Welsh Economy Research Unit
Yr Uned Ymchwil i Economi Cymru

Centre for Innovation Policy Research
Canolfan Arloesi Ymchwil Polisi

The innovative capacity of Welsh local authority areas: Introducing an innovation scorecard and some preliminary comparative findings (July 2025)

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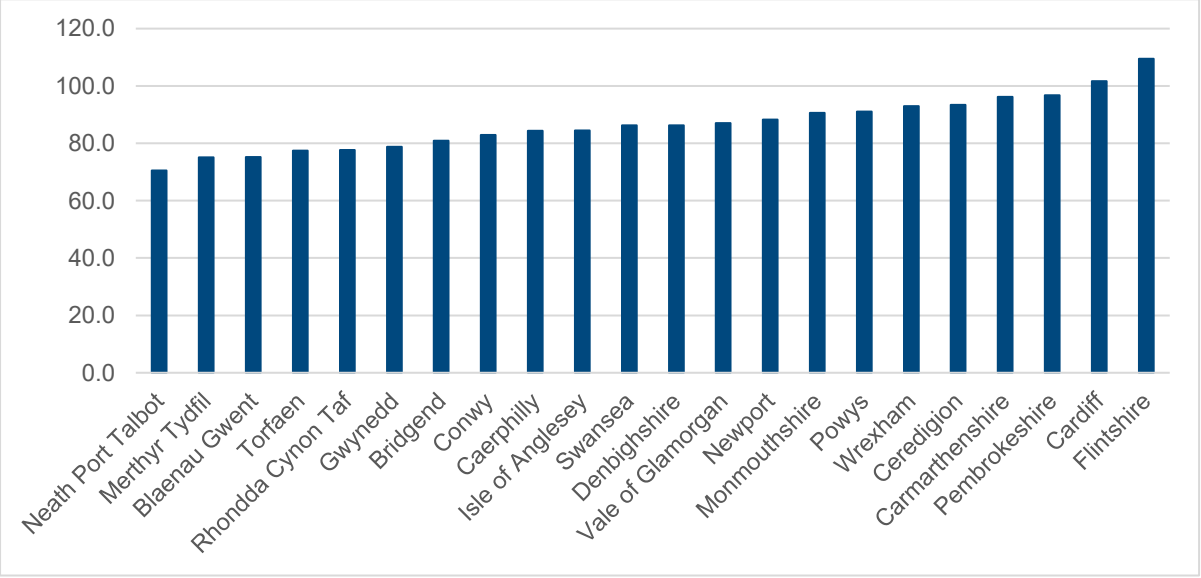
Summary

The report[1] identifies data which helps us to understand the key drivers, barriers and outcomes of innovation in local authority areas of the Welsh economy, presenting these in the form of an Innovation Scorecard. The work was undertaken in response to calls for more granular insights into these issues than are presently available and used to inform policy decisions. Our approach offers the opportunity for comparisons to be made in terms of both inputs and outcomes, but caution should be used in interpreting these as a 'league table'. Our objective is to assist policy makers in developing more informed policy choices and in seeking evidence of the consequences at each of local authority, economic region and national levels. To baseline the data, we introduce a GB local authority average on each measure. Moreover, in our approach we have not been able to capture all aspects of the innovation system or interactive elements of local innovation (for example, innovation linkages between firms, research, or the adoption of key technologies, such as digital).

In 2023, the strongest Welsh local authority on the innovation scorecard is Flintshire, but with a strong showing in Cardiff, Carmarthenshire, Ceredigion and Pembrokeshire. Critically in interpreting this and the position of Wales as a nation, none of the local authority areas in Wales are classified as 'Leading' when compared to the overall GB local authority innovation index score. Neath Port Talbot is the poorest performing local authority on the scorecard for Wales, followed by Merthyr Tydfil, Blaenau Gwent, and Torfaen. Twenty of the twenty-two local authorities in Wales reported scores below that of the GB average. On the scorecard there is less evidence of an East-West divide in Wales which is typically seen in investigation of productivity indices alone. Further research would need to examine how far these scorecard claims for these more rural areas can be substantiated.

Innovation Scorecard: Wales LA composite scores relative to the average 2023 snapshot (GB average=100)



[1] This report forms part of the Wales Innovation Insights and Productivity Performance (WI2P2) project. This project was supported by Cardiff Capital Region, Welsh Government, and the Wales Forum of the ESRC Productivity Institute.

The analysis undertaken in this report was very much in the spirit of a pilot exercise. It is accepted that more work needs to be undertaken in terms of data investigation, not least around the availability of finance to innovate, and critically more data which speaks to innovation in the public sector.

While rankings and league tables inevitably prompt comparative assessments and a focus on 'winners and losers', the real value in this exercise is in developing novel insight into both the individual and combinations of variables that drive innovation at a local authority level. Benchmarking at such levels of granularity can help interpret current performance and identify areas for further attention, and of potential improvement. It can also motivate renewed or revised policy interventions and encourage learning across different LAs. However, it is also important to recognise that in creating such a scorecard that there are typically trade-offs in terms of data reliability.

1. Introduction

1.1. Background

This report forms part of the Wales Innovation Insights and Productivity Performance (WI2P2) project. This project was supported by Cardiff Capital Region, Welsh Government and the Wales Forum of the Productivity Institute. The research was undertaken in response to calls for more granular insights into productivity and innovation issues than are presently available and might usefully inform policy decisions (Parsons et al., 2024). A key element of this project was to examine datasets available at subregional level to inform the development of local scorecards which would help us to understand the innovation potential of different parts of the Welsh economy. The project leverages information and data from these data-based activities for the formulation of actionable insights that inform innovation acceleration and consequent strategic productivity-enhancing interventions. The primary audience for communication of these insights in the first instance would be policy makers in the local authorities, economic regions and Welsh Government.

1.2. Objectives

Following from the above this report presents a framework for the evaluation of innovative capacity at local authority level.

We identify data which helps us to understand the key drivers, barriers and outcomes of innovation in local authority areas of the Welsh economy, presenting these in the form of an Innovation Scorecard. The identification, development and combination of data in this way is not an easy exercise with real problems finding data that is up to date and that can help us to understand why some areas of the Welsh economy may have better outcomes from innovation processes than others. Moreover, the approach taken is expected to be contested, but it is our contention that moves in this direction – in terms of both an innovation focus and the granularity of reporting at local authority level – are increasingly important in policy planning and understanding the outcomes of policy interventions,

In what follows we seek to provide some context on the need to better understand the factors driving innovation outcomes in different parts of Wales. The second section of the report provides a high-level description of the framework adopted and the data used. It then describes the method through which the data was combined into an index that ranks local authority areas of Wales in terms of identified innovation drivers, barriers and outcomes. The third section provides the results from the process, while the fourth section concludes with some policy implications arising from the framework and results presented.

1.3. Context and review

The innovative capacity of a region is widely recognised as a critical driver of economic growth, enhancing productivity, and encouraging competitiveness, while also having the potential to enhance social development and wider societal benefits.

Innovation is a process that creates value. Understanding innovation requires analysis of both the activities and outcomes of such processes through the development of new or improved products or processes, or combinations of these (OECD, 2018). Potential outcomes of innovation include productivity growth, enhanced job creation potential, and raising individual incomes, developing new solutions to address human needs, improving health outcomes, and boosting overall social welfare (Guellec et al., 2020).

The developmental progress stimulated by innovation motivates interest in the factors that affect a region's innovative capacity. Commonly associated factors necessary to influence and appropriate innovation within a region include the volume and quality of human capital and skills, the degree of research and development (R&D) investment and infrastructure, the ability to access funding and financial resources, the market demand, the amount of entrepreneurial activity and the nature of the technological ecosystem and infrastructure. These factors can mark out competitive places. Regions scoring well on these factors might be able to improve their capability to respond to changing economic conditions, demands and challenges, and then move ahead of places not having these factors in place.

In producing the innovation scorecards for local authority areas of Wales (and with an extended analysis to consider selected GB local authority areas for comparative purposes), a review of the literature for different types of scorecards was undertaken. As well as exploring the rationale for prior scorecards, the review also helped us to examine the nature of opportunities and limits in terms of the data available to address these issues (and more importantly perhaps, the limits on data availability, particularly here at sub national level). Through the examination of an array of different scorecard methodologies, it was possible to explore the different ways in which the variables were combined and justified to gain visual representations of differences in productivity and innovation across geographies.

Among the material reviewed in coming to our approach was the EU Regional Innovation Scorecard (2023), the UK Competitiveness Index 2021 and The Productivity Institute's (TPI) UK ITL3 Productivity Scorecards (see Huggins et al., 2021; Gouma et al., 2023). It is accepted here that some of the material reviewed did not always focus on innovation, but issues of innovation, competitiveness and productivity are tightly interlinked. We were also mindful here of the 2023 Innovation Strategy for Wales focused on how innovation can be used to improve the lives of Welsh people.[2]

[2] See https://www.gov.wales/sites/default/files/pdf-versions/2023/10/2/1698143921/wales-innovates-creating-stronger-fairer-greener-wales.pdf

1.4. Framework for the innovation scorecard

In Section 2 of the report, we provide more detail on the framework. In summary here the approach focuses on factors expected to drive the innovative capacity of local authority areas, then factors expected to act as barriers or constraints to innovation, and then finally a series of factors talking to the expected outcomes of innovation processes. Thus, our approach emphasises innovation "Drivers", "Barriers" and "Outcomes". The local authority scorecard we have developed then draws upon six variables categorised as innovation drivers, six innovation barriers, and two innovation outcomes. This framing means that the analysis of individual local authorities can be broken down into comparisons of their individual scores on drivers, barriers and outcomes, and then also comparisons of their overall index score. In our view, the individual measures and the patterns of relationships between these are as (if not more) important than the overall score when developing policy.

1.5. Method in outline

Further details of the method through which the data collected was transformed and developed into a local authority index for Wales (and for selected GB-wide local authority areas) is found in the Appendix 1 to this report. The methodology in summary was to employ a min-max normalisation procedure to scale each of our quantitative data points to values between the range of 0 and 1, rescaling and ranking each local authority relatively to the minimum and maximum values observed in the sample. This method was particularly useful given that the raw data for the different variables used in our report displayed varying sized ranges, allowing us to compare the different variables more easily across each local authority area. It was also chosen due to the simplicity of calculation of the output scores and ease of replication, such that, should the report be used to influence policymaking decisions, anyone can adapt the scorecard to include different variables or update the scorecard to include more recent data. Such useability and the potential for adaptation are important in being able to tailor the assessment to the specific characteristics and concerns of a local area. At the same time, caution is then needed to ensure any ensuing comparisons are consistently 'like-with-like'.

1.6. Data and limitations

Given the scope of the report and the primary objective to analyse Wales at the local authority level, the variable selection process was constrained by the level of data availability at our desired level of geography and restricted by the timeliness of the data available. At the time of developing the innovation scorecard much of the economic and supporting data was only available up until 2022 or 2023.

It is also important to recognise that analysis at the level of Welsh local authorities creates a series of problems. Some local authority areas are small such that, for example, labour market variables which hint at a strong innovation supply side in one 'place' might result in positive outcomes in another 'place' because of commuting patterns. Moreover, strong R&D intensive businesses in one place could create opportunities for businesses to innovate in adjacent local authority areas because of knowledge and expertise occurring because of trade and collaboration. Some firms in Welsh local authority areas are part of multinational groups such that their activity can benefit from innovation in the wider business occurring overseas. More generally, we accept that the approach has not been able to capture all the aspects of the innovation system or interactive elements of local innovation (for example, innovation linkages between firms, research, or the adoption of key technologies, such as digital). We recognise the importance of these, but they are often more feasible to measure at the regional as opposed to local authority level.

This noted, the scorecard developed provides some indication of why it is that parts of the Welsh economy are better placed in terms of the outcomes for innovation. Such insights have potential implications for Welsh Government and Local Authority policymakers concerned with economic development. We acknowledge that the approach here and the progress to date is in the spirit of a pilot study and would need to be revised as better data becomes available.

2. Scorecard framework

2.1. Approach

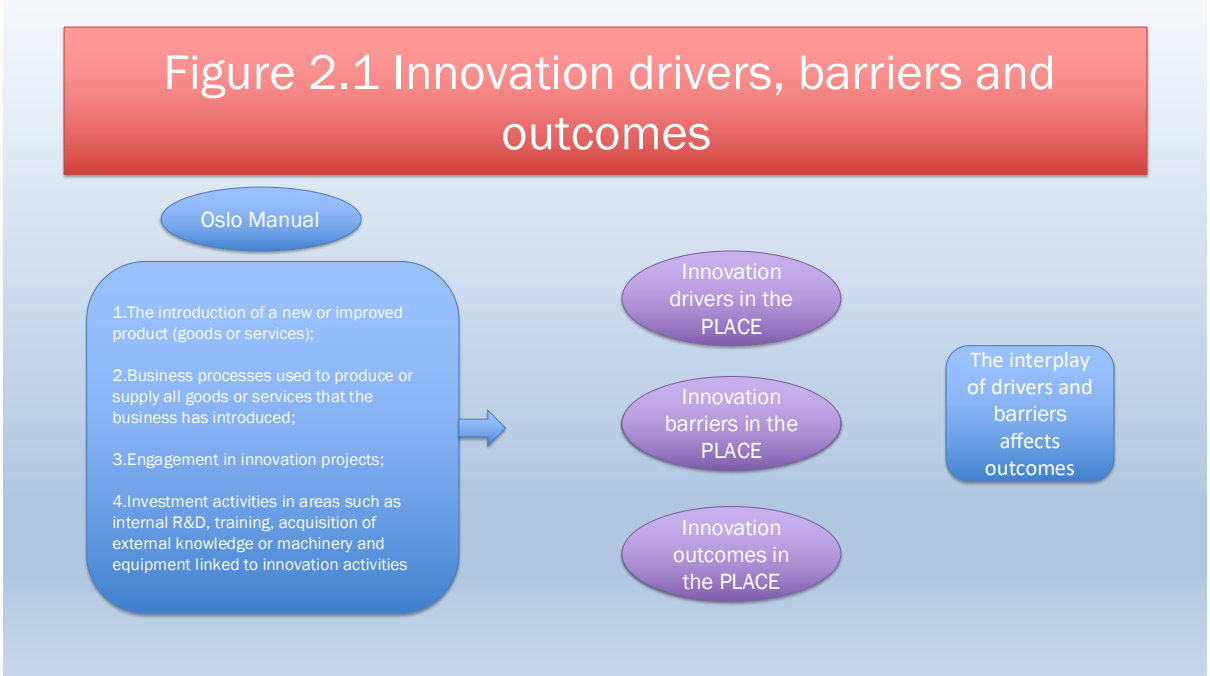
As revealed in Section 1 of the report, the primary objective was to create an innovation scorecard for different local authority areas of Wales. In developing the framework it was important to consider the following:

- That the approach should be transparent and easily replicable
- That the approach should use publicly available data as far as possible
- That the variables/data used in developing the index should as far as possible focus on the innovative drivers, barriers and outcomes in each place
- That the visual representation should be straightforward and provide clear messages for policy.

Figure 2.1 describes the overall framework. We begin with the definition of innovation activity as found in the Oslo Manual (OECD, 2018). Publicly available data to inform points 1-4 in Figure 2.1 is quite sparse, particularly at the geographical level of local authority areas. Then there is a requirement to provide an indication of how far such activity might be occurring by examining a series of data sources.

Our approach is first to consider for each local authority area what are the innovation drivers in the local authority area. Put in different terms, what is it that might increase the level of business innovation[3] potentially occurring in the local authority area? Second, there are a series of expected barriers to innovation activity in the present; conversely local authority areas with lower levels of barriers to innovation might perform more strongly. Thirdly, there are expected outcomes from successful innovation processes. It is recognised that there are dynamic connections between innovation drivers, barriers and outcomes. For example, successful outcomes in terms of productivity growth can work to provide the conditions for stronger innovation drivers in the future.

[3] We accept here that innovation is not restricted to the private sector. However, the lack of data available on public sector innovation meant that the developed scorecard was more focused on private sector activity. However, in one of the barrier measures (see later) we develop a variable based on gross domestic fixed capital formation which includes public sector investment.



In the next section we focus on the expected innovation drivers, barriers and outcomes and how publicly available data might be used to describe the conditions in each local authority area.

2.2. Innovation drivers

The main question here is what is it that increases the level of business innovation (see footnote 3 in respect of public sector innovation) occurring in the local authority area. We seek to pick up on this using six factors (D1-D6).

D1: The proportion of employment in the LA that is associated with R&D intensive industry sectors

It is expected that there will be higher levels of innovative activity in industries that are relatively more R&D intensive. This partly links through to the level of technological opportunity with R&D intensive sectors both more likely to be in the process of introducing new or improved products and processes and having the resources to innovate. Indeed this factor links to a great deal of past and current UK Government policy which, for example, recognises the value of R&D intensive firms to the UK innovation ecosystem.[4] Using D1 could reveal local authorities that have an advantage over others with regards to the presence of key actor firms in high-impact sectors identified by the OECD.[5] The level of business R&D expenditure is often viewed as a key economic driver of innovation on the input-side. However, due to the (lack of) availability of data at the LA level we take the level of employment in industry sectors that are known to experience the highest levels of R&D expenditure internationally as a close proxy (see also Ganau and Grandinetti 2021).

[4] See for example enhanced support for R&D intensive SMEs Enhanced support for Research & Development (R&D) intensive small or medium enterprises (SMEs) - GOV.UK

[5] See OECD (2016) 5jlv73sqqp8r-en.pdf

D2: The concentration of economic activity in the LA (GVA) that is in industries known to be growing relatively quickly at international level

Faster growing economic sectors are expected to be undertaking more innovative activity. D2 seeks to examine how far local authority areas are specialised in terms of the amount of gross value added that is currently generated by relatively fast growing industries. This then aims to capture the existing capabilities of each LA in current and upcoming sectors that drive innovation, as well as the economic dynamism of each local authority area in its ability to attract investment into businesses at the frontier of innovation. Since these industries are often leading global innovation trends, we assume that the higher the GVA per employee in these industries within a local authority area are then the more likely the region is both benefitting from and contributing to global innovation trends. The regional specialisation in these high-value innovative industries could also help drive future innovative capacity by capitalising on their comparative advantage and attracting investment, talent and access to global value chains that prioritises innovation. This will aid in the regions capacity to attract and assimilate innovation produced outside of the region, an important factor for a regions capacity to produce innovation (see Rodriguez-Pose and Crescenzi 2008).

D3: Historical record of output growth in LA

This factor speaks to the record of past output growth in the local authority area. An area's ability to both scale and sustain economic growth through time is likely to be partly explained by the innovation activity present within the local economy (Cameron, 1996; Verspagen, 2009; Maradana et al., 2017). The link between innovation and economic growth has been recognised as important since the seminal research of Solow (1957).

D4: The proportion of businesses in LA in R&D intensive sectors

While D1 and D2 speak to amounts of employment and GVA in R&D intensive sectors, it is also important to reflect on the proportion of businesses in a local authority area in these sectors. We note that this does not include innovation that would be occurring in universities. For example, it might be the case that activity in the local authority area speaks to just one R&D intensive business rather than a stock of innovation capable businesses. Understanding the number of R&D intensive businesses may also better link to the capacity for spillovers, future attraction of talent and investment, and potential for increased regional competitiveness and productivity. Proximity of a number of R&D intensive businesses could be important for the transmission of economically productive knowledge (Rodriguez-Pose and Crescenzi, 2008).

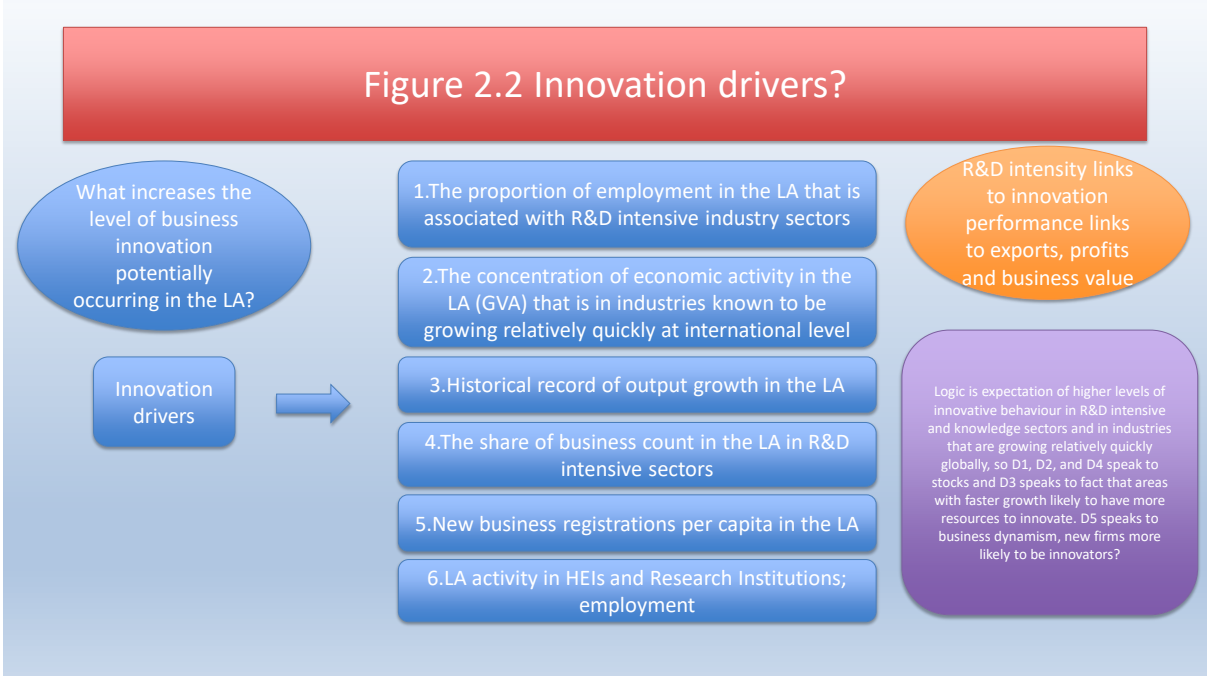
D5: New business registrations in LA per capita

As well as R&D intensive businesses it is also necessary to pick up on total new business registrations in an area. This is an indicator of dynamism and with new entrant firms being a source of innovation, and perhaps more likely to have new ideas, products and processes. Moreover, in the light of Schumpeterian economic growth theory, it is assumed that the threat of technologically advanced entries into the market will drive innovation incentives and so we might expect that a higher number of business registrations will drive innovation, particularly in sectors that are close to the technological frontier (Aghion et al., 2009).

D6: LA activity in HEIs and Research Institutions

Higher education institutions (HEIs) can directly contribute to regional innovation development and stimulate regional innovation systems through the output of research publications, the education of the workforce and future workforce, and through collaboration with regional public and private actors (see for example, Caniëls and van den Bosch, 2011). The effect of applied research institutions on regional innovation activity is found to be large and significant, with the effect present for both new institutions and existing institutions, as well as for both small and large firms. The complementary effects of combining the research of universities with applied research institutions is also found to be an effective way of increasing innovation outputs and fostering innovation (Pfister et al., 2021). It is appreciated that the outputs and networks of higher education institutions will be extensive but still with expected innovation impacts locally.

Figure 2.2 summarises the innovation drivers in the scorecard.



2.3. Innovation Barriers

As well as drivers of innovation processes, there are factors on the supply side of the local economy that could work to form barriers to innovation potential. Conversely, local authority areas which do better on these factors may see better innovation returns. Figure 2.3 identifies six barrier factors. The overall logic model here is that innovation requires investment and that innovation is also more likely to occur where there are human skills available and a stronger financial supply side to support firms (i.e. some firms may not be able to gain finance to innovate). A final barrier is access to digital or ICT skills.

B1: Gross fixed capital formation (GFCF) per employee in LA

Investment is necessary to develop and foster innovation, and the total business investment of a local authority area will indicate the activity and capacity of the region for innovation. Gross fixed capital formation not only promotes innovation, but it promotes employment and thus economic growth, with the effect being more pronounced in more innovative sectors (Destefanis and Rehman, 2023). Clearly, investment into more novel forms of capital, such as intangibles and digital, would be preferable as an indicator, since these are more widely recognised as necessary for innovation, and would better reflect the regions lacking the key modern drivers of innovation. However, due to data availability it is necessary to proxy here in terms of total gross fixed capital formation.

B2: LA workforce qualified to RQF 4 or above

The presence of innovation is more likely to occur in regions where there are human capital skills available, and we proxy this human capital base by taking the proportion of the local authority workforce qualified to RQF 4 or above. Clearly, this potentially acts as both driver where there are high levels of well qualified workforce or potential barrier otherwise. This captures the proportion of highly skilled labour within the local authority, which is essential for innovation-driven industries. It has also been found that in peripheral regions, such as Wales, in order for innovative efforts to be as productive as those in the core regions, there needs to be large complementary investments into human capital (Crescenzi, 2005). The greater the level of human capital, the more likely innovation will be developed and the more easily innovations will be adopted.

B3: Proportion of workforce in Occupational Groups 1-3

Similarly to B2, this also captures an element of the human capital base of a region, but rather than just speaking directly to the skills level, it speaks to the deployment of skilled labour in the workforce, further highlighting the role of the human capital in the development and absorptive capacity for innovation. The occupation groups captured are: managers, directors, and senior officials; professional occupations; and associate professional and technical occupations. This element of the occupational base of the workforce might engage in the most technical business and innovation activities. Once again high levels of workforce in Occupational Groups 1-3 might be considered a driver, but lower proportions might constitute a barrier.

B4: Strength of local demand for finance to innovate

Finance is often required by firms (particularly SMEs) to invest in new products and processes, while enabling them to hire skilled workers. More innovative firms are expected to have a higher demand for external capital, and new firms who wish to introduce new products and enter markets need access to finance to do this. The local demand for finance might then proxy as to how far monies are available for innovation (see Lee et al., 2014). Wales post-code lending data is used to develop this variable.

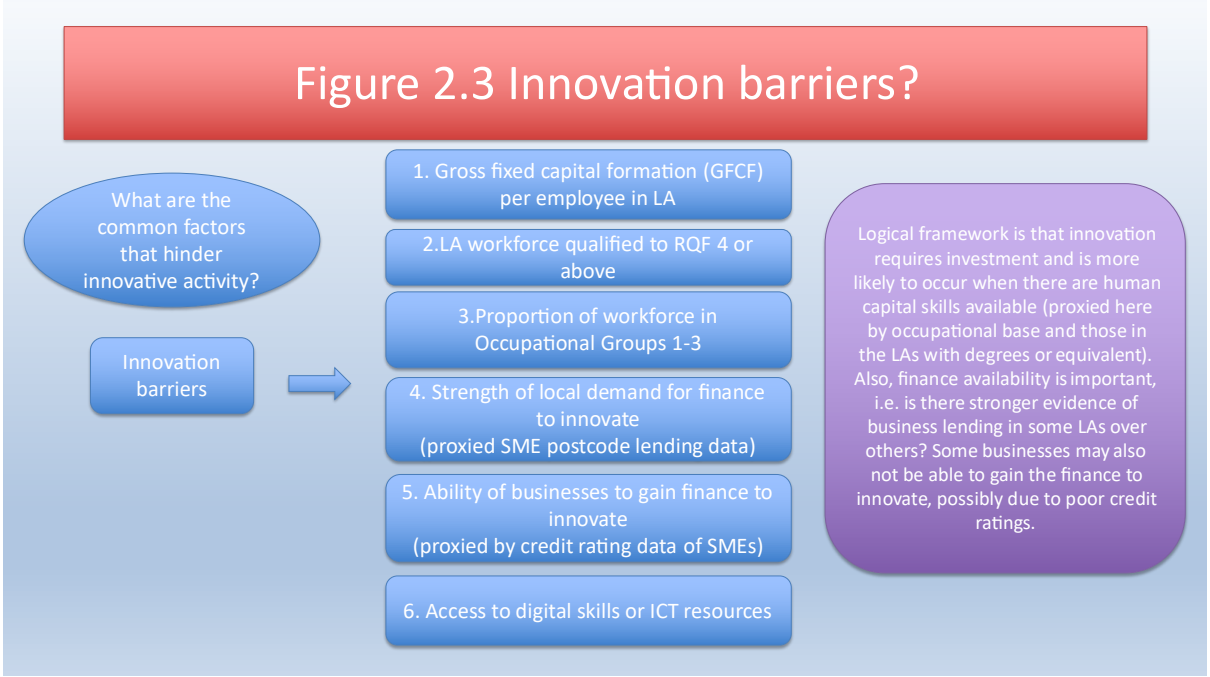
B5: Ability of businesses to gain finance to innovate

Innovative SMEs often engage in higher risk activities, such as R&D, which resultantly lead to uncertain and delayed returns. They also tend to have a higher reliance on intangible assets, which credit rating agencies tend to view as riskier due to the lack of tangible collateral. It is found that the most innovative firms are less successful than their less innovative peers in loan markets, which is reflected in their overall credit rating (Freel, 2006).

In the scorecard developed here we take the view that a stronger balance sheet improves the ability of firms to gain finance to promote innovation. This factor uses credit rating data from the business population in the local authority area to indicate the ease with which businesses in the area concerned can gain access to capital.

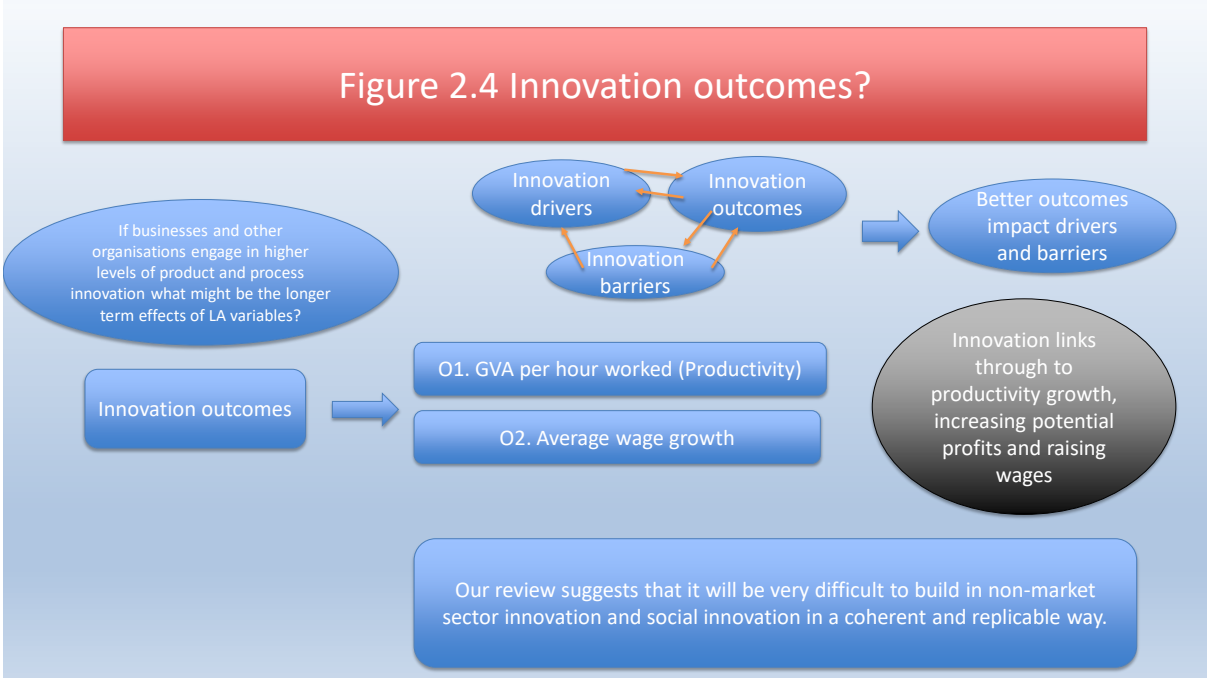
B6: Access to digital skills or ICT resources

Utilisation of the Internet can be shown to improve R&D efficiency, which in turn has a significant impact on firms' innovative capacity (Kafouros, 2006). Access to the internet allows for firms to have increased connectivity, enhanced productivity, access to digital tools, potential for market expansion, support for remote and flexible work, and improved resilience and adaptability, which, therefore, should benefit the innovative capacity of a region (Henderson et al., 2021). There are a series of issues in gaining information here on business access to digital skills and infrastructure such that for this pilot index we employ a local authority measure based on the percentage of premises with full fibre availability.



2.4. Innovation Outcomes

Finally, in Figure 2.4 we identify a series of local authority outcomes from the innovation process. The question being addressed here is if businesses and other organisations engage in higher levels of product and process innovation, then what might be the longer term effects in terms of local authority economic variables. Then it is expected that local authority areas with a stronger record on innovation will see better productivity growth and wage growth. It is accepted here that the innovation outcomes identified are tightly interconnected. While it is possible to capture some aspects of innovation through numbers of patents there are problems in that some sectors simply do not patent.



O1: Output per hour worked (labour productivity)

Output per hour worked provides a measure of productivity. However, this instead directly shows the efficiency of the labour force, and the total value of the output being produced for every hour worked by the labour force. This is a narrower measure than GVA per capita and potentially reflects much more sensitivity to innovations in efficiency and technology, though it should also capture the historic and present innovations within a region. Latest data here was available for 2022.

O2: Average wage growth

Firms that are found to be more R&D intensive, that we expect to be the most innovative, are also seen to pay higher wages, and experience higher wage growth, and with this also connected to higher productivity. This premium is also found to be present across both high- and low-skilled employees, with some research showing that the premium for working at more R&D intensive firms is higher for low-skilled workers, underscoring the potential advantages of fostering innovation within the regional economy (Aghion et al., 2017). Higher growth in wages can also be seen to stimulate innovation, in addition to productivity, with a greater propensity to affect core nation economies where there is a higher level of research intensity (Fontanari, 2024). The growth of wages within a local economy may then provide procyclical benefits to the innovative, and productive, capacity of a regional economy.

2.5. Data employed

Local authority (LA) level data was collected for the fourteen different indicators that speak to the innovative capacity of a place. We initially focused on collecting Wales local authority data but then collected data for all GB local authority areas such that our scorecards are compared to an overall GB 'average'. The data collected for the indicators within this scorecard were obtained from an array of different sources and data repositories and then combined to produce the final scorecard. Though there is full coverage for each indicator across each local authority, there are disparities in what was the most recently available data, such that for the 2023 scorecard snapshot data ranges from 2022 to 2024. The indicators are split into three distinct categories: innovation drivers; innovation barriers; and innovation outcomes.

Figure 2.5 summarises the main sources of the data used to develop the innovation scorecards. Appendix 1 to this report provides more details of the variable construction process.

Figure 2.5 Summary of Data Sources

Variable	Data sources
D1: The proportion of employment in the LA that is associated with R&D intensive industry sectors	OECD (2016) used to identify R&D intensive industries, SIC codes 20,21, 26-29, 71, 252, 303, 325). Other data was collected from the Office for National Statistics (ONS) data repository NOMIS, which provided access to the open access Business Register and Employment Survey (BRES) dataset. Data available for the period 2015-2023.
D2: The concentration of economic activity in the LA (GVA) that is in industries known to be growing relatively quickly at international level	Industries that exhibited the greatest total level of GVA growth over the period of 2017-2022 at the UK (ITL1) level were identified, and the proportion of GVA in each local authority attributed to these industries was used for comparison. Data for GVA was obtained from the ONS, from their data on regional GVA by industry and local authority. Data available for the period 2015-2022.
D3: Historical record of output growth in LA	Regional data for gross domestic product (GDP) annual growth rates was obtained for each local authority, and an average of the period 2018-2022 was taken. The data was collected from the ONS website, using the Regional GDP: local authorities dataset. Data available for the period 1999-2022.
D4: The proportion of businesses in LA in R&D intensive sectors	The same R&D intensive industries were used as in D1. Data for the total number of businesses and for the number of businesses in each R&D intensive industry was obtained using NOMIS and the UK Business Counts – local units by industry and employment size band dataset. Data available for the period 2013-2023.
D5: New business registrations in LA per capita	The data for business registrations was collected from the Business Demography, UK dataset. The total estimated population data for each local authority was obtained using Mid-year population estimates, provided by the ONS and obtained via the NOMIS portal. Data available for the period 2021-2022.

Variable	Data sources
D6: LA activity in HEIs and Research Institutions	Data on the total number of employees working in higher education institutions (HEIs) and research institutions was collected from NOMIS, using the BRES open access data set. Data available for the period 2018-2023.
B1: Gross fixed capital formation (GFCF) per employee in LA	The data for GFCF investment was collected directly from the ONS website, from the experimental regional gross fixed capital formation (GFCF) estimates by asset type dataset. The data for total number of employees per LA was collected from NOMIS, using the BRES open access data set. Data available for the period 2015-2022.
B2: LA workforce qualified to RQF 4 or above	The proportion of working age adults qualified to RQF 4 or above. Data was collected directly from NOMIS, using the ONS Annual Population Survey (APS) dataset, which collates the highest qualification level of working age adults by region and local authority online. Data available for the period 2008-2023.
B3: Proportion of workforce in Occupational Groups 1-3	The data was collected directly from NOMIS, using the Annual Population Survey (APS) dataset. Data available for the period 2004-2023.
B4: Strength of local demand for finance to innovate	The data was collected from UK Finance, using the SME Lending within UK postcodes dataset. Data is available for the period 2013-2023.
B5: Ability of businesses to gain finance to innovate	The data was collected from the FAME database, which collates an array of different information on companies. Data available 2021-2024.
B6: Access to digital skills or ICT resources	The percentage of premises with full fibre availability was used as a proxy for access to digital skills or ICT resources. This data was collected from the Ofcom Connected Nations and infrastructure reports datasets. Data available for the period 2018-2024.
O1: Output per hour worked (labour productivity)	Data was collected from the ONS website, using the Subregional productivity (GVA per labour hour worked): labour productivity indices by local authority district dataset, obtained via the ONS website. Data available for the period 2004-2022.
O2: Average wage growth	The data was collected from the ONS Annual Survey of Hours and Earnings Stats (ASHE) which collates the Average (median) gross weekly earnings by local authority areas and year (£) dataset online from (ASHE), obtained via NOMIS portal. Data available (though limited) for the period 2008-2024.

2.6. Methodology of scorecard construction

The methodology employed in this research to obtain the final scorecard adopted a similar approach to that of the European Commission's Regional Innovation Scoreboard 2023, utilising a min-max normalisation procedure to attain scores for each innovation indicator (European Commission, 2023). The min-max normalisation procedure allowed for the rescaling of the range of the innovation indicators to a standardised range of between 0 and 1. For a single time period, the minimum value of an indicator across all LAs was subtracted from each LAs reported value, and then this value was divided by the range of the values for an indicator, being the difference between the maximum and the minimum reported values, see equation below.

$$Y_{i,normalised} = \frac{X_i - X_{i,minimum}}{X_{i,maximum} - X_{i,minimum}}$$

Where, $i = 1, \dots, n$ for the different Welsh and GB LAs.

A score of 0 indicates that the value is the minimum value observed within the data set for a specific variable, while 1 indicates the value that is the maximum observed value for the variable. Scores between these limits indicate the relative ranking of the local authority for each variable, with higher score indicating a better relative standing.

It was necessary before performing the min-max normalisation procedure to identify whether there were any outliers within our datasets, since these outliers will affect the distribution of each LA within the normalised range. The outliers were detected using the z-score, a statistical measure that describes how far each data point is from the mean of the dataset, where outliers were defined as having values greater than three standard deviations from the mean. The outliers were, therefore, rescaled, such that outliers were given the value of three standard deviations above or below the mean.

The drivers, barriers, and outcomes were analysed individually by creating composite scores for each, whereby the equally weighted average of the relevant indicators was calculated. It was then assumed, for simplicity, that each of the innovation indicators contributed to an LAs innovative capacity equally and thus the overall composite score was calculated as the equally weighted average of the sum of the fourteen indicators.

Performance subgroups (Leader, Strong, Moderate, Challenged) were defined by assessing the performance of the individual LA composite scores relative to the unweighted average of the LA scores combined. To obtain cutoff values for performance subgroups the 10th and 90th percentiles were used to capture the top and bottom 10% of local authorities in the scorecard. The top 10% of scores in the scorecard, with scores greater than 122.37 (22.37% greater than the average), were categorised as Leader innovators, while the bottom 10% of scores, with scores less than 80.41 (19.59% smaller than the average), were categorised as Challenged innovators. Scores between 80.41 and <100 were categorised as Moderate innovators and then scores between >100 and 122.37 were categorised as Strong innovators.

2.7. Local Authority Comparison

While the focus of this report is on Welsh local authority areas the analysis was extended to show how Welsh local authority areas compared with selected local authority/equivalent areas in the wider GB economy (capturing all local authorities in England, Scotland and Wales), and here selecting areas that have been identified in prior analysis as having strong elements of an innovation ecosystem. This approach used the same methodology to that outlined above but here the values in the scorecard are connected to how Welsh local authorities measure up to all GB local authority areas.

3. Innovation Scorecard 2023 Snapshot

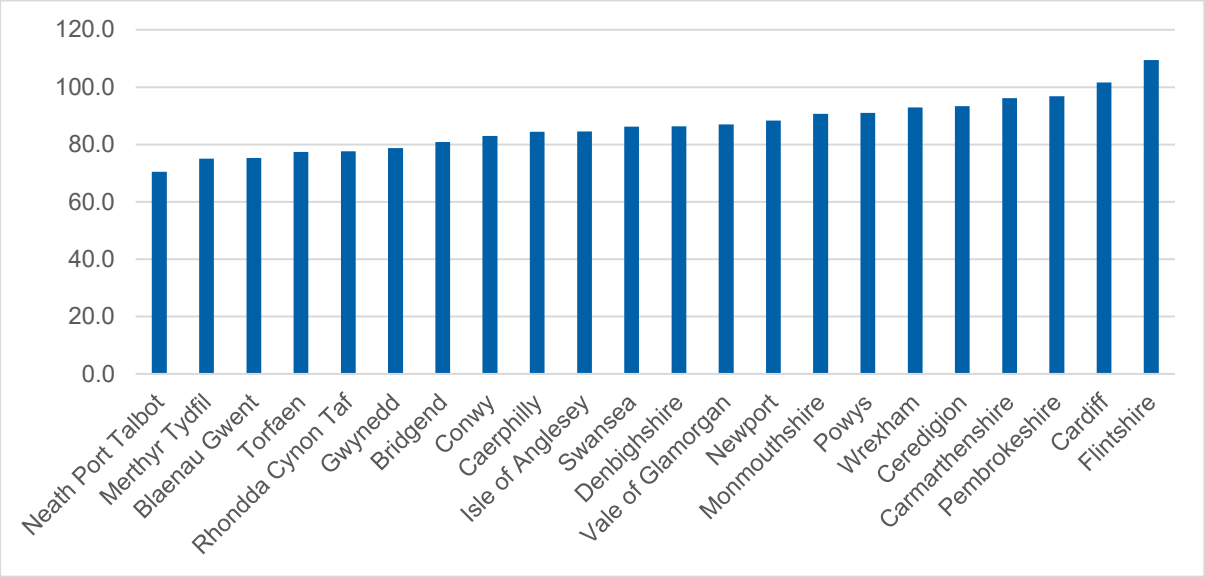
3.1. Composite scores

The innovative capacity of each local authority is measured using a composite indicator, here taking the unweighted average of the normalised score of each innovation indicator. This yields an overall picture of the innovative capacity of each area i.e. allowing for the identification of local authority areas that are more or less innovative than their counterparts by comparing their scores relative to the average composite score (see Figure 3.1).

Each of the twenty-two local authority regions is then given a performance subgroup indicating whether they are a Challenged innovator, a Moderate innovator, a Strong innovator, or a Leading innovator in Wales. Recall that performance subgroups were defined by assessing the performance of the individual LA composite scores relative to the unweighted average of the GB LA scores combined, with Challenged innovators possessing a relative score less than 80.4% of the average, Moderate innovators relative score being between 80.4% and <100%, Strong innovators relative score being between 100% and 122.4%, and Leading innovators relative score being greater than 122.4%.

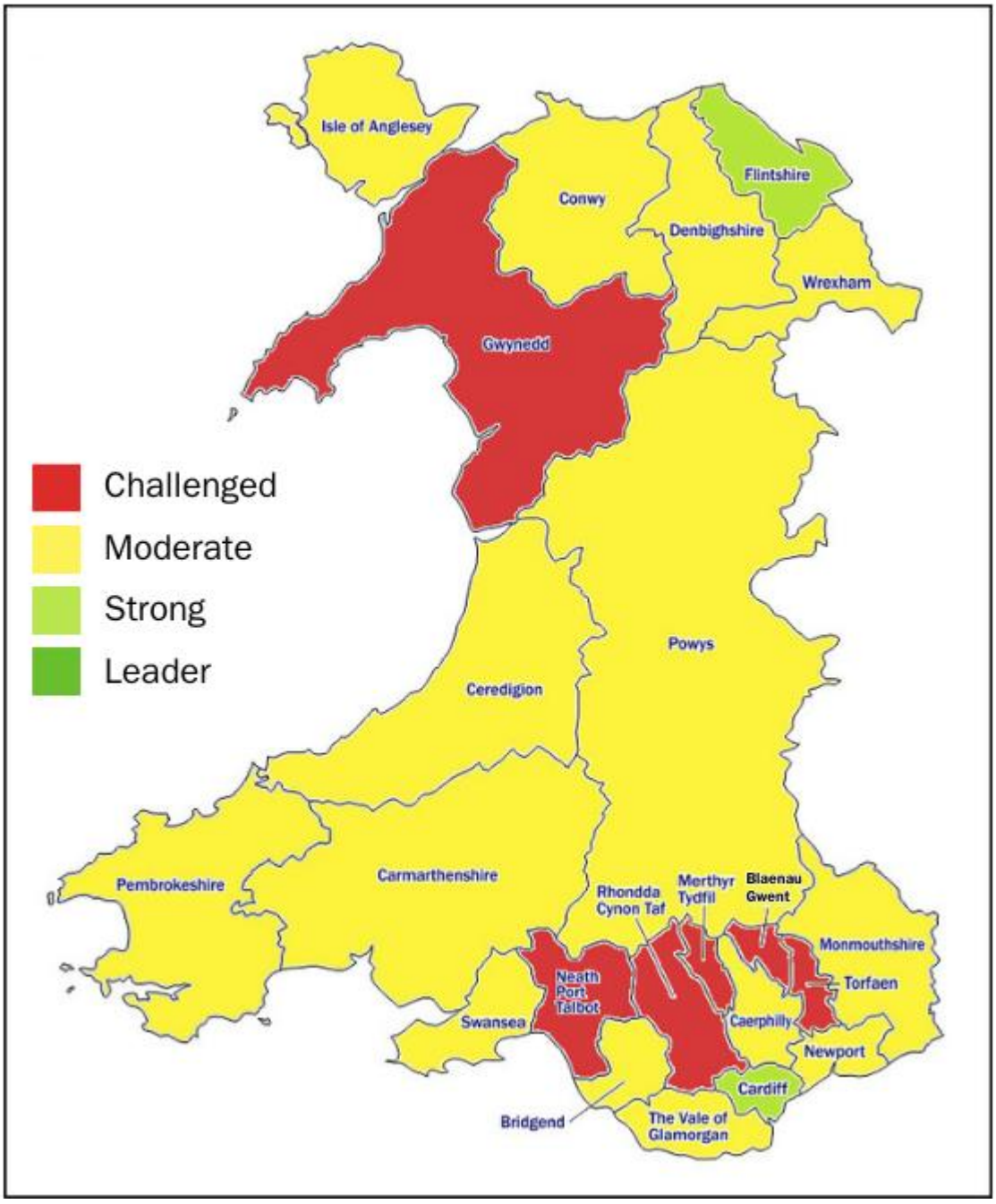
Figure 3.1 contains a few surprises. Leading the table of local authorities on the innovation scorecard is Flintshire, followed by Cardiff. More surprising perhaps is the strong showing of Pembrokeshire, Carmarthenshire, and Ceredigion on this index, who follow behind Flintshire and Cardiff on the scorecard and score higher than Wrexham. Critically here none of the local authority areas in Wales are classified as Leading when compared to overall GB composite scores (GB average). As will be seen later, the two strong local authority areas do not score well on every element of the scorecard (see below). At the other end of the spectrum, Neath Port Talbot is the poorest performing local authority, then comes Merthyr Tydfil. These two local authority areas, together with Blaenau Gwent, Torfaen, Rhondda Cynon Taf, and Gwynedd are classified as Challenged, with scores in the bottom 10% of GB. Twenty of the twenty-two local authorities in Wales reported scores below that of the GB average. However, some of the local authority areas exhibit composite scores that are around and similar to the average, suggesting that they possess similar overall levels of strengths and weaknesses across the innovation indicators. Note, however, that each individual LA's scores vary across the individual indicators. This suggests that some LAs have strengths in some of the individual indicators, and weak scores in others. Careful consideration of each variable and their combinations may open insights into the innovation *potential* of individual LAs.

Figure 3.1: LA composite scores relative to the average 2023 snapshot (GB average=100)



Of the twenty-two individual LAs, six were categorised into the performance subgroup for Challenged innovators: Blaenau Gwent, Gwynedd, Merthyr Tydfil, Neath Port Talbot, Rhondda Cynon Taf, and Torfaen. There were fourteen LAs in the performance subgroup labelled Moderate innovators: Bridgend, Caerphilly, Carmarthenshire, Ceredigion, Conwy, Denbighshire, Isle of Anglesey, Monmouthshire, Newport, Pembrokeshire, Powys, Swansea, Vale of Glamorgan, and Wrexham. The Strong performance subgroup contains two Welsh LAs: Cardiff, and Fintshire. The performance subgroup findings have also been visualised onto a map, with Challenged innovators in red, Moderate innovators in yellow, Strong innovators in light green, and Leading innovators in dark green (although none present in Wales, but see later colour coding), see Figure 3.2.

Figure 3.2: LA performance subgroup map, 2023 snapshot



3.2. Scorecards for individual local authority areas

The variation in innovation indicator scores for each individual LA can be observed in Figure 3.3. These provide insights into the performance on individual measures that collectively constitute the overall index score. In order not to make the colour coding too complex we highlight in red on each indicator where the Welsh local authority scores at 80% or less (arbitrarily taken here) of the GB average score for the indicator in question. For example, it can be seen that Cardiff has stronger scores relative to GB averages for eleven innovation indicators though has some weak scores for indicators such as 'D1: The proportion of employment in the LA that is associated with R&D intensive industry sectors', 'B1: Gross fixed capital formation (GFCF) per employee in LA' and 'B5: Ability of businesses to gain finance to innovate'. Overall, then, Cardiff can be seen to be ahead of other local authority areas on the innovation scorecard, despite some variance across the fourteen indicators. Figure 3.3. also points to the strength areas of Carmarthen and Ceredigion which both do relatively well on indicators D2 (LA activity in fast growth industries), D3 (output growth), B2 (workforce qualifications), B4 (local demand for finance) and O2 (average wage growth).

At the lower end of Figure 3.3 Merthyr Tydfil scores below 80% of the GB average in all but four of the fourteen indicators. Clearly, were the average here taken to be based on just Welsh local authority areas the performance of areas such as Flintshire and Cardiff would likely enter the Leader category, but it is more valuable to consider how Welsh local authorities measure up in GB terms as opposed to Welsh national terms.

A further conclusion from Figure 3.3 is that there are some indicators, namely D1, D2, D5, D6, B1, B5 and O1, where over half of all Welsh local authorities score poorly (less than 80%) compared to the GB average. It should also be noted here that the Welsh LAs are of quite different sizes in terms of employment. For example, Flint makes up around 5% of Welsh employment, while Cardiff makes up around 13% of employment. In this content the 'Challenged' local authority areas in Figure 3.3. combined account for an estimated 20.6% of Welsh employment (as of 2023: Blaenau Gwent 1.5%; Gwynedd 4.5%; Merthyr Tydfil 1.7%; Neath Port Talbot 3.8%; Rhondda Cynon Taf 6.3%; Torfaen 2.9%).

While Table 3.3. provides the composite index, Appendix 2 provides a decomposition of the composite innovation scorecard into its three constituent factors: Drivers, Barriers, and Outcomes. While the overall scorecard provides a broad and holistic picture of the relative innovation capacity across the Welsh local authorities, by decomposing the scorecard and analysing the factors in isolation some important variations can be distinguished (see Appendix 2).

Figure 3.3. Composite index and variables

LA	D1	D2	D3	D4	D5	D6	B1	B2	B3	B4	B5	B6	O1	O2	Composit	Rank	Relative t	Performance (80.41 / 122.37) (10%)
Flintshire	1.00	0.18	0.42	0.66	0.07	0.11	0.10	0.42	0.36	0.31	0.69	0.71	0.38	0.42	0.42	86	109.4	Strong
Cardiff	0.24	0.48	0.49	0.43	0.11	0.52	0.15	0.57	0.57	0.47	0.00	0.68	0.35	0.37	0.39	148	101.6	Strong
Pembrokeshire	0.15	0.64	0.28	0.39	0.03	0.04	0.46	0.41	0.39	0.86	0.41	0.38	0.19	0.55	0.37	193	96.8	Moderate
Carmarthenshire	0.27	0.48	0.53	0.35	0.03	0.09	0.17	0.48	0.42	0.87	0.30	0.53	0.17	0.44	0.37	201	96.2	Moderate
Ceredigion	0.13	0.34	0.42	0.20	0.02	0.74	0.18	0.50	0.47	0.76	0.35	0.37	0.12	0.39	0.36	218	93.4	Moderate
Wrexham	0.52	0.19	0.63	0.43	0.01	0.12	0.23	0.49	0.42	0.37	0.30	0.56	0.34	0.32	0.35	223	92.9	Moderate
Powys	0.35	0.46	0.31	0.30	0.02	0.01	0.21	0.45	0.43	1.00	0.45	0.34	0.04	0.48	0.35	242	91.0	Moderate
Monmouthshire	0.21	0.23	0.36	0.49	0.05	0.06	0.25	0.67	0.65	0.48	0.30	0.57	0.32	0.19	0.35	245	90.6	Moderate
Newport	0.42	0.22	0.41	0.46	0.07	0.04	0.20	0.47	0.41	0.54	0.23	0.61	0.27	0.36	0.34	263	88.3	Moderate
Vale of Glamorgan	0.47	0.10	0.27	0.43	0.06	0.02	0.32	0.57	0.54	0.43	0.18	0.76	0.18	0.31	0.33	271	87.0	Moderate
Denbighshire	0.42	0.16	0.48	0.43	0.02	0.02	0.14	0.38	0.37	0.70	0.33	0.67	0.17	0.31	0.33	278	86.3	Moderate
Swansea	0.14	0.39	0.31	0.39	0.04	0.47	0.21	0.52	0.50	0.34	0.23	0.51	0.23	0.31	0.33	279	86.3	Moderate
Isle of Anglesey	0.15	0.21	0.61	0.29	0.01	0.04	0.51	0.42	0.39	0.47	0.33	0.30	0.21	0.58	0.32	293	84.5	Moderate
Caerphilly	0.58	0.17	0.42	0.45	0.03	0.00	0.19	0.47	0.46	0.25	0.27	0.64	0.26	0.31	0.32	295	84.4	Moderate
Conwy	0.16	0.16	0.21	0.38	0.03	0.00	0.13	0.47	0.45	0.87	0.29	0.79	0.08	0.39	0.32	306	82.9	Moderate
Bridgend	0.35	0.16	0.42	0.49	0.09	0.01	0.09	0.43	0.49	0.24	0.29	0.66	0.31	0.28	0.31	313	80.9	Moderate
Gwynedd	0.16	0.21	0.35	0.27	0.01	0.43	0.10	0.49	0.35	0.56	0.46	0.39	0.11	0.30	0.30	323	78.8	Challenged
Rhondda Cynon Taf	0.28	0.07	0.38	0.39	0.04	0.25	0.60	0.33	0.30	0.26	0.27	0.40	0.27	0.30	0.30	329	77.6	Challenged
Torfaen	0.66	0.15	0.62	0.49	0.04	0.05	0.17	0.34	0.41	0.21	0.39	0.20	0.17	0.23	0.30	330	77.4	Challenged
Blaenau Gwent	0.84	0.02	0.54	0.36	0.01	0.03	0.19	0.32	0.26	0.27	0.22	0.37	0.16	0.43	0.29	336	75.3	Challenged
Merthyr Tydfil	0.19	0.04	0.52	0.33	0.03	0.09	0.31	0.29	0.31	0.29	0.20	0.67	0.14	0.59	0.29	337	75.1	Challenged
Neath Port Talbot	0.28	0.09	0.36	0.40	0.04	0.13	0.17	0.37	0.40	0.30	0.23	0.35	0.21	0.43	0.27	342	70.5	Challenged

Note:
D1: The proportion of employment in the LA that is associated with R&D intensive industry sectors
D2: The concentration of economic activity in the LA (GVA) that is in industries known to be growing relatively quickly at international level
D3: Historical record of output growth in LA
D4: The proportion of businesses in LA in R&D intensive sectors
D5: New business registrations in LA per capita
D6: LA activity in HEIs and Research Institutions
B1: Gross fixed capital formation (GFCF) per employee in LA
B2: LA workforce qualified to RQF 4 or above
B3: Proportion of workforce in Occupational Groups 1-3
B4: Strength of local demand for finance to innovate
B5: Ability of businesses to gain finance to innovate
B6: Access to digital skills or ICT resources
O1: Output per hour worked (labour productivity)
O2: Average wage growth

Some LAs display greater variation across the individual measures than others. The LAs which exhibited most variation among innovation indicator scores were Flintshire (Strong innovator), Conwy, Powys, and Pembrokeshire (Moderate innovators), and Blaenau Gwent (Challenged innovator). The LAs with the greatest variance included some of the top performers in this scorecard, however, evidently, they also performed poorly in some of our indicators, suggesting that there is room for improvement even in the best scoring LAs.

The LAs that exhibited the very lowest amounts of variance included Neath Port Talbot, Rhondda Cynon Taf, and Gwynedd (Challenged innovators), and Swansea and Newport (Moderate innovators).

While Figure 3.3 reveals the results for local authorities in Wales, Figure 3.4 reveals the results where a selection of English and Scottish local authority areas are included. The comparison here relates to the three UK city regions encompassed by the Innovation Caucus' report on regional innovation policy and business engagement, providing evidence of the activity observed in regions found to have made significant progress with regards to innovation policy (Parsons et al., 2023; Parsons et al., 2024). Here in Figure 3.4 only a selection of Welsh local authority areas is included to improve the ease of visualisation. Recall that in Wales there were no local authority areas that were able to be classified as Leaders. We highlight in green rows how Cardiff compares to two Leader city areas. In Figure 3.4, Manchester and Edinburgh are found to reveal scores in the Leader innovator category (score greater than 122.37 relative to GB average). While Cardiff was ranked as a Strong innovator, the gap between Cardiff and Manchester on the scorecard is larger than that of the gap between a Strong and Challenged local authority in Wales.

Figure 3.4 Scorecard Selected GB Local Authority Comparisons

LA	D1	D2	D3	D4	D5	D6	B1	B2	B3	B4	B5	B6	O1	O2	Composite Score	Rank	Relative to average	Performance (80.41 / 122.37) {10%}
City of Edinburgh	0.28	0.46	0.50	0.51	0.07	0.65	0.32	0.83	0.76	0.37	0.29	0.75	0.65	0.41	0.49	23	128.3	Leader
Manchester	0.28	0.58	0.75	0.34	0.15	0.48	0.43	0.70	0.64	0.35	0.50	0.62	0.44	0.45	0.48	26	125.6	Leader
Salford	0.23	0.41	0.88	0.35	0.12	0.20	0.47	0.54	0.48	0.39	0.69	0.72	0.43	0.33	0.45	51	117.1	Strong
West Lothian	0.57	0.34	0.72	0.60	0.03	0.23	0.33	0.58	0.55	0.28	0.24	0.61	0.46	0.42	0.43	73	111.9	Strong
Stockport	0.39	0.36	0.58	0.58	0.11	0.15	0.22	0.61	0.66	0.39	0.59	0.55	0.29	0.41	0.42	83	110.3	Strong
Renfrewshire	0.60	0.20	0.37	0.68	0.02	0.15	0.21	0.73	0.54	0.45	0.27	0.81	0.35	0.33	0.41	102	107.1	Strong
Glasgow City	0.31	0.38	0.56	0.49	0.08	0.44	0.14	0.65	0.53	0.38	0.23	0.72	0.32	0.38	0.40	119	105.0	Strong
Trafford	0.22	0.53	0.54	0.55	0.12	0.03	0.16	0.64	0.73	0.24	0.55	0.57	0.40	0.18	0.39	134	102.6	Strong
Wirral	0.23	0.32	0.49	0.54	0.05	0.13	0.27	0.53	0.54	0.26	0.53	0.83	0.29	0.44	0.39	137	102.4	Strong
Cardiff	0.24	0.48	0.49	0.43	0.11	0.52	0.15	0.57	0.57	0.47	0.00	0.68	0.35	0.37	0.39	148	101.6	Strong
Pembrokeshire	0.15	0.64	0.28	0.39	0.03	0.04	0.46	0.41	0.39	0.86	0.41	0.38	0.19	0.55	0.37	193	96.8	Moderate
Scottish Borders	0.31	0.44	0.27	0.35	0.02	0.11	0.28	0.52	0.45	0.93	0.37	0.37	0.24	0.42	0.36	207	95.4	Moderate
Wrexham	0.52	0.19	0.63	0.43	0.01	0.12	0.23	0.49	0.42	0.37	0.30	0.56	0.34	0.32	0.35	223	92.9	Moderate
Rochdale	0.34	0.29	0.54	0.45	0.07	0.01	0.38	0.40	0.39	0.27	0.68	0.34	0.20	0.49	0.35	241	91.2	Moderate
Powys	0.35	0.46	0.31	0.30	0.02	0.01	0.21	0.45	0.43	1.00	0.45	0.34	0.04	0.48	0.35	242	91.0	Moderate
Monmouthshire	0.21	0.23	0.36	0.49	0.05	0.06	0.25	0.67	0.65	0.48	0.30	0.57	0.32	0.19	0.35	245	90.6	Moderate
Newport	0.42	0.22	0.41	0.46	0.07	0.04	0.20	0.47	0.41	0.54	0.23	0.61	0.27	0.36	0.34	263	88.3	Moderate
Vale of Glamorgan	0.47	0.10	0.27	0.43	0.06	0.02	0.32	0.57	0.54	0.43	0.18	0.76	0.18	0.31	0.33	271	87.0	Moderate
Swansea	0.14	0.39	0.31	0.39	0.04	0.47	0.21	0.52	0.50	0.34	0.23	0.51	0.23	0.31	0.33	279	86.3	Moderate
Sefton	0.21	0.17	0.47	0.48	0.05	0.03	0.22	0.42	0.53	0.31	0.56	0.49	0.30	0.30	0.32	284	85.2	Moderate
South Lanarkshire	0.29	0.26	0.26	0.55	0.04	0.07	0.27	0.54	0.52	0.36	0.27	0.40	0.33	0.40	0.32	285	85.2	Moderate
St. Helens	0.16	0.18	0.38	0.56	0.04	0.09	0.32	0.47	0.53	0.20	0.73	0.31	0.13	0.43	0.32	289	84.8	Moderate
Tameside	0.39	0.15	0.34	0.59	0.06	0.00	0.11	0.35	0.38	0.26	0.66	0.56	0.19	0.43	0.32	299	83.9	Moderate
Wigan	0.27	0.13	0.48	0.59	0.06	0.08	0.25	0.33	0.46	0.31	0.66	0.35	0.24	0.27	0.32	301	83.8	Moderate
Oldham	0.28	0.17	0.37	0.46	0.11	0.02	0.23	0.27	0.40	0.34	0.58	0.65	0.17	0.38	0.32	305	83.0	Moderate
North Lanarkshire	0.38	0.15	0.45	0.52	0.03	0.08	0.22	0.48	0.35	0.28	0.25	0.31	0.44	0.45	0.31	310	81.9	Moderate
Rhondda Cynon Taf	0.28	0.07	0.38	0.39	0.04	0.25	0.60	0.33	0.30	0.26	0.27	0.40	0.27	0.30	0.30	329	77.6	Challenged
Torfaen	0.66	0.15	0.62	0.49	0.04	0.05	0.17	0.34	0.41	0.21	0.39	0.20	0.17	0.23	0.30	330	77.4	Challenged
Merthyr Tydfil	0.19	0.04	0.52	0.33	0.03	0.09	0.31	0.29	0.31	0.29	0.20	0.67	0.14	0.59	0.29	337	75.1	Challenged
Neath Port Talbot	0.28	0.09	0.36	0.40	0.04	0.13	0.17	0.37	0.40	0.30	0.23	0.35	0.21	0.43	0.27	342	70.5	Challenged
West Dunbartonshire	0.28	0.00	0.32	0.59	0.01	0.01	0.29	0.48	0.35	0.14	0.18	0.07	0.32	0.52	0.25	346	66.9	Challenged

Figure 3.5, for completeness, reveals the fifteen top GB local authority areas in respect of our scorecard. The UK Government's Social Mobility Commission revealed similar findings in an index seeking to reveal which UK local authorities offer favourable, or less favourable, conditions to promote innovation and economic growth (Social Mobility Commission, 2024). That index relies on fewer variables, yet reveals similar findings to this scorecard, which incorporates a broader, more holistic range of indicators of innovation. Comparing the top 15 local authorities found to offer the most favourable conditions for innovation and economic growth with Figure 3.5, it can be seen that seven local authorities are found to be in the top 15 of both: Camden, City of London, Hammersmith and Fulham, Islington, Reading, Westminster, and Wokingham. This scorecard also reveals that Cambridge, Forest of Dean, Oxford, Runnymede, Rushmoor, South Cambridgeshire, South Oxfordshire, and Vale of White Horse rank amongst the top 15 GB local authorities, as seen in Figure 3.5. Oxford and Cambridge are home to world renowned universities and research institutions, that along with Reading, South Cambridgeshire, South Oxfordshire, and Wokingham have high concentrations of technology- and innovation-driven companies and enterprises. These findings are therefore consistent with our qualitative expectations of the innovation capacity of such local authorities. At the other end of the index and this scorecard, local authorities seen to be at the very bottom of both scorecards (within the bottom 20), include Blaenau Gwent, Merthyr Tydfil, Neath Port Talbot, Rhondda Cynon Taf, and Torfaen.

Figure 3.5 Scorecard Top 15 GB Local Authority Comparisons

LA	D1	D2	D3	D4	D5	D6	B1	B2	B3	B4	B5	B6	O1	O2	Composite Score	Rank	Relative to average	Performance (80.41 / 122.37) {10%}
Wokingham	0.48	1.00	1.00	0.62	0.08	0.82	0.17	0.72	0.82	0.33	0.62	0.44	0.98	0.30	0.60	1	157.4	Leader
Westminster	0.15	1.00	0.65	0.28	0.98	0.37	0.28	0.83	0.61	0.17	0.93	0.75	0.96	0.11	0.58	2	151.4	Leader
City of London	0.22	1.00	0.74	0.24	1.00	0.11	0.00	1.00	0.00	0.20	1.00	0.51	1.00	1.00	0.57	3	150.4	Leader
Reading	0.19	1.00	1.00	0.47	0.09	0.24	0.26	0.72	0.66	0.67	0.78	0.88	0.65	0.28	0.56	4	147.8	Leader
Camden	0.31	0.59	0.36	0.37	0.69	0.92	0.21	0.87	0.88	0.28	0.80	0.76	0.68	0.10	0.56	5	146.4	Leader
Cambridge	0.40	0.68	0.67	0.66	0.04	1.00	0.32	0.74	0.69	0.42	0.42	0.80	0.55	0.39	0.56	6	146.0	Leader
Islington	0.37	0.88	0.81	0.47	0.49	0.37	0.26	0.87	0.88	0.30	0.59	0.55	0.74	0.15	0.55	7	145.0	Leader
Vale of White Horse	0.60	0.70	0.69	0.62	0.05	1.00	0.48	0.80	0.70	0.23	0.70	0.44	0.56	0.13	0.55	8	144.4	Leader
Runnymede	0.14	1.00	0.46	0.43	0.12	0.60	0.26	0.83	0.84	0.36	0.66	0.50	1.00	0.46	0.55	9	143.7	Leader
South Oxfordshire	0.45	0.85	0.61	0.56	0.06	0.57	0.45	0.75	0.86	0.30	0.71	0.53	0.57	0.26	0.54	10	141.0	Leader
Hammersmith and Ful	0.22	0.53	0.43	0.37	0.21	0.27	1.00	0.90	0.92	0.32	0.71	0.76	0.61	0.24	0.54	11	140.8	Leader
South Cambridgeshire	0.86	0.73	0.56	0.79	0.06	1.00	0.41	0.60	0.56	0.31	0.49	0.43	0.49	0.20	0.53	12	140.3	Leader
Forest of Dean	0.30	1.00	0.68	0.57	0.03	0.25	0.40	0.57	0.64	0.62	0.46	0.57	0.68	0.58	0.53	13	138.2	Leader
Rushmoor	0.45	0.85	0.74	0.57	0.04	0.58	0.29	0.48	0.38	0.26	0.81	0.59	1.00	0.26	0.52	14	136.8	Leader
Oxford	0.32	0.19	0.73	0.50	0.04	1.00	0.48	0.89	0.87	0.65	0.75	0.17	0.43	0.23	0.52	15	135.9	Leader

4. Policy implications and conclusions

As policy attention at both UK and Wales government levels is increasingly embracing the importance of place and the potential for local and regional interventions to drive productivity and innovation improvements, there is an acknowledged need for better local data of greater granularity. This report presents an initial attempt at collating data in the form of an innovation scorecard that might inform policy making at the LA, economic region and national Welsh levels. As noted above, in addressing this objective, the variable selection process was constrained by the availability of data at the desired level of geography and also restricted by the timeliness of the data available.

The analysis undertaken in this report is thus very much in the spirit of a pilot exercise. The focus here has been on local authority areas but with the potential to generate indices for more aggregated policy relevant areas, but also to subdivide rural from more urban areas. It is accepted that more work needs to be undertaken in terms of data investigation, not least around the availability of finance to innovate, and critically more data which speaks to innovation in the public sector. It is also accepted that the method adopted means that the 'position' of local authorities can be affected by good or bad performances on individual variables. This is but one reason the ranking of LAs and the production of league tables should be treated with caution; the scorecards should be interpreted through a more nuanced reading of the available evidence when shaping policy.

Nonetheless, such research offers some headline implications for policy makers at various levels of economic activity. For one, an important finding from the innovation scorecards developed here is that Wales has no local authority areas that might be classified as Leading innovators on the scorecard when compared to GB counterparts. This places the position of Wales in context and should be seen as adding weight to the importance of continuing to develop and deliver the Innovation Strategy across the nation. The position of Wales, and the role of Welsh Government in advancing its innovation potential, needs to include recognition of the variations across and within the four economic regions of the nation. A further finding of interest is that the stronger local authority areas of Wales on the scorecard included some areas of the rural economy that have been previously cast as areas of lower productivity. As a result, on LA performance on this scorecard, there is less evidence of an East-West divide in Wales than is typically seen in investigation of productivity indices alone. This is potentially a valuable and promising finding since innovation in the periphery is often ignored but remains crucial to the prospects of economic improvement (Henderson et al., 2024). Further research would need to examine how far these scorecard claims for these more rural areas can be substantiated.

Tailoring policy interventions to the specifics of place-based needs is increasingly recognised as crucial. The approach presented here offers the opportunity for comparisons to be made in terms of both inputs and outcomes between LAs and aggregations and sub-national level. Our hope is that these will assist policy makers in developing more informed policy choices and in seeking evidence of the consequences at each of local authority, economic region and national levels.

Rather than use rankings and league tables to produce comparative assessments and talk of 'winners and losers,' the real value in this exercise is in the opportunities to develop novel insight into both the individual and combinations of variables at a local authority level. Comparisons and benchmarking at these levels of granularity can both assist in the interpretation of current performance and identify areas for further attention and potential improvement. We hope that the scorecards will help to motivate and inform renewed or revised policy interventions and encourage learning across different LAs. Each LA is unique but there are undoubtedly patterns and shared challenges and objectives which would benefit from shared learning and potentially collaboration. There is a role here for Welsh Government in facilitating such discussion on the basis of these findings and in the context of the adaptation and delivery of the Innovation Strategy across each of the economic regions.

At an all-Wales level, there are insights into the profile of the Welsh nation on these measures and some opportunity to reflect on how current policies and the Welsh Government (2023) Innovation Strategy may be interpreted considering these. There is also some potential for the developed scorecard to play a role in examining the success of the Innovation Strategy.

Finally here the research team are in the process of undertaking further analysis in terms of exploring the correlation between the identified factors, and also examining how far factors can be combined, or simplified to develop indices.

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Appendix 1: Variable construction

D1: The proportion of employment in the LA that is associated with R&D intensive industry sectors

The R&D intensive sectors were chosen according to an OECD report that identified industries that exhibited the greatest levels of R&D investment relative to their gross value added (GVA) (OECD, 2018). These industries were identified as: **20** : Manufacture of chemicals and chemical products; **21** : Manufacture of basic pharmaceutical products and pharmaceutical preparations; **26** : Manufacture of computer, electronic and optical products; **27** : Manufacture of electrical equipment; **28** : Manufacture of machinery and equipment n.e.c.; **29** : Manufacture of motor vehicles, trailers and semi-trailers; **71** : Architectural and engineering activities; technical testing and analysis; **252** : Manufacture of tanks, reservoirs and containers of metal; **303** : Manufacture of air and spacecraft and related machinery; **325** : Manufacture of medical and dental instruments and supplies. Approach was to take the number of employees in each of these industries in each LA and dividing by the total number of employees in each LA. The data was collected from the Office for National Statistics (ONS) data repository NOMIS, which provided access to the open access Business Register and Employment Survey (BRES) dataset. Data available for the period 2015-2022.

D2: The concentration of economic activity in the LA (GVA) that is in industries known to be growing relatively quickly at international level

The industries seen to be growing fastest at the ITL1 UK level over the period 2017-2022 were used. These were found to be: **A (1-3)**: Agriculture, forestry & fishing; **09**: Mining support service activities; **39**: Remediation activities and other waste management services; **46**: Wholesale trade, except of motor vehicles and motorcycles; **62**: Computer programming, consultancy and related activities; **66**: Activities auxiliary to financial services and insurance activities; **69**: Legal and accounting activities; **70**: Activities of head offices; management consultancy activities; **72**: Scientific research and development; **75**: Veterinary activities. To obtain the amount of GVA within each LA for these industries required extrapolation from SIC subcategories. Assumption was made that employment in each subcategory contributed towards GVA evenly. The data for GVA was obtained from the ONS, from their data on regional GVA by industry and local authority. While the data for employment in each industry and subcategory were obtained via NOMIS and the BRES open access dataset. The proportion of GVA attributed to these high growth industries, relative to a LAs total GVA, for the year 2022 was compared. Data available for the period 2015-2022.

D3: Historical record of output growth in LA

Regional data for gross domestic product (GDP) annual growth rates was obtained for each local authority. The Gross domestic product (GDP) chained volume measures (CVM) annual growth rates used were then averaged over the period 2018-2022. The data was collected from the ONS website, using the Regional GDP: local authorities' dataset. Data available for the period 1999-2022.

D4: The proportion of businesses in LA in R&D intensive sectors

The same R&D intensive industries were used as in D1. Data for the total number of businesses in each R&D intensive industry was obtained. The data was collected using NOMIS and the UK Business Counts – local units by industry and employment size band dataset. This was then standardised by dividing by the total number of businesses in each local authority. Data available for the period 2013-2023.

D5: New business registrations in LA per capita

Data on the total number of business registrations in each LA per year was obtained and divided by the total population of each LA to obtain per capita values. The data for business registrations was collected from the ONS Business Demography, UK dataset. The total estimated population data for each local authority was obtained using Mid-year population estimates, provided by the ONS. Data available for the period 2021-2023.

D6: LA activity in HEIs and Research Institutions

Data on the total number of employees working in the four following industries: Higher education (SIC 854); Research and experimental development on natural sciences and engineering (SIC 721); Research and experimental development on social sciences and humanities (SIC 722); and Market research and public opinion polling (SIC 732). The data was collected for each LA, which was then divided by the total number of employees in each LA to obtain the proportion of total employees in each industry. The data was collected from NOMIS, using the BRES open access data set. Data available for the period 2018-2022.

B1: Gross fixed capital formation (GFCF) per employee in LA

A combination of data regarding GFCF investment in dwellings and other buildings and structures at the LA level was collected and then divided by the total number of employees within each LA in order to obtain GFCF per employee. The data for GFCF investment was collected directly from the ONS website, from the Experimental regional gross fixed capital formation (GFCF) estimates by asset type dataset. The data for total number of employees per LA was collected from NOMIS, using the BRES open access data set. Data available for the period 2015-2022.

B2: LA workforce qualified to RQF 4 or above

The proportion of working age adults qualified to RQF 4 or above data was collected directly from StatsWales, which collates the highest qualification level of working age adults by region and local authority dataset online from the ONS Annual Population Survey (APS). Data available for the period 2008-2023.

B3: Proportion of workforce in Occupational Groups 1-3

The number of people in employment in Occupation Groups 1-3 data was divided by the total number of people in employment, to obtain the proportion of workforce in place in Occupational Groups 1-3 in each local authority. The data was collected directly from NOMIS, using the Annual Population Survey (APS) dataset. Data available for the period 2004-2023.

B4: Strength of local demand for finance to innovate

To create the dataset for SME postcode lending data for each local authority, postcode data is matched to the ONS postcode directory for LAs and aggregated by LA. However, since the data is produced quarterly to show the outstanding loans and overdrafts of small and medium enterprises (SMEs), the average quarterly outstanding amount is used for each year. The data was collected from UK Finance, using the SME Lending within UK postcodes dataset. Data is available for the period 2013-2023.

B5: Ability of businesses to gain finance to innovate

To create this dataset the credit rating of all active SMEs, using their most recent financial accounts, was used and once again matched to LAs using the ONS postcode directory. The data was collected from the FAME database, which collates an array of different information on companies. Data available 2021-2024, though average taken and assumed to be for the year 2023 only.

B6: Access to digital skills or ICT resources

The percentage of premises with full fibre availability was used as a proxy for access to digital skills or ICT resources. This data was collected from the Ofcom Connected Nations and infrastructure reports datasets. Data available for the period 2018-2022.

O1: Output per hour worked (labour productivity)

To create this dataset we used current price smoothed GVA (B) per hour worked indices published by the ONS, see Subregional productivity: labour productivity indices by local authority district - Office for National Statistics. The 2022 value was taken for comparison, the most recently available time period.

O2: Average wage growth

The average wage growth for each LA over the period 2018-2023 was used. The data was collected from Nomis, which collates the Average (median) gross weekly earnings by local authority district and year online from the ONS Annual Survey of Hours and Earnings (ASHE). Data available for the period 2008-2024, though the data across the period is limited for some LAs. The average of the yearly growth in median gross weekly earnings was taken for the period 2018-2023 for each LA, though smaller periods were taken for those with less data available.

Appendix 2: Scorecard Decomposition

This appendix presents a decomposition of the composite innovation scorecard into its three constituent factors: Drivers, Barriers, and Outcomes. While the overall scorecard provides a broad and holistic picture of the relative innovation capacity across the Welsh local authorities, by decomposing the scorecard and analysing the factors in isolation some important variations can be distinguished. In some cases, local authorities do not appear to reveal any new information to the scorecard as a whole, reinforcing the patterns observed in the aggregate scorecard as consistent. However some local authorities present markedly different rankings across the different factors. This disaggregated view of the scorecard presents us with an analytical framework from which it is possible to identify the specific factors, and variables, that either contribute to or constrain a local authorities innovation performance.

The rationale for the performance rankings remains the same as above, with those ranked as Leaders scoring within the top 10% of GB local authorities and those ranked Challenged scoring within the bottom 10%. Strong innovators are then those in the range between the 50th and 90th percentile, while moderate innovators scores are between the 10th and 50th percentiles.

Table A1: Drivers

LA	D1	D2	D3	D4	D5	D6	Composite Score	Rank	Relative to average	Performance {10%}
Flintshire	1.00	0.18	0.42	0.66	0.07	0.11	0.41	44	129.0	Strong
Cardiff	0.24	0.48	0.49	0.43	0.11	0.52	0.38	70	119.9	Strong
Torfaen	0.66	0.15	0.62	0.49	0.04	0.05	0.33	132	106.0	Strong
Wrexham	0.52	0.19	0.63	0.43	0.01	0.12	0.32	158	101.2	Strong
Ceredigion	0.13	0.34	0.42	0.20	0.02	0.74	0.31	170	98.0	Strong
Blaenau Gwent	0.84	0.02	0.54	0.36	0.01	0.03	0.30	184	94.7	Moderate
Carmarthenshire	0.27	0.48	0.53	0.35	0.03	0.09	0.29	196	92.9	Moderate
Swansea	0.14	0.39	0.31	0.39	0.04	0.47	0.29	205	91.8	Moderate
Caerphilly	0.58	0.17	0.42	0.45	0.03	0.00	0.27	239	86.8	Moderate
Newport	0.42	0.22	0.41	0.46	0.07	0.04	0.27	243	85.8	Moderate
Denbighshire	0.42	0.16	0.48	0.43	0.02	0.02	0.26	257	80.8	Moderate
Bridgend	0.35	0.16	0.42	0.49	0.09	0.01	0.25	261	80.5	Moderate
Pembrokeshire	0.15	0.64	0.28	0.39	0.03	0.04	0.25	264	80.3	Moderate
Powys	0.35	0.46	0.31	0.30	0.02	0.01	0.24	282	76.2	Moderate
Gwynedd	0.16	0.21	0.35	0.27	0.01	0.43	0.24	284	76.2	Moderate
Monmouthshire	0.21	0.23	0.36	0.49	0.05	0.06	0.24	286	74.8	Moderate
Rhondda Cynon Taf	0.28	0.07	0.38	0.39	0.04	0.25	0.23	290	74.1	Moderate
Vale of Glamorgan	0.47	0.10	0.27	0.43	0.06	0.02	0.23	304	71.3	Moderate
Isle of Anglesey	0.15	0.21	0.61	0.29	0.01	0.04	0.22	311	69.0	Moderate
Neath Port Talbot	0.28	0.09	0.36	0.40	0.04	0.13	0.22	313	68.8	Moderate
Merthyr Tydfil	0.19	0.04	0.52	0.33	0.03	0.09	0.20	335	63.4	Challenged
Conwy	0.16	0.16	0.21	0.38	0.03	0.00	0.16	349	50.0	Challenged

Table A1 depicts the drivers variables in isolation from the barriers and outcomes, and as such the composite scores are derived from these variables alone. The 10th percentile score relative to GB was 67.98, the 50th percentile was a score of 97.21, and the 90th percentile was a score of 132.59. The table reveals that the Strong innovators, with respect to the drivers alone, are Flintshire, Cardiff, Torfaen, Wrexham, and Ceredigion. Unsurprisingly we see Flintshire and Cardiff lead the way in the drivers decomposition of the scorecard, consistent with their positioning in the overall scorecard, while Torfaen, Wrexham, and Ceredigion emerge as relatively strong performers in terms of our drivers of innovation. Flintshire can also be seen to rank highest in the country for variable D1: The proportion of employment in the LA that is associated with R&D intensive industry sectors. In contrast Merthyr Tydfil and Conwy fall below the 10th percentile and are categorised as challenged, potentially revealing significant weaknesses in terms of our innovation drivers. Conwy's scores in each of the drivers falls below 80% of the average for each, suggesting significant weakness across the board. The remaining Welsh local authorities fall into the moderate innovator category, highlighting that the majority fall below the median GB score.

Table A2: Barriers

LA	B1	B2	B3	B4	B5	B6	Composite Score	Rank	Relative to average	Performance {10%}
Conwy	0.13	0.47	0.45	0.87	0.29	0.79	0.50	107	109.8	Strong
Monmouthshire	0.25	0.67	0.65	0.48	0.30	0.57	0.48	122	106.3	Strong
Pembrokeshire	0.46	0.41	0.39	0.86	0.41	0.38	0.48	123	106.1	Strong
Powys	0.21	0.45	0.43	1.00	0.45	0.34	0.48	129	105.5	Strong
Vale of Glamorgan	0.32	0.57	0.54	0.43	0.18	0.76	0.47	152	102.5	Strong
Carmarthenshire	0.17	0.48	0.42	0.87	0.30	0.53	0.46	163	101.0	Strong
Ceredigion	0.18	0.50	0.47	0.76	0.35	0.37	0.44	204	95.9	Moderate
Denbighshire	0.14	0.38	0.37	0.70	0.33	0.67	0.43	210	94.7	Moderate
Flintshire	0.10	0.42	0.36	0.31	0.69	0.71	0.43	211	94.7	Moderate
Newport	0.20	0.47	0.41	0.54	0.23	0.61	0.41	250	90.0	Moderate
Cardiff	0.15	0.57	0.57	0.47	0.00	0.68	0.41	252	89.1	Moderate
Isle of Anglesey	0.51	0.42	0.39	0.47	0.33	0.30	0.40	257	88.1	Moderate
Wrexham	0.23	0.49	0.42	0.37	0.30	0.56	0.40	267	86.8	Moderate
Gwynedd	0.10	0.49	0.35	0.56	0.46	0.39	0.39	270	86.0	Moderate
Swansea	0.21	0.52	0.50	0.34	0.23	0.51	0.39	279	84.7	Moderate
Caerphilly	0.19	0.47	0.46	0.25	0.27	0.64	0.38	285	83.6	Moderate
Bridgend	0.09	0.43	0.49	0.24	0.29	0.66	0.37	299	80.4	Moderate
Rhondda Cynon Taf	0.60	0.33	0.30	0.26	0.27	0.40	0.36	309	79.2	Moderate
Merthyr Tydfil	0.31	0.29	0.31	0.29	0.20	0.67	0.34	319	75.6	Challenged
Neath Port Talbot	0.17	0.37	0.40	0.30	0.23	0.35	0.30	336	66.5	Challenged
Torfaen	0.17	0.34	0.41	0.21	0.39	0.20	0.29	342	63.1	Challenged
Blaenau Gwent	0.19	0.32	0.26	0.27	0.22	0.37	0.27	346	59.6	Challenged

Table A2 depicts the barriers variables in isolation from the drivers and outcomes, and as such the composite scores are derived from these variables alone. The 10th percentile score relative to GB was 76.76, the 50th percentile was a score of 99.58, and the 90th percentile was a score of 124.00. The table reveals that the Strong innovators, with respect to the barriers alone, are Conwy, Monmouthshire, Pembrokeshire, Powys, Vale of Glamorgan, and Carmarthenshire. This provides an interesting insight, as Conwy, who fell bottom of our drivers decomposition, lead the Welsh local authorities in terms of our innovation barriers, revealing that they show strengths in areas thought to act as barriers to innovation. Surprisingly, we see Flintshire and Cardiff towards the middle of the table, both scoring below the GB average and ranking as moderate innovators in terms of their performance. Merthyr Tydfil, Neath Port Talbot, Torfaen, and Blaenau Gwent were ranked as challenged innovators in terms of performance. Consistent with our drivers decomposition we find Merthyr Tydfil and Neath Port Talbot at the bottom of our barriers decomposition scorecard, though interestingly Torfaen, who scored towards the top of the drivers decomposition, ranks almost at the very bottom of the scorecard in terms of our innovation barriers. Blaenau Gwent's scores in each of the variables relating to innovation barriers falls below 80% of the average for each, suggesting significant weakness across the board. The remaining Welsh local authorities fall into the moderate innovator category, again highlighting that the majority fall below the median GB score.

Table A3: Outcomes

LA	O1	O2	Composite Score	Rank	Relative to average	Performance {10%}
Flintshire	0.38	0.42	0.40	87	114.0	Strong
Isle of Anglesey	0.21	0.58	0.40	95	112.4	Strong
Pembrokeshire	0.19	0.55	0.37	127	104.8	Strong
Merthyr Tydfil	0.14	0.59	0.37	128	104.3	Strong
Cardiff	0.35	0.37	0.36	143	101.3	Strong
Wrexham	0.34	0.32	0.33	179	94.6	Moderate
Neath Port Talbot	0.21	0.43	0.32	206	90.8	Moderate
Newport	0.27	0.36	0.31	216	88.4	Moderate
Carmarthenshire	0.17	0.44	0.30	228	86.4	Moderate
Bridgend	0.31	0.28	0.30	241	84.0	Moderate
Blaenau Gwent	0.16	0.43	0.29	245	83.7	Moderate
Caerphilly	0.26	0.31	0.29	261	81.0	Moderate
Rhondda Cynon Taf	0.27	0.30	0.28	262	80.8	Moderate
Swansea	0.23	0.31	0.27	276	77.6	Moderate
Powys	0.04	0.48	0.26	287	74.6	Moderate
Monmouthshire	0.32	0.19	0.26	295	72.5	Moderate
Ceredigion	0.12	0.39	0.25	300	71.6	Moderate
Vale of Glamorgan	0.18	0.31	0.24	310	69.1	Moderate
Denbighshire	0.17	0.31	0.24	312	68.3	Moderate
Conwy	0.08	0.39	0.24	316	67.5	Challenged
Gwynedd	0.11	0.30	0.20	339	57.7	Challenged
Torfaen	0.17	0.23	0.20	340	56.3	Challenged

Table A3 depicts the outcomes variables in isolation from the drivers and barriers, and as such the composite scores are derived from these variables alone. The 10th percentile score relative to GB was 67.49, the 50th percentile was a score of 95.00, and the 90th percentile was a score of 138.62. The table reveals that the Strong innovators, with respect to the outcomes alone, are Flintshire, Isle of Anglesey, Pembrokeshire, Merthyr Tydfil, and Cardiff. This provides an interesting insight, as Merthyr Tydfil, who fell towards the bottom of both our drivers and barriers decompositions and were categorised as challenged innovators, rank towards the top of Welsh local authorities in terms of our innovation outcomes, revealing that they show strengths in areas thought to be observed as a result of innovation. Unsurprisingly we see Flintshire and Cardiff towards the top of the table, both scoring above the GB average and ranking as strong innovators in terms of their performance. Conwy, Gwynedd, and Torfaen were ranked as challenged innovators in terms of performance. Consistent with our barriers decomposition we find Torfaen at the bottom of our outcomes decomposition scorecard, scoring below 80% of the GB average in both variables, though interestingly Torfaen were seen to have scored towards the top of the drivers decomposition. Most Welsh local authorities scored below 80% of the GB average in variable O1, relating to labour productivity, a finding few will be surprised to see. However, more than half of local authorities in Wales are seen to score above the GB average in variable O2, relating to the average wage growth, suggesting a stronger picture in terms of this implied outcome of innovation. Once again, most Welsh local authorities fall into the moderate innovator category, highlighting that the majority fall below the median GB score in terms of our innovation outcomes.

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