Assessing the impact of business broadband use on the Welsh economy

Dylan Henderson, Welsh Economy Research Unit (WERU), Cardiff Business School

Introduction

The Welsh economy, like that of most other nations, is undergoing a period of rapid transformation, with digital technologies playing an increasingly central role in both business and society. This is fundamentally affecting the ways in which businesses are operating, opening up the potential for improved business processes, new products and services, and access to new markets. Such technologies do not, however, affect all firms and geographical areas equally. The main evidence on broadband use comes from national and international research. This reports that a growing number of businesses in the UK have internet connections and are increasingly making use of ecommerce (ONS, 2016). Although IT-intensive businesses such as software companies, IT and business services, film and media are generally at the forefront of adopting and using the digital technologies that are enabled by broadband, such technologies are potentially relevant to all sectors and different business activities (Malecki and Moriset, 2008). Yet despite the importance of

these trends to businesses, surprisingly little is known about how they use it, and how it impacts on the wider Welsh economy.

To address the deficit in evidence on broadband impacts the Welsh Economy Research Unit (WERU) at Cardiff Business School is collaborating with the Welsh Government on a five-year project to conduct research on business use and exploitation of superfast broadband. This paper summarises the research programme and outlines the research progress to date. The paper is structured as follows. Section 2 explores the context for broadband and digital technology use in Wales, including the diffusion of broadband and the role of policies. This is followed by an overview of the research programme and framework adopted to measure impacts. The paper concludes by examining the next steps for the research.

The context for broadband in Wales: infrastructure, business adoption and public policy

Broadband adoption and use has become a high priority in

Wales, and reflected in Welsh Government strategies such as Digital Wales (Welsh Government, 2010). Within this context broadband has the potential to contribute towards increasing productivity in Wales by supporting SMEs to innovate and lever greater productivity gains. Broadband is also linked to societal benefits, as reflected in the recent moves at the UK level to establish a Universal Service Obligation for broadband access, set at 10 megabits per second (Mbps) by 2020 (Ofcom, 2016a).

Welsh Government's strategy for broadband has been delivered principally through its support for the roll-out of broadband to premises not covered by the private sector. Here the £425 million Superfast Cymru project, part-funded by the European Regional Development Fund (ERDF) through Welsh Government (launched in 2013), aimed to deliver high speed fibre broadband to 690,000 premises by the end of 2017 at speeds of at least 30 Mbps (645,000 had been achieved

by the end of March, 2017, Welsh Government (2017a)). This is designed to ensure that 96% of premises in Wales have access to superfast broadband (Welsh Audit Office, 2015). A contract for Superfast Cymru 2, addressing access for the remaining eligible premises is currently in the procurement process (Welsh Government, 2016). Figure 1 illustrates superfast fixed broadband coverage in the SME sector in Wales. This shows that SME coverage in Wales is below the UK average, but very similar to Scotland and Northern Ireland in 2016. Research also suggests that this access to broadband is particularly poor in rural areas, with seven out of 20 parliamentary constituencies with the slowest broadband speeds being in Wales

(British Infrastructure Group, 2017).

While access to broadband infrastructure is an important element in the development of firm and economy wide impacts, of equal, or potentially more, importance is the take-up and use of digital technologies by firms. Here, however, there have been claims that that take-up has been slow in areas served by Superfast Cymru, with lowest rates reported in rural counties (BBC News, 2016). To address the question of broadband use the Superfast Broadband Business Exploitation (SFBE) project, part-funded by ERDF through the Welsh Government, was created. This programme provides support to raising business awareness of digital technologies and their

benefits. The support is integrated into the primary enterprise support programme in Wales – Business Wales - and includes a combination of workshops and one-to-one advice.

More generally Welsh Government faces a number of policy limitations in ensuring full broadband coverage, take up and use. Here "telecommunications" and "internet services" are specified as exceptions to the devolved responsibilities of Welsh Government in the Government of Wales Act 2006 (National Assembly for Wales, 2013). Mobile broadband is an area of concern for policy, with coverage lowest amongst the devolved regions of the UK (Ofcom, 2016b). This desire for better coverage,

Figure 1: Superfast broadband SME coverage, 2015 - 2016
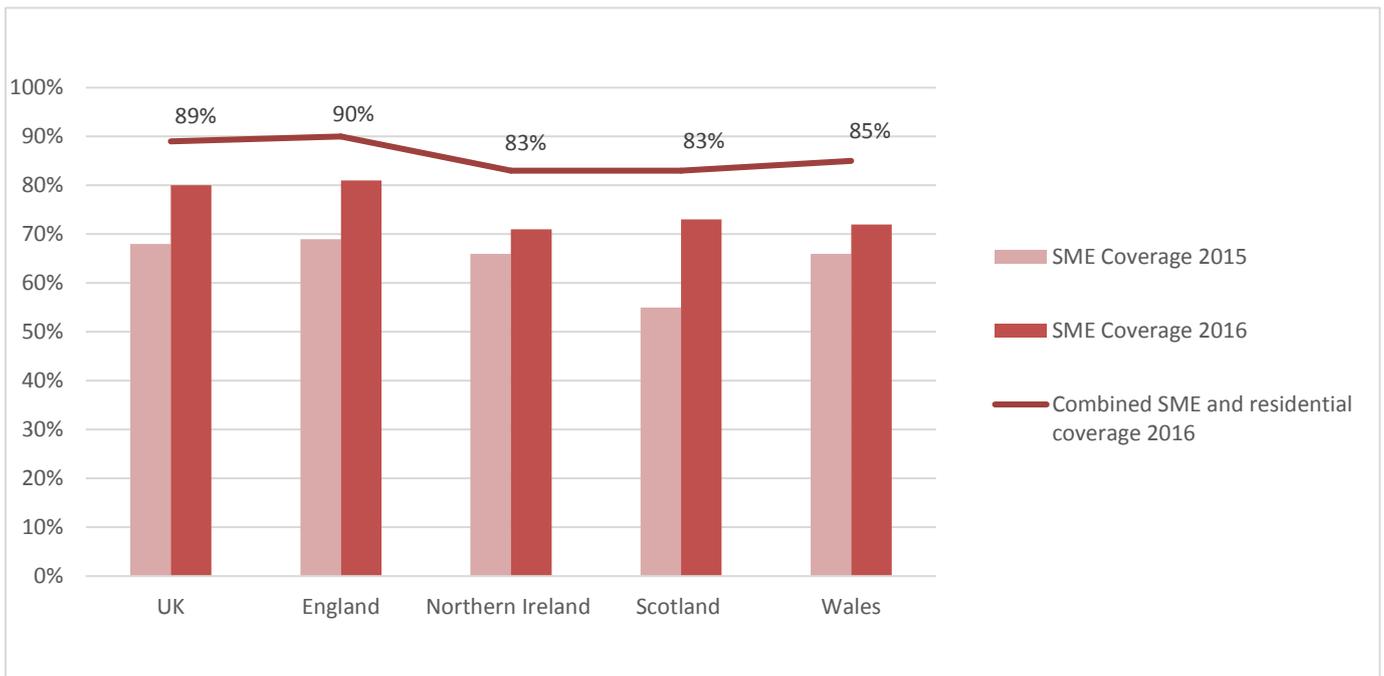
Source: Ofcom, 2016b

particularly in the remaining hard to reach areas, is the focus of the recently published Mobile Action Plan for Wales (Welsh Government, 2017b).

The Superfast Broadband Business Exploitation research project
Cardiff Business School is undertaking research in association with the SFBE project, over the period 2016-2020. This research is examining the economic impacts associated with business adoption and use of superfast broadband and enabled digital technologies.

Research programme
The research is structured around the following areas:

1. Digital maturity surveys – annual surveys of the use of digital technologies in Welsh SMEs and the associated business performance benefits gained.

2. Digital dashboard for Wales – draws together data from the digital maturity survey and secondary sources for policy makers in Welsh Government.

3. Economic impact report – annual reports on the economic impacts associated with firm benefits of using superfast broadband.

4. Case studies – detailed studies of firm-based experiences of digital technology use and associated benefits and challenges.

5. Horizon scanning – periodic reports examining technologies and future trends, and their implications for business and broadband policy in Wales.

The main objective of the research is to improve the understanding business adoption of superfast broadband and its role in competitiveness. To this end the research will provide evidence to inform policy makers in Wales, and provide outputs that are relevant to businesses in Wales. The research will also seek to make links with other researchers in this area, and contribute towards the development of a wider academic research network.

Developing the conceptual framework for examining broadband and business exploitation has been an important aspect of the early stages of the work programme. The following section examines this in more detail.

A framework for assessing broadband adoption, use and impacts on the Welsh economy
The broad framework adopted for researching impacts is set out in Figure 2. This framework has been developed from a review of existing studies on ICT impacts research and firm capacities, and is intended to reflect the development of digital maturity through broadband adoption, SME IT resources and usage of digital resources, and the subsequent firm performance and regional economic impacts. Several

Figure 2: From superfast broadband adoption to regional economic impacts – A conceptual framework.
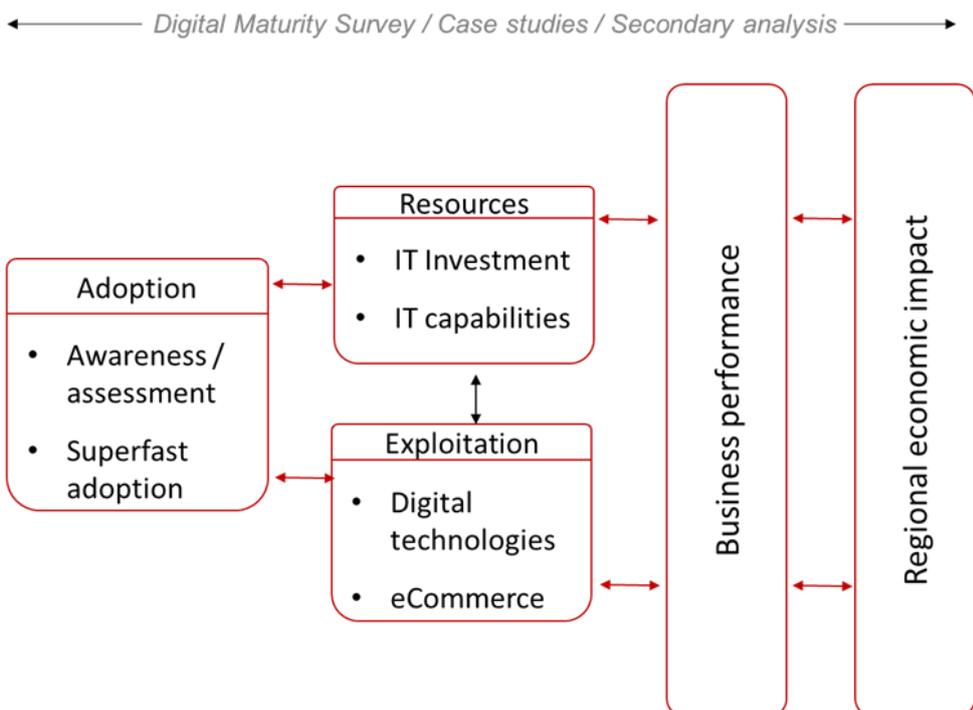
data collection methods are being used, including the Digital Maturity Survey and case studies. Similarly, the analysis will also draw on quantitative and qualitative techniques. This research framework is likely to evolve over the course of the research as results become available.

The initial broadband **adoption** decision represents an important stage for any firm wishing to exploit digital technologies. This is related to firms' ability to access superfast broadband, and requires there to be appropriate provision within a geographical area, at an affordable level (OECD, 2017). These factors can also shape a SME's location decisions, particularly where access, speed and services vary across geographical space (Grubesic and Mack, 2015).

Previous research (Martin and Matlay, 2001) has suggested that adoption decisions are shaped by a complex range of factors, including a firms':

- Perceived benefits of new technologies against those of existing technologies.
- Level of digital skills within the employee base.
- Presence of 'champions' to facilitate adoption and promote awareness, for example, the Chief Executive Officer.
- Pressure from external stakeholders, such as customers and suppliers, who wish to interact with the business using digital technologies.
- Context factors such as the regulatory and economic climate, shaping adoption and use.
- Size factors, with larger and growth-oriented SMEs likely to make greater use of ICT applications and functions.

The key 'adoption' themes that are considered in the research are (i) Superfast broadband adoption by SMEs in Wales, and (ii) awareness and assimilation of broadband by SMEs in Wales.

Digital **resources** have been identified as an important source of competitive advantage for SMEs. They include digital infrastructure (physical assets and software) and staff IT capability. These resources, as noted above, help to underpin a firm's ability to make productive use of the new technologies.

Digital infrastructure is increasingly enabled by the connectivity provided by superfast broadband, giving the potential to exchange information and communicate with customers, suppliers and stakeholders in new ways. In developing infrastructure, however, it is recognised that time and learning are required, as the purchase of infrastructure does not automatically convey competency on SMEs and their employees (Bharadwaj, 2000).

IT staff capability refers to the knowledge and skills of staff within a firm, and their ability to use and exploit digital technologies. The potential for firms to absorb new IT is dependent on prior experience and 'comfort' in using such technologies. While this capability may be linked to the presence of skilled IT staff (Ross et al., 1996), it is also embedded within the awareness and skills of the wider employee base. Indeed, in small SMEs this competency may be associated with a small number of individuals or the SME's owner.

The **exploitation** of broadband is based not only on SMEs adopting new technologies, but making use of them in their business processes. The scope of digital technologies in use has been a significant growth area in recent years, with the digital maturity of SMEs illustrated by the growing adoption of superfast broadband, and enabled technologies such as cloud computing (OECD, 2017).

ICT and broadband represent important enabling technologies. In this respect, they have the potential to

impact on **business performance** across a range of sectors and uses. These impacts have been studied in relation to profit, cost reduction, sales and productivity growth. They have also been identified in areas such as organisational capabilities and innovation (Gray, 2006), including new and improved products, processes and services (Zammuto et al., 2007), and new forms of communication with suppliers and partners (Corso et al., 2003).

There are a range of ways in which superfast broadband adoption and exploitation may be assumed to lead to business changes and hence **regional economic impacts**. The research will use a range of techniques to estimate some of these impacts. These include Input-Output analysis, which has the potential to provide detailed industry level estimates of the direct, indirect and induced-income impacts related to superfast broadband adoption and exploitation. The indirect and induced-income effects are related to supply chain impacts and to wage spending in an economy that arises from employees' income. This element of the research builds on WERU's long history of constructing the Input-Output tables which are used in the analysis

(See, for example, Jones, 2001; Pinto and Jones, 2012; Bryan et al., 2015).

Other techniques such as frontier analysis (business efficiency) are also being explored.

Economic impacts will be reported in terms of gross value-added (GVA), employment and business efficiency.

Emerging outputs from the research
In the early stages of research a number of outputs have been produced. These are:

- 2016 Digital Maturity survey report (WERU, 2016)
- 2017 Economic impact study (WERU, 2017)
- 19 case studies of SMEs in Wales
- Horizon scanning reports on Cloud computing (Henderson, 2017) and Business models (Norris, 2017).

This research provides evidence of firms adopting broadband, and making use of digital technologies. The findings indicate that firms using superfast broadband and digital technologies reported greater labour productivity and innovation rates. Significant spatial and
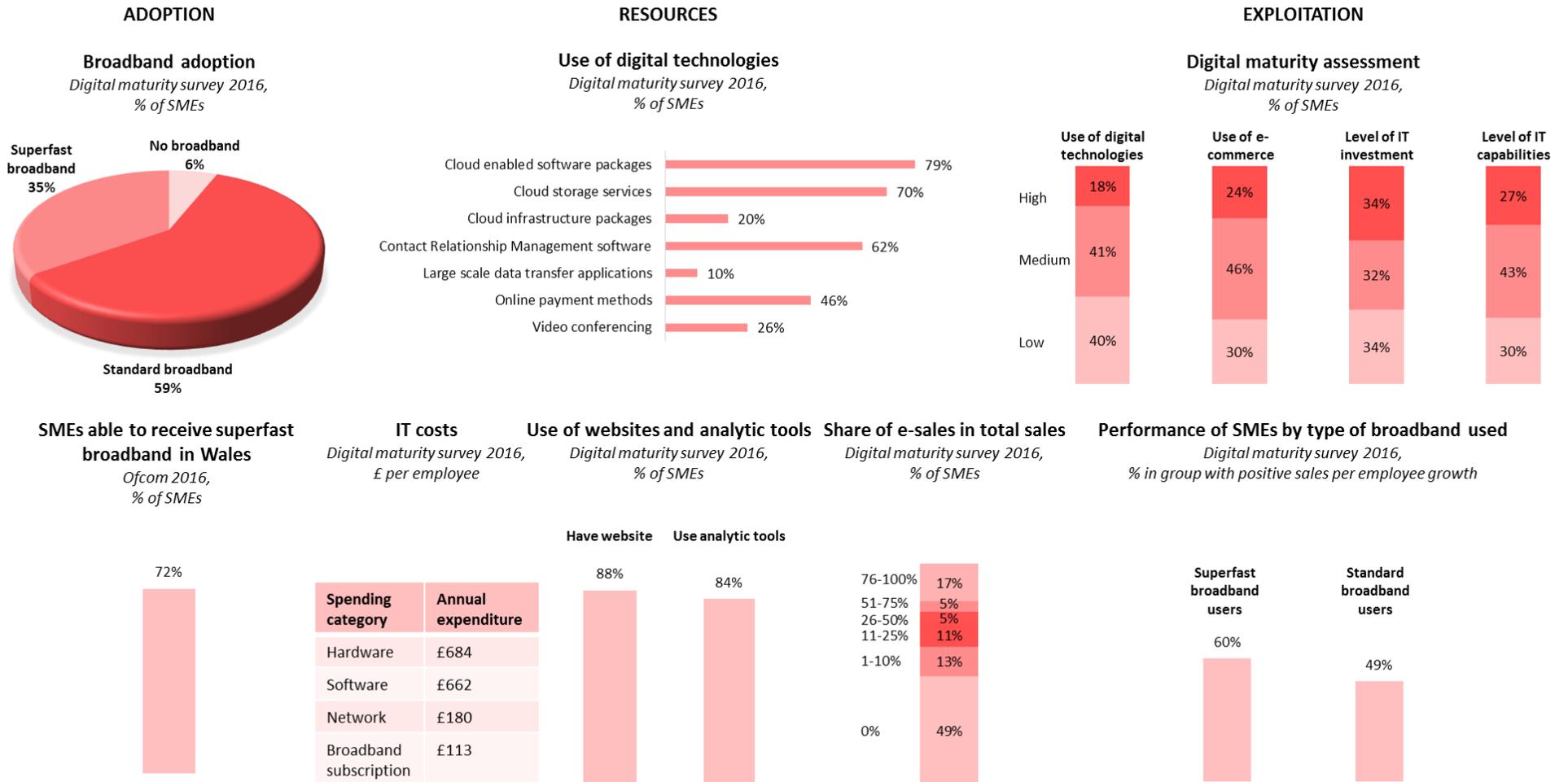
sectoral variations were, however, found in relation to sectors, firm size categories and geographical locations in Wales.

Space does not allow for the full exploration of these results, however all of these are available at the project website - http://www.cardiff.ac.uk/superfast-broadband-project. In the remaining years of the research programme the research team will be working to develop a longitudinal understanding of digital maturity, firm and regional economic impacts from superfast broadband.

An overview of key findings can be found in the digital dashboard (see Figure 3). This represents a policy output, and aims is to represent a snapshot overview of digital maturity for the sample of respondents in 2016, which will be monitored over time, whilst also providing some summary information from other (secondary) sources.

The first dashboard (2016) presents a static picture of digital maturity and business performance. In the coming years this dashboard will updated to show change data, as well as a greater number of comparisons against other regions.

Figure 3: Digital Dashboard for Wales 2016

ADOPTION

Broadband adoption
Digital maturity survey 2016,
% of SMEs

No broadband
6%

Superfast
broadband
35%

Standard broadband
59%

RESOURCES

Use of digital technologies
Digital maturity survey 2016,
% of SMEs

Cloud enabled software packages — 79%
Cloud storage services — 70%
Cloud infrastructure packages — 20%
Contact Relationship Management software — 62%
Large scale data transfer applications — 10%
Online payment methods — 46%
Video conferencing — 26%

EXPLOITATION

Digital maturity assessment
Digital maturity survey 2016,
% of SMEs

	Use of digital technologies	Use of e-commerce	Level of IT investment	Level of IT capabilities
High	18%	24%	34%	27%
Medium	41%	46%	32%	43%
Low	40%	30%	34%	30%

SMEs able to receive superfast broadband in Wales
Ofcom 2016,
% of SMEs

72%

IT costs
Digital maturity survey 2016,
£ per employee

Spending category	Annual expenditure
Hardware	£684
Software	£662
Network	£180
Broadband subscription	£113

Use of websites and analytic tools
Digital maturity survey 2016,
% of SMEs

Have website — 88%
Use analytic tools — 84%

Share of e-sales in total sales
Digital maturity survey 2016,
% of SMEs

76-100% — 17%
51-75% — 5%
26-50% — 5%
11-25% — 11%
1-10% — 13%
0% — 49%

Performance of SMEs by type of broadband used
Digital maturity survey 2016,
% in group with positive sales per employee growth

Superfast broadband users — 60%
Standard broadband users — 49%

Source: WERU (2016)

Conclusions

The shift towards digital technologies, and the associated development of high speed broadband infrastructure is one that is helping to transform economies and wider societies. Such developments are of particular importance to Wales given its comparatively weak levels of GVA (in relation to the rest of the UK and Europe). While there is still some way to go to achieving complete coverage of fixed and mobile broadband infrastructure the growing policy focus on broadband and its exploitation is now well established in Wales. This roll-out of superfast broadband is helping to address economic growth and is of increasing importance to research. The research programme has made a start in collecting detailed data on Wales. The next steps of the research programme will be to refine the research instruments, and work to secure more data relating to SMEs' use of superfast broadband, with the aim of providing further policy relevant data and research outputs.

Acknowledgement

References

BBC News (2016). *Superfast Cymru broadband scheme 'failed to deliver', say AMs*. http://www.bbc.co.uk/news/uk-wales-politics-37652514

Bharadwaj, A.S. (2000). A Resource-based perspective on information technology capability and business performance: An empirical investigation. *MIS Quarterly*, 24: 169-196. https://doi.org/10.2307/3250983

British Infrastructure Group (2017). *Broadband 2.0: The case for automatically compensating broadband customers.* A British Infrastructure Group report. http://www.britishinfrastructuregroup.uk/wp-content/uploads/2017/07/Broadbad-2.0-Final-2.pdf

Bryan, J., Evans, N., Jones, C. and Munday, M. (2015). Regional electricity generation and employment in UK regions. *Regional Studies*, 51:3, 414-425. https://doi.org/10.1080/00343404.2015.1101516

Corso, M., Martini, A., Pellegrini, L., et al. (2003). Technological and organizational tools for knowledge management: In search of configurations. *Small Business Economics*, 21: 397-408. https://doi.org/10.1023/A:1026123322900

Davies, J. (2017). *Digital infrastructure in Wales*. Ofcom Advisory Committee for Wales' consultation response to the National Assembly for Wales Economy, Infrastructure and Skills Committee inquiry into digital infrastructure in Wales. http://senedd.assembly.wales/documents/s57975/08%20Ofcom%20Cymru.pdf

Gray C. (2006). Absorptive capacity, knowledge management and innovation in entrepreneurial small SMEs. *International Journal of Entrepreneurial Behavior & Research*, 12: 345-360. https://doi.org/10.1108/13552550610710144

Grubesic, T.H. and Mack, E.A. (2015). Broadband Telecommunications and Regional Development, Abingdon (Oxon): Routledge.

Henderson, D. (2017). *The transformative potential of cloud technologies for SMEs in Wales*. http://www.cardiff.ac.uk/superfast-broadband-project/horizon-scanning

Jones, C., (2001). Mega-events and host region impacts: Determining the true worth of the 1999 Rugby World Cup. *International Journal of Tourism Research,* 3, 241-251. https://doi.org/10.1002/jtr.326

McGrath, R. (2013). The pace of technology adoption is speeding up. *Harvard Business Review*, 25. https://hbr.org/2013/11/the-pace-of-technology-adoption-is-speeding-up

Martin, L.M. and Matlay, H. (2001). "Blanket" approaches to promoting ICT in small SMEs: some lessons from the DTI ladder adoption model in the UK. *Internet research*, 11: 399-410. https://doi.org/10.1108/EUM0000000006118

National Assembly for Wales (2013). *Broadband internet in Wales*, Research paper. NAW, Cardiff. http://www.assembly.wales/Research%20Documents/Broadband%20internet%20in%20Wales%20-%20Research%20paper-02082013-248701/13-056-English.pdf

Negroponte, N. (1998). Beyond digital. *Wired* 6(12): 288. https://www.wired.com/1998/12/negroponte-55/

Norris, L. (2017). *The potential of business model digitisation for SMEs in Wales. A superfast broadband business exploitation project horizon scanning report*. http://www.cardiff.ac.uk/superfast-broadband-project/horizon-scanning

OECD (2017). *OECD Digital Economy Outlook 2017*, Paris: OECD Publishing. http://www.keepeek.com/Digital-Asset-Management/oecd/science-and-technology/oecd-digital-economy-outlook-2017_9789264276284-en#page138

Ofcom (2016a). *Designing the broadband universal service obligation - Final report to Government*. https://www.ofcom.org.uk/consultations-and-statements/category-1/broadband-uso

Ofcom (2016b). Connected nations report 2016. London: Ofcom. https://www.ofcom.org.uk/research-and-data/multi-sector-research/infrastructure-research/connected-nations-2016

ONS (2016). *E-commerce and ICT activity, 2015 Statistical Bulletin*. Newport: ONS. https://www.ons.gov.uk/businessindustryandtrade/itandinternetindustry/bulletins/ecommerceandictactivity/2015

Pinto, V. and Jones, C. (2012). The Economic Impact of Tata Steel in Wales. *Welsh Economic Review*, 23, pp. 20-32. https://wer.cardiffuniversitypress.org/13/volume/23/issue/0/

Ross J.W., Beath C.M. and Goodhue D.L. (1996). Develop long-term competitiveness through IT assets. *Sloan management review,* 38: 31. http://sloanreview.mit.edu/article/develop-longterm-competitiveness-through-it-assets/

Zammuto R.F., Griffith T.L., Majchrzak A., et al. (2007). Information technology and the changing fabric of organization. *Organization Science,* 18: 749-762. https://doi.org/10.1287/orsc.1070.0307

Wales Audit Office (2015). *Welsh Government investment in next generation broadband infrastructure.* Cardiff: Auditor General for Wales. https://www.audit.wales/system/files/publications/Broadband_2015_English.pdf

Welsh Government (2010). *Delivering a Digital Wales. The Welsh Assembly Government's Outline Framework for Action.* http://gov.wales/docs/det/publications/101208digitalwalesen.pdf

Welsh Government (2016). *Superfast 2 Cymru Wales*, Prior Information Notice. https://www.sell2wales.gov.wales/search/show/search_view.aspx?ID=DEC171500

Welsh Government (2017b). Tell us about your broadband needs. http://gov.wales/newsroom/science-and-technology/2017/170613-tell-us-about-your-broadband-needs/?lang=en

Welsh Government (2017b). *Mobile Action Plan.* http://gov.wales/topics/science-and-technology/digital/infrastructure/mobile-action-plan/?lang=en

WERU (2016). *Superfast Broadband Business Exploitation Project: Economic impact report.* Cardiff: Cardiff University.

WERU (2017a). *Superfast Broadband Business Exploitation Project: Economic impact report.* Cardiff University, Cardiff. http://www.cardiff.ac.uk/superfast-broadband-project/economic-impact-research

WERU (2017b). *Superfast Broadband Business Exploitation Project: Digital Maturity Survey Report 2017.* Cardiff University, Cardiff. http://www.cardiff.ac.uk/superfast-broadband-project/digital-maturity-survey