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# Infrastructure investment on the margins of the market: The role of niche infrastructure providers in the UK

## **Abstract**

Across Europe, policymakers and market forces are striving to deploy next generation access (NGA) networks and ensure ubiquitous access to superfast broadband services. Due to scale economies and sunk costs, the roll-out of NGA is expected to be profitable only for large-scale providers and in densely populated areas. Nonetheless, alternative providers, such as utilities and local communities, have significantly contributed to NGA diffusion in many countries. Over the past five years, several small-scale initiatives have emerged in the UK, bringing fibre networks to urban and rural areas previously overlooked by either commercial or subsidised deployments. A multiple case study approach is employed here to explore the nature and the drivers of niche providers in the UK NGA market. All these initiatives are demand-driven and to follow a modular approach. Despite adopting different business models, they all rely on the resources inherited from past broadband initiatives and relationships with local partners. By investigating the strategies of niche providers in NGA market, this analysis sheds light on their contribution to bridging the digital divide in the UK and is presented as a preliminary assessment of their sustainability and potential growth.

## **Keywords:**

Alternative broadband providers; niche strategies; digital divide; digital inclusion; broadband policy; UK

## 1. Introduction

The considerable opportunities of digitisation require an infrastructure capable of providing faster and more reliable connections (Broadband Commission, 2015). Basic broadband<sup>1</sup> is no longer sufficient to support the rising consumption of data and to satisfy the increasing hunger for bandwidth (Ericsson, 2013). However, in 2016, 26% of the European premises were unable to access either superfast<sup>2</sup> or ultrafast<sup>3</sup> broadband (EC, 2017). With 72% of premises unserved by next generation access (NGA)<sup>4</sup> networks (EC, 2016), rural areas are the most likely to be digitally divided (Townsend, Sathiaselalan, Fairhurst, & Wallace, 2013).

As a consequence, public authorities are increasingly committed to promote the development of NGA networks, as only the interplay between public and private operators is expected to provide the optimal level of coverage and speed (Falch & Henten, 2010; ITU, 2012). Nonetheless, the potential contribution of other organisations, such as utilities and local communities, has been highlighted due to their historic role in supporting broadband development (Analysis Mason, 2011; Mölleryd, 2015; Ragoobar, Whalley, & Harle, 2011).

The development of NGA in the United Kingdom exemplifies how the interaction between public and private parties in broadband market has evolved over the past twenty years. The focus of public intervention shifted from access regulation (Nardotto, Valletti, & Verboven, 2015; Ruhle, Brusic, Kittl, & Ehrler, 2011) to the subsidisation of NGA investment (DCMS, 2011). The combination of private investment and public subsidies is expected to deliver superfast broadband to 95% of UK premises by 2017 (Hirst & Sutherland, 2015). In this context, though, numerous small-scale infrastructure providers have emerged across the UK to build fibre networks in underserved rural and urban areas (PRISM, 2014).

Such initiatives are increasingly drawing the interest of policymakers and practitioners because of their potential contribution to NGA diffusion in the UK (Ofcom, 2015b). Accordingly, this paper explores the nature and the strategies of these new infrastructure providers, to shed light on their implications for NGA development and their interaction with public and private initiatives. With this in mind, Section 2 reviews the literature on the drivers of broadband investment and, in particular, the role of alternative providers, while Section 3 investigates the rationales for these initiatives. The

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<sup>1</sup> Basic broadband provides a download speed between 2 and 30 Mbit/s and is delivered through DSL on copper wires.

<sup>2</sup> In this paper we adopt Ofcom's definition of superfast broadband, namely, providing a download speed of 30Mbit/s or higher. The UK government, instead, defines superfast broadband as providing a minimum download speed of 24 Mbit/s.

<sup>3</sup> According to Ofcom's definition, ultrafast broadband delivers a download speed of 300 Mbit/s or higher.

<sup>4</sup> NGA networks deliver superfast or ultrafast broadband through a mix of copper and fibre (FTTC, fibre to the cabinet) or end-to-end fibre connections (FTTH/P, fibre to the home or premise).

methodology is outlined in Section 4. Section 5 presents the four case studies, which are compared and discussed in Section 6. Concluding remarks are made and policy recommendations suggested in Section 7.

## 2. A theoretical framework for broadband development

A considerable amount of research has explored the factors affecting the development of broadband access networks (Avenali, Matteucci, & Reverberi, 2010; Grubestic & Murray, 2004; NESTA, 2015). NGA investment is expected to be viable only for a limited number of large-scale operators (Elixmann, Ilic, Neumann, & Plückebaum, 2008) focusing on the most densely populated areas (Grubestic, 2008). However, the incumbents might have an incentive to delay their investment unless they are exposed to the competitive pressure of other infrastructure providers such as cable operators (Briglauer & Gugler, 2013).

Due to this lack of competition and the externalities typical of network industries, a market failure exists in the provision of NGA networks (Gómez-Barroso & Pérez-Martínez, 2005). As a result, both incumbents and their competitors tend to invest only in urban areas, as the scale economies in network roll-out are a major deterrent to private investment outside cities (Glass & Stefanova, 2012). Rural areas can even experience an internal digital divide due to the excessive costs of connecting geographically dispersed premises (Rendon Schneir & Xiong, 2016). Where the market fails to provide universal access to broadband, public intervention is expected to complement private investment (Cave & Martin, 2010) through a variety of measures, such as access, regulation, demand aggregation or financial subsidies (Frieden, 2013; Gillett, Lehr, & Osorio, 2004)

Consistently, extant literature generally frames the development of NGA networks as relying upon the interplay between public and private players (Falch & Henten, 2010; Gomez-Barroso & Feijoo, 2010). However, often crucial has been the contribution of third-party players, that are alternatives to both telecommunications companies and public organisations (Tadayoni & Sigurðsson, 2007). Since the early 2000s, utilities, communities of end-users and private investors such as property developers have actively promoted the roll-out of fibre networks often focusing on small-scale projects (Nucciarelli, Sadowski, & Achard, 2010; Ragoobar et al., 2011; Saleminck & Bosworth, 2014). The characteristics and strategies of these alternative providers are discussed, albeit briefly, in the following three sub-sections.

## 2.1 Utilities

Since the telecommunications market was liberalised, utilities have provided long-distance and access networks (Falch & Henten, 2008), either through vertically integrated subsidiaries or in partnership with retail ISPs (FTTH Council Europe, 2015). Their entry into the broadband market has been mainly driven by the synergies existing in the roll-out and management of networks (Tadayoni & Sigurðsson, 2007): utilities could leverage their large customer base and reuse existing infrastructures to significantly reduce the costs of NGA deployment (Angelou & Economides, 2013; Gillett, Lehr, & Osorio, 2006). Public ownership has been another driver of the involvement of local utilities in the broadband market (Troulos & Maglaris, 2011), but also private companies, such as Dong in Denmark, have invested in NGA (Mölleryd, 2015).

Overall, the entry of utilities has been assessed positively as an enabler of investment and competition in broadband market (Ford, 2007; Troulos & Maglaris, 2011). However, their actual contribution to NGA diffusion has varied widely across developed countries. In the UK, their role has been negligible and scarcely successful, allegedly because of the limited involvement of public authorities in utility sectors (Ragoobar et al., 2011). More broadly, their influence has diminished over time across Europe, after most of their networks have been acquired by telecommunications companies<sup>5</sup>. Nevertheless, new projects involving utilities have been recently announced<sup>6</sup>, thereby suggesting that their involvement should be reconsidered in future.

## 2.2 Community networks<sup>7</sup>

Initially aimed at building cooperative Wi-Fi networks (Sandvig, 2004), community-led initiatives have also been undertaken in the fixed broadband market. For example, Guifi.net and OnsNet run FTTH networks financed and deployed by local residents in rural Catalonia (Spain) and Nuenen (Netherlands), respectively (Domingo, Van der Wee, Verbrugge, & Oliver, 2014; Sadowski, Nucciarelli, & de Rooij, 2009). These infrastructures are generally owned by non-profit cooperatives, which may either self-provide the retail services or partner with independent ISPs to do so (Plunkett Foundation & Carnegie UK Trust, 2012).

Community-led initiatives have proved to represent a valid alternative to commercial and public-funded deployments, especially in rural areas (Domingo et al., 2014; Heery & White, 2013), but their

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<sup>5</sup> For example, the Danish incumbent acquired the FTTH networks deployed by Dong and other power utilities.

<sup>6</sup> For example, Enel has started the roll-out of FTTB in 224 Italian cities.

<sup>7</sup> Community networks may indicate infrastructure deployed and financed by either local authorities or groups of end-users. In this paper, we adopt the latter definition.

long-term sustainability is still unclear. The success of these initiatives is deemed to rely on the dedication of volunteers and their capacity to involve other individuals (Middleton & Crow, 2008) as well as the technical skills within the communities, the leadership of local champions and the sense of commitment to the community (Wallace, Vincent, Luguzan, & Talbot, 2015).

As suggested by Wallace et al. (2015), successful community networks are likely to be acquired by major providers – for example, Reggefiber is now the majority stakeholder of OnsNet (Nucciarelli et al., 2010). On the other hand, initiatives like Guifi.net remain independent, thereby proving that community networks can develop without being incorporated by commercial operators.

### 2.3 Private companies from outside the telecommunications industry

Private investors from other industries – such as real estate and construction companies – have often partnered with telecommunications operators (Nucciarelli et al., 2010) and local authorities (Troulos & Maglaris, 2011), to act as facilitators of NGA deployment (Ragoobar et al., 2011). Furthermore, several private companies have also independently invested in fibre networks, with the most noteworthy example being Google, who launched its own FTTH project in 2010.

As a vertically integrated triple-play provider, GoogleFiber (2017) is serving ten cities across the United States, including Kansas City, Austin, Provo, Charlotte, Nashville and Atlanta. Its expansion has been based on both greenfield deployments and the acquisition of existing networks (Davidson & Santorelli, 2014). The deployments were entirely funded by Google, but local authorities and utilities have often provided indirect support by exempting right of ways fees (Trogdon, 2013) and giving access to existing passive infrastructures (Baumgartner, 2016). However, the FTTH project has recently been suspended, as Google is presumably going to focus on wireless networks (Telegeography, 2016).

**Errore. L'origine riferimento non è stata trovata.** Table 1 summarises the characteristics of the alternative broadband providers according to extant literature. The different drivers and strategies of these initiatives are reflected in their scope and objectives. Profit-oriented providers are unlikely to serve socially deprived areas (Halegoua, 2015). Community-led projects, in contrast, are more likely to enhance social inclusion and foster socio-economic development (Ashmore, Farrington, & Skerratt, 2015; Saleminck & Strijker, 2016). In both cases, alternative providers leapfrog the ladder of investment (Cave, 2006) to become fully independent from the legacy networks (Crandall, Eisenach, & Ingraham, 2013).

Table 1: Drivers and strategies of alternative NGA providers

|                  | Utilities   | Communities   | Other private investors   |
|------------------|---|---|---|
| Drivers          | <ul style="list-style-type: none"> <li>• Economies of scope (Gillett et al., 2006; Tadayoni &amp; Sigurðsson, 2007)</li> <li>• Public ownership (Troulos &amp; Maglaris, 2011)</li> </ul> | <ul style="list-style-type: none"> <li>• Commitment of community members (Middleton &amp; Crow, 2008)</li> <li>• Technological, relational, human, financial and identity capital (Wallace et al., 2015)</li> </ul> | <ul style="list-style-type: none"> <li>• Partnership with telco and municipalities</li> <li>• Reuse of existing infrastructures (Baumgartner, 2016)</li> <li>• Indirect public support (Trogdon, 2013)</li> </ul> |
| Technology       | • FTTH+wireless   | • FTTH+wireless   | • FTTH  |
| Geographic scope | • Urban and rural   | • Rural   | • Urban   |
| Investment model | <ul style="list-style-type: none"> <li>• Public company</li> <li>• Private company</li> </ul>   | • Cooperative   | <ul style="list-style-type: none"> <li>• Private company</li> <li>• Joint venture</li> </ul>  |
| Business Model   | <ul style="list-style-type: none"> <li>• Vertically integrated</li> <li>• Open access</li> <li>• Partnership with ISP</li> </ul>  | <ul style="list-style-type: none"> <li>• Vertically integrated</li> <li>• Open access</li> </ul>  | <ul style="list-style-type: none"> <li>• Joint-venture</li> <li>• Vertically integrated</li> </ul>  |
| Financing Model  | • Cross-subsidisation   | • Equity from community members, loans and grants (Heery & White, 2013)   | • Private capital   |

### 3. A rationale for alternative infrastructure providers

Despite acknowledging the contribution of alternative providers to broadband development, extant literature did not clarify how these initiatives are related to general theories of broadband development. Tadayoni and Sigurðsson (2007) explained the emergence of alternative providers in Denmark as a response to the path dependency of traditional operators, whose investment strategies are constrained by the legacy infrastructure. The low costs of wireless technology and the support of public sector were also identified as major enablers for the entry of new broadband providers.

In the current scenario, path dependency is emphasised by the choice of incumbents to invest in FTTC (Cave & Shortall, 2016), while wireless technologies are unlikely to play a central role in NGA market due to their limited bandwidth (KPMG, 2010). Furthermore, the role of public sector has changed significantly over the past decade, with autonomous initiatives of local authorities being replaced by top-down interventions coordinated by central governments (Broadband Commission, 2013).

As a matter of fact, the entry of small-scale infrastructure providers may be inconsistent with the trends in broadband markets and the economics of NGA investment. Further research is therefore needed to understand the rationales for alternative infrastructure providers in NGA market. In other industries, the entry of small-scale providers is explained by the existence of strategic niches in the market. A niche was defined as either “a small part of the market whose needs are not fulfilled” (Shani

& Chalasani, 1992, p. 34) or “a protected space where suboptimally performing experiments can develop away from regime selection pressures” (Seyfang & Haxeltine, 2012, p. 383).

The choice of focusing on small-scale markets has been explained as a competitive strategy based on market segmentation and product differentiation (Dalgic & Leeuw, 1994). By adopting a niche strategy, market players are able to achieve economies through specialisation (Parrish, Cassill, & Oxenham, 2006). On the other hand, the sustainability of this strategy may be endangered if demand reduces or stronger competitors enter into the niche, unless the niche operator has market power or its product is not replicable (Noy, 2010).

The theory of strategic niche management, instead, described a market niche as juxtaposed to the mainstream market (Levinthal, 1998) and the socio-technological regime (Raven, 2006). Niches attempt to resolve the conflicts and intrinsic problems of the socio-technological regime and can eventually reshape or replace it (Hargreaves, Hielscher, Seyfang, & Smith, 2013). Nevertheless, their small scale and geographically limited focus may hamper the transmission of radical innovation to the mainstream market (Seyfang & Smith, 2007).

As explained in Section 2, alternative NGA providers target a geographically delimited group of customers and differentiate their offer in terms of either coverage or speed. In fact, they address a niche market resulting from both market and policy failures (Salemink, Strijker, & Bosworth, 2016), as private and public players were unable to fully satisfy the demand for faster connectivity. Consequently, niche infrastructure providers challenge the status quo in NGA market by providing ultrafast broadband where large-scale operators and public initiatives failed to do it.

Strategic niche management theory suggested that a niche can ultimately replace the mainstream market or being incorporated by it (Schot & Geels, 2008). This paper will investigate the drivers affecting the entry of alternative NGA providers in the UK market, thereby clarifying the relationship between these initiatives and those of traditional players in broadband market. This analysis will therefore help to forge an understanding of the rationales and the sustainability of niche strategies in a capital-intensive industry.

#### 4. Methodology

The purpose of this study is to explore the strategies of niche infrastructure providers and explain their contribution to NGA development in the UK. For this reason, we employ a multiple case study approach that enables both exploratory and explanatory research (Yin, 2014). A multiple case study



is also expected to highlight within group similarities and intergroup differences (Eisenhardt, 1989), enhancing the reliability and accuracy of the results.

The analysis focuses on four niche providers in the UK: a community-led project, a private operator building FTTH in rural areas, and two private operators deploying fibre networks in urban areas. These cases have been selected as they are most relevant and representative of the UK market, after an extensive review of sources addressing NGA development. They represent a small yet significant sample of alternative infrastructure providers in the UK, exemplifying the variety of initiatives that are ongoing in the UK NGA market.

As shown in Table 2, the four case studies have been analysed in relation to three dimensions: their drivers, their investment strategies and their outcome. This framework enables an in-depth analysis of the relationship between the exogenous and the endogenous factors affecting the entry and the sustainability of niche broadband providers. The interaction between drivers and strategies is expected to explain the impact of these initiatives upon the market and shed light on the implications for policymakers and practitioners.

Data have been collected from a series of semi-structured interviews and secondary sources such as financial statements, company websites and press releases. Documentary analysis provided an overview of the business models and the strategies of niche providers in the UK, while interviews focused on their drivers and interactions with other public and private players in NGA market.

Table 2: A framework for the analysis of NGA initiatives

| Drivers   | Investment Strategy   | Outcome   |
|---|---|---|
| <ul style="list-style-type: none"> <li>• Supply- side</li> <li>• Demand-side</li> <li>• Policy</li> </ul> | <ul style="list-style-type: none"> <li>• Technology</li> <li>• Geographic Scope</li> <li>• Investment model</li> <li>• Business model</li> <li>• Financing model</li> </ul> | <ul style="list-style-type: none"> <li>• Coverage</li> <li>• Take-up</li> <li>• Speed</li> <li>• Price</li> </ul> |

Source: derived from Elixmann et al. (2008) and European Commission (2014)

## 5. Context

Since the NGA roll-out started in 2009, 89% of UK premises have been covered by superfast broadband with a take-up rate of 31%. British Telecom (BT) has brought FTTC to 68% of UK premises, investing £2.5 billion, while Virgin Media has deployed DOCSIS 3.0<sup>8</sup> to 44% of UK premises (British Telecom, 2016; Ofcom, 2014). Overall Ofcom (2014) estimated that private

<sup>8</sup> The standard enabling cable to provide up to 152 Mbit/s in downlink.

investment had delivered NGA to 78% of UK premises, with 35% of them covered by two competing networks.

As shown in Table 3, the UK government has adopted several strategies to expand NGA coverage. In 2011, the UK government launched the Superfast Broadband Programme to subsidise private investment in rural areas (DCMS, 2011). Under the supervision of Broadband Delivery UK (BDUK)<sup>9</sup>, this initiative is aimed at delivering a minimum download speed of 24 Mbit/s to 95% of premises by 2017 (Rathbone, 2016). Moreover, seven pilot projects have been undertaken to test alternative technologies for the provision of superfast broadband to the hardest-to-reach 5% of premises (DCMS, 2016). A complementary initiative, Superconnected Cities, sought to increase demand for superfast connections, by issuing vouchers to SMEs across 50 UK cities.

Table 3: BDUK programme

|   | BDUK funding (£m) | Target  | Status  |
|---|-------------------|---|---|
| Rural Broadband Programme – Phase 1     | 530               | 90% coverage by early 2016  | Achieved in April 2016  |
| Superfast Extension Programme – Phase 2 | 250               | 95% coverage by 2017  | Underway  |
| Competitive Fund                        | 10                | Pilot projects to identify alternative solutions for the final 5% | 7 pilots completed in March 2016                              |
| Superconnected Cities                   | 150               | Vouchers of up to £ 3,000 to help SMEs in 50 cities               | 55,000 vouchers issued between December 2013 and October 2015 |

Source: Ofcom (2014, p. 23), DCMS (2016), Rathbone (2016)

BDUK's funds have been awarded through competitive tenders, managed by the county councils and the devolved administrations. In phase 1, all the contracts were won by BT. Other competitors like Geo and Fujitsu withdrew from the bidding, being unable to meet BDUK's requirements (Telegeography, 2013). Within Phase 2, BT won the majority of contracts with only eight contracts awarded to alternative providers: Call Flow, Gigaclear, UKB Networks and Airband. This lack of competition has raised concerns about the suitability of the BDUK framework to maximise the value-for-money of public investment (Public Accounts Committee, 2014).

Despite the progress in NGA diffusion, the latest data from Ofcom (2016a) confirmed the persistence of a significant digital divide between rural and urban areas (see Table 4). 40% of rural premises do not have access to a speed greater than 30 Mbit/s, while 25% of rural households do not

<sup>9</sup> Broadband Delivery UK (BDUK) is an agency within the Department of Culture, Media and Sports

receive a speed greater than 10 Mbit/s. As a result, a reform of the Universal Service Obligation is under discussion, to give everyone a broadband connection with a minimum download speed of 10Mbit/s (Ofcom, 2016b). This is expected to also benefit that 2% of urban premises that could not access 10 Mbit/s in 2015 (Ofcom, 2016a).

Furthermore, Table 4 also shows a gap between the availability and the adoption of superfast broadband services, with the latter increasing at a much slower pace. In 2016, superfast broadband was available to 89% of the UK premises, but only 31% of them had subscribed to a superfast connection. Nevertheless, in BDUK-funded projects the actual take-up rate has generally resulted to be higher than expected (Jackson, 2016).

Table 4: Availability and adoption of broadband in the UK (% of premises)

|          |                       | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|----------|-----------------------|------|------|------|------|------|------|
| Coverage | < 2 Mbit/s – national | 14%  | 10%  | 8%   | 4%   | 2%   | 1%   |
|          | NGA – national        | 58%  | 65%  | 73%  | 78%  | n.a. | n.a. |
|          | SFBB – national       | n.a. | n.a. | n.a. | 75%  | 83%  | 89%  |
|          | NGA – rural           | n.a. | 19%  | 25%  | 33%  | n.a. | n.a. |
|          | SFBB – rural          | n.a. | n.a. | n.a. | 22%  | 44%  | 60%  |
| Take-up  | SFBB – national       | n.a. | 7.3% | 16%  | 21%  | 27%  | 31%  |

Source: Ofcom (2011, 2012, 2013, 2014, 2015a)

Alongside the major private and public initiatives, the number of alternative operators actively investing in NGA almost doubled between 2010 and 2014, from 34 to 65 respectively (PRISM, 2014). The most noteworthy alternative providers have been local communities and developers (Analysis Mason, 2011), with utilities historically playing a marginal role in the UK broadband market (BIS, 2010; Ragoobar et al., 2011).

In urban areas alternative NGA providers have focused on new-build developments and multi-dwelling units (MDUs) such as student accommodations (Analysis Mason, 2011). Many of these initiatives have been led by companies in the building industry – for example, Quintain and Brookfield Utilities, which started Velocity1 and IFNL respectively (Berendt, 2014).

Community-led initiatives have arguably been flourishing in rural areas since the early 2000s. For example, some villages in Lancashire and Cumbria established community Wi-Fi before deploying their own FTTH networks (Plunkett Foundation & Carnegie UK Trust, 2012). Some of these initiatives have proved to be successful (DCMS, 2016), while other community-led networks have recently been either acquired by private operators (for example, Vtesse Networks by Interroute) or abandoned (such as Internal Communications Systems in Kent).

## 6. Case studies: alternative NGA providers in the UK

### 6.1 Broadband for the Rural North (B4RN)

B4RN is a community benefit society based in rural Lancashire, an area historically provided with poor broadband (Lancashire County Council, 2011). Various communities, such as Wray-with-Botton and Wennington, established their own Wi-Fi networks in the early 2000s. These projects, backed by Lancaster University, succeeded in providing broadband to remote areas but were constrained by the lack of reliable backhaul.

The poor quality of existing telecommunication infrastructures was the major driver for local residents to build their own fibre network. B4RN was started in 2011 by a group of local citizens, championed by Barry Forde, who was previously a manager of several local telecommunications providers including LUNS Ltd. The project was expected to break-even at 1,000 connected customers and to pay back the investment within 10 years (B4RN, 2013). By November 2016, B4RN has connected 2,300 customers to FTTH in 43 parishes. In terms of take-up, on average 65% of homes passed have an active connection.

This project relies on a unique investment strategy. The network roll-out mainly relies upon volunteers, who are trained by B4RN in partnership with the equipment suppliers. The participation of local residents allows B4RN to lay its infrastructure across farmland, significantly reducing deployment costs. The roll-out is started once the residents have collected sufficient funds to cover all the premises in their parish. The deployment is based on parishes rather than postcodes.

Connected customers are charged a non-recurring connection fee of £150 and then £30 per month for 1 Gbit/s services. B4RN does not offer bundles with BT landline for voice services, but has a commercial partnership with Vonage, a voice over IP (VOIP) provider. Despite being vertically integrated, it also provides wireless ISPs with wholesale access to its backhaul network.

As a community benefit society, B4RN relies mainly on private funds from local investors. By November 2016 £4.8 million had been collected from 1,200 shareholders, who are required to invest at least £100 (for 100 shares), with the maximum investment set at £100,000. Private and public sponsors, like The Forest of Bowland AONB and the Land Rover Countryside Bursary, have also supported B4RN through grants and in-kind donations. Furthermore, additional funds have been collected from local lenders and through crowd-funding initiatives.

To date, no public funds have been awarded to B4RN. Initially the communities explored the opportunity of applying to the Rural Community Broadband Fund<sup>10</sup> (RCBF) and BDUK funds, but the requirements were considered unsuitable for their projects. BT won both the BDUK bids for a total amount of £36.3 million (Superfast Lancashire, 2013). The BDUK-funded roll-out has also included some of the parishes targeted by B4RN, which were initially excluded from BT's commercial and subsidised plans (Jackson, 2014).

## 6.2 Cityfibre

Cityfibre was founded in March 2010 by Greg Mersch and Mark Collins, who had previously been involved in the start-up and management of various telecommunications companies. One of these, i3 Group, built FTTH networks in Bournemouth and Dundee that were bought by Cityfibre in April 2011 for £4.7 million (Cityfibre, 2011). Over the past six years the company has invested in 40 towns and cities, by deploying both greenfield fibre networks and taking over existing assets from local authorities and other providers, such as Redcentric's and KCOM's metro networks (CityFibre Infrastructure Holdings plc, 2016). Therefore, the acquisition of existing infrastructure resulted to be a major driver of Cityfibre's geographic expansion.

Considering their investment strategy, the company builds and operates pure fibre metropolitan area networks that are meant to be "a backbone for a future deployment of a gigabit-capable fibre to the home access" (Cityfibre, 2015, p. 5). These networks do not serve end-users but enable retail providers to deliver broadband services and interconnect with the Internet. Cityfibre has opted for an open access business model, and by December 2016 it had partnered with 54 local and national ISPs.

The main source of revenues is the provision of dark fibre, but the turnover from active services is increasing<sup>11</sup>. Furthermore, Cityfibre is a major supplier of fibre links to the towers of mobile network operators like Vodafone and EE. The networks are usually designed according to the demand and needs of potential customers in the served cities, who are required to register their interest to be included in the network route. Anchor contracts with ISPs and the public sector enable Cityfibre to almost completely cover the initial investment, maximising the gross margins of network deployments.

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<sup>10</sup> A scheme of £ 20 million, jointly financed by DEFRA and BDUK, initially intended to provide superfast broadband to the hardest-to-reach premises.

<sup>11</sup> ISP can purchase either passive access (such as dark fibre) or active access services. The former requires the ISP to employ its own equipment to provide data services, while the latter include both the physical infrastructures and the data services.

Cityfibre is entirely financed by private capital and has been listed on the London Stock Exchange since January 2014. As of September 2016, it had a stock market capitalisation of more than £160 million. Investing in urban areas, Cityfibre is not eligible for public subsidies but it has qualified for debt guarantees under HM Treasury's Infrastructure UK scheme. Generally, it has a strong interaction with the public sector, since local authorities and other public agencies are often anchor tenants in Cityfibre's projects. In several cities, such as York and Peterborough, the local councils have been actively promoting and endorsing Cityfibre's deployment as a key component of their digital strategies and Smart City projects.

Being a wholesale-only operator Cityfibre is not directly involved in the retail market. However, Cityfibre Infrastructure Holdings also owns Gigler, a retail FTTH provider based in Bournemouth. Moreover, it holds a 33% stake in Bolt Pro Tem Ltd, a joint venture with Sky and TalkTalk for the roll-out of FTTH in York. As of September 2016, 14,000 premises had been passed (Cityfibre, 2016). In spite of its limited coverage, this project highlights Cityfibre's potential contribution to the diffusion of ultrafast broadband, by providing a pure fibre network that competes with BT's infrastructure.

### 6.3 Gigaclear plc

Founded in 2010 by Matthew Hare, the former CEO of Community Internet Group, Gigaclear plc builds FTTP networks in rural areas unserved by major providers and excluded by public interventions. Some of the served villages had previously established their own community networks, which have been later taken over by Gigaclear. Rutland Telecom's FTTC network was bought in May 2011 for £200,000, while Cotswolds Broadband C.I.C, a FTTP and fixed-wireless community provider, was acquired in December 2015 for £106,000.

Unlike these community-led projects, Gigaclear is a for-profit company and does not involve local residents in the funding and roll-out of the network. However, it works in partnership with local campaigners and businesses to raise broadband awareness and aggregate demand. In fact, unsatisfied demand is a major driver for Gigaclear, which invests only in 'qualified communities' with a minimum level of customer pre-orders ensuring a first-year project return of over 10%. On average, the percentage of pre-registered customers is 28% and the return on each project is expected to be over 20%, with a payback period of 5 years.

With regard to its business model, Gigaclear serves both residential and business users with superfast broadband, while voice services are provided in partnership with Vonage. Despite being vertically integrated, Gigaclear's networks are open to other ISPs. Currently the company has

commercial relationships with an ISP aggregator, two wireless ISPs, and three ISPs focused on the business segment.

The company is entirely owned by private shareholders. The main shareholders are Woodford Investment Fund and Prudential Infracapital, with an equity investment of £24 million and £20 million respectively. A £18 million loan has been secured from the European Investment Bank (EIB) in January 2016. Furthermore, Gigaclear has won public funds from five local authorities – see Table 5. The first contract was awarded by the parish of Northmoor in March 2014. In each project, the public funds have been matched with a significant investment from Gigaclear (up to £4 for every £1 of aid).

Table 5: Public funds awarded to Gigaclear

| Local authority                   | Public funding |                        | Gigaclear investment | Premises to cover | Cost per household passed by FTTH |
|-----------------------------------|----------------|------------------------|----------------------|-------------------|-----------------------------------|
|                                   | Amount         | Source                 |                      |                   |                                   |
| Northmoor                         | £186,000       | RCBF                   | £247,600             | 542               | £800                              |
| Berkshire                         | £3.7 million   | BDUK + Local authority | £16 million          | 11,700            | £1,684                            |
| Essex                             | £2 million     | BDUK + Local authority | £5.5 million         | 4,500             | £1,667                            |
| Gloucestershire and Herefordshire | £3 million     | BDUK + Local authority | £7 million           | 6,495             | £1,540                            |
| Devon and Somerset                | £39.50 million | BDUK + Local authority | £43.75 million       | 35,225            | £2,363                            |

Source: compiled by the authors from data provided by Gigaclear and Jackson (2015)

In terms of coverage, as of December 2015, the company owned and operated 56 FTTP networks in 11 counties (Buckinghamshire, Cambridgeshire, Essex, Gloucester, Hertfordshire, Kent, Lincolnshire, Northamptonshire, Oxfordshire, Rutland, West Berkshire), with 35 more networks under construction. In December 2015 the homes passed by Gigaclear totalled 15,000 with an average take-up rate of 36%. Generally, the deployments include all the premises in a village, but the hardest-to-reach premises may be required to subsidise the roll-out (Palmer, 2016).

Gigaclear's projects have focused on rural areas previously excluded by either private or public NGA investment. Nevertheless, as experienced by B4RN, the entry of Gigaclear led BT to amend its FTTC investment plan. The company estimates that 45% of its networks have been partly overbuilt by BT (Gigaclear, 2016).

## 6.4 Hyperoptic

Hyperoptic was founded in 2010 by Dana Tobak and Boris Ivanovic, entrepreneurs with long-standing experience of broadband markets. In 2005 they started BE Un Limited, the first ADSL2+ provider in the UK (BBC News, 2013), while Boris Ivanovic had previously launched BoStream, a FTTP provider in Sweden (O'Dwyer, 2004).

Hyperoptic rolls out FTTP networks to urban multi-dwelling buildings (that include 50 or more units). It works in partnership with developers, property managers and housing associations to install fibre in either existing or new properties. Unlike other niche providers, Hyperoptic's investment strategy does not rely on an independent passive infrastructure but focuses instead on the roll-out of point-to-point fibre wiring into end-users' premises.

The installation of fibre into the target building starts once 10% of residents have registered their interest. However, this does not imply either an upfront payment or an exclusivity requirement. Residential and business users can choose between 20Mbps, 100Mbps and 1Gbps offers. Further tailored services for businesses have been launched since March 2015 and a 'no contract' option for new customers has been made available.

Considering its financial mix, Hyperoptic is entirely financed privately. In May 2013 Quantum Strategic Partners Ltd became a major shareholder after investing £50 million in the company. A £21 million loan was secured from the European Investment Bank in July 2016, to serve an additional 300,000 premises in three years. Being focused on urban areas, Hyperoptic has not benefitted from public funds for fibre deployment but has partnered with the Connection Vouchers Scheme to deliver subsidised superfast broadband to SMEs.

Since 2011 Hyperoptic has deployed FTTP networks to MDUs building across 13 cities: Birmingham, Brighton, Bristol, Cardiff, Glasgow, Leeds, Liverpool, London, Manchester, Newcastle, Nottingham, Reading and Sheffield. New deployments are expected in Portsmouth, Watford, Leicester, Southampton, Slough, Edinburgh and Woking. Being focused on single buildings rather than widespread deployments, the overall coverage of Hyperoptic is still limited but the company aims to deliver FTTP to 500,000 premises by 2018. The take-up rate has varied across the served buildings, depending on the availability of other superfast broadband services, though the average is 30% one year after the network has been installed.



## 7. Discussion

Table 6 illustrates the heterogeneous nature and target of alternative NGA providers in the UK. Each provider addresses a specific niche in the market, defined by the gap between the demand and the supply of connectivity. Such a gap can be measured in terms of either broadband coverage or network performance. In the former case, the niche providers target those geographic areas where both the market and the public players have failed to provide either superfast or ultrafast broadband. In the latter case, the niche providers complement the existing supply of superfast broadband by delivering ultrafast broadband where a demand for faster and more reliable connectivity exists.

The differences between and within the niches have required these providers to implement different strategies. Cityfibre provides access to its metro networks on an open access basis, but delivers FTTH through either its retail subsidiary or a joint venture with two major ISPs. Hyperoptic, B4RN and Gigaclear are vertically integrated with both rural providers also offering wholesale services to other ISPs. Consequently, the case studies suggest that niche providers are likely to adapt their business model to the product they offer and the niche they serve.

Table 6: Summary and comparison of the four case studies

|   | B4RN                       | Cityfibre                             | Gigaclear                          | Hyperoptic                     |
|---|----------------------------|---------------------------------------|------------------------------------|--------------------------------|
| Date of incorporation                     | December 2011              | March 2011                            | December 2010                      | April 2011                     |
| Geographic focus                          | Rural                      | Urban                                 | Rural                              | Urban                          |
| Technology                                | FTTH                       | Fibre-only metro networks             | FTTH                               | FTTB/H                         |
| Investment model                          | Community-led initiative   | Private company                       | Private company                    | Private company                |
| Business model                            | Retail+wholesale           | Wholesale only                        | Retail+wholesale                   | Retail only                    |
| Financial mix                             | Local shareholders+debt    | Listed on AIM+debt                    | Financial investors +EIB loan+BDUK | Financial investors + EIB loan |
| Customer target                           | Residential users and SMEs | Public sector, ISPs, Mobile operators | Residential and business users     | Residential and business users |
| Turnover (£000), 31st December 2015       | 144                        | 6,408                                 | 1,369                              | 4,140                          |
| Profit (£000), 31st December 2015         | - 47                       | - 6,362                               | - 5,996                            | - 12,210                       |
| Network assets (£000), 31st December 2015 | 1,779                      | 48,712                                | 6,729                              | 8,839                          |
| Geographic scope, 31st December 2015      | 30 parishes                | 37 cities                             | 56 communities                     | 13 cities                      |
| Nos. of employees, 31st December 2015     | 10                         | 83                                    | 63                                 | 211                            |

Source: compiled by the authors from data provided by Bureau Van Dijk (2016)

Similarly, the investment model and the financial mix are affected by the geographic focus of the initiative. The urban niches are targeted by for-profit ventures funded by financial investors.

Gigaclear suggests that even in rural areas there may be a case for private investment, while B4RN's experience has shown that community-led initiatives in remote areas are feasible without public subsidies.

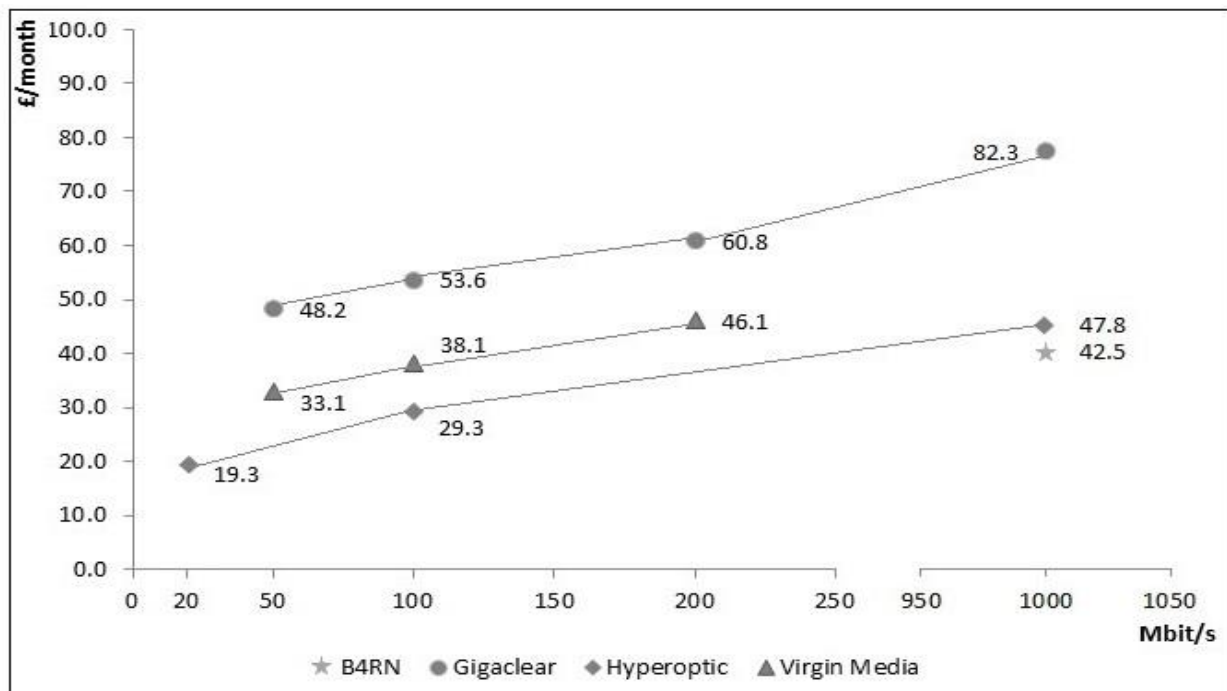
The access to public subsidies is a controversial issue. Gigaclear was awarded five contracts within the Superfast Extension Programme, while B4RN failed to obtain any funds from the Rural Community Broadband Fund. On the one hand, this might highlight a limitation of community-based projects, lacking the skills and the resources to successfully deal with the State Aid procedures. On the other hand, the effectiveness of these procedures in promoting competition could be questioned.

The different nature and scope of these providers are reflected also in their charges – see Figure 1 and Figure 2. Gigaclear's services are the most expensive, consistent with the higher deployment costs and lower competition in rural areas, while B4RN's product is the most affordable among 1Gbit/s offers perhaps due to its non-profit nature. Furthermore, the latter does not differentiate its services in terms of bandwidth, presumably to minimise the expenditure for network management and billing. Hyperoptic, instead, is the only one providing also a 20 Mbit/s product, to match the offering of its competitors in urban areas.

In any case, these providers offer higher speed than the major ISPs, since neither BT nor Virgin Media market a 1 Gbit/s product. Alternative providers are the only ones offering a pure fibre infrastructure in the UK, while both commercial and subsidised deployments primarily relying on the upgrading of existing copper and coaxial networks. In spite of its higher risks and costs, investment in fibre networks is future-proof and likely to generate a competitive advantage for alternative providers, especially when compared to traditional broadband providers. However, to date, the sustainability of their investment is yet to be proved, as none of the four case studies has been profitable.

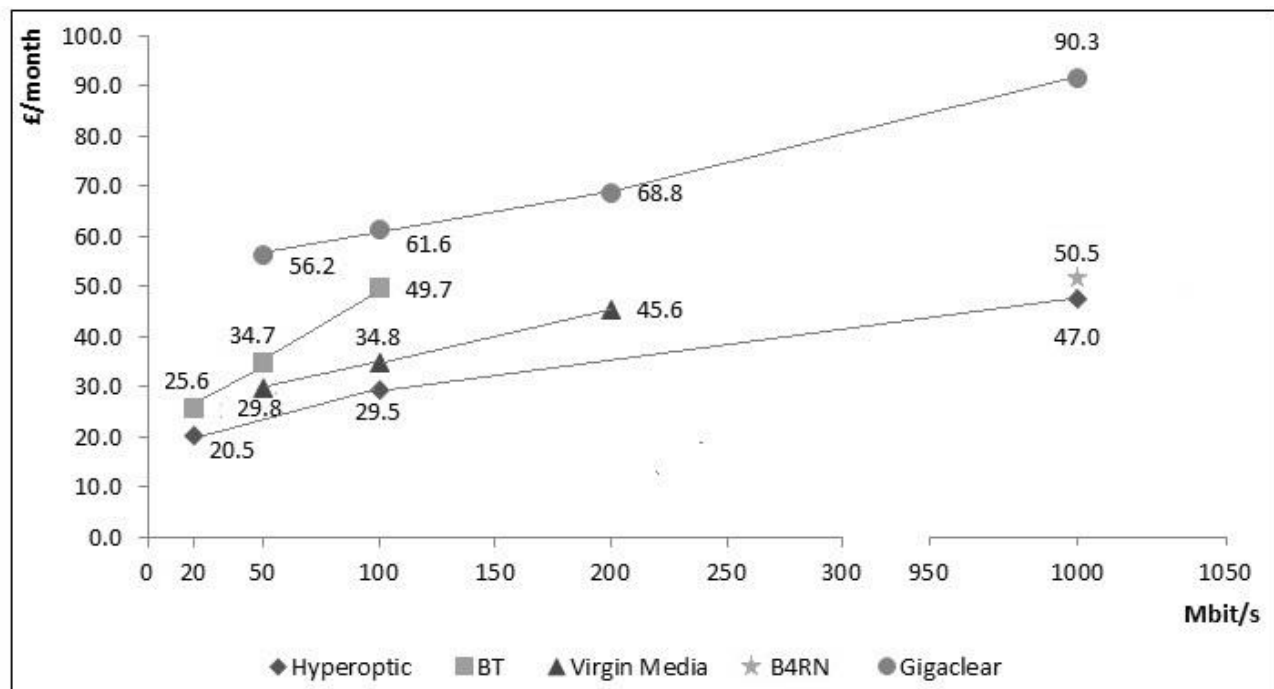
Furthermore, none of these niche providers offer triple play bundles. Tadayoni and Sigurðsson (2007) identified access to content as a barrier for alternative providers as they lack the resources to acquire content themselves. At this stage, the impact of media convergence on the sustainability of niche operators is unclear, and requires further assessment. However, the increasing availability of online content from OTTs and broadcasters may reduce the competitive advantage of triple-play providers.

Figure 1: Comparison of broadband-only packages<sup>12</sup> as of September 2016



Source: compiled by the authors from data provided by [www.uswitch.com](http://www.uswitch.com)

Figure 2: Comparison of double play bundles<sup>13</sup> as of September 2016



Source: compiled by the authors from data provided by [www.uswitch.com](http://www.uswitch.com)

<sup>12</sup> Average monthly price based on a 12 month contract with unlimited data usage.

<sup>13</sup> Gigaclear's and B4RN's fees include £8/month for unlimited landline calls with Vonage.

With regard to the relationship with the public sector, the experience of niche providers varies significantly across the case studies. Gigaclear is the only one to have benefitted from public funds. In contrast, B4RN has had a less straightforward interaction with the public sector, limited to the release of permits and wayleaves. Local authorities were neither actively involved in the project nor provided financial support.

Being based in urban areas, Hyperoptic and Cityfibre are not eligible for public subsidies but could benefit somehow from public initiatives. Hyperoptic joined the Superconnected Cities Voucher scheme, that subsidised SMEs to adopt fibre broadband. Cityfibre, in contrast, has often been supported by local councils, acting as either anchor customers or ‘evangelists’ promoting its projects within the local communities.

Overall, public support has not been a major driver for the entry of niche providers into the UK NGA market, even though it can facilitate their development. Conversely, these initiatives were often triggered by the failure of public intervention to provide access to ultrafast broadband. Rural niche providers are targeting those communities left behind by BDUK funded projects and unsatisfied with the broadband services delivered by BT. In urban areas, the entry of alternative providers might be seen as the response to the ineffectiveness of access regulation in pushing fibre roll-out beyond the street cabinet.

The influence of regulation has been negligible for all these initiatives due to their limited reliance on regulated services. Initially their interaction with Ofcom was aimed mostly at obtaining ‘Code Powers<sup>14</sup>’ to streamline fibre roll-out. However, the recent appeal of Cityfibre against Ofcom’s decision to impose a price cap on BT’s dark fibre (Competition Appeal Tribunal, 2016) highlights the potential impact of regulation upon niche providers. By influencing the cost opportunity and the return of infrastructure investment, access regulation affects the scope and the sustainability of niche strategies in NGA market. The regulator should, therefore, carefully consider the implications of access-based regulation for niche providers investing in NGA infrastructure.

Despite the diversity and complexity of alternative infrastructure projects across the UK, the analysis of these four case studies outlined a number of recurring elements across their strategies: the leverage of past experiences in broadband market; the implementation of demand aggregation mechanisms; the reliance on strategic partnerships; and the adoption of a modular approach to NGA

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<sup>14</sup> The Electronic Communications Code empowers network providers to build their infrastructure on public land and to take rights over private land. Providers with Code Powers can benefit from exemptions under planning legislation and carry out street works without applying for a specific licence.

deployment. These distinctive features can be identified as key determinants for the entry and the sustainability of niche infrastructure providers in the NGA market.

All these case studies are related, in different ways, to past initiatives in the broadband market. Gigaclear, Cityfibre and Hyperoptic have been founded by entrepreneurs with a long experience as creators and managers of telecommunications companies. Likewise, some of the communities involved in the B4RN project had previously established cooperative Wi-Fi networks. These past experiences have endowed the new providers with detailed knowledge of broadband markets and the technical know-how needed to manage the risks and complexity of network infrastructure investments.

This expertise has been vital to building trust around the projects, gaining support from financial investors and local stakeholders (public authorities, prospective customers, potential suppliers). Similarly, the skills within the local communities have been crucial to both the planning and the execution of B4RN, which periodically organises free training sessions for the locals to share and develop the technical know-how of fibre roll-out. This has enabled B4RN to expand beyond the first group of parishes, as technical skills were successfully transferred to new communities.

Cityfibre and Gigaclear have also sought to leverage past investment in NGA markets by taking over extant assets from other providers. Therefore, the existence of underutilised or underperforming assets is likely to be a major driver for the entry of niche providers in a specific area. On the other hand, this may also limit the geographic diffusion of niche providers, being anchored as they are on the footprint of pre-existing networks.

The location of alternative NGA deployments is also driven by the presence of unsatisfied demand. Niche operators target those areas where a demand for faster broadband already exists but has not been addressed yet by either commercial or subsidised deployments. Consequently, the case study companies have adopted a variety of mechanisms to detect and quantify this potential demand. Gigaclear, Cityfibre and Hyperoptic require their prospective customers to pre-register and trigger roll-out once a threshold is met. Similarly, B4RN covers a parish only when a sufficient number of households have joined and contributed to the project.

The level of demand aggregation required to commence the investment varies across the four initiatives, but the pre-registration is never binding and does not imply an upfront payment. When a certain threshold is met, the fibre is usually deployed to any premise, including those who did not register. As a result, this mechanism is primarily aimed at estimating the potential of each project and engaging with the target community. In contrast, the anchor tenant contracts signed by Cityfibre with ISPs and major customers are also apt to minimise the financial risks of the provider. In both cases,

demand aggregation is likely to increase broadband awareness, thereby stimulating the adoption of broadband services.

Consistently, niche providers quickly achieved a high take-up rate. Hyperoptic's uptake is in line with the national average in urban areas of 33% (Ofcom, 2016a). Gigaclear and B4RN outperform both the national average in rural areas (18%) and the BDUK funded projects, whose take-up ranges from 23% to 51.5% in September 2016 (BDUK, 2016). The higher uptake is likely to reflect the ability of these providers to both address unsatisfied demand in NGA markets and foster ultrafast broadband diffusion in their target communities. On the other hand, their demand-driven approach implies that these initiatives are unlikely to invest in those areas where the demand for broadband is suboptimal due to either socio-demographic factors or lack of digital literacy.

Furthermore, niche providers tend to engage in partnerships to access key inputs for their NGA projects. The nature and objective of these strategic relationships vary across the four case studies – see Table 7. The community-led initiative relies on the engagement of local residents in different stages of the projects. In each parish, volunteers act as champions to build consensus around the initiative and raise the funds to cover all premises. Local residents are also actively involved in the design and roll-out of the networks, to leverage their skills and their knowledge of the local geography.

The involvement of volunteers does not only minimise deployments costs. As such, a collaborative process also increases the social acceptance of this infrastructure and the tolerance for disruptions related to the rollout of the network. For example, landowners are willing to provide free wayleaves, once they understand the positive outcomes of ultrafast broadband for their community. Taking part in the project, the locals perceive the network roll-out as an opportunity to contribute to the community's development, thereby enhancing the sense of inclusion and social cohesion.

On the other hand, the relationships with suppliers and anchor tenants enable the providers to specialise in a subset of activities along the value chain. As a result, Cityfibre has focused on the provision of passive infrastructure with the local ISPs in charge of retail services, while the partnership with Vonage has enabled Gigaclear and B4RN to become fully independent from BT. This is consistent with their niche strategy and enabled them to be perceived as a complete alternative to both the incumbent and traditional ISPs.

Table 7: Key partners for the four case studies

| Provider   | Partners   | Input   |
|------------|--|---|
| B4RN       | Local communities<br>Vonage  | Voluntary work, in-depth knowledge of the area,<br>free wayleaves<br>Voice services |
| Cityfibre  | Local ISPs<br>Local authorities  | In-depth knowledge of the local market<br>Promotion within their communities        |
| Gigaclear  | Broadband campaigners<br>Subcontractors, equipment suppliers<br>Vonage | Promotion within their communities<br>Technical expertise<br>Voice services         |
| Hyperoptic | Developers, property managers  | Wayleaves and innovative bundles  |

These strategic relationships activate synergies that create value for both parties. The ISPs partnering with Cityfibre can differentiate from other operators relying on FTTC networks and reduce their reliance on BT, which is also their main competitor. The local councils can utilise Cityfibre's infrastructure to implement their digital strategies and enrich public services. Even the owners of MDUs can benefit from their relationship with Hyperoptic to enhance their value proposition, by providing innovative bundles and advanced services to their customers.

To leverage the existing demand and the strategic relationships in a specific context, all the case studies have adopted a modular approach. This implies that each deployment is developed autonomously and based on a single geographical unit: a parish for B4RN, a village for Gigaclear, a MDU building for Hyperoptic and a city for Cityfibre. Any incremental project is designed and implemented in order to minimise the diseconomies of scale and maximise the return on the investment, by leveraging the opportunities in each unit. As a result, B4RN deploys its ducts taking into account the geography of each parish to minimise the deployment costs, while Cityfibre's networks are routed according to the location of pre-registered and prospective customers.

This approach also ensures a high level of flexibility, since each project is developed according to the demand and the resources existing within the targeted area. Consequently, the niche providers can responsively differentiate their commercial proposition and adapt it to the requests of their customers and partners. For example, Cityfibre started providing active services to serve also those ISPs preferring lit to dark fibre. Hyperoptic, instead, offer its retail services as either a stand-alone product or in bundle with the monthly rent, according to the landlords' preferences. As a result, the four providers have been able to successfully expand their footprint, by replicating and adapting their model to new niches in the NGA market.

Since each project focuses on a single area, the niche providers tend to build their infrastructure in order to connect all the customers within that unit. Gigaclear's and B4RN's deployments usually include all the premises in a village or parish to achieve economies in the construction phase. This

implies that both providers are aiming at covering 100% of the premises in their targeted communities, thereby reducing the scope for further public interventions to bridge the digital divide in these areas.

On the other hand, the coverage of niche providers in the urban areas has so far been limited by their scope and focus. Cityfibre is currently delivering FTTH in just York and Bournemouth, though its metro networks are meant to be the starting point for the roll-out of fibre in the last mile. The commercial success and financial return of the ongoing projects in York and Bournemouth are likely to affect the scope and intensity of further FTTH investment within and beyond these cities.

Despite their overall coverage being limited by their niche strategy, the contribution of alternative providers to the development of NGA in the UK has been significant. By investing in pure fibre networks, they are leading the provision of ultrafast broadband (delivering a minimum download speed of 300 Mbit/s). Furthermore, their entry into the market has pushed the major players to revise their investment plans. In some cases, BT allegedly overbuilt the infrastructure deployed by niche providers. This has raised concerns about the fairness and efficiency of BT's behaviour (PRISM, 2014), especially in those areas where its deployments are subsidised by public funds. Nevertheless, these reactions have proved how competitive pressure exerted by niche providers can induce major providers to expand the coverage and the capacity of their NGA networks.

## 8. Conclusions

This paper shed light on the nature and the strategies of alternative infrastructure providers, investing in geographic and commercial niches overlooked by commercial and subsidised initiatives. Their deployments contradict the general view that private investment is profitable only in densely populated areas and for large-scale providers, since they bring fibre networks where major public and private initiatives have failed to fulfil the demand for fast and reliable broadband.

In fact, the four case study suggest that alternative NGA providers may emerge where unsatisfied demand for ultrafast broadband and past experience in broadband development can be leveraged. Furthermore, they tend to develop unique business models, based on key partnerships and a modular approach, to compensate the diseconomies of their small-scale. All these factors should be taken into account by policymakers when planning public intervention to bridge the access divide.

Currently, state aid is eligible for those areas where NGA is not yet available and commercial investments are not expected within three years. As a result, public intervention is based on the intentions of existing operators and does not consider the potential entry of new NGA providers.



However, the rural case studies suggested that the use of public funds could be minimised by encouraging alternative approaches to NGA development where local resources can be leveraged and a demand for faster broadband exists.

Furthermore, the four case studies showed that strategic synergies with local partners may counterbalance the small-scale of geographically delimited deployments and increase their take-up. Similarly, a more locally focused approach is likely to increase the effectiveness of public intervention in promoting digital inclusion. A greater engagement of local stakeholders is desirable to maximise the positive outcomes of NGA deployment.

At this stage, however, the sustainability of niche providers in the long-term remains unclear. None of the four case studies is profitable, but this may be consistent with the cost structure and the long payback period of NGA investment. On the other hand, financial constraints may limit their growth and their competitiveness in the long-term. Furthermore, their small scale may affect their ability to replicate the marketing offers of nationwide providers, in terms of pricing and bundle strategies, and their effectiveness in dealing with complex procedures, such as State Aid regulation.

Nevertheless, the four case studies show the potential of niche operators in a capital-intensive market such as NGA development. Consistent with their niche strategy, these providers are unlikely to become national and challenge the leadership of mass-market ISPs. Nevertheless, their contribution to ultrafast broadband development is unambiguous. On the one hand, they are rolling out fibre networks in areas otherwise underserved. On the other hand, they are pushing the major players in NGA market to revise their plans and shift their focus from superfast to ultrafast broadband.

In fact, the success of such disruptive initiatives is likely to be affected by the competitive responses of major broadband providers and the ability of public institutions to leverage their potential. Policymakers across Europe are increasingly aware of niche providers' contribution to NGA diffusion. However, further actions need to be taken to ensure an efficient allocation of public resources and minimise competitive distortion in NGA market. Both regulation and public subsidies need to be revised in order to take into account the emergence of new players in the NGA market.

This is likely to require a different approach to public intervention in broadband markets, which is still centred on the simplistic juxtaposition between competition in urban areas and market failure in rural areas. In fact, the emergence of niche providers in rural areas highlights some shortfalls in the State Aid process. Subsidised deployments were unable to fully satisfy the existing demand for faster broadband, exacerbating the digital divide in some areas. On the other hand, public intervention proved unable to recognise and leverage the potential incentives for private investment in areas where the market is supposed to fail.

The UK experience shows the potential contribution of niche providers to the development of NGA, under the European regulatory framework. On the one hand, policymakers across Europe should carefully consider the scope for alternative infrastructure providers in unserved and underserved areas. On the other hand, these initiatives can encourage the adoption of innovative approaches for the commercial delivery of faster broadband. Further research is, therefore, needed to assess the long-term sustainability of these alternative models and their implications for the NGA market, in terms of competitive pressure and diffusion of ultrafast broadband.

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