Cardiff University
Prifysgol Caerdydd

Welsh Economy Research Unit
Yr Uned Ymchwil i Economi Cymru

Superfast Broadband Business Exploitation Project

Horizon Scanning Report

SME Digital Maturity in Wales – Opportunities and challenges for the Welsh economic regions

20th December 2019

Undeb Ewropeaidd European Union
Llywodraeth Cymru Welsh Government
Cronfa Datblygu Rhanbarthol Ewrop
European Regional Development Fund

Table of contents

List of figures

List of tables

Summary

This report considers the current and future potential of digital technology adoption and use for the Welsh economic regions. The key findings can be summarised as follows:

- Wales economic regions are characterised by substantial sector, occupation, employment and business structure differences. This picture is reflected in uneven regional economic productivity.
- Analysis of the Digital Maturity Survey data shows that businesses in urban areas of the three regions tend to report higher rates of adoption of digital technologies enabled by broadband. These structural factors go some way to explaining the differences in the level and nature of digital technology adoption and use found in the regions.
- Findings from a Digital Maturity Index analyses business adoption and use of digital technologies, as well as their impact. This enables comparison between average business scores in each of the three regions, and more refined analysis of the factors that shape these scores. These results show that businesses in South East Wales (SEW) are, on average, more digitally mature than the other economic regions.
- While the sub regions share many challenges in terms of encouraging digital technology adoption and use (infrastructure availability, increasing levels of digital maturity, development and use of new digital products and services), several specific challenges are identified in the three regions.
    - In *SEW* the findings suggest the challenge is one of building on the comparatively high levels of digital maturity found in its businesses and supporting the development and adoption of higher end applications of technologies such as big data, AI, and robotics.
    - In Mid and *South West Wales (M&SWW)* the challenge is one of ensuring fixed and mobile digital infrastructure availability and access, and supporting sectorally focused approaches to digital maturity with a focus on modernising its business processes to enable businesses to overcome their remoteness to markets.
    - In *North Wales (NW),* like the M&SWW region, the challenges are one of improved digital infrastructure connectivity and raising average digital maturity in its businesses. Sectoral approaches, again, may enable its sectoral strengths in areas such as tourism and production to benefit from more strategic applications of digital technologies noted above.

The public sector also faces challenges in responding to the digital agenda, not least in ensuring services such as Business Wales continue to evolve and make effective use of digital technologies in its own delivery of business support. The challenges and opportunities noted in the report are not exclusively ones for public sector, alone, to address. Indeed, there may be opportunities to work with regional and national stakeholders in both the public and private sectors to address the challenges noted in this report. These findings suggest that digital technology adoption and use in the broadest sense has an important role to play in the Welsh Government's economic development activities.

1. Introduction

Cardiff Business School are collaborating with Welsh Government in the Superfast Broadband Business Support Programme, part-funded by European Regional Development Funds. As part of this project a regular series of Horizon Scanning reports are being produced to explore the potential for future social, economic and technological challenges and opportunities facing Small and Medium-sized Enterprises (SMEs) in Wales, and implications for public policy practice.

The focus of this paper is to examine SME digital maturity in Wales economic regions comprising: South East Wales (SEW), Mid and South West Wales (M&SWW) and North Wales (NW). These regions form part of the Welsh Government's Economic Action Plan, and reflect its focus on adopting a regional approach to economic development to reduce disparities and encourage growth (Welsh Government, 2018).

Findings from Cardiff Business School's project research have pointed to the uneven adoption and use of digital technologies across Wales' regions, sectors and business size groups (WERU, 2019). They have further highlighted the link between digital maturity and positive performance outputs (turnover, employment and innovation benefits). These results suggest that the challenges and opportunities facing SMEs in adopting and exploiting digital technologies are unlikely to be the same in each economic region and may require policy responses to digitalisation that reflect their different settings and capabilities.

This Horizon Scanning report seeks to address the current limitations of research on digitalisation of business in the economic regions, by drawing on data from the National Digital Maturity Survey for Wales, and evidence from the SME case studies to examine the current level of digitalisation in SMEs in the sub regions. It begins, however, by reviewing the socio-economic context facing the economic regions (Section 2) and how this may be shaping their potential to adopt and exploit digital technologies. It then goes on to review data on SME adoption and use of digital technologies in each of the three regions (Section 3). This is followed by analysis of regional digital maturity index data which explores digital maturity and its underlying factors (Section 4). The final section draws together the main results and draws out implications for public policy in the economic regions (Section 5).

The paper forms part of a series of Horizon Scanning reports which are available on the Cardiff Business School website: http://www.cardiff.ac.uk/superfast-broadband-project/horizon-scanning

The authors of this paper are Dylan Henderson, Laura Norris, Laura Reynolds, Neil Roche, Chen Xu.

2. The regional context

This chapter briefly introduces the Welsh Government Economic Regions before providing a selection of business and economic data at the economic region geography to provide background to the overall analysis.

2.1. Prosperity for All: Economic Action Plan and the Regional Model for Wales

The Welsh Government's *Economic Action Plan* to support delivery of Prosperity for All, the national strategy for Wales, was launched in December 2017. This Plan observes that each region in Wales possesses its own "distinctive opportunities and challenges" and sets out the introduction of a regionally focussed model of economic development. Chief Regional Officers of the economic regions are tasked with promoting "regional interests and issues to Welsh Government to tailor delivery on a broad range of issues".

The Economic Action Plan noted the success Government policy had in strengthening the underpinnings of the Welsh economy since devolution in 1999 citing, for example, more people in work than ever before and a record number of active businesses, but acknowledged the persistent issues of economic inactivity, relatively low productivity, and uneven distribution of growth and opportunity across regions. Additionally, the changing nature of work due to technological developments was identified as one of the important factors framing the context of the implementation of the Plan, along with fundamental challenges such as decarbonisation of the economy and the potential exit from the European Union.

To help tackle these issues, key elements of the Economic Action Plan were implemented in May 2018, including the development of a new relationship between Government and business to endeavour to drive inclusive growth and responsible business behaviours. This new *Economic Contract* focusses on improving how businesses are operating in the present by supporting improvements in health, skills and learning. Here, aspirations include optimising the potential of new and emerging technologies and highlighting the importance of collaboration- for instance in asking employers to commit to improving the general well-being and mental health of the workforce.

The Plan further outlines five *Calls to Action*, the aim of which are to better prepare businesses for the future, challenging Government and businesses to look at future investment through the contribution it will make to: innovation and entrepreneurship; research and development; exports and trade; high-quality employment and skills; and decarbonisation. Each of these Calls to Action is seen as a factor that can contribute to improving productivity in Wales. Financial support to businesses will be channelled through the *Economy Futures Fund*, which itself will be aligned to the Economic Contract and Calls to Action.

2.2. The Welsh Economic Regions

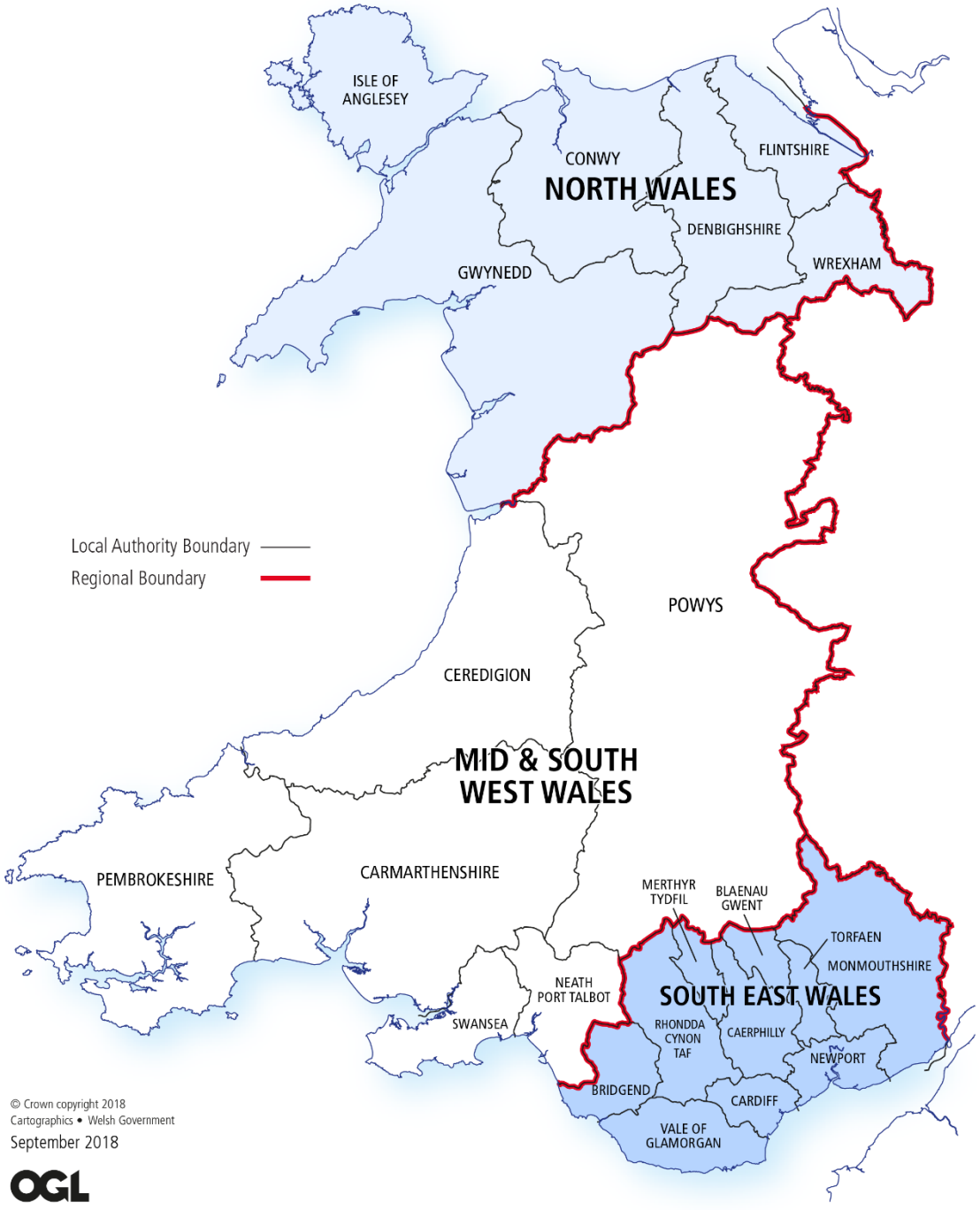
The regionally focussed model of economic development underpinning the Economic Action Plan aims to foster the individual strengths of each Welsh region to achieve growth in an inclusive way- "recognising and addressing the regional disparities in wealth and opportunity between different parts of Wales". As well as providing leadership, coordination, planning and alignment within the region, the Chief Regional Officers of the economic regions will develop and deliver regional business plans setting out priorities. These business plans will be created in partnership with local stakeholders and help channel the potential gains from City and Growth Deals, the Development Bank for Wales, and Regional Skills Partnerships.

The potential benefits of moving to a regionally focussed model of the economic development in Wales are described as being:

- joined up economic development planning;
- stronger local and regional supply chains;
- better integrated transport;
- strategic planning on a number of issues including land use to housing and skills;
- stronger complementary economic and cross border collaboration.

The three economic regions of Wales defined in the Welsh Government's Economic Action Plan are consistent with those used by the Regional Skills Partnerships, and the local government reform agenda. Figure 1 summarises the three economic regions in Wales and their respective local authority constituents.

Figure 1 Welsh economic regions



Broadband technologies will have a role to play in improving and maximising the benefits of Wales moving to a regional model of economic development. In order to identify factors where individual economic regions have a current relative disadvantage, and consequently where increased adoption and usage of broadband technologies might help improve prospects, a business and economic data profile of the three regions follows.

2.3. Data profile of the three economic regions

This section presents a brief examination of some the latest economic and business data available for the Welsh economic regions, along with all-Wales and UK/ GB data for context where appropriate. Although the scope of this analysis is to compare data at the Welsh economic region level, it should be remembered that disparities may exist within an economic region itself. An economic region as a whole may be doing relatively well on an economic indicator compared to the other economic regions, but might contain within it one, or a few, local authorities that are not performing so well.

Table 1 highlights the business structure in the three Welsh economic regions, showing the number of enterprises by industry. The data is taken from the Inter-Departmental Business Register (IDBR), Office for National Statistics, and additionally includes estimates for enterprises operating under the VAT threshold.

The sectoral breakdown of business is important as WERU research has indicated that different sectors in Wales vary in their adoption and use of broadband and superfast broadband enabled technologies (see Chapter 3).

Table 1 Welsh Economic Regions Business Structure, 2018 (% of Enterprises by Industry)

	North Wales	Mid and South West Wales	South East Wales
Agriculture	9.0%	12.9%	2.2%
Production	8.2%	6.9%	6.7%
Construction	16.8%	18.4%	18.8%
Wholesale, retail, transport, hotels, food & communication	23.3%	22.8%	23.5%
Financial and business services	20.9%	17.2%	23.1%
Private sector health and education	10.0%	10.2%	13.9%
Other services	11.7%	11.7%	11.8%
All	100.0%	100.0%	100.0%

Source: ONS, Inter-Departmental Business Register IDBR

Whereas NW has a relatively high proportion of enterprises in production sectors (8.2%), M&SWW has the highest proportion of enterprises in agriculture (12.9%). SEW has a relatively high proportion of enterprises in the Financial and business services sector (23.1%). Over the last few decades Wales as a whole has seen a relatively high level of employment in the non-market, and relatively low productive sectors of public administration, education and health. Business structure and employment link through to earnings and then to gross value added, an important measure of prosperity that will be looked at later in this section.

A measure of business density in a region can be found in the ONS statistics for active business enterprises per 10,000 of the population aged 16 to 64. As shown in Table 2, in 2018, NW had the highest figure at 572 enterprises per 10,000 people, as compared to the lowest of 530 in SEW. The latter region had experienced a 22.1% growth in the figure from 2014, outstripping the all Wales and all UK corresponding percentages. Factors influencing these figures include the relatively high number of large employers in the SEW as compared to elsewhere in the nation. Broadband enabled technologies can reduce the barriers to entry of setting up a new enterprise and can be a factor in increasing business density in a region (see Chapter 3).

Table 2 Active business enterprises per 10,000 of the population (aged 16 to 64), 2018

	Active business enterprises per 10,000 of the population aged 16 to 64, 2018	% change in active business enterprises per 10,000 of the population aged 16 to 64, 2014 to 2018
North Wales	572	+6.7%
Mid and South West Wales	560	+7.7%
South East Wales	530	+22.1%
Wales	548	+13.9%
UK	706	+13.5%

Source: ONS, Business Demography

Of particular interest, especially given the discussion on GVA per head figures alluded to earlier and explored in more depth later, is the employment rate. This is the number of people in employment of working age as a percentage of all people of working age. Table 3 shows ONS Annual Population Survey data by Welsh economic region and for the UK as a whole. The employment rate in the UK in the year ending June 2019 (75.5%), was higher than in any region of Wales.

This means that compared to the UK as a whole, relatively fewer people in Wales are in, or seeking, work. This difference in participation between the UK and the regions had narrowed between 2015 and 2019 in NW and SEW (by 0.9 of a percentage point and 1.9 percentage points respectively) but had widened in M&SWW (by 0.8 of a percentage point).

Table 3 Employment Rate, UK, Wales and Welsh Economic Regions, June 2019

	Employment rate year ending 30 June 2019	Percentage point change in Employment Rate 2015 to 2019
North Wales	74.9%	+3.5
Mid and South West Wales	71.4%	+1.8
South East Wales	73.5%	+4.5
Wales	73.2%	+3.5
UK	75.5%	+2.6

Source: ONS, Annual Population Survey

Underlying this participation (or activity) gap are such factors as higher levels of long-term sickness and early retirement, resulting largely from a scarcity of opportunities in certain areas. Average employment rates in Wales for the year ending 30 June 2019 were lowest in the local authorities of Ceredigion (66.8%), Swansea (68.3%) and Rhondda Cynon Taf (69.5%).

Table 4 shows the ILO unemployment[1] rate for Welsh economic regions (second column) and the percentage point change in the rate over the period 2015 to 2019 (third column). In historical terms the unemployment rates in Wales during 2019 have been relatively low with the nation succeeding in recent years in closing the unemployment gap with the rest of the UK. However, disparities still exist in some areas.

The SEW economic region had an unemployment rate of 4.5% in the year ending June 2019, 0.5 percentage points higher than the all UK rate (Table 4). Within SEW, the highest rates were found in Rhondda Cynon Taf (6.8%) and Merthyr Tydfil (5.6%).

Table 4 ILO Unemployment Rate and Economic Inactivity Rate, UK, Wales and Welsh Economic Regions, year ending June 2019

	ILO Unemployment rate, year ending 30 June 2019	Percentage point change in ILO Unemployment rate 2015 to 2019	Economic inactivity rate, year ending 30 June 2019	Percentage point change in Economic inactivity rate 2015 to 2019
North Wales	3.9%	-1.3	18.7%	-2.2
Mid and South West Wales	4.0%	-2.5	21.0%	-0.2
South East Wales	4.5%	-2.9	19.6%	-1.4
Wales	4.2%	-2.4	19.8%	-1.2
UK	4.0%	-1.7	17.4%	-1.1

Source: ONS, Annual Population Survey/ Local Labour Force Survey: Summary of economic activity

[1] This is the international definition of unemployment specified by the International Labour Organisation (ILO). This ILO definition defines unemployed people as being: without a job, have been actively seeking work in the past four weeks and are available to start work in the next two weeks; or out of work, have found a job and are waiting to start it in the next two weeks.

The fourth column of Table 4 shows the economic inactivity rate for Welsh economic regions for the year ending June 2019 (excluding students). The economically inactive are defined as those who are neither in employment or unemployed such as persons with a long-term sickness, retirees and people looking after family and home. The economic inactivity rate (working age) is the number of people who are economically inactive aged 16 to 64, expressed as a percentage of all working age people.

These figures give an indication of the extent of "hidden" unemployment existing within the areas. A higher rate of inactivity was found in M&SWW (21%) when compared to the other Welsh regions and the UK as a whole. The economic inactivity rate in NW had decreased by 2.2 percentage points between 2015 and 2019 to 18.7%, narrowing the gap to the UK figure which had decreased by 1.1 percentage point over the reference time period (shown in the fifth column of Table 4). Although SEW has a relatively low economic activity rate (19.6%) when compared to Wales as a whole (19.8%), the local authorities of Blaenau Gwent (23.8%) and Caerphilly (23.3%) fare relatively worse on the indicator.

In Wales a policy challenge of recent decades has been to halt the decline of incomes relative to the UK average. Wales' poor earnings performance coupled with low activity rates contributed in large measure to much of the region's qualification for European funding in the past. Table 5 shows ONS, Annual Survey of Hours and Earnings data on average gross weekly earnings in 2018, and the percentage change in gross weekly earnings from 2014 to 2018[2].

Average gross weekly earnings in Wales are around 90% of the UK average. Within Wales, average earnings are highest in the SEW economic region (£520), and lowest in NW - which also exhibited the lowest growth in average earnings in the reference period of 2014 to 2018.

[2] The values are the earnings values at the time (current prices) and have not been adjusted for inflation.

Table 5 Average (Median) Gross Weekly Earnings £s, All Full-Time Employees on Adult Rates 2018, workplace based

	Average gross weekly earnings 2018 (£s)	% change in average gross weekly earnings 2014 to 2018
North Wales	£498.8	+6.4%
Mid and South West Wales	£501.9	+9.1%
South East Wales	£520.0	+8.4%
Wales	£509.0	+7.4%
UK	£569.0	+9.8%

Source: ONS, Annual Survey of Hours and Earnings (ASHE)

The skills and qualifications of a workforce in a region give a broad indication of the potential people have to learn new skills to be ready for the digital age and engage in innovation. Qualification levels also link through to earnings potential and therefore have an impact on GVA. In Table 6, data from the ONS, Annual Population Survey for 2018 shows the percentage of the resident population, aged 16 to 64, of each economic region in Wales having a qualification equivalent to NVQ level 4 or greater[3] (column two). SEW is shown to have the highest proportion of residents attaining a qualification of NVQ4+ at 36.8%, with NW the lowest at 33.7%.

[3] This includes such qualifications as a HNC, HND, BTEC Professional award, Bachelor Degree, Certificate/ Diploma of Higher Education etc. (broadly, post-A/AS level qualifications).

Table 6 Qualifications GB, Wales and Welsh Economic Regions, January to December 2018

	% of resident population aged 16 to 64 with NVQ4+	% of resident population aged 16 to 64 with no qualifications
North Wales	33.7%	7.1%
Mid and South West Wales	34.3%	8.7%
South East Wales	36.8%	9.0%
Wales	35.4%	8.5%
GB	39.3%	7.8%

Source: ONS, Annual Population Survey (APS)

The third column of Table 6 shows the percentage of the resident population with no qualifications. Here, SEW had the highest proportion, at 9.0%, as compared to M&SWW (8.7%) and NW (7.1%). By local authority, the highest proportion with no qualifications were found in Blaenau Gwent (14.8%), Merthyr Tydfil (14.1%) and Neath Port Talbot (11.0%).

Table 7 uses data from the Labour Force Survey (year ending 30 June 2019) to calculate employment shares in each occupation category. In M&SWW, a relatively high proportion of people are employed in administrative, skilled and personal service occupations (35.2% of all jobs). A relatively high proportion of employment in SEW is found in managerial, professional and technical occupations (44.9%) for which the earnings potential is much higher.

Table 7 People in employment by area and occupation (SOC 2010), %, year ending 30 June 2019

	North Wales	Mid and West Wales	South East Wales
Managers and senior officials	10.7%	9.7%	9.3%
Professional occupations	16.9%	17.8%	20.3%
Associate professional and technical occupations	12.8%	11.9%	15.3%
Administrative and secretarial	8.5%	10.2%	9.4%
Skilled trades occupations	14.0%	14.1%	9.4%
Personal service occupations	10.9%	10.9%	10.1%
Sales and customer service occupations	7.5%	7.5%	8.6%
Process, plant and machine operatives	8.0%	6.6%	6.9%
Elementary occupations	10.7%	11.3%	10.7%
All	100.0%	100.0%	100.0%

Source: ONS, Labour Force Survey: Employment by occupation

Gross value added (GVA) is an indicator of the economic activity being undertaken in a region and is an important means of comparing the economic performance of one region with another. There are problems with conventional measures of economic progress such as GVA, particularly in its failure to accommodate key elements of welfare, but notwithstanding these problems, GVA continues to be the most important indicator of economic prosperity[4]. To make allowances for the different sized populations in the three Welsh economic regions, GVA data per head is used in the following short analysis.

[4] At the time of writing, data for GVA per hour worked, a measure of productivity, is not available at a local authority or economic region level.

Table 8 shows GVA per head in the Welsh economic regions in 2017, and the change in the indicator between 2013 and 2017. In the reference time period, GVA per head in Wales increased the most in NW, rising 13.4% to £20,753. M&SWW had a GVA per head figure of £17,616, just 65% of the UK average (£27,298).

The fact that GVA per head levels in Wales are relatively low compared to the UK average reflects many of the factors investigated above, such as lower average earnings, relatively high economic inactivity rates, as well as a relatively large number of employees in industries that are growing slowly at national and international levels.

Table 8 Regional Accounts (Output and Income) 2017

	GVA per head 2017	% change in GVA per head 2013 to 2017	GDHI per head 2017	% change in GDHI per head 2013 to 2017
North Wales	£20,753	+13.4%	£16,447	+6.7%
Mid and South West Wales	£17,616	+10.4%	£15,493	+4.7%
South East Wales	£20,863	+12.4%	£15,603	+6.3%
Wales	£19,899	+12.1%	£15,754	+5.9%
UK	£27,298	+12.9%	£19,514	+9.2%

Source: ONS, Regional Accounts

Disparities in GVA per head link through to differences between Wales and other regions in gross disposable household income (GDHI), also shown in Table 8 (the fourth and fifth columns). In 2017, household disposable income per head in Wales was lowest in the M&SWW region at £15,493 per head, around 21% below the average UK level (£19,514), and highest in NW at £16,447 per head. The difference between the regions of Wales and UK household income per head is smaller than that for GVA because social security and other transfer payments support a large number of Welsh households.

2.4. Summary

The above section has provided a sample of business and economic indicators to help identify issues that may have a particular resonance in the Welsh economic regions. These might be summarised as:

NW

- Proportion of working age population with qualifications at NVQ level 4+ below that of other economic regions of Wales.
- Average earnings levels relatively low.

M&SWW

- Relatively fewer people in the economic region are in, or seeking, work. Employment rate is lower than other economic regions in Wales, and Economic inactivity is relatively high i.e. those people who are neither in employment or unemployed such as persons with a long-term sickness, retirees and people looking after family and home.
- A relatively large proportion of workforce employed in lower paid occupations

SEW

- Unemployment rate is relatively high.
- Business density is below that found in other Welsh economic regions.
- SEW has a relatively large proportion of people of working age without any qualifications.

The next chapter presents research undertaken by the WERU team into how SMEs and other stakeholders in the Welsh economic regions may be able to utilise broadband and Superfast broadband enabled technologies to help address some of the above issues.

3. SME digital technology take-up & use in the Welsh economic regions

Building on the regional characterisations outlined in Section 2, this section combines WERU survey and case study data to identify regional differences in Welsh SMEs' access to and use of broadband and digital technologies.

3.1. Digital technology adoption and use: Descriptive statistics

Based on data obtained from WERU's annual Digital Maturity Survey (2017-2018), a trend towards greater adoption of broadband and superfast broadband across all regions is identified (Table 9). Across the sub-regions, the data points to the highest proportion of superfast broadband adoption in SEW, increasing from 41.2% of businesses reporting superfast adoption in 2017 to 63.6% in 2018. Similar increases in superfast adoption can be seen in M&SWW and NW, with the former increasing from 32.2 % of businesses surveyed in 2017 to 40.5% in 2018 and the latter from 40.5% up19.2 percent points to 59.7% in 2018. Further analysis of these results in the annual Economic Impact Report identifies the benefits associated with improvements to bandwidth, supporting both businesses and the region as a whole (WERU, 2019). Nonetheless, despite the increases across the regions, the disparity between adoption in SEW and M&SWW remains high (23.1 percentage points). These findings should be contrasted with the generally improved picture of superfast broadband availability across Wales and point to the ongoing challenge of improving take-up.

Table 9 Adoption of superfast broadband by region

	M&SWW%		NW %		SEW %	
	2017	2018	2017	2018	2017	2018
No broadband	3.1	*4.3*	5	*0.0*	1.5	*0.0*
Standard broadband	64.7	*55.2*	35.3	*51.5*	57.3	*36.4*
Superfast broadband	32.2	*40.5*	59.7	*48.5*	41.2	*63.6*

Alongside access to broadband, the mode of connection is important as it is likely to influence the confidence SMEs have in integrating digital applications into their business model. Table 10 shows that in 2018 SEW had the highest adoption levels of fixed broadband, whereas NW the highest adoption levels for mobile broadband. Comparing these regions, the varying adoption of fixed versus mobile broadband suggests that where fixed connection is not available SMEs are increasingly utilising mobile broadband to compensate. The varying adoption of broadband can influence the quantity and type of digital technologies the SMEs choose to use within the business, impacting the SMEs overall digital maturity (see Section 4). In particular, mobile broadband creates a number of limitations due to restrictions around the available data within the subscription period. Nonetheless, in recent years there have been significant improvements to mobile internet contracts, with improvements in data allowance reducing these limitations. Notably, in M&SWW where there is the highest percentage of SMEs who do not have access to broadband there is also the lowest level of mobile broadband connection, this points to potential geographical barriers to the provision and adoption of broadband infrastructure.

Table 10: Businesses primary broadband adoption type by region

How does your business primarily connect to broadband? (%)	M&SWW	NW	SEW	All
Don't have access to broadband	4.3	0.0	0.0	1.4
Fixed connection	86.8	91.2	93.5	90.9
Mobile Connection	3.8	7.0	5.2	5.2
Other	5.0	1.8	1.3	2.6

Table 11 details the percentage of SMEs surveyed in 2018 that are using cloud computing services, across the three sub-regions. Cloud computing is where the data service is available through the internet and can include a number of business functions, from accounts through to sales, promotions, communication and data storage. While the businesses in NW report the lowest use of a cloud computing service (77.5 percent), overall, the figures suggest that cloud computing is becoming an everyday necessity for Welsh businesses. Yet, disparities still exist across the regions. The variations and what they mean for the businesses' digital technology use is considered in-depth in Section 3.2.

Table 11: Use of Cloud Computing by Region (2018)

	Mid & South West Wales	North Wales	South East Wales	Total
Yes (%)	*83.3*	*77.5*	*87.0*	*83.6*

A further area of difference is in relation to the businesses' reported use of social media (including Twitter, Facebook, LinkedIn). While an average of 75.6 percent of businesses reported using social media in their business, variations can be seen across the three regions. Conversely to the other indicators, NW businesses report the highest social media use (81.4 percent) (Table 12), followed by SEW businesses at 75.3 percent. This may relate to the composition of businesses and industries across the different regions, with hospitality, tourism and retail businesses in NW using social media more frequently to promote their business and attract visitors. In contrast, in SEW there are more businesses and industries that operate within a business to business capacity, where social media is considered an optional extra as opposed to an essential part of the business model.

Table 12 Use of social media by region (2018)

	Mid & South West Wales	North Wales	South East Wales	Grand Total
Yes %	*71.9*	*81.4*	*75.3*	*75.6*

A further area of importance is the number of SMEs with intermediate or above ICT skills. The figures in Table 13 suggests that the overall number of Welsh SMEs with at least half of their employees with intermediate or above ICT skills is growing. Based on the survey data, and recognising that the sample of SMEs in 2017 and 2018 are not the same, it can be seen that M&SWW SMEs had the highest level of ICT skills in 2017, and that SEW has maintained a similar level of high skills with a particular growth in the mid-range percentiles in 2018. Whilst in some instances there has been a negative change in high-level IT skills reporting,. However, it is clear that in general, ICT skills are progressing with an increasing number of SMEs having employees with above average skills.

Table 13: SME employees with intermediate or above ICT skills by region

Percentage of businesses having at least half of their employees with intermediate or above ICT skills						
	Mid & South West Wales		North Wales		South East Wales	
	2017	*2018*	*2017*	*2018*	*2017*	*2018*
0	*2.2*	*2.1*	*2.7*	*3.4*	*3.9*	*3.2*

Percentage of businesses having at least half of their employees with intermediate or above ICT skills						
1-10%	*6.0*	*12.3*	*8.0*	*11.4*	*15.7*	*3.3*
11-25%	*1.9*	*5.0*	*3.9*	*11.2*	*8.6*	*4.1*
26-50%	*14.2*	*19.4*	*11.9*	*16.8*	*10.4*	*11.7*
51-75%	*17.5*	*12.4*	*23.3*	*14.4*	*11.0*	*25.8*
76-100%	*58.2*	*48.9*	*50.2*	*42.8*	*50.4*	*51.9*

3.2. SME case study findings by region

Building on the survey data detailed above, this section captures data from interviews with 36 case study businesses developed during the project to date. The case studies capture businesses from different industries across the three regions. The businesses range from micro businesses with only one full-time equivalent (FTE) to medium sized businesses with 135 FTEs. There are also some variations in number of interviews undertaken in each region, with the most interviews being undertaken in the SEW (15), in contrast to M&SWW (12) NW (9).

This section pinpoints themes developed from an analysis of the interviews, helping to identify the key issues assigned to a particular region and pinpoint variations across the regions. As such, the analysis is qualitative and thematic. Moreover, the rural-urban composition of the regions remains an important factor throughout the analysis (Henderson and Norris, 2019). Nonetheless, the rural-urban make-up of the region runs alongside a number of other considerations and should not be considered in isolation. Moreover, many of the themes are similar for the three regions. We examine these similarities and variations in their impact for the businesses within a given region. The following subsections will draw on these themes for each of the three economic regions:

SEW

The SMEs detailed a number of benefits related to the adoption of broadband-enabled digital technologies. From these benefits, three core themes are identified for SEW SMEs, namely the

- *Benefit of cloud computing enabling remote working,*
- *Improvements to efficiency*
- *Enhanced customer relationships*.

First, the benefits associated with cloud computing and in particular its impact on the ability to undertake remote working was considered to be a fundamental benefit for the businesses. In particular, the businesses focused on the flexibility that cloud storage introduced for employees and senior management. The flexibility means that staff are able to work remotely from the main office, whether it be onsite (for construction, for example), or at home or even between meetings. As such, the ability to store, share and retrieve data remotely meant that the location the work was undertaken was less important, while also removing the need to be based or return to a central office. In addition, businesses noted the benefits when operating across multiple offices, since all data is stored in the cloud making it simple to access when required from multiple sites. For SEW this degree of flexibility was essential, enabling workers to develop a work-life balance and allowing businesses to function across multiple sites.

The efficiency savings (time and spending) was noted by all of the SMEs in SEW. Savings range from modest estimates of a few hours in a working week to the equivalent of two to three FTE hours. Cost savings were also stark, with some businesses noting savings in the sum of £50,000 per annum. Despite the potential and realised benefits, the upfront initial investment was considered as a hurdle for a number of businesses, as well as the need to continually reinvest in the digital applications to ensure they remain up-to-date and relevant. Nonetheless, despite these hurdles the return on investment was highlighted, especially in terms of cost savings from time and process efficiencies. As such efficiencies were the most notable outcome for all the SMEs in the region. As digital developments continue, it is likely that these efficiency benefits will become more pronounced, especially where businesses fully integrate a digital model.

The progress in customer relationships achieved by SEW SMEs has multiple facets each relating to improvements in communication, both client facing and internal. For example, the introduction of customer relationship management (CRM) systems has helped to secure repeat business and ensure that information is disseminated to prospective and current clients. Moreover, collaboration has been significantly benefited by introducing digital communication tools, such as voice and video messaging (for example Skype), messaging applications (WhatsApp) and interactive digital whiteboards where information can be shared in real time between businesses and customers. These developments provide customers with an improved quality of service from SMEs while also allowing the SMEs to reduce their overheads through reducing travel needs. In addition, these communication tools can also allow for an interactive and personal experience, for example by using videos instead of emails to convey messages to clients. In tandem with the improved relationships with customers, the region's SMEs also noticed an improvement in communication within the business. This can be attributed to the ease of sharing data, and utilising technologies such as Skype and WhatsApp to communicate.

These benefits have iterative mechanisms, since utilising the digital technology acts as a catalyst to improve how the business functions leading to further improvements in other areas. Not least this has enabled SEW businesses to gain a competitive advantage, expand the business, and offer a mechanism to compete against larger businesses. This is an important development, particularly in industries that are dominated by larger national or international firms, such as those within software development and construction. SEW has a relatively high number of employees when compared to the rest of the country. In particular, as highlighted in Section 2, a higher number of employees hold associate professional and technical occupations and a significantly lower number hold skilled trades occupations. Whilst it is not possible to draw direct correlations, the case studies suggest that businesses within the professional and technical sectors are more able to take advantage of digitisation. This may favour SMEs within SEW, particularly until the skilled trades become increasingly digitised.

However, the extent that the businesses were able to maximise on the benefits of digitalisation was restricted by variations in the digital maturity of businesses along the supply chain. For example, a number of businesses noted that they were a part of supply chains that were a mix of digitised and non-digitised. In some cases, this enhanced digitalisation and associated expectation to implement digital tools encouraged greater uptake of digital technologies and made developments a necessity. In others the digitisation of their supply chain was considered beneficial to achieve further efficiencies and allow for syncing of digital technologies. This was particularly paramount in the construction industry (See Reynolds et al, 2019). Nonetheless, the process of digitisation was a gradual undertaking for many of these SMEs, and as a result of the nature of their business and the digitisation level of their supply chain, a mix of digital and non-digital processes remained important.

A further difference in relation to SEW was the link between improvements in digitisation and exports and development of an international client base. While the other regions discussed the benefits for extending the market regionally and nationally, SEW businesses made multiple mentions of extending the market internationally by using broadband enabled digital tools. Potentially since the region benefits from good levels of infrastructure connectivity (broadband and transportation), the focus on potential gain looked for alternative and more difficult to reach markets. This area offers a potentially fruitful avenue for SEW SMEs going forward, capitalising on the otherwise strong connectivity and using digital technologies to focus on the harder to reach international audiences.

A feature that could be developed further relates to using access to, and improvements in, digital technologies to support educating and upskilling employees. A number of online learning resources are easily accessible for businesses, including bespoke or generic online training videos, online resource depositories, and access to online mentors. Businesses in SEW noted intentions to utilise these resources more frequently, helping to support the career development of their employees and accessing relevant training materials to improve efficiencies in the operational processes. Moreover, there remain hurdles in terms of training staff to use the digital tools and ensuring staff feel confident accessing the benefits they can unlock. Digital training courses may provide a way to ease this transition through a cost and time efficient route.

M&SWW

SMEs in M&SWW also viewed one of the principal benefits of cloud functionalities to be the ability to work remotely. The emphasis here was on the potential use of cloud services to help to overcome sometimes substantial travel-to-work distances, particularly those restricted by the region's rural geography. However, SMEs from both rural and urban areas noted that the ability to work remotely also widens access to a pool of talent. This was viewed as providing great potential for improving business capacity and also the reduction of costs where particular software development functions could be carried out in a region with lower employment costs. This is particularly of note to regional development agencies as it poses a risk that SMEs will utilise digital technologies to recruit from outside the region. When coupled with the employment rate figures in Section 2, it can be seen that M&SWW have had a slower increase in employment than all other regions in Wales and that of the UK average. Furthermore, there is a high number of economically inactive persons in the region, so targeted training and facilitation of working-from-home could provide a great opportunity for these individuals. The flexibility introduced for employees was not particularly noted within this region, where the emphasis lay with overcoming spatial inequalities. This is a missed opportunity for many businesses, as digital technologies offer further training, development and remote working opportunities that might help to tackle some of the difficulties facing the region.

Cost and time reductions were viewed as an important element for the SMEs. Interestingly, SMEs from M&SWW were particularly aware of how digital technologies had allowed them to communicate and build relationships with other SMEs, undertaking collaborative activities as a result. Furthermore, the use of digital technologies for sales and promotion stood out for M&SWW SMEs. A number of the SMEs digitised as a result of the expectation of the supply chain; others outlined that employees needed training to upskill in line with the digitisation that took place. Of salience is again the assertion that online training can be particularly important as it allows employees greater and more flexible access to learning resources.

Some of the SMEs noted that it was necessary to future-proof their business by including digital technologies and that this would allow opportunities for the business to grow. Alongside this, SMEs advocated that their customer service offer had improved and that in some instances all relationships were maintained digitally through social media. A particularly interesting next step being undertaken by an SME is to develop an application that provides itemised costing for customers, allowing greater control of the bespoke process that they are undertaking with the SME.

M&SWW SMEs were cautious of the risk required in the initial investment or further investment due to the substantial changes that would need to be undertaken as a result. Indeed, one SME highlighted how their sales had grown significantly as a result of digital technologies achieving an international reach. As a result, the SME has needed to redesign its stock taking processes. Mobile broadband as a sole connection was noted, where one SME used mobile broadband at the main office but carried out more extensive uploads at home due to the fixed connection.

NW

In contrast to the other regions, in NW the SMEs particularly noted the use of digital technologies for sales and promotional purposes. For example, where the utilisation of CRM programmes allowed for targeted special offers for customers on the basis of revisits within a short timeframe or at a particular time of year. SMEs also highlighted that there was often an expectation of customers to be able to connect digitally or have access to WIFI when staying at the accommodation. Indeed, this was even a source of competitive advantage as a predominantly rural region NW has had more barriers in terms of the implementation of broadband infrastructure.

NW SMEs also noted that, as a result of the cost and time savings achieved, new jobs were created. The employment inactivity rate in NW has decreased significantly, narrowing the gap with the UK average. Again, linking to the rural-urban makeup of the region remote working was seen as enabling greater worker flexibility and reducing the distances travelled by employees in the course of their job.

Interestingly, this was the only region where particular concerns regarding data security and security of Internet connections was raised. Potential explanations for these pointers include the makeup of the industries that are traditionally less digitally mature (see Section 3.1) or because a number of newly established businesses are less familiar with digital integration and retain a level of caution surrounding its use. In addition, other explanations may include that many of the SMEs noted that a mixture of digital and non-digital processes was important and that the digital technologies performed more of a supporting role rather than central. Similarly, a few SMEs had been required to digitise and another was experiencing difficulties in encouraging its supply chain to digitise. Again, like M&SWW, NW SMEs highlighted the importance of mobile broadband to support their internet connection.

3.3. Summary

This subsection draws together the cross-comparisons across the three economic regions of Wales. A number of specific variations are highlighted in this analysis. For example, in M&SWW a key that that emerges is the benefits and hurdles of implementing broadband enabled digital technologies as a result of rural geography. In particular, businesses comment on importance of remote access to digital systems to support remote working and to widen the prospective employee base. Significantly, SMEs in M&SWW and NW also highlighted how this remote access could allow the business to widen their access to the talent pool, which links strongly to their ability to become more competitive. Conversely in SEW, commentary around this subject focused on employee flexibility with only one business noting the need to overcome spatial inequalities or related difficulties posed by rurality. To some extent these variations can be explained through the urban-rural divide in digital technology adoption and use. Nonetheless, it is an important consideration within regional development of digital technologies as those regions with a predominantly rural make-up can seek to harness digital technologies in a different way, maximising the potential benefits and overcoming spatial hurdles.

A further difference was the emphasis on data security for those in NW, alongside both NW and M&SWW raising issues around the benefits of utilising mobile broadband to support business functions. Again, these variations can be partially explained due to the geography and sector makeup of the regions. However, they also present different obstacles and potential benefits. As outlined previously, the data security emphasis may relate to a lack of confidence in fully applying digital technologies to less digitally mature industries. Moreover, the use of mobile broadband offers a potential supportive function for areas where adoption of alternative connections may be restricted.

Overall, WERU's survey and case-study data provides a helpful overview of the shared and specific opportunities and challenges faced by Welsh SMEs across the three economic-regions. A number of digital hurdles remain, including supporting the cost and time taken for investing in digital solutions. Moreover, while more businesses are integrating digital technologies that support the business models it remains less commonplace for digital technologies to be implemented across the business or in replacement of traditional practices. Nonetheless, overall many businesses are noting the current and future benefits of digital technologies and looking for new and creative ways to make digital changes to their traditional business offering.

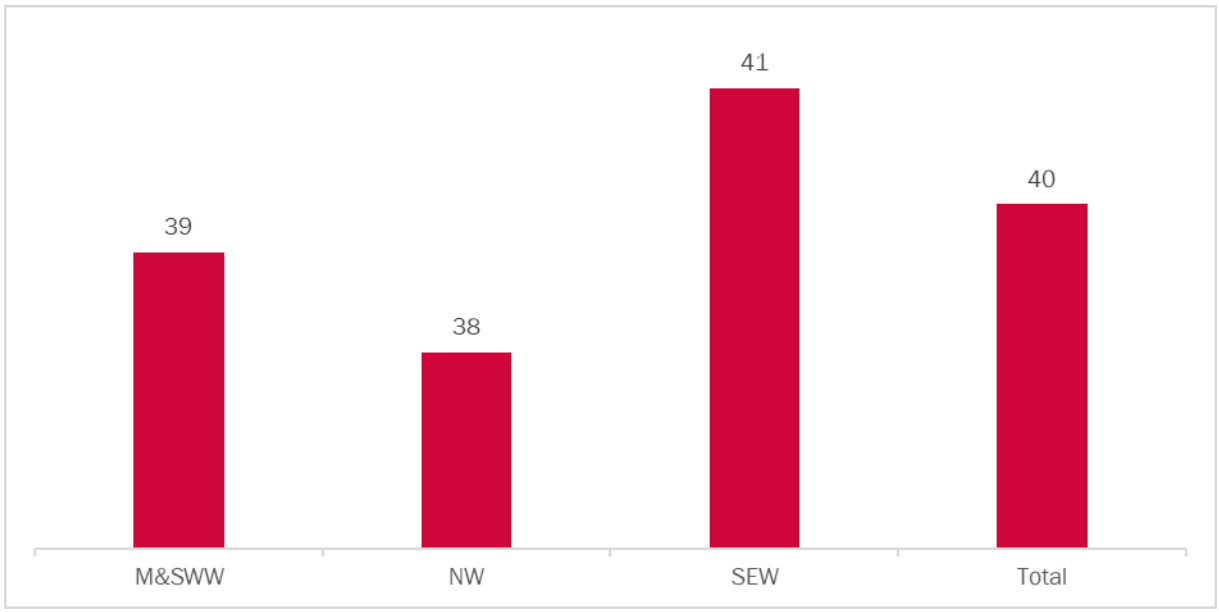
4. Digital maturity differences across the Welsh economic regions

In this section, the average digital maturity levels of the three economic regions: M&SWW, NW and SEW, are compared across different industries, five dimensions of digital maturity level, and specific digital technologies.

4.1. Average digital maturity scores by economic region

The DMI reflects the digital maturity level of SMEs by scoring the items from survey questions with a maximum score of 100. All the Yes/No items were coded as 1/0, items that refer to ranges were coded from 1 upwards in ascending order. Binary items were multiplied by a constant of 2 to calibrate the scale to a maximum of 2. The following Figures are based on DMS 2017-2019 except Figures 4, 5 and 6 on average number of Cloud Computing technologies per business, which is based on DMS 2019 because the number of advanced and foundational Cloud Computing technologies are only distinguished for DMS 2019.

Figure 2 Average Digital Maturity Index in the economic regions of Wales



Among the 1,445 businesses that have participated in the Digital Maturity Survey between 2017 and 2019, businesses located in SEW on average have the highest average DMI among the three economic regions- NW has the lowest average DMI per business. Average DMI in both NW and M&SWW are below the Wales average DMI as shown in Figure 2.

Figure 3 Average Digital Maturity Index by industry and economic region in Wales

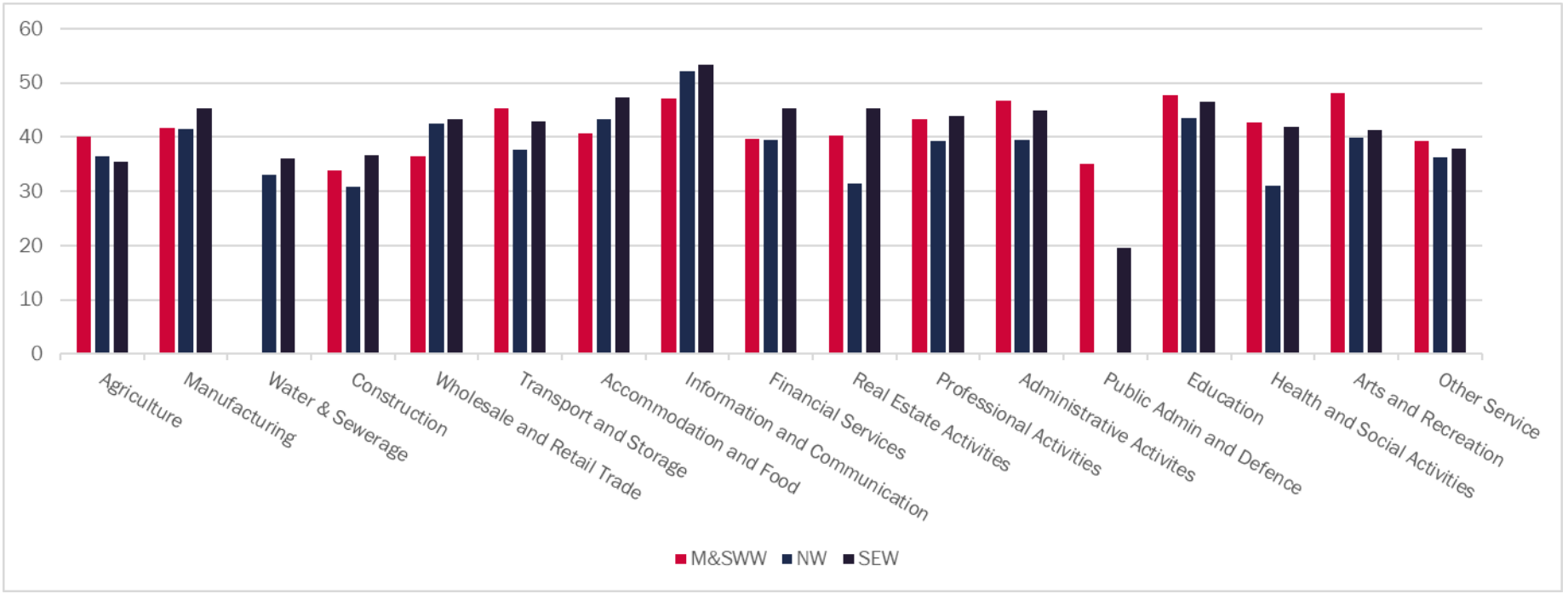


Figure 3 shows industry average DMI differences across the economic regions in Wales. SEW tops the average DMI among most of the industries in Wales, e.g. Information and Communication, Manufacturing, Real Estate Activities. Average DMI for M&SWW are higher than the other two subregions in the following five industries: Agriculture, Transport and Storage, Administration Activities, Education, Arts and Recreation. There were no sample businesses for Water & Sewerage in M&SWW and Public Admin and Defence in NW to compare.

4.2. Breakdown of Digital Maturity Index score by dimension

The DMI captures five dimensions of digital maturity as depicted in the conceptual framework in Table 14. Figures 4, 5 and 6 sum up the regional differences in adopting specific key technologies.

Table 14 Definiton and measurement of digital maturity dimensions

Digital maturity dimension	Definition	Measurement items
ICT infrastructure	Broadband adoption	• Access to broadband • Download speed • Upload speed
ICT investment	Business budget for ICT-related expenses	• Annual spending on hardware, software, network, broadband subscription • ICT-related staff training
ICT capabilities	Access to human ICT-related resources	• ICT human skills, both internal and external to the business. • ICT skills of internal staff are measured as the proportion of workforce with intermediate and above ICT skills • Access to additional ICT skills is measured according to whether SMEs employ ICT specialists and/or use external ICT support

Digital maturity dimension	Definition	Measurement items
Digital applications	Use of digital technologies	• Cloud applications for a variety of business functions • Website and its functionality • Social media and other broadband-enabled applications
E-commerce	Engage in online transactions	• Proportion of total sales serviced online • Proportion of purchases transacted online • Breadth of online channels for making e-sales and e-purchases

Figure 4 Average digital maturity score across 5 dimensions of Digital Maturity Index measurement

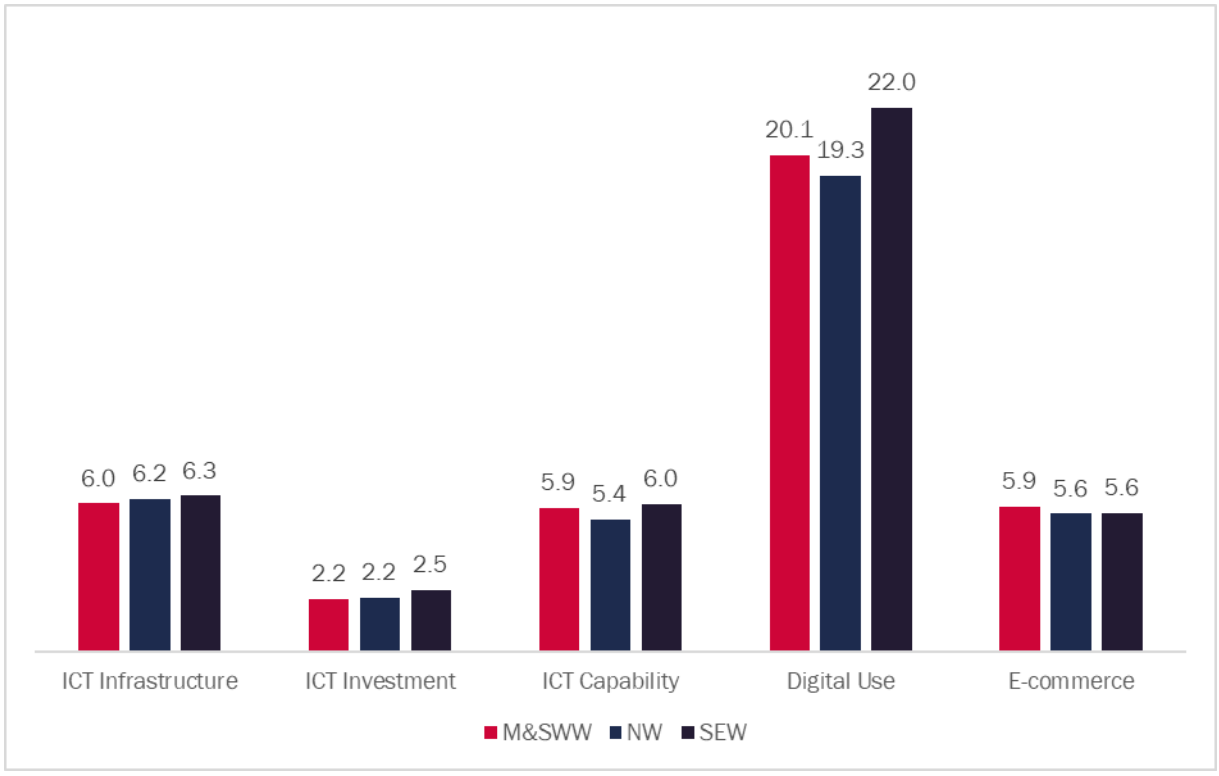


Figure 4 shows that SEW outperforms the other economic regions in terms of the average digital maturity score across all dimensions except E-commerce (where M&SWW achieved the highest average digital maturity score). SEW and M&SWW performs at about the same level (similar digital maturity score in E-commerce) in terms of adopting online transaction technologies.

Figure 5 Percentages of businesses using big data analysis

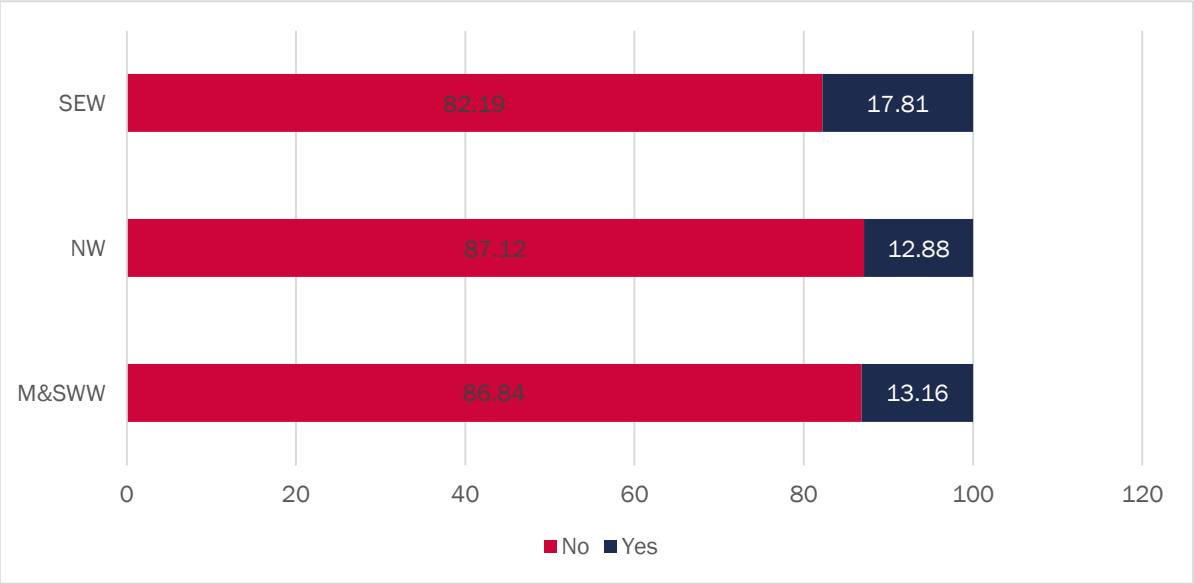
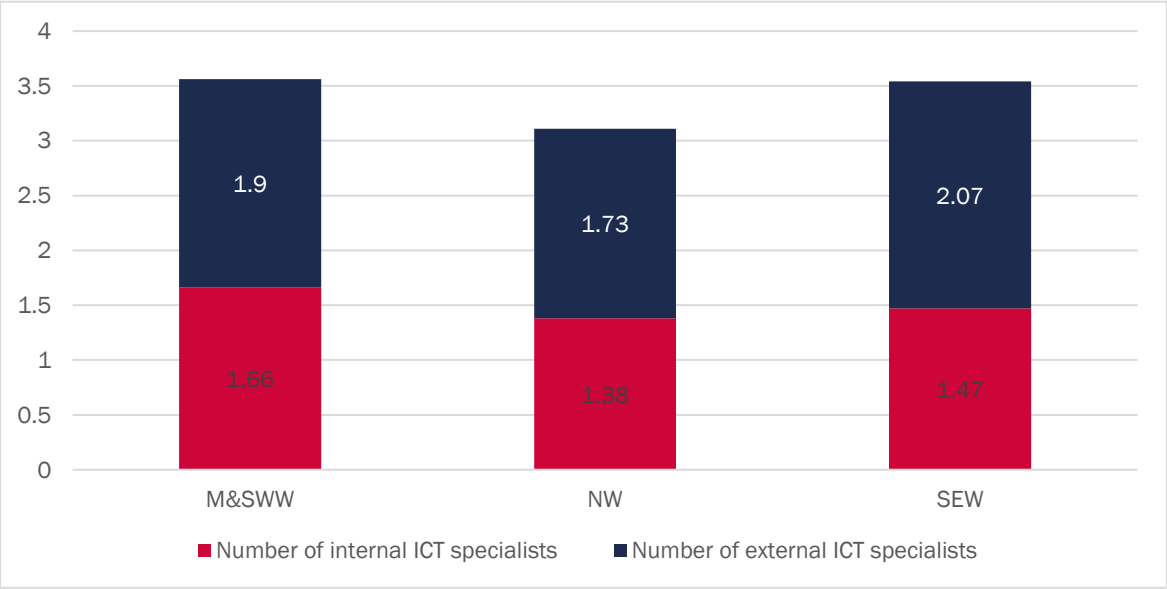


Figure 5 again shows that SEW is the economic region that has the largest percentage of businesses that apply big data analysis applications (17.81%). These findings suggest that SEW SMEs not only take up more digital technologies in general but also take up more advanced technologies, such as big data analysis.

Figure 6 The average number of functions where ICT specialists are used



Respondents to the Digital Maturity Survey were asked whether they employed any internal or external ICT support in five functions (these being: development of and support for web solutions; maintenance of ICT infrastructure; security and data protection; support for office software; and development of and support for business management software/ services). The average number of total functions ICT specialists are employed in per business, including both internal ICT specialists and external ICT specialists, are between 3.11 and 3.56. On average, businesses in SEW employ external ICT specialists in more functions than the other economic regions, whereas business in M&SWW employ internal ICT specialists in more business functions. In total, M&SWW businesses employ ICT specialists in a similar number of functions as SEW. NW employs ICT specialists in the least number of functions internal, external and overall number of ICT specialists among all three economic regions.

Figure 7 Average number of Cloud Computing technologies per business

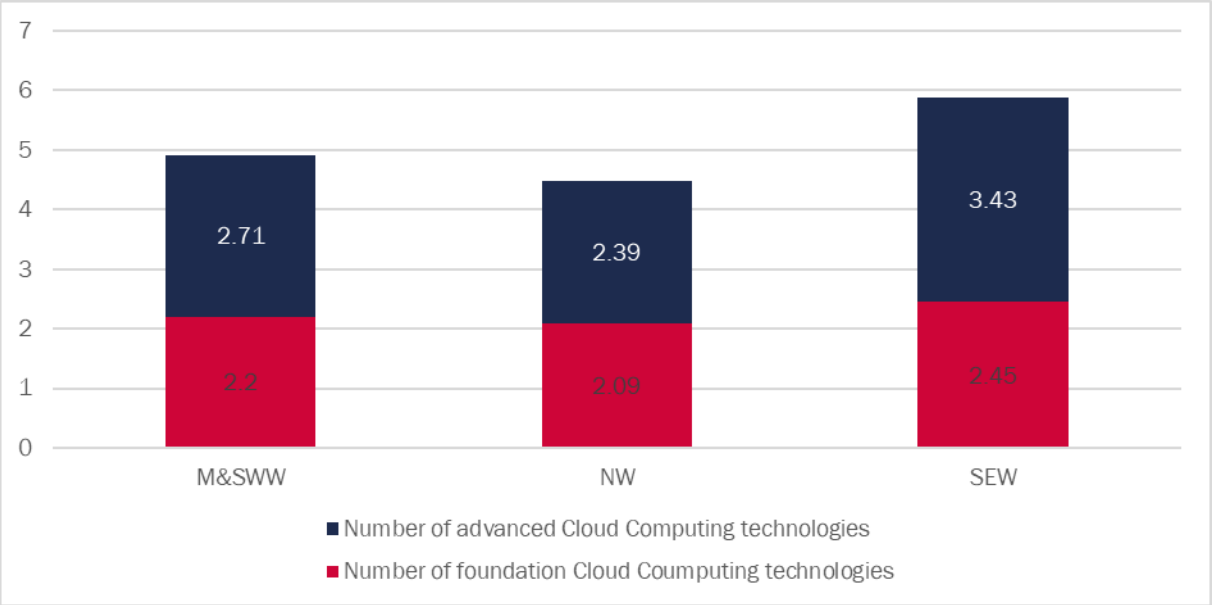


Figure 7 shows the average number of Cloud Computing technologies used by businesses in the three economic regions. SEW businesses again adopt most Cloud Computing technologies, M&SWW comes in second. SEW adopts slightly more foundational ones (for example, email, office software, file storage) than M&SWW and NW, but a significantly larger number of advanced Cloud Computing technologies than the rest of Wales.

4.3. Summary

In summary, among the 3 subregions of Wales, SEW has achieved the highest digital maturity level overall and across most of the industries, most of the digital maturity assessment dimensions. Its businesses not only adopt more broadband-enabled technologies in general, but also outperform the rest of Wales in terms of advanced technologies adoption such as big data analysis and advanced Cloud Computing technologies. M&SWW business score below SEW in most indicators, although it has the highest DMI in a small number of sectors such as Agricultural businesses, E-commerce technology take-up index, and average number of functions internal ICT specialists are employed in. However, in most of the cases, NW overall has the lowest DMI among the 3 subregions, including the number of example technologies adopted and functions ICT specialists are employed in.

5. Conclusion and implications for policy in the Welsh economic regions

The Welsh economic regions form part of the Welsh Government Economic Action Plan for Wales launched in 2017 and represents the focus for intervention in the coming years. This Horizon Scanning report seeks to examine the role that digital maturity may play in enabling economic progress to be made, and the ongoing economic development challenges addressed.

The socio-economic analysis (Chapter 2) points to disparities between the economic regions, many of which have their origins in both the historical development of the economic regions, which has tended to see the largest concentrations of economic activity in parts of SEW, but also the rural nature of much of Wales. This differing nature of economic activity in the economic regions, however, points to the importance of a place-based approach to addressing challenges and opportunities to economic development.

The digital maturity results (Chapter 3) show that businesses in each of the economic regions have begun to adopt digital technology, and have benefitted from public support to ensure that superfast broadband has been rolled out across the three regions. While this objective has largely been achieved in relation to fixed broadband, the results suggest there is an ongoing challenge for mobile broadband connectivity. The uneven deployment of such infrastructure technologies relates to the rural nature of parts of M&SWW and NW in particular. This chapter further points to the disparities of digital technology use in the economic regions, with case studies of SEW SMEs suggesting that they tending to be more advanced in their exploitation.

By developing a DMI for the economic regions the research shows the average scores for business digital maturity over the period 2017-2019 (Chapter 4). This supports the comparative digital maturity of SEW, relative to M&SWW and NW, and highlights the unevenness in sectoral digital maturity in Wales. Although businesses in the M&SWW region tend to score below the other regions on many indicators the results do show that in aspects of digital technology use it is comparatively strong in relation to e-commerce use. This may reflect the importance of online trading for business that are located in comparatively remote areas.

A key policy challenge will be to redress the sectoral variation in digital technology use across the economic regions. This will require support that is targeted at established and emerging sectors, responding to the specific challenges faced by particular regions. WERU's analysis suggests that *broad* themes will need to be considered for all regions, including ensuring that businesses have access to digital infrastructure, supporting innovative applications of new technologies, as well as supporting businesses to make use of digital technology applications:

Access to digital network infrastructure has been a strong focus of Welsh Government, through its Superfast Cymru / successor programmes. Challenges remain to ensure that mobile infrastructure availability catches up with fixed broadband coverage levels. Ensuring connectivity through technologies such as 5G and IoT represents further areas where future intervention may be required.

Encouraging digital innovation is a growing theme for all regions. Innovation, like digital technology adoption is known to be highly uneven, and typically concentrated in the most dynamic regional economies. The recent experimental approach adopted to support the foundational sector, however, shows how digital innovation can be supported in different types of sectors (beyond R&D intensive sectors).

In supporting digital technology use the results highlight the challenges of delivering support for business and sectors located in rural and remote areas. Here, greater use of digital delivery and online content for digital technology use may offer greater ways in future to reach such businesses, alongside more traditional face-to-face mechanisms. This is an area where the results suggest business needs are likely to go beyond foundational applications of digital technology, towards more advanced and strategic applications.

Business support services in Wales such as Business Wales also face an ongoing challenge of ensuring that its advisors keep up with the latest digital technological developments. Delivery of business support, in parallel, is an area where it is being challenged to make greater use of digital services, such as the provision of online information and support.

While the sub regions share many *broad* challenges in terms of encouraging digital technology adoption and use, a number of regional *specific* challenges can be identified as follows:

- *SEW:* The challenge here is one of building on the comparatively high levels of digital maturity found in its businesses and addressing pockets of passive adoption at the sub regional level. This may require action to ensure that digitally businesses are able to access the very highest speeds (fibre), and for the development and adoption support for higher end, more strategic applications of technologies such as big data, AI, and robotics.

- *M&SWW:* Here the challenge of digital infrastructure availability and access is likely to be greatest, including finding solutions for those premises still to connect to superfast broadband, and mobile connectivity. Supporting the use of digital technologies is a further ongoing challenge, with its businesses, on average, less digitally mature than in SEW. This may require sectorally focused approaches aimed at sectors to adopt new technologies (e.g. tourism and agriculture). This should be focused on enabling the region to retain its current strengths, while modernising its business processes to enable businesses to overcome their remoteness to markets.
- *NW:* Like the M&SWW region NW continues to face challenges in digital infrastructure connectivity and below average digital maturity in its businesses. This suggests an ongoing role for public support. Improved connectivity will enable the area to improve the efficiency of established businesses, but also attract new businesses seeking quality of life opportunities. There may also be opportunities for sectoral support – for example, production sector businesses in Wales may benefit from more strategic applications of digital technologies noted above.

References

Henderson, D. and Norris, R., 2019. Digital technologies and future opportunities for rural businesses and areas in Wales, Cardiff University, Cardiff.

Reynolds, L. and Henderson, D. and Roche, N., 2018. Digital technologies and future opportunities for the foundational economy in Wales, Superfast Broadband Business Exploitation Project Horizon Scanning report, Cardiff University, Cardiff.

Reynolds, L. and Henderson, D. and Roche, N., 2019. Digital Technologies and Future Opportunities for the Construction Industry in Wales, Superfast Broadband Business Exploitation Project Horizon Scanning report, Cardiff University, Cardiff.

Welsh Government, 2018. Prosperity for All: economic action plan.

WERU, 2019. Digital Maturity Economic impact report for Wales 2019. Cardiff University, Cardiff.

Cardiff Business School
Ysgol Busnes Caerdydd

Welsh Economy Research Unit

Cardiff Business School

Cardiff University,

Aberconway Building,

Colum Drive,

Cardiff CF10 3EU

For enquiries or to find out more please get in touch:

superfast@cardiff.ac.uk

http://www.cardiff.ac.uk/superfast-broadband-project/digital-maturity-survey

https://www.linkedin.com/company/welsh-economy-research-unit/

https://twitter.com/CUWERU