The Digital Divide: Implications for agribusiness and entrepreneurship. Lessons from Wales

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Abstract

This paper investigates the impact of broadband access on agribusiness in rural Wales and the resulting implications on entrepreneurial activity. Despite attempts by Government and telecommunications providers to develop widespread broadband coverage in Wales, concerns remain in relation to an increasing digital divide between urban and rural locations. Broadband is a key enabling technology therefore connectivity is significant, not only in communication, but also in the ability for businesses to innovate and grow. Wales is a predominantly rural country with 84% of the total land area in Wales being used for agriculture (Welsh Government, 2013). The food and farming sector represents a significant part of the Welsh economy, and is dominated by small businesses. Connectivity and increased use of technology are vital for these businesses to overcome location constraints and various industrial challenges, notably Brexit.

The research uses survey data from 738 farmers and 107 food SMEs in Wales, with 19 follow-up semi-structured interviews. The survey results highlight issues of technology adoption, with 19% of farmers in the survey having no access to broadband internet, with others reporting the speed of connection being a limiting factor. The consequences of poor connectivity point to limited computer skills and low levels of soft technology adoption, a lack of engagement with social media, limited scope for innovation and restricted business growth, with 55.1% of food respondents identifying poor broadband access as a barrier to internationalisation. This has led to agrifood businesses adopting a passive approach to growth opportunities.

The findings suggest that rural areas remain at a disadvantage due to poor connectivity, an issue that must be tackled by the Welsh Government to readdress the balance in the economy and limit a brain drain of skilled people moving to urban areas, often outside Wales. Support for such businesses is vital, particularly given the pressures and uncertainty in the industry, as broadband access represents an important enabler for future innovation and entrepreneurial activity.

Keywords: Broadband, rural economy, agribusiness, entrepreneurship

1. Introduction

The aim of this paper is to investigate the impact of digital connectivity challenges on rural agrifood businesses. With a growing global population, there is increasing pressure on the agrifood sector to seek more innovative ways to meet food demands. The focus of the paper is on Wales, as a predominantly rural country, where agribusiness is a significant part of the economy, with 84% of the total land area in Wales being used for agriculture (Welsh Government, 2013) . Approximately 80,000 people are employed across agriculture and food production in Wales (Food and Drink Wales, 2017), around 5.7% of the total workforce. Employment in this sector in Wales remains higher than the average across the UK as a whole (approximately 1.42%) (Armstrong, 2016), and has greater significance in the rural economy where opportunities for employment are limited. Concerns have been raised about the development of a digital divide between urban and rural locations (Townsend, Sathiaseelan, Fairhurst, & Wallace, 2013) and there is a growing debate surrounding the challenges faced by rural economies and how these economies can be developed (Marsden, 2016; Marsden & Sonnino, 2008; Wilson, 2008; Winter & Lobley, 2009). These areas are compounded by issues relating to the rural-urban divide that are seen to be disadvantaging rural businesses. The situation is even starker in areas where agriculture is dominated by upland faming where these farms face greater pressures on connectivity and a lack of innovation (Morris et al., 2017). As such, this paper aims to evaluate the impact of the digital divide on the opportunities for rural-based farmers and food SMEs to grow their business. The paper adheres to calls from Salemink et al. (2017b) for more focussed research on specific places and communities in relation to urban-rural divisions in digital connectivity, with the aim of exploring customised policies.

There are increasing concerns regarding variable economic conditions across Wales, particularly between more affluent urban areas and poorer rural areas, where food production is a significant activity. Varying levels of broadband internet access have heightened these concerns, with evidence of stark differences in connectivity to premises between Cardiff (98.7%), Ceredigion (29.5%) and Powys (42.0%) (Ofcom, 2013). Despite attempts to develop widespread broadband coverage (95% of premises) across Wales, superfast coverage levels (85%) remain lower than the total UK coverage (89%). Rural Wales (19%) also lags behind UK rural levels (38%) of connectivity to 4G mobile services (Ofcom, 2017). Local inequalities underline the need for better infrastructure across the UK (Philip, Cottrill, Farrington, Williams, & Ashmore, 2017). Greater digital connectivity is recognised for its importance for business start-ups (Audretsch, Heger, & Veith, 2015) and enables entrepreneurship (Alderete, 2017). Areas that lack adequate broadband may experience out-migration to areas of better connectivity (Townsend, Wallace, Fairhurst, & Anderson, 2017). As a result, this paper focusses on the impact of connectivity on the entrepreneurial activities of agrifood businesses in Wales and rural economies with the aim of identifying policy areas that could develop digital equality across all parts of Wales.

In the next section this paper explores in detail these themes of connectivity, agrifood industry challenges, ICT adoption and entrepreneurship. Through the use of quantitative and qualitative methodology presented in section 3, this paper investigates the implications of

this digital divide on agrifood businesses. The unit of analysis for this paper are agrifood businesses which is broken down into farms and food SMEs. The results of the analysis are presented in section 4 and discussed in detail in section 5. The study makes a contextual contribution to understanding the impact broadband access has on agribusinesses, by highlighting the specific issues evident in Wales, where a clear urban-rural divide exists in connectivity levels. Additionally, this study draws together theoretical knowledge of entrepreneurship and location effects in food and farming and builds on the digital clusters identified by Henderson et al. (2018). The importance of this research are highlighted by the imminent threats faced by agrifood businesses, such as changing trends in food consumption, price volatility, and the uncertainty of Brexit. There is an urgency that agrifood businesses engage with ICT to develop more innovative activities seeking new opportunities. ICT adoption can facilitate a shift from reactive entrepreneurial activity to a more proactive attempt to seek business growth.

2. Rural Connectivity

Broadband is central to a range of everyday activities and should therefore be accessible to all (Townsend et al., 2013), however rural areas are most at need to overcome challenges of remoteness (Salemink et al., 2017b). Studies show that Information and Communication Technology (ICT) can address some of the issues faced by rural businesses such as location and remoteness. Yet, small and medium-sized enterprises (SME) growth can be stifled due to poor access to technology (Smallbone, North, Baldock, & Ekanem, 2002).

Galloway and Mochrie (2005) find that ICT uptake in the rural context is lagging due to supply and demand failures: the supply relating to poor infrastructure, and the demand relating to poor uptake of the technology. Warren et al. (2000) identify demand failures from an agricultural perspective and consider farmers' behaviour to be a barrier, with farmers preferring lower technology alternatives due to download time, cost, perceived lack of need, and insufficiency of existing services. It is evident that there is a lack of implementation and awareness of ICT in SMEs and that the lack of entrepreneurial drive or strategy of business owners is also a barrier to technology adoption, along with the skill set required (Galloway & Mochrie, 2005). If these technologies are not embraced by rural companies there is the growing possibility that they will be used by customers and competitors which in turn will challenge the unconnected (Fuller, Warren, & Rahman, 2015).

According to Donnelly (2014), further advances in technology will create employment opportunities back on the farm for educated young people in 'white collared' positions and, as a result, can return farming back to the family, whereas reforms of agriculture can occur through technology assisting in the reduction of waste. Burch et al. (2007), suggest that a global food shortage is likely to happen if the agriculture sector does not adopt new information communication interventions. ICT is a key enabling technology for many precision agriculture developments, managerial support tools as well as providing greater access to customers (Malecki, 2010). Farming activity is increasingly determined by the technology that is available and adopted. Therefore policy decisions on research and development may be as influential as the Common Agricultural Policy (CAP) itself with regards

to technology development and adoption in agriculture (Angus, Burgess, Morris, & Lingard, 2009).

ICT adopters may be categorised by speed of adoption (Rogers, 1962), but evidence shows that rural areas continue to lag due to gaps in infrastructure provision and quality (Galloway, 2007; Galloway, Sanders, & Deakins, 2011; Salemink, Strijker, & Bosworth, 2017a), as well as lower skill levels. As a predominantly rural area, connectivity issues in Wales are particularly significant. As also witnessed in developing countries, connectivity in Wales is a major barrier to technology adoption, especially in uplands areas (Morris et al., 2017). Indeed, in a study of UK regions, Blank et al. (2017) identified Central Wales as the second lowest area of internet use after the North East of England. Table 1 highlights differences in mobile coverage between the UK nations, with Wales displaying levels of coverage much less than the UK average, particularly compared to levels of coverage in England.

Table 1: Summary of outdoor mobile coverage from all operators in the UK and the nations

Technology (Coverage threshold**)**	Scotland	England	Wales	Northern Ireland	Whole of UK
2G	90%	94%	84%	83%	93%
3G	79%	91%	67%	73%	88%
4G	37%	50%	20%	0%	46%

(Ofcom, 2013)

A National Assembly for Wales research paper into broadband internet access (Wilkinson, 2013) states that Wales lags behind the other regions of the UK. The report, using 2012 data, shows that Wales has 1.8% of premises in potential not-spots; compared to 1.3% in the UK as a whole. Northern Ireland leads the way in terms of broadband infrastructure with just 0.6% of potential not-spots, and 91% of rural areas in Northern Ireland having the availability of superfast broadband services; compared to 6% in Welsh rural areas. Although Wales is geographically small in size, there are considerable variations in connectivity between urban and rural locations. Table 2 highlights a clear urban-rural divide in Wales by presenting connectivity data on three counties: Cardiff, the capital of Wales and the largest urban city, and Ceredigion and Powys, which are both traditional rural upland farming regions. While it is recognised that broadband access should be available to all across the UK, rural areas are more dependent on broadband to overcome problems of social and physical isolation. Better connected rural areas would be more attractive places to live, however, as some urban areas develop superfast broadband infrastructure, many vulnerable rural areas are being left behind (Townsend et al., 2013). Areas that lack adequate broadband infrastructure, are more susceptible to out-migration towards areas of better connectivity (Townsend et al., 2017), leading to a brain drain of skills in rural areas.

Table 2: Connectivity in Cardiff, Ceredigion and Powys

Region	Cardiff	Ceredigion	Powys
Premises Coverage			
No Reliable Signal	0.00%	7.50%	6.00%
Coverage from all operators	99.70%	52.70%	67.50%
Geographical Coverage			
No reliable signal	0.00%	26.90%	22.40%
Broadband take up	98.70%	29.50%	42.00%
Mobile data MB/Premises/Month	1261	682	591

(Ofcom, 2013)

While connectivity factors are important, so are adoption trends (Salemink et al., 2017a). Technology adoption in agriculture is driven by regulation and by changes to farming objectives (e.g. organics) as well as by wider socio-economic conditions (Reed et al., 2009; Warren et al., 2000). Innovation adoption is critical for agricultural development (Feder & Umali, 1993; McFadden & Gorman, 2016), and is a key factor in understanding how farm households operate and remain viable or competitive.

2.1 Industry challenges

Although many industries have embraced technological change, agriculture is perceived as lagging behind in adopting these technologies (Barrett, Carter, & Timmer, 2010). There are fears that the digital revolution is bypassing agriculture, a factor more prominent in upland livestock systems. Arable and dairy sectors seem more amenable to adopt new technologies. Many of these farm types are already utilising big data, biotechnology, satellite tracking, robotics and drone technology. In upland livestock systems there is a clear lag in technology uptake that requires investigation (Zuckerberg & Kennes, 2017). In order to meet the challenges facing the industry, including Brexit, agriculture is required to generate, promote and increase the uptake of new technology, skills and knowledge. Pollock (2012) comments on the need to develop a research and development framework that identifies the skills and knowledge gaps, which are likely to reduce competitiveness.

With increasing challenges within the food and farming sectors, businesses are seeking to develop greater entrepreneurial activity through diversification to enable business growth. Despite a wealth of literature on farm diversification a precise definition of farm diversification is still to this day fuzzy and contested (Hansson et al., 2013). However, for the purpose of this study diversification will relate to off-farm income and any income derived from non-food production. Reliance on off-farm income generating activity, or pluriactivity, has for some time been a strategy adopted by farm-based households to absorb economic shocks and protect rural society (Shucksmith, Bryden, Rosenthall, Short, & Winter, 1989). With many farming households deriving some proportion of their total income from off-farm sources (Farm Business Unit, 2013). According to a 2010 survey, 41% of Welsh farming households were pluriactive (Wales Rural Observatory, 2011) . The scope for pluriactivity may be a function of both internal factors and geographic location and the interplay between these (Bateman & Ray, 1994). Other research, which focuses on the alternative income

seeking motives of farmers (Agnete Alsos, Ljunggren, & Toril Pettersen, 2003; Grande, Madsen, & Borch, 2011) is concerned with on-farm technology options that can assist revenue enhancement and production efficiencies. Technology adoption is therefore regarded as a rural entrepreneurship opportunity. Diversifying farmers may pursue resourced-based entrepreneurial strategies and/or portfolio entrepreneurial activity which seek to widen the range of farm-based opportunity-seeking activity (Agnete Alsos et al., 2003).

Whilst diversification might be a common income-seeking strategy, recent evidence for Wales contends that 'most farmers preferred to improve the quality and efficiency of their farming skills, instead of diversifying their business' (Wales Rural Observatory, 2011). However, the existence of market opportunity, arising from location and (digital) connectedness, may continue to be one of the most important influences (Galloway et al., 2011; Midmore, 2011), leading on to the importance of innovation and technology adoption as a key enabling influence behind farm diversification and entrepreneurial strategies. Entrepreneurship, in the form of on-farm diversification activity, deploying resources either as a substitution for current farm enterprise or to increase the range of farm business activity, may be critical for the survival of contemporary family-managed farm businesses (Hansson et al., 2013; McFadden & Gorman, 2016; Seuneke, Lans, & Wiskerke, 2013).

A diversification of entrepreneurial activity among food and drink SMEs is evident through internationalisation as a means of spreading the risk across different markets (Spowart & Wickramasekera, 2012). The internet is a valuable resource for small and medium-sized enterprises (SMEs), which often face greater challenges due to their smaller size. Advantages for SMEs from internet access are manifested in various ways, notably through marketing, network connections and internationalisation opportunities. The internet is seen as an indispensable marketing tool for smaller firms, providing access to communication, information and foreign collaborators, customers and suppliers (Etemad & Wright, 1999). A study by Sparkes and Thomas (2001) into the internet as a critical success factor in the marketing of Welsh agrifood SMEs, observed an increasing trend towards local food production and recognised the need for Welsh agrifood SMEs to develop their own websites in order to establish a customer base and help international growth. Results showed that only 38% of companies had their own website at a time when the internet was less widespread and not as widely used as nowadays.

It has long been recognised that internet access has facilitated internationalisation (Giustiniano & Fratocchi, 2002; Sparkes & Thomas, 2001; Testa, 2011). Smaller firms have been able to internationalise at a faster rate due to global networks and developments in technology, particularly in communication and the production process (Knight & Cavusgil, 1996). This is evident in the emergence of Born Globals (Hollensen, 2014), companies which internationalise from their inception (Oviatt & McDougall, 1994). The growth of such companies is attributed to the globalisation of markets, capacity development of people, and smaller companies and technology development, particularly the development of the internet and mobile technology (Gabrielsson & Kirpalani, 2012).

2.3 ITC Adoption and Entrepreneurship

Whilst there is an extensive literature on farm diversification, more recently entrepreneurship in the wider rural context has been the research focus (McElwee and Smith, 2014; Pato and Teixiera, 2016). Entrepreneurship may be critical for the survival of contemporary family-managed farm businesses and the developed of food SMEs (Seuneke et al., 2013; Hansson et al., 2013; McFadden and Gorman, 2016). De Rosa et al. (2019) considers how 'resource orchestration' is important for strategic and entrepreneurial activities on family farms. However, it is argued that farmers are not entrepreneurs because the external market environment at present is subsidised and therefore not necessitating competitive responses (McElwee, 2006). However, with the changing political and trading environment this subsidised environment is likely to change, factors that will also impact on food SMEs.

The adoption of technology in search of diversified farm business opportunities appears to be consistent with wider conceptions of entrepreneurship. Morone (1989) considers why some enterprises appear to build competitive advantage on the basis of technology (efficiency-focused) or technology-based opportunities (differentiation/diversification focused), yet other enterprises do not. Morone, (1989) proposes that successful enterprises have better management of technology. Research by Galloway and Mochrie (2005) on ITC connects with the entrepreneurship literature in that the business owner or decision-maker is the main barrier to ITC adoption. There is evidence that this is not only an issue for agriculture-based enterprises but rural firms, in general, lack skills and ambitions to engage in entrepreneurial activity (Laukkanene and Nittykangas, 2003).

The literature on the role of social media and entrepreneurship is limited (with exception to Samuel and Joe 2016; Morris et al. 2017), who explore the role of social media and entrepreneurship in the context of SMEs. The research finds that social media increases market access and customer relations whilst also being a valuable tool for strategic growth. However, the existence of market opportunity, arising from location and (digital) connectedness, may continue to be one of the most important influences (Galloway et al., 2011; Midmore, 2011). Social media, in an agrifood context, gives rise to both threats and opportunities. There is significant opportunity to transfer knowledge in a cheaper and less time-consuming manner than the traditional routes of demonstration farms, agricultural shows, workshop events and industry press. The adoption of the internet to communicate with consumers and inform them of production methods can change the perception of the firm and its products (James & Hopkinson, 2005; Martin & Matlay, 2003). This can also contribute to improved traceability at the level of the individual farm. However, threats are ever-present through misinformation, trolling and an accelerating volume of messages. The development of digital and marketing skills are key drivers for further entrepreneurial activity among agrifood businesses. Social media provides farmers and food producers with a voice and creates networking opportunities. The barriers observed are that social media users do not utilise the tangible facts before forming opinions. The risk aversion of some users prevents them from moving from observation to engagement (Morris & James, 2017).

A review of the literature and contextual background underlined that connectivity levels in Wales were among the lowest in the UK and that a clear digital divide is evident between rural and urban areas of Wales. Given that Wales is a predominantly rural country and that levels of connectivity have a bearing on the entrepreneurial activities of smaller firms, this paper

investigates the impact of this digital divide on the entrepreneurial activities of agrifood businesses in Wales.

3. Methodology

The study uses multi-methods research to study the implications of broadband access on agribusinesses in Wales. The use of multi-methods was deemed the most appropriate to gain an in-depth understanding of the topic and allow for triangulation of results. This includes an initial questionnaire aimed at understanding the main undertakings in which these respondents require broadband internet access, and how this impacts on their entrepreneurial activities. The questionnaire was sent to 7,500 upland beef and sheep farmers, with responses from 738 farmers (response rate 9.84%), and 451 food and drink SMEs, obtaining 107 responses (23.7%). The sample was a convenience sample utilising the previously mentioned databases. Bryman and Bell (2003) argue that a low response rate for a convenience sample is less significant and satisfactory due to the large number of responses. Descriptive analysis was conducted on the primary survey data with Chi-square and correlation analysis used to analyse and compare the different groups of respondents.

Additionally, follow-up semi-structured interviews were conducted with 10 farmers and 9 food and drink SMEs in order to conduct a more in-depth investigation of the respondents' experiences. A purposive sampling technique was used to identify interviewees based on location and businesses type. The questionnaires and interview guides were tailored towards the type of respondent, with farmers representing sole traders or micro enterprises and food and drink companies representing SMEs of all sizes, from micro to medium-sized. The interviews (n=19) ranged between 50 minutes and three hours and were conducted through the medium of English (17) or Welsh (2). Data obtained through the medium of Welsh was later translated into English for analysis. The number of interviews reached data saturation where no new themes were being captured. Responses from both farmers and food SMEs were collected and analysed independently, followed by case-by case analysis (Patton, 1990; Yin, 2003) and finally thematic analysis (Braun & Clarke, 2006) with results then triangulated for interpretation together.

4. Results

4.1 Farmers Results: Quantitative

The results of the survey of 738 upland sheep farmers in Wales highlight that 19% of respondents had no access to broadband as can be seen in Table 3.

Table 3: Farmers' Access to Broadband

Have broadband access	Number of farms	Percentage
No	140	19
Yes	598	81
Total	738	100

Cross tabulation of the survey data highlight the importance of broadband connectivity as a key enabler for other technologies. The data presented in table 4 explains that 37.3% of

sample farmers are using computerised accounts. Using a Chi Square analysis we find that broadband access is significant to $p<0.001$ when farmers adopt computerised accounts. The same is true for the adoption of decision support systems at a significance level of $p<0.001$, where only 2 respondents that use decision support systems had no broadband compared to 120 that did.

Table 4: Farmers' Use of Computerised Accounts

Computerised accounts used	Number of farms	Percentage
No	463	62.7
Yes	275	37.3
Total	738	100

The literature, such as Morris et al. (2017), highlights the role of ITC in assisting business strategies and entrepreneurial stance. Using Chi square analysis we see that there is a relationship between broadband access and off-farm income at a significance level of $p=0.039$. Where 310 respondents engaged in off-farm income had broadband access as opposed to 59 that had no access to broadband. It is recognised that diversification in farming activities is important in overcoming periods of economic difficulty (Shucksmith et al., 1989) and widening the range of farm-based opportunities (Agnete Alsos et al., 2003).

Morris and James (2017) analyse the role of social media in assisting entrepreneurship amongst farmers. Despite low numbers using social media (see table 5), the use of social media among farmers is more prevalent among younger farmers, with 71% of respondents under 30 using social media, compared to only 14% of those aged over 65 (Morris & James, 2017). However, the percentage of farmers using social media for their farm work was much lower, with 14% of under 30s and only 4% of over 65s engaged in this. With an average age of 60.3 in the Welsh agriculture industry (Welsh Government, 2013), it comes as little surprise that engagement numbers in social media are low. Not surprisingly connectivity was vital to social media engagement at a significance level of $p<0.001$ using Chi Square analysis.

Table 5: Farmers' Use of Social Media

Use social media	Number of farms	Percentage
No	555	75.2
Yes	183	24.8
Total	738	100

4.2 Farmers Results: Qualitative

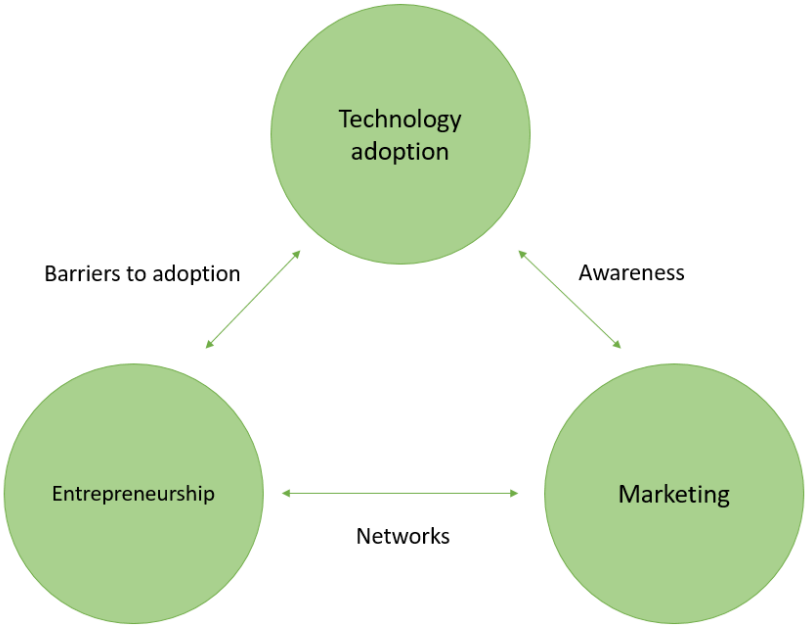
Follow up interviews were conducted with 10 farmers aimed at adding more contextual information to provide a comprehensive understanding of the main issues relating to broadband access. Table 6 presents a profile of the respondents, highlighting differences in age, farm type and location of the respondents. The table also identifies farmers that engage with social media, and those that use social media for their farm work.

Table 6: Profile of Farmers Respondents

Respondent	Age	Farm Type	Location	Social Media Use	Social Media Use for Farm
Farmer 1	Under 40	Hill	Ceredigion	Yes	No
Farmer 2	51-65	Hill	Clwyd	Yes	Yes
Farmer 3	Over 65	Upland	West Glamorgan	No	No
Farmer 4	Over 65	Hill	Mid Glamorgan	No	No
Farmer 5	41-50	Upland	Pembrokeshire	Yes	No
Farmer 6	51-65	Upland	Gwent	No	No
Farmer 7	Under 40	Hill	Powys	Yes	No
Farmer 8	51-65	Hill	Powys	No	No
Farmer 9	51-65	Upland	Pembrokeshire	No	No
Farmer 10	41-50	Hill	Powys	Yes	Yes

Following analysis using the Braun and Clarke (2006) method for thematic analysis, three themes were identified from interview responses (see Figure 1), namely technology adoption, entrepreneurship and marketing.

Figure 1: Themes from Interviews with Farmers



Although Table 3 documented high levels of connectivity among survey respondents, the qualitative findings create a starker situation where the majority comment that despite being connected many experience slow download speeds and often intermittent connectivity. Farmer 4 comments *"ours is so slow, it's only like 2 megabytes. So, often I'm doing the VAT and all about 12 o'clock in the morning"*. This is an issue with Government subsidies applications to be made online and there is increased demand for online record keeping. Farmer 4 is concerned *"They've got to make sure that everybody's got broadband, haven't they, and that it's working properly?"* This represents a barrier to technology adoption and impacts on the entrepreneurial activity of the business.

Further issues of connectivity are raised in the qualitative findings, where despite the majority of farmers having broadband access, two interviewees had to invest in Airband.

> Luckily enough this is actually a satellite broadband, we're too far from the internet to get it, we've got Wi-Fi in the house but there's no phone signal either, there's no mobile signal. So that does cause certain difficulties to pick up even a bit of signal (Farmer 1)

Whilst there is access to broadband on the majority of farms in the sample, access to mobile phone signal is also problematic as mentioned by Farmer 1. Farmer 8 highlights the issue of not spots in the uplands *"The signal in the house here, no, there isn't a signal, you've got to be up the yard, up the fields, so I end up going without it."* Farmer 10 also experiences restrictions on mobile phone use:

> I don't do a lot with apps, I want to, but we have WiFi in bits of the house but not in all of it, and the trouble with my phone is, that if I turn the internet bit on, it uses the battery that quickly, because it's constantly searching, a bit like when you've got no signal, it's constantly searching for a signal it uses way more battery than if it's got signal (Farmer 10)

Engaging with the power of social media can create opportunities for entrepreneurship on farms and overcome some location remoteness factors. Social media is recognised as a means for increasing awareness of small businesses, therefore acting as a significant marketing tool (Samuel & Joe, 2016). Morris and James (2017) underlined the risk aversion that prevents farmers from engaging in social media, but some are already embracing this, such as Farmer 2: "*The butcher has had people coming in, seen it on Twitter and asked for a leg of lamb from Mr X's farm".*

Embracing the digital revolution is critical for future farm survival and rural economy resilience (Roberts, Anderson, Skerratt, & Farrington, 2017). Connectivity is key with broadband and mobile phones as enablers of such technologies. Farmer 5 recognises the opportunities the digital revolution can have on developing networks in agriculture:

> Everything's changing really quick and perhaps technologies will allow us to be more interconnected because essentially we're just individual businesses in the same sector and perhaps with time technology will allow us to be more interconnected so that perhaps we could collaborate or better understand how we are all getting on (Farmer 5)

4.3 Food and Drink SMEs: Quantitative Results

Survey responses from the 107 food and drink SMEs distinguished between 64 rural-based and 43 urban-based SMEs, as shown in Table 7. All of the participants possessed a company website, a considerable advancement since the work of Sparkes and Thomas (2001), and the majority had a presence on social media, although this was more evident in urban SMEs (90.70%) than rural SMEs (81.25%). Urban SMEs were also more likely to internationalise (34.88%), although this was only marginally higher than rural-based SMEs (31.25%).

Table 7: Descriptive Statistics of Food Producers' Survey

	SMEs	Website	Social Media	Internationalise
Rural	64	100%	81.25%	31.25%
Urban	43	100%	90.70%	34.88%

Exploring the main issues relating to food and drink SMEs and internet access, Table 8 presents a comparison of means on a national, rural and urban basis. A mean of 3.5888 was observed for the need for companies to access broadband internet, however the mean for rural-based companies (3.7656) was higher than that in urban areas (3.3256), which implies that access to broadband internet is a more important resources for rural-based SMEs (Salemink et al., 2017b). Similar results were observed for technology, which is seen as a more significant resource for rural-based SMEs. With a view to internationalisation, access to foreign market knowledge was recognised as a significant variable, with urban-based SMEs observing a higher mean (3.6279) compared to rural SMEs (3.3750). The *Respond to international demand* variable highlights that urban SMEs (3.2326) had a higher likelihood of taking a reactive approach to internationalisation, slightly higher than rural SMEs (2.9688).

Table 8: Comparing means on a national, rural and urban scale

			Wales		**Rural**		**Urban**	
Item	Min.	Max.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Access to broadband	1.00	5.00	3.5888	1.18921	3.7656	1.12323	3.3256	1.24825
Technology	1.00	5.00	3.0093	1.03245	3.0781	1.05867	2.9070	0.99556
Foreign market knowledge	1.00	5.00	3.4766	0.96491	3.3750	1.00000	3.6279	0.90035
Respond to international demand	1.00	5.00	3.0748	1.24916	2.9688	1.27203	3.2326	1.21179

A correlation analysis (see Table 9) outlines the relationship between these variables and internationalisation. No significance was observed in rural or urban areas for access to broadband, with a positive correlation coefficient for rural SMEs and a negative correlation for urban SMEs. Technology was observed as a significant resource, both for rural and urban areas. In terms of internationalisation, access to foreign market knowledge was also seen to be significant for SMEs in both rural and urban areas. No significance was found for urban SMEs to the respond to international demand variable, however this was significant for rural SMEs, implying that rural SMEs are more likely to internationalise in a reactive manner, with international buyers approaching rural Welsh SMEs to sell their products abroad.

Table 9: Correlation results

	Wales			**Rural**			**Urban**		
Variable	N	Correlation Coefficient	Sig. (2-tailed)	N	Correlation Coefficient	Sig. (2-tailed)	N	Correlation Coefficient	Sig. (2-tailed)
Access to broadband	107	0.030	0.756	64	0.158	0.213	43	-0.114	0.467
Technology	107	0.375**	0.000	64	0.376**	0.002	43	0.400**	0.008
Foreign market knowledge	107	0.310**	0.001	64	0.259*	0.039	43	0.398**	0.008
Respond to international demand	107	0.208*	0.031	64	0.260*	0.038	43	0.123	0.432

* Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.01 level (2-tailed)

The quantitative results underline the importance of the internet as a key resource for food and drink SMEs in Wales (Giustiniano & Fratocchi, 2002; Sparkes & Thomas, 2001; Testa, 2011), both in rural and urban areas. All survey companies possessed a website and a high percentage of respondents also had a social media presence. It is clear that access to broadband internet is an important resource for food and drink companies, indeed access to relevant technology is a significant resource for internationalisation. Access to foreign market knowledge is also significant for internationalisation, which could be facilitated by access to the internet. The reactive nature observed for internationalisation among rural SMEs highlights the significance of connectivity to food and drink SMEs, as internationalisation is more likely to occur through internationally-based companies approaching Welsh SMEs to buy their products. As a result, the possession of a company website or social media pages is crucial for Welsh food SMEs to raise awareness of their products and their company story. Access to the internet would also be necessary for SMEs in order to conduct research into foreign markets and foreign buyers that approach them, as well as facilitating communication.

4.4 Food and Drink SMEs: Qualitative Results

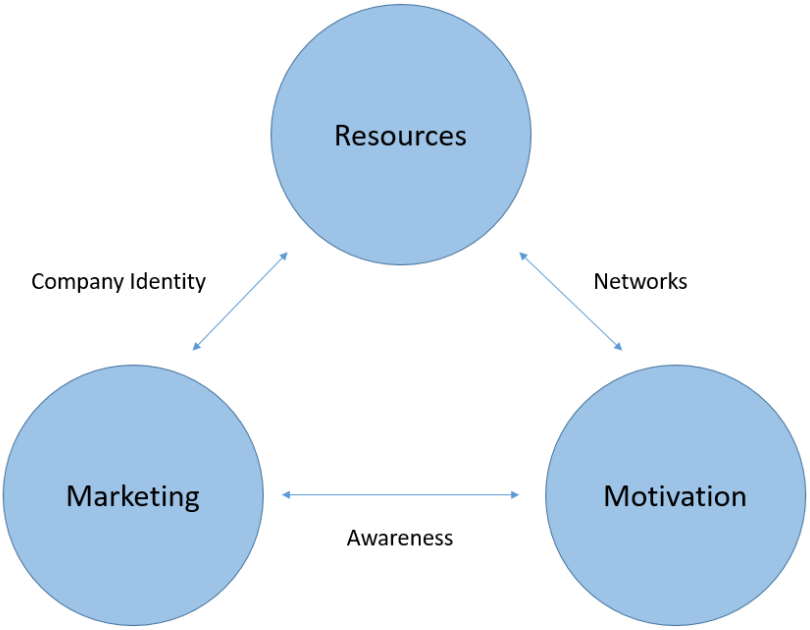
Nine follow-up interviews were conducted with owner-entrepreneurs from Welsh food and drink SMEs. Table 10 presents a profile of the respondents, which include 7 exporters and 2 non-exporters. Respondents are also distinguished according to their company age, size and location. Details are also provided of international sales and locations of exporting SMEs.

Table 10: Profile of Food and Drink SME Respondents

Respondent	Company Age (years)	Size (employees)	Location	Activity	Sales Abroad	Sales Location
Food 1	0-2	1-9	Rural	Exporter	0-5%	North America
Food 2	11-20	10-49	Rural	Exporter	11-20%	Europe, Middle East, Asia, North America, Oceania
Food 3	3-5	1-9	Rural	Exporter	0-5%	Europe
Food 4	21+	10-49	Urban	Exporter	11-20%	Europe, Africa Asia, Oceania
Food 5	11-20	10-49	Rural	Exporter	21-50%	Europe, Middle East
Food 6	21+	10-49	Rural	Exporter	0-5%	Europe, North America
Food 7	11-20	1-9	Rural	Exporter	0-5%	Europe
Food 8	3-5	1-9	Urban	Non-exporter		
Food 9	11-20	10-49	Urban	Non-exporter		

Using the Braun and Clarke (2006) method for thematic analysis, interview responses led to the identification of three themes (see Figure 2), namely resources, motivation and marketing.

Figure 2: Themes from Interviews with Food and Drink SMEs



The resources theme refers to the importance of internet access as a resource for the company. Respondent Food 2 spoke of limited access to broadband internet as being a challenge to their ability to operate, however, it is evident that the internet is an important tool for small food companies to raise awareness of their products on a local, national or international scale and can also develop e-commerce opportunities. Company websites exist for all respondents, and this was recognised as a significant resource in raising awareness of the company and its products, as well creating opportunities for internationalisation as they received unsolicited orders from international buyers.

> We have a shop online on our website and we get orders coming in from everywhere. We send our stuff to about half a dozen customers across Europe and Canada, but we don't have any control over that, it just happens. That wasn't my intention, it's just that we get orders through the online shop. That's how it started (Respondent Food 7)

The use of the company website as a means of generating awareness of the company underlines the role the internet plays in building networks for food and drink SMEs, which are significant for international growth. However, it is clear that the initiation of international sales stems largely from international buyers rather than the company, as they take a reactive approach to internationalisation (Hollensen, 2014). Given the small nature of SMEs, particularly micro-enterprises, such companies lack the resources (particularly time, personnel and experience) to engage proactively in seeking international opportunities.

> We don't try to export our products. Export for us is something completely opportunistic. If people come to us, we're not going to say no, we try to accommodate them. We only have one sales manager and usually it is important that we work in the local market…I don't want it to be a waste of time (Respondent Food 6)

The third theme pointed to the use of the internet in marketing food and drink SMEs. Nowadays, the internet is an important fountain of information, therefore having a company

website, social media pages and effective use of digital marketing techniques can raise awareness of the company and its products (Samuel & Joe, 2016). For small businesses the company story is an important aspect of their marketing, as it represents their identity and distinguishes them from larger companies. This was echoed by respondent Food 3, stating "it came from the kitchen and that it's proper fudge rather than mass produced, so it really adds to the story that you're trying to sell as well". The same was true for respondent Food 7, who emphasised that the company narrative is something inherently unique to the company.

> People can copy your product, but they can't copy your story. That is so powerful. If you have seen our website, we do a lot about who we are and where we come from, the family, Snowdonia, fresh air, all of this stuff. That is the story (Respondent Food 7)

5. Discussion

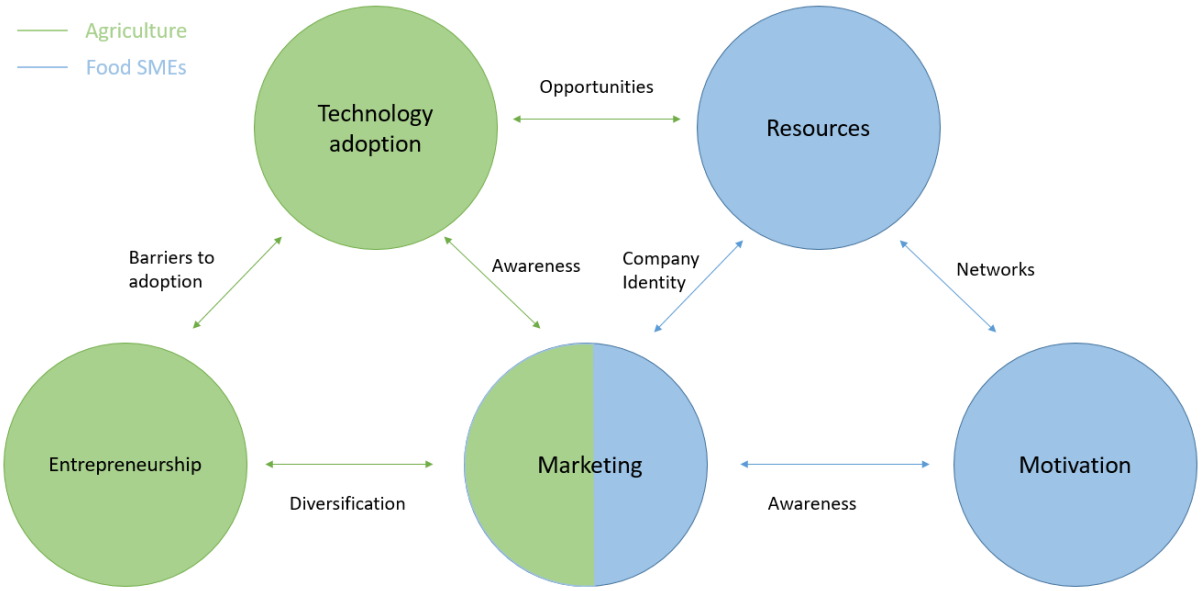
Collective results (see Figure 3) highlight the similarities and differences that exist between food and farming businesses in relation to their entrepreneurial activities through internet access. Technology adoption was an issue among farmers, with only 81% of farmers having access to broadband internet, whereas 100% coverage was observed for food and drink SMEs. Access to broadband internet and ICT more generally is a vital resource for the growth of small businesses. For farmers, this was manifested in the need to diversify, as it was recognised that developing a wider range of entrepreneurial activities is important at a time when farm incomes are under pressure (Hansson et al., 2013; McFadden & Gorman, 2016; Seuneke et al., 2013). Growth for food and drink SMEs is expressed through internationalisation, facilitated through internet access (Giustiniano & Fratocchi, 2002; Sparkes & Thomas, 2001; Testa, 2011). This is particularly evident in generating international awareness of the company and its products, leading to the company receiving unsolicited orders from international buyers (Hollensen, 2014).

The development of these entrepreneurial activities differ between food and farming businesses. The lack of available technology acts as a barrier to the development of entrepreneurial activities for farmers. This is evident either through limited access, or through a lack of ICT skills, therefore it is essential that farmers have access to the internet and are educated to use the technology (Lowe & Talbot, 2000; Morgan, Marsden, Miele, & Morley, 2010; Sutherland, Toma, Barnes, Matthews, & Hopkins, 2016). For food and drink SMEs, international growth is dependent on the company's motivation to grow. The presence of a company online through a website or social media pages is an important means of raising awareness of the company and its products, however it is evident that food and drink SMEs take a more reactive approach, being pulled into internationalisation through receiving orders from abroad (Etemad, 2004; Hollensen, 2014). Findings in Table 7 underline that although all food and drink SMEs possessed a company website, levels of engagement with social media and internationalisation were lower among rural-based SMEs compared to those in urban areas.

A common theme observed across both industries is the use of ICT for marketing. Both food and farming businesses saw advantages in promoting their business through their online presence, such as the company website or social media pages. The mass influence of this

online presence provides opportunities for agribusinesses to engage with stakeholders and develop more entrepreneurial activities (Morris & James, 2017). This was significant in raising awareness of the companies' activities, but this was especially important for food businesses in conveying the companies' identity. The company narrative is an inherent part of the business, as food products are closely associated to their place of origin (Tregear, 2001). For food SMEs, their unique narrative serves as a competitive advantage as this appeals to many customers over mass-produced products from larger companies (Respondent Food 7).

Figure 3: Combined themes from interviews with agrifood businesses



The study underlines the reactive nature of businesses in the food and farming industries. The hesitancy of farmers to adopt technology implies a lack of desire to engage in new and innovative activities. With an average age of farmers in Wales being of 60.3 (Welsh Government, 2013), it can be inferred that farmers are less open to innovative practices, as seen by the fact that only 4% of respondents over 65 used social media for their farm business. Indeed, Welsh farmers are seen to be more interested in improving quality than diversifying their business (Wales Rural Observatory, 2011). Those that do use social media for their farm also displayed reactive approaches to business growth as they responded to demand that came their way after being found on Twitter. The same is true for food SMEs that, despite a much higher uptake in online engagement, favour a passive approach to internationalisation as they respond to international orders. As small businesses, the lack of resources, such as foreign market knowledge, explains why a reactive approach is taken towards internationalisation, with a correlation analysis underlining the significance of this approach.

The reactive nature of agribusinesses observed in this study corresponds with the Passive Exploiters and Digitally Disengaged clusters outlined by Henderson et al. (2018) in their 2017 Digital Maturity Survey for Wales (see Figure 4). This echoes distinctions between passive and static rural areas compared to mobile urban areas (Bell, Lloyd, & Vatovec, 2010). Food SMEs mostly correspond to the Passive Exploiters, as they do possess ICT skills and use online platforms to generate e-sales, although this study has shown that this is done through

receiving orders rather than seeking to generate international sales. Some farmers that have an online presence also fit into this cluster, as has been seen with sales being generated through Twitter. Despite this, the majority of farmers could be considered as Digitally Disengaged, as the majority have below average ICT skills and do not use digital technologies to develop online sales. This reactive nature to growth is in line with Kubíčková et al. (2014) who concluded that micro and small enterprises were primarily motivated by reactive approaches to internationalisation, through a demand for their products from abroad.

Figure 4: Digital maturity clusters in Wales

Digitally Embedded	Adopters of superfast broadband with a very high proportion of employees with above average ICT skills; using a high number of digital applications, and secure the majority of their sales from online transactions.
Active Exploiters	Businesses likely to have adopted superfast broadband, having a high proportion of staff with above average ICT skills, and using a wider range of digital platforms and technologies. Nearly half of businesses in this cluster report online channels as the primary source of their sales.
Passive Exploiters	Businesses tending to have adopted standard broadband; more likely to have staff with above average ICT skills. They make use of basic cloud-based applications, but their use of online platforms to generate e-sales is generally low.
Digitally Disengaged	Businesses tending to be standard broadband users, with a high proportion of employees with below average ICT skills. The majority of such businesses do not use digital technologies and report no sales from online transactions.

Henderson et al. (2018)

The Digital Maturity Survey (Henderson et al., 2018) emphasises the importance of digital technologies to the performance of SMEs. This is in line with the need for such companies to have access to broadband internet, however 2017 levels showed that only 42% of participants had access to superfast broadband. Given that 99% of all businesses in Wales are SMEs (Welsh Government, 2016), sufficient access to broadband internet is vital for the performance of SMEs. This is especially true for agribusinesses, which tend to be mostly micro in size (less than 10 employees). With the survey identifying potential performance increases of up to 50% among the more digitally mature clusters, it is essential that agribusinesses in Wales strive to develop a more active engagement with ICT and aim to move towards the Active Exploiters and Digitally Embedded clusters. To achieve this, Welsh agribusinesses should seek support from the Welsh Government and other relevant sources to develop their ICT skills and develop a more proactive attitude towards digital technologies within their business. Simultaneously, there is a duty with the Welsh Government to ensure that broadband levels in Wales are improved so that small businesses in all industries and all parts of Wales can have access to broadband internet, as this is vital for the development of the Welsh economy (Henderson et al., 2018).

6. Conclusions

Findings of the study underline the importance of internet access to agribusinesses, echoing findings of Henderson et al. (2018). Differences are observed between farming and food

businesses in their attitude towards the use of ICT. The older average age and characteristics of farmers explain the low uptake of technology within the industry, as the younger generation have grown up with internet technology and therefore possess greater skills and an awareness of the advantages of such technology to their business (Donnelly, 2014). This is evident in the differences observed in the use of social media between farmers and food SMEs. Only 24.8% of the 738 farmers used social media compared to 85% food SMEs surveyed.

The study makes a contextual contribution to knowledge of the impact broadband access has on agribusinesses, by highlighting the specific issues evident in Wales, where a clear urban-rural divide exists in connectivity levels, responding to calls from Salemink et al. (2017b) for a greater focus on urban-rural divisions in specific places. Additionally, this study draws together theoretical knowledge of entrepreneurship and location effects in food and farming and builds on the digital clusters identified by Henderson et al. (2018). Findings underline differences between issues of limited connectivity between food and farming respondents, particularly in resource allocations, and opportunities and motivations for growth. Despite this, a common theme observed across all agribusinesses was reactivity to entrepreneurial activity, thus, the paper points to a need to develop a more proactive approach to digital business activities among agribusinesses, as this could improve the performance of these businesses (Henderson et al., 2018). Small businesses' lack of resources is a challenge and the use of ICT is a means of overcoming some of these in seeking new market opportunities, such as diversification or internationalisation. Findings show that these opportunities exist and can be enhanced through digital technologies, therefore support is needed to realise this potential.

Given the reactivity of rural agribusinesses, the government plays a significant role in raising awareness of the opportunities that can arise from ICT adoption and supporting the development of ICT skills, as well as ensuring that the digital infrastructure supports such advancements, where businesses are not disadvantaged from their location. It is clear that a digital divide still exists between urban and rural areas of Wales (Ofcom, 2017), with findings among food SMEs showing lower levels of engagement in ICT and internationalisation in rural areas, therefore there is a need for improvements in infrastructure to ensure that opportunities for rural SMEs are equal to those in urban areas. As such, economic policies should ensure that rural areas possess the same opportunities as urban areas. The emergence of city deals across the UK, including Wales, points to greater opportunities for regional cities to develop economic activities. With city deals established for Cardiff and Swansea in South Wales and a North Wales growth deal also in place, it is essential that rural areas such as Mid Wales are not overlooked, as these are the areas that most need improved digital infrastructure (Salemink et al., 2017b). The same is true for rural areas across the UK and elsewhere, as broadband is a central enabler to a range of activities (Townsend et al., 2013). Failure to address divisions between urban and rural areas only serves to exacerbate the brain drain and the loss of skills from rural to urban areas.

The food and farming industries face many challenges, such as changing trends in food consumption and price volatility, however the uncertainty of Brexit has emerged as an

overriding threat to these industries in the UK. As such, there is an urgency that farmers and food producers engage with ICT to develop more innovative activities and seek new opportunities and connect to new markets. It is therefore necessary that agribusinesses seek to develop their skills in this area and that appropriate support is offered. Such changes can facilitate a shift from reactive entrepreneurial activity to a more proactive attempt to seek business growth. Although general support in seeking to overcome a reactive attitude to growth opportunities is essential, specific tailored support to the farming and food sectors would also be beneficial due to the different entrepreneurial activities evident between the sectors, with farming focussed on diversification of activities, and food SMEs on internationalisation. It is acknowledged from the literature that entrepreneurial activity is critical for rural-based businesses (Seuneke et al., 2013; Hansson et al., 2013; McFadden and Gorman, 2016). Farmers would benefit from support in facilitating opportunities for developing off-farm activities to supplement farm income, or developing more efficient farming practice through automation. Support in facilitating access to international markets, such as through attending international trade shows, would be beneficial to food and drink SMEs in pursuing internationalisation opportunities.

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