Remote rural home based businesses and digital inequalities: Understanding needs and expectations in a digitally underserved community

Lorna Philip[a,*], Fiona Williams[b,**]

[a] Geography and Environment, School of Geosciences, University of Aberdeen, Aberdeen, Scotland, UK
[b] Geography and International Development, University of Chester, Chester, UK

ABSTRACT

The digital economy offers home based micro-businesses in rural areas many advantages but stubborn social, economic and territorial digital divides continue to create challenges for this sector of the rural economy. Complex digital inequalities are illustrated in our case studies of the digital behaviour and Internet experiences of those running micro, home based businesses in a remote, digitally underserved rural community before, during and after the deployment of broadband technology. Findings draw attention to the role and importance of fit-for-purpose broadband in promoting digital inclusion for individuals, households and small, home based businesses: in a fast changing digital national and global economy remote rural home based micro-businesses are at risk of being left behind.

1. Introduction

Digital telecommunications have transformed contemporary society. Engagement in the digital society is widely assumed to be ubiquitous, yet amid a phenomenal pace of change stubborn social, economic and territorial divides remain between those who are digitally connected and those who are not. From a rural economic development perspective, advances in digital telecommunications have much to offer, yet "studies related to broadband and *rural* economic development are limited" (Whitacre et al., 2014, p1013). Literature does suggest, however, that broadband provides opportunities for rural businesses including, for example, supporting local income growth (Whitacre et al., 2014) opening up new markets (Huggins and Izushi, 2002) and helping to overcome friction of distance and other challenges associated with rural areas including "isolation from markets, relatively less networking and support provision and … the increasing profile of and competition from external web-based providers" (Galloway et al., 2011, p255). In the UK and elsewhere, many remote rural areas and the small businesses located therein are lagging behind in the digital race; at least in part due to inadequacies in telecommunications infrastructure. Territorial digital infrastructure divides compound other

more nuanced reasons for a lack of digital engagement. Complex combinations of personal attributes, for example, age, income levels, digital skills, and perceived benefits of Internet use, influence the ability of individuals, households and businesses to capitalise on the opportunities presented by the digital economy.

This paper reports findings from a study[1] that installed and trialled satellite broadband technology introduced to households in a remote, digitally underserved[2] rural community. We focus specifically on an inherently ethnographic study of three case study households all operating a small business from their home. Such home based businesses are an important component of the economy in remote rural areas yet, with few exceptions (e.g. Townsend et al., 2017), remain an underresearched group in respect of their digital engagement and behaviour. To help address this gap in the literature we report on the digital journeys of three of our case study households following the deployment of a broadband technology service and address two connected research questions: (i) what were the personal and business-related digital behaviour and Internet experiences of households who ran a home based business before, during and after their engagement in the project? and, concomitantly, (ii) with attention to both business and household contexts, did study participation have a longer term

---

influence upon the ways in which digital engagement became entwined with business practice? We contextualise Internet use within an understanding of the social context of the household and related business activity and we discuss the potential implications of these insights for those living and working in remote rural areas in an increasingly digital social and economic world.

The paper begins with an overview of the spatial unevenness of digital telecommunications infrastructure, the challenge of bringing effective digital connectivity to the 'final few', and the implications of this framed in terms of digital inequality. It then considers the role of digital connectivity in a small business context - as a technology that has the potential to overcome physical remoteness and stimulate business development. We explore these issues via the narratives of our case study participants, each household illustrating a different digital social context and business type, through which to explore business-related digital behaviour. The paper concludes by reflecting upon the dimensions of digital exclusion implicated in our case study, the potential ramifications of these for business critical and household income generation activities and, thus, the broader economic development agenda for remote rural areas.

2. Digital telecommunications infrastructure and rural digital divides

Digital technologies and the Internet have transformed everyday lives and business practices over the last three decades (World Economic Forum, 2014), fuelling a global assumption that all are on-line, participating in the myriad of social, recreational, commercial and administrative activities supported by the digital economy. In 2017 c.87% of European households had Internet access (Eurostat, 2018), an increase of c.32% since 2007: most but by no means all Europeans are digitally connected at home. Increased Internet use worldwide has been facilitated by developments in digital infrastructure that support both fixed and mobile Internet access, yet "it would be wrong to infer that the [digital telecommunications] picture is universally a rosy one" (Ofcom, 2016, p3). In advanced economies many remote rural areas, from a digital infrastructure provision and capabilities perspective, are lagging behind (e.g. Riddlesden and Singleton, 2014; Philip et al., 2017).

2.1. Digital telecommunications infrastructure

The history of digital telecommunications infrastructure over the last three decades is one of progressive technological innovation supporting increased diffusion and faster and more reliable connections. Numerous digital strategies, plans and recommendations have been published by governments and other institutions, indicative of the importance of digital engagement to support social and economic development (e.g. European Commission, 2012, 2015; Federal Communications Commission, 2010; Cabinet Office, 2012; Department of Culture, Media and Sport, 2013; Scottish Government, 2017; World Economic Forum, 2014). National and regional governments worldwide have invested large sums of public money in supporting digital infrastructure upgrades to benefit both private consumers and businesses.

2.2. Rural digital inequalities

The 'digital divide' has been defined as "the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard to both their opportunities to access information and communication technologies (ICTs) and to their use of the internet for a wide variety of activities" (OECD, 2001, p5). Much of the digital divides research conducted up to the mid-2000s, a period when public and business use of the Internet was steadily increasing but by no means ubiquitous, framed studies around a binary of those who

did or did not use computers and/or those with or without Internet access described by many as explorations of a 'first level digital divide'. Rural Internet use/non-use, when connectivity was supplied by dial-up or early types of broadband connection, was interrogated in, for example, North America (Malecki, 2003; LaRose et al., 2007; Strover, 2001), Australia (Black and Atkinson, 2007) and in the UK (Grimes, 2003; Tookey et al., 2006).

As the availability of digital connectivity proliferated, and Internet use has become much more prevalent, embedded in everyday life and associated with complex usage patterns and modes of access, the focus of debate has shifted to discussion of 'second level digital divides' (e.g. Hargittai, 2002; van Dijk, 2006; Strover, 2014) whereby digital divides are more about differences in skills and usage than the 'does/does not use Internet' binary. Park (2017) described potential outcomes of second level digital divides, suggesting that "the ways in which people engage with the technologies may further widen the gap between those who are skilled and capable of using the service to their benefit and those who are not" (p400). Reasons posited for second level digital divides include personal motivation, (lack of) ICT skills, public policies that fail to adequately address dimensions of digital divides (in terms of education and training and infrastructure provision) and the local environment, specifically the telecommunications infrastructure serving specific areas. Park (2012) suggested that second level digital divides could be better described as 'digital exclusion', advocating that the provision of better infrastructure and measures to promote wider adoption and more diverse use of the Internet would result in more people experiencing positive outcomes of digital engagement: digital inclusion could thus be promoted.

Digital exclusion arises from a mix of digital inequalities and it is the latter term that frames the discussion in this paper. Digital inequalities research interrogates barriers to participation in an increasingly digital society, identifying what prevents the adoption of new technologies. Cited barriers to adoption tend to focus around the socio-economic attributes of individuals who are not digitally engaged: demographic attributes, financial status and educational attainment. However, as noted by Salemink et al. (2017), most digital inequalities research has not considered spatial factors or has favoured urban studies, research conducted in environments where infrastructure is likely to be good, and being updated regularly. Some research, however, has focused on the rural realm, highlighting persistent territorial digital divides and their consequences in various national contexts (e.g. Howard et al., 2010; New Zealand Department of International Affairs, 2011; Carson, 2013; Skerratt, 2013; Pant and Hamby Odame, 2017; Park, 2017; Philip et al., 2015). This paper contributes to this comparatively small body of literature by further interrogating rural digital inequalities and explicitly considering the extent to which inadequate connectivity exacerbates other socio-demographic barriers to adoption and use. In other words, do persistent territorial rural digital divides further entrench digital inequalities and digital exclusion?

Contemporary digital connectivity debates should recognise that "nearly every household in advanced western societies is connected through a telephone line and, therefore, has the possibility of a fixed Internet connection" (Salemink et al., 2017, p362). Basic broadband should be available for all thus first level digital divide debates about connectivity are losing relevance in many national contexts. However, one type of connectivity gap is being replaced by another. As 'next generation' broadband, supporting higher speeds and more reliable connections, is rolled out, the focus is shifting in that the issue is less about a broadband penetration gap and more about the implications of a broadband *quality* divide:

> "*Only some years ago the analysis of broadband diffusion was focused on who had an Internet connection and who did not. Now, the relevant questions are: how good is it? How fast? And, how fast is fast? Thus, the broadband gap can no longer be seen as a penetration divide. It is becoming more and more a quality and capacity divide and therefore, a*

divide in the range of services people can access and use" (Vicente and Gil-de-Bernabé, 2010, p816).

Some rural areas in advanced economies still await basic fixed broadband infrastructure to be installed. Many others are now feeling the effects of new spatial digital divides: their connections are too slow to allow full and effective participation in a digital society where already well served areas (predominantly urban areas) are getting faster, fastest (see, for example, Farrington et al., 2015).

Premises in rural areas, and remote rural areas in particular, are much more likely than those in urban areas to be digitally 'underserved'.[3] This is due in large part to fixed telecommunications infrastructure upgrade activities that have taken place across North America, Australasia and Europe over the last decade having prioritised effort (and spend) in densely populated areas with the more costly and technically challenging remote rural upgrades left until last, if scheduled at all. There has been a reluctance on the part of Internet Service Providers (ISPs) to invest in remote areas where a small potential consumer base makes commercial roll out of upgraded infrastructure unprofitable (e.g. Ivus and Boland, 2015; LaRose et al., 2007; Malecki, 2003; Park, 2017). Publically funded investments in infrastructure upgrades have improved connectivity in many (but not all) rural areas, yet a divide remains in the capabilities of urban-rural digital infrastructure. This means many rural communities are unable to exploit the full potential of the Internet and thus continue to be at a comparative disadvantage to the majority of their urban counterparts. When "access to online resources or information is now normative, taken for granted by an ever larger array of basic commercial and other service providers, including government services" (Strover, 2014, p118) it is essential that rural citizens can both (a) access and use the Internet and (b) access a fit for purpose Internet connection, capable of providing access to online resources which are often designed with fast connections in mind. Mobile Internet coverage is far from universal. There is considerable potential for mobile connectivity to compensate for poor fixed broadband but for this to be achieved considerable improvements to mobile telecommunications infrastructure in remote and rural areas is required. The broadband quality divide means that rural digital inequalities result from infrastructure availability *and* socio-economic barriers to digital participation, the latter made more difficult to overcome if the capabilities of Internet connectivity serving rural consumers are not fit for purpose. Slow connections struggle to support many online activities that have become part of normal behaviour: for example, live streaming of video content and the use of some cloud-based applications are difficult, if not impossible.

3. Rural businesses and digital connectivity

Broadband has been described as a *General Purpose Technology*, an innovation that has spread "throughout all aspects of the economy and creates productivity gains in many industries" (Prieger, 2013, p494) and which has the "potential to improve most industries and society sectors" (Cruz-Jesus, 2016, p73). In this context it is unsurprising that a considerable literature has been generated in which the economic

benefits of ICTs are explored. Writing when dial-up connections were still the norm, Rogers et al. (2000) suggested that a pre-requisite for business survival was "some kind of e-business strategy" (p184). Since then, as Internet use has become increasingly widespread, digital engagement has become an essential element of day-to-day business practice, regardless of the size, sector or location of an enterprise.

The European Commission's Small Business Act 2008 positioned Small to Medium Sized Enterprises (SMEs, those employing up to 250 people) as the backbone of the European economy, a very important source of jobs and economic growth. SMEs provided employment for "no less than two thirds of the EU-27's non-financial business economy workforce" in 2008 (Eurostat, 2011, p10). Micro-businesses, with fewer than 10 employees, represented 29% of all private sector jobs in the European non-financial business sector in 2011 (Eurostat, 2011). Micro-businesses are particularly important in rural communities. For example, in the UK, 90% of rural businesses employ up to 9 employees and micro-businesses employ a higher proportion of rural than urban employees (29% compared with 19% respectively) (Wilson et al., 2018). The proportion of the workforce working from home is much higher in rural (22%) than in urban (12%) areas (Wilson et al., 2018). UK rural micro-businesses are at the heart of UK debates surrounding rural development and economic growth (*c.f.* Atterton, 2016; Copus et al., 2012; North and Smallbone, 2000; Phillipson et al., 2011; RELU, 2013; Scottish Government, 2016a, 2016b).

The benefits that information and communications technologies (ICTs) can bring to SMEs, micro-businesses, home based businesses and the self-employed in rural areas are well documented (e.g. Galloway et al., 2011; Grimes, 2003; Pant and Hambly Odame, 2017). Increasingly, businesses are *required* to engage with the digital economy and many attempt to capitalise on supply and demand side advantages the Internet offers. Advantages of the Internet to small rural businesses centre on opportunities to reduce the friction of distance and to maximise growth potential.[4] In addition to business development and efficiency, wider issues of social support, the availability of information and resources and delivery of government services increasingly necessitate Internet access. However, cautionary observations sit alongside these advantages. Digital connectivity "creates Internet-based external competition for local entrepreneurs … which disadvantages the local entrepreneurs" (Salemink et al., 2017, p364) and, although now a necessity, adoption of broadband technology is not in itself a guarantee of rural economic development (Hudson, 1999 cited in Park, 2017) or "alone a panacea for regional and rural innovation" (Pant and Hambly Odame, 2017, 448).

3.1. Remote rural small and micro-businesses and broadband requirements

Remote rural small and micro-businesses are an intrinsic part of the 'new rural economy' and are characterised by their sectoral diversity, to some extent a function of the increasingly differentiated nature of rural areas (Lowe and Ward, 2009). Three small business sectors are of particular importance to remote, rural economies, namely upland farming, tourism and leisure, and the arts/creative sector (Shucksmith, 2012). Characterised by small size (in terms of employee numbers), being household-run and embedded in a specific place, these business sectors are no different to others in that they are increasingly subject to digital expectations and requirements internal and external to the business, fuelled by a society in which Internet access, availability, and routine use is the norm.

---

[3] The European Commission (2014) in its *Digital Agenda* set out an aspiration that all European citizens should have access to broadband supporting download speeds of 30Mbit/s by 2020. This replaced a target of 'basic broadband' for all, enabling at least 1-2Mbit/s download speeds, by 2013. This illustrates the pace of change in digital infrastructure capability in recent years. The UK telecommunications regulator's 2016 *Connected Nations Report* described broadband supporting download speeds of between 10 and 30Mbit/s as 'standard', superfast broadband had download speeds greater than 30Mbit/s and ultrafast broadband delivered download speeds of at least 300Mbit/s (Ofcom, 2016). A description was not applied to services slower than 10Mbit/s despite, in early 2017, 2.4 million UK premises not receiving broadband above that speed, the majority of which were located in rural areas.

[4] Advantages include, for example: enhanced visibility which attracts new customers and suppliers from beyond the local area; an online identity for advertising, marketing and wider engagement; online modes of communication with customers and suppliers, between business colleagues and collaborators, and the development of professional networks; intelligence gathering and skills development; financial, data management and storage solutions via online platforms; and support for routine administrative tasks.

3.1.1. Farming and digital communications

A mass of information that could support and enhance everyday farm business practice is available online, from detailed weather forecasts to stock market reports and price comparison information for machinery (Pant and Hambly Odame, 2017; Williams et al., 2016). Farm governance increasingly demands the use of digital platforms. In the UK and in Ireland, for example, notification of all livestock movements is compulsory and administered through online systems, as part of a wider European agenda to standardise the electronic identification of animals (Pavon, 2014).

In the early 2000s Warren (2002, 2004) observed that ICT use in British agriculture lagged behind that in other business sectors, resulting from a combination of a lack of necessary infrastructure and the skills required to use digital technological innovations effectively. Today, despite visible advances in precision farming (Banu, 2015) and data-driven digital farming (IFSA, 2016), barriers to digital engagement remain stubborn in parts of the farming sector, particularly in upland farming communities. In 2015 it was reported that 10% of farmers in England and Wales did not have a computer or access to broadband (Environment, Food and Rural Affairs Committee, 2015). In the USA only 73% of farmers were reported to have computer access in 2017 (United States Department of Agriculture, 2017). Compounding the digital inequalities arising from no or poor digital infrastructure serving farm premises is a potential lack of digital skills in the farming community. The ongoing and widely debated issue of an ageing farming population in Europe (e.g. Zagata and Sutherland, 2015) likely correlates with a farming population who are less digitally-aware compared to other segments of the older population, let alone in comparison to younger adults. Many farmers will have had no experience of using computers during their formal education, the common 'way in' to using ICT and further opportunities to update IT skills in the workplace are not routine for work in a predominantly outdoor, primary sector occupation. Territorial and other barriers to digital adoption and use raise questions as to the ability of farmers to identify business opportunities and capitalise upon information exchange and resources of relevance to their business as well as being empowered to fulfil statutory obligations.

3.1.2. Remote rural tourism and digital communications

Across Europe, tourism represents a significant and diverse sector in many rural economies, in areas responsive to changing consumption patterns (Shucksmith, 2012) and in areas potentially 'lagging' in development terms (Clark and Chabrel, 2007). Increasingly rural tourism providers are expected, if not required, to engage in digital tourism, defined as "the digital support of the tourist experience before, during and after the tourist activity" (Benyon et al., 2014, p522), a practice actively promoted by the European Commission (2017). Engagement in digital tourism is only possible if an individual business has access to a reliable Internet connection and the skills required to create, use and maintain a digital presence. Tourists routinely identify and book accommodation online thus an accommodation provider without a web presence and/or access to third party booking and payment systems is unlikely to pick up new custom (Scottish Enterprise, 2016). Visitors increasingly expect Internet access to be available at their accommodation and whilst 'out and about' so that holiday related Internet use and their routine and habitual digital activities can be undertaken away from home. Many tourists have pre-conceived expectations of rural destinations, consciously or sub-consciously engineered via commodification of a countryside idyll for touristic consumption (Woods, 2011), however this does not mean that visitors are expecting or accepting of poor or no digital connectivity. Thus, another economically important rural sector is potentially compromised by a lack of digital infrastructure and/or a lack of IT skills and engagement amongst the rural tourism business sector.

3.1.3. Arts/creative industries and digital communications

The creative industries hold much promise for future economic growth in remote rural areas (Nordregio, 2017; Townsend et al., 2017) with the 'creative economy' posited as a cornerstone of the 'new rural economy'. Creative small firms are assumed to be 'footloose' and 'less tied' to a specific physical location than other enterprises (Florida, 2002), an inference being they are thus able to capitalise upon the aesthetic creative milieu and the quality of life offered by the rural context. However, the promise of a creative countryside assumes much in terms of economic growth potential - the willingness and ability of small and heterogeneous rural firms to locate in rural areas and the technical and social feasibility of digital connectivity (Bell and Jayne, 2010).

While Naylor (2007) claims that creative industries are at the fore of the information age, this implies access to enabling technologies, not least adequate broadband. Recent studies of the creative business sector in northern Scotland (Anderson et al., 2015; Townsend et al., 2017) found that broadband connectivity was "vital for the connectivity, self-promotion and marketing of rural creative enterprises operating from remote geographical areas" (Townsend et al., 2017, p455) with small creative businesses using ICT in varied ways. Email communication was a fundamental application for all, but marketing (including sales) and collaborative practices involving extensive digital communications and media applications and large file sharing services, was impaired by the absence of fast and reliable broadband. Small creative business owners, located in remote rural areas, were acutely aware that they were being left behind as technological improvements progressed rapidly elsewhere (Anderson, 2015). It was also found that a lack of access to adequate broadband for the creative sector was prompting business owners to consider relocating to areas with better digital connectivity.

4. The rural PAWS project: case study area and methods

4.1. Rural PAWS

The Rural Public Access WiFi Services project (hereafter Rural PAWS) was an interdisciplinary collaboration involving Internet Engineers and Human Geographers, supported by contributions from the satellite broadband company Avanti. The experimental approach was 'in the wild' – a term used when testing new technological systems with users outside of a laboratory setting (Brown, 2011; Goulden et al., 2017). Ultimately this involved the study of experimental digital technologies with those in a digitally un-served or underserved rural community with the goal of addressing digital exclusion. Rural PAWS was designed to provide a rate-limited (download speeds of 1.5Mbit/s) broadband service, capable of supporting activities such as email, on-line banking and basic web browsing, alongside a faster service for 'whitelisted' sites, for example business-specific sites and public sector websites (those with a 'gov.uk' domain name).

Goulden et al. (2017) suggest that interdisciplinarity in the wild poses a unique set of challenges for social scientists, which the authors labelled as 'problems of time', 'digital plumbing' (described on p140 as "the work of installing and maintaining the technologies in the social worlds of the setting"), and 'going native'. To mediate these issues it was essential to access in a timely manner a suitable case study area that provided opportunities to promote digital engagement and inclusion in a finite number of participating households; the limited number being due to the cost constraints and the technical logistics associated with the installation and usage monitoring of a free to participants satellite broadband service. The core social science objective of the project was to explore the impact that use of the technology had on personal and business lives, involving both participants who were existing Internet users and those with little or no Internet experience. This required an inherently 'hands-on' ethnographic approach, deploying qualitative methods to support in-depth, frequent, repeat engagements with case study household participants. This ethnography, combined
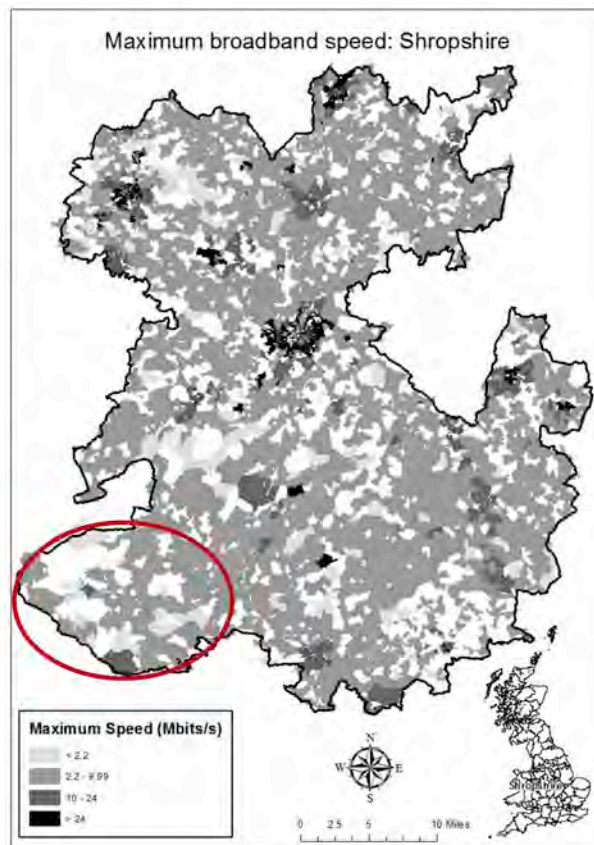
Note: Map produced using Ofcom's December 2013 postcode infrastructure data. Data available at http://maps.ofcom.org.uk/broadband/. Postcodes for which Ofcom reported there was insufficient data or which no or insufficient premises were filtered out to improve visualisation and are shown as white areas on the map. Baseline postcode data were obtained from the EDINA Digimap Ordnance Survey Service (2016). OS Code-Point with Polygons (Shapefile geospatial data last updated in May 2008) were used and are available from http://edina.ac.uk/digimap. Caitlin Cottrill prepared the map.

Fig. 1. Maximum broadband speeds, Shropshire with location of Rural PAWS case study area identified.

with a requirement for technical and digital-literacy trouble-shooting, demanded at least one researcher 'in the field' for the duration of the study, or in this instance, a researcher who was a community 'native' leading the fieldwork.

4.2. The case study area

Geographical concentrations of very slow broadband speeds in the UK were highlighted in other dot.rural funded research that mapped UK broadband speeds across urban, shallow rural and deep rural areas (Farrington et al., 2015; Philip et al., 2017); one such deep rural area showing slow broadband speeds was in south-west Shropshire (see Fig. 1). Characterised by low population densities, widespread livestock farming and a small-scale tourism sector, this area has previously attracted attention from rural geographers focusing on agricultural change (Evans, 2009), rural tourism (Saxena and Ilbery, 2010) and the rural creative sector (Bell and Jayne, 2010). In late 2013, superfast broadband was found only in Shropshire's urban centres. South-west Shropshire was designated by the BDUK programme, at the time Rural PAWS fieldwork commenced, as an 'intervention area' but no superfast broadband connections had been installed and there were no immediate plans for infrastructure developments. In this locale, existing digital infrastructure was particularly inadequate in a community of three parishes comprising a village and surrounding open countryside. This as a case study area met the project requirements on two counts.

The area contained both digitally unserved and under-served households. It was also an area where an experienced researcher (Yin, 2009) was already 'in-situ', well known to the community and the community was well known to the researcher. The importance of this second requirement to the success of the project cannot be overstated. With reference to Goulden et al.'s (2017) counsel, adopting this case study area went some way to alleviate potential 'digital plumbing' and 'going native' issues in the project.

4.3. Rural PAWS households

Resources were available to install a satellite broadband service to eight households.[5] Participating households were required to illustrate

---

[5] Ethical approval for the case study research was obtained from the University of Aberdeen's College of Physical Sciences Ethical Review Committee. Informed voluntary consent was sought from all participants in advance of them formally signing up to participate in the Rural PAWS study. Consent covered the installation of a satellite terminal to the exterior of their home, agreement for Internet usage to be monitored by the research team and agreement to participate in pre, mid and post-deployment interviews. Arrangements were also made with the Rural PAWS industrial partner for participating households to have the option to transfer, if they so wished, to Avanti's domestic satellite broadband service at the end of the project with no installation or set-up charges due. Technical details of the installation are described in Hamdoun et al. (2014). Households that participated in the study

the following attributes:

- digitally un-served households (those without fixed broadband) and digitally underserved households (those with very slow and/or un-reliable fixed broadband)
- households with Internet users and non-Internet users who were willing to 'give the Internet a go'
- households running a business or demonstrating an employment-related and/or an education-related digital requirement
- different age groups and household composition

These narrow sampling parameters required a high degree of local knowledge to recruit suitable participants. A researcher '*in situ*' with pre-existing links proved invaluable to the recruitment and retention of participants, those households that met the study criteria and collectively illustrated variable household composition scenarios. In practice, this was largely achieved through utilising personal contacts, word-of-mouth, snowball sampling and included initial informal discussions, often serendipitous, about the project with community members at the local primary school, in the local pub and at events held in the local community centre.

Participants were recruited in two phases: four households were recruited to phase one, a manageable number for the technical trouble-shooting that was anticipated and realised 'in the wild'. This group participated in the project for eighteen months. A further four households, recruited in phase two, participated for twelve months. The participating households were home to twenty individuals aged between mid-teens and early 70s. As noted in Table 1, two households comprised non-Internet users who had never previously had an Internet connection. The occupants of the other six households were all Internet users, of varying levels of proficiency, and were all experiencing digital connectivity challenges. Six households ran a small business, four were pluriactive households, and between them these participants ran a tourism enterprise (campsite), a print business in the creative sector, and three upland farm businesses (two participating households ran an inter-generational farm business together).

For the purposes of this paper, we focus on three of our participating households running a business from their home, each representing a different business type, operating on a different scale (importance to household income), and in a different household context: the campsite (tourism), the print business (creative sector) business, and one of the inter-generational farm business households (where digital roles and responsibilities associated with the farm business were clearly ascribed to the younger generation). Table 1 provides some contextual information about all the households that participated in the project and serve to introduce the home-based businesses examined in this paper within their households' economic and social context.

4.4. Data collection

Ethnographic case study research often draws on a number of data sources (Yin, 2009). In our study, contact between the researcher and participants was necessarily frequent to accommodate the depth of data collection required and the technical logistics and trouble-shooting inherent in an 'in the wild' project. Data collected over the study period and drawn upon for this paper was gathered via: in-depth interviews, participant (user) diaries, and a researcher diary (noting direct and participant observations). 'In-situ' qualitative interviews with all members of participating households were conducted at pre, mid and

post-stages of the broadband service deployment, with follow-up interviews conducted 12 months after formal participation in the project had ended. Participants were asked at the project outset to keep diaries in which to record their Internet usage and to note anything they considered to be relevant in terms of their experiences of using the service. The diary data provided useful context to inform and tailor the interviews, and/or provide a prompt for discussion. Finally the researcher in the field kept a diary to note issues of relevance that were not picked up through the more formal scheduled channels, for example, trouble-shooting requests and responses, phone call queries, and frequent chance meetings in the community where participants were often keen to discuss the study and relay their recent experiences. All formal interviews were recorded and transcribed in full to facilitate an iterative framework approach to analysis that also incorporated a thematic analysis of participant and researcher diary materials (Spencer et al., 2003).

5. Findings

We now present insights into the digital needs, experiences and expectations of three remote rural businesses via detailed vignettes, each case study seeking to capture the complexity of each context (Simons, 2009) yet also the 'everydayness' illustrative of micro, family/home based businesses commonly found in remote rural areas across the UK and elsewhere in Europe. Our vignettes represent three sectors of importance to the remote rural economy, and whilst each has unique scale and sector-specific attributes, all illustrate the wider remote rural businesses digital context, their experiences of which, we suggest, resonate beyond the case study area. Domestic Internet use was variable within and between the three home based businesses. None used a dedicated business-only Internet service. As introduced in Table 1 and narrated below, a complex mix of business characteristics, personal and off-site employment/education experiences shaped home and business Internet use and these influenced perceived digital needs and expectations. Each business is now considered in turn, with pre-deployment digital circumstances outlined before experiences of using the Rural PAWS service are recounted.

5.1. Business 1: sheep and cattle hill farm

Evan[6] is a third generation hill farmer who runs the farm business in a working partnership with his parents (who live off-farm). The cattle and pedigree and commercial sheep enterprise employs a permanent farmworker. Apart from a period at University, Evan, in his 40s, has lived on the farm all his life. His wife Vicky works off-farm. Evan and Vicky are ICT literate and owned a number of digitally enabled devices but infrastructure limitations meant that they struggled to be digitally engaged.

5.1.1. Pre-deployment digital experiences

The couple had attempted to get broadband at the farmhouse to support farm business and personal Internet use. Despite repeated efforts, they were unable to install a fixed broadband connection to the farm which is located a few miles from the nearest village. Evan and Vicky were using a mobile Internet dongle despite the signal in and around the farm being patchy and unreliable. Prior to participating in Rural PAWS they were finding this means of Internet access increasingly ineffective (e.g. it took almost 5 min to load a Sheep Society webpage via the dongle during the pre-deployment interview).

Farm businesses are increasingly required to carry out their administration online. Important farm business information is also online. Evan and Vicky were fully aware of these online requirements and opportunities and understood the financial penalties their business

_____

[6] Pseudonyms have been used throughout.

Table 1
Overview of participating Rural PAWS households, with emphasis on three of the home-based businesses.

	Household context	Business/ household income context	Digital status	Digital literacy (prior to participation in project)
PHASE I (Fieldwork months 1 to 18)				
1. Seasonal campsite business: John* and Fran*	Couple (John* and Fran*) with two secondary-school aged girls: Carol* and Christine*.	• John* works full-time for a utility company. • Fran* works part-time at a local school. • Campsite provides some additional income but is highly seasonal and small-scale.	Underserved	All digitally literate to varying degrees: skills gained through work or education. Daughters more digitally adept than parents.
2. Third generation family farm business: Evan* and Vicky*	Couple (Evan* and Vicky*)	• Evan* is a partner in the family farm. • The business provides income for: two households (four adults); one regular employee; others on contractor basis. • Vicky* works full-time in the health/social care sector.	Underserved	Both digitally literate: Vicky* more adept, skills gained through work; Evan* taught largely by Vicky.
3. Older Generation	Couple	Farming partnership	Unserved	None prior (though with access to younger family generations for support).
4. Older Generation	Couple	Farming partnership	Unserved	None prior (though with access to younger family generations for support).
PHASE II (Fieldwork months 7 to 18)				
5. Young farm family	Couple with two (pre-school) infants.	Second generation family farm and agricultural contractor business.	Underserved	Basic digital literacy – reliant on family, neighbours, friends for more complex tasks.
6. Print business: Thomas* and Deborah*	Couple (Thomas* and Deborah*) with two young adult sons: Richard* and David*.	• Specialist design and print business: two FTE employees; one in the household - Thomas*. • Deborah* works full-time at a local school and also provides administrative support for the business. • Own a smallholding which provides some rental income	Underserved	All digitally literate to varying degrees: skills gained through work or education. Young adults more adept than parents and Deborah* more adept than Thomas*.
7. Semi-retired couple	Couple	Semi-retired couple: both adults work part-time (in farming/leisure sectors).	Underserved	Both digitally literate, skills gained through previous employment.
8. Single person household	Single person	Employed: works in the public sector.	Underserved	Digitally literate, skills gained through employment.

*Indicates a randomly allocate pseudonym.

*Indicates a randomly allocate pseudonym.

would incur if they had to use paper based rather than online systems. They were frustrated with the challenges they faced when trying to conduct essential farm business online via their mobile dongle, illustrated in a discussion about submitting livestock notifications online:

> The [Sheep] Society fees for 2014 […] male and female birth notifications […] each one's costing £1.80 including VAT - if you were to use the paper system … that's £1.98…. Well we tag … between six and seven hundred and birth notify on average about 450 lambs, … it's £81 just on birth notifications so then, when you come to register your ewes, it's 57 pence [more per ewe], … tend to register 70 to 80 ewes a year. It's about £45 isn't it?

> What I'm saying is that when you submit it - it's nice to press the button and you don't mind waiting a couple of minutes and it says submitted or sent or something like that but the fact the little thing keeps going round and round for six, seven hours and you go to bed and then in the morning you look to see whether it's gone or not. Quite often I'll phone the [Sheep] society up to confirm that they've had it.

Evan and Vicky were increasingly aware that time and money could be saved if they had better Internet connectivity. Participating in Rural PAWS came at an opportune time and they were keen to see if the satellite service would be better than their existing provision.

5.1.2. Experiences of using the rural PAWS service

Evan and Vicky made extensive use of the Rural PAWS service for a mix of business, household, entertainment and leisure activities. They used 'whitelisted' (Rural PAWS enhanced-access) UK government websites, mainly farming related, and price comparison and other online retailing sites which resulted in savings being made on farm

business and household purchases. Of benefit to both the business and the household was being able to research biomass systems and associated Renewable Heat Incentive (RHI) payments which led to the installation of a biomass generator. They also made significant savings by comparing farm machinery prices online.

During the mid and post deployment interviews Evan and Vicky illustrated how their business practice had developed as a result of access to a reliable Internet connection. They could easily keep up to date with online information relevant to the farm business published by the Department for the Environment, Food and Rural Affairs (DEFRA). This included being up-to-date about problems with the online Single Farm Payments applications system in 2015,[7] particularly pertinent given their intention to submit their application online. Vicky recounted that their mobile Internet service had been unavailable for four out of 6 weeks at a time when they needed to submit cattle movement records (a mandatory requirement) and without access to Rural PAWS this online regulatory task would have necessitated engaging a proxy Internet user based elsewhere; this experience brought time, resource and efficiency gains associated with a reliable connection into sharp focus.

Evan made extensive use of online stock reports listed on a pedigree Sheep Society's website. He meticulously researched sheep pedigrees which informed plans for livestock purchases to grow the farm's breeding regime. Evan made reference to how laborious and time

---

[7] Despite awareness of inadequate broadband in many remote rural areas and a lack of skills amongst some sectors of the farming community applications for Single Farm Payments in England and Wales became online only in January 2015. Technical problems with the £154 million system forced a reversal to the use of paper forms in March 2015 (BBC News, 20th March 2015).

consuming it was to track down similar information offline. Evan also reported checking weather forecasts for the area, often multiple times a day, allowing him to ' … *plan … around what the forecast is'* and informing aspects of day-to-day practice impacted by weather conditions, for example during lambing and harvest.

Evan and Vicky's experiences align very closely with those of farmers in Eastern Ontario reported by Pant and Hambly Odame (2017), where the enabling role of broadband for farm businesses was highlighted. In the Canadian study, impacts of investment in broadband networks on small businesses and community organisations were examined. Farmer participants were able to provide numerous examples of what broadband Internet access could do to support and enhance their business practice, and it was reported that "broadband Internet opened several possibilities to diversify on-farm, off-farm and non-farm operations" (Pant and Hambly Odame, 2017, p442). Within six months of using Rural PAWS Evan and Vicky had cancelled their mobile dongle service having found the Rural PAWS project service to be more efficient and reliable. Participating in Rural PAWS had made them realise how digitally underserved they had been and had reinforced the necessity of a reliable Internet connection for both business and household purposes.

5.2. Business 2: seasonal campsite business

John, Fran and teenage daughters Carol and Christine live in the village at the centre of the Rural PAWS case study area. John works from home and is often 'on call' for his employer and Fran works at a local school. They operate a small-scale, seasonal campsite business from the field adjacent to their home that contributes to their discretionary household income.

5.2.1. Pre-deployment digital experiences

This is a 'next generation'[8] Internet user household, who were attempting to operate nine digitally enabled devices off their existing home broadband service. The demands made of their very slow broadband, at best a 0.5 - 1Mbit/s service, caused tensions within the household:

> *'When we are all on our devices it's so slow isn't it? And then things start crashing. You know. I mean I'm only getting my emails and doing my online shopping and sometimes it just takes so long I may as well have just gone over to* [the nearest town]*' (Fran)*

John's work mobile operated off the home broadband. He accessed his work schedule for the day online via a work laptop and was often 'on call'. Being digitally underserved was increasingly causing problems for John as he struggled to meet his employer's expectations of being digitally connected and to respond quickly to their requests. He told us *'you don't want to spend three quarters of an hour trying to get the job down on your laptop'.*

Fran and John have run their seasonal campsite business for over 20 years, the business being a non-essential but useful additional source of household income. The campsite focuses on providing accommodation during bank holiday weekends and the summer holiday period; visitors are a mix of return and new customers. Campsite bookings, website maintenance and other business activities were undertaken via the home broadband connection which, as already noted, was very slow and prone to dropping out and buffering. Despite advertising on their website that the campsite does not have a broadband service the couple spoke about the surprise of some visitors to the site on discovering they had no connectivity, ' … *when people come out and haven't read the*

website or anything they're like - *"Ah, no broadband"* ' (Fran).

By participating in Rural PAWS John and Fran hoped they would be able to take some of the pressure off their existing home broadband service and be able to provide Internet access to those staying at their campsite. They were aware that other campsite businesses were offering wi-fi connections and had first-hand experience that visitors were discouraged by a lack of Internet connectivity. They were keen to test whether a wi-fi hotspot serving the campsite could be run off the Rural PAWS service, so freeing up their home broadband service for their regular employment, school, and other household-related digital activities.

5.2.2. Experiences of using the rural PAWS service

Fran and John's household had problems with the Rural PAWS service from the day it was installed and it did not enhance their domestic digital connectivity in the way the research team had hoped. They had retained their commercial Internet service when the Rural PAWS service was introduced and towards the end of the project it became apparent that the two broadband wi-fi services in their home had been in conflict, rendering both ineffective; illustrating 'digital plumbing' issues in practice. For a household that made heavy use of, and was highly reliant upon, a broadband service for work, education and business purposes this was problematic. The household stopped using the Rural PAWS service after six months, but not before the difficulties encountered had prompted the household to review their digital connectivity (discussed in Section 6) and seek an alternative connectivity solution.

The introduction of the Rural PAWS service to the campsite itself was, however, successful. The Rural PAWS research team installed a wi-fi service to the campsite and visitors were given the option of registering to use it. Visitors mostly used the service to access communications options on their mobile phones, overcoming the absence of a 3G (mobile Internet) signal in the vicinity, and they also used it to access social media sites and for basic web browsing. John and Fran's campsite users were, we were told, very pleased with the service:

> *'The … campers we've had have loved having the facility and they are really pleased … they can wander about with their devices and that is absolutely perfect for them. Yes, it is slower than where some of the people live but it's perfectly acceptable for the site. They don't get any buffering, they can load their emails, they were doing Skype as well'* (Fran).

Being able to add wi-fi as a facility their business could offer was considered beneficial, attractive to their repeat customers and to first time visitors:

> *'They haven't expected [if] they've been before … [but] they are pleased to see it. Any newcomers find it an absolute bonus, so do the regulars but, yes, certainly the appeal is that there is a service on the site and I do believe that people nowadays would come back and choose this site over another site if we've got wi-fi and they haven't'* (Fran).

The challenge John and Fran were left with at the end of their participation in the Rural PAWS project was to identify a means of being able to continue providing broadband access for their campsite visitors. With the business being seasonal, and visitor numbers fluctuating throughout the summer months, the central issue was what type of contract or payment model, potentially involving negotiations with a broadband service provider and the establishment of a registration and payment system for visitors, could meet their requirements. They did not require a year round service, and many ISP contracts are for a minimum period of twelve months. Heavy demands could be placed on a service when the campsite was busy yet at other times, when there were small numbers and/or no users, no demands would be made. Any costs of providing broadband would have to be passed on to visitors, and John and Fran were unsure how they could set up an effective pay-to-use registration system with access codes that would ensure that only those who paid for the service could use the campsite wi-fi.

---

[8] The concept of a 'next generation' Internet user was first promulgated in the report of the 2011 Oxford Internet Survey when Blank and Dutton (2011, p4) defined a Next Generation User as "someone who accesses the Internet from multiple locations and devices".

5.3. Business 3: specialist design and printing business

Deborah and Thomas live one mile outside the village. One of their two adult sons, Richard, lives at home most of the time, the other, David, visits regularly. Both sons had personal experience of using superfast broadband and were aware of the deficiencies in their parents' home broadband. The couple run, with a third person, a design and printing business from their home. They also manage a small holding at their property and Deborah works at a local school.

5.3.1. Pre-deployment digital experiences

Deborah and Thomas's property is at the end of the line served by the local telecommunications network infrastructure and their fixed home broadband was very slow (a speed test conducted during one interview recorded a download speed of 0.1Mbit/s, slower than many dial-up connections would achieve). They were thus digitally underserved yet they owned and used multiple digitally enabled devices. Deborah was frustrated by having a very slow connection that frequently dropped out. The household had previously explored switching to a satellite broadband service but had been discouraged by two factors; the costs they were quoted which were much higher than what they were paying for their fixed broadband and the need to move from an unlimited use contract to one where the monthly data usage would be capped.

The couple used the Internet for personal activities such as web browsing, Internet banking and email. They ran their mobile phones from their wi-fi because there is no mobile phone signal at their home. Deborah sometimes used online resources from home to support her work at school. The home broadband was used to support the couple's design and printing business which had an international customer base. The business made low demands on Internet applications. Email was the default mode of liaising with customers and correspondence was dealt with once a day. Artwork was designed on a computer, but completed offline. Clients sent, by email, illustrations of the nature of the artwork (for self-assemble models and kits) they wanted to be designed and printed. Bespoke designs were emailed back for approval and then block printed using specialist equipment on site. Sometimes the artwork files were too big to be sent/received easily over the fixed broadband connection. Test pieces of products to be printed were routinely sent to clients by post or by courier because exact colours do not always reproduce well in a digital format. The business accounts were maintained using dated software and an accountant was employed to deal with the online tax return.

The business did not have a website. Custom was generated by word of mouth although, increasingly, new custom came from their work having been viewed online via chat forums and specialist model-making sites. Deborah felt that they did not have time to run and maintain a website, it would be costly to set up, and that a website would generate too many speculative enquiries from people who were unaware that their bespoke products were ' … *not cheap'*. The couple were reluctant to generate more trade because they did not wish to expand mainly for fear of not being able to maintain enough custom to keep on any newly recruited employees. Such reluctance to grow the business has been recognised for some time in the small business literature. For example, in their sample of rural business owners, Deakins et al. (2003) found that 86% had no ambitions to grow their enterprise and, in the current economic climate it is understandable that microbusinesses are reluctant to take on risks that could compromise medium to long term viability (Recruitment International, 2017). Deborah and Thomas hoped that participating in Rural PAWS would give them access to a more reliable Internet connection which would make some online household and business tasks quicker and easier to undertake.

5.3.2. Experiences of using the rural PAWS service

During their participation in the Rural PAWS research, Deborah and Thomas kept their existing fixed broadband, which supplied their home telephone landline and Internet. It was essential for home and business that uninterrupted access to their landline and wi-fi enabled mobile phone connectivity was maintained. They were thus able to make direct comparisons between Rural PAWS and their fixed broadband service.

Thomas used the Rural PAWS service for some web-browsing. Deborah primarily used it for streaming radio programmes and she continued to use the fixed broadband for the business administration tasks she undertook. Deborah and Thomas found that the Rural PAWS service was faster than their fixed broadband, but less reliable. They struggled with the latency (delay in sending and receiving data) inherent to satellite broadband connections. Their son Richard did not use Rural PAWS because latency made streaming and online gaming impossible. When asked about whether the Rural PAWS service would be better than nothing at all, members of the household agreed it would be. An exchange about the importance to different members of the household of being digitally connected articulated interesting attitudes aligned with how online business tasks were divided between Deborah and Thomas:

Interviewer: 'Could you manage without the Internet?'

Thomas: 'Yes'

Interviewer: 'You could?'

Thomas: 'Yeah'

Deborah: 'No'

Richard: 'I think it's the difference between generations'

Thomas: 'For me, I see it as a tool, when I need the [Internet] … and I do it, in my own time, but just that'

Thomas went on to state that he could manage, personally and for the business, with the telephone alone. This downplaying of digital connectivity to support the business most likely reflected the division of business tasks between the couple. Deborah undertook most tasks that had to be undertaken online whilst Thomas used design software offline and left online liaison with clients to his wife. Deborah's view that she could not manage without the Internet reflected the fact that she not only had to undertake online activities for their business but also to complete work in relation to her employment at the local school.

6. After rural PAWS: negotiating digital inequalities

The digital experiences of our three case study businesses serve as a timely illustration of how digital inequalities are impacting upon small, home based businesses in remote rural areas. All of our participants felt digitally disadvantaged exhibiting an awareness that: poor connectivity was detrimental to their businesses; and/or impacted on other household income activities (e.g. employment off-site); and/or was a constraint upon their domestic lives. Self-perceived disadvantage was influenced by contextual factors including personal experiences, requirements, and expectations of online engagement, which in turn were mediated by the scale and nature of the business and the social context of the household. Our findings show that digital inequalities were mediated by age (older participants were less concerned about poor connectivity than young and mid-life participants), off-site workplace experiences and requirements (the three households considered here were pluriactive), social experiences (most vociferously reported by young adults), the requirements, ambitions and motivations driving the individual businesses (rather than being sector specific) and the households' social and physical embeddedness in place. The latter is of particular importance - our case study households were rooted in place through the ownership of land and related capital assets, through familial and other social ties within a specific community, and employment within the local labour market. Relocation was not a feasible option thus a solution to digital connectivity challenges *in situ* was essential. Post-project follow up engagements with rural PAWS

participants shed some light on how *in situ* solutions have developed.

The rate limited, free satellite broadband service provided by Rural PAWS was described by the hill farm business as being a distinct improvement on their previous attempts to be digitally connected at home. Over the time they used the Rural PAWS service Evan and Vicky realised that good digital connectivity at the farmhouse had been of considerable benefit to the farm business as well as supporting extensive personal use. When the Rural PAWS connection period ended the couple had a short period without farmhouse-based broadband while an alternative service was being procured in conjunction with the research team. This caused problems almost immediately - livestock export licences had to be communicated and obtained through proxy Internet access via a family member and routine applications such as access to weather and livestock sales reports were also very quickly missed. These experiences reinforced how essential digital connectivity had become for the farm and securing a permanent broadband solution became a matter of business priority.

Evan and Vicky's first proposed solution was to sign up for a commercial satellite service. This proved unreliable with speed and service being determined by, for example, the weather conditions, and it also proved costly. They experienced surcharges for using data in excess of their quota and a reduction in speed as the monthly data quota was reached. The second solution Evan and Vicky subscribed to was a local alternative provider, Secure Web Services (SWS), who had recently extended coverage to the Rural PAWS case study area. This provider uses a fixed wireless access network to deliver high speed Internet connectivity over low power, line of sight radio. Evan and Vicky were quick to adopt the SWS service as one which best suited and met their requirements, in the knowledge that they had first-hand experience of the limitations of each of the mainstay of connectivity options for premises in situations similar to their own: fixed broadband, mobile dongle, and satellite services.

John and Fran found that the Rural PAWS service worked well as a means of providing an Internet service to their campsite visitors, but for household and business use the rate limited satellite service proved inadequate. John found it challenging to meet the connectivity expectations of his employer and Carol and Christine found the service too slow for their school homework and exams revision. Securing adequate digital connectivity became paramount and this household switched from fixed broadband to the local, alternative company - SWS - halfway through the Rural PAWS research period.

Participation in Rural PAWS undoubtedly acted as a spur for John and Fran to research and install a better Internet connection, which fortunately coincided with the local deployment of SWS coverage. The household are happy with the service provided by SWS both in terms of speed, data usage and value for money. However, they are also mindful that there is little else in the way of choice: in a follow-up interview Fran told us ' … *it's as good as you are going to get around here*'. Addressing the home broadband situation also provided a solution for the campsite. The equipment installed to provide wi-fi at the campsite remained in place once the Rural PAWS project concluded and was reconfigured to operate off the home SWS service. This provided the flexible connectivity the business required and is embedded in their existing household Internet contract; an Internet provision model that may have traction for other tourism accommodation providers, especially those that operate on a seasonal basis.

Deborah and Thomas's experiences are a useful example of how some small businesses run a risk of being left behind by digital transformations. From both a household and a business perspective, Deborah and Thomas were 'making-do' with their existing, objectively defined as inadequate, digital connectivity, despite inadvertently referring to two business-related issues directly related to their slow and unreliable home broadband connection. Firstly, Deborah's reference to often having to send artwork to clients in compressed file formats is indicative of a problem that is only likely to worsen as business operations involve transmission of increasingly large artwork files. Townsend

et al. (2017) observed that creative practitioners based in remote rural areas with poor digital connectivity often have difficulties dealing with clients based elsewhere who expect them to have fast, efficient broadband and to be able to send and receive large files instantaneously. Deborah and Thomas's niche business has avoided such problems for now, but to future proof the business, better connectivity may be required to ensure that bespoke artwork files can be sent and received. Secondly, Deborah was reluctant to carry out business administration and related activities online. While she acknowledged that she had to '*get a new accounts program*', she also said that she was not going to do her accounts online because '*I don't like the fact that … if the connection is down you can't then do any work*'. Many small businesses use accounts software to manage their finances and new, cloud based systems compliant with UK business tax and VAT returns are now widely available. However, Deborah was dissuaded from the use of such systems because of the unreliable connectivity at her home. While the broadband provision options available to this couple were limited, business-related connectivity issues did not, from the couple's perspective, warrant exploring further the availability of alternative broadband provision after their participation in the Rural PAWS project ended. For this business remaining with their existing fixed-line service and the couple's abstention from engagement with online business software, marketing and media developments, behaviour compounded by inadequate broadband provision, reinforces a direction of travel towards digital exclusion. The experiences of this business illustrate how broadband connectivity in itself is insufficient to ensure digital inclusion. Pant and Hambly Odame's observation that, for local businesses to make the most effective use of Internet access, they "require a host of other complementary services, such as finances, skills training, legal advice, social media engagement and advice on marketing strategies" (p448) is pertinent here, as is their suggestion that public and not-for-profit organisations based in communities are "important for helping rural businesses access or adapt services that are often structured to serve larger urban-based businesses" (Townsend et al., 2017). In the UK context, bodies which support and promote rural business development continue to have an important role to play in educating micro-businesses to ensure they are equipped with what are increasingly essential e-business skills.

Thomas's ambivalence towards the Internet reflects, as his son Richard observed, a generational digital divide, albeit one that is contracting rapidly (ONS, 2016). Fran's daughters, in jest, also made reference to Fran's lack of digital awareness given that she was not a 'digital native', of a generation that had not grown up with digital communications and the Internet. Fran does, however, engage with the digital world in her personal, professional and home based business life and has opportunities to informally develop her ICT skills. In Thomas's case, running his own business from home and the division of business activities between himself and his wife means that he has not had to become more digitally literate or e-business savvy. Huggins and Izushi (2002) observed that business use of the Internet is likely to be informed by personal experiences and use: Thomas makes little use of the Internet and his limited digital engagement is likely to colour his perceptions towards the utility of increased digital engagement for his business. Evan chose to engage fully with the opportunities offered by digital connectivity, initially for reasons of farm business efficiency and, as the study progressed, he combined this with an interest in respect of pedigree sheep breeding lines. At the beginning of the study, Evan reluctantly admitted that he lacked sufficient ICT skills. He was of an age where he had had limited ICT exposure at school and University, and working from home on the farm had not required him to directly engage with ICT applications and thus develop ICT skills 'on the job'. Participating in Rural PAWS acted as a catalyst to upskill, helped by his ICT literate wife being able to offer informal advice and training as required. Other hill farm businesses may not be in a position to exploit digital opportunities so well, due to inadequate or no digital connectivity and/or a lack of ICT skills within the household that could be

deployed for the benefit of the farm business. Our study highlights the existence of a cohort of a 'certain age' across the farming sector that while willing to engage with the digital world, in part motivated by the requirement to move towards using online regulation and administration systems, are caught in a vicious cycle of inadequate connectivity to farm premises and a need to improve ICT skills. As highlighted in this paper, the nature of that upskilling will at least in the immediate future be incremental, dependent upon informal training by spouses, other family members, friends and neighbours and likely to be hindered by a lack of suitable digital connectivity service options. ICT skills development programmes targeted explicitly at, and to accommodate the requirements of, the farming community, as pioneered by Warren in the early 2000s (Warren, 2002, 2004), are still required to help address digital exclusion in parts of this rural economic sector.

7. Conclusions: uncertain futures for digitally un-served and underserved remote rural communities

The deployment of a project-specific broadband service (Rural PAWS) to households in a remote rural community provided a unique research opportunity to examine the personal and business-related digital behaviour and Internet experiences of households at the micro-level. In this paper we profiled the digital activity of three home based businesses, of variable scale and household composition, over a period of more than two and a half years. Our findings demonstrate the complexity at play when examining the challenges faced by small and micro-businesses operating within remote rural areas in an increasingly digital economy and draw attention to the underlying importance of fit for purpose digital infrastructure to rural household livelihoods in the broader sense now and in the future.

Recounting the digital journeys of the three home based businesses over the course of the project provides a timely reminder that access to and use of fit-for-purpose broadband is not ubiquitous for those living and working in the UK's remote rural areas. Those whose experiences form the core of this paper were all using the Internet prior to participation in the Rural PAWS study. The digital inequalities they experienced were not due to Internet non-use, they were disadvantaged because their digital connectivity could not support sufficiently the online activities they wished to undertake. These findings align with Salemink et al.'s (2017) observation that fixed Internet connections are available to almost every household in advanced western societies and, as such, digital divides research framed around an Internet users/non-users binary is no longer sufficient. The findings also highlight that *broadband quality divides*, as articulated by Vicente and Gil-de-Bernabé (2010), are increasingly the challenge facing rural communities. Our study provided an opportunity for our case households to review their pre-existing 'unfit-for purpose' broadband service. In two cases this facilitated, and to a certain extent forced, the adoption of new-to-the-locality alternative Internet provision illustrating that interventions designed to improve digital connectivity can have a long term, positive influence.

From the business perspective, although very different in size and nature, the hill farm and seasonal campsite businesses are both now able to undertake business critical online activities faster and more reliably. In the case of the hill farm, the ICT competencies of the household have improved because access to better broadband has encouraged informal ICT upskilling and increased online activity has generated tangible cost benefits for the business: a virtuous cycle of digital behaviour has been supported. Being able to provide Internet access to campsite visitors has increased the attractiveness of this accommodation provider in a highly competitive market, but more importantly in this instance, freed up the Internet capacity required by the household to both support their paid employment activity (the main source of household income), and to undertake education-related and other day to day digital activity unhindered.

A much more complex picture of territorial digital divides combined with and compounding other facets of digital inequality is illustrated by the design and print business which used digital applications but in a limited manner. Participation in Rural PAWS did not stimulate this business to review digital behaviour and requirements: we suggest two factors are at play. Firstly, unlike the other households, the new-to-the-locality Internet provision did not reach these premises (post Rural PAWS), so the household remained restricted to fixed broadband or satellite service options, both of which have limitations in this locality as our study has shown. Secondly, we suggest that in this example, a territorial digital divide that cannot be easily overcome has exacerbated a motivational dimension - the business owners do not feel the need to become more ICT literate. They are not fully aware of what the digital realm offers their business, in part due to their broadband service's limitations, their requirements and expectations of it; they are running the digital aspects of their business in a way that complements their lifestyle and what they want to achieve from their business. Thus the connectivity environment, business motivations and social context fuse to act as a deterrent to exploring digital applications by 'playing around' with online content and capabilities. It is likely that these experiences and behaviour are not uncommon. For a multitude of lifestyle and business-related reasons, small home based businesses may choose not to fully engage with an enhanced broadband service, even in the event that it should become available.

A further dimension to highlight in relation to the longer term influence of the study upon modes of digital engagement and corresponding business practice is that corresponding to the social context of the household. While the emphasis of this paper is on the home based business, it has also highlighted the entanglement of the business and the home in terms of variable digital requirements, expectations and use by the household. Our case studies are illustrative but the utility of digital connectivity attributed by each household to the Rural PAWS service tended to be referenced in relation to the main income-generating activity in the household – the business in the case of the hill farm, the employment of the main earner and other key household requirements in the case of the campsite, and reference to both business and off-site employment in the example of the print business. A related point is the embeddedness in place of many rural home based businesses. In addition to the prevalence of owner occupied rural business premises rooted in immobile cultural and natural resources, household circumstances and lifestyle choices also temper the options to move the business to locations with better connectivity.

Our research highlights how vulnerable home based micro-businesses in remote rural Britain are to being left behind in the fast changing national and global digital economy. This vulnerability is unlikely to be due to a business not actually using the Internet. The continued viability of small and micro-businesses in some sectors of the rural economy is compromised by persistent digital inequalities that are rooted in the inadequacies of local digital infrastructure. In a scenario where small businesses' engagements with the state are moving to an online only environment and wider business-customer interactions are increasingly online encounters, this presents a significant challenge for the bigger rural digital economy picture, one where small and micro-businesses are such important sources of rural employment (Atterton, 2016; Eurostat, 2011).

To support the digital future of remote rural businesses faced with a phenomenal and unrelenting pace of technological change, a far more nuanced understanding of the requirements, circumstances and aspirations of such businesses needs to be acknowledged: the particularities of the remote rural context, the heterogeneity of the micro-businesses therein, and the interplay between household and business. Further, it is essential that the business community and enterprise/rural development agencies recognise that the digital capabilities of small and micro-businesses, in terms of access to adequate connectivity and digital skills, are far from equal and that in a rural context the former is required to promote the latter.

Further research examining relationships between digital

connectivity and rural economic development is warranted to provide insights into the type of digital upskilling support most likely to help micro-businesses across all sectors of the rural economy to thrive. Support for businesses notwithstanding, what remains of fundamental importance is that remote rural areas are not ignored in ongoing and future digital infrastructure upgrade programmes. Extensions of programmes exploring the viability of digital connectivity technologies including 5G and wireless line-of-sight for areas where fixed broadband will never be financially attractive are, we suggest, worth further assistance under national government digital strategy programmes. Without effective connectivity solutions for the 'final few' and better connectivity for the digitally undeserved further entrenchment of territorial digital divides could be the death knell for some rural economies. The Environment, Farming and Rural Affairs Committee at Westminster has warned against digital infrastructure upgrade programmes perpetuating a two-tier digital society, advocating that it "is vital that the last premises in the UK to have access to basic and superfast broadband are treated just as well as the first premises and are not left behind or forgotten" (EFRA, 2015, p3). If this warning is not heeded there could be profound implications for maintaining a diverse and sustainable economic base in remote rural areas across the UK and beyond.

Acknowledgements

References

Anderson, A., Wallace, C., Townsend, L., 2015. Great expectations or small country living? Enabling Small Rural Creative Businesses with ICT. Sociol. Rural. 56 (3), 450–468.

Atterton, J., 2016. "Scotland's rural economies – looking beyond the land-based sector". Section 2. In: Skerratt, S., Atterton, J., McCracken, D., McMorran, R., Thomson, S. (Eds.), (2016) Rural Scotland in Focus 216 Rural Policy Centre, Scotlands' Rural College, Edinburgh, pp114-149, Available at: https://www.sruc.ac.uk/downloads/file/3184/rural_scotland_in_focus_2016_-_full_report.

Banu, S., 2015. Precision agriculture: tomorrow's technology for today's farmer. J. Food Process. Technol. 6 (8), 468–473.

BBC News, 20th March 2015. Online farm payment system abandoned after 'performance problems'. Available at. http://www.bbc.co.uk/news/uk-31976230.

Bell, D., Jayne, M., 2010. The creative countryside: policy and practice in the UK rural cultural economy. J. Rural Stud. 26, 209–218.

Benyon, D., Quigley, A., O'Keefe, B., Riva, G., 2014. Presence and digital tourism AI and Society. 29 (4), 521–529.

Black, R., Anderson, J., 2007. Addressing the Digital Divide in Rural Australia. Available at: http://ausweb.scu.edu.au/aw07/papers/refereed/black/paper.html.

Brown, B., Reeves, S., Sherwood, S., 2011. Into the wild: challenges and opportunities for field trial methods. In: Proceedings of the SIGCHI Conference of Human Factor in Computing Systems, pp. 1657–1666.

Cabinet Office, 2012. Government Digital Strategy November 2012. Available at: https://www.gov.uk/government/publications/government-digital-strategy.

Carson, A.S., 2013. The remote rural broadband deficit in Canada. J. Rural Community Dev. 8 (2), 1–6.

Clark, G., Chabrel, M., 2007. Rural tourism in Europe. Tourism Geogr. 9 (4), 345–346.

Copus, A., Dubois, A., Hedstrom, M., 2012. Expanding horizons: local embeddedness and local engagement among small firms in the European countryside. Eur. Countrys. 3 (3), 164–182. Available at: https://www.degruyter.com/view/j/euco.2011.3.issue-3/v10091-012-0002-y/v10091-012-0002-y.xml.

Cruz-Jesus, F., Vicente, M.R., Bacao, F., Oliveira, T., 2016. The Education-related Digital Divide: an Analysis for the EU-28 Computers in Human Behaviour, vol. 56. pp. 72–82.

Deakins, D., Galloway, L., Mochrie, R., 2003. The Use and Effect of ICT on Scotland's Rural Business Community Research Report for Scottish Economist Network, Scottish Economist Network, Stirling.

DEFRA, 2005. urban-rural definition. Available at: https://www.gov.uk/government/collections/rural-urban-classification.

Department of Culture, Media and Sport, 2013. Stimulating Private Sector Investment to Achieve a Transformation in Broadband in the UK by 2015. 27th February. Available at: http://www.gov.uk/government/policies/transforming-uk-broadband/supporting-pages/rural-broadband-programme.

Environment, Food and Rural Affairs Committee, 2015. Rural Broadband and Digital-only Services, Seventh Report of Session 2014-15. HC 834, 3rd February 2015. HMSO, London. Available at: https://www.publications.parliament.uk/pa/cm201415/cmselect/cmenvfru/.../834.pdf.

European Commission, 2017. Digital Tourism. Actions to Help Tourism Businesses Go Digital. Available at: https://ec.europa.eu/growth/sectors/tourism/support-business/digital_en.

European Commission, 2012. Digital Agenda for Europe. Available at: http://www.ec.europea.eu/digital-agenda/en/our-goals/pillar-iv-fast-and-ultra-fast-internet-access.

European Commission, 2014. Digital agenda for Europe. Available at: https://eige.europa.eu/resources/digital_agenda_en.pdf.

European Commission, 2015. Digital Agenda in the Europe 2020 Strategy. Available at: http://www.ec.europa.euy/digital-agenda-about-our-goals.

Eurostat, 2011. Key Figures on European Business with a Special Feature on SMEs Luxembourg. Publications Office of the European Union Available at: http://ec.europa.eu/eurostat/web/structural-business-statistics/structural-business-statistics/sme?p_p_id=NavTreeportletprod_WAR_NavTreeportletprod_INSTANCE_vxlB58HY09rg&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-2&p_p_col_pos=1&p_p_col_count=4.

Eurostat, 2018. Digital Economy and Society Statistics – Households and Individuals. Available at: http://ec.europa.eu/eurostat/statistics-explained/index.php/Digital_economy_and_society_statistics_-_households_and_individuals.

Evans, N., 2009. Adjustment strategies revisited: agricultural change in the Welsh Marches. J. Rural Stud. 25, 217–230.

Farrington, J., Philip, L., Abbot, P., Blank, G., Dutton, W., 2015. Two-speed Britain: Rural Internet Use. Aberdeen University Press, Aberdeen.

Federal Communications Commission, 2010. Connecting America: National Broad-band Plan. Available at: http://www.fcc.gov/national-broadband-plan.

Florida, R., 2002. The Rise of the Creative Class and How It's Transforming Work, Leisure, Community and Everyday Life. Basic Books, New York.

Galloway, L., Sanders, J., Deakins, D., 2011. Rural small firms' use of the internet: from global to local. J. Rural Stud. 27 (3), 254–262.

Goulden, M., Greiffenhagen, C., Crowcroft, J., McAuley, D., Mortier, R., Radenkovic, M., Sathiaseelan, S., 2017. Wild interdisciplinarity: ethnography and computer science. Int. J. Soc. Res. Meth. 20 (2), 137–150.

Grimes, S., 2003. The digital economy challenge facing peripheral rural areas. Prog. Hum. Geogr. 27 (3), 174–193.

Hamdoun, H., Williams, F., Mohideen, A., Philip, L., Farrington, J., Fairhurst, G., 2014. Reaching the hard to reach? The rural public access wi-fi service delivery model – role, potential and pitfalls. In: Paper presented at the Fifth Annual Digital Economy All Hands Meeting, London, December 2014, Available at: http://aura.abdn.ac.uk/handle/2164/4450?show=full.

Hargittai, E., 2002. Second-level digital divide: differences in people's online skills. Clin. Hemorheol. and Microcirc. 7 (4) (no page numbers).

Howard, P.,N,, Busch, L., Sheets, P., 2010. Comparing digital divides: internet access and social inequality in Canada and the United States. Can. J. Commun. 35, 109–128.

Huggins, R., Izushi, H., 2002. The digital divide and ICT learning in rural communities: examples of good practice service delivery. Local Econ. 17 (2), 111–122.

International Farming Systems Association, IFSA, 2016. Social and technological transformation of farming systems: diverging and converging pathways. In: Proceedings of the 12th European IFSA Symposium, Available at: https://www.harper-adams.ac.uk/events/ifsa/about.cfm.

Ivus, O., Boland, M., 2015. The employment and wage impact of broadband deployment in Canada *Canadian*. J. Econ. 48 (5), 1803–1830.

LaRose, R., Gregg, J.L., Strover, S., Straubhaar, J., Carpenter, S., 2007. Closing the rural broadband gap: promoting adoption of the Internet in rural America. Telecommun. Pol. 31, 359–373.

Lowe, P., Ward, N., 2009. England's Rural Futures: a socio-geographical approach to scenarios analysis. Reg. Stud. 43 (10), 131901332.

Malecki, E.J., 2003. Digital development in rural areas: potentials and pitfalls. J. Rural Stud. 19, 201–214.

Naylor, R., 2007. Creative industries and rural innovation, pp35-51. In: Mahroum, S., Atterton, J., Ward, N. (Eds.), Rural Innovation. NESTA, London.

New Zealand Department of Internal Affairs, 2011. Digital Divide Literature Review. Available at: http://www.dia.govt.nz/pubforms.nsf/URL/Digital-divide-Literature-Review.pdf/$file/Digital-divide-Literature-Review.pdf.

Nordregio, 2017. Future Regional Development Policy for the Nordic Arctic: Foresight Analysis 2013–2016. Available at: http://www.nordregio.se/Templates/NordRegio/Pages/PublicationPage.aspx?id=4829&epslanguage=en.

North, D., Smallbone, D., 2000. Innovative activity in SMEs and rural economic development. Some evidence from England. Eur. Plann. Stud. 8 (1), 87–106.

OECD, 2001. Understanding the Digital Divide. OECD, Paris.

Ofcom, 2016. Connected Nations Report 2016. Available at: https://www.ofcom.org.uk/research-and-data/infrastructure-research/connected-nations-2016.

Office for National Statistics, 2016. Home Internet and Social Media Usage. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/householdcharacteristics/homeinternetandsocialmediausage/bulletins/internetaccesshouseholdsandindividuals/2016.

Pant, L.P., Hambly Odame, H., 2017. Broadband for a sustainable digital future of rural communities: a reflective interactive assessment. J. Rural Stud. 54, 435–450.

Park, S., 2012. Dimensions of digital media literacy and the relationship with social exclusion. Media Int. Aust. 142, 87–100.

Park, S., 2017. Digital inequalities in rural Australia: a double jeopardy of remoteness and social exclusion. J. Rural Stud. 54, 399–407.

Pavon, S., 2014. Animal identification in the European union. In: Presentation at ICAR Seminar on Key principles of Creation of National Systems of Identification and Traceability of Farm Livestock, Moscow, June 2014, Available at: https://www.icar.org/wp-content/uploads/2015/09/Pavon-AI-in-EU_EN1.pdf.

Philip, L., Cottrill, C., Farrington, J., Williams, F., Ashmore, F., 2017. The digital divide: patterns, policy and options for connecting the final few in rural communities across Great Britain. J. Rural Stud. https://doi.org.10.1016/j.jrurstud.2016.12.002.

Philip, L., Cottrill, C., Farrington, J., 2015. Two-Speed Scotland: patterns and implications of the digital divide in contemporary Scotland. Scot. Geogr. J. 131 (3–4), 148–170.

Phillipson, J., Shucksmith, M., Turner, R., Garrod, G., Lowe, P., Harvey, D., Talbot, H., Scott, K., Carroll, T., Gkartsios, M., Hubbard, C., Ruto, E., Woods, A., 2011. Rural economies: incubators and catalysts for sustainable growth. In: Submission to Government's Growth Review – Stage 2. Centre for Rural Economy and RELU, Available at: http://relu.ac.uk/news/Consultations/Growth%20Review.pdf.

Prieger, J.E., 2013. The broadband digital divide and the economic benefits of mobile broadband for rural areas. Telecommun. Pol. 37, 483–502.

Recruitment International, 2017. Over Half of SMEs Have No Plans to Take on Staff in 2017, Research Reveals. Friday 20th January, 2017. Available at: https://www.recruitment-international.co.uk/blog/2017/01/over-half-of-smes-have-no-plans-to-take-on-staff-in-2017-research-reveals.

RELU, 2013. *Rural Areas as Engines of Economic Growth* Policy and Practice Notes No.41 April 2013. Available at: http://www.relu.ac.uk/news/policy%20and%20practice%20notes/41%20Phillipson/PP41%20Phillipson.pdf.

Riddlesden, D., Singleton, A.D., 2014. Broadband speed equity: a new digital divide? Appl. Geogr. 52, 25–33.

Rogers, J.A., Yen, D.C., Chou, D.C., 2000. Developing e-business: a strategic approach. Inf. Manag. Comput. Secur. 10 (4), 184–192.

Salemink, K., Strijker, D., Bosworth, G., 2017. Rural development in the digital age: a systematic literature review on unequal availability, adoption and use in rural areas. J. Rural Stud. 54, 360–371.

Saxena, G., Ilbery, B., 2010. Developing integrated rural tourism: actor Practices in the English/Welsh border. J. Rural Stud. 26, 260–271.

Scottish Enterprise, 2016. How Digital Technology Can Help Transform Your Tourism Business. Available at: https://www.scottish-enterprise.com/knowledge-hub/articles/insight/how-digital-tech-can-help-transform-your-tourism-business, Accessed date: 22 November 2016.

Scottish Government, 2016a. Rural Scotland Key Facts 2015.

Scottish Government, 2016b. A Plan for Scotland: the Scottish Government's Programme for Scotland 2016-17. Available at: http://www.gov.scot/Publications/2016/09/2860.

Scottish Government, 2017. Achieving Scotland's Full Potential in a Digital World: a Digital Strategy for Scotland. Scottish Government March 217. Available at: http://www.gov.scot/Publications/2017/03/7843.

Shucksmith, M., 2012. Future Directions in Rural Development Carnegie UK Trust, Dunfermline. Available at: https://www.carnegieuktrust.org.uk/publications/future-directions-in-rural-development-full-report/.

Simons, H., 2009. Case Study Research in Practice. Sage, London.

Skerratt, S., 2013. Hot spots and not spots: addressing infrastructure and service provision through combined approaches in rural Scotland. Sustainability 2, 1719–1741.

Spencer, L., Ritchie, J., O'Connor, W., 2003. Analysis: practices, Principles and Processes. In: Ritchie, J., Lewis, J. (Eds.), Qualitative Research Practice. Sage, London pp199-218.

Stover, S., 2014. The US Digital Divide: a call for a new philosophy. Crit. Stud. Mass Commun. 31 (2), 114–122.

Strover, S., 2001. Rural internet connectivity. Telecommun. Pol. 25, 331–347.

Tookey, A., Whalley, J., Howick, S., 2006. Broadband diffusion in remote and rural Scotland. Telecommun. Pol. 30, 481–495.

Townsend, L., Wallace, C., Fairhurst, G., Anderson, A., 2017. Broadband and the creative industries in rural Scotland. J. Rural Stud. 54, 451–458.

United States Department of Agriculture, 2017. Farm Computer Usage and Ownership, August 2017 USDA National Agricultural Statistics Service. Available at: http://usda.mannlib.cornell.edu/usda/current/FarmComp/FarmComp-08-18-2017_correction.pdf.

van Dijk, J.A.G.M., 2006. Digital divide research, achievements and shortcomings. Poetics 34, 221–235.

Vicente, M.R., Gil-de-Bernabé, F., 2010. Assessing the broadband gap: from the pnetration divide to the quality divide. Technol. Forecast. Soc. Change 77, 816–822.

Warren, M., 2002. Agrinet - taking technology to the countryside. In: Paper presented at the 13th International Farm Management Congress, Wageningen, 2002.

Warren, M., 2004. Farmers online: drivers and impediments in the adoption of Internet in UK agricultural businesses. J. Small Bus. Enterprise Dev. 11 (3), 371–381.

Whitacre, B., Gallardo, R., Strover, S., 2014. Broadband's contribution to economic growth in rural areas: moving towards a causal relationship. Telecommun. Pol. 38, 1011–1023.

Williams, F., Philip, L., Fairhurst, G., Farrington, J., 2016. 'Digital by Default' and 'the hard to reach': exploring solutions to digital exclusion in remote rural areas. Local Econ. 31 (7), 757–777.

Wilson, B., Atterton, J., Hart, J., Spencer, M., Thomson, S., 2018. Unlocking the Digital Potential of Rural Areas across the UK Rural England CIC and Scotland's Rural College. Available at: https://ruralengland.org/unlocking-the-digital-potential-of-rural-areas-research/.

Woods, M., 2011. Rural Routledge: London.

World Economic Forum with The Boston Consulting Group, 2014. Delivering Digital Infrastructure. Advancing the Internet Economy. Available at: http://reports.weforum.org/delivering-digital-infrastructure/.

Yin, R.K., 2009. Case Study Research, fourth ed. Sage, London.

Zagata, L., Sutherland, L.-A., 2015. Deconstructing the 'young famer problem in Europe': towards a research agenda. J. Rural Stud. 39, 39–51.