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Fibre to the countryside: A comparison of public and community initiatives in the UK

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Abstract

Although digitisation offers multiple opportunities for rural areas, they still lag behind cities in terms of access and adoption of Internet-based services. This divide is the result of multiple market failures in both the demand and supply of broadband access, which have been addressed through public, private and community-led initiatives. Based on interviews and ethnographic analysis, this paper explores how a community network and a public-private partnership have contributed to promoting the delivery and adoption of superfast broadband in rural Cumbria, a county in the north of England. The case study analysis compares the outcomes of each model, highlighting their strengths and weaknesses. Although expanding the coverage of superfast broadband across the county, the public-private partnership did not solve the access divide afflicting the hardest to reach areas. Some of the latter were served by the community network, which relied on volunteers and demand aggregation to reduce the cost of fibre rollout. The scalability of this approach, however, has yet to be demonstrated. On the demand side, both initiatives achieved a high take-up proving that the rural ‘adoption’ divide has decreased over the years. Nevertheless, more needs to be done to ensure that rural communities and businesses are able to leverage the benefits deriving from superfast broadband.

Keywords: broadband, public initiatives, community initiatives, UK

1. Introduction

There is increasing evidence that digital technologies can hugely benefit rural communities and businesses (Roberts, Beel, Philip, & Townsend, 2017; Wilson, Atterton, Hart, Spencer, & Thomson, 2018). However, a gap still exists between rural and urban areas in terms of access and use of digital services (OECD, 2018). This is commonly referred to as a ‘digital divide’ (OECD, 2001) and has been a major concern for researchers and policymakers over the past twenty years or so (European Union, 2015; Kruger & Gilroy, 2013). The rural ‘digital divide’ has been addressed by a mix of public, private and community-led initiatives (Ashmore, Farrington, & Skerratt, 2017; Pant & Hambly Odame, 2017) addressing the failures on both the demand and supply side of broadband markets (Gomez-Barroso & Feijoo, 2010). These initiatives have primarily supported the rollout of next-generation access (NGA) networks¹ capable of delivering superfast broadband², but demand-side programmes have also been launched as well (Feldmann, Khodabakhsh, Valiucko, Weber, & Beck, 2014).

The outcomes of these initiatives has been analysed from different perspectives (Ashmore et al., 2017; Beltran, 2014; Hauge & Prieger, 2015), but a comprehensive evaluation of their impact on the rural divide is missing from the literature. This paper addresses this research gap by exploring how different initiatives have addressed the failures in the UK broadband markets and contribute to reducing the rural digital divide to be found across the country. Based on semi-structured interviews and an ethnographic methodology, the comparison a public-private partnership (PPP) and a community-led initiative revealed a series of strengths and limitations of each model.

The remainder of the paper is structured as follows. Section 2 reviews extant literature on the digital divide between rural and urban areas. In Section 3, a conceptual framework is developed to

¹ NGA networks are partially or entirely composed of optic fibre and include multiple technologies, such as Fibre-to-the-cabinet (FTTC), combining fibre and copper lines, and Fibre-to-the-home (FTTH), with fibre directly reaching the end-users.

² Although different definitions of superfast broadband exist, this usually refers to connectivity with a minimum download speed of 30 Mbit/s (ITU, 2013).

visualise the market failures underlying the rural digital divide. Section 4 outlines the methodology for data collection and analysis. The two case studies are analysed in Section 5 and discussed in Section 6, with policy recommendations and suggestions for further research being outlined in Section 7.

2. The rural digital divide: a literature review

The digital divide has been conceptualised as being composed of three different levels (Scheerder, van Deursen, & van Dijk, 2017). The ‘access’ divide refers to the uneven distribution of broadband infrastructure (Compaine, 2001), while the ‘use’ and ‘adoption’ divide reflects the unequal diffusion of information technology (IT) skills (DiMaggio & Hargittai, 2001). More recently, scholars have also explored the ‘outcome’ divide that accrues from the different benefits to be derived from the use of digital technologies (Kwok-Kee, Hock-Hai, Hock Chuan, & Tan, 2011).

The existence of such divides has been analysed at cross-country level (Venkatesh & Sykes, 2013; Vicente & López, 2011) as well as between genders (Hilbert, 2011), different ages (Niehaves & Plattfaut, 2014) and social groups (Salemink, 2016; Vicente & López, 2010). The rural dimension of these digital divides have also been explored, with regard to, in particular, both the access and adoption of online services (Grubestic & Murray, 2004; Warren, 2007).

The rural access divide has been explained as a direct consequence of the cost structure of broadband networks (BEREC, 2016; Grubestic, 2008). These infrastructures are characterised by high fixed costs and economies of scale that make their deployment unprofitable in sparsely populated areas (Glass & Stefanova, 2012). As a result, commercial providers are unlikely to invest in rural broadband (Whitacre, 2010). A divide may also emerge within rural communities, as broadband is made available to the main villages while remotely located premises remain unserved (Rendon Schneir & Xiong, 2016).

The lack of broadband access is a major impediment to the adoption of digital technologies (Townsend, Sathiaselan, Fairhurst, & Wallace, 2013), but the latter has been further constrained by socio-economic factors idiosyncratic to rural communities such as the lack of human capital and the ageing population typical of rural areas (Malecki, 2003; Preston, Cawley, & Metykova, 2007). However, later research found that the correlation between rurality and lower adoption is not significant when other demographic factors are taken into account (Schleife, 2010; Wang, Bennett, & Probst, 2011).

Due to the positive externalities expected from broadband access, the digital divide has been addressed by numerous different public interventions (Gomez-Barroso & Feijoo, 2010). On the supply-side, local and national authorities have either subsidised private investment or developed public networks (Gillett, Lehr, & Osorio, 2004; Ramos, Arcos, & Armuña, 2009). To support the demand side, public libraries and computer centres have provided free broadband access and promoted digital literacy (Hauge & Prieger, 2010; Jayakar & Park, 2012).

The effectiveness of these initiatives is highly debated. When public interventions succeed in expanding broadband access, this did not automatically result in higher broadband adoption (Beltran, 2014; Liu, 2016; Strover, Chapman, & Waters, 2004) due to the lack of educational programmes and digital services targeting the needs of rural communities (Freeman & Park, 2015; LaRose, Strover, Gregg, & Straubhaar, 2011). Furthermore, public investment often benefitted areas already covered by commercial providers rather than targeting unserved rural communities (Eisenach & Caves, 2011; Strover et al., 2004).

The failure of both market-based and government-led initiatives has facilitated the emergence of alternative broadband providers focusing on unserved rural areas (Galperin & Bar, 2007; Salemin, Strijker, & Bosworth, 2017). These operators have relied on strategic partnerships and innovative business models to compensate their small-scale and minimise the cost of network rollout (Gerli, Wainwright, & Whalley, 2017). In particular, cooperative networks, funded and developed by local

communities, have been proposed as an alternative approach to NGA delivery in rural areas (Lelie, Sadowski, Brennenreads, & Smits, 2017). Extant research has emphasised the positive impact that these projects have on the cohesion and resilience of rural communities (Ashmore et al., 2017; Wallace, Vincent, Luguzan, Townsend, & Beel, 2017). On the other hand, their reliance on internal resources poses a threat to the replicability of community-led initiatives with the risk to exacerbate inequalities within rural areas (Salemink & Strijker, 2018).

3. The rural digital divide as a market failure

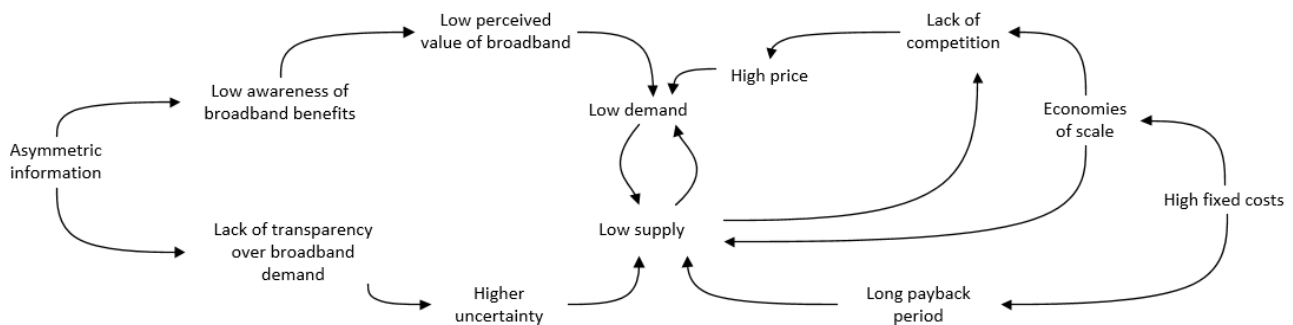
Both public and community-led initiatives have been described as a response to the market failures that have occurred in the supply and demand of broadband (Gomez-Barroso & Feijoo, 2010; Salemink et al., 2017). Two types of failures have been observed in broadband markets. Firstly, broadband provision is characterised by externalities such as network effects and economies of scale. Furthermore, imperfect information and lack of competition affect both the demand and supply of broadband (Gómez-Barroso & Pérez-Martínez, 2005; Martinez Coral, 2014). These are outlined in Figure 1.

The rural access divide can be described as a failure on the supply side, due to the incompleteness of broadband markets (Gómez-Barroso & Pérez-Martínez, 2005). The cost structure of communications networks discourages private suppliers from providing broadband access to rural users even when a strong demand for connectivity exists (Strover, 2001). Furthermore, the supply of broadband is undermined by information asymmetries that impede private providers to precisely estimate the existing and potential demand, thereby increasing the investment uncertainty that they face (Martinez Coral, 2014).

Asymmetric information also results in failures on the demand side. The lack of awareness of broadband benefits diminishes the perceived value of having an Internet connection, thereby discouraging the adoption of broadband access (Hauge & Prieger, 2010). Another variable

influencing the demand side is the price of connectivity, which, in turn, reflects the lack of supply side competition (Lehr, Sirbu, & Gillett, 2006). The low demand resulting from these combined factors further deters private investment in broadband networks (LaRose et al., 2014).

Figure 1: market failures and digital divide



Source: developed by the authors based on extant literature

Figure 1 outlines the interplay between demand- and supply-side market failures that mutually reinforce each other, and thus affects the availability and adoption of broadband. Since both public interventions and community networks are expected to fix these failures, this diagram allows to visualise how different initiatives address these issues and to map their impact on both the ‘access’ and the ‘adoption’ divide.

4. Methodology

This research compares two case studies - Connecting Cumbria and B4RN - purposely selected for their significance and representativeness. Case study analysis is commonly employed to assess the impact of public and community-led initiatives in rural areas (Clark, Southern, & Beer, 2007; LaRose et al., 2011; Li, Westlund, Zheng, & Liu, 2016). This method allows us to explore and explain a

complex social phenomena, such as rural digital divide, in different yet comparable contexts (Yin, 2009).

Following the case comparative model of causal explanation (Lofland, J., Snow, D., Anderson, L., & Lofland, 2006), our study assessed how different configurations - a public-private partnership and a community-led initiative - affect a particular state, namely, the access and adoption divide. The purposive sampling and the comparative model were expected to enhance the reliability and generalisability of our analysis (Tsang, 2014).

Data were collected through multiple qualitative methods: semi-structured interviews, documentation analysis, and direct and participant observation. The use of multiple methods is common in the analysis of case studies and is recommended to enhance their construct validity (Yin, 2009). Method triangulation also allows us to combine the strengths and offset the weaknesses of individual different methods (Ammenwerth, Iller, & Mansmann, 2003).

The selection of the interviewees was based on a purposive and snowball sampling to include all the relevant and diverse stakeholders of these projects (Ritchie, Lewis, Nicholls, & Ormston, 2013). Overall, 16 interviews were conducted, recorded and transcribed verbatim – see Table 1 for more details. Internal stakeholders (Interviewees 1-6) were asked to explain the actions and outcomes of their initiatives with regard to the market failures and the digital divide in Cumbria. In contrast, external stakeholders (Interviewees 7-16) shared their views of the benefits and drawbacks of each project.

The interviews were triangulated with the analysis of documentation and data collected through observation. The former covered a wide range of sources, including strategic plans, final reports and newsletters. Ethnography was used on five occasions – see Table 2 for more details - to explore the context where these initiatives take place and observe their interaction with end-users.

The data collected through these multiple sources were organised and analysed in Nvivo, a software commonly used for the analysis of qualitative data (Welsh, 2002). Thematic coding was

applied for directed content analysis (Hsieh & Shannon, 2005), to understand how the PPP and the community network addressed the rural digital divide and contributed to expanding both the coverage and the adoption of superfast broadband.

Table 1: List of interviewees

Interviewee	Role	Connecting Cumbria	B4RN	Medium
1	Cabinet Member	✓		Face-to-face
2	Programme manager	✓		Face-to-face
3	Project manager	✓		phone
4	Project manager	✓		phone
5	Founder		✓	phone
6	Volunteer		✓	phone
7	District	✓	✓	phone
8	MP	✓	✓	phone
9	Business consultant	✓		face-to-face
10	Representative of trade organisation	✓	✓	phone
11	Entrepreneur		✓	face-to-face
12	Estate developer and volunteer	✓	✓	face-to-face
13	Entrepreneur		✓	phone
14	Representative of a local charity	✓	✓	phone
15	Representative of a local charity	✓	✓	phone
16	Broadband campaigner	✓		phone

Table 2: Sources of ethnographic data

	Method	Event
1	Direct observation	B4RN presentation to a new community interested in joining the project
2	Direct observation	Connecting Cumbria workshop on the benefits of superfast broadband
3	Participant observation	B4RN IT Club
4	Participant observation	B4RN IT Club
5	Participant observation	On-field session with B4RN volunteers

The case study analysis explored the results of these initiatives as well as their design and execution. Their comparison is expected to shed light on the impact of the different organisational structures and managerial practices on the capability of public and private actors to address the market failures underlying the rural digital divide.

5. Case studies: description and analysis

5.1 The rural divide in the UK

Although the UK ranked 7th out of 28 EU Member States in the Digital Economy and Society Index (EC, 2018), a gap still exists between urban and rural in terms of the access and diffusion of digital technologies (NFU, 2016). As highlighted by Philip et al. (2017), such a divide reflects the uneven distribution of broadband infrastructure across the UK. As of May 2017, 34% of UK rural premises were still unable to access superfast broadband and 17% of these were provided with a download speed lower than 10 Mbit/s (Ofcom, 2017).

As of May 2017, 82% of the premises adopted fixed broadband, with 38% of these being subscribed to superfast services (Ofcom, 2017). However the Office of National Statistics (2017a) reported that 9% of the UK adult population had never used the Internet. Although recent data on broadband penetration in rural areas are not available, a survey by Farrington et al. (2015) revealed that non-users are more frequent in deep rural areas, especially among the over 65 years old age group.

The provision of broadband networks in the UK has historically relied upon private providers, due to the limited role of local authorities and utilities (Gerli, Van der Wee, Verbrugge, & Whalley, 2018). The former telecommunications monopolist (British Telecom, hereinafter BT) and the cable TV operator (Virgin Media) started to deploy NGA networks in 2008: as of 2014, they had covered 78% of the UK premises, but limited this to urban areas (Ofcom, 2014). Alongside these large-scale deployments, rural communities and small-scale private providers have also invested in local NGA projects across the UK (PRISM, 2014).

In 2011 the UK government launched Broadband Delivery UK (BDUK), a nation-wide programme to support both the supply and the demand of superfast broadband. Its aim was to provide

England with “the best superfast³ broadband network in Europe by 2015” (BDUK, 2011, p. 5) by complementing private deployments to connect 90% of the UK premises. The target coverage was later extended to 95% of UK premises (National Audit Office, 2015).

These goals were primarily pursued by subsidising NGA rollout in underserved areas through two programmes: the Rural Broadband Programme (also referred to as Phase 1) and the Superfast Extension Programme (Phase 2). Furthermore, BDUK funded ten pilot projects to test alternative approaches for broadband delivery in remote areas and awarded vouchers to cover the connection costs of SMEs (Rathbone, 2016)

The two main programmes have been implemented by public-private partnerships formed between local authorities and at least one private supplier, selected through a competitive process. In line with EC (2013), these partnerships have focused on those areas where no private investors have delivered superfast broadband or planned to do so within three years as identified through an open market review (BDUK, 2011).

Within each partnership, the private partner is in charge of building and operating the infrastructure, which remains under its control. The funding, in contrast, is shared between BDUK, the local authorities and the private suppliers. In some cases, the partnerships also received funding from the European Regional Development Fund (ERDF). Overall, the public sector has invested £1.7 bn in more than 50 projects, most of which were awarded to BT (Rathbone, 2016)

In January 2018, the UK government announced that 95% of the UK premises were able to access a minimum download speed of 24 Mbit/s. Although some local authorities have plans to reach more premises within the next couple of years, there is no national plan to connect the last 5% with superfast broadband. A reform of the universal service obligation to ensure that anyone will get at

³ BDUK defined superfast broadband as connectivity with a minimum download speed of 24 Mbit/s.

least 10 Mbit/s in download and 1 Mbit/s in upload was launched in 2016, but it still has to be implemented (DDCMS, 2018).

Our analysis focused on two initiatives ongoing in Cumbria, a county in the north west of England. With a population density of 74 inhabitants per km², it is the second most sparsely populated local authority in the UK (ONS, 2017c). A large part of its territory is classified as predominantly rural: in 2011, 54% of Cumbrian population lived outside of urban areas (ONS, 2017b). The county has a declining and ageing population, with 23.5% of the Cumbrian residents being aged over 65 years of age (ONS, 2017c).

Historically BT has been the only broadband infrastructure provider in Cumbria though Virgin Media entered the local market in 2014. In 2011 Cumbria was chosen as a pilot project for BDUK. Since then, the County Council has been directly involved in the deployment of superfast broadband through ‘Connecting Cumbria’ in partnership with BT. Community networks have also operated in Cumbria since the early 2000s, and a number of new projects were launched after 2010 (PRISM, 2014). Broadband for the Rural North (B4RN), a community-led FTTH network initially founded in Lancashire, has gradually expanded to Cumbria and currently reaches 10 communities in the southwest of the county.

As of June 2018, superfast broadband was available to 92% of the premises in Cumbria, ranking 311th out of 418 local authorities. Ultrafast broadband was provided to just 7.4% of premises in the county. 5.4% of Cumbrian premises were unable to access a speed greater than 10 Mbit/s in download and 1 Mbit/s in upload (Thinkbroadband, 2018).

The most recent data about broadband adoption in the country refers to 2013, when 69% of the premises had taken up fixed broadband but only 2% had subscribed to superfast services (Ofcom, 2013). As of March 2017, 11% of Cumbrian adult population had never used Internet (ONS, 2017a), and five out of six districts were classified as being of ‘high risk’ of digital exclusion (Tech Partnership, 2017).

Although acknowledging the challenges to digital inclusion in Cumbria, interviewees highlighted a change in the attitude towards broadband over the years, as summarised by the promoter of a local broadband project:

“When I first started this project, I was talking to an estate agent and saying “Look, you need to back this because you’re not going to be able to sell properties”. They told me I was talking rubbish! Whereas now they can’t sell a property if it hasn’t got broadband” (Interview 16)

From both interviews and ethnography, broadband emerged as an essential service to complete a wide range of personal and business tasks such as school homework and administrative duties for farmers. Furthermore, superfast broadband was seen as improving the quality of life and alleviating the isolation of rural communities. As emphasised by a member of a local charity:

“If you’ve got your own transport and if you’ve got broadband, then living in a rural community is possible. And if you haven’t got broadband and you haven’t any means of transport, then you’re isolated and you’re not in connection with the rest of the world.” (Interview 15)

5.2 Connecting Cumbria

Connecting Cumbria was created in 2012 as a partnership between Cumbria County Council and BT. The latter was the only supplier to bid for the contract, although nine suppliers had prequalified for the tender (Thomas, 2012). The first phase of the programme aimed to provide 100% of Cumbrian premises with download speeds of at least 2 Mbit/s and 93% of them with superfast broadband by the end of 2015. In July 2015, a second phase was launched to expand superfast broadband coverage to 95% of the premises in the county by the end of 2018 (Jackson, 2015b).

As of June 2018, BDUK and the County Council had invested £38.8 m, including £13.7m from ERDF (BDUK, 2018). BT had contributed £15 m to the first phase (Jackson, 2015a). Public information about private investment in Phase 2 have not been released. Across the two phases, the partners have agreed to cover 120,000 premises, that is, 48% of the premises in the county (BDUK, 2018).

According to the local broadband plan, the partnership was meant to “support the capex cost for the supplier in areas where a commercial case for broadband investment cannot be met” (Cumbria County Council, 2011, p. 11). In the most remote areas, the County Council planned to establish community hubs and support locals to deliver the service beyond that point. This approach, though, was later abandoned, as explained by the representative of a local charity initially involved in the programme:

“the original plan in Cumbria was to service the rural areas first instead of the urban areas, because the rural areas seemed to be the most in need. That actually didn’t happen because the provider wanted to go to the urban areas first because that provided more income for them to carry on with their investment so I think if Cumbria County Council could have stuck with its principles and done the rollout from rural into urban instead of urban into rural, that would have been a big thing. But the government didn’t support that either” (Interview 15)

The programme has primarily deployed fibre-to-the-cabinet (FTTC) that partially reuses the existing copper network owned by BT. While this requires lower investment, its actual speed depends on the length of the copper loop (Henkel, 2015). The managers of the partnership clarified that the 95% coverage expected at the end of Phase 2 refers to fibre networks providing at least 8 Mbit/s.

As explained by the civil servant managing the project on behalf of the County Council, the rollout started from the most cost-effective locations in order to maximise value-for-money. Although admitting the “injustice of the approach”, which prioritised premises already receiving good broadband speeds, they defended it as the “logical way to build a network, which is how BT wanted to build it” (Interview 2). In fact, the public partner admitted to having limited control over the rollout, as remarked by a member of the Council Cabinet:

“the nature of the contract that County Council has with BT was given to us and it’s a... if one wishes to make it, a contractual... it’s a weak contract in that sense, it’s difficult to make BT do things” (Interview 1).

Overall, external stakeholders questioned the ability of the local authority to direct the partnership and manage the project, due to the lack of resources and support from central government. In particular, the latter was blamed for creating an unbalanced partnership model. A district councillor noted that:

“the government gave the job of putting this process into practice to relatively low paid Council officials, with limited expertise who were then completely outsourced by outmanoeuvred, by well-paid experts from BT.” (Interview 7)

The national government was also perceived as unable to understand the local circumstances being distant from Cumbria. As explained by the member of the Council Cabinet:

“as government gets nearer to the national target, 95%, it may think that the job is done, whereas in Cumbria we’re lagging 4-5% behind because of the rural nature of Cumbria. I think it’s our combined effort (...) to keep reminding the government that... Cumbria isn’t special... everyone wants to be special, but we’re special because we’re rural and sparse and therefore this national target hasn’t been achieved here” (Interview 1).

On the other hand, Cumbria County Council never had the ambition to achieve universal access to superfast broadband. The local broadband plan promised “to deliver superfast broadband to the greatest extent across the whole of Cumbria” but specified that “in some remote areas the case will still not be met for a service to the property” (Cumbria County Council, 2011, pp. 8–11).

Representatives of both partners confirmed that the programme “will never get to 100%, that’s not possible” (Interview 2) because “it’s not worth economically” (Interview 3). A clear trade-off emerged between coverage and cost-effectiveness, as clarified by a manager of BT (Interview 3):

“We can get fibre broadband to everybody in Cumbria, that wouldn’t be an issue, but it’s how much it’ll cost to actually get it there and, you know, when you’re dealing with single premises on 5 miles tracks, they don’t even have a dedicated national grid power supply, for example.... It’s just not cost-effective to do that”.

Despite recognising that Connecting Cumbria had contributed to expanding the coverage of fibre networks, external stakeholders doubted that the partnership effectively targeted the areas most

in need of public intervention. The BDUK framework was criticised for incentivising this strategy, as explained by a local MP:

“the government (...) did not set off with the stated intention of reaching the 5% of most-difficult-to-reach homes and businesses, it started off by looking at how many houses were already connected and how can we create the biggest number of new places to be connected and that meant that they got a lot of homes connected but they were homes that would have probably always been connected by BT at some point” (Interview 8)

In addition to the deployment of FTTC, Connecting Cumbria actively supported the encouragement of demand for superfast broadband. The local broadband plan identified a number of actions to stimulate the take-up, including the pre-registration of costumers and the enhancement of e-government services. A network of local champions was created to keep the public informed about the project (Cumbria County Council, n.d.). Nevertheless, external stakeholders expressed discontent regarding the lack of transparency due to commercial confidentiality. As outlined by one interviewee:

“from the perspective of having worked with a group of community volunteers, there were 50 or 60 at one point, and they were so frustrated by the conversation that the County Council couldn’t have with them and BT wouldn’t have with them (...) and that was said because of the commercial confidentiality. Well, that’s not very helpful when people are trying to engage a broader audience and get a lot of people wanting the service and signing up to make it viable” (Interview 15)

The partnership also launched two initiatives to promote broadband awareness among local communities and businesses. The Digital Inclusion programme organised free events run by BT to inform the villages served by Connecting Cumbria about the benefits of superfast broadband (Connecting Cumbria, n.d.). The Business Support programme, instead, involved a third party to provide SMEs with one-to-one tutorials regarding the use of digital technologies (Cumbria County Council, 2012).

The Business Support programme ended in 2016, after meeting its targets to engage with 3,300 companies (BIG Cumbria, 2016). However, both external and internal stakeholders shared the

view that more needed to be done to change the attitude of local businesses towards digital technologies, with a manager at BT stating that:

“Businesses just haven’t taken it up, they seemed to have this view that it’s not really going to benefit them. I think that’s because, and this will lead to digital inclusion, it’s that for lots of people isn’t speed of broadband that makes a difference. It is how actually you change your business model, you exploit speed, that makes a difference. You’re not suddenly just getting more business because you got higher speed on your line” (Interview 3)

The Digital Inclusion programme ended in 2018 and delivered more than 80 events in villages across the county to, in the words of one interviewee, “encourage people to get better access to the internet and to use the internet” (Interview 4). These events included a presentation on the benefits of superfast broadband, primarily described as a potential solution to the economic and social challenges faced by Cumbria (Observation 2). The presentation also provided an overview of the services available online and shared tips with users to obtain the highest value out of an internet connection. Further information was provided through the website of Connecting Cumbria, including short guides on both basic skills (such as “Finding Information Online”) and complex issues (such as “Phishing” and “Internet Safety for Children”).

As of December 2017, 45.2% of the premises covered by Connecting Cumbria in Phase 1 had subscribed to superfast broadband (BDUK, 2018). This take-up was in line with the average adoption rate registered by other BDUK-funded projects but much higher than the 20% target set by BDUK (2011). The partners agreed that the success of their efforts significantly depended on the support of other stakeholders and the involvement of local representatives:

“We’ve got take-up there of over 60% on the infrastructure, that’s purely because somebody is really championing the technology in that area and looking after it”. (Interview 2)

Since the take-up resulted in higher adoption than the threshold set by BDUK (2011), the clawback clause was triggered and BT had to return £2.5 m (Jackson, 2015a). This mechanism was described by a manager of BT as a “self-help opportunity” (Interview 4): as the demand grows, more

funding are made available to further extend the rollout of superfast broadband. However, the County Council has yet to announce how the clawed-back funds will be utilised. Furthermore, the clawback mechanism was seen by external stakeholders as a disincentive for BT to promote the adoption of superfast broadband.

The disengagement of commercial ISPs also emerged as a constraint on demand stimulation. Since the network deployed by Connecting Cumbria is open to any ISP, the latter were expected to contribute to advertising the new services. However, the lack of effective communications from commercial providers often created confusion and frustration among end-users. As highlighted by a manager of BT, this opens to question as to whether the partnership should have also invested in marketing:

“We’re very conscious of the fact that every pound spent on the digital inclusion programme, it is a pound less, if you like, that gets spent on deployment. But I think the assumption or the condition that BDUK puts on the contract that leaves the publicity solely to service providers has backfired to a certain extent” (Interview 4)

5.3 B4RN

Broadband for the Rural North (B4RN) is a community interest company founded in 2011 by a group of residents with expertise in telecommunications (B4RN, 2011). Initially meant to cover eight parishes in the northeast of Lancashire, the project has progressively expanded beyond its original footprint to include communities in Cumbria, East Anglia, Northumbria, Cheshire and the Scottish Borders. As of September 2017, the network had 42 active nodes and 15 more were under construction (B4RN, 2017b).

B4RN operates a fibre-to-the-home (FTTH) network which is owned, funded and built by local communities. Whereas the cost of FTTH rollout in rural was estimated at £10,000 per premise (Analysis Mason, 2008), B4RN has adopted an operational model that reduced the rollout cost to an average of just £700 per premise (B4RN, 2017b). The fibre is laid into soft land to minimise the digging costs and landowners are required to give free wayleaves. Moreover, prior to joining the

project, each community needs to aggregate demand and raise enough funding to finance the rollout. Once both targets have been met, the community can start designing the route. The network is then built by local volunteers, under the supervision of B4RN staff, but each household is responsible for digging the last bit connecting the main infrastructure to their property.

Not only does the involvement of volunteers minimise the labour cost, but also helps when identifying the most efficient route. As explained by one of the founders:

“when you take it to the people and you say ‘here is the way we’re digging in’, they look at the maps and then they say ‘well, there’s no point in going through that garden, because it’s all concrete now, we are going to have to move that line and go through that garden’...(…) or ‘you can’t dig straight that field, it’s an alluvial plan ... yet the field next to it is peat, you know, that’s the field will have to come through’. And so, all the feedbacks means Barry⁴ changes the maps to suit the people and the landlords and the wayleaves and everything else” (Interview 5)

However, the reliance on free volunteers may threaten the ability of local projects to be operational, with one volunteer explaining:

“when we actually started digging, we got nearly a 100 that might volunteer. Experience so far has shown that you don’t get very many people turning up for the work days and because of that we are now going to be talking about to buy some machineries to speed up the workers’ installation. So, volunteer fatigue - we think - might be a problem in the next 12 months” (Interview 6)

Since its inception, B4RN has been committed to deliver “both technical excellence and 100% inclusivity within those targeted parishes” (B4RN, 2013, p. 3). By deploying FTTH, the company offers 1 Gbit/s – download and upload - and the service is made available to everyone with, “no exclusions because a property is too far away or too difficult to reach” (B4RN, 2013). Accordingly, a community can join the project only once enough funding is raised to connect all the houses in the area, as remarked by one of the founders:

“If you are going to do your parish, you do the whole parish, or you don’t do it” (Interview 5)

⁴ The CEO of B4RN

The network is designed to reach any premise, but owners can decide whether to subscribe to the broadband service or just install the fibre into their house. As of October 2017, more than 3,500 properties were connected to the network (B4RN, 2017b). The average take-up across the projects is 65% (B4SW, 2016), though in some communities more than 90% of the households have expressed an interest in being connected (B4RN, 2013; B4SW, 2017).

The rules of the society commit it to “promote the take up of broadband, the Internet and the use of ICT generally” (B4RN, n.d., p. 2). Every week, an IT club is held in the company’s headquarters, where “all are welcome to come and find things out, or get help, or help others” (B4RN, 2017a). Furthermore, B4RN organises occasional sessions on specific activities, such as online shopping or editing photos (B4RN, 2017d) and provide online guides on several technical issues. These are often designed in response to the requests of end-users, as reported in the company’s newsletter:

“Several people have asked recently about Phishing. We have prepared a document about it and put it on the resource section of our website” (B4RN, 2016b).

Our ethnographic analysis revealed the diversity of users receiving support from B4RN, arguably mirroring the heterogeneity of skills and digital literacy within the communities. The majority of the participants were elderly people but their familiarity with technology varied significantly: some had both smartphones and laptops, while others were using older phones without internet connection. The assistance provided by the volunteers was not limited to B4RN’s services and devices, but could also extend to generic support with IT-related issues such as setting a Gmail account or using an e-commerce website to buy personal items (Observation 3 & 4).

‘The Club’ was also an occasion for the participants to share their experience with different devices and operators. In general, users have been encouraged to circulate tips and best practice (B4RN, 2017c). For example, the company does not provide phone services, but these can be acquired

from different VoIP providers. B4RN does not endorse any of these providers, but share the instructions and recommendations of its users via the website and the newsletter (B4RN, 2016a).

During the interviews and the ethnography, external stakeholders emphasised how B4RN had enabled themselves and their neighbours to take advantage of digital technologies. For example, a participant to the IT club explained that during lambing season farmers no longer need to spend the night in the barns because they have installed webcams to monitor the ewes from their homes (Observation 4). The improved quality of Internet connections also open up opportunities for local businesses, as highlighted by the manager of a company providing photography courses:

“we used to dread 4 o’clock when all the world just seems to slow down, you get the dreaded wheel of death, as we used to call it. And now, there’s still a little bit of slower traction at 4 o’clock here, however downloading picture, being able to stream online, is an enormous gain change for our business, because our operations is now transferring, these have to be practically 80% online. So, for us, being here in Cumbria, that was essential” (Interview 11).

Since its foundation B4RN has significantly expanded its customer base and geographic footprint, providing superfast broadband to communities that were otherwise unserved. Having said that, ethnography and interviews have highlighted a series of concerns regarding the growth of the project. In particular, the expansion of the network has slowed down the local deployments, as noted by a volunteer:

“B4RN is being too successful in one sense and that is that so many parishes have started doing their own broadband project that the delay in B4RN checking routes and so on has been excessively long and it causes a lot of delays for us” (Interview 6)

6. Discussion

The case study analysis shed light on the actions undertaken to increase the availability and the adoption of superfast broadband in rural Cumbria. The strategies developed by B4RN and Connecting Cumbria widely differed, in terms of technology and operational business models. The comparison, therefore, provides meaningful insights into the effectiveness of government-led and community-led initiatives as ways to tackle the market failures underlying the rural digital divide.

B4RN adopted a demand-driven and bottom-up approach. As outlined in Figure 2, demand aggregation and the involvement of volunteers in the design and deployment of the network enabled them to reduce the uncertainties and costs associated with FTTH rollout. As a result, the community network succeeded in supplying superfast broadband to remote areas, which both market-based and public-led initiatives had previously failed to cover.

Connecting Cumbria, in contrast, followed a top-down and delivery-led approach. As showed in Figure 3, public subsidies reduced the payback period and increased the return on broadband investment but did not affect the overall cost of NGA rollout. In fact, the partnership model did not incentivise the private supplier to explore alternative approaches for the delivery of rural broadband. Consistently, failures on the supply side were not addressed and the cost of covering the remotest locations remained prohibitive.

The emphasis on value-for-money further discouraged the private partner to serve the hardest to reach communities. Although this approach may have ensured that public spending was minimised, it did not necessarily guarantee an efficient allocation of public funding. The interviews provided compelling evidence, albeit anecdotal in character, that the programme had invested in areas where BT could have deployed superfast broadband on a commercial basis. Although the ‘misallocation’ of public funding has to be empirically proved, this preliminary finding suggests that an in-depth scrutiny of the current mechanisms for the allocation of state aid in broadband markets is needed.

Overall, state aid contributed to expanding the scope for broadband supply in rural areas, thereby increasing the coverage of NGA networks. However, Connecting Cumbria, and more generally the BDUK programme, was never designed to target the remotest areas and provide all premises with superfast broadband. By setting two different coverage targets (100% with 2 Mbit/s and 95% with 24 Mbit/s), the partnership model has in fact perpetuated the divides *within* rural communities, thereby supporting the findings of Rendon Schneir & Xiong (2016).

Figure 2: the impact of B4RN upon the market failures underlying the rural digital divide

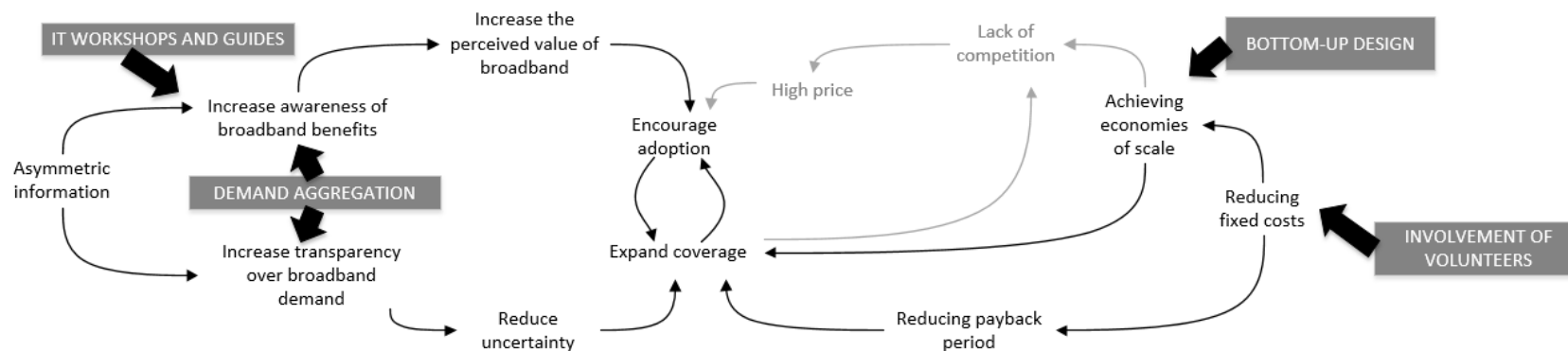
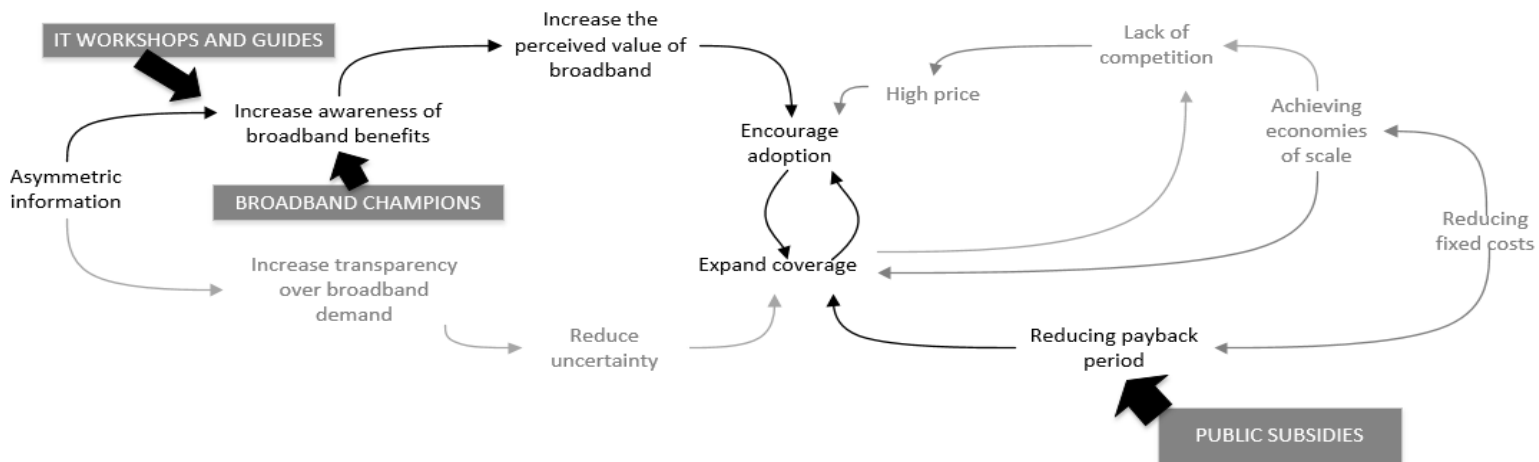


Figure 3: the impact of Connecting Cumbria upon the market failures underlying the rural digital divide



This internal divide has been further exacerbated by the technology chosen for the deployment. Since the actual speed of FTTC is variable, certain users connected to fibre may be unable to achieve a download speed greater than 30 Mbit/s. As the demand for bandwidth-intensive applications is expected to grow in the coming years (OECD, 2018), further interventions may be required in the medium-term. In other words, the issue of intervention in the market to minimise digital divides may need to be returned to at some point in the medium-term future due to the network investment decisions being taken today.

Conversely, B4RN integrated universal access to superfast broadband into its business model, by setting 100% FTTH coverage as a prerequisite for each parish joining the project. The local networks have been designed to reach every premise within the parish, thereby ensuring that anyone willing to connect to the network can do so at a small cost. The focus on FTTH has also ensured that arguably the most ‘future-proof’ technology is available to everyone. Overall, the community-led initiative has followed a more equitable approach, which has prevented the emergence of further divides within the rural communities that it serves.

However, B4RN’s ability to address the access divide on a larger scale has yet to be demonstrated. The company has expanded significantly over the years, but its growth has been perceived by some as a threat to the timely execution of local projects. Furthermore, the success of its approach entirely depends on the existence of financial and human resources capable of supporting the local deployments. Our analysis confirmed that proactive and wealthy communities are better placed to benefit from these initiatives, thereby supporting the findings of Saleminck & Strijker (2018). Consequently, a divide may persist *between* (relatively) affluent and deprived rural communities, as highlighted by the representative of a local charity:

“B4RN is doing very well, I mean, they’re providing, they’re meeting all their needs and that’s a great thing, but it’s still creating, well, it’s still maintaining an inequitable position for rural communities” (Interview 14)

On the demand side, both B4RN and Connecting Cumbria succeeded in supporting the adoption of superfast broadband, by, as shown in Figures 2 and 3, addressing information failures. The small scale of B4RN allowed it to offer personalised training and content focused on the needs and interests of individuals. Similarly, Connecting Cumbria managed to provide a wide range of supportive information through its workshops and website, with a strong emphasis being placed on the benefits of superfast broadband for the local economy. The involvement of local champions emerged as a key factor to promote the adoption of superfast broadband for both the public- and the community-led initiative. This confirms the importance, in a rural context, of ‘information intermediaries’ gathering, disseminating and interpreting information to make it available and intelligible to other users (Warren, 2007).

The high take-up observed in both cases may also prove the existence of a strong demand that was previously unsatisfied. In line with Farrington et al. (2015), our regional case suggested that the adoption divide most likely reflects the unavailability of broadband access rather than a lack of awareness or interest in Internet services. On the other hand, mixed evidence was found regarding the attitude of local businesses and communities towards digital technologies. Despite the emphasis put on the socio-economic benefits of digital services, interviewees agreed that the demand for broadband has been primarily triggered by private interests, as explained by a founder of B4RN:

“they [the government] want you to do E-Gov, they want everybody digital to save them billions, but that is not what people want the internet for, they want it for the television, they want it for gaming, they want it for skypeing the friends and watching their grandchildren, they don’t want it just to do DEFRA forms.”

Superfast broadband is expected to generate socio-economic benefits, but to what extent rural communities will manage to actualise these outcomes is unclear. The decrease in the adoption divide does not imply that rural communities and businesses are ready to leverage the opportunities derived from digital services. As a consequence, more emphasis should be put on the appropriation of digital

services to ensure that the value of private and public investment in broadband networks is maximised (Armenta, 2012).

7. Conclusion

The digital divide is an unsolved issue that risks exacerbating the socio-economic exclusion of rural communities. Multiple initiatives have been launched to support both the demand and the supply of connectivity in rural areas, with, however, ambiguous results. Our case study analysis clarified how community- and government-led initiatives have contributed to reducing the rural digital divide, by addressing the underlying market failures.

Through adopting a demand-driven and bottom-up approach that minimises rollout cost, B4RN has succeeded in providing FTTH to remote areas that were otherwise unserved. Its overall contribution to reducing the rural digital divide, though, will depend on the scalability *and* long-term sustainability of its business model. However, our analysis of the business model adopted by B4RN also identified a number of concerns emanating from its reliance on volunteers and private funding – quite simply, these suggest that their approach is unlikely to be sustainable in communities with limited financial and human capital.

On the other hand, Connecting Cumbria has reduced the digital divides that exist between rural and urban areas, but failed to ensure universal coverage in the county. The lack of competition and the national framework did not encourage the private partner to modify its business model to address the failures in broadband supply. Furthermore, the emphasis on value-for-money pushed the partnership to focus on FTTC and exclude the remotest communities. As a result, the programme has exacerbated the divide *within* rural areas in terms of both access to and quality of broadband that is available to them.

Across the two models, the involvement of local communities emerged as a key factor to alleviate the failures on both sides of the broadband market. Having said this, our case studies

highlighted that local authorities may be unable to leverage these synergies due to their limited resources and the constraints placed on them by the structure and objectives of top-down state aid programmes.

Whereas earlier research highlighted the conflicts between public and private partners (Po-An Hsieh, Keil, Holmström, & Kvasny, 2012), our analysis revealed a tension between national and local authorities involved in state aid programmes. Broadband policies are increasingly designed by central governments to ensure a harmonised approach at national level. Consequently, regional and municipal authorities are left with little resources and autonomy to manage local broadband projects. This frustrates their ability to tailor public interventions to the local context and drive PPPs towards the needs of local communities.

In particular, the allocation of public funding emerged as a controversial issue for the PPP, due to the asymmetric information and limited competition in broadband markets. The emphasis on value-for-money ensured that public funding was efficiently spent, but concerns about their allocation have been raised. These aspects need to be further researched to identify possible pitfalls in the current regulation of state aid in broadband markets.

From a theoretical perspective, this paper also contributes to the ongoing debate on the nature and determinants of the digital divide. Although our comparison reinforced the view that the access and adoption divides are gradually reducing in rural areas, new digital inequalities need further consideration. A quality access divide is likely to persist since end-users are connected through different technologies whose bandwidth and speed vary significantly. This issue is not specific to rural communities but they are historically left behind when new standards are imposed by the market (Warren, 2007). Additional interventions may be needed in future, should the current technology being unable to sustain the demand for bandwidth-intensive applications.

Importantly, the increased diffusion of broadband access does not imply that rural communities are already able to maximise the benefits of digital services. The latter aspect was not

fully investigated in this paper, as the two case studies are still ongoing and it is arguably too early to assess their consequences upon the affected communities. Further research could explore the outcomes of community- and government-led initiatives in order to understand how the socio-economic benefits of broadband access can be capitalised on in rural areas.

A second area of further research would focus on the viability of different infrastructural models of providing broadband networks in rural areas. One aspect of this research would focus on the scalability of the models that have been adopted, while a second would concentrate on the availability of the skills needed to initially provide and then operate broadband infrastructures within rural communities.

Finally, further research is also needed to expand our analysis to other countries, in order to clarify the impact of context factors upon the rural digital divide. Despite being developed under the EU regulatory framework, our case studies reflect the approaches adopted at local and national level in the UK. The inclusion of other cases would reinforce the validity and generalisability of our findings, to identify the best practices to bridge the rural digital divide.

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