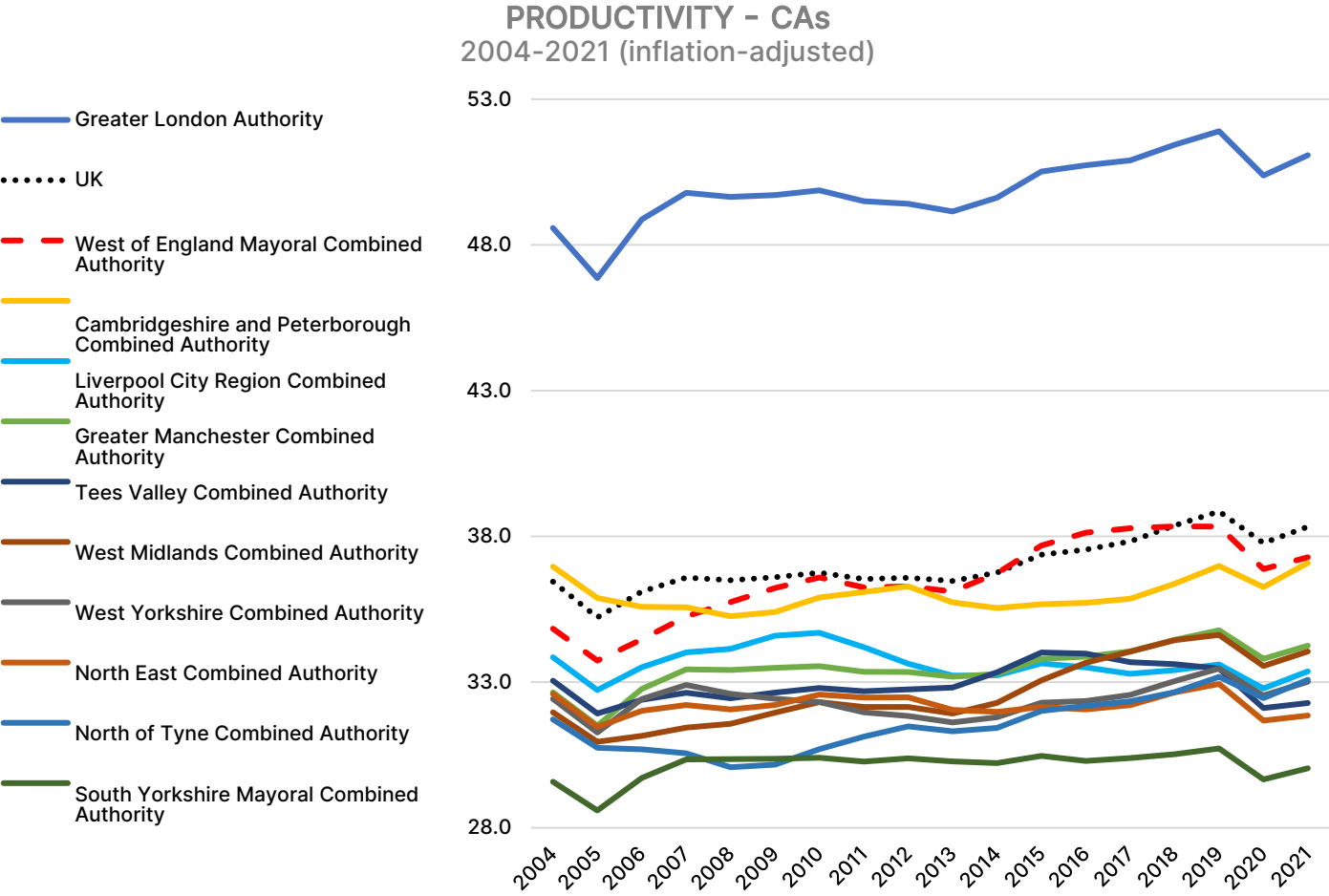


Figure 9. Labour Productivity across all CAs (2004-2021)

We further investigate how the productivity rates vary by the population size of the CAs. Figure 10 presents the corresponding scatterplot for 2021. The West of England Mayoral Combined Authority lies in the upper left part of the graph having the 4<sup>th</sup> smallest population (954,300) and the highest productivity (£37.3 GVA per hour worked) after the GLA. When compared to CAs with a population in the range of [804,300– 1,104,300], i.e., ±150,000 from the West of England Mayoral Combined Authority population (954,300), the West of England Mayoral Combined Authority ranks 1<sup>st</sup> – in terms of productivity – out of 3 similarly populated CAs. More specifically, the West of England Mayoral Combined Authority is slightly more productive than the similarly populated Cambridgeshire and Peterborough CA and significantly more productive than the similarly populated North of Tyne CA. (These CAs are bounded within the two red

vertical dashed lines of Figure 10.) By considering a slightly wider interval [754,300 – 1,154,300], i.e.,  $\pm 200,000$  from the West of England Mayoral Combined Authority population (954,300), the West of England Mayoral Combined Authority ranks 1<sup>st</sup> out of 4 similarly populated CAs, now also surpassing the similarly populated North East CA. (These CAs are bounded within the two blue vertical dashed lines of Figure 10.) This leads us to conclude that the West of England Mayoral Combined Authority punches above its population weight in terms of productivity.

The only CA that has a very similar productivity to the West of England Mayoral Combined Authority is the Cambridgeshire and Peterborough CA as the two horizontal dashed lines of Figure 10 show. [These lines denote the [36.3 – 38.3] productivity range, i.e.,  $\pm \text{£}1$  from the West of England Mayoral Combined Authority productivity rate ( $\text{£}37.3$ .)] As there is only one similarly productive CA, we cannot reach any conclusions from this investigation.

After excluding the obvious outlier of GLA, we find practically no correlation between the productivity rates of CAs and their respective population size (Pearson's  $r = -0.04$ ). (When we include the GLA, we find a strong positive correlation – Pearson's  $r = 0.87$  – which is spurious as it is driven by the GLA.) This means that productivity is not sensitive to the population size of CAs and if the West of England Mayoral Combined Authority's population was to expand disproportionately to other CAs in the near future, there should be no influence on its productivity.

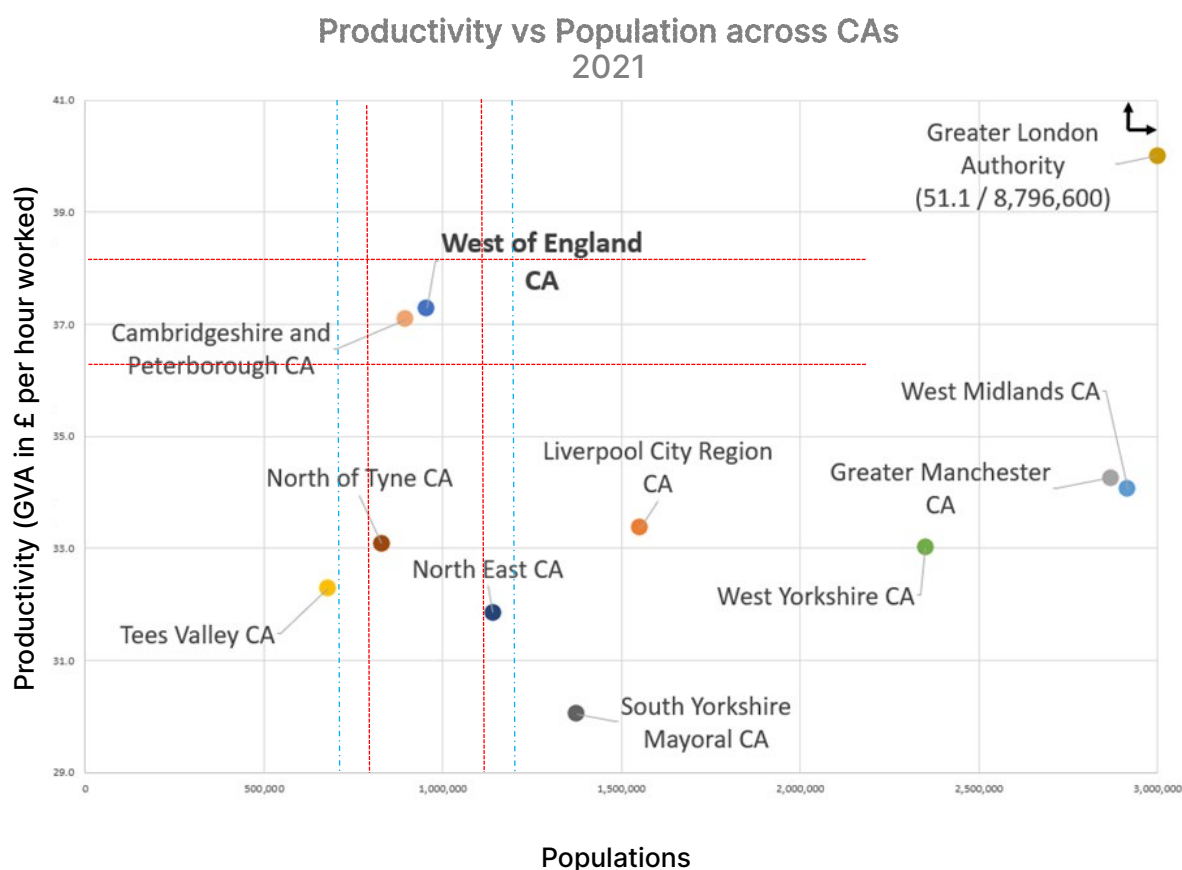


Figure 10. Labour Productivity vs Population across all CAs (2004-2021)

As no data on skills exist at the CA level, we only use qualification data for the populations of CAs. Data on the qualifications in the area may serve as a proxy of how the 'quality' of human capital in CAs may influence their productivity rates.

Figure 11 illustrates the scatterplot of productivity rates and the percentage of Level 3 qualifications or above. The West of England Mayoral Combined Authority is not only the CA with the highest productivity rate (£37.3 GVA per hour worked in 2021) but also with the highest percentage of Level 3 qualifications or above (70.2% of the population aged 16-64).

We find a strong positive correlation between the productivity rates of CAs and their respective percentages of Qualification 3 or above (Pearson’s  $r = 0.79$ ). (When we exclude the GLA, we still find a strong positive correlation – Pearson’s  $r = 0.78$ .) This finding confirms the strong link between the ‘quality’ of human capital and productivity. This implies that an avenue to increase productivity in the West of England Mayoral Combined Authority is to invest more in training and upskill the local pool of employees.

The only CA that has a very similar productivity to the West of England Mayoral Combined Authority (£37.3 GVA per hour worked) is the Cambridgeshire and Peterborough CA (£37.1 GVA per hour worked) as the two horizontal dashed lines of Figure 11 show. [These lines denote the [36.3 – 38.3] productivity range, i.e., ±£1 from the West of England Mayoral Combined Authority productivity rate (£37.3).] However, the West of England Mayoral Combined Authority has a much higher percentage of Level 3 qualifications or above than the Cambridgeshire and Peterborough CA (70.2% vis-à-vis 64.0%). If we also consider the positive relationship between the productivity rates of CAs and their respective percentages of Qualification 3 or above, this may suggest that the West of England Mayoral Combined Authority may not fully reap the productivity gains that may stem from its high ‘quality’ of human capital.

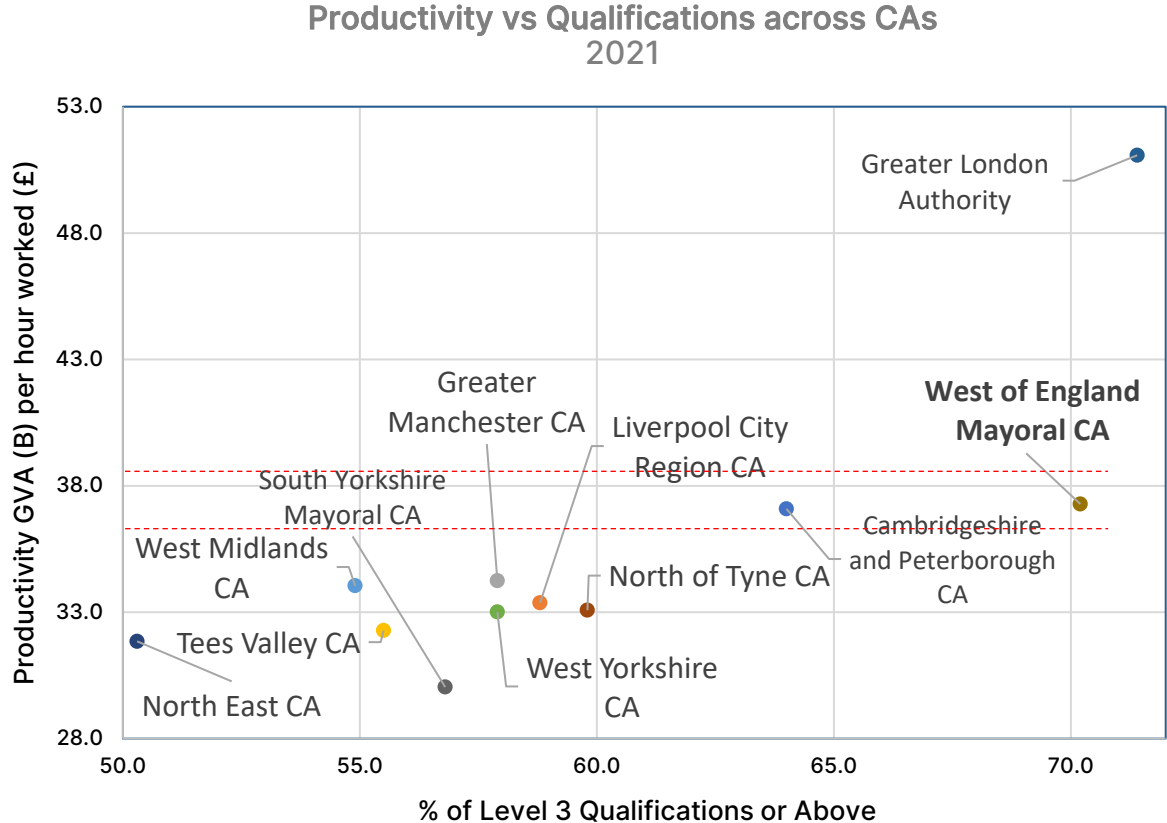


Figure 11. Labour Productivity vs Qualifications across all CAs (2004-2021)

## 2.3 LA Level

By separately investigating the constituent parts of the West of England Mayoral Combined Authority, we can shed light on the individual contribution of each LA to the overall productivity of the West of England Mayoral Combined Authority. Figure 12 presents the productivity of all LAs making up the West of England Mayoral Combined Authority, namely the City of Bristol, Bath and North East Somerset, and South Gloucestershire. As we are also interested in the WoE LEP (please see above), we also include North Somerset in our analysis.

South Gloucestershire is the most productive LA of the WoE LEP and the only one with a productivity level above the national average. After 2009 its productivity has risen steadily only to slow down in the years before the pandemic before it decreased in the 2020 lockdown year. The City of Bristol exhibits the second highest productivity with North Somerset and Bath and North East Somerset following. The City of Bristol experienced a productivity increase in the 2005-2010 period, followed by a productivity decrease in the following three years before productivity rose again after 2013 only to be interrupted by the COVID-19 pandemic. In the aftermath of the Great Financial Crisis of 2008, the productivity trends in North Somerset and Bath and North East Somerset were very similar, with the exception of the 2012-2015 period when the productivity of North Somerset grew faster than in Bath and North East Somerset. The graph also documents that North Somerset has a lower productivity rate compared to the constituent parts of the West of England Mayoral Combined Authority which explains the higher productivity of the West of England Mayoral Combined Authority vis-à-vis the WoE LEP (please see Section 2.2).

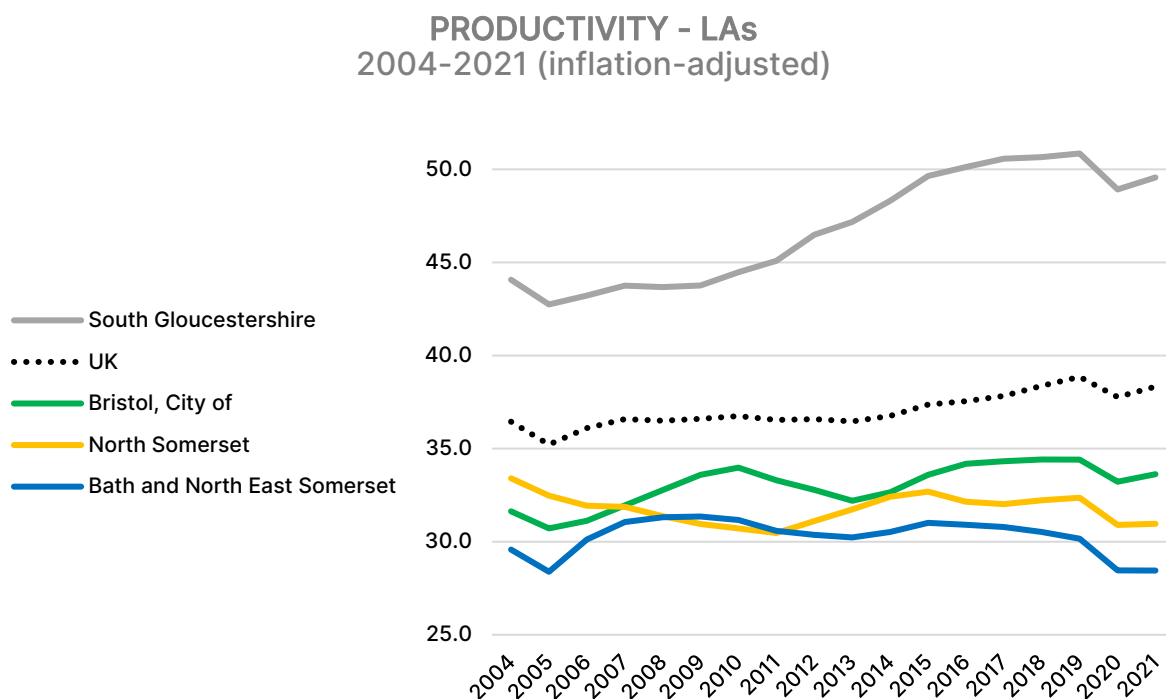


Figure 12. Labour Productivity across LAs of the WoE LEP (2004-2021)

In addition to the productivity figures for the four LAs of the WoE LEP, Table 1 also presents their respective population, 'skills gap' and qualification percentages. Bath and

North East Somerset has both the lowest productivity and the smallest population in 2021, North Somerset follows with the second smallest population and productivity whereas the City of Bristol has the largest population and the second largest productivity. If we were to exclude South Gloucestershire, which has the highest productivity and the second largest population in the WoE LEP, then we would observe a perfectly positive relationship between productivity and population in the WoE LEP.

Bath and North East Somerset has the lowest 'skills gap' (11%) followed by South Gloucestershire (13%) and the City of Bristol and North Somerset (15% in each LA). In terms of productivity, the two LAs with the lowest 'skills gap' have a combined higher productivity (£28.5 and £49.6 of GVA per hour worked) than the LAs with the two highest 'skills gap' (£33.6 and £31.0 of GVA per hour worked).

The two LAs containing the largest urban areas of the WoE LEP (the City of Bristol and Bath and North East Somerset) have the highest percentages of Level 3 qualifications or above whereas South Gloucestershire and North Somerset have substantially lower percentages and very similar to each other. In terms of productivity, the two LAs with the lowest percentages of Level 3 qualifications or above have a combined higher productivity (£31.0 and £49.6 of GVA per hour worked) than the more urban LAs (£28.5 and £33.6 of GVA per hour worked).

Table 1. Productivity, population, skills gap and qualifications in the LAs of the WoE LEP (2021).

LA	Productivity (GVA in £ per hour worked)	Population	Skills gap (%)	Level 3 Qualifications or above (%)
Bath and North East Somerset	28.5	192,400	11%	71.4%
City of Bristol	33.6	471,100	15%	72.4%
North Somerset	31.0	217,400	15%	64.2%
South Gloucestershire	49.6	290,700	13%	65.5%

Notes: The 'skills gap' figures correspond to the year 2019.

## 2.4 ITL3 Level

To obtain a better understanding of the productivity in the area that surrounds the West of England Mayoral Combined Authority, we additionally explore all ITL3 regions within the wider Gloucestershire, Wiltshire and Bath/Bristol ITL2 region. Figure 13 presents the respective productivity rates of all these ITL3 regions.

The Gloucestershire, Wiltshire and Bath/Bristol ITL2 region is the most productive in the South West with the productivity of all of its ITL3 regions being higher than the South West average. The only exception to this is the City of Bristol whose productivity is

somewhat lower than the South West average for most of the 2004-2021 period. Indeed, since 2009, the two productivity series move very closely to each other.

The productivity of the City of Bristol is the lowest among all ITL3 regions within the Gloucestershire, Wiltshire and Bath/Bristol ITL2 region. On the other hand, the Bath and North East Somerset, North Somerset and South Gloucestershire ITL3 region is significantly more productive than the City of Bristol with an average 'productivity gap' of £5.2 of GVA per hour worked across the 2004-2021 period. As these two ITL3 regions jointly form the WoE LEP, we demonstrate that it is not the City of Bristol that drives the WoE LEP productivity but, instead, its counterpart areas. This is consistent with evidence that large cities in the UK lie considerably below the 'productivity potential' that their size would suggest and are, thus, systematically less productive than their international counterparts (e.g., Brussels, Lyon, Gothenburg, Munich etc.) (Swinney and Enenkel, 2020; Centre for Cities, 2021).

On the other hand, Swindon is the driver of productivity in the Swindon and Wiltshire LEP. Based on the argument of the productivity underperformance of cities as they grow larger, we argue that Swindon may have not yet reached a critical size that negatively influences productivity.<sup>5</sup>

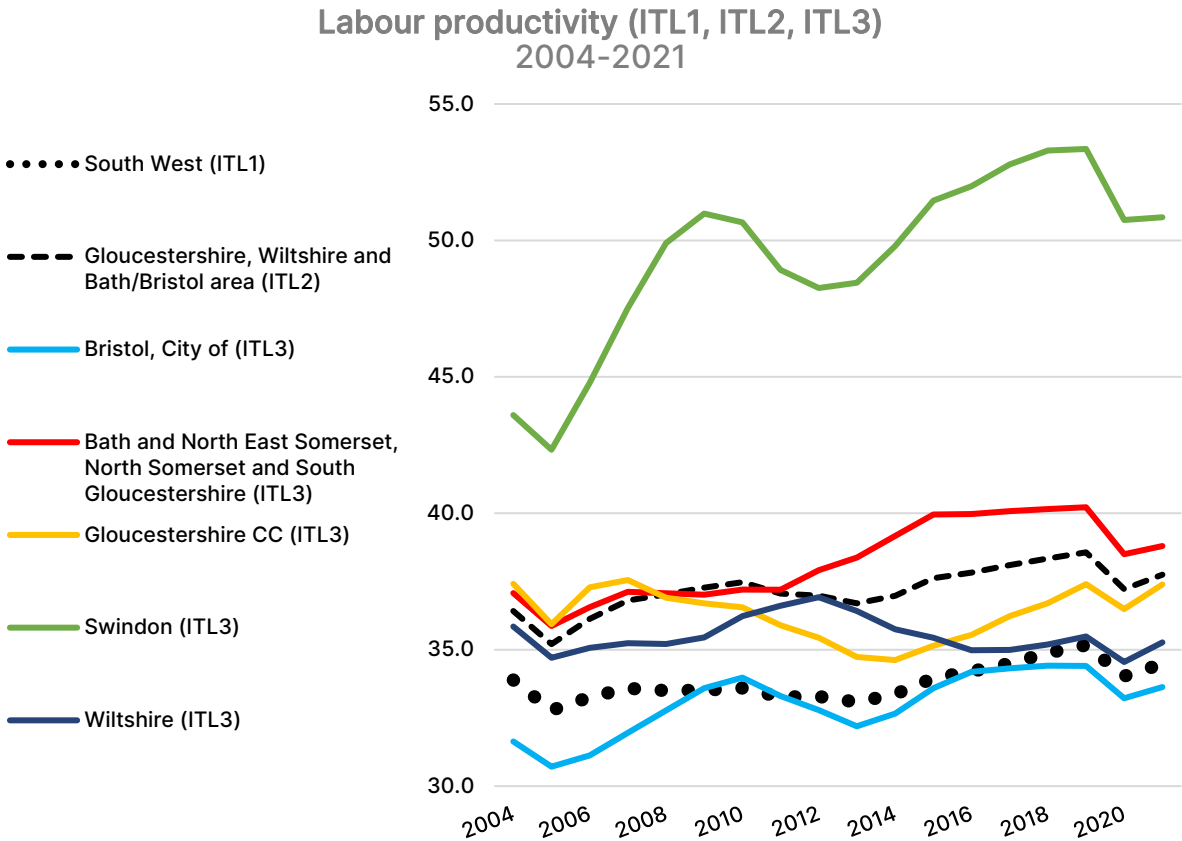


Figure 13. Productivity at the ITL3 level

<sup>5</sup> Swindon has a strategic location which allows businesses in the area to easily access markets, suppliers, and customers, enabling efficient operations and trade. Affordable housing may also render the area attractive to individuals and families.

## *2.5 Firm & Industry Level (City of Bristol)*

To better understand productivity patterns across businesses and industries in the area, we use firm-level and industry-level productivity data for the non-financial business economy for city regions in Great Britain. This data is publicly available and published by the ONS (with the most recent year being the year 2017) and unlike the data presented above, the productivity figures are expressed in GVA per worker rather than GVA per hour worked.

Figure 1 presents firm-level productivity data for city regions in Great Britain. The data show the proportion of firms at different levels of GVA per worker. Overall, the distributions are skewed to the right, indicating that in all city regions there are fewer firms with very high productivity levels than firms with very low productivity levels. All distributions appear to be leptokurtic which means they have few outliers. An exception to this is London whose distribution resembles more of a platykurtic distribution, implying that there are not as many outliers as in the other (leptokurtic) distributions. (Another exception is the Aberdeen city region whose distribution is unusual reflecting a significant number of firms with high productivity levels as well as a share of firms with more typical productivity levels.)

Figure 1 shows that in 2017 most city regions in Great Britain had a large proportion of firms with a GVA per worker around £10,000 to £45,000. The distribution for the City of Bristol is located towards the right of the main body of distributions reflecting a significant proportion of firms with higher levels of GVA per worker compared to most city regions. Compared to Great Britain, the distribution of firm-level productivity in the City of Bristol has a higher share of firms with productivity between £20,000 and £55,000 of GVA per worker but a lower share of firms with higher productivities (higher than £70,000 of GVA per worker). Finally, we observe that firms with very high productivity levels exist across all city regions and the City of Bristol is not an exception to this.



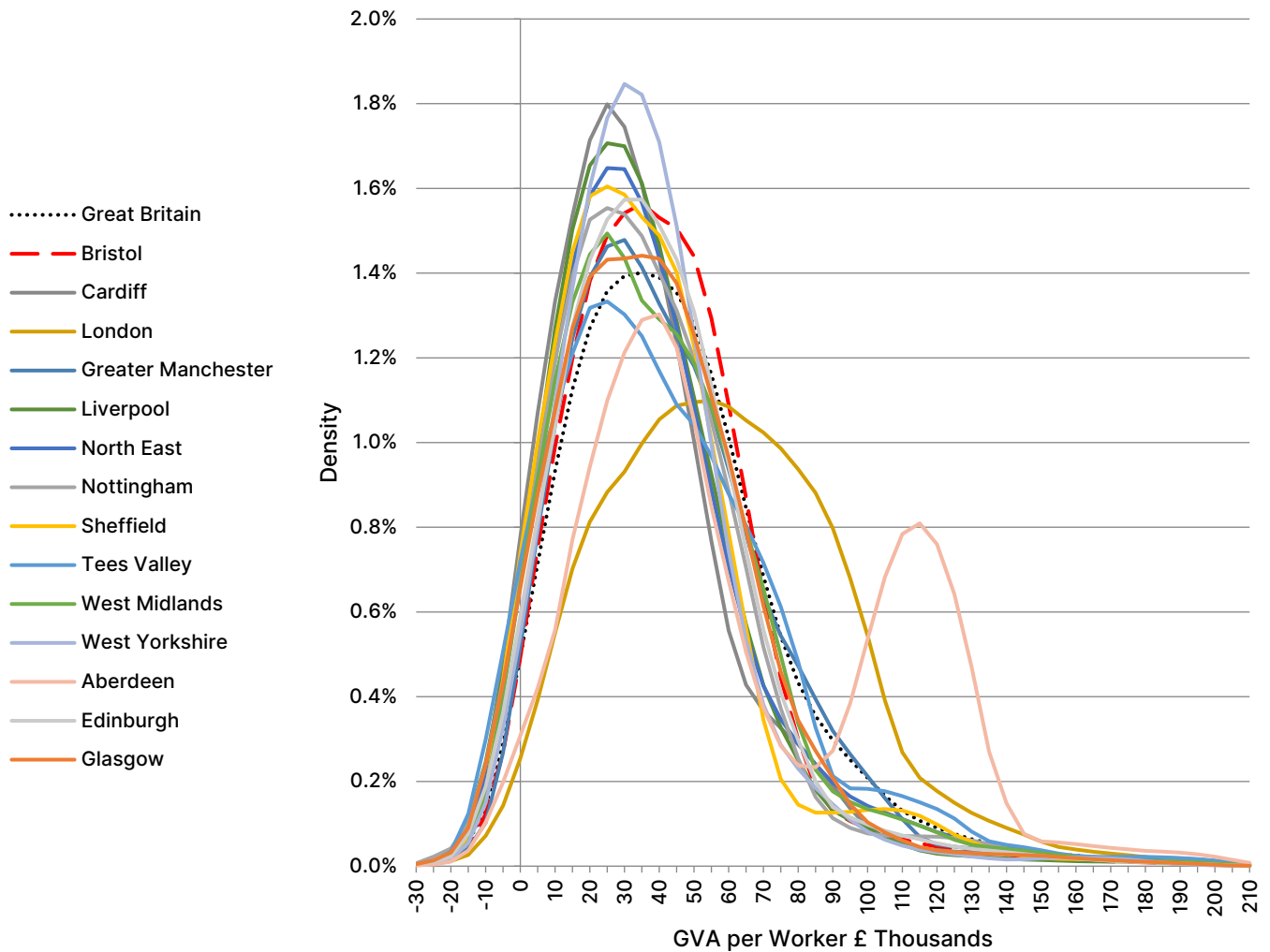


Figure 14: Productivity (GVA per worker) distributions across City Regions in the UK (2017). Source: ONS

Figure 15 shows firm-level distributions within widely defined industries (i.e., sectors) comparing the City of Bristol and Great Britain. It shows the median level of GVA per worker (the arrow), the inter-quartile range (the interquartile range contains the second and third quartiles, i.e., the middle half of the data) (the bars) and the 10<sup>th</sup> and 90<sup>th</sup> deciles (the lines). The median firm-level GVA per worker is lower in the City of Bristol compared to Great Britain for Administrative and Support Service activities, for Professional, Scientific and Technical activities, for Real Estate activities and for Construction. For Information and Communication, for Transportation and Storage, and for Mining and Utilities the median firm-level GVA per worker is higher in the City of Bristol than in Great Britain. In fact, these three industries are the most productive industries in the City of Bristol. For the remaining industries, the median firm-level GVA per worker is very similar between the City of Bristol and Great Britain.

## Bristol and Great Britain - GVA per Worker

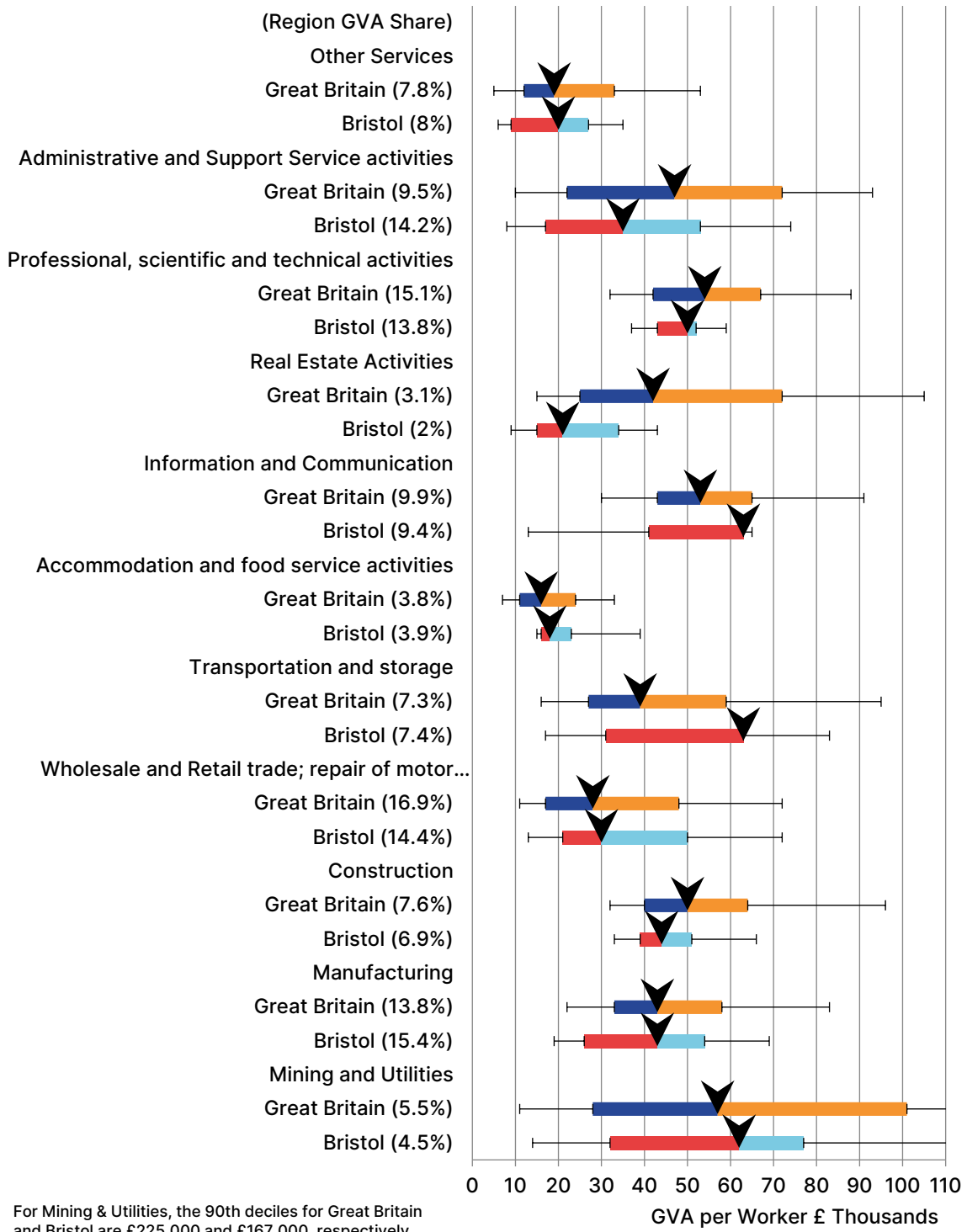


Figure 15: Productivity (GVA per worker) across Industries in the City of Bristol and Great Britain (2017). Source: ONS

### 3. Research and Development (R&D)

#### 3.1 Business Enterprise R&D

Figure 16 presents data on business expenditure in R&D and the number of R&D employees across all ITL2 regions of the UK for year 2018. The business expenditure in R&D in the Gloucestershire, Wiltshire and Bath/Bristol ITL2 region is the 6<sup>th</sup> largest across the ITL2 regions of the UK. Businesses in this region invested approximately £1.5bn in R&D for 2018, about half of what businesses in the highest ranked ITL2 region of East Anglia invested.

The Gloucestershire, Wiltshire and Bath/Bristol ITL2 region ranks higher (4<sup>th</sup>) when R&D activity is captured by the R&D employees. In 2018, there were 14,466 R&D employees (FTE) in the region or about three fifths of the number of R&D employees in the highest ranked ITL2 region of Berkshire, Buckinghamshire and Oxfordshire with 24,144 R&D employees.

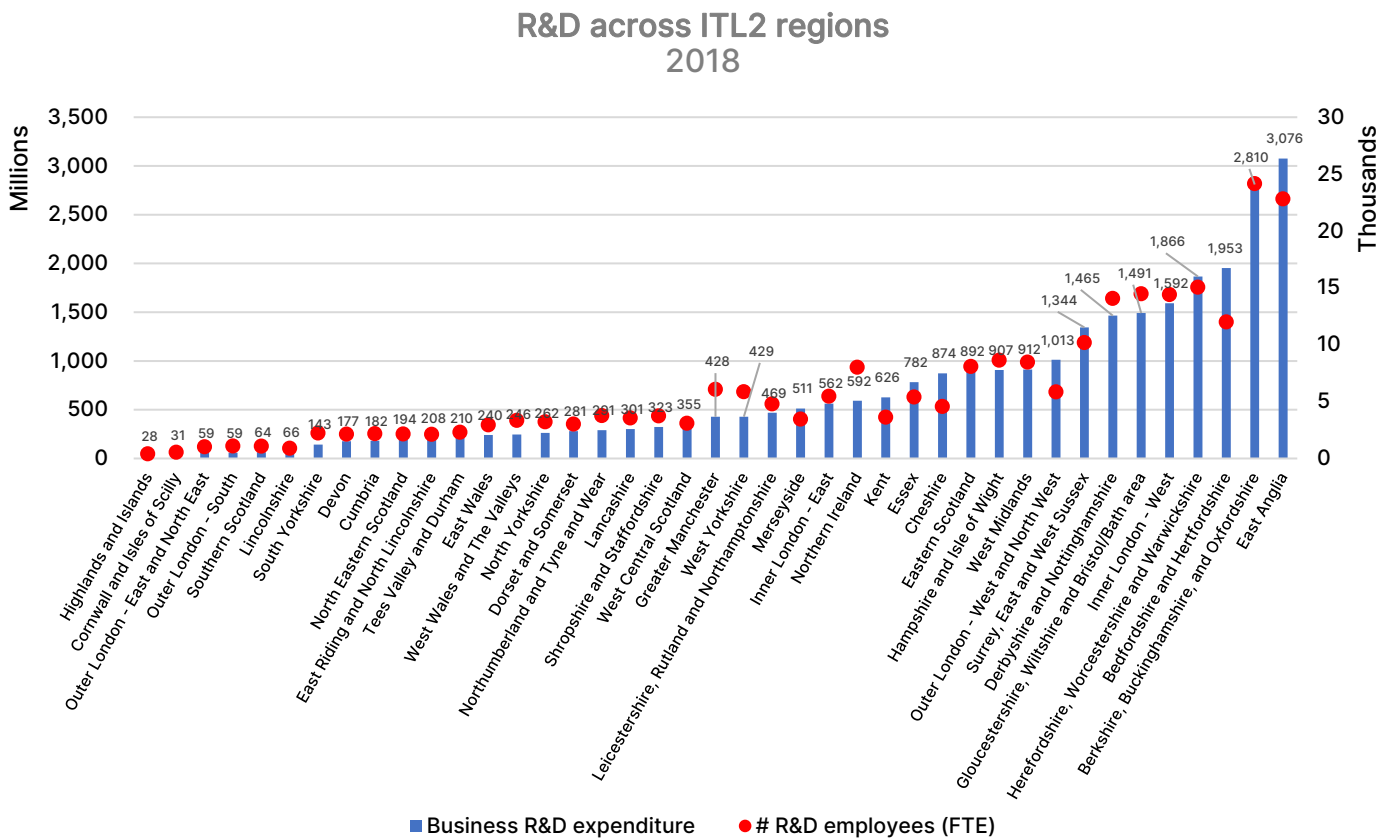


Figure 16. R&D across ITL2 regions (absolute size). Source: ONS

To better understand the intensity of R&D activity across ITL2 regions, we additionally present the R&D expenditure as a percentage of the GVA and the number of R&D employees per 1,000 residents. The ranking of the Gloucestershire, Wiltshire and Bath/Bristol ITL2 region remains almost unchanged. In Figure 17, the Gloucestershire, Wiltshire and Bath/Bristol ITL2 region is ranked 7<sup>th</sup> in terms of R&D expenditure as a percentage of the GVA with 2%, and 6<sup>th</sup> in terms of R&D employees per 1,000 residents

with 5.8. However, on the 1<sup>st</sup> place now sits Herefordshire, Worcestershire and Warwickshire with the highest R&D expenditure as a percentage of the GVA (5%) and the second highest number of R&D employees per 1,000 residents (about 11). The Inner London – West region with 12 R&D employees (FTE) per 1,000 residents has the highest intensity of R&D employment.

We therefore conclude that in the wider region of Gloucestershire, Wiltshire and Bath/Bristol, in which the West of England Mayoral Combined Authority is located, there is one of the highest investments in R&D on behalf of the regional businesses – both in absolute size and in relative size – across all ITL2 areas of the UK. Investing in R&D constitutes a critical aspect of innovation ecosystems as, apart from laying the foundations of innovation, it implies a long-term commitment to science, technology and innovation.

R&D across ITL2 regions (relative to size)  
2018

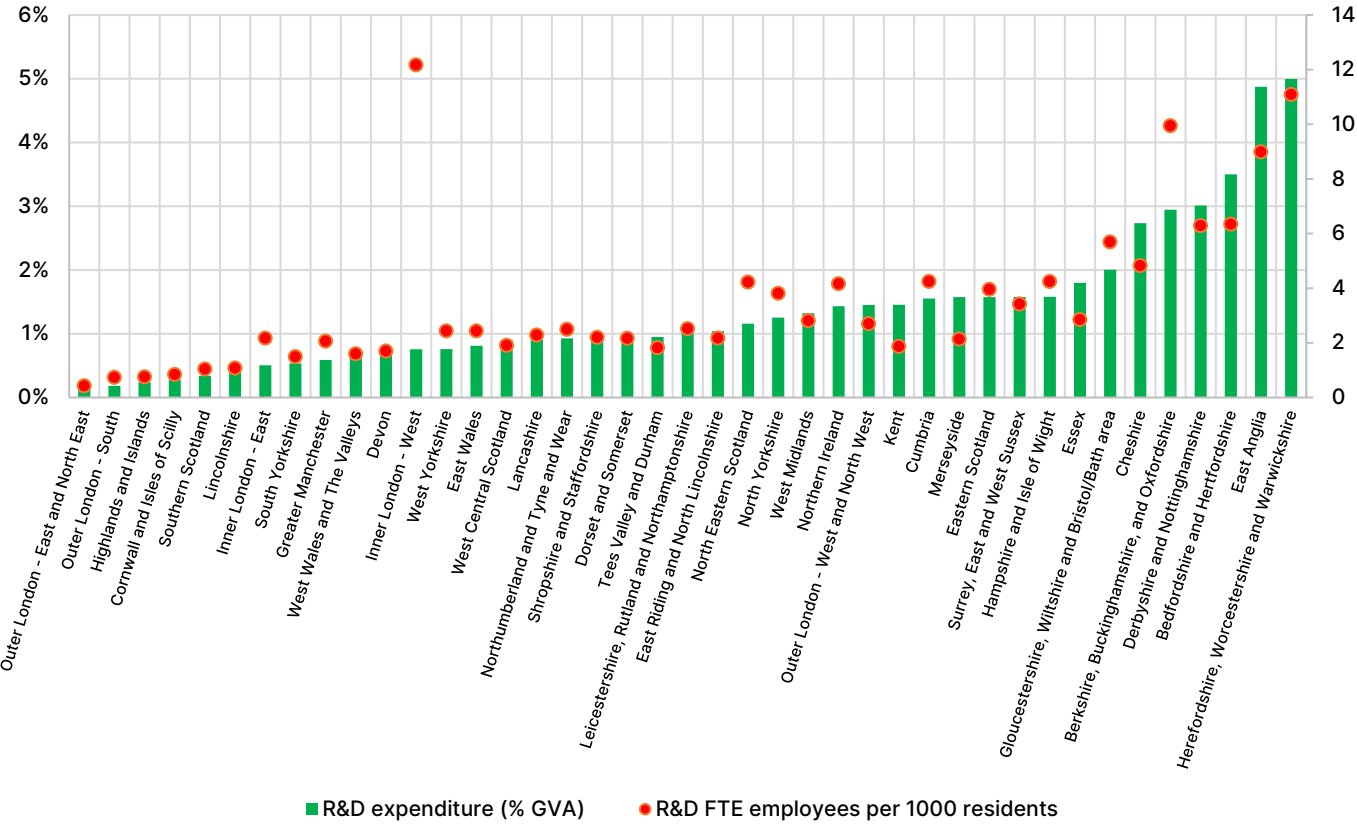


Figure 17. R&D across ITL2 regions (as a % of GVA and per 1,000 residents). Source: ONS

### 3.2 UKRI R&D

Apart from the private sector, which is the major investor in R&D, there is a significant public investment in R&D which is mainly channeled through the UK Research and Innovation (UKRI), a non-departmental body of the UK Government funded by the Department for Science, Innovation and Technology (DSIT).

Figure 18 shows the total UKRI spend across ITL2 regions for the 2020-21 financial year (blue bars). UKRI spent approximately £362m in the Gloucestershire, Wiltshire and Bath/Bristol ITL2 region, which was the 5<sup>th</sup> largest spending of UKRI across all ITL2 regions. Only areas overlapping the 'Golden Triangle' formed by the university cities of Oxford, Cambridge and London - i.e., the Inner London area, the Berkshire, Buckinghamshire and Oxfordshire area, and the East Anglia area – and the West Midlands have been recipients of larger amounts of UKRI funding. Inner London was the recipient of the largest UKRI investment which amounted to approximately £1.3bn.

Figure 18 also reports the UKRI spend per person (orange dots). Similar to the total UKRI spend, the Gloucestershire, Wiltshire and Bath/Bristol ITL2 region also has the 5<sup>th</sup> largest UKRI spend per person with approximately £143 of UKRI spend per person. The four ITL2 regions that have a higher total UKRI spend than Gloucestershire, Wiltshire and Bath/Bristol also have a higher UKRI spend per person. Inner London sits atop the ranking with £1,037 UKRI spend per person, which is more than double the amount of the Berkshire, Buckinghamshire and Oxfordshire ITL2 region that follows with £420 of UKRI spend per person.

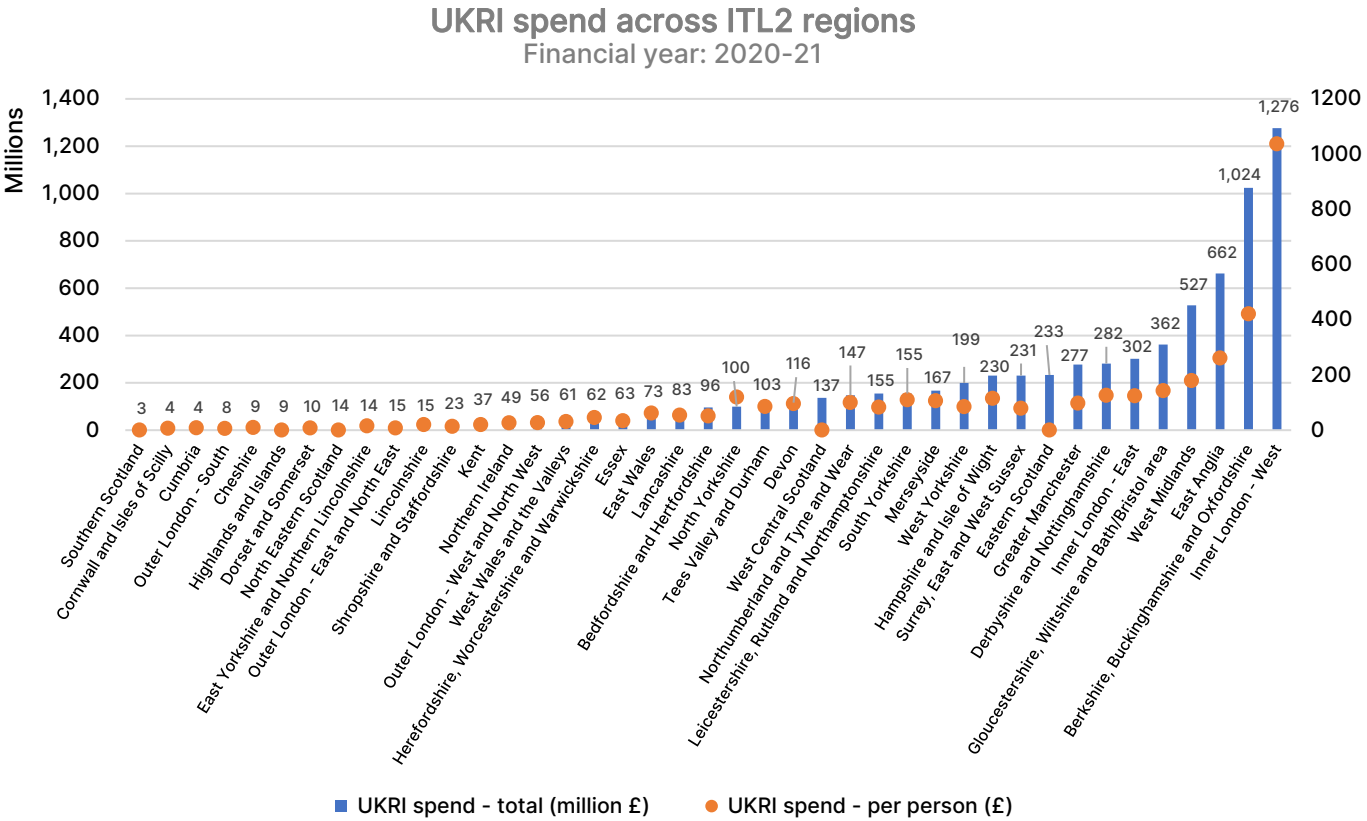


Figure 18. UKRI spend across ITL2 regions: total and per person. Source: ONS

When we look at the UKRI spend across ITL2 regions as a percentage of the region’s GVA (Figure 19), the Gloucestershire, Wiltshire and Bath/Bristol ITL2 region still enjoys one of the highest UKRI investments proportionate to the size of its economy (as measured by the GVA). More specifically, the Gloucestershire, Wiltshire and Bath/Bristol ITL2 region ranks 8<sup>th</sup> with a percentage of 0.45% while Berkshire, Buckinghamshire and Oxfordshire leads the ranking with 0.99%. The

UKRI spend statistics presented in Figure 18 and Figure 19 document that Gloucestershire, Wiltshire and Bath/Bristol is a recipient of very significant funding from the UKRI, both in terms of its population and the size of its economy.

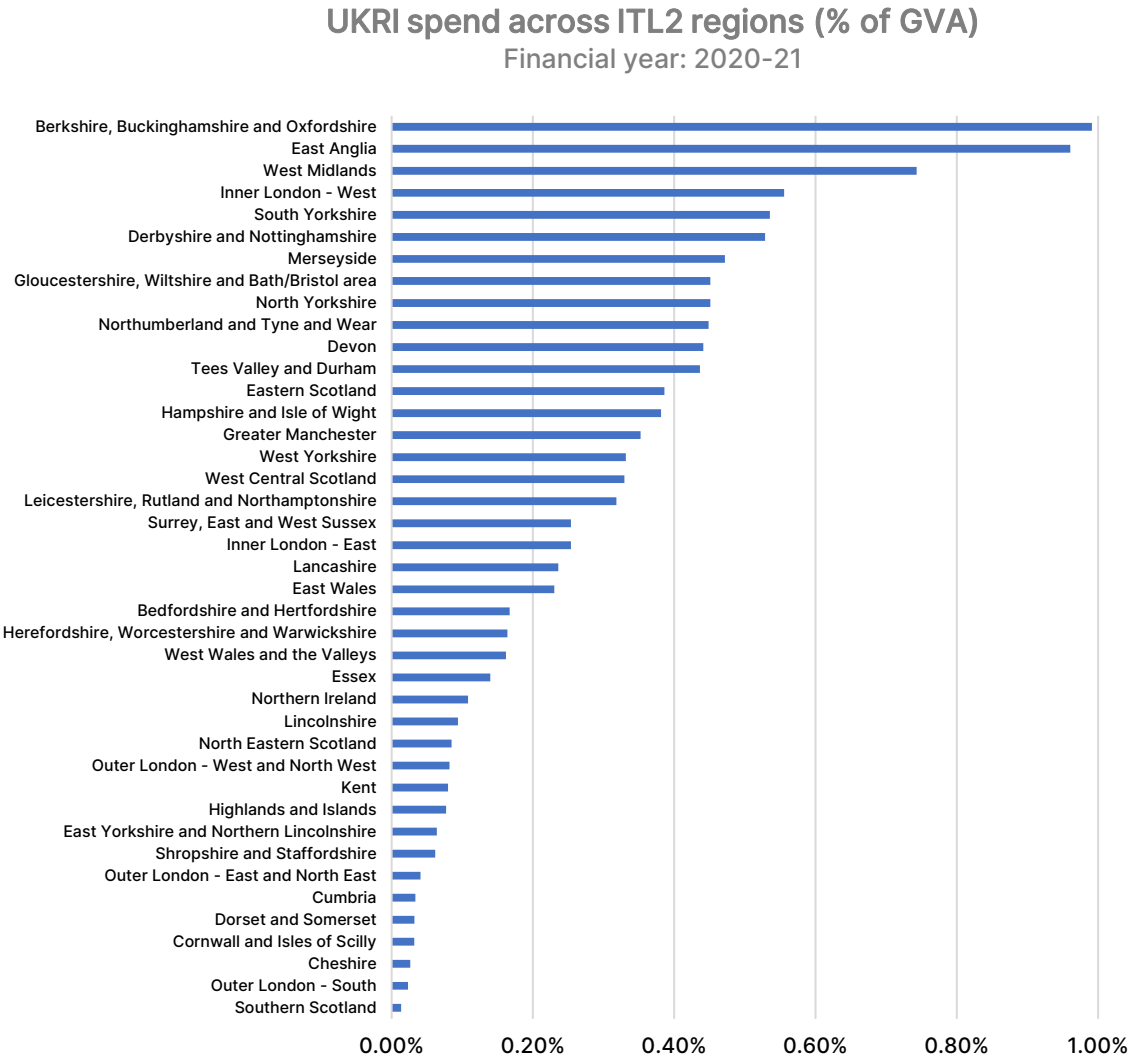


Figure 19. UKRI spend across ITL2 regions: percentage of GVA. Source: ONS

To better understand how the UKRI spend is distributed within the Gloucestershire, Wiltshire and Bath/Bristol ITL2 region, which is critical in also understanding the part of the UKRI spend allocated to the WoE LEP and its constituent parts, we present statistics for the ITL3 regions of the Gloucestershire, Wiltshire and Bath/Bristol ITL2 region. In Figure 20, we show that the largest part of UKRI funding within the Gloucestershire, Wiltshire and Bath/Bristol ITL2 region goes to the City of Bristol (approximately £174m in total and £550 per person) with Bath and North East Somerset, North Somerset and South Gloucestershire following (approximately £122m in total and £285 per person). In total, the UKRI invests almost £300m in the WoE LEP, which corresponds to approximately £400 per person (aged 16-64). The intensity of UKRI funding in the WoE LEP is significant and one of the highest across LEPs in England (UKRI, 2021).

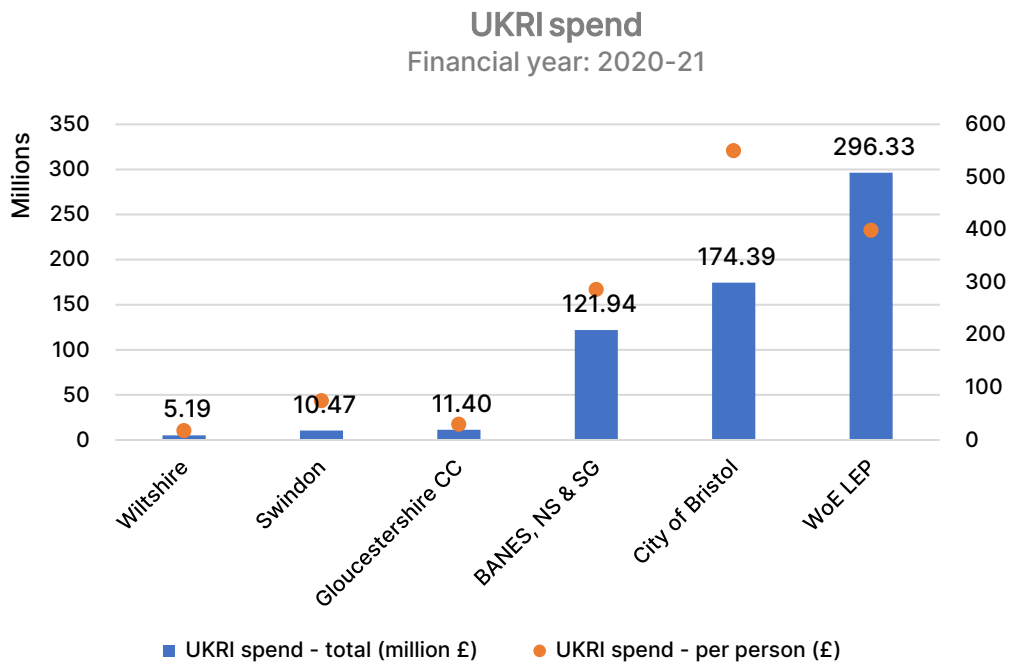


Figure 20. UKRI spend within Gloucestershire, Wiltshire and Bath/Bristol: total and per person. Source: ONS

## 4. Innovation

The data used in this Section correspond to the LEP level, hence in our discussion we refer to the West of England Local Enterprise Partnership (henceforth, WoE LEP). The WoE LEP boasts a dynamic and diverse ecosystem that nurtures innovation and facilitates business growth. A multitude of actors, activities, institutions and relations support the ecosystem and render innovation rather widespread in the area. Indeed, the WoE LEP showcases a widespread culture of innovation, with a strong presence of innovative industries, research and development activities, business support infrastructure, and collaboration networks.

The WoE LEP is home to several sectors that are known for their innovation and technological advancements. Industries such as technology, digital services, aerospace, robotics, creative media, and clean tech have a strong presence in the area. These industries attract innovative businesses, startups, and research institutions, contributing to the dynamism and growth of the area.

At the same time, the WoE LEP hosts research-intensive universities, including the University of Bristol, the University of Bath, and research institutions such as the Bristol Robotics Laboratory and the Institute for Advanced Automotive Propulsion Systems in the Bristol and Bath Science Park. These institutions actively engage in cutting-edge research and collaborate with businesses on research projects.

A flourishing innovation ecosystem also requires adequate business support infrastructure. The WoE LEP offers a range of business support services and incubation spaces for startups and innovative businesses. Organisations such as the Engine Shed and SETsquared Bristol provide resources, mentoring, and funding opportunities, while supporting the growth of innovative ventures.

In particular, collaboration and the formation of business and knowledge networks is vital to both startups and established businesses. In the WoE LEP, collaboration and networking between businesses, academia, and innovation-driven organisations is encouraged and nurtured. Initiatives such as the five-year Bristol+Bath Creative R&D programme serves as a prime example of this. The programme facilitates collaboration and knowledge exchange while helping to develop new skills in creative industries with far reaching implications for the rest of the economy. The presence of such collaborative networks further highlights the widespread nature of innovation in the area.

#### *4.1 Innovation Diffusion*

In measuring how widespread innovation is in the WoE LEP, we use data from the UKCIS survey. We find that the WoE LEP has one of the highest rates of innovation diffusion in its private sector. Figure 21 shows the percentage of businesses that are innovation active, i.e., businesses that engage in product, process or business model innovation. More than one in two businesses (54.5%) were innovation active during the 2018-2020 period which translates to approximately 25,000 innovative businesses (out of a total of approximately 46,000 businesses). This rate is substantially larger than the average rate across all LEPs (45.7%).

Figure 22 presents the evolution of the percentage of innovation active businesses over time for the 15 LEPs with the highest rates. The percentage of innovation active businesses in the WoE LEP has somewhat dropped compared to the 2012-2014 period (58.6%). However, this is a more systematic pattern observed for almost all LEPs, with only a few exceptions, the most notable ones being the Oxfordshire and Solent LEPs. The trough in the 2016-2018 period observed for all LEPs may be a result of low investment in R&D following the decline in business confidence due to economic uncertainty introduced by the EU Referendum of 2016.



### Innovation active businesses (% of total) 2018-2020

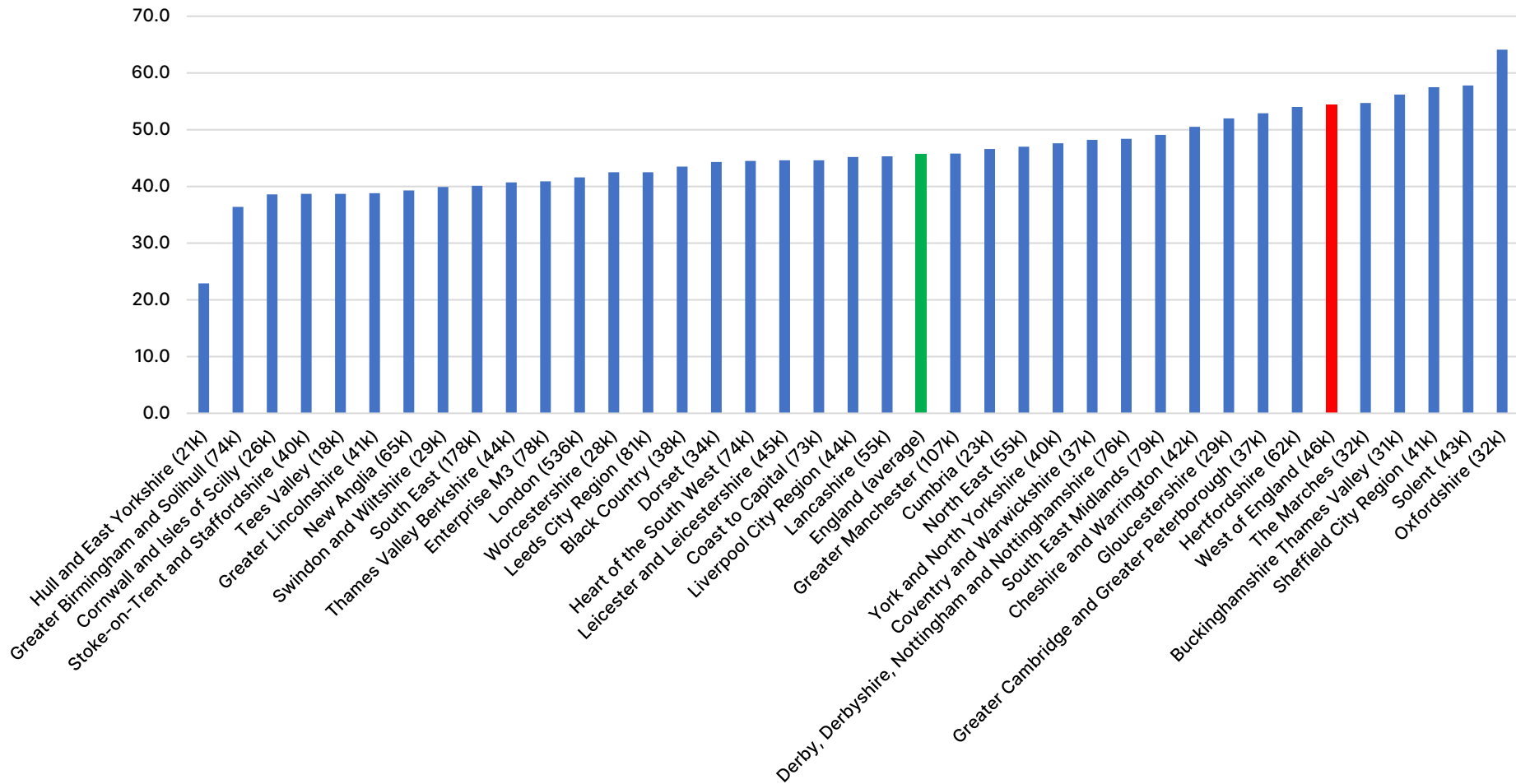


Figure 21. Innovation diffusion across all LEPs

## INNOVATION ACTIVE BUSINESS ACROSS LEPs / TOP-15 2012-2020

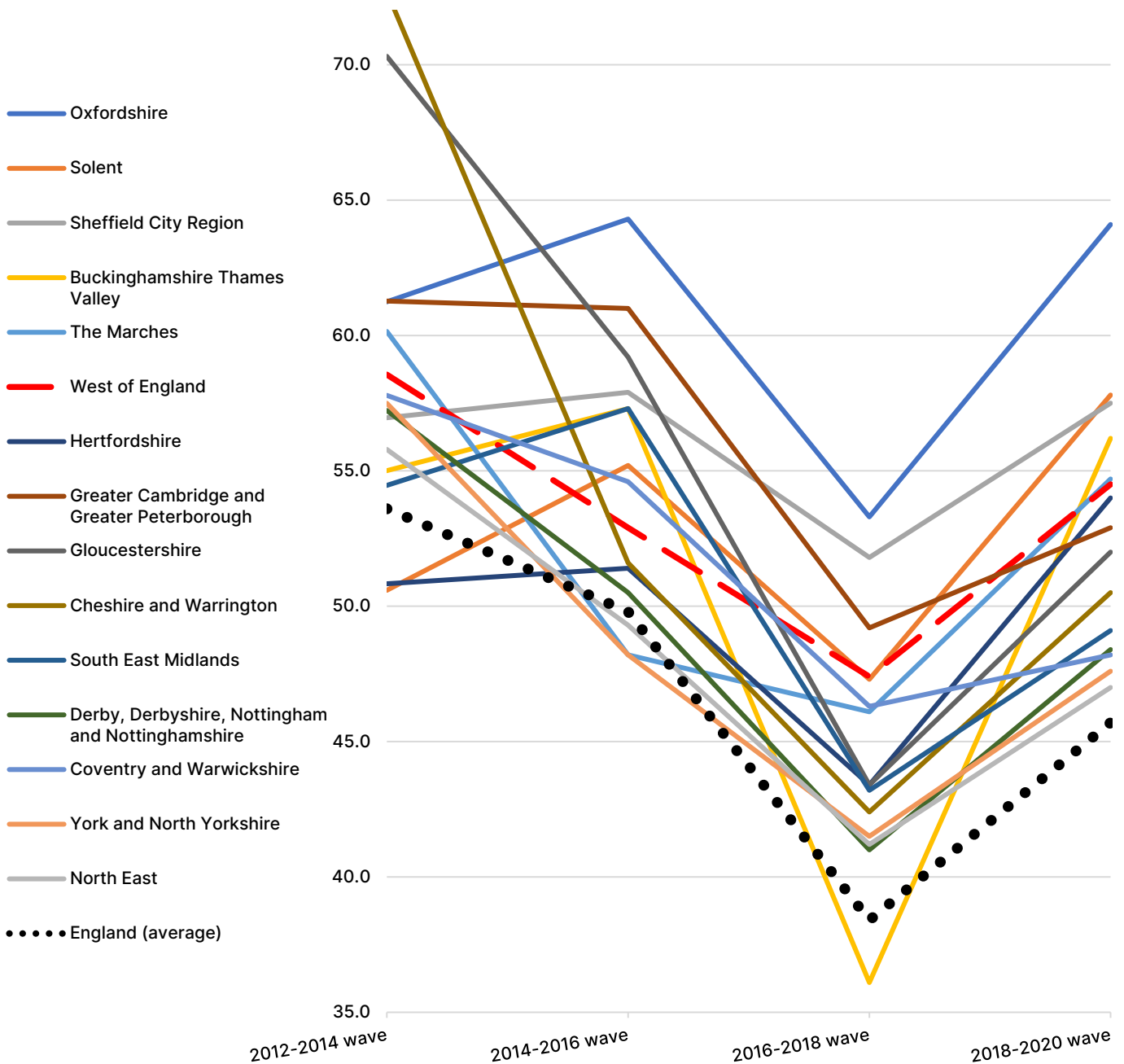


Figure 22. Innovation diffusion across LEPs (TOP-15)

Figure 23 presents the evolution of the percentage of innovation active businesses over time for all LEPs in the South West region. The WoE LEP had the highest percentage of innovation active businesses in the South West for the 2018-2020 period, with a 10 percentage point lead from the second LEP (Heart of the South West). The WoE LEP was also the only LEP in the South West above the country average. With the remaining LEPs of the South West being below the country average, the innovation disparities within the South West are vividly portrayed.

## INNOVATION ACTIVE BUSINESSES ACROSS LEPs / SOUTH WEST 2012-2020

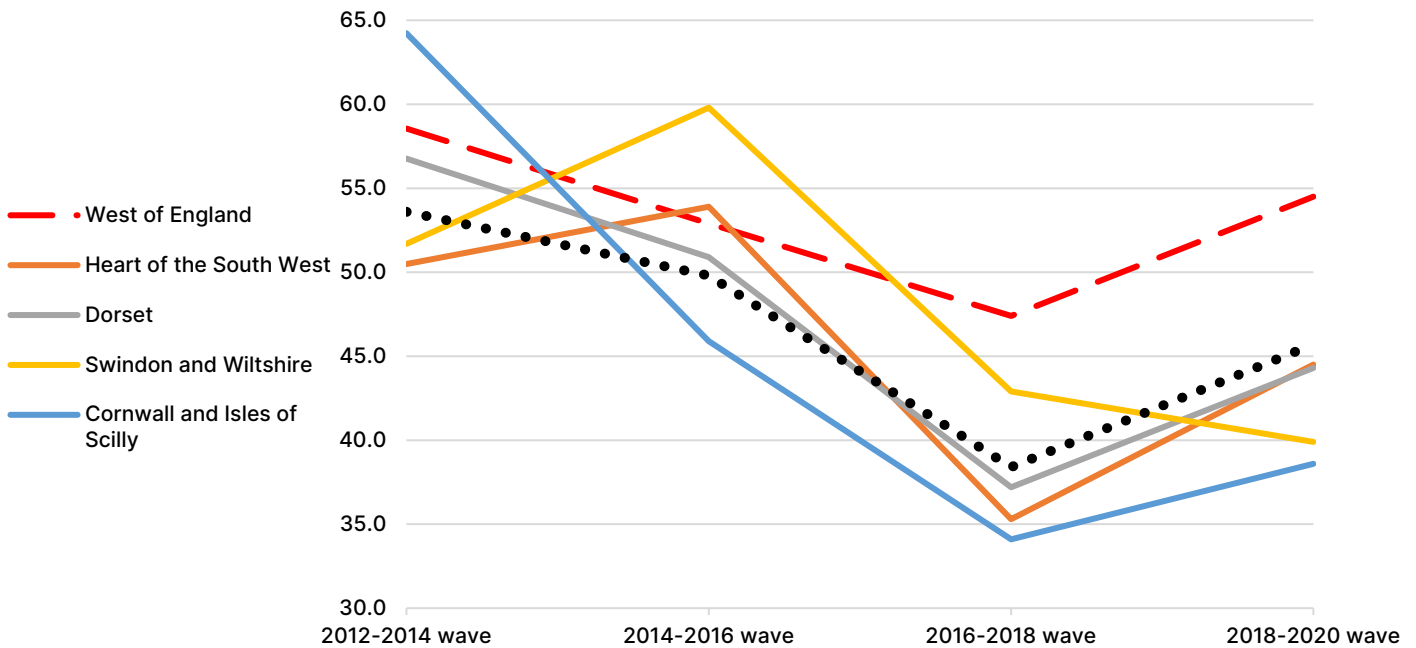


Figure 23. Innovation diffusion across LEPs of the South West region

In understanding how the size of the local population may condition the extent of innovation diffusion across businesses in the WoE LEP and other LEPs, we plot the percentages of innovation active businesses of all LEPs against their respective population sizes. Figure 24 presents the resulting scatterplot. Compared to LEPs with a similar population [i.e., within the 1,071,700 – 1,271,700 range], the WoE LEP is the LEP with the second highest percentage of innovation active businesses (second only to Solent).<sup>6</sup> More specifically, innovation is more widespread in the WoE LEP compared to the similarly populated areas of Hertfordshire, Leicester and Leicestershire, Black Country, Greater Lincolnshire, and Stoke-on-Trent and Staffordshire. (All these LEPs are bounded within the two vertical dashed lines of Figure 24.) This is indicative that the WoE LEP punches above its population weight as far as innovation is concerned. Out of the LEPs with a similar percentage of innovation active businesses (within the 49.5%-59.5% range, i.e.,  $\pm 5$ pp from the WoE LEP percentage of 54.5%), the WoE LEP is in the higher end of the population distribution.

<sup>6</sup> We use the population figures from the 2021 Census data, although the percentages of innovation active businesses correspond to the period 2018-2020. In the absence of precise population data for the 2018-2020 period, the 2021 population data should provide a very close approximation, especially if we consider that population figures are slowly moving.

### Innovation Active vs Population across LEPs 2018-2020

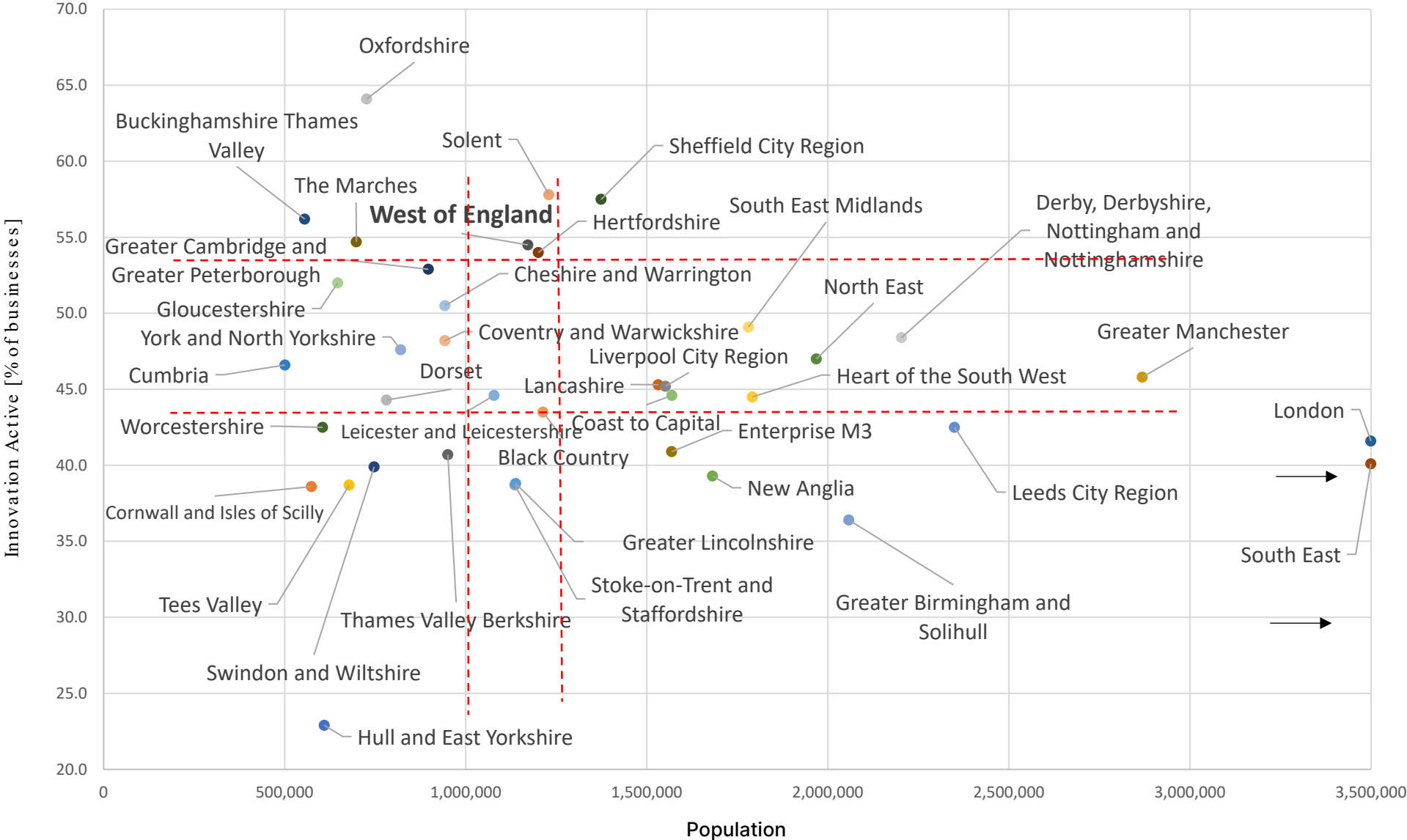


Figure 24. Innovation types & turnover in innovative businesses – TOP-15 most innovative

## 4.2 Innovation Characteristics

In what forms does innovation take place in the WoE LEP? Figure 25 provides the answer. Out of all innovation active businesses in the WoE LEP for the 2018-2020 period, about one fifth of them (22.4%) introduced to the market a new or a significantly improved good or service, i.e., a product innovation. On the other hand, process innovation, i.e., the implementation of a new or significantly improved production process, distribution method or support activity for goods or services, was less frequent (15.0%). Implementation of changes to marketing concepts or strategies, i.e., marketing or strategic innovation, was the most frequent type of innovation with approximately two out of five innovation active businesses introducing such types of innovation (37.7%).

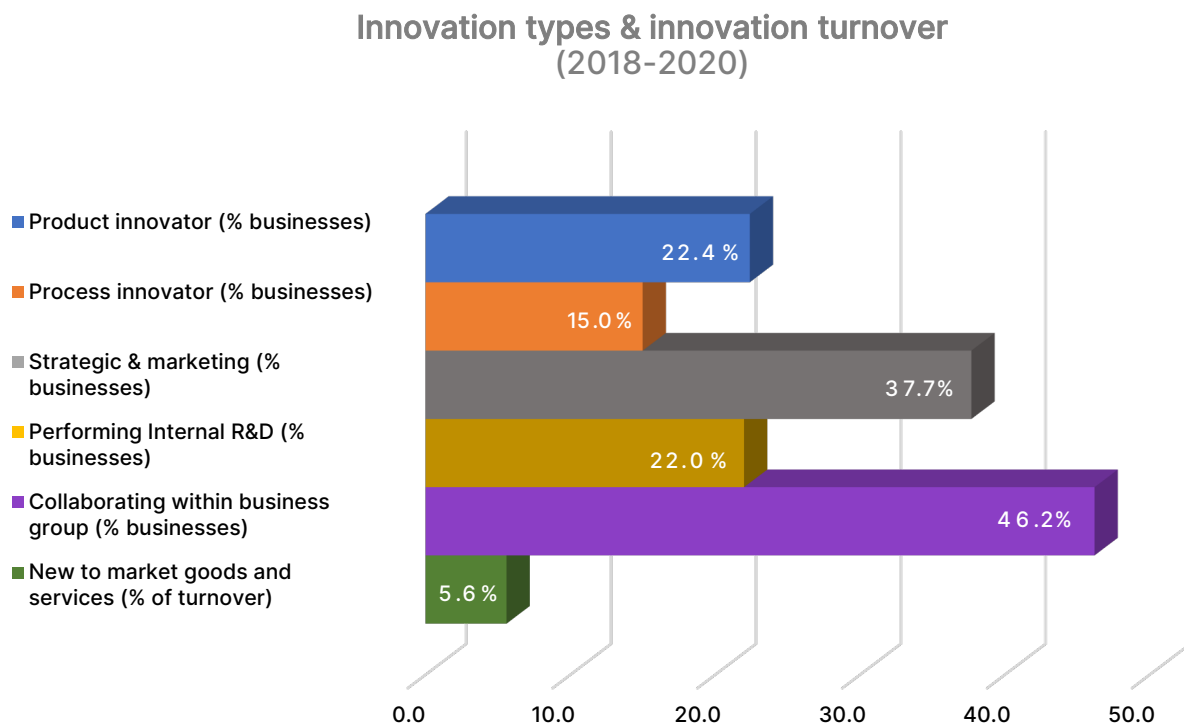


Figure 25. Innovation types & turnover from innovation in the WoE LEP

While R&D often plays a crucial role in driving innovation, it is not always a prerequisite for business innovation. Innovation can occur through ‘out of the blue’ ideas, collaboration and/or partnerships, and imitation, and businesses can pursue innovative strategies without necessarily investing in R&D. This is supported by the data as only one in five innovation active businesses (22%) in the WoE LEP performed internal R&D. However, approximately half of the innovation active businesses (46.2%) collaborated within their business group on R&D and innovation.

Innovative businesses may not simply introduce a ‘new to the business’ good or service that is essentially the same as a good or service already available from competitors, but also a ‘new to the market product’, i.e., before competitors. The second type of innovation is indicative of a higher degree of innovativeness of the business and can result in significantly increased revenue. New to the market goods and services were associated with 5.6% of the total revenue for innovative businesses in the WoE LEP. In other words, 5.6% of the turnover was a result of the sale of new to the market goods and services.

How do these characteristics of innovation in the WoE LEP compare to other LEPs? Figure 26 presents the innovation characteristics for the top 15 most innovative LEPs as defined by their respective percentage of innovation active businesses (see Figure 21).

The WoE LEP ranks 12<sup>th</sup> in product innovation (22.4%), with the three leaders in this category (Sheffield City Region, Cheshire and Warrington, and Greater Cambridge and Greater Peterborough) having a combined average of 32.9%. The WoE LEP holds a similar ranking position for process innovation (11<sup>th</sup>), with innovative businesses in the Buckinghamshire Thames Valley, Cheshire and Warrington, and Sheffield City Region being more likely to yield process innovation. When it comes to marketing or strategic innovation, the WoE LEP ranks 4<sup>th</sup>, with Oxfordshire, South East Midlands and Gloucestershire in the lead.

Innovative businesses in Greater Cambridge and Greater Peterborough, and Oxfordshire are the most likely to perform internal R&D, with a combined average of 31.4%. Compared to these areas, WoE LEP businesses are less likely to perform internal R&D (22.0%), with the LEP ranking 12<sup>th</sup> for this category. The WoE LEP maintains the same ranking position for collaboration within the business group on R&D and innovation, with the most likely innovative businesses to collaborate located in The Marches, Cheshire and Warrington, and Gloucestershire.

Finally, innovative businesses in Oxfordshire and Greater Cambridge and Greater Peterborough can generate turnover from new to the market goods and services to a greater extent compared to businesses in any other LEP. Reflective of its relatively low ranking in product innovation (12<sup>th</sup>), the WoE LEP also ranks low in the 'turnover from new to the market goods and services' category (13<sup>th</sup>).

In sum, whereas the WoE LEP boasts one of the highest proportions of innovation active businesses in the country (6<sup>th</sup>), the intensity of innovation within these innovative businesses is somewhat less pronounced compared to innovative businesses in other highly innovative LEPs. Nonetheless, the WoE LEP is consistently in the top 15 for each of the categories, showcasing its strong propensity towards innovation.

### Innovative businesses in most innovative LEPs (TOP-15)

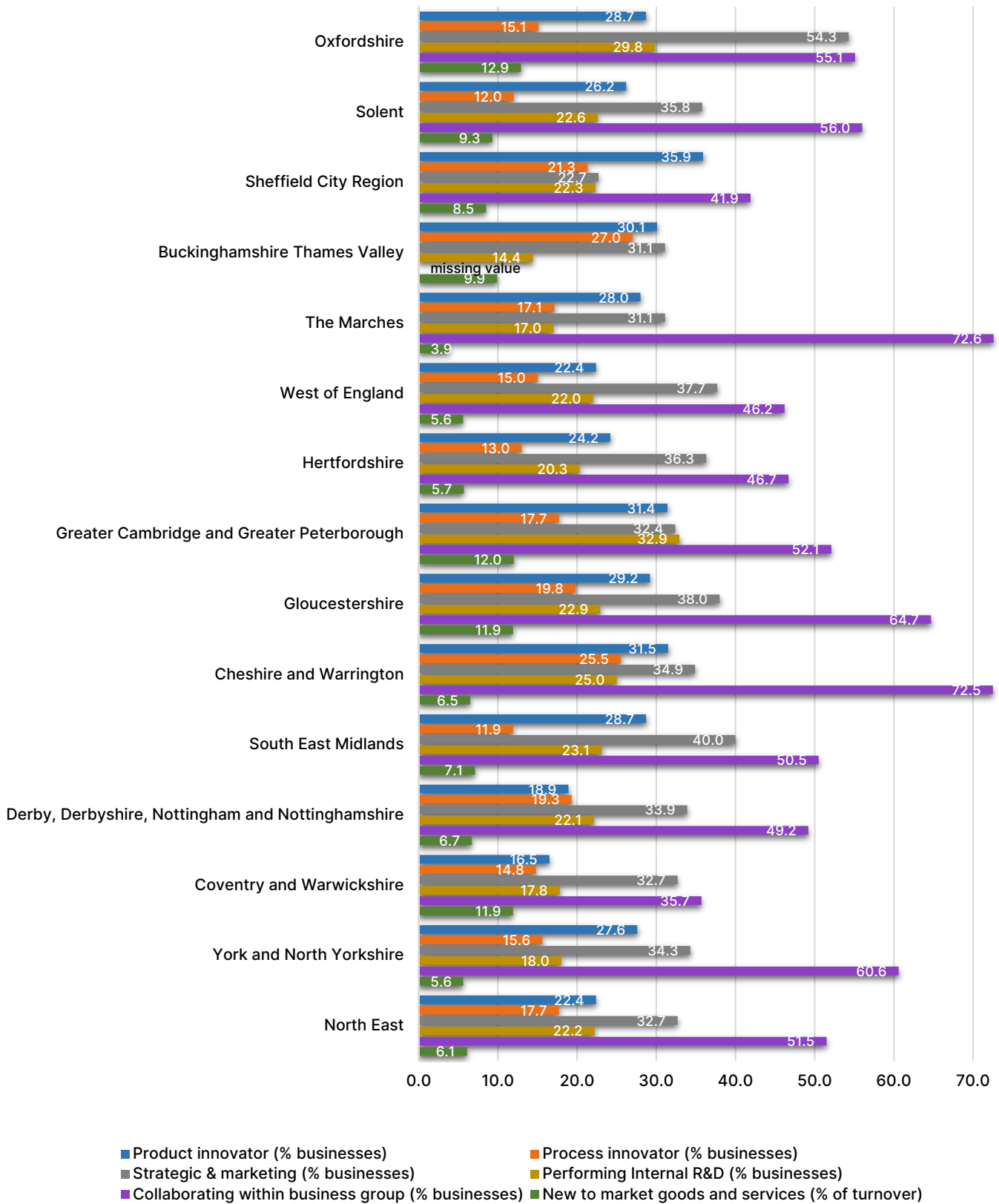


Figure 26. Innovation types & turnover in innovative businesses – TOP-15 most innovative LEPs

### *4.3 Clusters of Innovation*

The West of England Mayoral Combined Authority features several vibrant industries, thriving academic institutions, centres of excellence, technological incubators, and development hubs. All these organisations, which are vital for fostering and promoting innovation in the West of England Mayoral Combined Authority, are dispersed across the local region but co-located in areas of geographical proximity. By forming clusters, organisations of the same industry can reap a series of benefits, including technological cooperations, knowledge spillovers, efficiency gains and attraction of highly skilled labour. Clusters, in turn, contribute to the economic activity and competitiveness of the region, often creating a brand or identity for a region based on its unique industrial strengths. Figure 27 illustrates the location and type of clusters across the West of England Mayoral Combined Authority.

#### **4.3.1 University-based Innovation**

The West of England Mayoral Combined Authority is home to four universities, with two of them based in the City of Bristol (the University of Bristol and the University of the West of England) and two in Bath and North East Somerset (the University of Bath and the Bath Spa University). All universities have contributed to R&D and innovation in a variety of ways, from cutting-edge research, laboratories and research institutes to spin-off companies, startups and partnerships.

For example, the Centre for the Analysis of Motion, Entertainment Research and Applications (CAMERA), which is funded by the EPSRC and the University of Bath, aims to accelerate the impact of academic fundamental research through conducting world-leading research in Intelligent Visual and Interactive Technology. The University is also home to several specialist research institutes and centres which focus on innovative and interdisciplinary research. Some examples are the Institute for Policy Research, the Institute for Sustainability, the Centre for Sustainable and Circular Technologies, the Centre for Therapeutic Innovation, and the Neuroscience Network.

The West of England region also hosts the Pfizer Centre of Excellence, a result of the partnership between Pfizer and the University of Bristol, and Pfizer's first centre of epidemiological excellence outside of the US. The Pfizer Centre of Excellence undertakes world-leading research into specific vaccine-preventable diseases supporting the development of next-generation vaccines. Some of the most innovative research centres and institutes of the University of Bristol are the Jean Golding Institute, which aims to advance scientific understanding through interdisciplinary collaborations on innovative data-intensive research, the Centre for Multilevel Modelling, which has developed new software for implementing analysis on data with complex hierarchical structures and is committed to the dissemination of related techniques to the national and international social science community, and the Elizabeth Blackwell Institute for Health Research, which is a multidisciplinary research centre established to foster innovative and impactful health research.

Another significant University-based organisation is The Studio at Palace Yard Mews, operated by the Bath Spa University. The Studio offers a space designed to foster creativity, innovation, and enterprise through working on related projects and ideas. Its strategic positioning in the city centre allows for easy access and collaboration among



diverse stakeholders, which is not confined to local small businesses, university students, academics, and graduates but it is open to the wider community.

A similar organisation is the UWE Bristol Ventures which is managed by the Enterprise Team of the University of the West of England (UWE) Bristol. This initiative offers physical space, business support, and funding through start-up grants and connections to investors to get innovative ideas of students off the ground with the aim of fostering entrepreneurship and innovation. The UWE Bristol also participates in a collaborative partnership with the University of Bristol in forming the Bristol Robotics Laboratory, the most comprehensive academic centre for multi-disciplinary robotics research in the UK.

Another collaborative partnership of academic institutions focused on innovation and entrepreneurship is the SETsquared partnership, which is not confined in its entirety within the boundaries of the West of England Mayoral Combined Authority as it entails the University of Bristol, the University of Bath, Cardiff University, the University of Exeter, the University of Southampton, and the University of Surrey. The SETsquared partnership specialises in growing high-tech start-ups through its incubation programme and other business acceleration services. The University of Bristol and the University of Bath operate their own SETsquared centres in the West of England Mayoral Combined Authority.

Often companies are created from universities with the aim of transforming basic research and inventions into commercial applications. By commercially exploiting university-based research that would be otherwise of limited value, these university spin-offs contribute to the local economy by becoming important counterparts of the local innovation ecosystem while creating highly paid jobs. Some university spin-offs may have a more far-reaching impact. Such a case is Ziylo, a spin-off from the University of Bristol, which was acquired by Novo Nordisk. Ziylo focused on diabetes treatment by developing a novel glucose-binding molecule that could improve the accuracy of glucose monitoring and insulin delivery for diabetic patients. Ziylo's innovation caught the attention of Novo Nordisk, a global pharmaceutical company, which acquired the company for its groundbreaking research.

Another excellent example of how innovative organisations can emerge from universities and successfully commercialise their R&D activities is the Institute for Advanced Automotive Propulsion Systems (IAAPS), which is a centre of excellence supporting the aerospace and automotive industries in the transition to net zero. Although bearing many similarities to a spin-off, strictly speaking the IAAPS is not a spin-off as it is a commercial subsidiary of the University of Bath. The IAAPS is based at the Bristol and Bath Science Park, a site that has witnessed a significant growth in its high-tech tenants in recent years and who range from engineering (such as the Clade Engineering Systems Ltd) and manufacturing (such as the Cubik Innovation and the N-and Group Ltd) companies to technical consultancies (such as the Osprey Consulting Services Ltd and the SQEP Ltd), IT businesses (such as the Kbase Connect Ltd and the Neatrix Ltd) and AI companies (such as the Smartia Ltd).

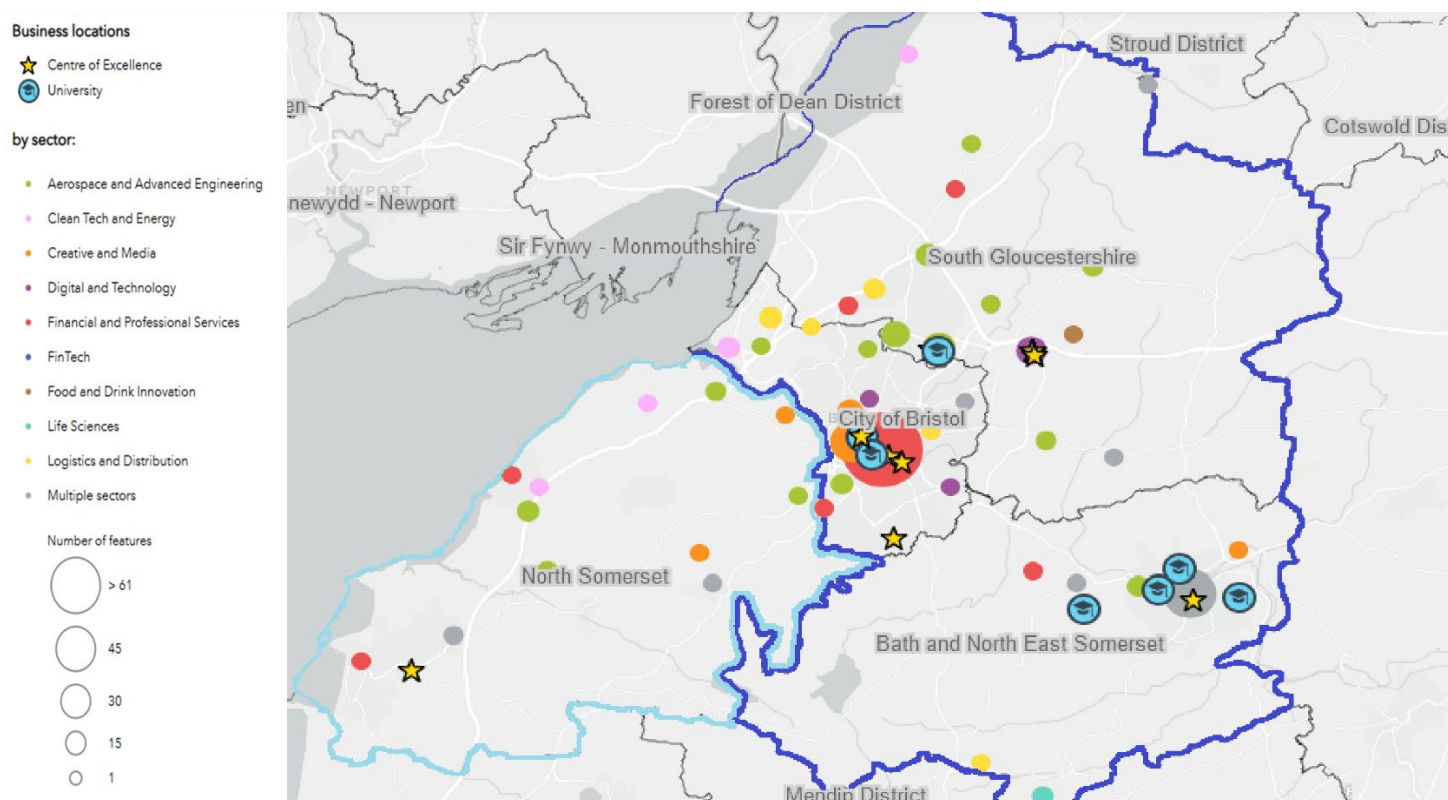


Figure 27. Cluster map of the WoE LEP and the West of England Mayoral Combined Authority. Source: Invest Bristol + Bath ([bristolandbath.co.uk](http://bristolandbath.co.uk))

### 4.3.2 Industry-based Innovation

The West of England Mayoral Combined Authority has a rich history of innovation (and entrepreneurship), and it continues to be a hub for cutting-edge businesses across various industries. As Figure 27 illustrates, the West of England Mayoral Combined Authority is home to innovative clusters across various industries including aerospace and advanced engineering, financial and professional services, creative and media, logistics and distribution, life sciences, and clean tech and energy.

There are many examples of successful innovations having taken place in businesses based in the West of England Mayoral Combined Authority. In the aerospace and advanced engineering industry, GKN Aerospace, with a presence in both Bristol and Filton, is a multinational focusing on developing advanced materials and manufacturing processes, as well as innovative aircraft systems. In financial services, Hargreaves Lansdown is a leading firm. In the creative and media sector, Aardman Animations, a world-renowned animation studio based in Bristol, is known for its unique style of stop-motion animation, which combines claymation with storytelling.

In the logistics and distribution industry, the region hosts facilities of both national and international businesses (such as Ocado and Amazon, respectively) benefitting from and contributing to innovations in automated warehousing and distribution. In life sciences, besides Ziylo (see section above), Zentraxa – another spin-off from the University of Bristol – is an innovative company in the biotechnology industry that develops innovative solutions in the field of protein engineering. The company is dedicated to R&D and is actively engaged in multiple ongoing projects. In clean tech and energy, an example of business innovation comes from OVO Energy, an energy supplier based in Bristol. Instead of transferring electricity from the power grid to the vehicle alone, the company has

developed a vehicle-to-grid (V2G) technology that allows for electrical energy to be pushed back to the grid. This enables surplus electricity in the EV's battery to aid the power grid at times of the day with high electricity demand while at the same time generating revenue for the EV owner.

Other examples of highly innovative businesses in the West of England Mayoral Combined Authority are Graphcore – a semi-conductor company with innovations in the AI space, Ultraleap – with cutting-edge innovations in motion technology that can shape Virtual Reality, and Blu Wireless – a pioneer in mmWave technology and communications which can transform global connectivity infrastructure. In fuelling the creation of more innovative companies in the area, the role of incubators, such as the Future Space which is based in Bristol and essentially a part of the Oxford Innovation network, have a crucial role to play.

In neighbouring areas to the West of England Mayoral Combined Authority, there are more companies performing cutting-edge R&D and parts of a wider inter-regional innovation ecosystem. Notable examples of this are Dyson (based in Malmesbury, Wiltshire), the technology company specialising in vacuum cleaner technology, and Renishaw (based in Wotton-under-Edge, Gloucestershire), a leader in precision engineering and metrology, known for its advanced measurement and additive manufacturing solutions used in industries such as aerospace, healthcare, and automotive.

#### *4.4 Innovation Capability Across Industries*

In understanding the innovation capability of industries in the WoE LEP, we use data produced by the Smart Specialisation Hub (2017). This data capture information on a variety of indicators of innovation activity (or innovation capability – we follow the Smart Specialisation Hub and we are using the two terms interchangeably) which enable the construction of overarching innovation capability scores. More specifically, the innovation activity indicators relate to three categories:

- Innovation in Research / Higher Education. There are three indicators in this category: number of staff submitted to REF across STEM disciplines, publication output in line with the priorities of Innovate UK, and publication output to the 8 Great Technologies. Figure 28 presents the Eight Great Technologies.
- Innovation in Business / Industry. There are three indicators in this category: Investment of Innovate UK in the area, the number of FTE jobs in technology sectors, and the number of inventors on patents across various technology sectors.
- The Knowledge Transfer Network (KTN) experts. An indicator based on KTN experts' knowledge of the respective areas. The indicator was constructed by using a simple scale based on the answers of the KTN experts on the following question: "In your experience, how much innovation activity is present in your sector of expertise for each of England's LEPs?" (SSH, 2017).



Figure 28. The eight Great Technologies

By combining information from all the indicators, the innovation activity scores across industries and regions are constructed (for more information, please see SSH, 2017). Figure 29 presents the innovation activity scores across industries in the WoE LEP. The aerospace industry, including both its manufacturing and infrastructure, has the highest innovation capability among all industries in the WoE LEP. Companies such as Airbus and Rolls-Royce are not only integral parts of the innovation ecosystem of the WoE LEP but they are also two of the largest employers in the area, significantly contributing to the local economy.

The built environment, including architecture, engineering, building services and building control, has the second highest innovation capability. Amey PLC, AECOM and Arup belong in this industry. Other industries with a high innovation capability are: ICT, including telecoms, computer technology, information technology management and basic communication processes; electrical systems, including electronics, photonics, semiconductors and electronic sensors; and transport, including maritime/marine, rail and automotive transport systems.

On the other hand, the innovation capability in nanotechnology is non-existent (zero) reflecting the practical absence of a purely nanotechnology-focused industry in the WoE LEP – despite the presence of two dedicated University-based centres: the Bristol Centre for Nanoscience and Quantum Information (University of Bristol) and the Centre for Nanoscience and Nanotechnology (University of Bath).

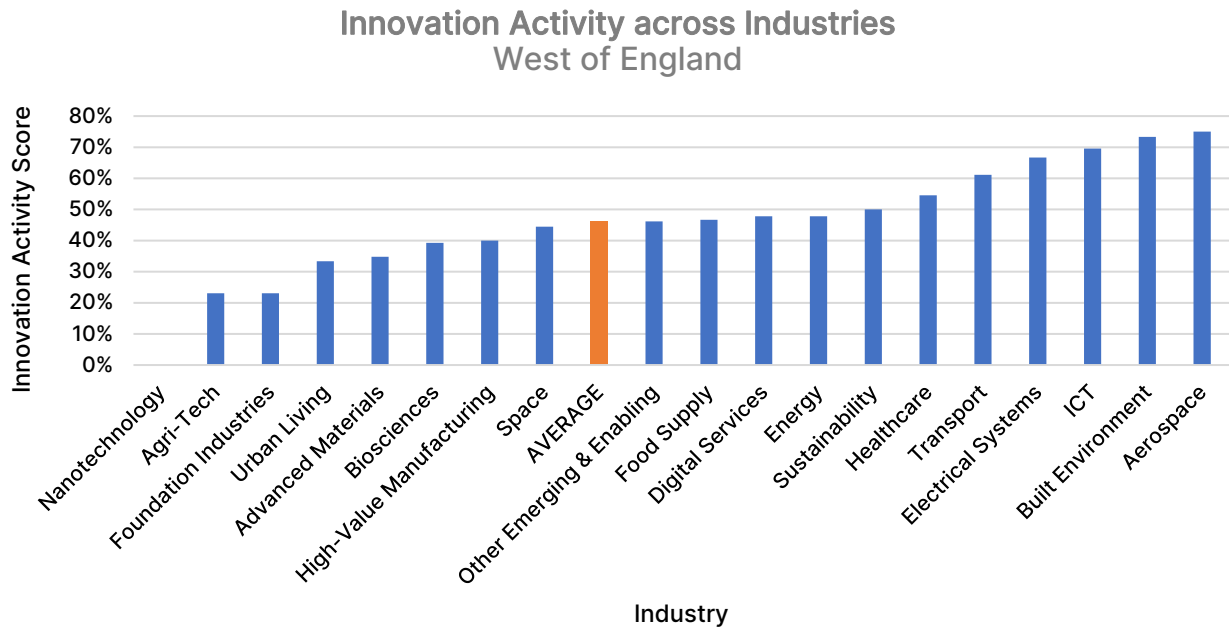


Figure 29. Innovation activity by industry – West of England LEP

But how does the innovation capability in the WoE LEP compare to the innovation capability of other LEPs? Figure 30 presents the innovation capability of industries across their respective LEPs. The overall industrial innovation capability of each LEP is also calculated as the average innovation capability across all industries (i.e., the last column in Figure 30).

In developing this matrix bubble chart, we used three bubble sizes to denote high, medium and low innovation capability. The three bubble sizes are determined by the following ranges of values of innovation capability (activity):

- small bubble size ( $0\% < x < 10\%$ );
- medium bubble size ( $10\% \leq x < 60\%$ ); and
- small bubble size ( $60\% \leq x$ )

Where the innovation activity value is zero, there is no correspondence to any bubble (such as nanotechnology for the WoE LEP or aerospace for the Cornwall and Isles of Scilly).

The South East region has the largest number of highly innovation capable LEPs and Oxfordshire is its leader. Greater Cambridge and Greater Peterborough is the other only LEP, apart from Oxfordshire, that achieves an overall innovation capability score higher than 60% (i.e., the large-sized bubble in the 'LEP Capability Average' column). With the only exception of Cornwall and Isles of Scilly, which has a low capability score, the other LEPs of the South West region have a 'medium' innovation capability.

Other LEPs with a considerable aerospace innovation capability are Enterprise M3, Solent, and Derbyshire and Nottinghamshire, whereas no LEP ranks higher than low innovation capability in nanotechnology (where it does exist). This suggests that, should the WoE LEP aspire to invest and develop a nanotechnology industry, catching-up with other LEPs should be within the feasible region.

Figure 31 presents the innovation capability scores for the top 20 most innovation capable LEPs. Besides the overall scores for each LEP, the innovation capability scores for the four industry groups in each LEP are also presented. The four industry groups are a result of the grouping of technologically adjacent industries presented in Figure 29 and Figure 30 above. More specifically:

- Emerging and Enabling Technologies: Digital Services, Electrical Systems, ICT, Other Emerging and Enabling Industries, and Space;
- Health and Life Sciences: Agri-tech, Biosciences, Food Supply, Healthcare;
- Infrastructure: Aerospace, Built Environment, Energy, Sustainability, Transport, Urban Living; and
- Manufacturing and Materials: Advanced Materials, Foundation Industries, High-Value Manufacturing, Nanotechnology.

Overall, the WoE LEP ranks 7<sup>th</sup> in innovation capability out of 37 LEPs. Greater Cambridgeshire and Greater Peterborough (GCGP), and Oxfordshire are the undisputable leaders with South East Midlands (SEMLEP) following. The particular innovation capability strengths of the WoE LEP are in Emerging and Enabling Technologies (5<sup>th</sup> out of 37 LEPs) and Infrastructure, where the WoE LEP is only behind GCGP and Oxfordshire (3<sup>rd</sup> out of 37 LEPs).

On the other hand, the WoE LEP scores lower in Health and Life Sciences (10<sup>th</sup> out of 37 LEPs) and even lower in Manufacturing and Materials (19<sup>th</sup> out of 37 LEPs). Should the WoE LEP wish to boost innovation capability in its sectors, industries from these two groups should be the target of any future innovation capability building programmes. We note that as the data correspond to year 2017, new capability may have developed for the WoE LEP (and elsewhere) more recently which is otherwise not captured by the statistics presented here.

### Innovation Activity across LEPs

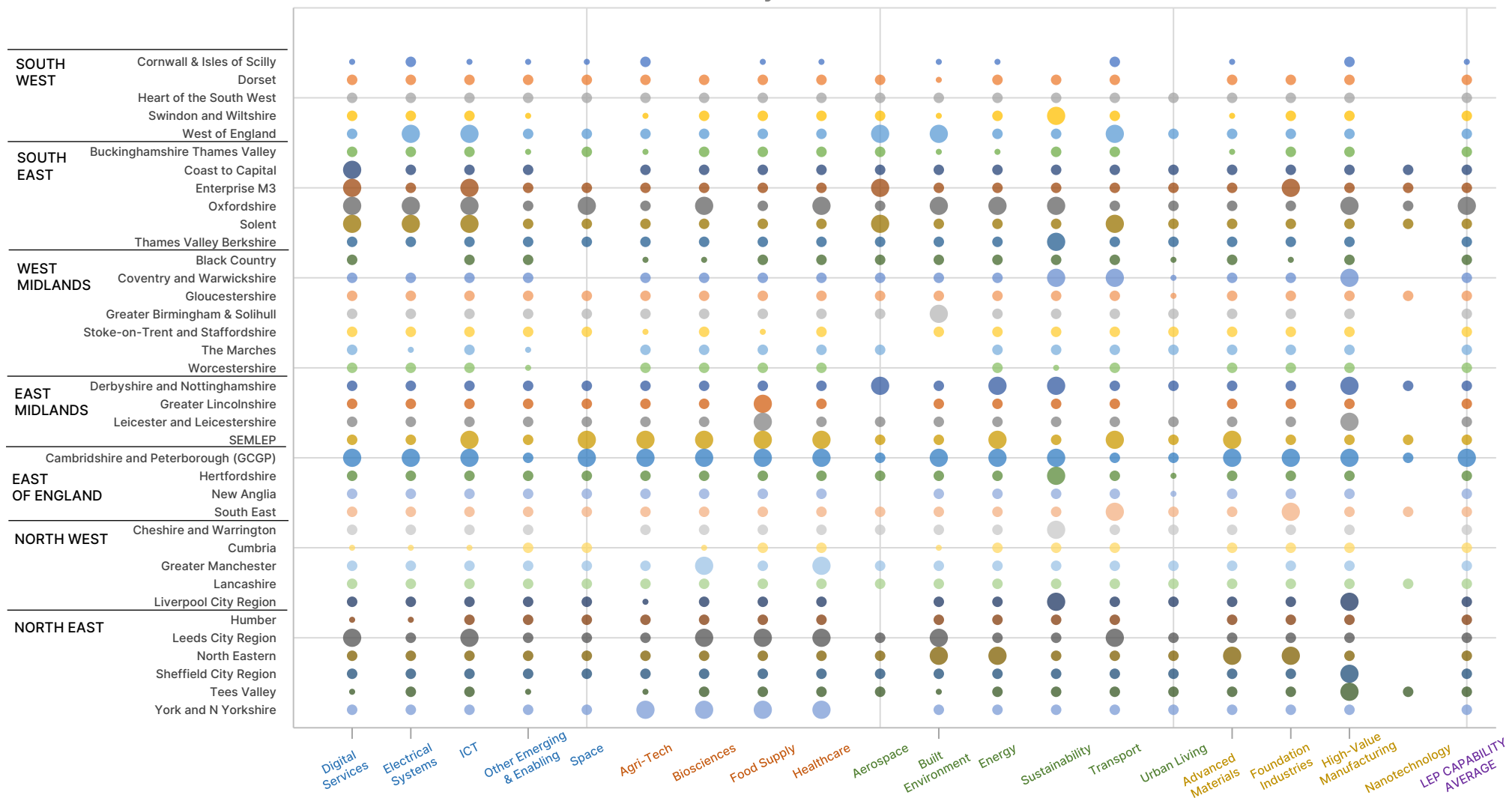


Figure 30: Innovation activity by industry – all LEPs

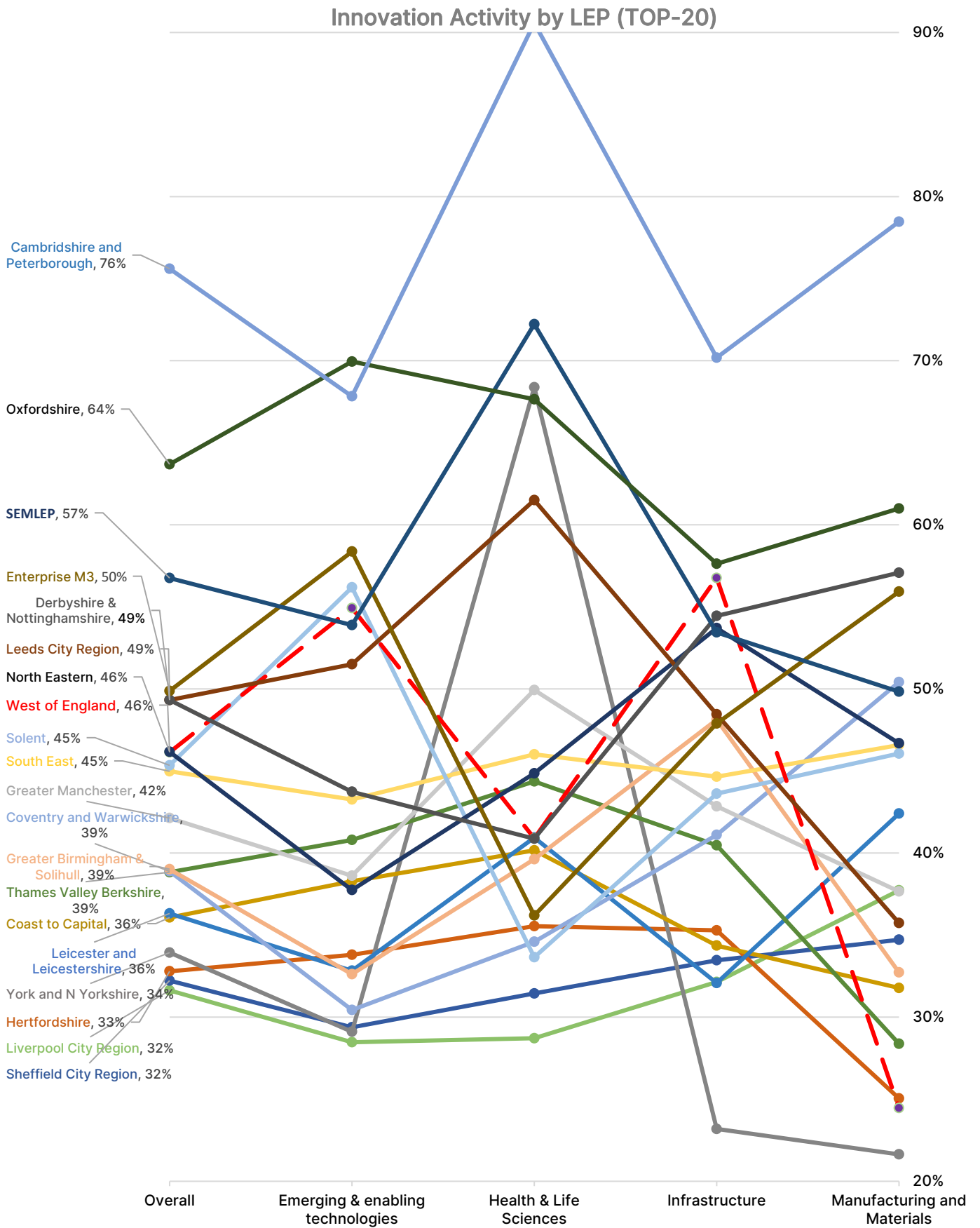


Figure 31. Innovation activity by industry groups – all LEPs



## *5. Summary & Conclusion*

This report has examined the key indicators of productivity, innovation and skills in the West of England, and compared these data to those for the rest of the Combined Authority and LEP areas in England. Outside of the Greater London Authority area, the West of England Mayoral Combined Authority is the most productive Combined Authority. It is also more productive than the WoE LEP area in which it belongs. The WoE LEP is among the 10 most innovative LEPs in England but not among the 10 most productive LEPs - which raises the question of how the WoE LEP can effectively use its innovation-capable businesses to generate productivity gains. We also find that the West of England Mayoral Combined Authority punches above its population weight in terms of productivity, while the WoE LEP is above its population weight but below its human capital (qualifications) weight. These are important findings for regional economic strategies and innovation policies.

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