



## Strathprints Institutional Repository

Whalley, J. and Howick, S.M. (2008) *Broadband in rural and remote areas: the impact of Scottish policy initiatives*. Working paper. University of Strathclyde. (Unpublished)

Strathprints is designed to allow users to access the research output of the University of Strathclyde. Copyright © and Moral Rights for the papers on this site are retained by the individual authors and/or other copyright owners. You may not engage in further distribution of the material for any profitmaking activities or any commercial gain. You may freely distribute both the url (<http://strathprints.strath.ac.uk/>) and the content of this paper for research or study, educational, or not-for-profit purposes without prior permission or charge.

Any correspondence concerning this service should be sent to Strathprints administrator: <mailto:strathprints@strath.ac.uk>



Whalley, J. and Howick, S.M. (2008) Broadband in rural and remote areas: the impact of Scottish policy initiatives. Working Paper. University of Strathclyde. (Unpublished)

<http://strathprints.strath.ac.uk/7457/>

Strathprints is designed to allow users to access the research output of the University of Strathclyde. Copyright © and Moral Rights for the papers on this site are retained by the individual authors and/or other copyright owners. You may not engage in further distribution of the material for any profitmaking activities or any commercial gain. You may freely distribute both the url (<http://eprints.cdlr.strath.ac.uk>) and the content of this paper for research or study, educational, or not-for-profit purposes without prior permission or charge. You may freely distribute the url (<http://eprints.cdlr.strath.ac.uk>) of the Strathprints website.

Any correspondence concerning this service should be sent to The Strathprints Administrator: [eprints@cis.strath.ac.uk](mailto:eprints@cis.strath.ac.uk)

Broadband in rural and remote areas:  
the impact of Scottish policy initiatives  
**Whalley, J, Howick, S**

**Working Paper 2008/06**  
Management Science  
Theory, Method and Practice Series  
2008

---

**Broadband in rural and remote areas:  
the impact of Scottish policy initiatives**

---

Jason Whalley\* and Susan Howick

\* corresponding author

Department of Management Science  
Strathclyde Business School  
University of Strathclyde  
40 George Street  
Glasgow  
G1 1QE  
Email: [jason.whalley@strath.ac.uk](mailto:jason.whalley@strath.ac.uk)

---

## ABSTRACT

The ability to participate in the Internet-based economy that is emerging requires access to broadband. However, in many countries, ‘digital divides’ occur, with those in geographically remote and rural areas being particularly disadvantaged. Through focusing on rural and remote Scotland, the paper identifies three different categories of policy initiatives that have been adopted and their interaction with broader UK and industry wide developments. Whilst these initiatives have encouraged the adoption of broadband, it is argued that UK initiatives are creating a new series of challenges to the adoption of broadband.

*Keywords: broadband, diffusion, rural & remote Scotland.*

Draft – no part of this work may be reproduced without written permission, and proper acknowledgments should be made to the authors for citation etc..

---

## 1. INTRODUCTION

With the growth of Internet-based economic activities, many countries have turned their attention to ensuring national broadband coverage. Broadband enables the Internet-based economy to be accessed, so that a wealth of online information, services and products can be enjoyed. However, not everyone has access to broadband on the same terms. Some areas, such as those that are geographically remote, are without broadband whilst other areas may have broadband that is slower, and perhaps more expensive, than say in urban areas. Driven by a range of socio-economic motives, governments have sought to reduce these differences and have employed a range of initiatives to do so.

This paper examines the initiatives undertaken in one particular area, rural and remote Scotland. In doing so, we show the diversity of initiatives that have been undertaken but also the strength of market forces to fragment the UK telecommunications market into those areas that enjoy better access to broadband and those areas that do not. With this in mind, the remainder of this paper is divided into seven sections. In the next section background information on broadband is provided, and is followed by an overview of Scotland. In the fourth section, the focus is on the policy initiatives that have been undertaken to date. The fifth section explores the impact of the initiatives, with the sixth asking whether a UK-wide broadband market exists. In the final section, conclusions are drawn.

## 2. Background

The rapid growth of broadband has recently attracted much attention (ANALYSYS MASON, 2008a & 2008b; CABINET OFFICE, 2005; FRANSMAN, 2006; ITU, 2003 & 2007). It has been argued that there are many benefits associated with broadband, benefits which are both social and economic in nature. Broadband contributes to national economic competitiveness (TURK *et al*, 2008; WARREN *et al*, 2006; Weiser, 2005) and allows industries to access distant markets as well as develop and deliver new services (ITU, 2003; PLUM CONSULTING, 2008). FRANSMAN (2006) notes that although there is no 'killer application' associated with broadband its faster download rates have given rise to a wide range of uses. Tele-medicine and tele-education are possible (FRITH & MELLOR, 2005), as is gaming and video-conferencing (BLEHA, 2005) and the online sharing of pictures or the use of IP-based telephony services such as Skype. There are also social benefits associated with broadband, though it has been noted that the low levels of information and communication technology (ICT) adoption will hamper the realisation of these benefits (VAN WINDEN, 2001). In developing countries, the general use of ICT is being encouraged through communal access (JAMES, 2002).

The availability of such services has contributed to the rapid growth of broadband, both globally as well as within particular nations. Globally there are now more than 300 million broadband subscribers (INTERNET WORLD STATISTICS, 2008), and whilst these are largely concentrated in developed countries there is considerable variation between each of these countries (OECD, 2008). Around one-third of OECD subscribers are located in the USA, and whilst average penetration rates are 20 subscribers per 100 people the figure in countries such as Sweden and Finland are above 30 (OECD, 2008). Broadband speeds are fastest in Japan where prices/MB are also lowest, whereas Korea has the highest penetration rates (FRANSMAN, 2006).<sup>1</sup> The high-speed connections made possible through fibre, either to the home or to the building, account for 40 per cent of

---

all Japanese broadband subscribers and 34 per cent of all Korean subscribers (OECD, 2008).

Whilst it is not possible to say that one factor above all else drives the adoption of broadband, it is possible to draw on the literature to identify a range of factors that play a significant role. The first of these is cost. BAUER *et al* (2005a) argues that the relationship between broadband penetration and cost is not yet fully understood whereas FLAMM & CHAUDHURI (2007) found that price did significantly influence demand for broadband. As broadband prices fall and dial-up prices increase, substitution occurs with dial-up subscribers switching to broadband. Interestingly FLAMM & CHAUDHURI (2007) also found that a rise in broadband prices resulted in some users opting for a dial-up connection instead. GEROSKI (2000) states that cost is an important issue for those dial-up (narrowband) Internet users considering switching to broadband. As broadband Internet access is typically more expensive than its dial-up counterpart, potential switchers who are unaware of the benefits of broadband may be reluctant to pay more for what they perceive to be the same service.

It is worth noting, however, that whilst the difference in price between dial-up and broadband may not be that great, the cost of the service is often not the only cost that has to be considered by potential switchers as new computer equipment and training may also be required. In the late 1990s research found that households in rural America were less likely to own a computer than their urban counterparts, thereby adding to the cost of using the Internet (STROVER, 2001). Moreover, BIGGS *et al* (2006) draw attention to broadband pricing and speed trends – drawing on ITU data they show, on average, that between 2003 and 2005 broadband prices have fallen whilst speeds have increased. In other words, broadband prices are falling in absolute terms and are thus less of a barrier to adoption than was previously the case.

Secondly, the attributes or characteristics of broadband can also influence its adoption. SAVAGE *et al* (2005) identified three such attributes – speed, service reliability and ‘always-on’ – whose influence on adoption varies depending on the social status of the potential adopter. Potential adopters with higher incomes value these more than those with lower incomes, and those with a degree value speed more, always-on less and reliability about the same as those without a degree.

Thirdly, would-be adopters should feel a need to use the Internet and believe that access is best serviced through a broadband connection. In a 2006 survey by Ofcom, a lack of need or interest was found to be the overwhelming reason why the Internet was not used at home (OFCOM, 2006a: 71). GALLOWAY *et al* (2005) reported a perceived lack of need among rural small and medium sized enterprises, whilst more broadly in rural England it has been observed that businesses adopt ICT at a significantly slower rate than their urban counterparts (DEFRA, 2005; WARREN, 2004).

A fourth factor that can encourage broadband adoption is the social context within which the potential adopter is located. SAVAGE *et al* (2005) found that broadband adoption is most likely in households with a higher income, college education and multiple computers. OFCOM (2006c: 64) also draws attention to the supporting role played by friends and family when it comes to learning about digital services and products. Across the UK as a whole, the most popular way to learn about digital products and services was through reading the manual, with the second most popular being through asking friends and family for assistance.

Governments can also play a role in encouraging broadband adoption. BAUER *et al* (2005b) identify four different roles that governments can play in the United States, namely: user, financier, developer and rule maker. As a major user of telecommunication

---

services, governments can implement demand side policies to encourage its development. In addition, governments can also influence the regulation of the telecommunications industry to encourage both the provision of broadband infrastructure and its adoption. Both PICOT & WERNICK (2007) and TRKMAN *et al* (2008) stress the need to ensure that telecommunication markets are competitive. Regulatory initiatives could be taken to unbundle the local loop so that the network access is accessible to operators competing against the incumbent,<sup>2</sup> or to encourage adoption by aligning prices to subscribers with costs incurred by operators with TURK *et al* (2008) suggesting that broadband price caps could be adopted.

Alternatively governments can provide subsidies to encourage the rollout of broadband infrastructure by the private sector or enact supply-side initiatives and become infrastructure owners in their own right. The Swedish government, for example, has a significant presence in the telecommunications market through its ownership of TeliaSonera, the incumbent operator, but also other utilities that have since invested in the telecommunications industry (FRANSMAN, 2006). Within the United States, HAUGE *et al* (2008) found that private and municipal telecommunications investments complemented rather than competed against one another. In addition many governments have also provided, to a lesser or greater extent, financial support to encourage the development of broadband infrastructure (BAAKE & WEY, 2008; FRANSMAN, 2006; LATTEMANN *et al*, 2006; ITU, 2003). Over a five year period, Sweden provided €400 million (ESKELINEN *et al*, 2008: 416) whilst the Korean government provided \$77 million in both 1999 and 2000 to ‘pump prime’ infrastructure development (PICOT & WERNICK, 2007: 668). A more market-orientated focus can be seen in the UK, with the CONSUMER PANEL (2008) and O (2008) stating that ‘next generation’ broadband should be primarily funded through the market and not state intervention.

Although a wide variety of initiatives have been adopted by governments (CAVA-FERRERUELA & ALABAU-MUNOZ, 2006; PICOT & WERNICK, 2007; TRKMAN *et al*, 2008), a key consideration for many is the need to ensure that a ‘digital divide,’ between those who have access to broadband and those who do not, does not develop. Whilst access to broadband may be shaped by income or literacy, probably the principal way it is conceptualised is in terms of urban and rural. The attractive economics of higher population densities of urban areas encourage investment, whilst conversely the lower population densities associated with rural and remote areas discourage investment. Quite simply, if a company was to invest a given amount of capital in its network in a urban market it would cover more potential subscribers than if the same investment was made in a rural and remote market. A key question, therefore, is how can the digital divide that results be overcome so that parts of society are not disadvantaged? The remainder of this paper explores this question with reference to rural and remote Scotland.

### 3. Scotland

Located in the north of the British Isles, Scotland is the second largest of the four countries that form the United Kingdom. The population of Scotland is just over five million people, the majority of whom live within the central belt that connects Glasgow in the west with Edinburgh in the east. Around one third of the population live in one of Scotland’s six cities,<sup>3</sup> which are shown on Figure 1 (over), with the consequence that population densities vary considerably across Scotland.<sup>4</sup> Figure 1 also highlights the areas served by Scotland’s two regional development agencies, Highlands & Islands Enterprise (HIE) and Scottish Enterprise (SE).

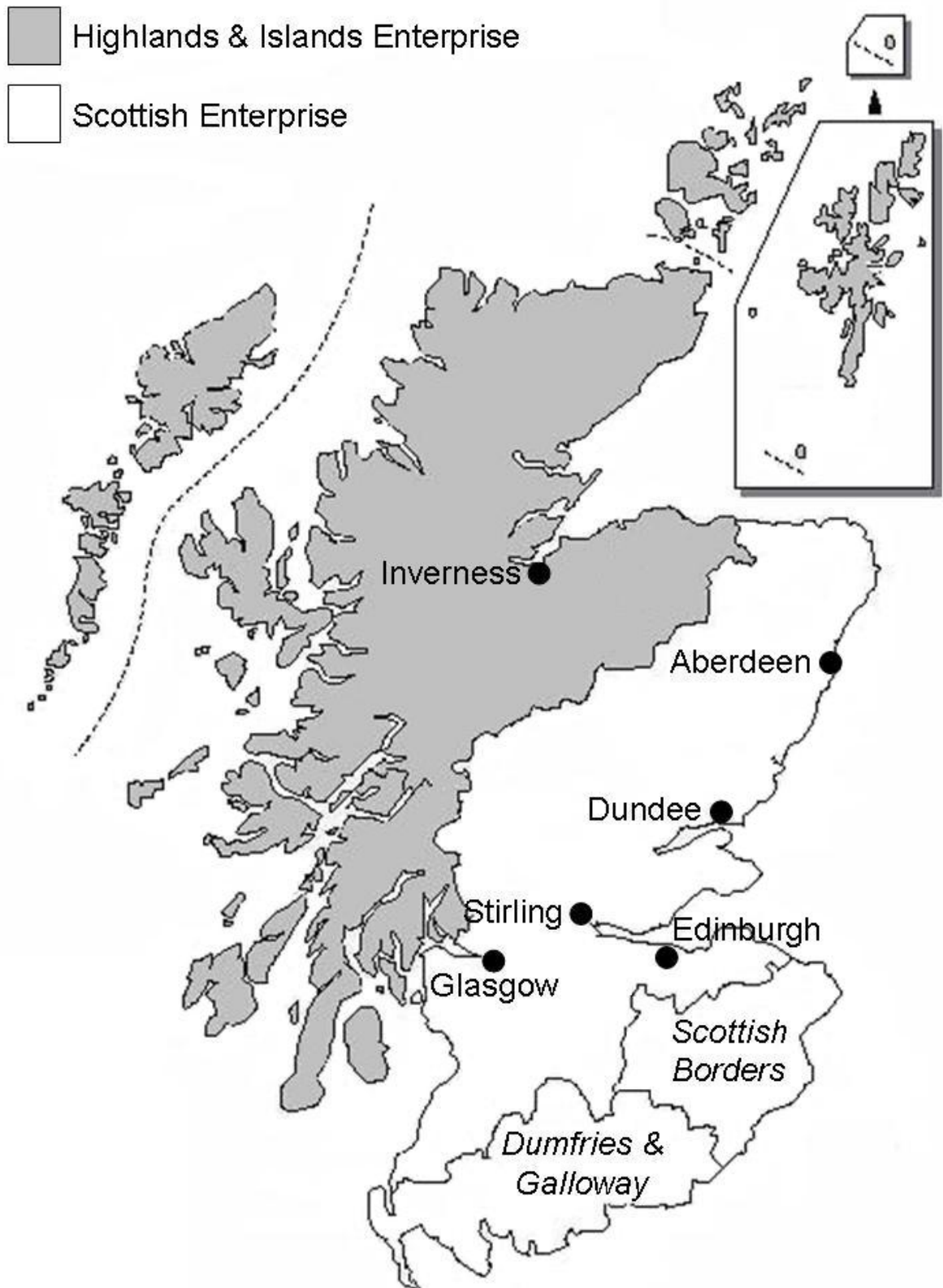
---



The Scottish Executive is the devolved government of Scotland.<sup>5</sup> The range of responsibilities and roles undertaken by the devolved government is determined by the Scotland Act 1998. Some policy areas such as education and health are devolved to Edinburgh whilst others like the UK single market and defence were retained in London. Those policy areas that were retained in London are referred to as 'reserved matters' and as telecommunications relates to the UK single market responsibility remained in London. As a consequence, the Office of Communications (Ofcom),<sup>6</sup> regulates the telecommunications industry across all of the UK.

Since devolution the Scottish Executive has sought to encourage socio-economic regeneration of many parts of Scotland with both regional development agencies playing a pivotal role (FULLER *et al*, 2003; KEATING & STEVENSON, 2006). With respect to rural and remote areas, the Scottish Executive has sought to reinvigorate the delivery of public services as well as the economy (NATURAL SCOTLAND, 2007; WAKEFORD, 2006). The ownership of land has been reformed<sup>7</sup> and new ways of delivering services such as public-private partnerships developed.<sup>8</sup> Inward investment into rural and remote areas has been encouraged, not least through undertaking infrastructure improvements.

Figure 1: Scotland



Although telecommunications is a 'reserved matter' and thus not within the remit of the Scottish Executive, this does not mean that policy development has been left solely to London. Instead the two Scottish regional development agencies have developed their own broadband initiatives within the wider UK framework and have sought to influence Ofcom through the consultation process.<sup>9</sup> The Scottish Executive has sought to ensure

that those households and businesses in rural and remote areas of Scotland have access to telecommunication services in general and broadband in particular as those in urban areas (SCOTTISH EXECUTIVE, 2001a & 2002).

It is hoped that through broadband the economy of rural and remote areas will be revitalised – businesses will be able to trade with counterparts located elsewhere with all that this entails. Through heightened economic activity, migration to elsewhere in Scotland and the UK will be reversed with the consequence that the viability of the provision of social services such as health and education will be enhanced. Ultimately the improving economy of rural and remote areas, coupled with other benefits such as quality of life, will attract migrants. In short, through broadband the economy will be revitalised and population levels stabilised, thereby allowing social services to be provided (SCOTTISH EXECUTIVE, 2001a).

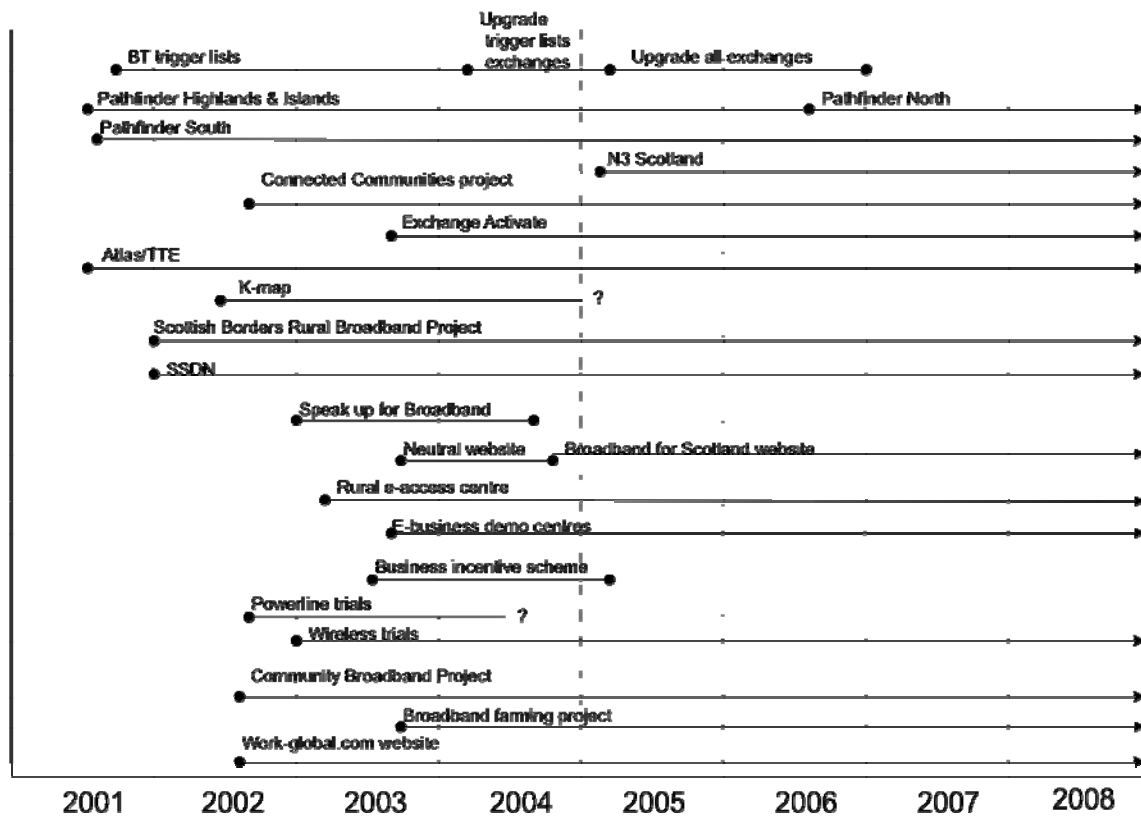
#### .4. Past Policy Initiatives

Since 2001 a number of policy initiatives have been introduced that have sought to encourage the adoption and use of broadband by households and business within Scotland. Figure 2 provides a summary of the main initiatives that have been introduced<sup>10</sup>. The timeline in Figure 2 indicates the period for which an initiative has or is running, with solid circles marking the beginning or end of a project. Arrows indicate that the project is still running, whilst question marks indicate some uncertainty over when a project began or ended<sup>11</sup>.

The main focus for many of the initiatives has been to increase the availability of broadband in rural and remote areas. However, once availability began achieving high levels, for example, 99.6 per cent in 2004 (BT, 2004), there was a shift in the focus of initiatives to promoting an understanding of the attributes of broadband and thus attempting to promote broadband adoption. The following three sub-sections summarise the main initiatives shown in Figure 2 (above) with respect to availability and then adoption. The third sub-section details the smaller, less significant, initiatives that have been undertaken.

---

Figure 2: Timeline of Broadband Initiatives



*Encouraging the availability of broadband*

As can be seen from the above figure, one of the earliest initiatives to encourage broadband availability was that of the BT trigger lists. These lists involved residents registering their interest in broadband. Once sufficient numbers of individuals had registered, BT would then make the necessary investment so that the exchange was enabled for broadband. As these lists involved the voluntary registration of an individual's interest in broadband, they provided a measure of potential demand within a particular exchange area. When a pre-determined number of registrations had been reached, BT would then enable the exchange safe in the knowledge that there was a market for broadband from which they could recoup their investment. However, when the individual registered their interest on the trigger list they were not obligated to take up the service that BT was making available at a later date. In other words, the trigger lists reflected potential and not actual demand for broadband.

In April 2004 BT announced the immediate end of its trigger list scheme. Those exchanges that had reached more than 90% of their trigger level were given a 'ready for service' date sometime in the following weeks. This was followed in June 2004 by BT's announcement that it would systematically upgrade all those exchanges that had a trigger level by the summer of 2005 and that several exchanges would be upgraded earlier than anticipated. When completed, broadband would be available to around 99.6% of UK businesses and homes (BT, 2004).

The two Pathfinder projects were aimed at delivering broadband to the public sector in the form of schools, health and local authorities.<sup>12</sup> Both Pathfinder projects brought together the Scottish Executive with Scotland's enterprise agencies, with the lead role being taken by the local authority participants. With the establishment of a NHS focused

network, N3 Scotland, the projects subsequently narrowed their scope to schools, libraries and council offices.

The Connected Communities' project began in 2004, though it was in many respects a continuation of projects that began in the mid-1990s that sought to improve the ICT infrastructure of the Western Isles.<sup>13</sup> Five islands would be linked together through the use of wireless broadband technologies, with the initial focus being on connecting public sector organisations together. Once the public sector organisations have been linked together, network coverage will then be expanded to include the private sector in the form of households and businesses. In other words, the initial public organisations provide a hub from which the subsequent expansion is derived.

Although it was reported that tendering was being organised in August 2002, the actual tendering occurred almost two years later in December 2004. Early 2005 saw the construction of the network backbone and community access nodes, with orders for broadband provision being accepted from December 2005 onwards.<sup>14</sup>

It is worth noting that at the heart of the Connected Communities is public – private co-operation. Through acting as hubs, public sector organisations like schools will form the backbone from which coverage to surrounding households and businesses will expand.<sup>15</sup> In addition, local communities will own the infrastructure within their locality/community with maintenance being provided centrally by Connected Communities (HEBRIDES.NET, 2006). The private sector will build the infrastructure and manage Hebrides.net, the Internet service provider that delivers broadband services to individuals and businesses within the local communities covered by the project.

The above projects are complemented by a series of less important initiatives. These are:

- *Atlas* – provides broadband to six business parks across Scotland, namely, Aberdeen Science & Technology Park, Dundee Technology Park, Heriot-Watt Research Park, Strathclyde Business Park, West of Scotland Science Park and Crichton Campus. The project is an example of public – private partnerships, as it was funded by Scottish Executive and EU whilst the operations are managed by Aktins.<sup>16</sup>
  - *Exchange Activate* – a limited number of exchanges in rural areas have been upgraded using D-SLAM (BROADBAND STAKEHOLDERS GROUP, 2004), which supports a limited number of subscribers. More recently, however, some exchanges have been further upgraded to offer faster broadband speeds (SCOTTISH GOVERNMENT, 2008).
  - *K-Map* – this is an analytical tool that collects and then facilitates the analysis of broadband data. Provided to broadband suppliers, K-Map will help them in their decision-making and planning.
  - *Scottish Borders Rural Broadband Project* – piloted where ADSL is not available, this initiative provides broadband services to households and small and medium enterprises within nine areas. Initially successful, the project was undermined when BT opted to upgrade its border-region exchanges with the consequence that it was wound down.
  - *Spark/SSDN* – this project, which emerged out of a report commissioned in 2001, provides broadband connections to schools. Broadband connections were installed during late 2003, with the network becoming operational in the first half of 2004.
-

- *Telecoms Trading Exchange* – is a service provided to Internet Service Providers and large corporate customers so that they can compare wholesale prices and connect to a trading platform to gain access.

Although the main focus of the above initiatives is on encouraging broadband availability, some of the initiatives have a dual purpose in that they also promote the appreciation of broadband attributes through its use in school or at work. As a consequence, initiatives such as Pathfinders Highlands & Islands/Pathfinder North, Pathfinders South, N3 Scotland and Spark/SSDN will also impact on the use of broadband at home.

#### *Encouraging broadband adoption*

In contrast to the aforementioned initiatives that focused on ensuring the availability of broadband, there are a smaller number of projects addressing its adoption. Broadly speaking these initiatives have sought to encourage adoption through either providing an incentive or through engaging in marketing campaigns.

Of the four initiatives identified, three involve a marketing campaign designed to encourage broadband adoption. The earliest campaign – Speak up for Broadband – involved a Highlands & Islands-wide TV campaign that asked households and businesses to register their interest in broadband. Between January 2003 and April 2004 this campaign delivered 26,134 registrations, which may not sound a lot until it is recognised that proportionally the Highlands & Islands accounted for 0.7 per cent of the UK population but almost three per cent of all UK registrations (SCOTTISH EXECUTIVE, 2003a). The end of the project in April 2004 coincided with BT's decision to abandon its trigger list method of determining which exchanges to upgrade and upgraded all exchanges.

This initiative was complemented by other broadband marketing initiatives. In December 2002 Scottish Enterprises had launched an impartial website to provide businesses with information about broadband (SCOTTISH ENTERPRISE, 2003). This was subsequently replaced by another website – Broadband for Scotland - in November 2003, though the website was complemented by newspaper, TV and radio advertisements (SCOTTISH ENTERPRISE, 2004a). Around the same time that the first of these initiatives was being launched, Scottish Enterprise inaugurated a series of e-business demonstration centres to highlight what e-business and broadband can offer small and medium sized enterprises. Interestingly these centres are ongoing, demonstrating the continued need to engage with small and medium sized enterprises.

Direct subsidies, albeit small, have also been offered to businesses to encourage them to adopt broadband for the first time. From mid-2003 both regional development agencies offered subsidies ranging from £300 to £1200 to businesses adopting broadband for the first time. If DSL or cable-based broadband was available amounts tended to be towards the lower end of this scale, and if they were not then amounts were larger as a satellite connection was required (BROADBAND STAKEHOLDERS GROUP, 2004). Unsurprisingly more companies successfully applied for the Scottish Enterprise version of the scheme than they did for the Highlands & Islands Enterprise counterpart.<sup>17</sup> Whilst both Highlands & Islands Enterprise and Scottish Enterprise launched their scheme in mid-2003, Highlands & Islands Enterprise ended its scheme in April 2004 and Scottish Enterprise in March 2005.

### *Availability and adoption*

As shown above, there have been fewer initiatives focusing on broadband adoption than compared to broadband availability. Figure 2 (above) contains a further seven initiatives that, to varying degrees, encourage both the availability and adoption of broadband within rural and remote Scotland. All things considered, these initiatives have had a small individual impact on broadband availability and adoption not least because their focus has been quite narrow.

Three of the initiatives can be described as technology trials. Wireless trials were announced in December 2002 as part of the Scottish Executive's push to make broadband available to 70 per cent of the population. A second technology trial is the 'Community Broadband Initiative' in Ayrshire, though in contrast to the previous project this one involves multiple technologies. The final identifiable technology trial seeks to determine whether broadband can be delivered over the electricity supply network which is present in areas where broadband is not.

A fourth project provided broadband to farming-related businesses. Whilst this would widen the availability of broadband, only 20 businesses would benefit. The broadband skills base in rural areas was enhanced through another project that took the form of an e-access centre.

Through highlighting the commercial opportunities available in the Hebrides, the work-global website sought to attract inward investment into the region. The website draws attention to the cost of premises in the Hebrides, as well as the availability and quality of labour and the presence of broadband.

The final initiative allowed the bulk buying/reservation of ADSL from BT by other telecommunication service providers. This enabled them to advertise their broadband services with the knowledge that they could then deliver the service via BT.

## 5. Impact of Policy Initiatives

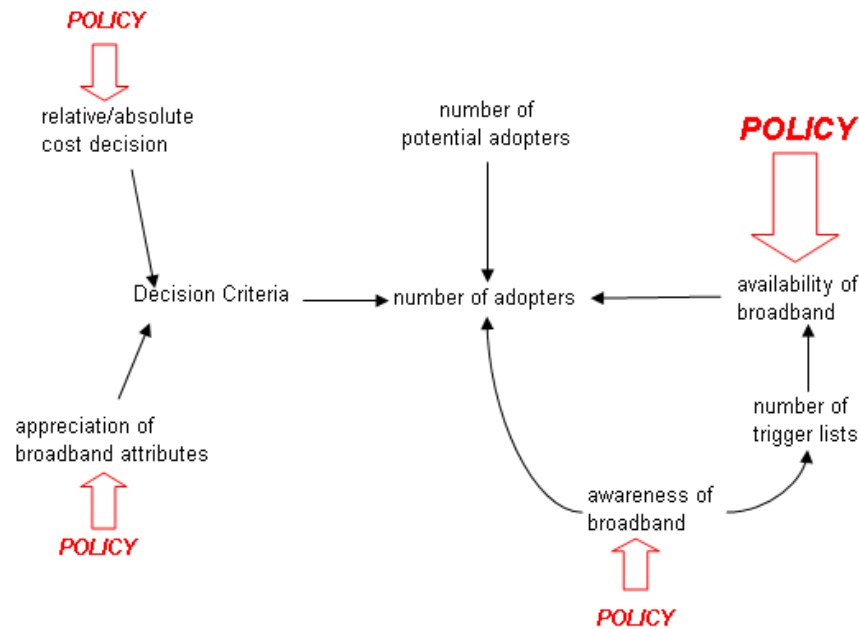
The previous section has highlighted the range of broadband initiatives that have been undertaken in rural and remote Scotland. From the balance of these initiatives, it is readily apparent that the main focus has been on encouraging the increased availability of broadband. In contrast, fewer initiatives have sought to encourage broadband adoption. This could be viewed as being surprising given that 47 per cent of Scottish household do not yet subscribe to broadband (OFCOM, 2008c: 27).

Of course, the number of people who actually adopt broadband is influenced by a variety of factors. Increased availability enables more people to be able to potentially adopt broadband. Also, initiatives to highlight the attributes of broadband or subsidies and incentives will encourage broadband adoption. A consideration of the key drivers of broadband adoption in rural and remote Scotland was undertaken by HOWICK & WHALLEY (2008). This process involved reviewing the literature on broadband and interviewing key stakeholders in the industry. Figure 3 (below) has been extracted from this work. This figure highlights the key factors that impact on the number of broadband adopters. In this figure 'Decision Criteria' refers to the various criteria that a potential adopter will take into account when making a decision regarding whether or not to adopt broadband. This includes, for example, the cost of broadband (SCOTTISH EXECUTIVE, 2001b: 7), if there are any concerns regarding either the content that is available on the Internet or its security (OFCOM, 2006a), or if broadband has any attractive attributes. The size of the policy arrows shown in figure YY reflect the amount of attention that has been placed on past policies to promote the particular driver of broadband adoption.

---

Using Figure 3, a series of observations regarding the policy initiatives that have been implemented to date can be made. In addition, it can also be used to identify where policies could be directed towards to facilitate the future adoption of broadband by households and businesses.

Figure 3: the key factors that impact on the number of broadband adopters



*Note:* an arrow should be read as ‘impacts’, for example, ‘awareness of broadband impacts the number of adopters’.

Focussing on past policy initiatives, the first observation is that more initiatives have been undertaken to widen the availability of broadband than they have for other areas. This is reflected in Figure YY by the larger policy arrow. However, now that availability has largely been achieved, attention needs to shift towards the other policy arrows as areas such as ‘appreciation of broadband attributes’ and ‘awareness of broadband’ that have been downplayed in the past.

A second observation is that policy initiatives have targeted the cost of broadband. Through offering subsidies, the initiatives have sought to encourage broadband uptake. The initiatives have, however, not reduced the monthly costs of a broadband subscription incurred by households or businesses. Broadband subscription charges are offered on a UK-wide basis, that is, the same price is charged across the country. As a consequence of this, customers in rural and remote areas benefit from the competition that occurs in urban areas. In addition, these customers will also benefit from UK-wide policies like local loop unbundling that have sought to encourage competition that uses, to a greater or lesser extent, the existing infrastructure of BT.

A third observation is that those policies that target broadband attributes may also encourage its adoption. This is largely a Scottish issue, as until recently Ofcom was not actively engaged in consumer issues. Since mid-2006 this has, however, changed as evidenced by a series of reports that have been published in areas like the consumer



experience (OFCOM, 2006b, 2007b & 2008). One issue that these reports have highlighted is that of product complexity. Before a broadband connection can be used, a certain degree of expertise needs to be displayed by the would-be user. Quite simply, this raises barriers to adoption. One way that this has been countered is through the would-be user drawing on the expertise of friends and family whilst another is the user ignores the instruction manual and adopts a 'trial and error' approach to installing broadband (OFCOM, 2006c). The first assumes that the would-be user has friends and family (s)he can draw on, whilst the latter implies a degree of confidence that may be lacking in some adopters.

A final observation is that past policy initiatives have focussed on all the key drivers of broadband adoption shown in Figure YY, except for the number of potential adopters. This number is not the same as all those who do not presently use broadband. A proportion of the population in rural and remote areas have excluded themselves from adopting broadband, arguing that broadband has nothing to offer to them (OFCOM, 2006d). Others, however, are financially excluded from adopting broadband – it may be too expensive for them or they may lack acceptable credit histories to obtain service. If broadband is to be brought to as many households as possible, encouraging the first self-excluded group through policy initiatives is likely to be unproductive whereas initiatives targeting the latter group may be more rewarding as the reason for exclusion is known and is not a life style choice. In other words, the reasons for exclusion need to be understood and taken into account when initiatives are being developed (HOWICK & WHALLEY, 2008). For example, a consideration of whether individuals have adequate material, social and cognitive resources amiable to them to support adoption (VAN DEN BERG & VAN WINDEN, 2002).

Broadband awareness is, in some respects, the reverse of availability. Whilst there have been national marketing campaigns, especially in respect to trigger lists, the Scottish dimension has been active in three areas. Firstly, marketing campaigns sought to enlist registration as part of the trigger list campaigns whilst secondly Highlands & Islands Enterprise used a touring demonstration bus to raise awareness of broadband and what it could do for would-be adopters in rural and remote areas. Thirdly, local champions were promoted to highlight in a local context the benefits of broadband (TOOKEY *et al*, 2006: 487). However, once almost full availability was achieved these awareness campaigns have declined in prominence with some TV advertisements ceasing almost immediately.

## 6. Is there still a UK-wide market?

The focus of the previous section was on the consequences of the policy initiatives that have been undertaken to encourage broadband availability and adoption in Scotland. At the same time the discussion has also drawn attention to the fragmentation of the UK telecommunications market that is underway.

Four different categories of broadband market have been identified in the UK,<sup>18</sup> differentiated by the extent to which competition is present (OFCOM, 2007). Interestingly Ofcom did not specify how policies would vary between these four markets, though it is reasonable to assume that their different economic attractiveness will shape the policies that will eventually emerge. Service based competition is likely to predominate where BT is the only infrastructure provider; whereas where more than one infrastructure is available infrastructure-based competition will occur. Whilst infrastructure based competition is possible across much of the UK, around one-third of the Scottish population live in areas where no alternative infrastructure to BT exists (HUNTER &

WHALLEY, 2008). In other words, one-third of the Scottish population will need to rely on service-based competition for broadband with all the vagaries that this entails.

The interaction between UK-wide developments and Scotland is also evident in the trigger list scheme operated by BT. The scheme was applied across the UK and can be viewed as being a response to pressures from the regulatory authority to widen the availability of broadband and the emergence of Internet access competition in large, primarily English, urban markets. Whilst it is undoubtedly the case that the scheme did result in a significant expansion of broadband enabled exchanges, some parts of the UK were, for a variety of reasons, omitted. A significant proportion of those areas omitted were located in Scotland. The devolved government sought to counter this through supporting local initiatives and providing a subsidy via development funds to expand availability into those areas omitted by BT.

One such initiative is 'Connected Communities' in the Western Isles. Although limited in its geographical scope to the Western Isles, the scheme attracted funding of £5 million which compares unfavourably with the £16 million given to BT to upgrade 260 of the Scottish exchanges that it did not upgrade when it ended its trigger list scheme. The initial plans for the Connected Communities network was actually more ambitious geographically than those which were finally agreed. The project's coverage was, however, reduced to reflect the expansion of broadband availability that occurred when BT ended its trigger lists scheme and upgraded the majority of its exchanges. The scaled back nature of the Connected Communities project that eventually emerged underlines an earlier point, namely, the necessity to place Scottish developments within the wider context of UK telecommunications market developments.

Another way to consider the widening of broadband availability is in terms of universal service. Incumbent telecommunication operators like BT have universal service obligations placed upon them that state that certain services must be made available (OFCOM, 2006). These obligations are, however, limited in their scope.<sup>19</sup> With respect to Internet access, BT is required to "provide access to basic telephone services with a narrowband connection capable of 'functional internet access' upon reasonable request and at uniform prices, irrespective of location" (OFCOM, 2006: 29). Consequently, BT is presently obligated to provide narrowband and not broadband Internet access. This could change if the universal service obligations placed on BT are extended to include broadband. However, XAVIER (2003) found that there was no convincing argument for such an extension and the recent review in the UK did not make such a suggestion (OFCOM, 2006). The EU has recently launched a review of broadband availability (EU, 2008), which may result in the extension of universal service to include broadband if it is concluded that existing regulatory approaches are unsatisfactory. Moreover, it is arguably the case that the benefits associated with investment from new entrants and the incumbent identified by HÖFFLER (2007) and MAJUMDAR *et al* (2007) outweigh those from service competition using the incumbent's infrastructure.

The restricted nature of the universal service Internet access obligations placed on BT explains the incremental expansion of broadband availability that occurred in practice. Prior to upgrading its exchanges, BT would have been able to meet its universal service Internet access obligations through offering narrowband (dial-up) connections through its existing network infrastructure. The initially selective nature of exchange upgrading reflected, in essence, the presence of local demand, whereas the more widespread upgrading that accompanied the ending of the trigger list scheme reflected the presence of both network externalities within the Internet access market and investment economies of scale. Thus, those exchanges that were not upgraded either lacked

---

sufficient demand to warrant the investment or were too costly to upgrade given the nature of the existing infrastructure on the one hand or the dispersed nature of the local population on the other.

## 7. Conclusions

This paper has focused on policy initiatives that have impacted the availability and adoption of broadband in rural and remote Scotland. It is clear that a diverse array of policy initiatives have been undertaken. Some of these policy initiatives have focused on availability, some on adoption and a handful on both. The first conclusion that can be drawn is that a patchwork quilt of initiatives has emerged in rural and remote Scotland. This reflects the underlying nature of the Scottish economy in general and the telecommunications industry in particular. It is arguably the case that such an approach has thinly spread the available resources across the initiatives, questioning the value of some not only in terms of their value for money but also their effectiveness.

A second conclusion is that these initiatives highlight the interest at the Scottish level in broadband even though telecommunications does not fall within the remit of the devolved government. Although some of these initiatives complement those initiated at the UK-level, it can be argued that there is a tension between those policies enacted at the two different administrative levels.

One such tension relates to the balance between infrastructure and service based competition, whilst a second is concerned with market definitions. Due to the ubiquitous nature of BT's infrastructure, service based competition is possible throughout the UK. That is, a company can use BT's network to deliver their services regardless of where they are based. As other competitors lack similar national coverage, infrastructure based competition is not possible to the same extent. This places those locations relying solely on service-based competition at a disadvantage compared to those that also enjoy infrastructure-based competition, with one of the main differences being that the latter enjoy faster access speeds.

A third conclusion, therefore, is that any fragmentation of the market is likely to detrimentally affect subscribers in rural and remote Scotland. The present UK wide set of tariffs reflects the state of competition in urban areas, with the consequence that less competitive areas such as rural and remote locations benefit as tariffs are lower than would otherwise be the case. Any move away from this will adversely affect the less competitive parts of the market. Having said this, operators may find the billing arrangements required to be too complex and expensive to implement and Ofcom could insist on national tariffs regardless of the identification of four different types of broadband market.

Any discussion of the possibility of the market fragmenting draws attention to the universal service obligations placed on BT. If those parts of the market where BT is the only infrastructure operator are not to be disadvantaged, additional investment is required. BT has already demonstrated a reluctance to invest in rural and remote exchanges in Scotland, with the consequence that it is unlikely to invest unless others fund all or part of this investment. Universal service obligations could be placed on BT, though this would require a change in policy on the part of Ofcom on the one hand and result in a protracted consultation process on the other as the exact terms of the obligations are finalised.<sup>20</sup> Regardless of the exact nature of the obligations, they need to be sufficiently onerous on BT to ensure that areas are not disadvantaged through receiving slower and more expensive broadband services than other parts of the UK.

Although significant progress has been achieved in making broadband available across Scotland, adoption has lagged behind for a variety of reasons. Some potential adopters

---

see no value to them in adopting broadband, whilst others consider it to be too expensive. Thus, a fourth conclusion is that if the full benefits of broadband are to be realised in rural and remote communities, then potential adopters need to be convinced that adopting broadband will bring benefits to them. Consideration has to be given to the material, social and cognitive resources available to individuals in these communities (VAN DEN BERG & VAN WINDEN, 2002). Also, although actions have been taken to reduce the cost of broadband, attempts to identify a 'killer application' that would encourage hesitant adopters to move have yet to be successful. This is, of course, outside of the remit of governments but will instead be determined by the market.

## 8. Notes & References

### Notes

- 1 The lack of an agreed definition of broadband is highlighted by Picot & Wernick (2008: 662). In some respects this is not surprising, as the underlying technologies also differ (Fijnvandraat & Bouwman, 2006) and some governments view having the fastest broadband speeds as being a point of national pride. Given the UK focus of this paper, the definition adopted here is that of Ofcom, namely, always on and data rates of at least 128 kpb (Ofcom, 2004).
  - 2 See, Whalley & Curwen (2008), for a discussion of local loop unbundling initiatives in the UK.
  - 3 Collectively, the six cities of Scotland have a population of around one third of the overall population of the country.
  - 4 According to National Statistics (2003: 19) the highest population densities can be found in Glasgow (3290 people per square kilometre) and the lowest in the Highlands (8 people per square kilometre).
  - 5 For a detailed discussion of the role and remit of the Scottish Executive see, for instance, Scottish Parliament (1999). Somewhat confusingly the Scottish National Party, which formed a minority administration in late 2007, changed the formal title of the government from Executive to Government. To avoid confusion, the term Scottish Executive is used throughout.
  - 6 Ofcom, Office of Communications, was created in 2002 as a converged regulatory authority covering the telecommunications industry, broadcasting and spectrum management. For an overview of the authority's remit, see, for instance, Ofcom (2008b).
  - 7 For details of the land reforms that were enacted in the Land Reform (Scotland) Act 2003 see, for instance, [www.scotland.gov.uk/topics/rural/land](http://www.scotland.gov.uk/topics/rural/land)
  - 8 An overview of public-private partnerships and private finance initiatives can be found at [www.scotland.gov.uk](http://www.scotland.gov.uk).
  - 9 Ofcom regularly consults on policy development as well as its implementation, a full list of which can be found at [www.ofcom.org.uk](http://www.ofcom.org.uk). The Scottish Executive, along with the other devolved administrations such as the Welsh Assembly, contribute to these consultations.
  - 10 For a more complete discussion of the initiatives, see Tookey *et al* (2006).
  - 11 The uncertainty here arises from a lack of information as to whether the initiative has run its course, subsumed within another initiative or is still running but under a different name of with little promotion.
-

- 12 The two Pathfinder projects were pathfinder Highlands and Islands, which was later renamed Pathfinder North, and Pathfinder South. Both were launched in December 2004.
- 13 In Gaelic, the Western Isles Council is known as Comhairle nan Eilean Siar.
- 14 For details of the project timeline see [www.connectedcommunities.co.uk](http://www.connectedcommunities.co.uk).
- 15 The idea of the public sector acting as hubs is suggested by Smith (2001).
- 16 See [www.atlasbroadband.co.uk](http://www.atlasbroadband.co.uk) for more information. The project was subject to a EU state aid investigation, though after a two-year investigation the project was allowed to go ahead (European Commission, 2004a & 2004b).
- 17 As the area covered by Scottish Enterprise is more populous it not surprising that more businesses applied in this area than they did in the highlands & Islands Enterprise region. In all, more than 9000 companies have applied to the Scottish Enterprise scheme by June 2004 and 421 in the Highlands & Islands Enterprise (Scottish Executive, 2004; Highlands & Islands Enterprise, 2004).
- 18 The four markets identified are as follows: 'Hull' where Kingston Communications is the only operator, 'market 1' where BT is the only operator, 'market 2' where there are exchanges with two or three operators and exchanges with three or four operators serving less than 10,000 premises and 'market 3' where there are exchanges with two or three operators and exchanges with three or four operators serving more than 10,000 premises (Ofcom, 2007: 2).
- 19 Four areas are identified in the statement, namely, the provision of public phone boxes, the availability of low cost schemes and services for customers with disabilities and the provision of telephone lines on request (Ofcom, 2006).
- 19 Not only would the services to be included within the universal service obligations have to be finalised, but so would the funding mechanisms as well. One such mechanism would be to create a fund that operators proportionately contribute into, whilst another would be place the obligations solely on BT as presently is the case. BT would provide the bundle of services, gaining either regulatory freedom in other markets or the benefit of network externalities.

## References

- ANALYSYS MASON (2008a) *Final report for the Broadband Stakeholders Group – Models for efficient and effective public sector interventions in next-generation broadband access networks*, 9 June, Cambridge, England
- ANALYSYS MASON (2008b) *Final report for the Broadband Stakeholders Group – The costs of deploying fibre-based next-generation broadband infrastructure*, 8 September, Cambridge, England
- BAAKE, P. AND C. WEY (2008) *Telecommunications Policies in Comparison: Industrial Policy Indicators*, Politikberatung kompakt 44, September, DIW Berlin, Berlin, Germany
- BAUER, J.M., KIM, J.H. AND S.S WILDMAN (2005a) Effects of national policy on the diffusion of broadband in OECD countries, paper presented at the *UFL-LBS workshop on the future of broadband*, Gainesville, Florida, February
- BAUER, J.M., KIM, J.H. AND S.S WILDMAN (2005b) An Integrated Framework for Assessing Broadband Policy Options, *Michigan State Law Review*, Vol.21, pp 2150
- VAN DEN BERG, L AND VAN WINDEN W (2002) Should cities help their citizens to adopt ICTs? On ICT-adoption policies in European cities, *Environment and Planning C: Government and Policy* 20(2) 263-279
- BLEHA, T. (2005) Down the Wire, *Foreign Affairs*, Vol.84 (3), May/June, pp 111-124
-

- BIGGS, P. AND T. KELLY (2006) Broadband pricing strategies, *Info*, Vol.8 pp 3-14
- BROADBAND STAKEHOLDERS GROUP (2004) *Third Annual Report and Strategic Recommendations*, available at [www.broadbanduk.org](http://www.broadbanduk.org)
- BT (2004) *Press release – BT confirms timetable for broadband roll out*, 30 June, available online at [www.bt.com](http://www.bt.com)
- CAIO, F. (2008) *The Next Phase of Broadband UK: Action now for long term competitiveness*, September, available at [www.berr.gov.uk/sectors/telecom](http://www.berr.gov.uk/sectors/telecom)
- CAVA-FERRERUELA, I AND A. ALABAU-MUNOZ (2006) Broadband policy assessment: A cross-national empirical analysis, *Telecommunications Policy*, Vol.30, pp 445-463
- CONSUMER PANEL (2008) *What is the value of next generation broadband?* September, Ofcom, London
- DEFRA (2005) *ICT in England's rural economies: a final report to DEFRA*, available online at [www.defra.gov.uk](http://www.defra.gov.uk)
- ESKELINEN, H., FRANK, L. AND T. HIRVONEN (2008) Does strategy matter? A comparison of broadband rollout policies in Finland and Sweden, *Telecommunications Policy*, Vol. 32, pp 412-421
- EUROPEAN COMMISSION (2004a) *State aid N 213/2003 – United Kingdom, Project ATLAS; broadband infrastructure scheme for business parks*, Brussels, C(2004) 1809 fin, 20 July.
- EUROPEAN COMMISSION (2004b) *State aid N 213/2003 – United Kingdom, Corrigendum to decision C(2004)1809 fin – Project ATLAS; broadband infrastructure scheme for business parks*, Brussels, C(2004) 3408 fin, 9 September.
- EUROPEAN COMMISSION (2008) *Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee on the Regions on the second periodic review of the scope of universal service in electronic communication networks and services in accordance with Article 15 of Directive 2002/22/EC*, Brussels, COM(2008) 572 Final, 25 September,
- FLAMM, K. AND A. CHAUDHURI (2007) An analysis of the determinants of broadband access, *Telecommunications Policy*, Vol.31, pp 312-326
- FIJNVANDRAAT, M. AND H BOUWMAN (2006) Flexibility and broadband evolution, *Telecommunications Policy*, Vol.30, pp 424-444
- FIRTH, L. AND D. MELLOR (2005) Broadband: benefits and problems, *Telecommunications Policy*, Vol.29, pp 223-236
- FRANSMAN, M. (2006) *Global Broadband Battles*, Editor, Stanford University Press, Stanford, Ca.
- FULLER, C., BENNETT, R.J AND M. RAMSDEN (2003) Organised for inward investment? Development agencies, local government, and forms in the inward investment process, *Environment & Planning A*, Vol.35, pp 2025-2051
- GALLOWAY, L AND R. MOCHIE (2005) The use of ICT in rural firms: a policy orientated review, *Info*, Vol.7, pp 33-46
- GEROSKI, P.A. (2000) Models of technology diffusion, *Research Policy*, Vol.29, pp 603-625
- HAUGE, J.A., JAMISON, M.A. AND R.J. GENTRY (2008) Bureaucrats as entrepreneurs: Do municipal telecommunications providers hinder private entrepreneurs? *Information, Economics & Policy*, Vol.20, pp 89-102
- HEBRIDES.NET (2006) *Community Broadband Initiative*, 1 March, available at [www.hebrides.net](http://www.hebrides.net), accessed 13 March 2006
- HIGHLANDS & ISLANDS ENTERPRISE (2004) *Annual Report 2003-2004*, Highlands & Islands Enterprise, Inverness
-

- HÖFFLER, F. (2007) Cost and benefits from infrastructure competition. Estimating welfare effects from broadband access competition, *Telecommunications Policy*, Vol.31, pp 401-418
- HOWICK, S. AND J. WHALLEY (2008) Understanding the drivers of broadband adoption: the case of rural and remote Scotland, *Journal of the Operational Research Society*, Vol.59, No.10, pp 1299-1311.
- HUNTER, J. AND J. WHALLEY (2008) *Reply – consultation on wholesale broadband access markets*, February, Ofcom, London
- JAMES, J. (2002) Universal Access to information Technology in Developing Countries, *Regional Studies* 36(9) 1093-1097.
- Keating M and Stevenson L (2006) Rural policy in Scotland after Devolution, *Regional Studies* 40(3) 397-407.
- LATTEMANN, C., KUPKE, S., SCHNEIDER, A-M. AND S STEIGLITZ (2006) Financial funding and organisation models in Public Private Partnerships for broadband projects in Europe, paper presented at *16<sup>th</sup> European Regional Conference of the International Telecommunications Society*, Amsterdam, DATE, Amsterdam, The Netherlands
- INTERNATIONAL TELECOMMUNICATIONS UNION (2003) *Birth of broadband*, ITU, Geneva, Switzerland
- INTERNATIONAL TELECOMMUNICATIONS UNION (2007) *Trends in Telecom Reform 2007 – The Road to Next-Generation Networks (NGN)*, ITU, Geneva, Switzerland
- INTERNET WORLD STATISTICS (2008) *Broadband Statistics, November 2007*, available at [www.internetworldstatistics.com](http://www.internetworldstatistics.com) of 12 September 2008
- MAJUMDAR, S.K., MISHRA, B. AND H. CHANG (2007) Technology investment strategy in the presence of competitor entry: broadband deployment in the US telecommunications industry, *Technology in Society*, Vol.29, pp 422-430
- NATIONAL STATISTICS (2003) *Yearbook 2003 – The official handbook of the United Kingdom of Great Britain and Northern Ireland*, Office of National Statistics, London
- NATURAL SCOTLAND (2007) *Rural Scotland: Better Still, Naturally*, Scottish Executive, Edinburgh
- OECD (2008) *Broadband Statistics (December 2007)*, OECD, Paris, France
- OFCOM (2004) *Internet and Broadband Update*, April, Ofcom, London
- OFCOM (2006) *Review of the Universal Service Obligation – statement*, 14 March, Ofcom, London
- OFCOM (2006a) *The Communications Market Report: Nations and Regions*, Ofcom, London
- OFCOM (2006b) *Ofcom's Consumer Policy*, 8 December, Ofcom, London
- OFCOM (2006c) *Media Literacy Report*, April, Ofcom, London
- OFCOM (2006d) *The Communications Market Report: Nations and Regions: Scotland*, Ofcom, London
- OFCOM (2007) *Review of the wholesale broadband access markets 2006/07 – identification of relevant markets, assessment of market power and proposed remedies. Explanatory Statement and Notification*, 15 November, Ofcom, London
- OFCOM (2007b) *Taking Account of Consumer and Citizen Interests. Progress and evaluation – 12 months on*, 28 February, Ofcom, London
- OFCOM (2008) *Citizens, Communications and Convergence. Discussion Paper*, 11 July, Ofcom, London.
- OFCOM (2008b) *Annual Report 2007 – 2008*, Ofcom, London
- OFCOM (2008c) *The Communications Market Report: Nations and Regions: Scotland*, 22 May, Ofcom, London
-

- PICOT, A. AND C. WERNICK (2007) The role of government in broadband access, *Telecommunications Policy*, Vol.31, pp 660-674.
- PLUM CONSULTING (2008) *A Framework for Evaluating the Value of Next Generation Broadband – A report for the Broadband Stakeholder Group*, June, London
- SAVAGE, S.J. AND D. WILDMAN (2005) Broadband Internet access, awareness and use: analysis of United States household data, *Telecommunications Policy*, Vol. 29, pp 615-633
- SCOTTISH ENTERPRISE (2003) *Annual report 2002/03*, Scottish Enterprise, Glasgow
- SCOTTISH ENTERPRISE (2004a) *Scottish e-business survey 2004*, Scottish Enterprise, GLASGOW
- SCOTTISH EXECUTIVE (2001a) *Connecting Scotland*, Scottish Executive, Edinburgh
- SCOTTISH EXECUTIVE (2001b) *Digital Inclusion*, Scottish Executive, Edinburgh
- SCOTTISH EXECUTIVE (2002) *Making it Happen*, Scottish Executive, Edinburgh
- SCOTTISH EXECUTIVE (2003a) *Summary of research on broadband in Scotland*, report prepared by Analysys consulting ltd for the Scottish executive, Edinburgh
- SCOTTISH EXECUTIVE (2004) *Home Computer Initiative – framework contract*, available online at [www.scotland.gov.uk](http://www.scotland.gov.uk)
- SCOTTISH GOVERNMENT (2008) *Latest News on Exchange Activate*, 26 June, available at [www.scotland.gov.uk](http://www.scotland.gov.uk), accessed 16 October 2008
- THE SCOTTISH PARLIAMENT (1999) *The New Scottish Government*, 27 May, available at [www.scottish.parliament.uk](http://www.scottish.parliament.uk) of 15 September 2008
- SMITH, M.M. (2001) *The Future of Broadband Telecoms Provision in the Western Isles and Associated Skills Development Requirements*, available at [www.connectedcommunities.co.uk](http://www.connectedcommunities.co.uk), accessed 13 March 2006
- STROVER, S (2001) Rural Internet connectivity, *Telecommunications Policy*, Vol.25, pp 331-347
- TOOKEY, A., HOWICK, S. AND J. WHALLEY (2006) Broadband diffusion in rural and remote Scotland, *Telecommunications Policy*, Vol.30, pp 481-495
- TRKMAN, P., BLAZIC, B. AND T. TURK (2008) Factors of broadband development and the design of a strategic policy framework, *Telecommunications Policy*, Vol.32, pp 101-115
- TURK, T., BLAZIC, B.J. AND P. TRKMAN (2008) Factors and sustainable strategies fostering the adoption of broadband communications in an enlarged European Union, *Technological Forecasting and Social Change*, Vol.75, pp 933-951
- UK GOVERNMENT (1998) *The Scotland Act 1998*, The Stationery Office, London
- WAKEFORD, R. (2006) *Sustainable Rural Scotland*, September, Scottish Executive, Edinburgh
- WARREN, M. (2004) The digital vicious cycle: links between social disadvantages and digital exclusion in rural areas, *Telecommunications Policy*, Vol.33, pp 374-388
- WARREN, M., CHILDE, S. AND T. ROGERS (2006) *Business Impacts of Broadband Adoption – A Study of Businesses in Devon*, November, Universities of Plymouth and Exeter, UK
- WEISER, P.J. (2005) Which Broadband Nation? *Foreign Affairs*, Vol.84 (5), September/October, pp 161-166
- WHALLEY, J AND P CURWEN (2008) Equality of access and local loop unbundling in the UK broadband telecommunications market, *Telematics & Infomatics*, Vol.25 (4), pp 280-291
- VAN WINDEN (2001) The End of Social Exclusion? On Information Technology Policy as a key to Social Inclusion in Large European Cities, *Regional Studies* 35 (9) 861-877.
-



XAVIER, P (2003) Should broadband be part of universal service obligations? *Info*, Vol.5 (1), pp 8-25

