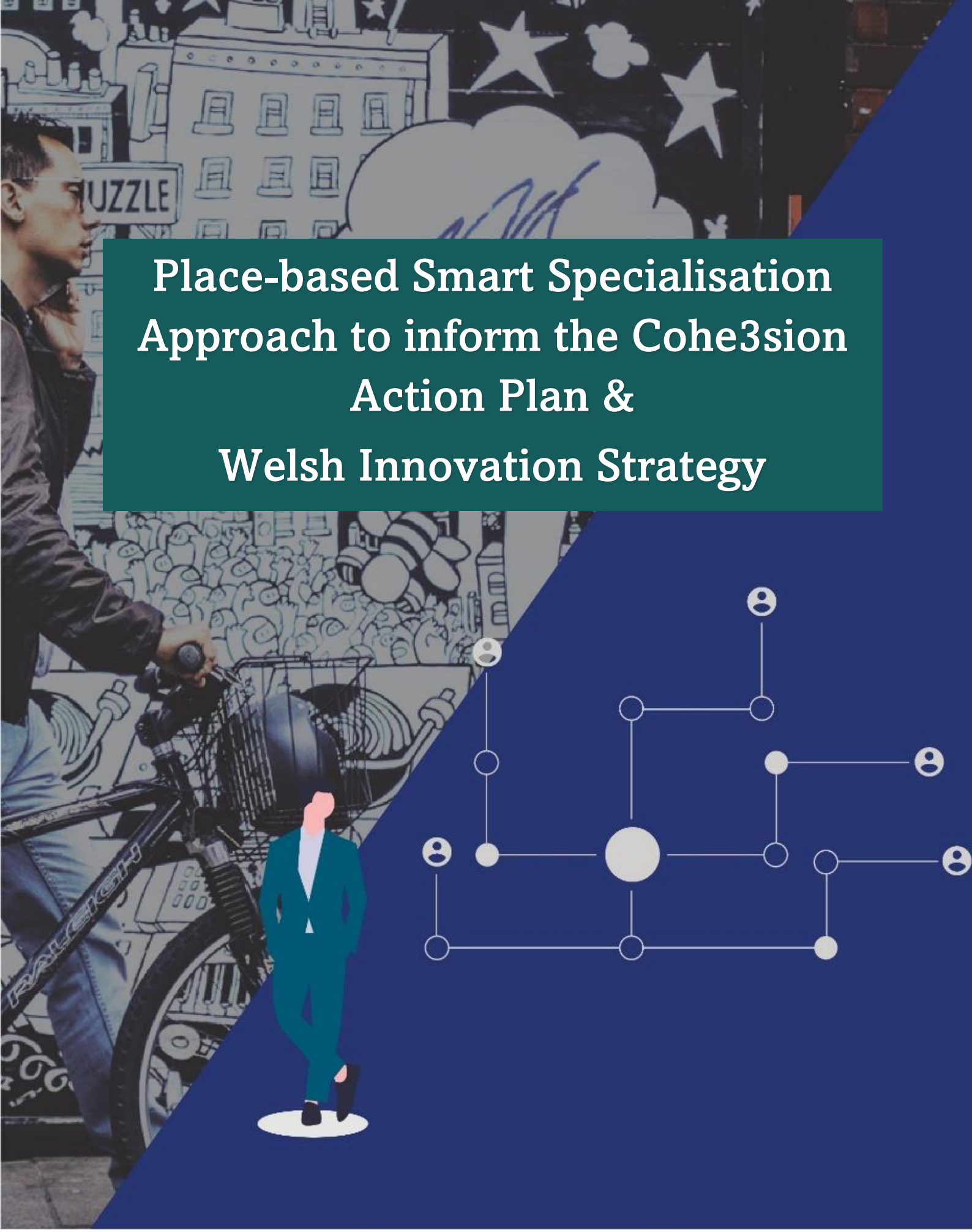

Place-based Smart Specialisation Approach to inform the Cohe3sion Action Plan & Welsh Innovation Strategy

COHES3ION
Interreg Europe

Llywodraeth Cymru
Welsh Government

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Executive Summary

Welsh Government has set out to co-create an Innovation Strategy for Wales for the next decade with a vision to build the nation's innovation ecosystem with a fairer, prosperous, healthier, and globally responsible Wales. The COVID-19 pandemic, Brexit, and other systemic problems in the Welsh Innovation ecosystem have hindered sustainable economic development and require the adoption of more innovative ways of policymaking to create systemic change with lasting impact.

To achieve the ambitious goals set out by the Prosperity for All strategy and Wellbeing of Future Generations Act (2015), Wales needs careful redesign and co-ordination of targeted innovation policies, a robust multi-level governance structure (MLG) for effective delivery, as well as capacity building for policy implementation and learning by and at all levels of government. Precisely for this reason, the Welsh Government, as a partner on the Interreg Europe funded COHES3ION project, has adopted the European Commission's Smart Specialisation approach to redefining the nation's future research and innovation priorities, reflecting the distinctive strengths and constraints of each of its territories and, at the same time, refining its governance and investment approaches to regional development. This report will help inform the development of the Welsh Government regional action plan (RAP) which is a key output of the COHES3ION project.

In order to inform and support the forthcoming Wales Innovation Strategy from the perspective of the smart specialisation framework, this work has analysed the current innovation dynamics across Wales, intending to map the existing innovation support landscape, as well as identifying gaps and barriers to innovation in Wales. The following themes recurred throughout the consultation and the research, as key gaps and barriers to innovation in Wales:

- Lack of innovation culture and the desire to change traditional ways of working in both public and private sector
- Administrative barriers associated with accessing funds
- Lack of risk-tolerant funds for ideating and scaling
- Lack of support for networking and collaboration ecosystem development
- Difficulty faced by businesses in determining the most suitable support mechanisms
- Lack of physical infrastructures and digital connectivity, especially in rural areas
- Need for more targeted funding as funds are usually spread too thin and have therefore had a very minimal systemic impact so far
- Multi-level governance barriers that account for the lack of cohesion and coordination in the overall innovation landscape in Wales.

Developed through a stakeholder co-creation process comprising of representatives from both the public and private sectors and informed by an in-depth analysis of the innovation ecosystem in Wales and the strength analysis performed by the Welsh Government Innovation Team, the report recommends adoption of key Smart Specialisation principles and approaches to strengthen the forthcoming Innovation Strategy. Some of the key recommendations include:

1. Adopting a more targeted approach when offering Innovation support, leveraging on the region-specific innovation capabilities
2. Adopting S3's evidence-based and agile approach
3. Putting businesses front and centre by enabling Entrepreneurial Discovery Process
4. Adopting a reinforced multi-level governance for a co-ordinated regional delivery
5. Considering the key role of science parks, enterprise hubs and RTOs

In addition to the above, efforts should be made to address the more general gaps and barriers across the different sectors in Wales such as skills gap, access to talent, and digitalisation know-how to name a few. The deployment of horizontal strategies, alongside the more targeted smart specialisation approach, has the potential to strengthen the innovation ecosystem in Wales and bring about prosperity for all.

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Glossary of Terms

BERD – Business Expenditure on R&D

EDP - Entrepreneurial Discovery Process

ERDP - European Regional Development Fund

ESF - European Structural Funds

EU - European Union

GDP - Gross Domestic Product

GVA - Gross Value Added

R&D - Research & Development

R&I - Research & Innovation

RD&I - Research, Development & Innovation

RIS3 - Regional Innovation Strategies for Smart Specialisation

S3 - Smart Specialisation Strategy

SME - Small & Medium Enterprises

UKG - UK Government

WG - Welsh Government

1 Introduction

Prosperity for All is at the heart of the Welsh economic policy agenda and the Economic Action Plan (EAP). Thus, challenged by prevailing territorial disparities and entrenched productivity problems, **the Welsh Government has set out an ambitious trajectory for place-based regional development with the dual goal of generating sustainable growth while reducing inequalities, where innovation is seen as a key driver of increased productivity and thereby of inclusive economic growth and prosperity**.

The link between research and innovation and a stronger, more inclusive economy is also a key theme of **the UK Government's current policy priorities, providing an important strategic and supportive backdrop for the Welsh Government to advance its innovation agenda;** with the recent 'Build Back Better' plan, which established innovation as one of three 'pillars of growth', as well as the 'levelling up' agenda, which seeks to drive greater place-based outcomes and address regional inequality.

Achieving these ambitious goals, however, depends to a large extent on the careful design and co-ordination of targeted innovation support instruments, a robust multi-level governance structure for effective delivery, as well as capacity building for policy implementation and learning by and at all levels of government. Precisely for this reason, the Welsh Government has adopted the European Commission's Smart Specialisation approach to redefining the nation's future research and innovation priorities, reflecting the distinctive strengths and constraints of each of its territories and, at the same time, refining its governance and investment approaches to regional development. The definition of a Smart Specialisation Strategy (S3) should therefore help prioritise and concentrate the efforts in areas of activity and technological sectors likely to generate innovative activities, thereby giving a competitive edge to the Welsh regions within the global economy.

As a partner in the Interreg Europe-funded COHES3ION project, the Welsh Government is collaborating with 9 other European partners in their common challenge to integrate a regional and place-based dimension into S3 governance and policy mix considerations, thereby further contributing to regional cohesion and improved performance and impact in the delivery of innovation policies. **In alignment with the objectives of the COHES3ION project, the Welsh Government is exploring how best to inform a Welsh Smart Specialisation approach, focussing on place and governance as the basis for identifying specialisation on which to build the nation's research and innovation policies, interventions, and investment.**

COHES3ION – Project Overview

COHES3ION is a two-year Interreg Europe project with the aim of improving the performance and impact of Smart Specialisation Strategies in terms of delivery of innovation by RD&I actors, by integrating a regional and sub-regional dimension into the S3 governance and policy mix, contributing additionally to territorial cohesion in terms of Growth and Jobs. The intended outcomes of this project include:

- Increase the overall impact of each partner S3
- Improve links between programmes in the RD&I environment and public / private sectors.
- Promote a multi-level governance model

The project includes 10 partners from 8 European countries, including Spain, Poland, Sweden, Ireland, Italy, Romania, Germany and Wales.

The Smart Specialisation approach relies on key defining aspects: profound knowledge of the territorial economic fabrics and innovation ecosystems (diagnosis, SWOT); 'Entrepreneurial Discovery' and close involvement of the private sector; concentration of resources in strong technological fields or sectors; an associated diversification strategy designed to guarantee spill-over effects and inclusive growth; definition of a roadmap, action plan and dedicated budget; the establishment of a coordinated multi-level governance delivery structure; and the sound implementation of a monitoring and assessment system.

This document presents an analysis of the business innovation landscape in Wales and the policy implications for adopting a Smart Specialisation approach in line with its key defining aspects. It underlines the various regional contexts in which Wales should emphasise its place-based S3 approach and highlights distinctive strengths and potentials of each of the three wider Welsh regions. It provides an overview of existing innovation-related business support structures available pan-Wales, building on a review of the mapping exercise undertaken as part of the COHES3ION project. It identifies where there may be opportunities for simplification in the innovation support landscape, from the perspectives of businesses, government officials, and other innovation stakeholders across the region, by outlining some of the main gaps and barriers to innovation and access to business support. It provides recommendations on how a new place-based S3 for Wales could ensure inclusive economic growth and prosperity while addressing issues relating to regional multi-level governance. Finally, it also incorporates learnings from other regions outside Wales, by including best practices from examples of COHES3ION partner regions, as well as from elsewhere in Europe.

The purpose of this document is therefore to strengthen the evidence base for a Welsh Smart Specialisation framework by providing guidance on key aspects for the successful adoption of place-based innovation and multi-level governance at the regional and sub-regional levels. **It also aims to inform the development of the COHES3ION Regional Plan** as well as the forthcoming Wales Innovation Strategy, from a smart specialisation perspective.

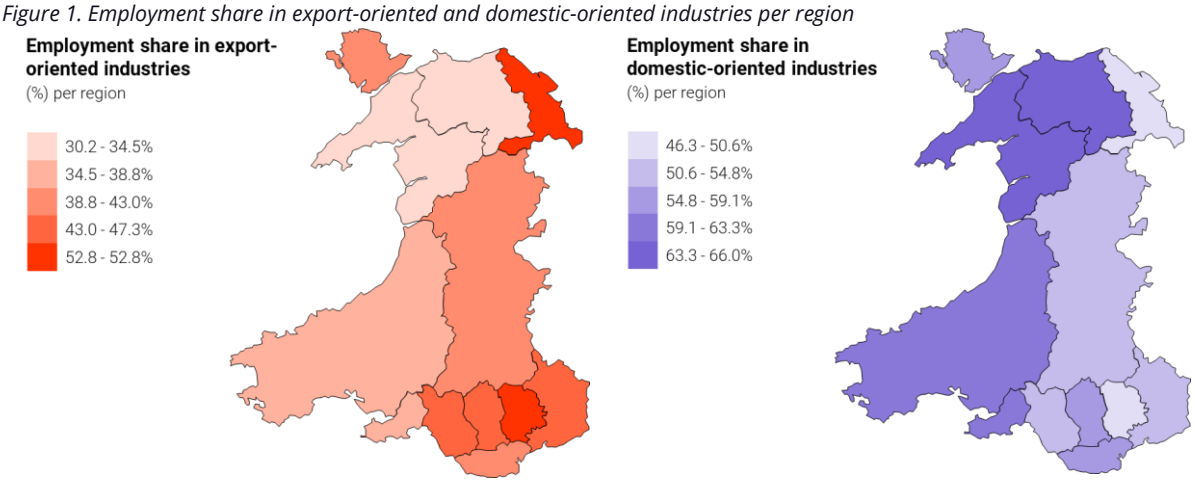
2 Analysing the Welsh Regional Context through an S3 perspective

Before analysing the Welsh business innovation support landscape, it is worth putting into context the place-based approach by examining the innovation dynamics and economic structures of its constituent regions and sub-regions through the lens of smart specialisation. **Each of the regional areas across Wales is characterised by a specific context relating to unique socio-economic features, which in turn highlights the need for a place-based approach. The regional innovation dynamics determine their unique potential and barriers to innovation and the way they approach the concept. These specific characteristics are therefore decisive in the definition and deployment of a Welsh Smart Specialisation Strategy.** Analysing specific indicators helps to underline the economic and innovation diversity of the Welsh landscape and to distinguish defining territorial characteristics for smart specialisation such as the employment factor in export- or domestic-oriented industries, the degree of sectoral concentration in the economic fabric, the employment trends, the size of the businesses, the localisation of innovation infrastructure, the number of patents, the expenditure in R&D, and the overall sectoral performance.

2.1 Differences in regional economies marked by their predominant market orientation

Innovation issues differ depending on whether each region's industrial structures are geared towards foreign markets (exports) or towards domestic or residential markets (services to people). **Export-oriented industries tend to be more productive and often feature a greater ability and willingness to innovate, given the highly competitive global marketplace they cater to.** Therefore, for regions that rely heavily on export-oriented activities, a crucial factor for economic growth and regional competitiveness lies in the industry's quality and intensity of innovation activities. On the other hand, the productivity of domestic-oriented industries is largely limited by the size of the domestic market and the size of the population; where competition is not only market competition, but also resource competition. In the case of smaller domestic-oriented regions, productivity constraints imposed by market size and population can negatively affect the innovation capacity of local organisations; moreover, the scarcity of skilled human capital can become a fierce competition for resources.

Figure 1. Employment share in export-oriented and domestic-oriented industries per region



Note: Export-oriented industries include manufacturing, energy, business services, freight transport, wholesale and real estate business, whereas domestic-oriented industries include construction, accommodation and food services, administrative and support services, public tertiary services, and arts, entertainment and recreation.

Source: StatsWales

The regions in the east of Wales generally account for a greater share of employment in export-oriented sectors as compared to the regions in the west of Wales. For example, Flintshire and Wrexham account for the highest percentage, with 52.8% of its employment in export-oriented industries, especially in the manufacturing sector (24.8%), given existing strengths in aerospace and automotive and the proximity to highly specialised industrial areas in the Midlands. The Valleys as a whole follow with an average of 48.8%, given their long heritage of traditional (energy-intensive) manufacturing, with the highest share of manufacturing jobs in the Gwent Valleys (20.9%). On the other hand, Gwynedd and Conwy-Denbighshire have the highest percentages of employment in domestic-oriented industries (66.0% and 65.0%, respectively), particularly in public tertiary services (incl. public administration, education, and health sectors).

Further insights can be obtained by contrasting the employment share with regional sectoral productivity**. High-tech and knowledge-intensive industries generally exhibit superior firm-level innovation capabilities[1], which translates into increased productivity and sustained competitive advantage.** For example, the manufacturing sector in Flintshire and Wrexham contributes almost as much GVA (£3,346) as The Valleys combined (£3,911), with nearly 60% of the total number of employees of the latter. This further highlights the strong legacy of manufacturing in The Valleys, alongside the more sophisticated and high-tech innovation activities in Flintshire and Wrexham's core industries, namely Aerospace, Automotive and Petrochemical. In fact, in terms of Business R&D Expenditure (BERD) by broad product groups, Aerospace and Transport are the leading sectors in Wales in 2019, with £68m and £50m respectively (15.4% and 11.3% of total BERD), while Petrochemicals is close behind with £47m (10.6%), directly after the £49m (11.1%) of Electrical Machinery (ONS, 2020).

These differences in productivity are also evident in domestic-oriented sectors. Certain regions marked by productive activities, such as Swansea or Cardiff and Vale of Glamorgan, also have a large proportion of public tertiary service jobs, with Swansea being the largest (38.8%); compared to Gwynedd, the second largest (37.9%), Swansea's public tertiary sector accounts for 2.3x more GVA, however, it also has 2x more employees. This further highlights the dependence of sectoral productivity on size, as more populated areas with a larger pool of human capital consistently show higher productivity in domestic-oriented sectors. However, it is important to note that, in these populated southern regions of Wales, the above-average level of productivity present in the service sector, in general, indicates the presence of knowledge-intensive industries as well as knowledge workers, which in turn could imply the presence of externalities and spill-overs to the public tertiary services sector, further underlining the productivity differences in the service sector.

2.2 Regional economies as a function of sectoral concentration and territorial specialisation

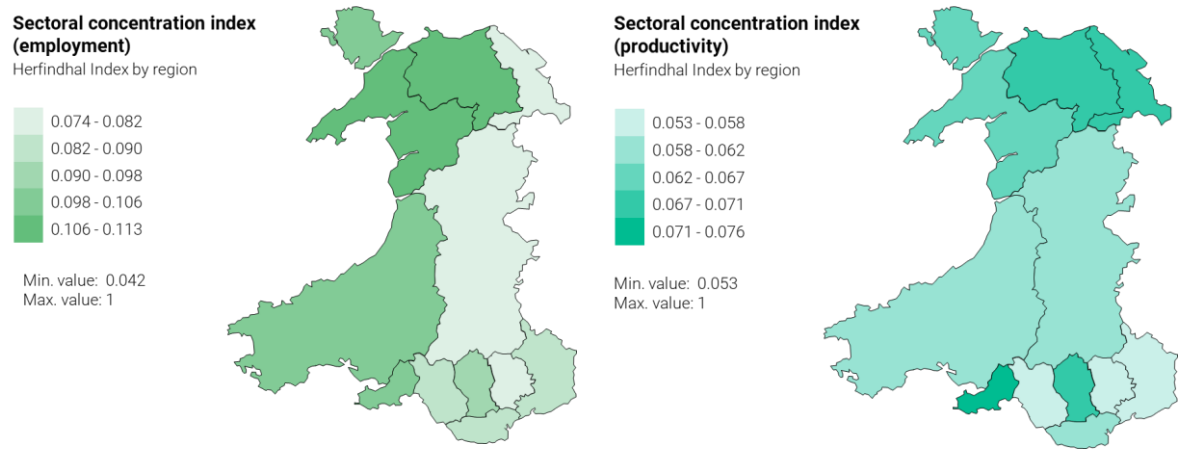
In order to maximise economic benefits, the smart specialisation approach requires the definition of smart specialisation areas where investment should be prioritised and concentrated. However, this prioritisation process does not necessarily apply equally to all regions and depends largely on whether the regional economy is more concentrated or more diversified. Until the last decades of the 20th century, the Welsh economy consisted of agriculture and heavy industry, where coal mining, oil refining and traditional manufacturing were the most important industries in the region. Since then, heavy industry has been declining as the service sector has grown. As discussed earlier, the public sector is a major contributor to GDP in areas

[1] Firm-level innovation capabilities are not only limited to R&D departments and facilities, but also to sophisticated organisational and managerial practices, such as technology management and software development, IP management, market intelligence, skills development, and much more.

such as health and education. However, over the last 10 years, employment growth in the private sector has been higher than in the public sector.

But how diverse or specialised are the Welsh regional economies? And which industries are concentrated in fewer regions or spread over more regions? Using regional data on sectoral employment and GVA, an analysis of the Herfindahl index for regional specialisation helps to identify the regions with a more diversified or specialised economy, while the Herfindahl index for industrial concentration helps to identify whether a specific industry is geographically concentrated among the regions in question. The Herfindahl index increases with the degree of specialisation/concentration, reaching its maximum value of 1, when a given region is specialised in only one industry or, conversely, when a given industry is concentrated in only one region. The minimum value of specialisation/concentration means that all regions have equal shares of an industry or that all industries are equally distributed among the regions.

Figure 2. Sectoral concentration index in terms of employment and productivity by region



Note: Herfindhal index was calculated based on the number of jobs and GVA data for industries according to the SIC-level 1 classification (manufacturing broken down in SIC-level 2). The Herfindhal index ranges from a specified minimum value to 1. The closer to 1 the index is, the more uneven the distribution of the working population and/or GVA contribution between the different sectors are. A value of 1 indicates that the entire working population or GVA contribution is in one sector and region.

Source: StatsWales, own calculations.

At first, the results indicate some regional differences in terms of employment, where regions in the west and north-west of Wales show a relatively higher degree of specialisation than the rest of the regions, which in turn show a relatively more diversified economy. In contrast, regional specialisation in terms of productivity appears to be less pronounced, with the north-east of Wales and specific regions such as Swansea and Central Valleys being the most notable. Regarding employment, western regions seem to have higher employment shares in fewer sectors, particularly in Accommodation and Food Services Activities for the Isle of Anglesey and Gwynedd, and Human Health and Social Work Activities for Gwynedd, Conwy and Denbighshire, and South West Wales. While regions such as Flintshire and Wrexham and the Valleys feature a higher concentration of manufacturing jobs as a whole, each specific manufacturing sub-sector does not account for a high and statistically significant share of employment compared to other sectors in these regions.

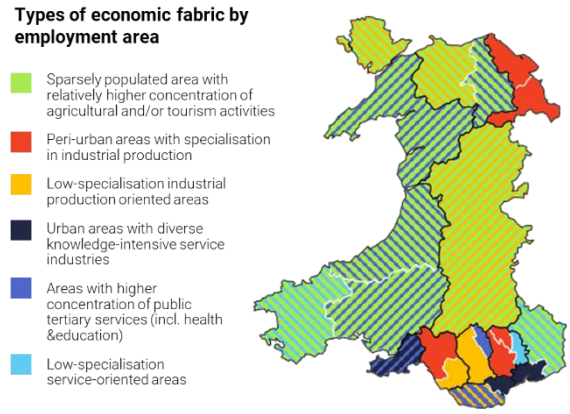
The same is true for productivity, where relatively more specialised regions contribute more GVA from fewer sectors. Of particular note are Flintshire and Wrexham with Manufacture of Machinery and Transport Equipment; Swansea and Cardiff with Financial and Insurance Activities; Central Valleys with Other Manufacturing, Repair and Installation; Gwent Valleys with Manufacture of Electronic, Optical and Electrical Products; and the Isle of Anglesey with Transportation and Storage.

This analysis however comes with a particularly important caveat: despite the differences described above, the index broadly indicates that no region has significant specialisation – i.e., all regions have fairly similar employment distributions and thus diverse economies, and that no sector is significantly concentrated in any one region. The reason for this is that all calculated indices fall well below the midpoint of the range, considerably closer to the minimum value. The direct implication of this is that the Welsh smart specialisation approach should not rely exclusively on broader industrial economic data (i.e., productivity, employment) to define and prioritise smart specialisation areas, but in addition look at more specific and granular data related to R&D and other innovation activities at the regional level, in order to provide further and sounder analysis on the regional potentials and opportunities.

2.3 The diversity of the economic fabric within the Welsh territories

Although Welsh regions do not seem to have substantial sectoral concentrations, there are nevertheless significant regional variations in terms of economic structure and performance. The definition of a coherent and shared regional innovation strategy, following a place-based S3 approach, requires a profound understanding of these structural differences within regions and how they impact the performance and innovation capacity of local industries. Wales is generally a sparsely populated region. It comprises 22 Local Authorities and includes large rural areas, national parks, industrialised coastal towns and ports, as well as medium-sized cities such as Cardiff and Swansea. A first broad characterisation of employment areas at the Local Authority level can therefore underline the diversity of the regional economic fabrics across Wales.

Figure 3. characterisation of the economic fabric



Note: This exercise is a first attempt to identify broad types of employment areas based on the analysis of employment, productivity, market orientation and the degree of regional specialisation, complemented by population density and average gross weekly earnings data at the Local Authority level (22 regions). These results are by no means definitive and further analysis and validation are needed.

Source: own production.

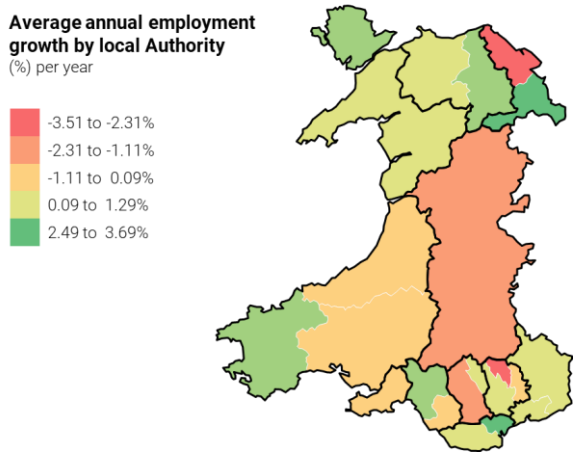
In general, employment and earnings are higher in densely populated urban areas in South Wales and peri-urban areas in North East Wales, with its good connections to the economic environments of the Bristol area, the West Midlands and London. **These characteristics are widely represented in the different types of employment areas identified, which in turn could help to guide the complex process of accounting for the various regional economic structures of a place-based approach.** Looking at the three broader regions identified in the Welsh Economic Development Strategy: North Wales is characterised by four types of territories, while Mid and South West Wales features 5 and South East features all 6 types.

2.4 Unequal regional conditions dictated by differences in employment growth

The smart specialisation approach encourages regional authorities to concentrate on dynamic and growing sectors and markets. However, this process can be challenging for regions facing economic weaknesses and employment losses, not only because the number of growth sectors is limited, but also because the concentration of scarce resources in a few dynamic

sectors may be difficult to justify. Compared to the rest of the UK, Welsh regions are underperforming, largely due to lower employment rates and lower average wages, as a result of prevailing low or unskilled labour, lack of a large urban agglomeration, and a relatively high proportion of people of retirement age (EC, n.d.). Nonetheless, the gap between the employment rate in Wales and the UK as a whole has been closing since 2010, even after a significant decline since 2018, further exacerbated by the 2020 COVID-19 pandemic, employment rates in Wales have increased from 72.2% at the end of 2020 (75.0% in the UK) to 74.2% by mid-2021, slightly below the 75.3% in the UK (Welsh Government, 2021).

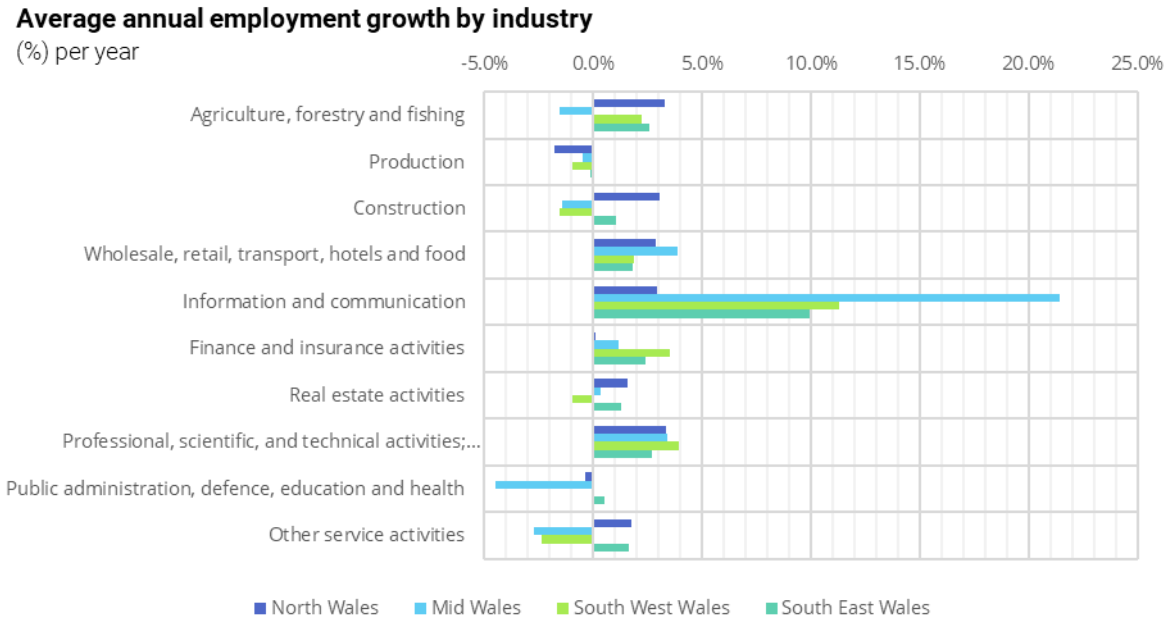
Figure 4. Annual employment growth by region (2015-2019)



Source: StatsWales, own calculations

At the Local Authority level, Cardiff and Wrexham had the largest increases in average employment growth between 2015 and 2019 (3.69% and 2.84%, respectively), and even more rural areas of Wales, such as Pembrokeshire (2.33%), Denbighshire (2.18%), and the Isle of Anglesey (2.11%). Overall, the northern and southern coastal belts have experienced positive growth, while Mid and South West Wales and some parts of The Valleys and North East Wales have seen a decline, particularly steep in Blaenau Gwent (-3.51%) and Flintshire (-2.49%).

Figure 5. Annual employment growth by industry (2015-2019)

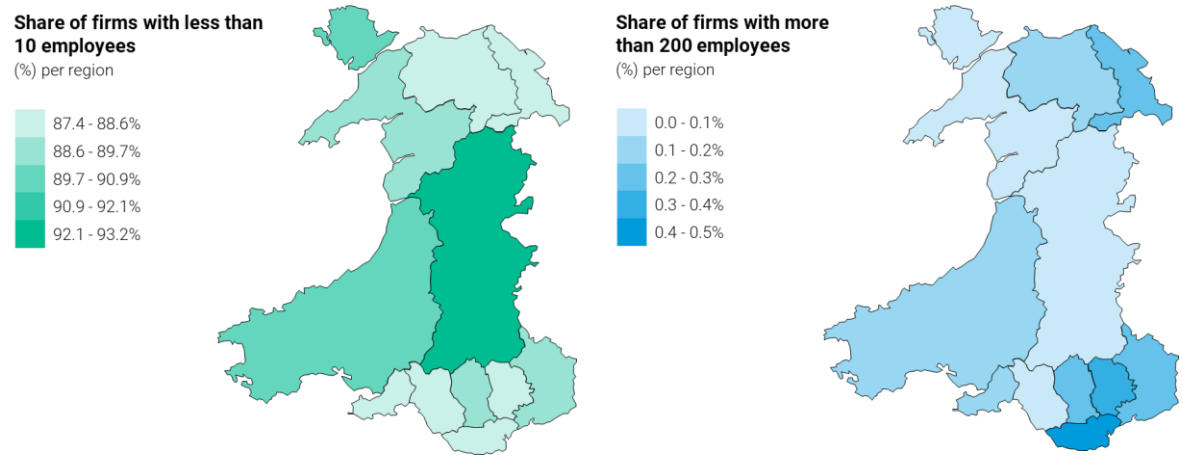


Source: StatsWales

2.5 Predominant high concentration of SMEs across regions

Small firms are generally ill-equipped for innovation as they have fewer assets at their disposal to finance their innovation and R&D activities and find it particularly challenging to absorb new technologies. For instance, research shows (OECD, 2019) that the uptake and diffusion of innovation and digital technologies are much lower among SMEs than among larger firms, attributed to a variety of factors such as less knowledge about technology's impact on the business, lower R&D levels, and lack of incentives to change traditional methods.

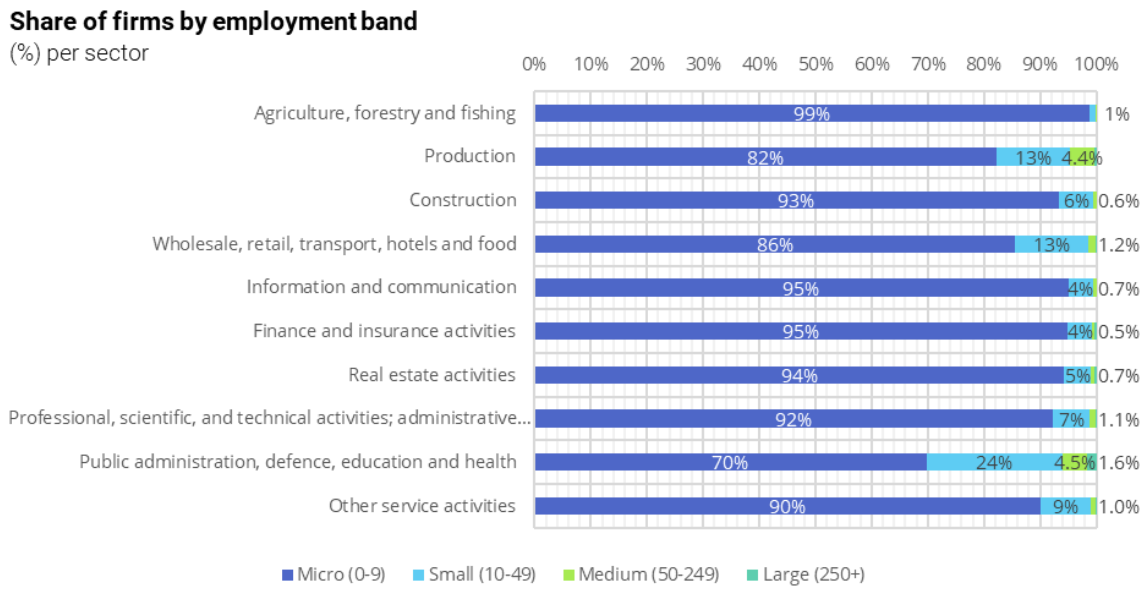
Figure 6. Share of micro-businesses and large businesses by region



Source: StatsWales

The industrial structure in Wales is predominantly composed of SMEs. In every region, the proportion of micro-businesses –i.e., with less than 10 employees– is higher than 87%, and regions such as Powys and South West Wales have the highest proportions, with 93.2% and 90.8%. On the other hand, although there are significantly fewer large firms –i.e., with more than 250 employees– in all regions, some differences become evident, with urban areas, such as Cardiff, or areas with legacy manufacturing industries, such as Gwent Valleys, having the highest proportions (0.5% and 0.4% respectively). Similarly, the sectoral composition shows the predominance of micro-enterprises, although with greater differences in their distribution, where there is a much higher proportion of medium-sized enterprises in the production and tertiary public services sectors (4.4% and 4.5%, respectively) with the latter having the highest percentage of large enterprises (1.6%) well above all other sectors (less than 0.3%).

Figure 7. Share of firms by employment band per sector



Source: StatsWales

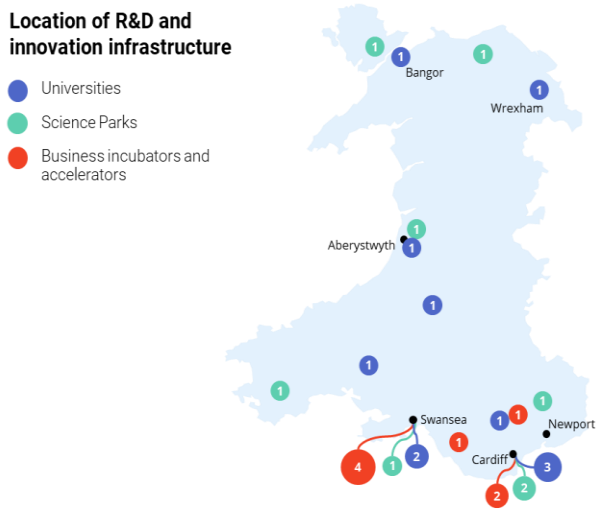
This represents a crucial policy challenge for Wales where regional approaches to innovation must address the specific nature of small businesses in order to strengthen their innovation capabilities. **A focus on inclusive innovation support should therefore build upon existing SME support, where policy tools such as entrepreneurship promotion, trade and investment, and general**

business support can be leveraged to identify ways to stimulate innovation within the high population of micro and small businesses.

2.6 Strong geographical concentration of research infrastructure and innovation stakeholders

Extensive research points to the presence of a fully-fledged infrastructure as a necessary condition for promoting the development of innovation at the local level, as it underpins firms' innovation processes and shapes their interactions with other innovation stakeholders, thereby enabling the development of local innovation ecosystems. **The density of the local innovation ecosystem is important for smart specialisation, as the approach encourages the mobilisation and concentration of resources in priority areas of activity within dense networks of innovation actors that are often anchored to local infrastructure nodes or hubs.** An analysis of the distribution of the R&I and R&D landscape –i.e., where innovation and research take place– reveals uneven conditions at the local level for innovation to flourish.

Figure 8. Location of the R&D and innovation assets



Note: This list is not intended to be exhaustive, but representative of the concentration of different innovation assets and infrastructures.

Source: Royal Society.

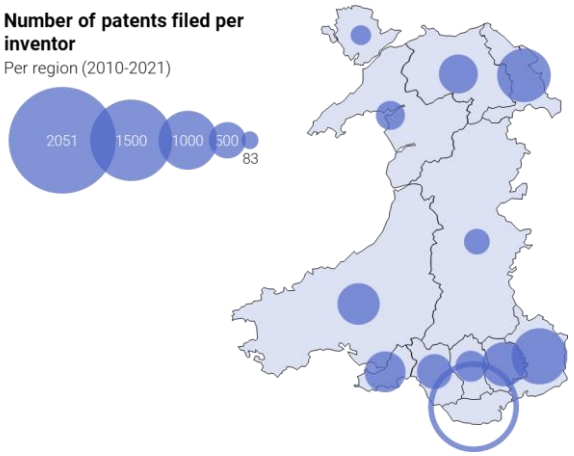
Wales is home to eight universities, plus the Open University in Wales. It has two research-intensive universities with strong science, technology and engineering departments at the Universities of Cardiff and Swansea, where the former is the largest Welsh university in terms of both staff and research income (Tilby, 2021). In addition, there are a small number of public research institutes (8), science parks (7), accelerators and incubators (8), as well as enterprise hubs (4), many of which are based at, owned or jointly run with a university (Tilby, 2021; The Royal Society, 2018). Most recently, two additional research and innovation centres have been established in Wales backed by the Innovate UK's Catapult Network: the first one is the Compound Semiconductor Applications Catapult Innovation centre in South Wales, and the second is the Advanced Manufacturing Research Centre (AMRC) Cymru in North Wales.

In terms of innovation stakeholders, data on R&D personnel and researchers by sector of performance show that Wales ranked the lowest in 2018 with 1.83% (about 27.2k personnel headcount) of total employment, below the national average of 2.3% and the EU average of 2.2% (Eurostat, 2021). The lack of disaggregated data at the local level, unfortunately, does not allow for an in-depth analysis of regional differences; however, given the notable geographical concentration of research and innovation infrastructures and based on the above hypothesis on the density of innovation ecosystems, it is fair to say that **innovation stakeholders are likewise highly concentrated in a few regional areas. Consequently, these regions benefit from a large pool of human resources to support the smart specialisation process**.

2.7 Strong geographical concentration of patents in a few regions

Another way to corroborate the concentrated nature of innovation dynamics within Wales is to look at the differences in regional technological advantage, dictated by the location of patents filed per inventor which is consistent with the distribution of innovation stakeholders. However, it is worth mentioning that while the number of patents is a commonly used indicator of innovation performance, it is only a reflection of technological innovation, one of the various elements of innovation as a broader concept. Furthermore, this indicator does not recognise other methods of IP protection.

Figure 9. Number of patents filed per inventor by region



Note: Number of patents filed per inventor and all technological fields to better account for regional knowledge assets, for the period 2010-2021 to account for path dependencies.

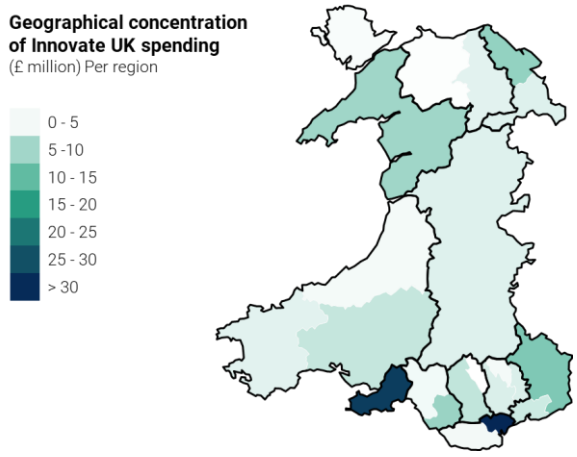
Source: EPO (Patsat), OECD (Regpat), own calculations.

In 2019, the number of patent applications per million inhabitants was only 107.5, down from 112.2 a year before (IPO, 2019). This lags behind the 179.6 UK average in the same year. With regards to the regional distribution of patents filed per inventor during the past 10 years, as expected, there is clearly a high concentration in South Wales and North East Wales, which seems to coincide with the regions featuring an equally high concentration of infrastructure and innovation stakeholders. Notably, Cardiff has the highest number of patents (2,051 in total across all technology areas) and at the same time is home to the most research and innovation-intensive university in Wales. **Consequently, these regions are better positioned (advantage) to capitalise on their technological capital and local dynamics of technological innovation.** This has clear implications in the way regions define the policy instruments to support the smart specialisation approach, as regions with less technological advantages may have to focus on other types of innovation.

2.8 Geographical contrasts in terms of research and development expenditure

R&D expenditure in Wales lags behind at 1.0% (around €794 million) of total Gross Domestic Product (GDP), compared to the UK 1.7% average (StatsWales, 2021) and the EU 2.1% average (Eurostat, 2019). The reasons are largely structural, as Wales lacks a large R&D base in the private and public sectors. On the other hand, Business enterprise R&D (BERD) accounted for 55.7% of the total in Wales, with higher education accounting for 41.7% and government making up 2.9% (StatsWales, 2021). BERD in particular has seen an increase of 8% in average annual growth rate within the period 2010-2019, however, the rate has been slowing down to 5.0% on average for the period 2015-2019. This is also in accordance with the UK Innovation's survey results, which evidence a decline in the proportion of innovation active businesses in Wales, falling from 51% in the period 2012-2014 to 34% in the period 2016-2018 (StatsWales, 2020).

Figure 10. Geographical concentration of Innovate UK spending



Source: Innovate UK.

As with the innovation stakeholder's data, the lack of granular BERD data limits the analysis of regional differences; however, another way of evidencing the level of innovative activity in firms is to look at how Innovate UK grants are distributed in Wales. The results show that funding in Wales is geographically concentrated in South East and South West Wales, where 66% of the funding was allocated to all types of organisations in Cardiff and Swansea, and almost 48% was allocated to only businesses in the same two locations. **This highlights another challenge for regional innovation policies: placing too much emphasis on funding support for research runs the risk of it being captured largely by regions with high research capabilities, to the exclusion of less research-intensive regions that need support in other forms of innovation.**

2.9 A cross-regional sectoral performance analysis

Smart specialisation fundamentally involves the targeted support of a number of sectoral and technological areas with high growth potential as well as the concentration and mobilisation of resources and investments in initiatives that have a strong leverage effect for the regional economy. Therefore, the definition of smart specialisation areas is a decisive phase of the process, which, in turn, requires a robust evidence base and a profound understanding of the local economies and dynamics. The Welsh Government has previously identified wider strategic areas of specialisation in its Innovation Wales strategy and brought forward several reports and comparative analyses of sectoral strengths and innovation potential at the macro level, benchmarking the nation against the rest of the UK. At the same time, in order to support their strategic agendas and driven in part by progress on the City Deals and Growth Deals with the UK Government, a number of local and regional authorities have also taken a step towards defining their strategic priority areas, for example, through the development of in-depth regional analyses, such as the Mid Wales Study on Applied Research and Innovation, or even the implementation of exploration processes in close collaboration with industry –along the lines of the EDP, as is the case with the Cardiff City Deal

Adding to this growing body of evidence, a cross-regional review was conducted aimed at gathering evidence of the distinctive strengths and potentials of each of the wider territories of North Wales, Mid and South West Wales and South East Wales, based on an overall assessment of sectoral performance at the sub-regional level. It provides a territorial baseline for positioning (ranking) each sector according to four main criteria: Economic Importance, Relative Specialisation, Growth Potential and Critical Mass, which are defined by specific economic indicators that capture essential dimensions of the strength or potential of the sector

Economic Importance	Relative Specialisation	Growth Potential	Size
Captures how significant the sector is in the regional economy in terms of its productivity and employment. • Share of total Gross Value Added (GVA) 2019 • Share of total Jobs 2019	Captures how concentrated the sector is in the region as compared to the rest of the regions in Wales and the UK. • Average Location Quotient of GVA 2019 • Average Location Quotient of Jobs 2019	Captures the dynamic performance of the sector over time to reveal future growth potential. • Annual Average Growth Rate of GVA 2017-2019 • Annual Average Growth Rate of Jobs 2017-2019	Captures the potential absorption capacity of the sector in terms of the level of critical mass. • Total Number of Firms 2019 • Total Number of Jobs 2019

Figure 11. Welsh cross-regional sectoral analysis

Welsh Cross-regional Sectoral Analysis

This infographic shows the results of a general sectorial performance analysis based on statistical data available for the territorial level NUTS-3 (12 regions) and sectorial level SIC-1 (with manufacturing further subdivided into SIC-2).

Each sector is evaluated and ranked on four criteria: Economic Importance, Relative Specialisation, Potential for Growth and Size (Critical Mass), thereby allowing the identification of Sectoral Strengths, Potential Specialisation areas and High-growth Sectors (i.e. emerging strengths) for each region.

The results were then aggregated across the wider regions of North Wales, Mid and South West Wales and South East Wales, highlighting the number of inner regions in which the sector ranked highest.

List of sectors and their SIC codes

AB	Agriculture, forestry and fishing; mining and quarrying
CA	Manufacture of food, beverages and tobacco
CB	Manufacture of textiles, wearing apparel and leather
CC	Manufacture of wood and paper products and printing
CDCG	Manufacture of petroleum, chemicals and other minerals
CH	Manufacture of basic and fabricated metal products
CICJ	Manufacture of electronic, optical and electrical products
CKCL	Manufacture of machinery and transport equipment
CM	Other manufacturing, repair and installation
DE	Electricity, gas, water; sewerage and waste management
F	Construction
G	Wholesale and retail trade; repair of motor vehicles
H	Transportation and storage
I	Accommodation and food service activities
J	Information and communication
K	Financial and insurance activities
L	Real estate activities, excluding imputed rental
M	Professional, scientific and technical activities
N	Administrative and support service activities
O	Public administration and defence
P	Education
Q	Human health and social work activities
R	Arts, entertainment and recreation
S	Other service activities

COHESION Interreg Europe · BABLE · Llywodraeth Cymru Welsh Government

Sectoral Strength: Economic importance in terms of high employment share and/or productivity contribution (GVA).

Potential Specialisation: Relative specialisation in terms of high employment and/or productivity (GVA) location quotient.

High-growth Sector: Potential for growth in terms of high annual average growth rates of employment and/or productivity (GVA).

Lack of Critical Mass! Sectors highlighted in red and with an exclamation mark represent those where the total number of firms and/or jobs is less than 0.5% in the region concerned.

Isle of Anglesey

Sectoral Strength
FI, G, H, I, O, P, Q

Potential Specialisation
AB, CA, CM, DE, I

High-growth Sector
CBI, CI-CJI, CK-CLI, J, M, P

Gwynedd

Sectoral Strength
FI, G, I, O, P, Q

Potential Specialisation
AB, I, O, Q, R

High-growth Sector
AB, CCI, CD-CG, CK-CLI, F

Conwy and Denbighshire

Sectoral Strength
F, G, I, N, O, P, Q

Potential Specialisation
AB, CI-CJI, I, N , Q

High-growth Sector
AB, CH, DE, I, R

Flintshire and Wrexham

Sectoral Strength
CAI, CD-CG, CK-CL, G, N, P, Q

Potential Specialisation
CAI, CC, CD-CG, CK-CL, N

High-growth Sector
AB, CBI, CH, CI-CJI, H

South West Wales

Sectoral Strength
CDCGI, G, I, O, P, Q

Potential Specialisation
AB, CH, I, O, Q

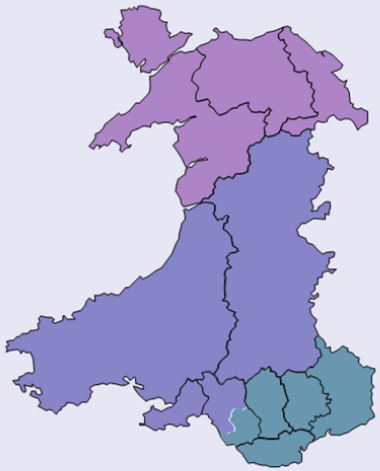
High-growth Sector
CCI, CMI, G, K, S

Swansea

Sectoral Strength
G, I, K, N, O, P, Q

Potential Specialisation
K, N, O, P, Q

High-growth Sector
ABI, CBI, I, K, N



Powys

Sectoral Strength
AB, G I, O, P, Q

Potential Specialisation
AB, CBI, CC, CH, CICJI

High-growth Sector
AB, CH, CM, J, K,

Monmouthshire and Newport

Sectoral Strength
F, G, I, N, O, P, Q

Potential Specialisation
CAI, CH, CICJI, H, N

High-growth Sector
CAI, CKCLI, CM, H, K

Bridgend and Neath Port Talbot

Sectoral Strength
F, G, H, I, O, P, Q

Potential Specialisation
CBI, CH, CKCL, N, O

High-growth Sector
CM, K, L, O, S

Cardiff and Vale of Glamorgan

Sectoral Strength
G, I, K, N, O, P, Q

Potential Specialisation
DE, K, L, N, O

High-growth Sector
ABI, CBI, CICJI, J, N

Central Valleys

Sectoral Strength
CM, F, G, I, P, Q

Potential Specialisation
CDCG, CM, DE, F, N

High-growth Sector
CBI, H, I, R, S

Gwent Valleys

Sectoral Strength
CICJI, F, G, N, O, P, Q

Potential Specialisation
CA, CC, CDCG, CICJI, CKCL

High-growth Sector
CH, CM, F, J, S

Source: StatsWales

North Wales

Sectoral Strength			Potential Specialisation			High-growth Sector		
G	Wholesale & retail	(4)	AB	Agriculture, forestry...	(3)	AB	Agriculture, forestry...	(3)
P	Education	(4)	I	Accommodation...	(3)	CBI	Mnf. textiles, wear...	(2)
Q	Human health...	(4)	CA	Mnf. food, beverage...	(2)	CH	Mnf. basic fab. metal	(2)
F	Construction	(3)	N	Administrative...	(2)	CICJI	Mnf. electronics...	(2)
I	Accommodation...	(3)	Q	Human health...	(2)	CKCL	Mnf. mach. & trans...	(2)
O	Public admin. & def.	(3)	CC	Mnf. wood paper...	(1)	CC	Mnf. wood paper...	(1)
N	Admin., support serv.	(2)	CDCG	Mnf. petrol., chem...	(1)	CDCG	Mnf. petrol., chem...	(1)
CA	Mnf. food, beverage...	(1)	CICJI	Mnf. electronics...	(1)	DE	Electricity, gas, wat...	(1)
CDCG	Mnf. petrol., chem...	(1)	CKCL	Mnf. mach. & trans...	(1)	F	Construction	(1)
CKCL	Mnf. mach. & trans...	(1)	CM	Other manuf., repair...	(1)	H	Transport & storage	(1)
H	Transport & storage	(1)	DE	Electricity, gas, wat...	(1)	I	Accommodation...	(1)
			O	Public admin. & def.	(1)	J	Information & comm.	(1)
			R	Arts, entertainment...	(1)	M	Prof., scientific, tech.	(1)
						P	Education	(1)
						R	Arts, entertainment...	(1)

Mid and South West Wales

Sectoral Strength			Potential Specialisation			High-growth Sector		
G	Wholesale & retail	(4)	CH	Manuf. basic, fabric...	(3)	K	Financial & insurance	(4)
I	Accommodation...	(4)	O	Public admin. & def.	(3)	CM	Other manuf., repair...	(3)
O	Public admin. & def.	(4)	AB	Agriculture, forestry...	(2)	AB	Agriculture, forestry...	(2)
P	Education	(4)	CBI	Mnf. textiles, wear...	(2)	S	Other serv. activities	(2)
Q	Human health...	(4)	N	Admin., support serv.	(2)	CBI	Mnf. textiles, wear...	(1)
AB	Agriculture, forestry...	(1)	Q	Human health...	(2)	CC	Mnf. wood, paper...	(1)
CDCG	Mnf. petrol., chem...	(1)	CC	Mnf. wood paper...	(1)	CH	Mnf. basic fab. metal	(1)
F	Construction	(1)	CICJI	Mnf. electronics...	(1)	G	Wholesale & retail	(1)
H	Transport & storage	(1)	CKCLI	Mnf. mach.& trans.	(1)	I	Accommodation...	(1)
K	Financial & insurance	(1)	I	Accommodation...	(1)	J	Information & comm.	(1)
N	Admin., support serv.	(1)	K	Financial & insurance	(1)	L	Real estate activities	(1)
			P	Education	(1)	N	Admin., support serv.	(1)
						O	Public admin. & def.	(1)

South East Wales

Sectoral Strength			Potential Specialisation			High-growth Sector		
G	Wholesale...	(5)	N	Administrative and...	(4)	CM	Other manuf., repair...	(3)
P	Education	(5)	CAI	Mnf. food, beverage...	(2)	S	Other service activity	(3)
Q	Human health...	(5)	CDCG	Mnf. petrol., chem...	(2)	CBI	Mnf. textiles, wear...	(2)
F	Construction	(4)	CH	Manuf. of basic and...	(2)	H	Transport & storage	(2)
I	Accommodation...	(4)	CICJI	Mnf. electronics...	(2)	J	Information & comm.	(2)
O	Public admin. & def.	(4)	CKCLI	Mnf. mach.& trans.	(2)	K	Financial & insurance	(2)
N	Admin., support serv.	(3)	DE	Electricity, gas, wat...	(2)	AB	Agriculture, forestry...	(1)
CICJI	Mnf. electronics...	(1)	CBI	Mnf. textiles, wear...	(1)	CAI	Mnf. food, beverage...	(1)
CM	Other manuf., repair...	(1)	CC	Mnf. wood paper...	(1)	CH	Mnf. basic fab. metal	(1)
H	Transport & storage	(1)	CM	Other manuf., repair...	(1)	CICJI	Mnf. electronics...	(1)
K	Financial & insurance	(1)	F	Construction	(1)	CKCLI	Mnf. mach.& trans.	(1)
			H	Transport & storage	(1)	F	Construction	(1)
			K	Financial & insurance	(1)	I	Accommodation...	(1)
			L	Real estate activities	(1)	L	Real estate activities	(1)
						N	Administrative and...	(1)
						O	Public admin. & def.	(1)
						R	Arts, entertainment...	(1)

Generally speaking, the results highlight interesting aspects of sectoral performance that are shared by all territories, as well as by most of their sub-regions. Overall, the sectors that scored highest in regional economic importance represent less knowledge-intensive market service industries[2], namely: Wholesale and retail, and repair of motor vehicles; Transport and storage; Accommodation and food; and Administrative support. The Public tertiary services sector group, which also features prominently in this category, is an exception, as they are considered to be a knowledge-intensive sector and include Public administration and defence; Education; and Human health and social work activities.

As these sectors are often not innovative but still vital to regional economies, it is crucial to establish cross-sectoral linkages or foster spill-over effects from the key innovation activities and potential areas of specialisation within the region. For instance, both the Wholesale (...) and Transport (...) sectors are export-oriented and potentially strategic given their "downstream" position in the supply chain, where better integration with the regional productive sector (and its innovations) could lead to highly specialised export or transport services. On the other hand, although the Accommodation and food and Administrative support sectors are rather domestic-oriented industries, they could still benefit from spill-over effects by leveraging highly skilled human capital or local technological capabilities to tap into major trends and disruptions, such as sustainable tourism or back-office digitalisation.

On the other hand, several of the manufacturing sub-sectors featured as sectors with a relatively high level of specialisation and/or high growth potential in all regions, especially in those regions with industrial economic fabric, where manufacturing represented a sectoral strength. However, of the manufacturing industries that are generally categorised as high-tech industries, all have relatively low critical mass in terms of the number of firms, in most regions. These industries are found in the 'Manufacture of electronic, optical, and electrical products' and 'Manufacture of machinery and transport equipment' sectors, as well as specific sub-sectors such as pharmaceuticals and chemicals, within the broader 'Manufacture of petroleum, chemicals, and rubber, plastic and non-metallic minerals' sector[3].

In terms of knowledge-intensive service industries, two sectors in particular presented high-growth potential in many of the regions. Frist, the 'Financial and Insurance Activities' sector ranked high in five regions, four of which are in Mid and South West Wales. Secondly, the "Information and communication" sector, categorised as a high-tech and knowledge-intensive industry, given its extensive use of digital technologies, came up with high growth potential in four regions, two of which are in South East Wales but also two which are in more rural areas, namely the Isle of Anglesey and Powys.

Ultimately, this sectoral performance analysis provides both a regional baseline and an overview of specific strengths and emerging potentials in broader sectoral terms for each of Wales's three regions. As such, it can serve as a guide for more in-depth exploratory analyses aimed at identifying promising innovation activities or technological areas within the outlined sectors. However, it should be reiterated that such a high-level analysis cannot serve exclusively as a basis for the identification of areas of specialisation for each of the regions, as mentioned in Section 2.2 above.

[2] The categorisation referred to is based on that developed by Eurostat (htec), where data are aggregated to represent various levels of high-tech industries and knowledge-intensive services. (euostat, n.d.)

[3] Manufacture of coke and refined petroleum products, as well as Manufacture of rubber, plastic and non-metallic minerals are both categorised as low-tech industries.

3 Business Innovation Ecosystem in Wales & Barriers to Innovation

Prior to moving forward with the smart specialisation approach to improving business innovation support, it is important to evaluate the existing support in Wales. Here, an assessment of the status quo, including gaps and barriers to innovation is presented. The inputs highlighted in this section stem from stakeholder consultations carried out in the form of workshops, interviews, and surveys, alongside in-depth analysis of the innovation ecosystem in Wales.

The following chapter, therefore, summarizes the stakeholder inputs and highlights the main support programmes and perceived barriers to be improved upon.

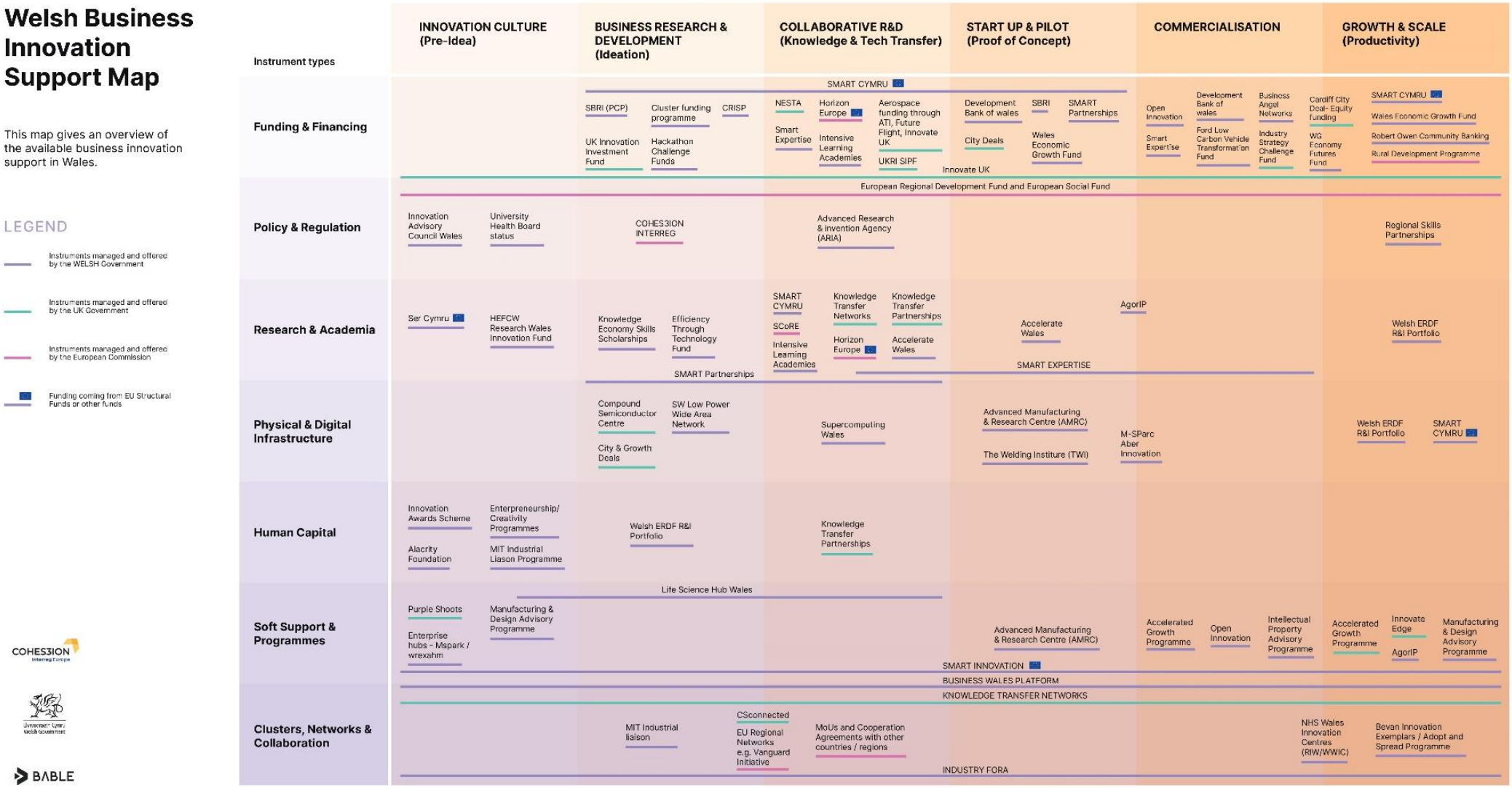
3.1 Existing Innovation Support

There is a variety of Business Innovation Support instruments available for Welsh companies. The following graphic depicts the results of a comprehensive mapping of the existing support available based both on desktop research and stakeholder interviews and workshops, with representatives from both the private and public sectors. Seven innovation support industry types are charted against the six stages of innovation from Pre-Idea to Productivity. Support mechanisms include those with funding from the Welsh Government, UK Government and European Union, with an emphasis on mechanisms where the Welsh Government plays an active role. For a detailed overview of the main programmes, please see Chapter 3 of the Cardiff University Report "Scoping the future of Innovation Policy in Wales."[4]

The existing business innovation support mapping was based on the COHES3ION smart territorial mapping exercise, the specific goal of which was an initial regional diagnosis to identify complementarities and synergies in the fields of specialisation and areas of improvement for governance. The smart territorial mapping exercise completed by the Welsh Government as part of its work with COHES3ION provided the baseline for the innovation support map below and for the analysis in Section 3.2, which identifies areas with room for improvement. This information can then be used to identify improvement actions.

[4] https://gov.wales/innovation-advisory-council-wales-scoping-future-innovation-policy-wales

Figure 12. Welsh business innovation support map



3.1.1 Innovation Support Status-Quo Strengths and Weaknesses

The following section gives a high-level overview of the Strengths and Weaknesses of the Business Innovation Support System in Wales. The gaps are further analysed in Section 3.2.

3.1.1.1 Strengths:

- There is a wide array of funding sources for business innovation support available in Wales. These include programmes from the ERDF and Innovate UK, the SMART suite of programmes and the Development Bank of Wales.
- The Welsh ERDF portfolio includes a wide spectrum of support in fields including Research & Innovation, SME Competitiveness, Renewable Energy & Energy Efficiency and Connectivity & Urban Development. Also, EU-funded, the European Social Fund supports innovation in the areas of Sustainable Development, Skills for Growth and Youth Employment.
- Innovation campuses including AberInnovation, M-Sparc, Advanced Manufacturing Research Centre, Medi Centre Cardiff, TWI Port Talbot, ILS Swansea and Hydrogen Centre Port Talbot were listed by stakeholders as key resources for starting and commercialising innovation.
- Innovation projects receiving support from Welsh Government-supported projects have a 70% success rate of launching or implementing new products, largely due to the mentoring and support process carried out by Innovation Specialists who work closely with applicant companies
- Through the Horizon 2020 initiative from the European Union, 189 Welsh participants received €83 million in funding.
- The Welsh Government provides a versatile and dedicated team of Innovation Specialists that directly support businesses. They mostly support small companies and help them understand why innovation is important before guiding them through the journey of conducting R&D for business growth. As a result of its success, other regions in the UK and EU have considered adopting the model as a benchmark of good practice, such as Scotland and the Basque Country, with support from the Welsh Government.

3.1.1.2 Weaknesses:

- Some of the most-highlighted gaps identified by stakeholders are in programmes cultivating Innovation Culture (Pre-Idea) and in crossing the "valley of death" to commercialisation
- Despite the various sources that exist, they are perhaps too small as funding is still seen as the main barrier to innovation by stakeholders.
- Connectivity throughout Wales has been identified as a major barrier, especially for innovation in rural areas. Both digital connectivity and physical connectivity are areas that need improvement.
- There is low investment in R&D relative to the rest of the UK. Despite making up 5% of the UK's population, Wales spends just 2% of the UK's total investment in R&D.
- For a more comprehensive account of identified weaknesses, see Sections 3.2 and 3.3.

3.1.2 Innovation Support: Multi-level Governance

Governance of innovation support in Wales is complex, with many levels of governance involved but not always coordinating. The flagship innovation support programmes, Smart Cymru and Smart Innovation, grant funds to companies of all stages in order to encourage and cultivate innovation in Wales. A key component of the SMART programmes is the Innovation Specialists who support businesses directly. They work very closely with small companies across Wales to emphasize the importance of innovation and to guide them through the R&D process for business growth, providing technical expertise and knowledge of the different additional support mechanisms available. Complimenting the SMART programme are Innovate UK programmes, though collaboration with the Welsh government in implementing them is minimal. Thus far, much of the

UK Government structural funding for Wales has gone to City and Growth Deals, which work on a smaller scale than the Wales national level. R&I investment has a similarly split funding system. The Welsh Government allocates and distributes grants through the Higher Education Funding Council for Wales (HEFCW) and this funding is complimented by competitive UK-level funding, mostly provided by UKRI. Overall, innovation projects receiving Welsh business innovation support have been successful with a 70% success rate of launching or implementing new products. This includes a strong showing in Horizon 2020 activity, with Welsh organisations benefiting from €83 million of funding through 189 participants.

3.1.3 City and Growth Deals

City and Growth Deals provide innovation support on a sub-national level, involving consortiums of local authorities with funding split evenly between the UK and Welsh governments. There are currently four Deals in Wales of various scopes and sizes: the Cardiff Capital Region City Deal, Swansea Bay City Deal, North Wales Growth Deal and Mid Wales Growth Deal. Here we highlight some of the Business Innovation Support involved in each Deal.

Cardiff Capital Region City Deal:

The Cardiff Deal focuses its efforts on five clusters of specialisation: Compound Semiconductors, Creative, Cybersecurity, Fintech and Medical devices. To support businesses and innovation, they plan to create a revolving equity fund of approximately £50 million in addition to acting as a central body that can direct companies towards further support provided by the Welsh Government and elsewhere.

Swansea Bay City Deal:

The Swansea Deal has four broad strategic themes: Economic Acceleration, Life Science & Well-Being, Energy and Smart Manufacturing. Unlike the Cardiff deal, there is no revenue funding and the projects have been planned at the onset and are in various stages of implementation with 60-70% currently approved. Some of these projects include innovation support, such as Homes as Power Stations which aims to support private sector innovation, including the upscaling of the product. There is also a £60 million programme that has been submitted for final approval geared toward the creation of a decarbonised and innovative economy.

North Wales Growth Deal:

The North Wales Deal also consists of a pre-defined portfolio of projects. These focus on five areas: Digital Infrastructure, Land & Property, High Value Manufacturing, Agri-food & Tourism and Low Carbon Energy. A private sector investment strategy is also being developed and while the Growth Deal cannot make funding decisions, they plan to act as a signpost for businesses to direct them to entities that can.

Mid Wales Growth Deal:

The Mid Wales Growth Deal also consists of a pre-defined portfolio of projects. These focus on eight priority areas: Agriculture, food and drink, Applied research and innovation, Tourism, Energy, Supporting Enterprise, Digital, transport, and Skills & Employment. The details of the investment objectives for the Portfolio are being developed as part of the business case. Similar to other growth deals while the Growth Deal cannot make funding decisions, they plan to act as a signpost for businesses to direct them to entities that can.

3.2 Gaps in Business Innovation Ecosystem

Although lots of business innovation support instruments are available, as can be seen in the Business Innovation Support mapping above, Wales as a region still lags behind other regions in the UK in terms of innovation (Tilby, 2021). This suggests either a lack of proper distribution of the

support mechanisms across the different stages of innovation or a lack of effectiveness in the implementation of available supports. In a bid to assess the likelihood of these two pathways, stakeholder consultations in the form of workshops, interviews and surveys were carried out by BABLE with key representatives from both the public and private sectors across Wales.

As part of the stakeholder consultation activities, a total of 11 stakeholders were interviewed and 43 participants were engaged across two workshops. In addition to this, 39 responses were gotten from the survey that was sent out, with the participants consisting of private sector representatives across various industrial sectors.

Based on the inputs obtained from these interactions, the perceived gaps across the various stages of innovation, from the perspective of the stakeholders, are presented in the following sections. These gaps cut across funding and financing; policy and regulation; research and academia; physical and digital infrastructure; human capital; soft support and programmes; and clusters, networks, and collaboration.

3.2.1 Gaps in Innovation Culture (Pre-Idea)

- Lack of (pre-)seed funding to support early-stage business ideas/innovations
- Lack of angel/seed capital and venture capital opportunities locally
- Lack of risk-tolerant funding at an early stage
- Lack of supporting policy framework and infrastructure
- Lack of adequate support directed at micro and small businesses. Wales is replete with micro and small businesses and yet public funds are directed at large public organisations instead of small businesses
- Need for incubator hubs for both innovation and entrepreneurship
- Lack of understanding of what innovation really means and whether or not an idea is novel
- Lack of critical mass and networks. There is, therefore, a need for ecosystem development to overcome the spatial and geographical barriers that hinder collaboration and networking
- Need for stronger industry partnerships

3.2.2 Gaps in Business Research & Development (Ideation)

- Lack of finance for risky developments, as well as funding gaps for research and innovation
- Gaps in broader public procurement of innovation: No clear procurement routes in Wales where technology is developed in partnership
- Lack of access to specialised equipment and technology
- Need to maximise collaboration between academia and the industry to drive innovation
- Lack of ultrafast digital connectivity especially in rural areas
- Need for space to foster innovation e.g., labs, technological spaces such as digital platforms, etc
- Lack of access to skilled workforce in areas such as automation, digitalisation, etc, which hinders innovation
- Need for open-source public service innovation networks to enable collaboration

3.2.3 Gaps in Collaborative R&D (Knowledge and Tech Transfer)

- Lack of focus on indigenous growth and collaboration in research and development
- Need for incentives to collaborate and share innovation
- There is a wide debate about IP sharing between industry and academia
- Lack of commitment on the side of academia for the rapid roll-out of research outcomes and scale-up
- Need for legal support to navigate the complexities of IP sharing, acquisition/assignment, and licensing between businesses and between academia and the industry, both within and outside

Wales. Although this was highlighted as an important issue by the stakeholders, SMART Expertise does address this gap. Agreeing on the IP share at the start of the research programme alleviates any future issues that may arise.
- Need for the establishment of mandates for collaboration across Health Boards to support engagement and uptake in both innovation and commercial research to enable a positive and competitive environment
- Need for space to foster innovation and collaboration such as office spaces and lab spaces

3.2.4 Gaps in Start-up and Pilot (Proof of Concept)

- Need for online start-up programmes like Enterprise Nation, a community that helps people start and grow successful businesses[5]
- Success of existing programmes is measured through short term wins rather than long term impact
- While there is a lot of information available for business innovation support, it is fragmented and incomplete.
- The Sell2Wales platform for public procurement is not very user-friendly.
- The application process for accessing innovation support is long and cumbersome, generally across all funding streams, for start-ups, which have limited capacity and are discouraged, especially by the low chances of success.

3.2.5 Gaps in Commercialisation

- Lack of investor ecosystem e.g., private investors, banks, venture capitalists, angel investors, etc
- Difficulty in accessing private equity
- Difficulty in "crossing the valley of death" between the end of grant funding support and commercial funding
- The market for advanced digital tech in Wales is small or non-existent
- Existing public service procurement rules work against innovative companies especially SMEs. There is difficulty in engaging with commissioners and even when conversations are ongoing, the threshold of risk in innovation with new companies is viewed as too great by procurement teams
- Supply chain ecosystem; the need for developing end-to-end supply chains.

3.2.6 Gaps in Growth and Scale

- Lack of adequate funding and equity financing for growth and scale-up. Although some of this funding exists from the Development Bank of Wales, there is still a need to attract international finance, especially for growth/scale funding
- Lack of physical infrastructure and space for growing companies
- Disruptions in business activities due to communications via road and rail
- Inability to scale without ultrafast infrastructure
- Lack of aspiration of companies to grow
- Need for more high growth networks

3.2.7 Additional Insights from Survey

Regarding the stages of the innovation process currently lacking the most business innovation support in Wales, about 45% and 80% of the participants ranked Innovation Culture (Pre-Ideation stage) as their first and top three choices respectively, which indicates an absence of attitude or drive to innovate or ideate in the Welsh ecosystem. In addition to this, commercialisation of innovation and collaborative R&D (knowledge and tech transfer with academia and industry) comes as

[5] https://www.enterprisenation.com/

a close second and third in terms of top three stages lacking business innovation support in Wales, as can be seen in Figure 13 below.

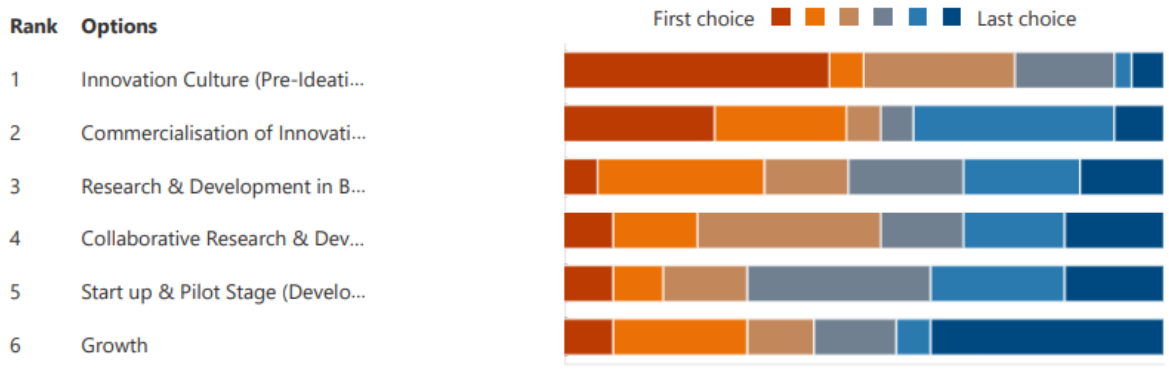


Figure 13. Stages of the innovation process most lacking in business innovation support in Wales

3.3 Major Barriers to Innovation

While the section above identified key gaps in the Business Innovation Support across the six stages, this section highlights key systemic and overarching barriers to innovation in Wales.

Responses from the survey conducted show that most businesses in Wales have been more frequently and occasionally involved in collaborative innovation activities with universities & academia, as well as business partners outside of Wales, but less so or never with business partners within Wales, as can be seen in Figure 14below,

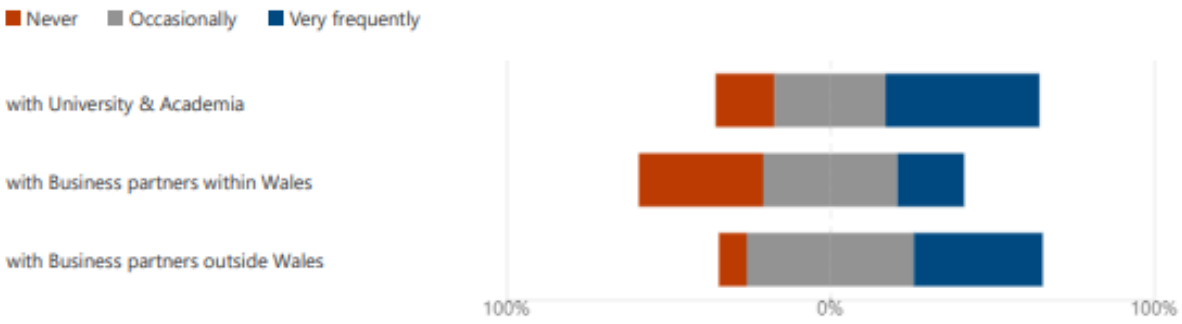


Figure 14. Frequency of involvement in collaborative innovation activities and partners involved

Also, lack of access to funding & financing, lack of talent in the region, and lack of physical and digital infrastructure were listed as the top three barriers to innovation by the participants. Some of the other barriers also indicated include unavailability of clusters; networks; and collaboration, lack of strong supply chain, and business research and development.

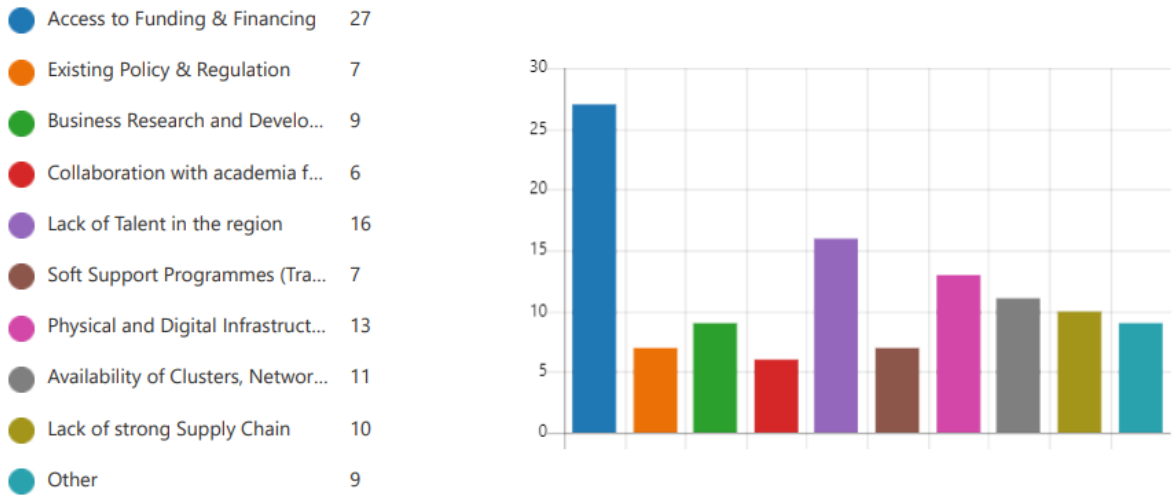


Figure 15. Top three barriers to innovation

In addition to the above, some of the barriers to innovation in Wales as highlighted by stakeholders, and in line with the gaps already mentioned, are provided in the following sections.

3.3.1 Funding & Bureaucracy with Accessing Funding

- Funding is usually geared to large companies and specific sectors rather than being more horizontal. With micro and small businesses being the rocket ship of innovation in Wales, there is a need for a change in the structure of innovation support in Wales.
- The biggest challenge that businesses face is "crossing the valley of death" between the end of grant funding support and commercial funding.
- Need for high risk/experimental funds, as most time R&D activities yield no return on investment, which can be problematic for SMEs.
- Heavy bureaucracy to access funds; attributed to overly complicated and time-consuming administrative and control procedures ("unnecessary KPI tracking").

3.3.2 Information and Signposting

- Businesses struggle to find the most suitable support and face difficulties in assessing whether they are fit for the purpose

3.3.3 Innovation Culture

Different innovation culture barriers exist both in the public and private sectors.

3.3.3.1 Business Perspective

- There is risk aversion and a perversive sense of inadequacy to innovate, especially in more rural areas (e.g., the Mid and North-east) due to low socio-economic conditions.
- Lack of common understanding of what innovation means – minor efforts are underestimated (not funded) and success stories are not lauded enough to inspire others.
- *"Entrepreneurship is more about being self-employed than realising an idea to improve the world"*

3.3.3.2 Public Sector Perspective

- There is a need for central leadership in sector-specific fields of innovation, which include public sector bodies such as the NHS, Local Authorities and Education, central Welsh Government infrastructure and a centre of excellence.
- Existing public service procurement rules work against innovative companies especially SMEs. The threshold of risk in innovation with new companies is considered too great by the procurement teams.

- Lack of collaboration across Health Boards to support engagement and uptake in both innovation and commercial research.

3.3.3.3 Collaboration

- Industry-academia collaboration is not sufficiently strengthened (e.g., IP sharing, commercialisation of research outcomes, etc.). SMART Expertise addresses this issue through collaborative agreements (including IP) signed prior to any work being undertaken.

3.3.4 Infrastructure, Talent & Market Access

- Lack of reliable and resilient digital infrastructure pose a barrier to doing more through digital means including training and collaboration
- Lack of physical infrastructure (office space) to grow companies outside the major cities
- Lack of Talent in the region
- For advanced digital technology, the marketplace within Wales is small or non-existent.
- Firms, especially SMEs, lack the capabilities and capacity needed to effectively undertake activities related to innovation

3.3.5 Delivery and Governance related barriers

3.3.5.1 Delivery & Assessment

- Limited funds are spread too thin, constituting a fragmented policy mix, with many instruments, which in turn is leading to limited impact
- Lack of impact-driven KPIs that properly assess whether initiatives are working and what impact they are having.
- Limited and overly prescriptive support for actors undertaking critical entrepreneurial support and ecosystem development activities (incl. networks, collaborations, etc.) – especially in more remote areas. The highly prescriptive level of funding support under the Welsh Enterprise Hubs programme was highlighted as a particular case in point.

3.3.5.2 Multi-level Governance

- Additional involvement of Local Authorities in the delivery of innovation strategy/support
- Misalignment of UK & Welsh Government Innovation support. This has led to competing innovation support mechanisms that are undermining each other's potential impact.
- At the same time, there is an intense competition for both public resources and beneficiaries by all other public and private actors providing different kinds of business innovation support and services.
- As a result, some organisations deliberately refrain from signposting or directing the beneficiary to the right service provider, in order to retain the beneficiary (as a KPI) and thus capture the funds, despite not having the right type or level of service.
- The main message on Welsh Government's policy objectives and priorities is fragmented and not widely shared among innovation stakeholders, hindering the coordination of activities across the region.

3.3.5.3 Regulation & Ecosystem

- The withdrawal of ERDF funds considerably reduces the budget available to the Welsh Government. There is therefore uncertainty as to how the UK government will fill this gap, which puts at risk Welsh Government's internal resources to build and expand its capabilities to implement effective innovation policies and delivery interventions
- The EU's transition from the Medical Device Directive (MDD) to the Medical Device Regulation (MDR) is proving to be a massive barrier to the release of new products

3.4 Main Implications for Wales

Based on all inputs and analysis performed, it has been revealed that:

- There are multiple, **placed-based market and system** issues hindering innovation, as well as widely differing levels of business **innovation capabilities** across Wales.
- Stronger evidence is needed to accurately diagnose and articulate the problems constraining innovation, in order to establish a **direct connection** between the problem, the chosen instruments, and the desired policy outcomes (objectives).
- Dwindling resources and detrimental competition are **weakening the institutional capabilities needed** to design, implement, and coordinate an effective policy mix.

There is therefore a need to ensure that existing inefficiencies are removed before embarking on a journey to balancing adequate distribution of the support mechanisms across the various stages of innovation and ensuring effectiveness in their deployment.

Some examples of good practices that have been implemented in other regions in Europe include:

Best Practice: INNO - Rethinking Business Networks

The North-West Development Region in Romania needed to attract higher value-added investments to accelerate its growth rate. The regional innovation ecosystem was poorly connected, so much so that after following several elicitation techniques used in research (survey, brainstorming sessions, workshops, and field visits) it was identified that the best solution to connect all actors with the purpose of developing and implementing smart specialisation projects was via an online open innovation platform.

The INNO platform was developed as a tool to promote investment at a regional level, as well as to stimulate innovation among all actors in the ecosystem. It is managed by a dedicated team within the North-West Development Regional Agency that animates the ecosystem and has permanent contact with stakeholders in the region to encourage them to create content and find solutions to the challenges they face through the platform. In other words, to make them "early adopters".

The platform addresses all actors in the innovation ecosystem, from companies to universities and research institutes, public authorities, or NGOs, at all levels, horizontally and vertically, on the principle of multi-level governance. Even individual users can find a purpose on the platform. The creation of digital communities and marketplaces allowing all regional stakeholders, and beyond, to interact was INNO's supreme scope.

For more information: INNO - Rethinking Business Networks

Source: Adapted from Interreg Europe Policy Learning Platform

Best Practice: Limerick Digital Leaders Network

The Limerick Digital Strategy (LDS) set out the vision for a Sustainable Smart Limerick in 2030 to guide Limerick to a new level of digital maturity between 2017 and 2020. On launching the LDS, it was quickly acknowledged that the objectives could not be successfully achieved without effective oversight and collaboration with relevant key stakeholders

who were subsequently brought together to form the Limerick Digital Leaders Network (LDLN).

The LDLN consists of stakeholders and thought-leaders from leading organisations that commit on a voluntary basis to work together and support the development of the 'Smart Limerick City Region' and LDS. So far, collaborations with other EU cities, regional initiatives, the digital maturity of Limerick, and the radical transformation of the Local Authorities are some of the evidences of success that has been realised from the establishment of the LDLN.

For more information: Limerick Digital Leaders Network

Source: Adapted from Interreg Europe Policy Learning Platform

Best Practice: Bizkaia Orekan (Biscay at Balance)

Bizkaia Orekan was born with the aim of promoting territorial balance in Bizkaia in terms of competitiveness, responding to an economically heterogeneous territory in terms of business fabric and competitiveness indicators, and highlighting the importance of multi-level collaboration with local and regional stakeholders in terms of territorial development strategies.

Through this project, local challenges were identified to give way to lines of action and specific projects that could be worked on at the operational level. Since its inception, it has permitted the establishment of trust (real collaboration) among entities and different levels of administrations, creation of formal contact channels and better knowledge on who is who and who does what, alignment and effectiveness (better allocation of resources and implementation of policies).

For more information: Bizkaia Orekan (Biscay at Balance)

Source: Adapted from Interreg Europe Policy Learning Platform

Best Practice: Regional cores for polycentric regional development (COHES3ION)

There are large variations in social and industrial structures within Stockholm region, with manufacturing industry dominating in some more rural municipalities and knowledge intensive business services (KIBS) dominating the centre of Stockholm and surrounding municipalities. The population of Stockholm region is growing with 30-40 000 inhabitants each year and the central municipalities are facing increased congestion, with transportation bottlenecks and shortages of housing.

To reduce these problems and encourage sustainable growth, an ambition to develop a more polycentric region was introduced in the Stockholm Regional Development Plans 2001. The process was inspired by participation in an EU-project on polycentric regional development. In the latest plan (RUFS2050), the central core of Stockholm city and 8 regional cores have been identified for prioritized actions. The dominating business structure vary between the regional cores, but they are all characterized by high accessibility for public transportation, urban density, some businesses diversification and green areas.

For more information: Stockholm regional development plan

Source: Adapted from Interreg Europe Policy Learning Platform

4 Recommendations for S3 Approach for Wales

The smart specialisation policy focuses on the identification and further development of activities that are likely to effectively transform the existing economic structures through R&D and Innovation. The goal is to leverage the strengths and capabilities of the regional ecosystem by concentrating resources on the further development of these high potential activities to drive innovation and economic growth.

Smart Specialisation can be envisaged as a process based on '4Cs': identify a Comparative advantage, make choices and aim for Critical mass, develop cooperation and Clusters, cultivate Collaborative leadership. Similarly, the S3 approach is based on several defining aspects: profound knowledge of the territorial economic fabrics and innovation ecosystems (diagnosis, SWOT); 'Entrepreneurial Discovery' and close involvement of the private sector; concentration of resources in strong technological fields or sectors; an associated diversification strategy designed to guarantee spill-over effects and inclusive growth; definition of a roadmap, action plan and dedicated budget; the establishment of a coordinated multi-level governance delivery structure; and the sound implementation of a monitoring and assessment system.

Active involvement of key innovation stakeholders and businesses from strategy development to execution is what sets Smart Specialisation apart from other forms of policy-making. **This defining aspect of Smart Specialisation is the Entrepreneurial Discovery Process (EDP).** The European Commission defines the EDP as *an inclusive and interactive bottom-up process in which participants from different environments (policy, business, academia, etc) are discovering and producing information about potential new activities, identifying potential opportunities that emerge through this interaction, while policymakers assess outcomes and ways to facilitate the realisation of this potential*.[6]

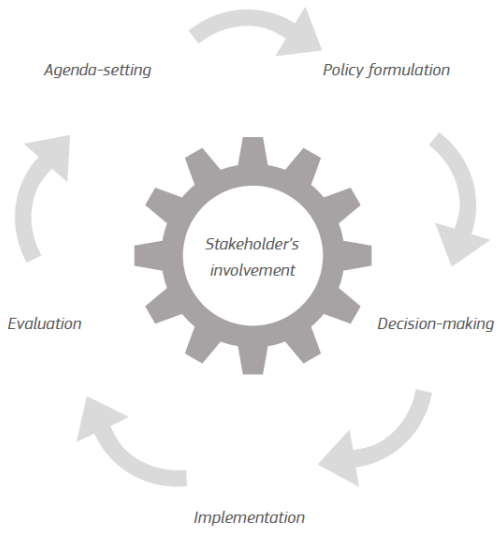


Figure 16. The cycle of EDP Source: Implementing Smart Specialisation Strategies a Handbook

The EDP is dynamic and cyclical in nature and should not be done only as an administrative exercise: Once defined, strategies are deployed, evaluated and modified throughout the new contracting period. The process starts with the joint identification of priorities, followed by the co-development of transformation roadmaps for the priority areas and their implementation. Regular monitoring of the activities and programmes followed by an evaluation of their impact is an essential feedback loop, to include developments in the smart specialisation areas and take into account the changes in the regional innovation ecosystem. In this sense, the process should be iterative, highlighting the need to reflect on the priority areas after an interval of time and update them to align with the changing market dynamics and regional ecosystem conditions.

[6] https://s3platform.jrc.ec.europa.eu/entrepreneurial-discovery-edp#:~:text=The%20EDP%20is%20an%20inclusive,this%20interaction%2C%20while%20policymakers%20assess

Building on the earlier analysis of the Welsh business innovation landscape, and considering the identified place-based system failures hindering innovation in Wales, the gaps in the business support structure and potential constraints to policy delivery capacity, **the following recommendations seek to provide guidance to the Welsh Government on the key aspects of smart specialisation for the successful adoption of place-based innovation and multi-level governance in the business innovation support landscape at the regional and sub-regional levels.**

4.1 More targeted innovation support and policies towards region-specific innovation capabilities

The smart specialisation approach calls for the accurate identification and further development of activities that can effectively transform the existing territorial economic structures through R&D and innovation. **The goal is to leverage the distinctive strengths and potentials of the regional innovation ecosystems by concentrating resources and targeted support in these high-potential activities**, in order to achieve key policy objectives such as increased productivity, employment, and ultimately inclusive growth.

In an effort to pursue 'Prosperity for All', the Welsh Government focused on establishing an inclusive and all-encompassing business innovation support structure Wales-wide. However, this has led to a combination of generic policies and innovation support that has been criticised for being 'spread out too thin' by some Welsh stakeholders, in view of the limited impact it has had in terms of increasing overall innovation performance as a result. Not all innovation problems in all sectors and regions can be tackled at the same time, nor can all socio-economic challenges be addressed with a single innovation strategy.

While the S3 approach calls for resource mobilisation and targeted support in high-potential areas, it also stresses the need to base the strategy on the incremental development of firm-level innovation capabilities to achieve a competitive technological frontier in these areas. While external factors such as competition or the cost of doing business are critical to encouraging innovation, the ability of firms to innovate ultimately depends on their capabilities to implement innovation projects successfully (Cirera, Frias, Hill, & Yanchao, 2020). These capabilities range from basic organisational skills and production techniques to more sophisticated managerial practices and technological and innovation capabilities, such as market intelligence, IP management, open innovation, and human capital building. Hence, there is a need for the accumulation of capabilities across several of these dimensions as firms increase the sophistication of their innovation activities.

This provides a more grounded and systematic approach on which to base the effective design and combination of policy and support for innovation, i.e., according to the stage of development of the innovation capabilities of the local firms. For each region and sector, innovation capabilities differ significantly between firms, so there is no single policy mix that can effectively work for all. **This presents both a policy challenge and a strong case for a more regional approach to innovation policymaking, given the need to address regional disparities and prioritise policies for each region accordingly.**

The Cardiff Capital Region City Deal is adopting a smart Specialisation approach for focusing on 5 key priority areas for Cardiff Region. Additionally, the WG Innovation Team is trialling a targeted approach via the Valley Taskforce Initiative in SE Wales. These pilots could provide valuable lessons for developing a pan-Wales Smart Specialisation Approach.

The Capabilities Escalator: Prioritising Policies for Each Region

Getting the right combination of policies and business innovation support means addressing the diverse regional contexts and conditions that influence innovation in Wales and lead to varying levels of innovation capabilities among local firms and industries. The Capabilities Escalator Framework can be a useful, foreword thinking tool to support the selection of the right set of policy instruments that are more appropriate based on the stage of the innovation capabilities of local firms.

The Capabilities Escalator suggests ways to deal with regional disparities by focusing on changing the intensities of policy support as firms accumulate capabilities and increase the sophistication of their innovation activities. This progression facilitated by the framework represents the process of catching up in terms of the firms' overall innovation performance and thus productivity within a region, which in turn can underpin inclusive growth objectives significantly.

The Capabilities Escalator outlines three main stages based on profiles representing the most prevalent characteristics and influencing factors of the region's innovation ecosystem, such as firm absorptive capacity, knowledge generation and collaboration capacity, entrepreneurship conditions, and critical resources and infrastructure, in order to guide the design of the policy mix. While any Welsh region may of course have firms at different capability stages, the framework facilitates a more nuanced approach to sequencing the mix of innovation policy instruments that best suits the local context. The three stages are:

- **Stage 1:** Companies accumulate primarily production and management capabilities to better manage basic innovation processes and technologies.
- **Stage 2:** Companies accumulate technological capabilities that allow them to introduce new processes and more sophisticated products.
- **Stage 3:** Companies expand on capabilities built in Stage 2 and replicate sophisticated innovation, eventually generating products and products that are new inventions.

Source: Cirera and Maloney 2017.

Source: (Cirera, Frias, Hill, & Yanchao, 2020)

Key messages:

- **Differentiating the Innovation Strategy from the Economic Strategy** by focussing on sectors with significant innovation potential and **offering targeted and tailored support** to foster and accelerate innovation in these areas.
- Establishing **what Innovation means for Wales** together with the local stakeholders and working towards inculcating an **Innovation culture** in Wales across the public and private sector.
- Adopting **innovative policymaking**: accumulating knowledge and competencies across government agencies, while improving policy learning, to gradually implement more complex policies.

4.2 Adopting both an evidence-based and agile approach

The Innovation Strategy, built on S3 principles, needs to be based on a sound analysis of the regional economy, society, and innovation structure, aiming at assessing both existing assets and prospects for future development. The common principle that is central to such analyses is the adoption of a wide view of innovation that spans across economic activities and involves many sectors of the civic society. The priority setting for regional smart specialisation should consist of the identification of a limited number of innovation and knowledge-based development priorities in line with existing or potential sectors for smart specialisation. While Wales does not yet have unique strengths with significant critical mass to have specific smart specialisation areas, innovative policy mechanisms have the potential to foster the development of such strengths.

Key messages:

- Conducting an **evidence-based analysis** of the existing assets, innovation and economic strengths and prospects for future development on a sub-regional level[7].
- Prioritising and facilitating the incremental process of **learning and accumulating innovation capabilities** within key sectors
- Building a sound **monitoring and evaluation** system to facilitate continuous and **impact-driven** decision-making and policy learning.
- Adopting an **iterative and incremental approach**, by closely monitoring the KPIs and impact of the policy support and **reprioritise and re-focus** at specific intervals based on the KPIs.

[7] The Cardiff Region and Mid Wales have both conducted this analysis to identify areas of strength.

4.3 Putting businesses at the centre and forefront by enabling entrepreneurial discovery

The concept of Entrepreneurial Discovery builds on the premise that the knowledge and insights need to accurately identify the most promising areas of specialisation in a region, as well as major place-based innovation bottlenecks, are fragmented and distributed across the local innovation ecosystem (businesses, research centres, universities, competitive clusters, hubs, etc.). As such, **the EDP requires a 'collaborative leadership' dynamic to be in place for regional stakeholders to find their way to work together, focusing on the search for consensus based on a shared understanding and vision of the region's future opportunities and capabilities, with the support from all levels of government**.

One of the most important roles of the public sector is to initiate and oversee the EDP by putting in place incentive actions, collaborative platforms and guiding structures that foster participation, transparency, independence, and integrated implementation. The role of these platforms is essential to ensure balance across competing interests and keep the dominance of particular industries, service providers, and lobbying in check.

With the evolving and increasingly fragmented innovation support offering in Wales, businesses and other stakeholders have been struggling with finding the right opportunities, mechanisms, or institutions to support them in their innovation endeavours, representing one of the major weaknesses of the Welsh business innovation support landscape. While the Welsh Government has been the main provider of business innovation support internally since the devolution of economic powers, the imperative now is to collaborate with all the other institutions and providers of innovation support to seek synergies and maximise the impact of policies and investments to help businesses innovate and grow. Putting businesses' innovation needs first will therefore be crucial for the successful implementation of these policies to drive inclusive economic growth.

> Businesses do not care about where the support comes from, but rather on how the support helps them to improve and expand their offerings! In the fastest possible way!

The EDP has proven effective in shaping the governance models of the regions, given the increasing need to enable collaborative leadership, with governance structures that encourage co-ownership and co-ordination of strategy development and implementation.

The S3 governance model should encourage co-ownership and sharing of the strategy enabling collaborative leadership. The S3 platform recommends multi-level governance (MLG) models further supported by the findings of the work on the COHES3ION project which is focused on the improvement of S3 governance through the integration of a regional element. **MLG encourages a move from the traditional top-down governance model to more network-like structures where-in hierarchies in decision-making are kept flexible enough to let each actor have a role and eventually take the lead in specific phases of the strategy, according to actors' characteristics, background, and capacities.**

Key messages:

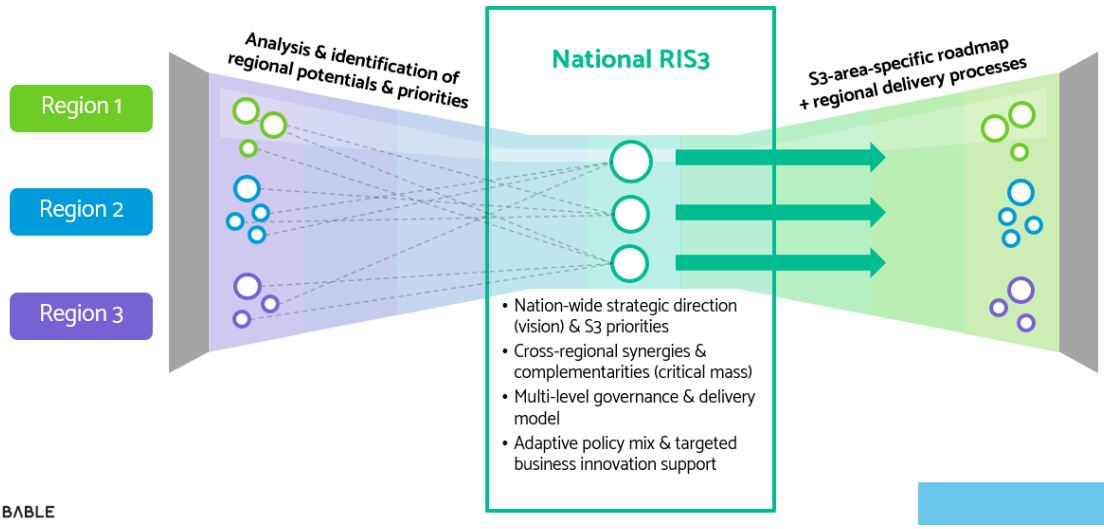
- WG should consider moving to an **'enabler' and 'facilitator' role**, responsible for supporting businesses in accessing the right kind of support, as quickly and as easily as possible. The WG Innovation Specialists could play a key role here.
- Adopting a collaborative '**multi-level governance approach'** by working together with the UK Government, local authorities, City and Growth Deals, Innovation networks, academia and most importantly the private sector.
- **Adopting the EDP approach** by working with the private sector, academia and innovation community to understand their needs and tailoring the support to fit the innovation needs of the local community.

Being conscious of the main joint ambition of improving the innovation performance of the businesses in Wales would be critical to achieving real success through the forthcoming Innovation Strategy while operating in a politically tense environment.

4.4 Adopting an improved and reinforced multi-level governance for a co-ordinated regional delivery

While the EDP has proven to be effective in shaping governance models in regions by involving key stakeholders in the development and implementation of their smart specialisation strategies, the EDP does not necessarily guarantee the coordination needed to deliver the complex set of innovation policies among the regions. As the current business innovation support landscape in Wales is fragmented, given the various institutions with different incentives and objectives, there is intense competition for public resources and beneficiaries as a result. **The Welsh Government should therefore take on an additional role as an "orchestrator" to bring coherence to activities and ensure coordination across all institutions and stakeholders at all levels, aiming at maximising the combined impact of multiple efforts and policies**. While the presence of several actors for business support makes this a challenging task, the stakeholder consultation highlighted the willingness of all actors to collaborate and work together. A mission-driven approach with a focus on improving Welsh Innovation performance is essential to facilitate collaboration.

This brings forward an important aspect of governance at the operational level related to policy implementation capabilities as well as arrangements to deliver the S3 roadmaps and action plans. Here, function matters more than form, i.e., it is not necessary to create new specialised innovation agencies to build the necessary capabilities for innovation programme design and delivery. Instead, **formal coordination arrangements, which are robust, transparent, efficient, and fair, are the surest way to effectively organise functions to advance innovation policies under several institutions and delivery organisations, further ensuring cohesion across regions**.



The implementation of these formal co-ordination arrangements not only provides the Welsh Government, as orchestrator, with a means of ensuring minimal overlap in the scope of programmes and initiatives across all levels of government. It also allows for the exploitation of 'hidden' synergies in terms of potential complementarities between different programmes, as well as significant network effects and critical mass arising from the coordination of regional assets and resources. For example, the active involvement of local and sub-regional authorities through the City and Growth Deal frameworks could lead to more effective coordination of targeted innovation support, taking advantage of the additional resources made available to them.

A more ambitious coordination effort would go beyond the operational level to a more strategic level that would include joint visioning and combined planning, the setting of shared objectives as well as regular monitoring and evaluation. In addition, such coordinated and collaborative arrangements can also benefit from policy learning and experimentation by establishing mechanisms for disseminating knowledge of best practices among actors.

Operational Model Alternatives for Efficient Business Innovation Support Delivery

How the business innovation support is delivered is a crucial component of stimulating innovation in Wales. There are three simplified models of delivering business support: the "one stop shop" model, the "no wrong door" model, and a mixture of the two.

1. **One Stop Shop:** The resources and methods available for innovation support are grouped under one institutional banner, e.g., all support available is presented on the Business Wales platform.[8]
2. **No Wrong Door:** Different actors coordinate their services to companies so that all companies are helped according to their specific needs. Each actor needs to be aware of other offers of institutional support and be ready to recommend the best one. This often leads to joint support by several organisations.

[8] The Business Connect initiative from Welsh Government was based on a "one stop shop" approach and worked successfully with the Welsh Development Agency, WG and LA's all collocated and working collaboratively.

3. **Blended Model:** The network of actors offering innovation support from the no wrong door model share a digital or physical space with institutional branding to improve accessibility of their services to companies.

Source: (Interreg Europe, 2020)

Key messages:

- **Assuming an additional role as an 'orchestrator'** to bring coherence to activities and ensure coordination at all levels of government, aiming at maximising the combined impact of multiple efforts and policies.
- **Leveraging the increased resources** available through the City and Growth Deal frameworks, to **tailor the innovation support** to the needs and requirements of the four sub-regions.
- The **gradual implementation of formal multi-level coordination arrangements**, from the basic operational level to a more strategic level, could lead to increased capabilities for effective regional delivery of business innovation support.
- **Blended operating models** could be a suitable alternative to bring together key stakeholders and institutions, by leveraging collaborative managed platforms and pooled resources.

Best Practice: DEV'UP- Blended Model Approach

In 2017 the region Centre–Val de Loire, France, aimed at overcoming the fragmentation of the regional business support structures and increasing their capacity to deliver highly professional and coordinated services, adjusted to the actual needs of businesses. The regional authorities decided to bundle the already existing regional innovation network serving innovative SMEs and the wider network of local economic developers under the roof of DEV'UP, the regional agency for innovation and economic development.

This implied both a widening of the scope and a significant increase in the size of the new network. The number of members of the regional economic development network rose from about 100 innovation specialists to about 350 persons (status 2019) with a large scope of expertise (innovation, export, business creation, intellectual property, investments, finances, etc.).

Rapidly it became clear that new approaches to the management and coordination of the new network were necessary in order to ensure good readability of "who does what", ensure a professional delivery of services, create a common identity throughout the different stakeholders, and build on the diversity of the members to generate added value for the SMEs of the region. One of the measures was the development of the ConnectUp portal.

4.5 Considering the key role of science parks, enterprise hubs and research and technology organisations

As described in the previous sections, all innovation actors play a key role in the S3 process. However, **Science, technology and business parks, as well as other enterprise and innovation hubs and research and technology organisations (RTOs), are essential stakeholders to be included in the S3 governance framework, given their particular contribution to key aspects of the smart specialisation approach**: their experience in stimulating and managing flows of knowledge and information between companies, researchers, entrepreneurs and technicians; their provision of an environment that enhances a culture of innovation, creativity and quality; their hands-on support in creating of new businesses via incubation and spin-off mechanisms, as well as in accelerating growth of small and medium-sized companies; their internal and external connections through networks that may extend beyond regional boundaries, facilitating cross-regional collaboration and internationalisation.

In addition, resident or member companies are generally specialised in very specific activities of several different sectors. This is why so many times, when these companies collaborate with others, new products, services or technologies appear through the combination of different activities and different sectors. **This process of cross-fertilization of activities and sectors (related diversity) is also one of the activities on the daily agenda of these actors and they can provide many insights on how they develop**.

Science parks have been present for over 60 years in many European regions, as well as in many regions of Great Britain, where the UK Science Park Association (UKSPA) has made an important contribution in supporting, promoting and representing the diverse and growing network of science parks and related innovation centres. However, Wales did not open its first science park until 2018, with the founding of the Menai Science Park (MS-Park) on the Isle of Anglesey by Bangor University. MS-Park has demonstrated to be a success story in Wales, especially considering its rural location and its strong role in establishing and nurturing the local innovation ecosystem and business community. Since then, more and more science parks have sprung up across Wales, totalling 7, if only UKSPA members are counted; whereas that number would be higher if all other types of innovation and enterprise centres were included.

This extended innovation infrastructure available in Wales presents a key mechanism for providing targeted support along the capability ladder for local innovation ecosystems and even reaching into more rural areas through 'spoke' programmes that extend these services to communities. In areas at the lower level of the escalator, different value-added services and access to technology

and clusters/networks can help in building both innovation and collaboration capabilities. Moving up the escalator, major weaknesses in technology generation and commercialisation can be tackled by providing direct links to university R&D and supporting the development of tech-intensive sectors through technology transfer and access to international networks for commercialisation. Similarly, science parks and enterprise hubs can be effective in addressing the low number of young innovative ventures in Wales, by facilitating the creation and growth of innovation-based companies through incubation and spin-off processes.

> *"In an ideal world [...] I would make use of the science parks now that we have them across Wales and challenge them to deliver that impact on innovation because they are right at the middle of industry, academia, and government programmes. They are really good vehicles that we have now in place. So, we have the infrastructure, and we have many ecosystems around the science parks, it's all about challenging them with a bit of extra resource"*
> – Managing Director at a Science Park

Best Practice: Joensuu Science Park (Finland)

The Joensuu Science Park has been established in 1990 and is part of the Finnish Centre of Expertise programme. It has specialised expertise in nanotechnology, future forestry industry, building technology and energy technology, in line with the region's main industry sectors (i.e., metal, wood and forestry). The main goal is to promote the commercialisation and use of research and new information in the business operations of companies. In addition, it supports companies in planning, developing, executing, and monitoring strategy-based development programmes, through an integrated package of services covering all aspects of innovation. This shows how different services can be targeted to support the development of innovation capabilities along the capabilities escalator.

Due to its central position in the knowledge-intensive economy of the region, the Science Park acts as an orchestrator of regional resources for the definition of a joint vision for growth and of a smart specialisation strategy. The science park was well placed to support the identification and stimulation of the intersection of technology domains and key sectors, at the same time the commitments to the implementation of the action plan. The strategic domains selected were: (1) Forest bioeconomy, (2) Technology and materials, (3) Creative industry and experiential content production.

Source: (JRC, 2014)

Best Practice: Brainport Eindhoven (Netherlands)

Brainport Eindhoven is a 'horizontal triple helix collaboration' partnership, since large companies and SMEs, knowledge institutes and governmental organisations collaborate at various levels in the Dutch region of Noord-Brabant. As a privately driven initiative, given that public government and public R&D investment have a minor role, Brainport fosters a large number of bottom-up initiatives and encourages the involved firms and/or knowledge institutes to take ownership.

One of the key actors in the Brainport region is the High-Tech Campus Eindhoven, which is the result of efforts by several collaborative partners promoting open innovation practices in and around the campus. The ambition was to develop the Eindhoven region as an internationally recognised technology region with the Campus as a central high-tech hub for the entire Dutch, German, and Belgian cross-border region. Brainport thus is a prime example of how a science and technology park can use its external connectivity as a strategic asset.

Source: (JRC, 2014)

Key messages:

- Wales's science parks and other business and innovation centres can play an important role as one of **the key 'quadruple helix' stakeholders** in the S3 governance structure.
- They represent **a readily available innovation infrastructure** to effectively implement policies and targeted support in response to different regional contexts and along the skills ladder.
- RTOs **strengthen regional innovation assets** and **root innovation within the region**, facilitating potential for spin-offs and leading to an increase in critical mass of companies.
- Science parks can actively and creatively co**ntribute to the design of innovation and smart specialisation strategies** by providing an adequate innovation ecosystem to **support the entrepreneurial discovery process**.
- They can be key in bringing the needed external and outward-looking dimension to smart specialisation strategies, by building on potential links with innovation networks across borders.

5 Conclusion & Next Steps

In order to inform the development of the Welsh Government Regional Action Plan (RAP) which is a key output of the COHES3ION project and support the forthcoming Wales Innovation Strategy from the perspective of the smart specialisation framework, this work has identified the current innovation dynamics across Wales, with the aim of mapping the existing innovation support landscape, as well as identifying gaps and barriers to innovation in Wales. Developed through a stakeholder co-creation process comprising of representatives from both the public and private sectors and informed by an in-depth analysis of the innovation ecosystem in Wales, the existing support mechanisms across the six stages of innovation, provided by the Welsh Government, UK Government, and the European Union, for Welsh companies have been highlighted.

Based on the stakeholder consultations performed, recurring themes for the gaps and barriers to innovation identified include lack of innovation culture or desire to change traditional methods; administrative barriers associated with accessing funds; the lack of risk-tolerant funds for ideating and scaling; the lack of support for ecosystem development (networks & collaborations between actors within Wales); the difficulty faced by businesses in determining the most suitable support mechanisms; the lack of physical infrastructures and digital connectivity, especially in rural areas; the need for more targeted funding as funds are usually spread too thin and have therefore had very minimal impact so far; and the multi-level governance barriers that account for the lack of cohesion and coordination in the overall innovation landscape in Wales.

To address these gaps and barriers, a more thorough analysis is therefore required to determine the root cause of the barriers, be it systemic or otherwise, with the aim of designing a more coordinated policy mix and ensuring its proper distribution and effective implementation across all six stages of innovation. As a start, some of the immediate next steps recommended include:

- Defining what innovation really means for Wales, through a co-creation and inclusive approach involving participants from different environments such as policy, business, academia, etc.
- Identifying activities and areas with high potential to effectively transform the existing economic structures through R&D and Innovation, and concentrating resources on their further development, to drive economic growth.
- Adopting a collaborative 'multi-level governance approach' by working together with the UK Government, local authorities, City and Growth Deals, and Innovation networks, to align support mechanisms and deploy policy instruments that encourage and inculcate an innovation culture across public and private actors across Wales.
- Building a sound monitoring and evaluation system by defining metrics that can be used to measure the impact of the various support instruments and implementing more impact-driven policies

In addition to the above, efforts should be made to address the more general gaps and barriers across the different sectors in Wales such as skills gap, access to talent, and digitalisation know-how to name a few. The deployment of horizontal strategies, alongside the more targeted smart specialisation approach, has the potential to strengthen the innovation ecosystem in Wales and bring about prosperity for all.

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