The Superfast and the Furious

Priorities for the future of UK broadband policy

Chris Yiu and Sarah Fink

Policy Exchange

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About the Digital Government Unit

We are helping policymakers and politicians unlock the potential of technology: for an innovative digital economy, smarter public sector and stronger society. For more information on our work programme please feel free to get in touch.

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Executive Summary

At first glance, the UK's broadband strategy is simple. At the end of 2010 the new coalition government set an ambition for the UK to have the best superfast broadband network in Europe by 2015.[1] Over the years, the word "best" has come to mean different things to different people. In summer 2012, the then Secretary of State for Culture, Media and Sport – whose department has responsibility for broadband policy – brought things back into focus. For Britain to have the best broadband network in Europe, he declared, it must also be the fastest.[2]

There are many different ways to measure the technical performance of a broadband network. On one of the simplest metrics – the average downstream speed of a fixed domestic internet connection – the UK currently stands at 18th in global rankings.[3]

When we look at the contribution that the internet makes to the economy, the picture is somewhat different. The UK is out in front on measures relating the internet to economic performance. The internet economy accounts for over 8% of UK GDP, a higher share than any other country in the G20.[4] This figure is forecast to rise to over 12% by 2016, with the internet now accounting for around a quarter of our economic growth.[5]

This observation alone makes it clear that speed should not be the primary lens for broadband policy. Technical performance does of course matter. Faster connections enable new and improved applications, and, historically, usage has closely tracked increases in the availability of bandwidth. But finding the right question for policymakers to focus on requires us to take a step back and ask: how can we enable the best economic and social outcomes through the roll out and use of broadband connectivity?

The right objectives for public policy

In our view, the basic building blocks of a progressive, pro-market approach to broadband should be relatively simple: put the conditions in place for competition to work effectively, remove any red tape that overly constrains the ability of industry to build out new capacity, and target public policy interventions on areas where action is necessary to protect fairness or cover off distributional concerns.

Equally important is what government should avoid. If competition is working and firms have a reasonable degree of regulatory certainty then, once the core infrastructure is in place, demand will pull through the appropriate products and services, and government should not be setting targets for speed or adoption of specific technologies. Once any excessive or overbearing regulation has been modernised, government should not be making special interventions to accelerate roll out faster than required to meet people's needs.

A place remains, of course, for policies designed to ensure that most people have access to a basic level of broadband connectivity, and moreover that they

1 Department for Business, Innovation and Skills & Department for Culture, Media and Sport, "Britain's Superfast Broadband Future", December 2010

2 Jeremy Hunt's speech at Campus, London, "Broadband in the UK – Faster, Higher, Stronger", 20 August 2012

3 Akamai, "State of the Internet", Q2 2012

4 Boston Consulting Group, "The Internet Economy in the G20", March 2012

5 McKinsey Global Institute, "Internet matters: The Net's sweeping impact on growth, jobs and prosperity", May 2011

have the capability to put this to good use. In fact, the network effects from connectivity mean that getting most people online is important for ensuring a sustainable market over the long term, as widespread uptake of core digital communications services makes connectivity more valuable to all users, and in turn eases the business case for private investment.

Summary of recommendations

This report is pragmatic and does not seek to unpick existing spending commitments or on-going processes (including the regional broadband fund being administered by BDUK and the 4G spectrum auction being administered by Ofcom). We have, however, identified the components necessary to upgrade the government's future broadband strategy. These have been assembled in light of recent market developments, and drawing on insights revealed by our polling with around 2,000 consumers and 500 small and medium sized businesses, conducted to inform this report. The key elements of such a package are as follows:

1. Vision

Recast the government's headline ambitions for broadband connectivity, focusing explicitly on economic and social outcomes rather than pursuing speed as a proxy for progress.

For the general public, broadband price and reliability matter as much as raw speed, and the optimal trade-off will vary from home to home and over time. The best way through is to let the market balance different needs, which in turn requires effective competition between providers. This puts a premium on continuing to ensure a level playing field for access to infrastructure, ensuring there is enough flexibility for innovation and for different providers to differentiate their offerings, and that there are no artificial barriers to switching from one provider to another.[6] In this world, whether or not the UK has the fastest superfast broadband relative to other countries is a redundant question.

Our polling found that four in five people think the internet is something that everyone should be able to get access to. Two thirds of people think it is more important for everyone to have access to a basic broadband service than it is to boost top speeds in select parts of the country. The government's current universal service commitment is anchored on achieving an absolute standard of 2Mbps access for everyone in the UK by 2015. Today, 2Mbps is the minimum requirement to access on-demand television via BBC iPlayer. We suggest the principle of a universal service commitment is maintained, but to keep pace with changing internet use the standard be modernised to accommodate a relative rather than absolute standard of service.

We found people are split about 50:50 on whether taxpayers should be investing in broadband infrastructure. And on whether it is fair for people in remote areas to pay more for connectivity, people are split 2:1 against. The truth is, of course, that it costs more to deliver broadband to remote areas, and comprehensive terrestrial coverage is not viable without some element of public subsidy. Once the current pot for regional broadband deployment has been allocated, and in keeping with the government's localism agenda, any further funding should be focused on raising capability (for both individuals

6 In other words, a level playing field for different communications providers needing to access underlying infracstructure.

and small businesses) to lift demand, and/or passed through to consumers to help those least able to pay for a basic broadband service, with appropriate tools for demand aggregation if necessary. Current ONS data shows that of those households without broadband, 22% cited a lack of internet skills as a reason for not having a connection, whilst less than 1% reported a lack of availability in their area as a reason.[7]

2. Red Tape and Regulation

Clear the way for the roll out of next generation networks, building on steps already taken by the government to cut red tape around the deployment of street cabinets, cables and access to private land.

The Law Commission is currently conducting an independent review of the Electronic Communications Code, and is due to make recommendations to government in spring 2013.[8] The pace of change in broadband means it will be important to respond quickly and decisively. Our review of the issues suggests that managing the rights of operators, dealing with delays and compensation for landowners will be important areas to prioritise.

Deployment of broadband infrastructure is often held up by the planning process. This reflects real differences of opinion about what matters, and our polling with the general public found a 50:50 split on whether it is more important to increase connectivity or preserve the local environment. A streamlined process for cables and street cabinets has already been announced and will make it easier to take forward fixed broadband developments. In the wireless space, the approval rate for new base stations is currently running at around two in three. Where these applications are initially rejected and appealed, the win rate is also around two in three (compared to just one in three across all appeals).[9] All of this suggests that the current planning process is a cumbersome way to arbitrate between different priorities. Where local authorities determine that better connectivity is a local priority, they should have more freedom to fast-track planning approval for the necessary infrastructure.

In many cases, public sector land and buildings are well suited to rapid infrastructure deployment – particularly in town centres where public buildings are often tall and reliably powered. Some public authorities are already taking advantage of their land and buildings as a base for broadband infrastructure. For those who are not, they should think creatively about how their assets could be used to facilitate better connectivity. In other domains like transport, government does not directly own or operate services but does control the framework that different participants operate under. This control can be used to align incentives and enable better connectivity. In rail, for example, future franchise awards could be modified to promote the cooperation required for enhanced mobile connectivity both in transit and at stations.

7 ONS, "Internet Access - Households and Individuals", 2012

8 Department for Culture, Media and Sport, "Electronic Communications Code to be reviewed", July 2011

9 Mobile Operators Association, 2012

3. Consumer Empowerment

Empower consumers and small businesses to gain the maximum benefit from access to the internet, and to put enough pressure on broadband providers to ensure that competition works in everyone's interests.

Only around one in five people is confident estimating how much data their household uses in a typical month (and this figure falls to fewer than one in ten for the over-65s). Only around a third of people are confident they can choose the best broadband package for their household's needs (again falling to below one in five for the over-65s). For competition to work effectively, consumers need to be confident in their interactions with broadband providers. The government is already supporting work led by Go ON UK (the successor organisation to Race Online 2012) to get people connected and to boost their capability once they are online. As outlined above, this should be the focus for any incremental spending in pursuit of good broadband outcomes.

About half of people think that most businesses should be ready to take bookings or orders online. Only about a third of small business, however, report that they have the capability to manage online transactions. This is particularly concerning for policymakers as we know that small businesses that embrace the internet grow three times as fast as their offline peers – so even accounting for some selection bias, many are passing up a major opportunity. This suggests that the focus for digital engagement needs to extend to cover capability for small businesses. This is already coming on to the Go ON UK agenda, and again should be a priority for further activity.

In addition to basic capability, consumers also need to have enough information to help them make good decisions. In other markets, including energy and financial services, there are moves to ensure consumers have access to personalised data about their usage so that they can compare products and shop around. Many ISPs and MNOs already provide this sort of information for their customers. Where this is not already happening it should be encouraged.

Just as most people think that most everyday businesses should be online, similar expectations are building around public services. The government is already pursuing improvements in its digital estate. To the extent that great online public services can provide a compelling reason to get connected, there is an opportunity for the government to nudge people online as it digitises the public sector. The big risk is that online public services are massively degraded by a requirement to cater to the lowest common denominator when it comes to internet connectivity. This would be a huge wasted opportunity. The government should be more relaxed about prioritising broadband-enabled digital services for the vast majority, as part of a concerted effort to get the general public engaged with life online.

4. The Long View

Place a higher priority on communications when it comes to designing national infrastructure policy, including the importance of digital communications as an enabler for smart cities, intelligent transport and other future technologies.

Small businesses rank communications second only to major roads when asked to prioritise different areas for infrastructure improvements. As outlined above,

we advocate a market-led approach to connectivity, with demand pulling through the appropriate amount of investment and provision. As the government sets the parameters for this market to operate, it should keep a close eye on potential synergies with other aspects of its national infrastructure agenda.

One key constraint over the medium to long term will be radio spectrum. As this is a common good it is necessarily allocated by government – and in a capacity-constrained future, there is likely to be a particular premium on freeing up additional spectrum for wireless communications. The government should take forward detailed planning now for future spectrum reform, recognising the economic importance of scarce spectrum for broadband, WiFi and white space uses. For example, Ofcom will consult on proposals that aim to use the gaps in radio spectrum allocated to television broadcasts, which could improve WiFi and rural broadband.[10] A radical reform plan might include contingency planning to shift broadcast television to internet protocol television (IPTV) considerably sooner than 2030.

5. Joining up Government

Strengthen the role of the minister responsible for broadband, giving the post an explicit remit to promote economic growth opportunities from mainstream use of communications and the internet.

The internet is a pervasive, general purpose technology whose importance to the economy extends far beyond the creative industries. Although responsibility for internet and broadband issues currently sits with DCMS, it is immediately apparent that a large number of central and local government bodies need to be a part of this agenda. Up to this point, much of the policy debate has been – either explicitly or implicitly – about retail and consumers. This is important, but needs to be seen alongside putting broadband to best use to support enterprise and growth, and taking advantage of connectivity to reform public services. There are also too many conversations focused on the issues as they relate just to fixed broadband or just to wireless broadband provision. However, the rapid convergence of technologies and services means that more attention must be paid to how fixed and wireless can work together to achieve good outcomes for the economy and society.

In practice this means embedding connectivity far more firmly into mainstream government business. In Whitehall this covers everything from the advice for small businesses developed for GOV.UK through to the government's growth strategy, infrastructure reviews and beyond. It also cuts across policy for the regions, for rural areas, for communities and local authorities.

10 The Telegraph, "White space broadband moves a step closer" November 2012

1
Introduction

Digital communications are an integral part of modern life. The latest data show that 85% of adults have a fixed telephone line, 92% of individuals have a mobile phone, 39% have a smartphone, and 80% of the population are online at home in one way or another.[11] These figures on penetration make it abundantly clear that the communications story we are about to tell is one that cuts across our society and economy: old or young, rich or poor, north or south, the decisions that policymakers navigate will have an impact on day-to-day life.

Of course there is a lot to learn from examining how younger people are using communications technology. It's clear that, for those who have grown up with the internet, it occupies a different place in their lives compared to previous generations. Today's teenagers are the only age group that would give up television rather than be cut off from the web and social networks.[12] At the other end of the spectrum, previous Policy Exchange research has shown that there are still 5.4 million older people offline and in need of more support to fully benefit from the opportunities the internet offers.[13]

Figure 1.1: The UK economy has a high internet intensity
Internet economy as a percentage of 2010 GDP

	GDP ($trillions)	GDP (%)	
UK	2.3	8.3	
South Korea	1.0	7.3	
China	5.9	5.5	
Japan	5.5	4.7	
U.S.	14.5	4.7	
G-20	54.9	4.1	4.3 Developed market average
India	1.7	4.1	
EU-27	16.2	3.8	3.6 Developing market average
Australia	1.2	3.3	
Germany	3.3	3.0	
Canada	1.6	3.0	
France	2.6	2.9	
Mexico	1.0	2.5	
Brazil	2.1	2.2	
Saudi Arabia	0.4	2.2	
Italy	2.1	2.1	
Argentina	0.4	2.0	
South Africa	0.4	1.9	
Russia	1.5	1.9	
Turkey	0.7	1.7	
Indonesia	0.7	1.3	

Legend: Natives, Players, Laggards, Aspirants

Source: Boston Consulting Group, 2012

11 Ofcom, "Landline and mobile phone services"; 2011. Ofcom, "Adults media use and attitudes report", 2012

12 Ofcom, "Adults media use and attitudes report", 2012

13 Policy Exchange, "Simple Things Done Well: Making practical progress on digital inclusion and digital engagement", 2012

Overall, however, we have become a nation of internet users. Compared to other developed economies, we spend more time online, buy more online and the internet contributes a larger share to our GDP than almost all of our peers.[14] The internet matters enormously for our personal lives and for British businesses.

Digital communications are of course an area of rapid change. It's easy to get caught up in the excitement around new technology and anticipation of the next big thing. This applies as much to politicians and policymakers as it does to consumers and business leaders. We are as enthusiastic about the transformational potential of the internet as anyone. But the economics of connectivity and communications infrastructure are such that our broadband future is at least in part – and unavoidably – a matter of public policy.

Executing good public policy requires a framework for understanding and analysing the issues at stake, a vision for the future, and a clear idea of the steps required to get from here to there. In the arena of digital communications, there are competing interests to juggle and difficult tradeoffs to make. We have produced this report to pull together all of the main issues, to establish where citizens and businesses sit on some of the tradeoffs, and to signpost a way forward for broadband policy in the UK.

A very British paradox

For the most part, broadband in the UK is neither as fast nor as extensive as it is in other developed economies. In bandwidth comparisons we tend to place mid-table, with the UK ranked 18th by Akamai at mid 2012.[15] We have less fibre to the home than any other country in the European Union, with only 0.05% of households connected.[16] We have lagged behind other G20 countries in activating 4th generation mobile networks (4G) for consumers, with countries like Norway and Sweden several years ahead in terms of availability.

Yet the UK has a tremendously strong internet economy. The internet contributes more to GDP in the UK than it does in any other G20 country – 8.3% in 2010 and forecast to rise to 12.4% in 2016.[17] Between 2004 and 2009, the internet economy has accounted for 23% of economic growth.[18]

On the corporate side, internet pioneers and high-tech and digital clusters are gradually giving way to a mainstream integration of the internet into modern business operations. For the businesses that make good use of technology, the gains can be significant. Small businesses that execute well online grow three times as fast as their offline peers.[19] Big businesses are also benefiting. Over the past year John Lewis has seen a 40% growth of sales through its online channels.[20]

These developments have been helped by British consumers, who have been enthusiastic adopters of online shopping, entertainment and social networks. We buy more online per capita than any other country.[21] The BBC's iPlayer alone has 2.5 million users per day.[22] Between them, Facebook and Twitter have over 40 million people signed up across the UK. The most popular websites for UK internet users include eBay, Amazon, Facebook and the BBC.[23]

However, 16 million British adults lack basic online skills, such as the ability to send an email.[24] While UK internet users are the most likely to shop online, they are among the least likely to learn online. IBM UK revealed that they were unable to fill one in five jobs last year because they couldn't find people with the

14 ComScore, "European Internet Usage by Country", 2011; BBC, "UK is the most internet-based major economy", 2012; The FT, "The UK leads the world in e-commerce", 2012

15 Akamai, "State of the Internet", 2012

16 Techworld, "UK has lowest fibre-to-home rate in Europe: report", October 2012

17 Boston Consulting Group, "The Internet Economy in the G20", 2012

18 McKinsey Global Institute, 'Internet matters: The Net's sweeping impact on growth, jobs and prosperity', May 2011

19 Boston Consulting Group, "The Internet Economy in the G20", 2012

20 Computerworld UK, "John Lewis sees online sales jump 40%", September 2012

21 Boston Consulting Group, "The Internet Economy in the G20", 2012

22 BBC iPlayer, Monthly Performance Pack, September 2012

23 Experian Hitwise, "Data Centre: Top Sites and Engines", June 2012

24 Go ON UK and Booz & Co, "This is for Everyone: The case for universal digitisation", November 2012

appropriate computing skills.[25]

All of which begs a critically important question for policymakers. Does the UK's already strong internet economy mean that having the "best" network matters less than what you do with it? Or would investing significantly to enhance communications networks in the UK leverage even greater performance from an area of demonstrable comparative advantage?

The £5 billion – or perhaps £25 billion – question

Politicians of all parties accept that, so far as the public finances are concerned, these are austere times. And there is broad consensus among forecasters that this and future governments will remain under continued pressure to bear down on debt and the deficit.[26] So regardless of political alignment, there is no escaping a close examination of public spending priorities. Spending restraint and efficiency savings will have to be found, and on many fronts.

As a nation, our aspirations for digital communications infrastructure and connectivity have unavoidable implications for government policy and spending decisions. At the bare minimum, a degree of regulation will always be required to ensure that the communications market operates effectively for end users. Furthermore, the economics of communications infrastructure mean that many of the outcomes we might like to see require some degree of public subsidy or spending commitment.

A few years ago, a series of defining studies by the Broadband Stakeholder Group set out the scale of the investment challenge.[27] Providing fibre optic broadband for every household, using fibre-to-the-cabinet (FTTC) technology, requires capital expenditure of around £5 billion. FTTC is when fibre is laid as far as a street cabinet located within a particular distance of the building

> " Taking fibre optic broadband all the way to the premises for the entire UK population would cost between £25 – £30 billion "

it serves. Copper then provides the connection for the remaining distance. This provides the user with downstream speeds of up to 80Mbps, but this speed can fall as distance from the cabinet increases. There is a commercial investment case to take fibre to around two-thirds of the population, at a cost of around £2.5 billion. Topped up with an additional £1 billion or so of extra funding (based on a central government contribution leveraging further funding from industry, local government and the European Union), we should be able to extend coverage to around 90% of the population. Taking fibre optic broadband all the way to the premises (FTTP) for the entire UK population would cost between £25 – £30 billion, depending on the precise technology employed, and could provide speeds up to 300 Mbps.

Similarly, rolling out 4G mobile networks across the UK also requires significant investment. Work led by Capital Economics estimates that the deployment of 4G in the UK will require capital expenditure of around £5.5 billion over a three to four year period.[28] This does not include the cost to network operators of purchasing spectrum licences from the regulator (which although they are a real financial flow, are a redistribution of resources rather than a productive

25 The Telegraph, "Google: Britain must embrace the web's innovators", November 2012

26 Fiscal Sustainability Report, Office for Budget Responsibility, July 2012

27 Broadband Stakeholder Group, "The costs of deploying fibre-based next generation infrastructure", September 2008

28 Capital Economics, "Mobile Broadband and the UK Economy", April 2012

investment in economic terms).

Of course we are not entering this debate in a vacuum. The present government has already articulated its ambitions for the next few years, and has allocated funding in line with the fibre-to-the-cabinet pathway described above (more on this later). The first services are now up and running, with more to follow. We do not propose to unpick past decisions, and when it comes to the detail of current programmes we will restrict our comments to areas where we think delivery could be accelerated or otherwise enhanced.

Nor do we dispute that better broadband will deliver real economic benefits for the UK. A range of previous studies have investigated the impact of broadband on economic growth. With the benefit of hindsight, there have been clear and significant benefits flowing from the introduction of broadband as a mainstream replacement for dial-up connectivity. Looking forward, a number of studies link superfast fixed and/or mobile broadband to economic growth, and report that the introduction of these technologies could add up to 0.5% to GDP.[29]

The important question for policymakers, however, is not whether better broadband is good for the economy. It clearly is. Rather, we need to know to what extent government support is required and justified to help move things forward.

So this report is about where we go next. Digital communications is an astonishingly fast-moving arena. This government has set its sights on 2015, and regardless of what we attain by then, many things may change dramatically along the way. In this context, there is a clear need for a long-term strategy for UK connectivity. We believe this can and should be an issue of genuine cross-party consensus, and an opportunity for the public and private sectors to collaborate in a way that maximises the benefits to the British economy.

Following an important focus on delivery over the past few years, it's time for the UK government's approach to broadband to tilt back toward strategy.

29   Capital Economics, "Mobile Broadband and the UK Economy", April 2012

2
Broadband Basics

There is no doubt that connectivity is tremendously important. The ability to get online and access information, products and services is instrumental for people wanting to make smarter decisions and save time and money. Connectivity also enables important social benefits, helping communities to communicate and individuals to make connections that foster and enhance social inclusion.

The following pages set out the essential foundations for a policy debate about broadband. For the sake of brevity we have narrowed this down to the elements we consider essential to the core discussion in this report. A more detailed set of primers on connectivity and on markets is included at Annex A and Annex B respectively. A glossary of selected technical terms is included at Annex D.

Technologies for Connectivity

Internet connectivity can be delivered to the consumer through a number of different technologies. This report is not focused on any technology in particular. In the course of our discussion we will encounter fixed broadband technologies like DSL and fibre-optic broadband, terrestrial wireless technologies like 3G and 4G services, and other technologies like satellite broadband. The chart below provides a stylised illustration for how these different technologies connect end-users to the internet.

Figure 2.1: Different ways to get connected

Stylised representations for fixed and wireless broadband connectivity

Source: DCMS, Policy Exchange
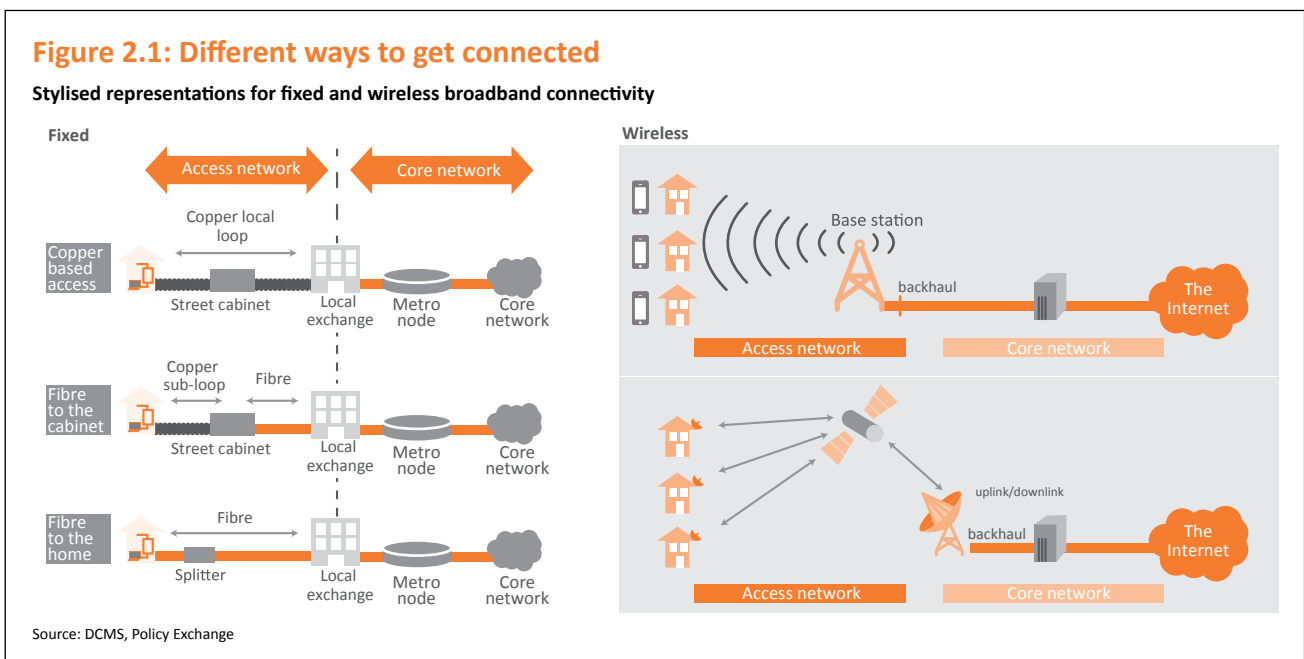
Like many policy areas, the debate about broadband is littered with terminology. For clarity, we speak about the key terms as follows:

- Broadband: an internet connection rated at 2Mbps down or faster
- Superfast broadband: 24Mpbs down or faster
- Ultrafast broadband: 80Mbps down or faster

We use these terms without reference to the technology used to deliver connectivity to the end user. In fact, rapid convergence of technologies and services, and interdependencies between different forms of connectivity, mean that policymakers should approach the topic by thinking about connectivity in the round. There may be some areas where fixed and wireless priorities are in tension, and others where there are opportunities for greater collaboration. Where our discussion is specific to fixed or wireless broadband we will make it clear.

To get a sense of what all this terminology means in the real world, it's helpful to have a sense of what sorts of applications different levels of connectivity can comfortably support. The chart below provides a rough guide to how much bandwidth is required to support different applications for different numbers of simultaneous users.

Figure 2.2: Speeds for needs

Approximate bandwidth required for online tasks, with consideration for number of users

Number of simultaneous users	Send an email or download and submit an online form	Make a high quality video call (e.g. Skype)	Stream Video in SDTV (e.g. Watch BBC iPlayer)	Stream Video in HDTV
1	< 1 Mbps	< 1.5 Mbps	2 Mbps	6–8 Mbps
2	< 1 Mbps	< 3 Mbps	2–4 Mbps	12–16 Mbps
3	< 1 Mbps	< 4–5 Mbps	3–6 Mbps	18–24 Mbps
4	< 1 Mbps	< 6 Mbps	4–8 Mbps	24–32 Mbps

▬ Superfast connection needed

Source: Industry reports, Policy Exchange analysis

Markets sometimes fail, but so do governments

With all of the economic potential inherent in connectivity, it's not surprising that broadband attracts attention from policymakers. This in itself is welcome, but there are two big pitfalls to avoid. First, as in other areas of public policy, it is far easier to count inputs than it is to count outcomes. There is a real risk that official documents and Ministerial speeches end up cluttered with initiatives, spending commitments, and targets phrased in megabits per second – because this is sometimes the most effective way to convey the impression that decisive action is being taken.

Second, it's easy to forget that broadband is ultimately a commercial endeavour. At the end of the day we rely on industry to lay fibre in the ground, to hang antennae on masts, and to deliver devices like routers and smartphones to end users. All of which means policymakers need to be very careful when thinking about government intervention. The best measures will be those that help a competitive market to work effectively to match supply to demand. This is emphatically not about ending government intervention in the broadband arena. Rather, it's about finding the right approach and appropriate regulation to enable the market to deliver an efficient, sustainable outcome for the economy over the long haul.

In economic terms, the market for broadband has a number of unusual and important features. The core infrastructure shares some fundamental characteristics with natural monopoly utilities: high fixed costs, low marginal costs, and economies of scale that tend to favour a small number of participants. The radio spectrum required to deploy wireless connectivity is rivalrous but non-excludable. Some firms are vertically integrated across backhaul and wholesale or retail activities, or horizontally across fixed and wireless connectivity, whilst others focus more closely on a particular segment of the market. For consumers there are information asymmetries that can make it difficult to match products to needs, issues for some people who lack the capability to make the best use of the internet, and network externalities that make connectivity more valuable the more that other people are also online. And cutting across all of this, continued advances in technology are driving convergence and pushing the limits of network performance.

Individually, none of these characteristics are unique to the broadband market. Moreover, although they make it a complex landscape to navigate, they do not justify sustained, directive government intervention.

Managing the policy trade-offs

There is a role for government in this space, but the difficult part for policymakers is managing the trade-offs between competing objectives. For example, we know that uncertainties about costs and consumer willingness to pay mean that some element of government subsidy is required if we want fibre optic networks to reach more than about two-thirds of the population. In seeking to overcome difficulties in the commercial investment case for fibre, the government necessarily faces a three-way trade-off between cost, reach and competition. Similarly, in the wireless arena, tensions between letting networks find and exploit economies of scale, maintaining effective retail competition and a desire to extract maximum rents from spectrum allocation also need to be managed.

Lessons from history and from other areas of public policy teach us that the best solution is for policymakers to be crystal clear about their end goals. Without this clarity, government risks getting stuck in a cycle of over-specifying short-term solutions, with little time or energy left to put in place the right fundamentals for taking a step back and letting the market lead the way.

3
Broadband in the UK

Today's broadband market is populated by a number of businesses, so it is helpful to provide a brief, high-level sketch of the landscape. Starting on the infrastructure side, Openreach is the infrastructure division of the BT Group. It was created after an agreement was reached between BT and Ofcom that Openreach's establishment would help promote competition by ensuring other operators would have access to BT's local network. Openreach is responsible for providing services and products to communications providers across the UK, including maintaining the "last mile" – cables and wires running from homes and businesses to the local exchange.

BT Wholesale, also a division of the BT Group, leases telephone lines, fibre optic cable and provides other communications products to internet service providers. They are the UK's largest wholesaler of broadband services, and allow ISPs to then offer these largely under their own brands to consumers.

Fujitsu provides broadband through a partnership with the Post Office, and is building fibre broadband infrastructure throughout a range of cities in the UK. It was the only company picked alongside BT to compete under the Government's framework (described in greater detail later in this report) to help allocate funds for remote broadband. However, Fujitsu has withdrawn from past bidding processes, making BT the sole winner of any regional tender.[30] Virgin Media have their own broadband network in many areas. Arqiva provides infrastructure for television, radio, satellite and wireless communications in the UK.

The major providers of fixed broadband to consumers and businesses include BT Retail, Virgin Media, TalkTalk, Sky, Plusnet, O2 and EE, among others. Major providers of mobile broadband include Vodafone, O2, EE and Three. Mobile Broadband Network Ltd. (MBNL) is a joint venture between EE and Three that allows them to share 3G infrastructure, and deliver a better network to consumers than they could independently. O2 and Vodafone also share infrastructure through Cornerstone, their joint venture.

Both internet take up and the number of devices owned and used have risen over the last decade. 21 million households (or eight out of ten homes) have access to the internet, and on average, each household has three internet connected devices. Total broadband take up is at 76%, up from 52% in 2007. In 2009, internet take up via a mobile phone was at 20%, and is now at 39%. However dongle-based mobile broadband take up decreased between 2011 and 2012, from 17 to 13%.[31]

30 The Financial Times, "Fujitsu withdraws from broadband bidding", July 2012

31 Ofcom, "The Communications Market", 2012

Figure 3.1: Internet take-up and devices over the past five years

Internet take-up and device ownership has risen significantly

Source: Ofcom, Communications Market Report, 2012
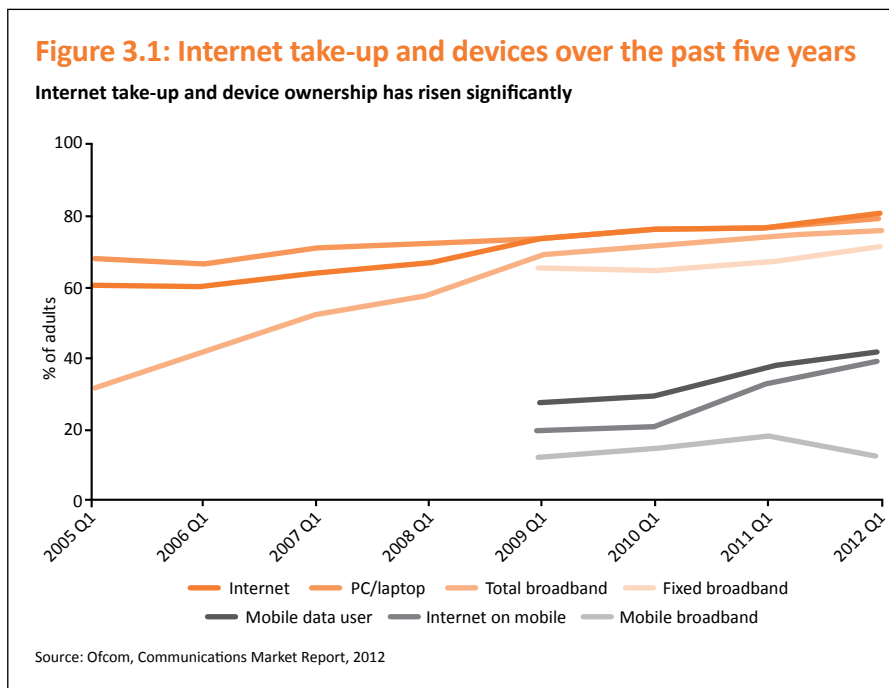
57% of households with internet access have a DSL connection and 30% are connected via cable or fibre optic. Six percent rely on satellite or public WiFi, 8% on a mobile phone, and 5% on a dongle.[32]

Laptops are the most popular internet-enabled devices, and are found in 61% of households. Laptops are followed by game consoles, at 52%, and then by desktop computers at 44%. Eleven percent of households have an internet enabled tablet such as an iPad.[33]

On average, UK consumers achieve average fixed broadband speeds of 12.7Mbps.[34] This increase in average speeds is largely driven by the migration of consumers to higher speed packages thanks to network upgrades by ISPs. For instance, BT is upgrading its both its copper ADSL network and fibre network, while Virgin Media has embarked on programme to double the speed of its broadband connections.[35]

At the other end of the spectrum, according to the ONS, there are 5.2 million households in the UK without internet access. To be clear, lack of access does not necessarily mean that broadband isn't available. Of those households without broadband, 54% said they did not have a connection because they felt they didn't need one, 22% cited a lack of internet skills, 15% reported equipment costs were too high and 14% said that the cost of connection was too high. Less than 1% reported a lack of broadband availability in their area as a reason.[36]

32 ONS, "Internet Access - Households and Individuals", 2012

33 Ofcom, "The Communications Market", 2012

34 Ofcom, "Infrastructure Update", 2012

35 Ofcom, "UK fixed-line broadband performance", May 2012

36 ONS, "Internet Access - Households and Individuals", 2012

4
Broadband Around the World

Overall, the UK is neither a long way ahead nor a long way behind in terms of raw infrastructure performance or deployment. The following charts provide an at-a-glance overview of how the UK ranks compared to its peers in the EU.

Figure 4.1: UK well above EU average in household take-up of broadband

Households with a fixed or wireless broadband connection, 2011
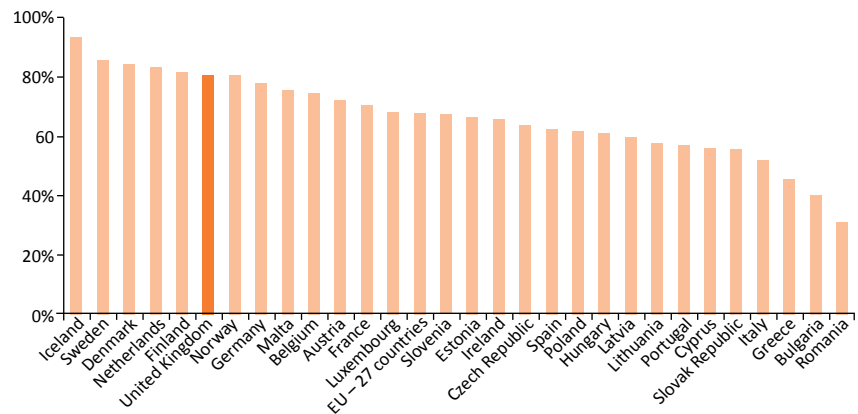
Source: European Commission, Digital Agenda Scorecard, 2011

Figure 4.2: UK below EU average in NGA broadband connections

Next Generation Access and other superfast broadband technologies (at least 30 Mbps download) expressed in % of fixed broadband subscriptions, 2011
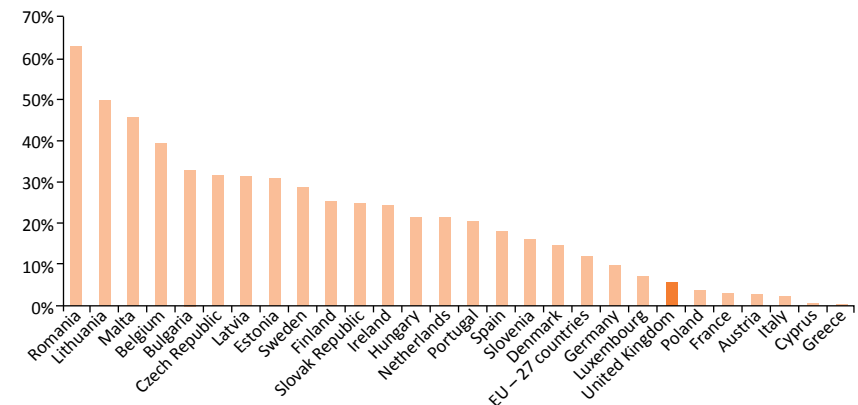
Source: European Commission, Digital Agenda Scorecard, 2011

International Case Studies

Before proceeding any further into the issues facing the UK, it is instructive to consider developments in other broadband markets. From ambitious government targets to innovative initiatives from the private sector, the following case studies provide interesting and important insights for UK policy makers.

France

The French government has devised a national incentive programme for very high-speed internet, and for giving every household access to it by 2025.[37] France has demonstrated its commitment to expand its digital economy, primarily by investing £3.7 billion (€4.5 billion) in the sector as part of the French government's "National Investment Programme" launched in 2010, including £1.6 billion (€2 billion) to develop internet infrastructure. This spending is a part of France's plan to "invest in the country's strategic growth", and the digital economy is seen as a priority area for its potential for growth and job creation.

France's incorporation of spending on internet infrastructure in its economic strategy reinforces the importance of considering not only the process of rolling out access to broadband, but considering take up and how it will be used to help drive economic growth and deliver positive outcomes.

Although broadband take up was initially slow, France now sits above average. DSL broadband penetration saw an increase after a shift in the regulatory regime and the implementation of local loop unbundling. This allowed competing providers to access France Telecom's network, and helped to drive down prices for consumers, now among the lowest in the world. This focus on competition seems to have shifted with the French government's involvement in deploying fibre towards sharing infrastructure and access. The debate in this area is ongoing, but could provide insight on how to ensure competition at the service level alongside the sharing of infrastructure, while avoiding the duplicated installation.

France's emphasis on the digital economy as a priority area for growth and job creation is applicable for the UK, especially considering superfast broadband is a component of a strategy that is also concerned with usage and take up. France also exemplifies how competition and lower prices for consumers is a key driver in compelling people to use new communications infrastructure.

Finland

Finland was the first country to make access to broadband a legal right, and set a minimum standard at 1Mbps. 96% of the country is now online. [38]

The Finnish government has set especially ambitious targets for superfast broadband. They expect 100Mbps to be available to everyone through a fixed or wireless connection by 2015. Although it seems unlikely they will reach over 99% by then, it is expected that 95% of the population will live within 2 kilometres of a 100Mbps connection. Interestingly, there has been less interest from nationwide operators in the government programme, and most of the subsidies have been taken by smaller companies or local cooperatives.

86% of the Finnish population lives within 2km of a 100Mbps connection. About half have opted to carry this connection to their home, but about half of these are via a mobile connection, which has theoretical speeds of 100Mbps but in practice may be slower. Furthermore, only a small percentage of people are

37 Harvard University, "Next Generation Connectivity: A review of broadband internet transitions and policy from around the world", 2010

38 BBC, "Finland makes broadband a 'legal right'", 2010

opting for the full fibre-to-the-premises connection with the maximum speeds available.[39]

The Finnish experience highlights an interesting case around the involvement of small, local companies in delivering access, and the significant use of mobile to provide broadband in rural and remote areas.

South Korea

South Korea is often singled out as a broadband utopia, where average peak speeds hit 48Mbps, 95% of households are broadband subscribers and wireless broadband penetration is at 100%.[40] By the end of 2012, they plan to have every home connected at 1 Gbps on fixed and wireless speeds at 10Mbps. The Korean government has engaged in multiple programs to promote demand, including subsidizing ICT training, computers and access.

Although broadband infrastructure and superfast speeds in South Korea are impressive, it is not an ideal comparator for the UK. South Korea is much denser than the UK, and over 50% of Koreans live in apartment buildings. Such economies of scale do not exist in the UK, making the logistics of deploying broadband in the UK more difficult than in South Korea. Also, landlords, not the incumbent provider KT, own local loop facilities, and competing providers negotiate with landlords rather than KT. In addition, there has been discussion around the lack of applications and tangible benefits coming out of South Korea that are dependent on superfast broadband.[41] Evidence submitted to the House of Lords included this discussion, with some arguing that the top global applications do not come from South Korea, but the United States, even though Silicon Valley for instance does not have especially good broadband infrastructure.[42]

Take up has depended on aggressive pricing. A key driver in getting people to pay for superfast broadband has meant pricing it comparably to, or even cheaper than, copper. The South Korean government has also invested extensively in stimulating demand for broadband through subsidised skills training, leasing computers and paying for the broadband connection of low income families, free computers to every school, free training and access at newly constructed public sites, free computers for low income students with good grades, and school curriculums that were developed to be more dependent on a good connection.[43]

There are interesting lessons from South Korea, but we cannot assume that that it is an applicable model for the UK. Although South Korea may top the list for speed and take up, their means of achieving this aren't necessarily feasible or even appropriate for the UK.

Australia

Australia's National Broadband Programme (NBN) involves a ten year rollout that will cost £23.9 billion, £19.4 billion coming from government investment.[44] The programme will deploy FTTP to 93% of homes, schools and businesses which will get speeds of up to 1Gbps. The remaining 7% will get peak speeds of 12Mbps with fixed wireless and next generation satellite technologies.

> **Although broadband infrastructure and superfast speeds in South Korea are impressive, it is not an ideal comparator for the UK**

39 Ars Technica, "Finland: Plan for universal 100 Mbps service by 2015 on track", 2012

40 Harvard University, "Next Generation Connectivity: A review of broadband internet transitions and policy from around the world", 2010

41 Harvard University, "Next Generation Connectivity: A review of broadband internet transitions and policy from around the world", 2010

42 House of Lords Select Committee on Communications, "Inquiry into Superfast Broadband, Oral and Written Evidence", March 2012

43 Harvard University, "Next Generation Connectivity: A review of broadband internet transitions and policy from around the world", 2010

44 Australian Government - Department of Broadband, Communication and the Digital Economy

The NBN is seen as the first step of the National Digital Economy Strategy which aims to make Australia a leading digital economy by 2020. The strategy outlines how with the help of 93% access to superfast broadband speeds and universal access to broadband, Australia will increase digital participation, improve government service delivery and see wider societal benefits from take up. In addition to laying the pipes, the Government's Digital Enterprise Programme will communicate the benefits to SMEs and non-profit organisations. The Government will also provide £15 million over three years as a part of Digital Communities Funding to set up digital literacy funding in the form of Digital Hubs.[45]

The NBN has received varied feedback from stakeholders, from enthusiastic support for the infrastructure, to criticism for the size of the budget. Thus far, take up has been much lower than expected, with 24,000 premises of a possible 230,000 connected.[46]

The NBN is ambitious, to say the least. Australia provides an example of what it means to deploy fibre-to-the-premises on a massive scale by way of a large amount of public funding, and like the comparison to South Korea, isn't necessarily appropriate for the UK.

Brazil

In Brazil, as of 2010, only 31% urban homes and 6% of rural homes had internet access. When asked why they didn't have internet access at home, 17% of urban homes cited a lack of availability, and 52% cited the high cost of getting connected. 61% of rural homes cited a lack of availability, and 31% cited high prices. Although, the UK has much higher levels of internet availability and take up, Brazil provides an interesting example of spectrum management.

Anatel, the Brazilian Agency of Telecommunications, is responsible for awarding spectrum to operators, including the auction process for the 450MHz license, to be used for 4G LTE. Originally, Anatel planned to auction off the 450Mhz licenses on their own, with the following conditions attached to the winning bidder:

- A coverage obligation at 100% by 2015, and by 2017 the licensee has to offer minimum download speeds of 1Mbps and upload of 256 kbps.
- Highest discount on prices for mobile and broadband services
- Highest discount on the resale prices offered to other operators
- Free broadband connectivity to state schools in rural areas
- Bear the costs of migrating current 450 MHz users, except those using it for public safety, where the government will pay.

The 450 MHz spectrum did not gain bidders independently, and was then auctioned off alongside 2.5 GHz spectrum. Additionally, these are challenging conditions, especially for attracting new entrants and handling a 100% coverage obligation.

Delivering broadband over fixed wireless and mobile using 450 MHz as a solution in the UK isn't impossible, but there are barriers. This band of spectrum is already in use and freeing some of it up for the use of broadband would mean moving public use elsewhere, and using the spectrum more efficiently. Anatel outlined that mobile operators should bear the costs of migrating those frequency users except in the case of public safety.

45 Australian Government - Department of Broadband, Communication and the Digital Economy

46 John McDuling, Financial Review, "Voters hungry for broadband rollout", 2012

Kansas City, USA

Through a competitive selection process across the United States, Google chose Kansas City from over 1,100 entries to build and fund an ultrafast broadband network.[47] The ultrafast broadband provides customers speeds of 1Gbps for £43 per month or bundled with TV at £75. They also offer a connection at 5Mbps for free for 7 years, but with a £186 connection fee or a fee of £16 per month for 1 year.

The project is 'built by demand', and residents of Kansas City registered their interest (at a cost of £6) in Google Fiber, pre-empted by workshops demonstrating the benefits of 1Gbps. Fiberhoods – portions on the city made up of 250 to 1500 households – had to reach a specified goal to qualify for fibre rollout. Goals varied from getting 5% to 25% of a neighbourhood registered, with the goal amount depending on the ease of construction. Construction is currently scheduled through 2013. The current focus for delivery is a residential, FTTP focus, but there are plan for a small business offerings in qualifying 'fiberhoods'.[48]

Google Fiber in Kansas City is not being framed as Google's entrance into being an ISP. Rather, Google is framing it as an experimental, innovative network with the potential to foster new behaviour. The outcomes remain to be seen, but in the meantime, the examination of the regulatory concessions provided by Kansas City to Google merits interest.

Google has agreed it will bear all costs for the project, but the city will not charge Google to use city assets and infrastructure. In return, Kansas City government has delivered access to public rights of way, offered office space at city facilities, and an expedited permit process without any charges for facilities, or any permit and inspection fees. Kansas City was also to develop and implement a marketing and education programme regarding the project.[49] Kansas City was successful in its bid for Google Fiber because of the conditions it was able to create to allow Google quick and efficient rollout.

Romania

Romania provides an interesting comparison to the UK. On the surface, Romania appears to be ahead of the UK in terms of superfast broadband and fibre connections. In Romania, 16% of broadband connections are at least 100Mbps, compared to less than 1% in the UK. As of 2011, 63% of lines were Next Generation Access (NGA) in Romania, compared to 6% in the UK. However, over half of Romanians have never used the internet, only 30% have broadband at home, and only 6% shop online.[50]

To remedy this, Romania has developed a broadband strategy to be carried out between 2009 and 2015 to overcome some of the key challenges in addressing broadband take up. These challenges include low computer ownership and the lack of internet access at home, especially in rural areas. Many suggest that more needs to be done to emphasise the value of the internet, as well as making internet access more affordable. Their strategy identifies not only the need for infrastructure and competitive pricing for access, but the creation and improvement of content for users, particularly businesses and government.[51]

Lessons for the UK

Broadband policy across the world is regularly a part of overall economic strategy. Deployment of superfast broadband is recognised as a driver of growth and

47 Fiber.google.com

48 Fiber.google.com

49 Forbes, "How Kansas won the fiber jackpot and California never will", Elise Ackerman

50 European Commission, "Digital Agenda for Europe", 2011

51 Broadband Commission for Development, Strategies for the Promotion of Broadband Services and Infrastructure, 2012

innovation. However, this does not mean laying fibre and ending there. Often these countries also have programmes in place to inform usage and encourage take up of broadband services. South Korea, Australia and many other countries have used government activity to build up people's interest in superfast broadband, in order to help ensure the investment is worthwhile for commercial players.

5
The State of Public Policy

The UK government already has a number of broadband policies and initiatives in place, the majority of which are focused on enabling or achieving high-level speed and coverage targets for 2015. Primary responsibility for broadband policy rests with DCMS, with Ofcom as the relevant sector regulator. A number of other government departments and agencies also have an interest in broadband. This chapter provides a very brief overview of what is currently on the agenda and where different governmental interests lie.

DCMS

In June 2009, the then Secretary of State for Culture, Media and Sport published the final report of the Digital Britain review.[52] This pulled together thinking at the time on broadband policy, and sketched out the foundations for two key pillars of government policy. First, a Universal Service Commitment for every household to have access at 2Mbps by 2012, leveraging a range of technologies including fixed, wireless and satellite infill. Secondly, a part subsidy for the deployment of next generation broadband to the final third of homes, funded by a 50p per month supplement on all fixed copper lines. Digital Britain also confirmed the then government's intentions to modernise spectrum for mobile data networks.

In December 2010 the coalition government published a refreshed strategy for UK broadband, consolidating its position that broadband is a top priority and setting out an ambition to have the best superfast broadband network in Europe by 2015.[53] The strategy remains in play and has two main objectives for 2015:

1. To stimulate private investment to take superfast broadband (download at 24Mbps or faster) to 90% of UK premises
2. To deliver basic broadband coverage (of at least 2Mbps) to virtually everyone else

These objectives are backed by £530 million of funding allocated during the last spending review. Within DCMS, Broadband Delivery UK (BDUK) are working with local authorities in England and with the devolved administrations to ensure local broadband plans are consistent with the government's targets. The approach is designed to leverage additional funding from local budgets and the European Union, taking the total public investment to over £1 billion.

The government describes its current approach as supporting the extension of fibre deeper into the network, whilst encouraging infrastructure competition by focusing funding on areas where the commercial investment case is weak, and where investment would be unlikely to take place without a public subsidy.

52   Department for Culture, Media and Sport, "Digital Britain", 2009

53   Department for Business, Innovation and Skills & Department for Culture, Media and Sport, "Britain's Superfast Broadband Future", December 2010

The government has allocated a further £150 million to support the development of super-connected cities across the UK.[54] Birmingham, Bristol, Leeds & Bradford, Newcastle and Manchester, along with the four UK capital cities, will share funding to develop ultrafast fixed broadband access (download at 80Mbps or faster) and large areas of wireless connectivity. Additional participating cities were announced in the Autumn Statement.

The government has also allocated £150 million to extend mobile phone coverage to areas which currently experience poor or no service.[55] This is intended to take premises coverage to over 99.9%. Ten priority roads have also been identified for improved coverage in transit corridors.

In September 2012 the government announced a number of measures to fast-track the roll out of superfast broadband.[56] These steps focused on removing red tape for fixed broadband provision, including:

- Making provision for street cabinets and other infrastructure to be able to be installed without prior approval from the local council
- Making it less costly and bureaucratic for companies laying cables in streets
- Allowing cables and cabinets to be installed on or under private land without the bureaucratic burden of long-running negotiations

Progress toward the government's broadband delivery ambitions is being tracked publicly on the DCMS website.[57]

Ofcom

Ofcom is the independent regulator and competition authority for the UK communications industries. Its activities are governed by the Communications Act 2003, which established Ofcom's duties and the limits of its powers to intervene.[58] It is accountable to Parliament, and funded by fees from industry and grant-in-aid from the government.

Ofcom is active across a number of technical and regulatory areas. The most relevant in recent years have been:

- Establishing the parameters for functional separation of BT's Openreach division within BT Group, to ensure that competition in the market for broadband access products was not distorted by market power stemming from vertical integration
- Developing a voluntary code of practice for fixed-line ISPs to provide consumers with more information and advice on the maximum broadband speed they can expect to achieve.[59] This followed research showing that actual speeds often fell short of headline speeds being advertised by ISPs
- Ongoing involvement in the implementation of the Digital Economy Act.[60] This includes provisions related to site blocking and copyright infringement
- Spectrum allocation and regulation.[61] This includes policy on spectrum liberalisation and spectrum allocation. Following the switchover to digital terrestrial television, Ofcom is managing the process of auctioning unused spectrum for use by mobile network operators

54 HM Treasury, "Reforms to support growth", Budget 2012

55 HM Treasury, "Chancellor announces increase in mobile phone coverage in UK", October 2011

56 Department for Culture, Media and Sport, "Fastest broadband in Europe: delivering infrastructure to boost UK businesses", September 2012

57 Culture.gov.uk

58 Communications Act 2003, Chapter 21, legislation.gov.uk

59 Ofcom, "Voluntary Code of Practice: Broadband Speeds", 2008

60 Digital Economy Act 2010, Chapter 24, legislation.gov.uk

61 Wireless Telegraphy Act 2006, Chapter 36 and Communications Act 2003, Chapter 21, legislation. gov.uk

Ofcom is a key source of research and statistics on the state of the UK's communications sector. It publishes an annual report on the state of the communications market, along with quarterly updates on key facts and figures.

Ofcom is also responsible for producing a scorecard on the UK's broadband performance relative to the rest of Europe, as part of the government's broadband strategy. The original intention was for this to capture a range of indicators across speed, choice, price and coverage. The first scorecard is due to be published by the end of 2012.[62]

Figure 5.1: The government is developing a broadband scorecard

Draft "best in Europe" scorecards for UK broadband policy

DCMS, 2010
Illustrative composite measures for inclusion in UK broadband scorecard

Ofcom, 2011
Proposed measures to be included in the Broadband Best in Europe scorecard

Speed x out of 27	Coverage x out of 27	Price x out of 27	Choice x out of 27
Average download speed	Household coverage	Price up to 2Mbps	Market share top 5 – fixed bb
Average upload speed	Business coverage	Price up to 30Mbps	Market share top 3 – mobile bb
Average advertised speed	Mobile broadband coverage	Price up to 100Mbps	Satisfaction fixed broadband
Average mobile bb download speed	Taken up by household	Price Mobile Broadband	Satisfaction mobile broadband

Coverage and take-up	Speed	Price	Choice
Standard broadband coverage and take-up	Fixed download speed	Price of standard broadband	Market concentration in fixed broadband market
Superfast broadband coverage and take-up	Fixed upload speed	Price of superfast broadband	Market concentration in mobile broadband market
Mobile broadband coverage and take-up	Mobile download speed	Price of mobile broadband	

Source: Ofcom, DCMS

Other government departments

Defra and BDUK have set up a Rural Community Broadband Fund (RCBF), which provides £20 million of support from the Rural Development Programme for England and BDUK's funding pot to superfast broadband projects in the last 10% of hard to reach areas.[63] The RCBF provides up to half of the eligible costs to these areas if they can demonstrate a local need and demand for superfast broadband. Eligible costs include infrastructure and establishment, and although the project may include activities like demand aggregation, the fund will not cover these costs.

HM Treasury is responsible for the overall state of the public finances, and negotiates financial settlements with individual departments as part of the spending review cycle. The most recent spending review included the allocation described above for BDUK's delivery programme. The government's plans for super-connected cities were announced by the Chancellor of the Exchequer in the 2012 Budget statement.[64] HM Treasury also publishes the National Infrastructure Plan. The most recent update was launched in late 2011 and contained commitments to improve the UK's transport and broadband networks (the latter in line with the strategy document published by DCMS).[65]

Other departments with direct interest in broadband policy include the Department for Transport (DfT), Department for Communities and Local

Government (DCLG), and Department for Business, Innovation and Skills (BIS). For DfT the government's objectives to improve connectivity along transport corridors are important, with a particular focus on major roads and rail. For DCLG the involvement of local authorities in developing and funding local broadband plans is a key issue, along with community-led broadband projects. For BIS there are broader issues around the part that broadband plays in the UK economy, its use by small businesses and its contribution to growth.

Devolved Administrations

Scotland

In March 2011, the Scottish Government published "Scotland's Digital Future: A Strategy for Scotland". The ambitions laid out in the report included the provision of next generation broadband to everyone by 2020, with significant progress by 2015. It also said that take up of broadband should be at or above UK average by 2013, and the highest in the UK by 2015.[66]

To reach these targets, Scotland's Infrastructure Action Plan is made up of four main programmes. "Step Change 2015" involves building infrastructure where the market won't reach to address the digital divide and ensure there is a step change in speeds by 2015. This included an uplift in current speeds as well, with 85 to 90% of premises getting 40 − 80Mbps. "World Class 2020" is about having a long term plan to make sure Scotland has world class, sustainable broadband infrastructure. The programme recognises that it is difficult to predict what world class means or will look like, but sees fibre as best placed to deliver future proof infrastructure. "Demonstrating Digital" refers to promoting local products and technology trials. In addition "Think Digital First" is aimed at raising digital participation for both businesses and individuals to increase demand for services. Improving mobile coverage also plays a role in the plans.[67]

Wales

In 2009, the Welsh Local Government Association raised concerns that parts of rural Wales were being left behind in terms of access to good broadband. In 2010, the Welsh Assembly Government published "Delivering a Digital Wales", which included plans for enhancing broadband infrastructure.[68] 96% of businesses and homes in Wales are to have access to a fibre to the premise or cabinet by the end of 2015. Improving mobile and wireless coverage also plays a role in overall plans for a digital Wales.

The Next Generation Broadband for Wales project will see £205 million pounds in public sector funding in order to cover over half of the premises where there is no plans for commercial investment in superfast broadband. This includes £89.5 million of European Structural Funding, £56.9 million from the UK Government and £58.6 million from the Welsh Government.[69]

Wales also has the Broadband Support Scheme for people with connections at less than 2Mbps to apply for up to £1,000 to cover upfront costs for a broadband connection.[70]

66 House of Commons Library, "UK Broadband – Policy and Coverage", June 2011

67 Delivering a step change in broadband speeds, Scotland. gov.uk

68 House of Commons Library, "UK Broadband – Policy and Coverage", June 2011

69 Next Generation Broadband Wales, wales.gov.uk

70 Broadband Support Scheme, wales.gov.uk

Northern Ireland

Northern Ireland has the highest level of availability of superfast broadband, reaching about 94% of premises.[71] However, only 69% of homes have taken up a broadband connection at all. [72]

In addition to investment from BT, this level of availability was funded by £16.5 million from the Department of Enterprise, Trade and Investment (DETI) in Northern Ireland, and £16.5 million from the EU under the ERDF Competitiveness Programme. A further £1.5 million has been invested from the Department of Agriculture and Rural Development (DARD) under the EU ERADF Rural Development Programme. In 2011, £4.4 million from BDUK went to Northern Ireland to ensure everyone has access to 2Mbps, with the Northern Ireland Assembly in charge of how to use the funding.[73]

Local Government

Local government plays an important role in the delivery of state-subsidised broadband infrastructure. Under the model for regional broadband development being pushed out by BDUK, central funding must be matched by local and European funding, along with private sector funding, for projects to go ahead.

Some local areas have also chosen to strike out on their own to press ahead with broadband infrastructure deployment. The Yorkshire Digital Region project, for example, secured funding in 2008 from the European Union and from partners in the public and private sectors, to accelerate superfast broadband deployment.[74] Recent reports suggest, however, that the network is having trouble attracting providers to its wholesale product. The Digital Region contract has been subject to a tender process, with the outcome expected to be known by the end of 2012.[75]

"In many cases, planning approval is required before new broadband infrastructure can be deployed"

Local authorities also have a particular role with respect to planning. In many cases, planning approval is required before new broadband infrastructure can be deployed. As planning is a local responsibility, industry must engage with each local authority on a case by case basis. There are also some variations in the precise procedures between local authorities in the different devolved administrations.[76] These variations are especially apparent in the delays in approval for installing infrastructure. For instance, in Northern Ireland, it can take between six months and one year to gain planning permission for a mobile phone base station. England and Wales use a three-tiered approach where the size of the structure requires a different application process. In Scotland, where the Local Review Body deals with the appeals for installing infrastructure, win rates for mobile phone base stations are much lower than the industry average UK-wide.

European Commission

The European Commission published its own broadband strategy in September 2010. This is somewhat more aggressive than the UK targets, and proposes that all EU citizens should have access to a basic level of broadband by 2013. The Commission's ambition is for 100% of EU citizens to have access to a 30Mbps broadband service, and for 50% of citizens to be subscribed to services running at

71 Belfast Telegraph, "Northern Ireland top for broadband", July 2012

72 Ofcom, "Adults media use and attitudes report", 2012

73 The Department for Culture, Media and Sport, "£4.4 million for broadband roll-out in Northern Ireland", August 2011

74 Digitalregion.co.uk

75 The BBC, "South Yorkshire Councils investigate Digital Region scheme", 2012

76 Department for Culture, Media and Sport, "BDUK Delivery Programme: Delivery Model", September 2011

100Mbps or faster, by 2020. It is important to note that these targets are framed in terms of both speed and take up – the Commission is clear that it wants a world where citizens buy very fast broadband products, not just have access to them.

The European Commission is also the body with power to grant the required State Aid approvals for the UK government's domestic broadband plans. Both the BDUK programme to accelerate and extend the coverage of superfast connectivity, and the government's other plans for super-connected cities, involve introducing a significant element of public subsidy into the infrastructure markets. This requires clearance from the European Commission to ensure that any detrimental impacts on competition are mitigated or minimised, and justified on the basis of a legitimate public policy objective to correct a market failure.

State Aid clearance for the BDUK programme was given in November 2012.[77] State Aid clearances for individual super-connected cities projects are being issued case-by-case; in at least one initial clearance has been granted but challenged by BT and Virgin Media, on the grounds that there would be significant overlap with existing or planned commercial networks.[78]

Law Commission

At the time of writing, the government has asked the Law Commission to conduct an independent review of the Electronic Communications Code, to consider whether and how it should be modernised.

The Electronic Communications Code enables electronic communications network providers to construct infrastructure on public land or to take rights over private land. The code was frequently cited throughout the course of our research as insufficient for dealing with the reality of modern infrastructure deployment.

Some of the most notable issues up for review include balancing the rights of landowners and network providers (and third parties where necessary). The Commission is also looking at the obligations of network providers, financial awards involved, and when to give rights to a network provider when a landowner objects.

The Commission has made a series of provisional recommendations. Based on the conversations we had during the course of our research, important areas to focus on include: extending code rights for network operators similar to those in place for other utilities, reforming entitlements to compensation for landowners, and more consistent notice procedures. Any modernisations that strike a better balance and make it more viable for operators to build networks over multiple sites should help deliver better outcomes for industry and consumers.

The Law Commission is expected to deliver its recommendations to government in spring 2013. A more detailed exposition of the issues under review is included at Annex C.

77 Computer Weekly, "EU gives green light to £530m superfast broadband plans", 2012

78 The BBC, "BT and Virgin Media oppose Birmingham broadband", 2012

6
Lessons from Previous Research

Broadband policy has attracted considerable interest over the years, with a wide range of organisations and institutions examining different aspects of the debate. A selection of important publications from the past five years, along with their key findings and recommendations, is summarised in the table below.

Table 6.1

Year	Report	Author	Key findings
2007	Pipe dreams? Prospects for next generation broadband deployment in the UK	Broadband Stakeholder Group	The UK leads the world in terms of the availability of first generation broadband. Continued market evolution of ADSL2+, cable, wireless and FTTH will likely result in a patchwork of broadband availability. The commercial case for investment in next generation broadband is uncertain; the government should forbear from intervention at this stage but it is highly likely that public sector support will be required at some point. Models for intervention, regulation and universal service/access should be explored.
2008	A framework for evaluating the value of next generation broadband	Plum Consulting/ Broadband Stakeholder Group	There is likely to be significant economic and social value from the deployment of next generation broadband. Where benefits are largely private and outweigh costs, a lack of private sector investment likely reflects investor uncertainty about business models and consumer willingness to pay. In terms of timing, there is a large option value attached to waiting in the short term - though prolonged delay could be costly in the long term. The case for investment should be examined independently of what other countries are doing.
2008	Models for efficient and effective public sector interventions	Analysys Mason/ Broadband Stakeholder Group	Phased deployment of next generation broadband may lead to pressure for public sector interventions to accelerate and/ or increase coverage. The criteria for intervention will vary depending on local conditions. Interventions should seek to offer a standard set of wholesale products, to attract multiple retail providers, and consider aggregating infrastructure partners to achieve economies of scale. More work needs to be done to help provide clarity on the commercial business case for investment.

2008	The cost of deploying fibre-based next generation broadband	Analysys Mason/ Broadband Stakeholder Group	For FTTC, FTTH/GPON and FTTH/PTP, deployment costs remain broadly constant across all urban areas. If the business case is attractive for any of these technologies, then the private sector should be able to deliver coverage to around two thirds (58-68%) of the population. The cost of deploying a national FTTC solution is estimated at around £5.1 billion, rising to £24.5 billion for FTTH/GPON and £28.8 billion for FTTH/PTP. Access to alternative infrastructure from Virgin Media and utility networks could reduce costs by between 16 and 23%. There are some cost synergies between FTTC and FTTH, accounting for about 42% of the total costs for FTTC. The economic case for sub-loop unbundling in FTTC is challenging, so most operators are likely to rely on wholesale bitstream products; these will need to offer enough flexibility to provide innovative services at a reasonable cost.
2008	The next phase of broadband in the UK	Caio	In the short term, the case for a major government intervention is weak. The government should, however, act to support investment in next generation access. The framework for this should encompass a combination of technologies, recognise the importance of open network models and access for creating a competitive wholesale market, and encourage local developments. A number of specific initiatives can be launched to provide momentum, from stimulating the upgrade of access infrastructure to lowering the cost of build out and creating conditions that favour new investment models. Government should also establish a permanent benchmarking process to monitor developments in the UK, and being able to identify remedies to adopt should the market fail to deliver the required investment.
2009	Digital England: a rural perspective	Commission for Rural Communities	Internet access in rural areas is higher than ever before. Use and demand is growing faster than in urban areas; rural users make more use of online transactions and consume more online entertainment. Digital exclusion can lead to limited access to government services, limited job search opportunities, isolation and stifled business innovation. More work needs to be done on whether a universal service commitment at 2Mbps can be achieved and how long this speed will be sufficient to deliver high quality (public) services.
2010	The costs and capabilities of wireless and satellite technologies	Analysys Mason/ Broadband Stakeholder Group	Based on a hypothetical analysis of fixed wireless development in the UK. Based on assumptions about bandwidth required per home, network dimensioning is likely to be mainly capacity driven (i.e. the size of each cell is determined by the amount of traffic it needs to carry, not by achieving maximum coverage). This limits scope for economies of scale and potential benefits from further infrastructure sharing. Costs could be reduced by releasing additional spectrum for terrestrial wireless and satellite communications (with the amount of spectrum more important than the band in which it is available) and by sideloading content to reduce peak demand.

2010	Optimal investment in broadband: the tradeoff between coverage and network capability	Ingenious Consulting Network	Based on an analysis of incremental consumer surplus per £ of subsidy, the most effective approach to intervention is to extend the coverage of standard broadband (defined here as up to 15Mbps) to 100% of households. After this, the most effective area is subsidising fast broadband (up to 50Mbps) to urban areas not already served, though in areas of low population density the case becomes highly reliant on the incremental externalities of fast over standard broadband. The case for subsidising superfast (over 50Mbps) is weak and requires a very optimistic view of potential externalities.
2011	Contribution of the digital sector to UK economic growth	Frontier Economics	Digital communications is a general purpose technology that pervades all sectors of the economy and contributes to growth and productivity. This could be enhanced by improving the quality and coverage of infrastructure, helping to achieve a critical mass of users, and reforming management practices to help organisations exploit the benefits of communications.
2011	Estimating the cost to businesses of slow mobile broadband	Open Digital	If 4G mobile technology were deployed sooner than planned, faster data transfer would save over 37 million business hours per year. Linking this to measures of productivity, more ambitious targets for the roll-out of nationwide 4G networks could save UK businesses around £730 million a year. The 3-6 month delay in holding the auction is estimated to cost the economy £180-360 million.
2011	Small businesses and infrastructure: broadband	Federation of Small Businesses	The government should set out a clear commitment to universal superfast broadband, and in particular a commitment for the 10% of areas not covered by 2015. The government should also introduce an awareness and capability scheme for businesses akin to the Race Online initiative for individuals, and attach a 98% coverage obligation to future 4G spectrum licences.
2011	Superfast broadband: is it really worth a subsidy? (second edition)	Communications Chambers	Governments should be wary of stepping in just because telecoms companies are not yet rolling out widespread fibre networks. The appropriate question is not whether people will use subsidised capacity (they will, in time) but whether the subsidy itself will be worth it. There is no clear market failure for superfast broadband - streaming HD video does not have the same network externalities as phone or email.So if there is no apparent need to rush in, the answer is to wait. In the meantime, scarce resources are best spent on widening access to basic broadband, helping people to get online and freeing up spectrum to deal with capacity constraints on mobile services.

2011	Spectrum	House of Commons	Spectrum is an important and finite resource. Ofcom has to strike a difficult balance between the needs of different users and the public purse. For the upcoming 4G spectrum auction, a coverage obligation should be set at 98% of the areas where people live, and potentially attached to more than one licence. Ofcom's proposal to secure at least four mobile network operators is an adequate measure to safeguard plurality.
2011	How a co-investment model could boost investmetns in NGA networks	Oxera	Achieving the EU Digital Agenda targets will require Europe-wide capital expenditure of around €268 billion, well in excess of announced investment plans. A commercial co-investment model could help overcome demand uncertainty, willingness to pay problems, regulatory uncertainty, the dynamics of large fixed/sunk costs, and cannibalisation of existing products, and help internalise external benefits.It would require extensive industry cooperation, long-term planning and an effective code of conduct.
2012	The UK communications sector in a global economy	Confederation of British Industry	Communications is a key source of comparative advantage for the UK. Government should broaden the scope of its ambitions for broadband, and consider a new long-term aspiration to have the best broadband economy in the world - where best would be captured in a basket of metrics that go beyond speed. Government should clarify the role of public investment in relation to coverage, digital enterprise hubs and super-connected cities. And government should resolve spectrum issues, avoiding any further delays to the 4G spectrum auction and making a fully accessible 3G service an immediate priority, particularly in regions where a good fixed broadband connection is hard to secure.
2012	Superfast broadband: boosting business and the UK economy	Regeneris	Superfast broadband can deliver three main benefits for businesses: improved performance among existing firms, new business creation (through reduced barriers to entry) and more flexible working. Assuming that update for superfast services approaches those currently found for ADSL services, the introduction of superfast broadband in an area could result in an increase in GVA of between 0.3-0.5% over 15 years.
2012	Costs and benefits of superfast broadband in the UK	London School of Economics	Broadband investment provides essential services for relatively modest outlays. The costs of broadband infrastructure run into billions but are modest compared to energy and transport infrastructure, which together are forecast to require over £200 billion of investment. Achieving the full benefits of superfast broadband will require education and behavioural change, which will take time. Both public and private funding will be needed to reach fast and superfast broadband targets. As entertainment may be a key driver for superfast services, revenue from online content may be one way to help generate funds for private investment.

2012	Systemic risks and opportunities in UK infrastructure	Frontier Economics	Infrastructure systems are increasingly interdependent, either because of physical proximity or for operational reasons (e.g. reliance on energy or communications technologies). Significant future investments are planned, these increasingly have long lead times and are underpinned by a reliance on information flows and communications technologies. Taking better account of interdependencies could save costs and make a significant contribution to growth. There could also be positive impacts on inward investment, the wider environment and healthcare requirements.
2012	The internet economy in the United Kingdom	AT Kearney	The UK internet ecosystem is worth £82 billion a year, with mobile connections accounting for 16% of this and rising. The UK has a much stronger business-to-consumer e-commerce sector than other countries. Most traffic on mobile phone networks is data rather than voice; large capital investments will be needed to ensure fixed and mobile networks are equipped to handle significant future traffic growth. To encourage investment the government must get the regulatory balance right, preserving competition whilst giving operators and service providers a framework to innovate and invest.
2012	Mobile broadband and the UK economy	Capital Economics	Mobile is now the dominant telephone technology, and between them the mobile network operators are expected to invest around £5.5 billion to deploy 4G LTE in the UK. As a result, up to a fifth of the population may get access to superfast broadband via mobile who wouldn't otherwise have had access via fixed line. Up to 5% of the population may be able to access broadband by mobile rather than a poor or non-existent fixed broadband connection. The use of new data technology will also have a macroeconomic impact through productivity improvements. Although it is difficult to make precise estimates, the eventual boost from 4G LTE could be in the order of 0.5% of GDP.
2012	Broadband for all: an alternative vision	House of Lords	The preoccupation with the delivery of certain speeds to consumers has had a detrimental effect on policy making. The government should be focused on driving fibre-optic cable, the most future-proof technology, as close as possible to the eventual user. Then, in addition to mandating open access to this optical fibre from the cabinet to the exchange, there should also be open access to links between exchanges. And just as there is national planning for transport hubs, there should be national planning for a network of communications hubs where different operators can site equipment and exchange traffic, all linked by optical fibre that is open to use by competing providers.

2012	Superfast Britain: myths and realities about the UK's broadband future	Economist Intelligence Unit	The shift to superfast broadband will deliver growth and jobs, but it is difficult to see how this will match up in the near term to the shift from dial-up. For many anticipated benefits, including in healthcare and education, it is less a case of the pipe needing to change and more that of established systems, processes and skills needing to evolve. In many areas, including business, a shortage of skills is a big a hindrance as constraints on bandwidth. In the near term, ensuring pervasive internet access to all parts of society will be at least as beneficial to society as a whole as upgrading to superfast broadband.
2012	"This is for Everyone": The case for universal digitisation	Go ON UK and Booz & Co.	The UK should strengthen its digital foundations and maximise the use of digital channels to realise the social and economic benefits to be had for individuals, SMEs, charities and government. Digital foundations include internet infrastructure – such as access to superfast broadband, quality online services and human capital. Usage is particularly important. For instance, in 2011, superfast broadband coverage reached 60% of the UK but only 6.6% were using it. Although the UK currently ranks 12th out of 150 on the Booze & Company Digitisation Index (using 23 key metrics to determine), had the UK been world leader on this index in 2011, the GDP would have increased by up to £63 billion.

Looking back through all of this material, a number of themes can be drawn out:

● Left to its own devices, the market will not deliver complete coverage of next-generation broadband coverage in the near term. This is because the commercial investment case is challenging – large capital expenditures are required with significant uncertainty around costs, consumer willingness to pay, business models and future regulation. If government wants to guarantee certain levels of speed or coverage it will need to invest public money and/or impose coverage obligations on ISPs and MNOs.

● There are clear economic benefits from improved broadband connectivity and coverage, including superfast broadband. Far less clear is the extent to which these benefits are private vs external. If the vast majority of benefits from next-generation broadband are private, then, provided the market is working effectively, there is less case for government to subsidise them. Where there are external benefits, these are most concentrated on parts of the population who are not yet making best use of basic broadband connectivity.

● Significant issues around capability remain, for both consumers and business users of broadband connectivity. This limits the benefits that individuals are realising when they have access to an internet connection. It also limits willingness to pay, with a knock-on detrimental effect on the commercial investment case for broadband infrastructure.

7
Listening to the Public

Like other areas of public policy, the debate about broadband benefits from efforts to bring evidence to bear on the difficult questions facing policymakers. Existing research serves us relatively well for an understanding of market size, structure and consumer decisions. We are less clear, however, on the population's general attitudes to connectivity, and the tradeoffs between better broadband and other policy priorities.

In particular, for politicians listening to constituents there is a real risk of selection bias in the views that reach the constituency mailbox. We know from experience that people tend to be most vocal when they are significantly agitated about a particular issue. On the whole, people (rationally) tend not to raise minor concerns or comment when something is basically satisfactory. And in cases where people are simply unaware of an issue they may not engage at all – even if the outcome might make a big difference to their personal situation.

> "From our conversations with policymakers and politicians over the course of this project, it is clear that many feel pressure from constituents lobbying for better fixed and/or mobile broadband"

From our conversations with policymakers and politicians over the course of this project, it is clear that many feel pressure from constituents lobbying for better fixed and/or mobile broadband. They are also aware, however, that the messages received may not necessarily reflect a majority or consensus view.

To address this deficit in understanding about the public's attitudes to broadband and broadband policy, we incorporated a significant fieldwork exercise into our work. To help us deliver this component we engaged Ipsos MORI to conduct an extensive programme of fieldwork and polling with consumers and small business decision makers. In September 2012 we contacted around 2,000 consumers and 500 small and medium sized businesses to explore their attitudes to the issues around broadband and internet connectivity. The results have been processed and weighed to be nationally representative.

Consumers

Comfort, capability, and what people are looking for

Unsurprisingly, most people are not sure how much data they typically use each month. Potential explanations include a general lack of understanding about how the internet and connected devices work, along with a proliferation of devices and a rational disengagement where data services include unmetered use up to a cap (as opposed to paying by the Mb).

Figure 7.1: Most people are not sure how much data they use/need

How confident are you that you could estimate how much data you typically use per month? Please answer on a scale of 1 to 10 (% by age, n=1,659)

Age	Confident (7–10)	Intermediate (5–6)	Not confident (1–4)
15–24	22	21	56
25–34	24	19	57
35–44	19	17	63
45–54	19	15	64
55–64	13	9	77
65+	7	9	82

Source: Policy Exchange analysis
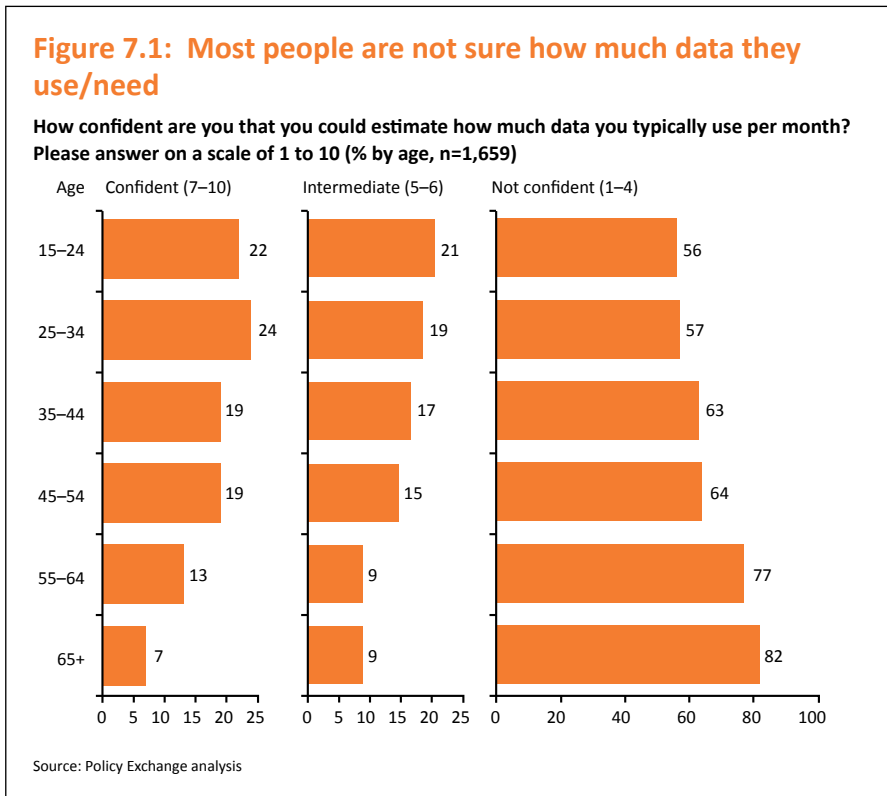
This corresponds to only about a third of people thinking they could choose the best deal for their household needs from all of the different packages on offer.

Figure 7.2: About a third of people think they could choose the best deal

How confident are you that you could choose the broadband package that best suits your household's needs? Please answer on a scale of 1 to 10 (% by age, n=1,752)

Age	Confident (7–10)	Intermediate (5–6)	Not confident (1–4)
15–24	33	24	43
25–34	39	22	38
35–44	32	25	43
45–54	32	19	46
55–64	29	19	52
65+	17	15	67

Source: Policy Exchange analysis
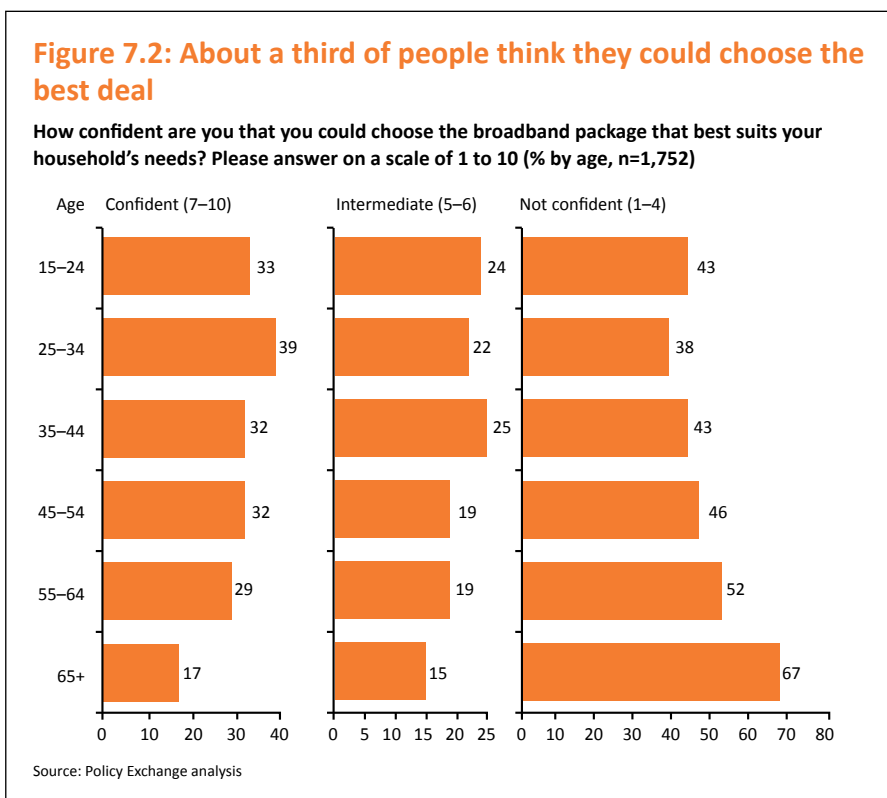
Price and reliably consistently rank amongst the features that matter most to consumers, across age bands and across both fixed and mobile. Speed, data allowances and access to WiFi hotspots are more frequently cited by younger consumers. Products and services that are easy to set up are more frequently cited by older consumers. Rural consumers are slightly more likely to focus on price, reliability and speed over other factors.

Figure 7.3: Price and reliability matter most for consumers 1/3

Which attributes are most important to you when choosing a fixed broadband package? You may choose up to three (% by age, n=1,752)

Attribute	15–24	25–34	35–44	45–54	55–64	65+
Price	56	70	73	69	67	60
Reliability	49	52	52	54	50	52
Speed	61	57	55	54	46	36
Data allowance	17	15	11	12	11	7
Wifi hotspots	11	6	6	4	3	3
Bundled devices	9	5	8	4	9	6
Bundled services	6	8	7	9	7	6
Ease of set-up	10	9	11	14	18	21
Brand	3	5	3	7	7	7
Reccomendation	5	5	6	5	11	6
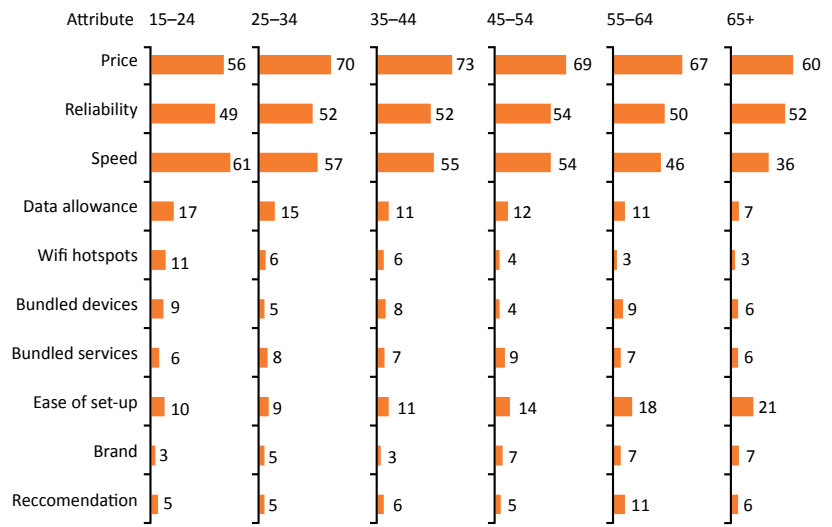
Source: Policy Exchange analysis

Figure 7.4: Price and reliability matter most for consumers 2/3

Which attributes are most important to you when choosing a mobile broadband package? You may choose up to three (% by age, n=1,752)

Attribute	15–24	25–34	35–44	45–54	55–64	65+
Price	49	55	62	56	50	45
Reliability	48	50	48	48	40	39
Speed	52	48	45	42	30	24
Data allowance	15	14	11	12	8	5
Wifi hotspots	21	13	11	8	10	5
Bundled devices	5	3	5	2	2	3
Bundled services	5	3	3	4	3	3
Ease of set-up	9	7	8	13	13	11
Brand	4	4	3	3	5	3
Reccomendation	4	4	5	5	9	5

Source: Policy Exchange analysis

Figure 7.5: Price and reliability matter most for consumers 3/3

Which attributes are most important to you when choosing a broadband package?
You may choose up to three (%, n=1,752)

Attribute	Urban Fixed	Urban Mobile	Suburban Fixed	Suburban Mobile	Rural Fixed	Rural Mobile
Price	61	49	69	57	67	50
Reliability	45	40	53	49	59	50
Speed	50	40	53	43	55	37
Data allowance	12	13	13	11	9	9
Wifi hotspots	7	13	6	12	3	8
Bundled devices	8	5	6	3	5	2
Bundled services	7	3	9	4	5	2
Ease of set-up	10	8	14	10	18	13
Brand	6	4	5	4	4	3
Reccomendation	5	4	7	6	6	5

■ Fixed   ■ Mobile
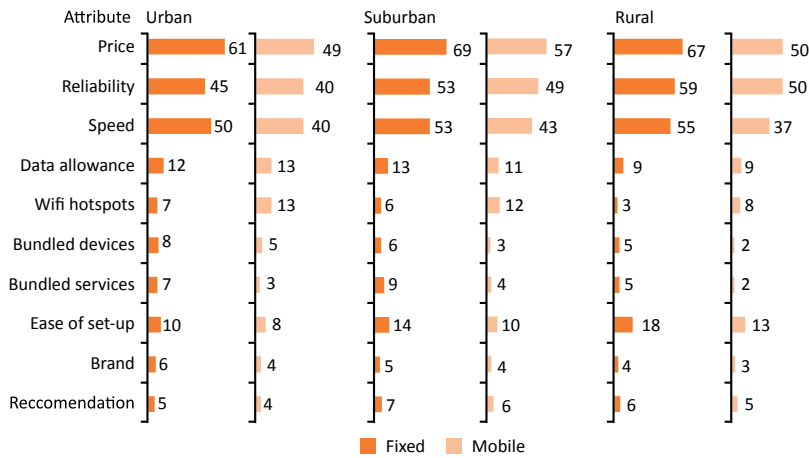
Source: Policy Exchange analysis

Public policy issues

In the early stages of our research, we identified many calls for improved broadband connectivity, and many other calls to protect local environments and neighbourhoods from unwanted development. There is a clear trade-off here: improving broadband connectivity necessarily requires some physical infrastructure to be deployed, and not all of this can be buried or put out of sight.
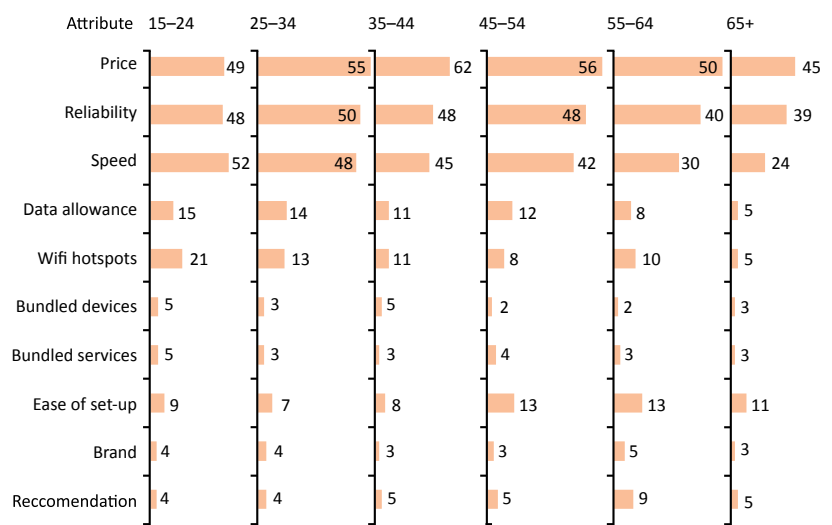
To understand better how people think about this issue, we asked people to make a forced choice about which is more important to them. Furthermore, to guard against not-in-my-back-yard effects we split our sample and deployed two different forms of questioning, one general and one specific to the respondent's local connectivity and local environment.

Figure 7.6: People are split on the pros and cons of infrastructure 1/2

Which of the following statements more closely represents your view?
(% of group/subgroup, n=875) (split sample, national variant)

Overall: 49 / 49 / 2

Gender:
Male: 53 / 45 / 2
Female: 45 / 53 / 2

Age:
15–24: 60 / 40
65+: 44 / 51 / 5

Area:
Urban: 51 / 48 / 1
Rural: 50 / 48 / 2

Internet use:
Frequent: 52 / 47 / 1
Offline: 37 / 58 / 5

■ It's important to improve broadband speed and coverage in the UK, even if that means more masts, street cabinets and overhead lines

■ It's important to preserve the local neighbourhood and environment, even if that means UK broadbandis slower and has less coverage overall

□ Don't know

Source: House of Commons Written Answers, 10 January 2012, c. 264W

Figure 7.7: People are split on the pros and cons of infrastructure 2/2

Which of the following statements more closely represents your view?
(% of group/subgroup, n=877) (split sample, local variant)

- It's important to improve broadband speed and coverage in the UK, even if that means more masts, street cabinets and overhead lines in the vicinity of my home
- It's important to preserve my local neighbourhood and environment, even if that means UK broadband is slower and has less coverage overall
- Don't know
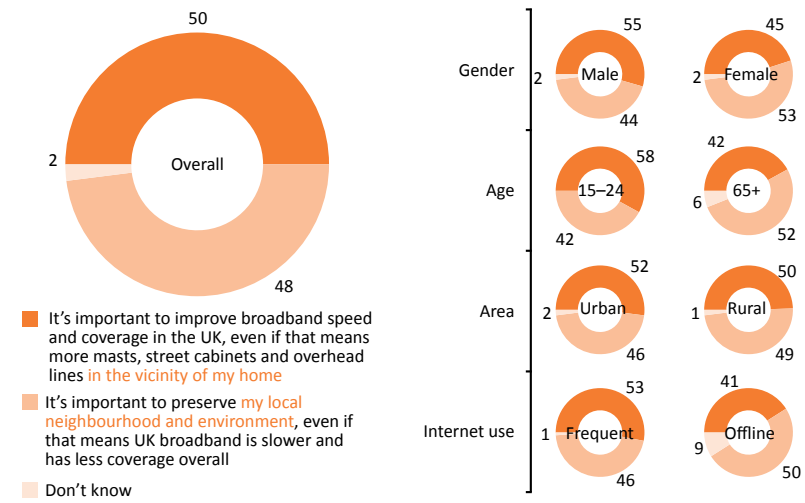
Source: Policy Exchange analysis

In both cases respondents divided equally about whether better connectivity or preserving the environment was more important to them.

As described earlier, the government's broadband strategy has two main elements: funding superfast broadband to cover up to 90% of the population, and ensuring that everyone has access at a basic speed of at least 2Mbps. We asked people which of these broad elements was more important; for around two-thirds of the population, coverage is deemed to be more important than speed.

Figure 7.8: Two thirds think coverage is more important than speed

In your opinion, which of these should be a higher priority for government policy?
(% of group/subgroup, n=1,977)

- Ensure basic broadband speed available everywhere in the country
- High broadband speeds available in most (but not all) places
- Don't know
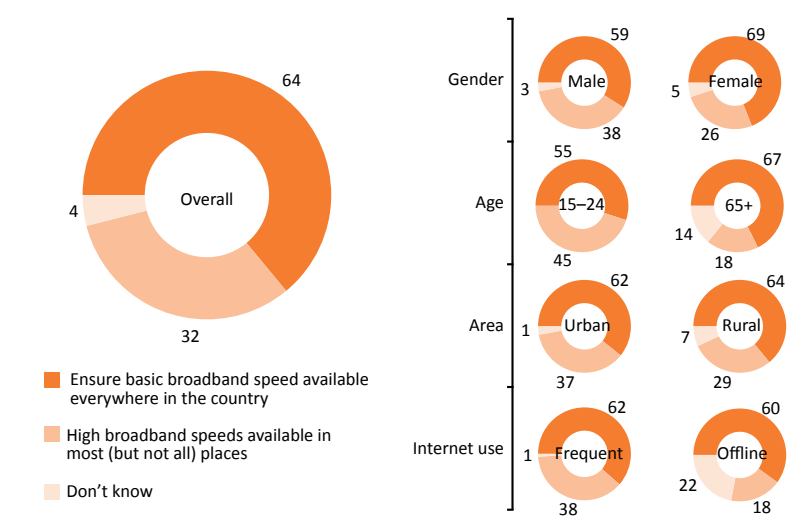
Source: Policy Exchange analysis

When it comes to internet access overall, four in five people think that this is something that everyone should be able to have. Disagreement was strongest amongst the over-65s, lower socioeconomic groups and those who are not online. Even among the offline group, however, more than half think the internet is something everyone should be able to get access to.

Figure 7.9: Four in five think the internet is something everyone should have

In today's world, access to the internet is something every household should be able to have access to. On a scale of +2 to -2, to what extent do you agree or disagree? (% of group/subgroup, n=1,977)

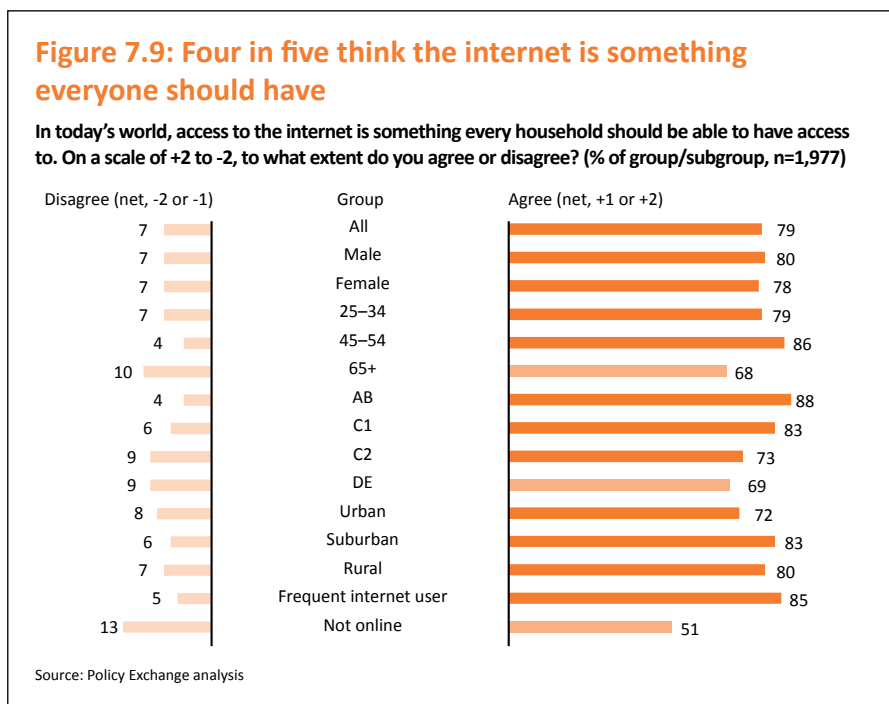| Disagree (net, -2 or -1)	Group	Agree (net, +1 or +2)
7	All	79
7	Male	80
7	Female	78
7	25–34	79
4	45–54	86
10	65+	68
4	AB	88
6	C1	83
9	C2	73
9	DE	69
8	Urban	72
6	Suburban	83
7	Rural	80
5	Frequent internet user	85
13	Not online	51

Source: Policy Exchange analysis

When asked whether it is fair for people in remote areas to pay more for internet access, the majority of people disagree. This is particularly true for rural consumers, where fewer than one in five think it would be fair to pay more.

Figure 7.10: The older, rural and offline feel particularly strongly about fairness

If you live somewhere remote, it's only fair that you pay more if you want to get connected to the internet. On a scale of +2 to -2, to what extent do you agree or disagree? (% of group/subgroup, n=1,977)

Disagree (net, -2 or -1)	Group	Agree (net, +1 or +2)
57	All	24
52	Male	29
61	Female	20
52	25–34	29
60	45–54	23
57	65+	17
63	AB	25
57	C1	34
57	C2	22
50	DE	26
45	Urban	30
59	Suburban	24
70	Rural	16
56	Frequent internet user	28
46	Not online	17

Source: Policy Exchange analysis

Overall, communications infrastructure (including broadband) does not appear to be a priority for the general public. Roads, rail, electricity, gas, water and sewerage all rank higher when people are asked about infrastructure priorities. To some extent this reflects the fact that people are encountering crunch points on transport networks and rising household bills for energy and water. For broadband, by contrast, it is less clear that congestion is delivering a major degradation in service quality or that costs are salient enough compared to other draws on household finances.

Figure 7.11: Communications infrastructure is not a priority for the public

Which of the following areas of national infrastructure should be priorities for government spending? You may choose up to three (%, n=1,984)

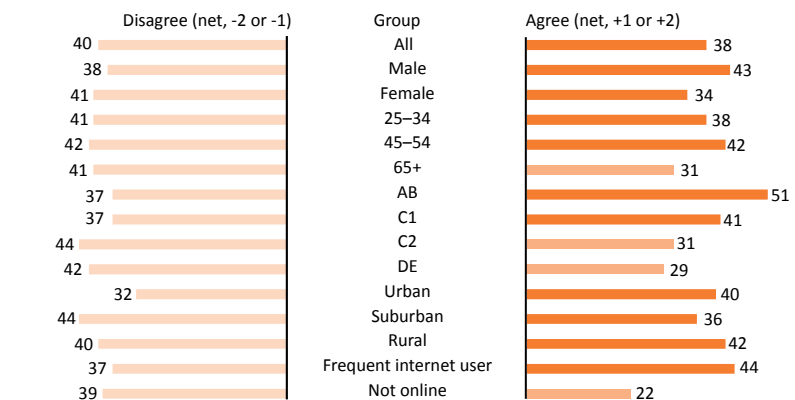| Infrastructure	All	Urban	Suburban	Rural	Frequent	Offline
Major roads	52	49	51	58	52	53
Rail	33	33	33	32	35	23
Airports	10	11	8	11	10	8
Ports	3	6	2	2	3	3
Electricity	33	32	35	33	31	43
Gas	27	25	30	24	24	38
Communications	16	17	13	23	20	4
Water/sewerage	25	22	28	25	24	30
Waste	21	19	22	21	22	16
Flood defences	19	17	21	17	18	18
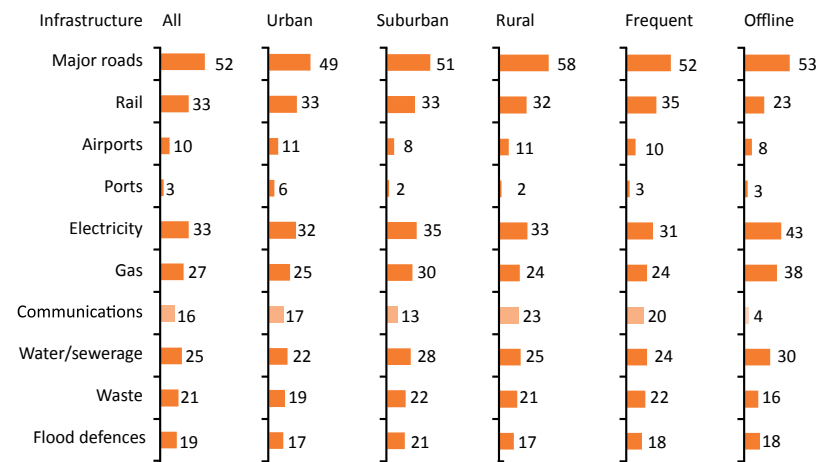
Source: Policy Exchange analysis

In terms of public spending to enhance broadband infrastructure, the public are split fairly evenly between those who think it is right for taxpayers to bear some of the cost of investing, and those who disagree. A significant minority are ambivalent or don't know.

Figure 7.12: The older, less well off and offline see less case for government spending

It's right for taxpayers to bear some of the cost of investing to improve broadband speed and coverage. On a scale of +2 to -2, to what extent do you agree or disagree? (% of group/subgroup, n=1,977)

Disagree (net, -2 or -1)	Group	Agree (net, +1 or +2)
40	All	38
38	Male	43
41	Female	34
41	25–34	38
42	45–54	42
41	65+	31
37	AB	51
37	C1	41
44	C2	31
42	DE	29
32	Urban	40
44	Suburban	36
40	Rural	42
37	Frequent internet user	44
39	Not online	22

Source: Policy Exchange analysis

Doing business online

Previous research has shown that people are increasingly likely to look for information and make transactions and payments online. In the course of our research we investigated what sorts of online activity people thought most everyday businesses should be providing these days. For completeness we asked the same questions first about everyday businesses like shops and restaurants, then again for everyday public services like schools and doctors' surgeries.

Figure 7.13: Half of people think most organisations should be online

What online services do you think most...(tick all that apply, %, n=1,977)

	Businesses, e.g. shops and restaurants, should provide	Public services, e.g. schools and doctors' surgeries, should provide
Facility to order or book online	50	42
Facility to fill in paperwork online	29	39
Facility to pay online	37	25
Facility to request someone contact you	26	34
A website with basic information	49	49
Direct email contact	45	51
Direct social media contact	15	11

Source: Policy Exchange analysis

Half of people think that most organisations should have a website, email address and a facility to make bookings or reservations online. For businesses, a large minority of people think that most businesses these days should let customers fill in paperwork and make payments online. For public services a similar picture emerges, though facilities to fill in forms and paperwork are more important than making online payments.
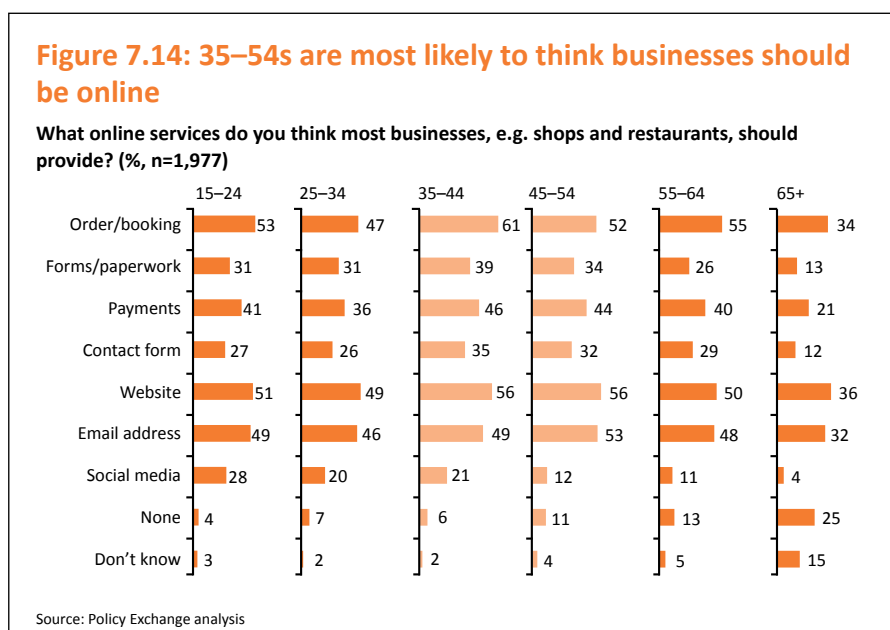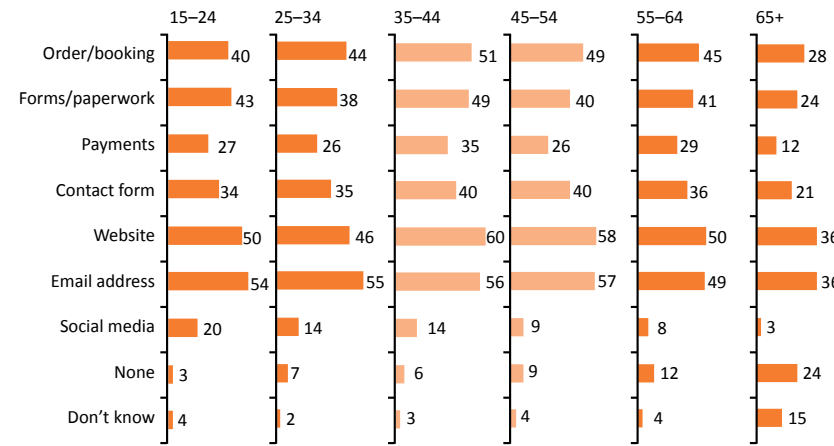
Figure 7.14: 35–54s are most likely to think businesses should be online

What online services do you think most businesses, e.g. shops and restaurants, should provide? (%, n=1,977)

	15–24	25–34	35–44	45–54	55–64	65+
Order/booking	53	47	61	52	55	34
Forms/paperwork	31	31	39	34	26	13
Payments	41	36	46	44	40	21
Contact form	27	26	35	32	29	12
Website	51	49	56	56	50	36
Email address	49	46	49	53	48	32
Social media	28	20	21	12	11	4
None	4	7	6	11	13	25
Don't know	3	2	2	4	5	15

Source: Policy Exchange analysis

Figure 7.15: 35–54s are most likely to think public services should be online

What online services do you think most public services, e.g. schools and surgeries, should provide? (%, n=1,977)
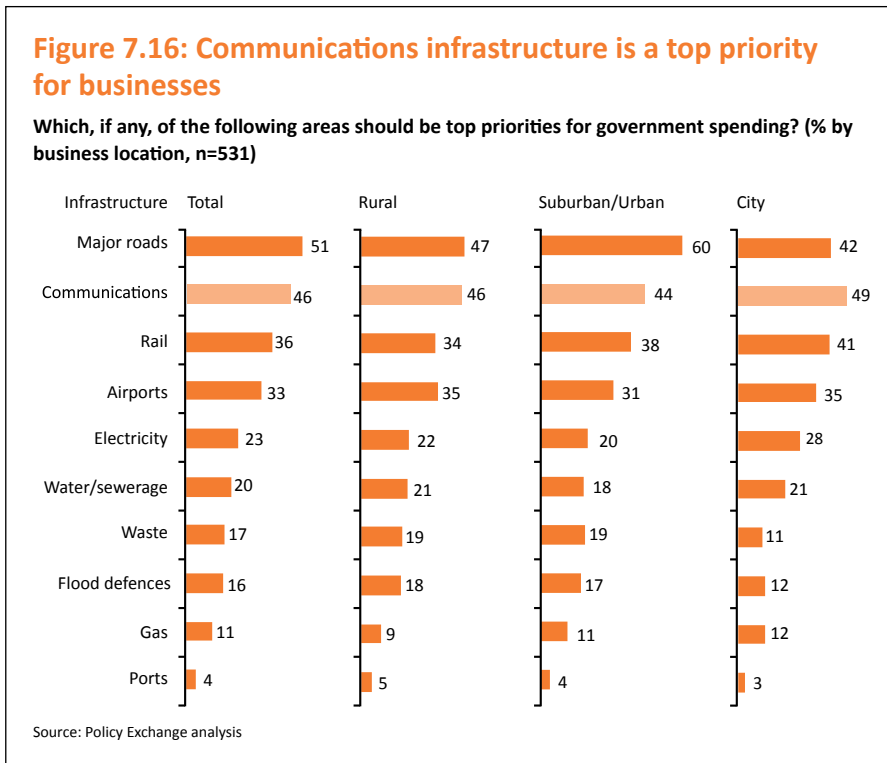
	15–24	25–34	35–44	45–54	55–64	65+
Order/booking	40	44	51	49	45	28
Forms/paperwork	43	38	49	40	41	24
Payments	27	26	35	26	29	12
Contact form	34	35	40	40	36	21
Website	50	46	60	58	50	36
Email address	54	55	56	57	49	36
Social media	20	14	14	9	8	3
None	3	7	6	9	12	24
Don't know	4	2	3	4	4	15

Source: Policy Exchange analysis

In both cases, people in the 35–54 age bracket are most likely to think that most organisations should be online – perhaps reflecting instances where people in this group are at stages in their lives where they are very busy and/or have a lot of touch points with the state.
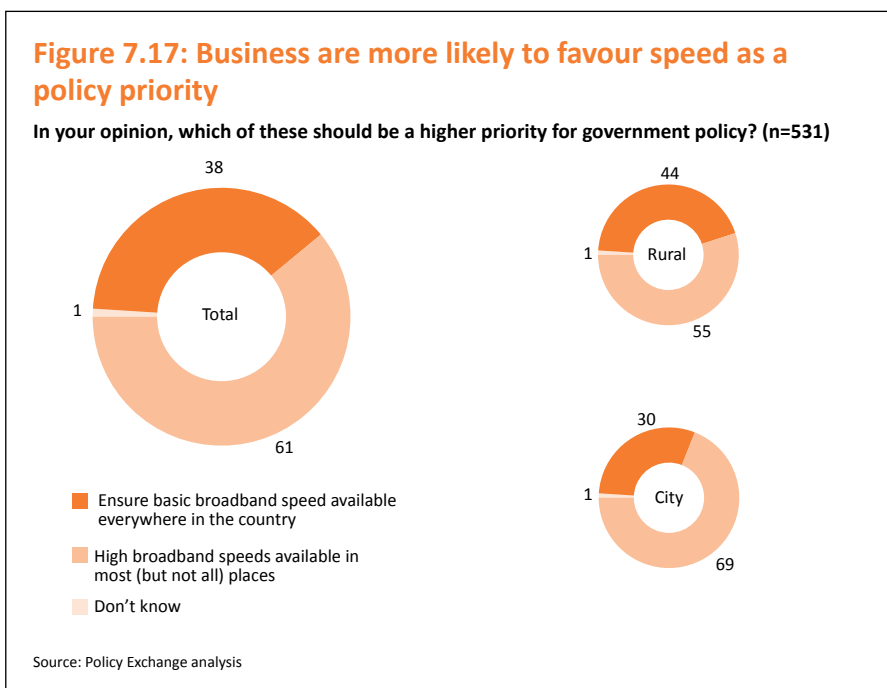
Expectations about social media activity were closely correlated with age, with nearly a third of 15–24s thinking that most businesses should be on social media, compared to fewer than one in twenty for the over 65s. The over 65s were much more likely to say that most organisations did not need an online presence (or answer "don't know").

Small Businesses

Overall, small businesses put a high priority on communications infrastructure. When asked to rank the importance of a range of national infrastructure investments, communications networks were placed second only to major roads.

Figure 7.16: Communications infrastructure is a top priority for businesses

Which, if any, of the following areas should be top priorities for government spending? (% by business location, n=531)

Source: Policy Exchange analysis

Overall, small businesses were more likely to select high broadband speeds for some people rather than good basic broadband speeds for everyone as priority for public policy. There was divergence between locations, with rural businesses more likely to cite universal broadband as a priority.

Figure 7.17: Business are more likely to favour speed as a policy priority

In your opinion, which of these should be a higher priority for government policy? (n=531)

- Ensure basic broadband speed available everywhere in the country
- High broadband speeds available in most (but not all) places
- Don't know

Source: Policy Exchange analysis

The vast majority of businesses consider adopting new technologies only once they are proven to work and firmly established. A small but significant minority are

prepared to adopt new technologies prior to general release or as soon as they are released onto the market.

Overall three quarters of respondents said that better broadband would have a positive effect on their business.

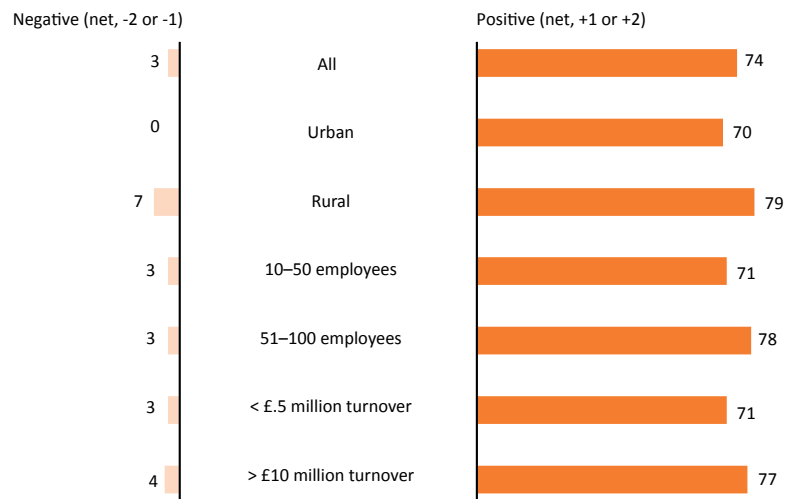## Figure 7.18: Most businesses are cautious in adopting technology

Which of the following best describes the attitude of your business toward new communications technologies and the internet? (n=531)

	All	Urban	Rural	10–50 Employees	51–100 Employees	<£.5m Turnover	<£10+m Turnover
Adopt prior to general release	5	4	5	4	6	0	6
One of the first to adopt, once released to the market	11	11	4	11	10	8	10
Adopt as soon as it is proven to work	43	43	42	43	43	32	46
Adopt once it is firmly established	30	33	30	34	23	47	27
Adopts when there is no other alternative	5	5	7	4	7	0	5
Doesn't know how to adopt new technology	2	1	7	1	6	3	4
They aren't relevant to my business	1	1	3	1	1	11	0
Don't know	3	2	3	2	4	0	2

Source: Policy Exchange analysis

Figure 7.19: The majority of business think better broadband is a good thing

To what extent would new technologies such as significantly faster and more reliable fixed and wired broadband services have a positive or negative effect on your business? (n=531)

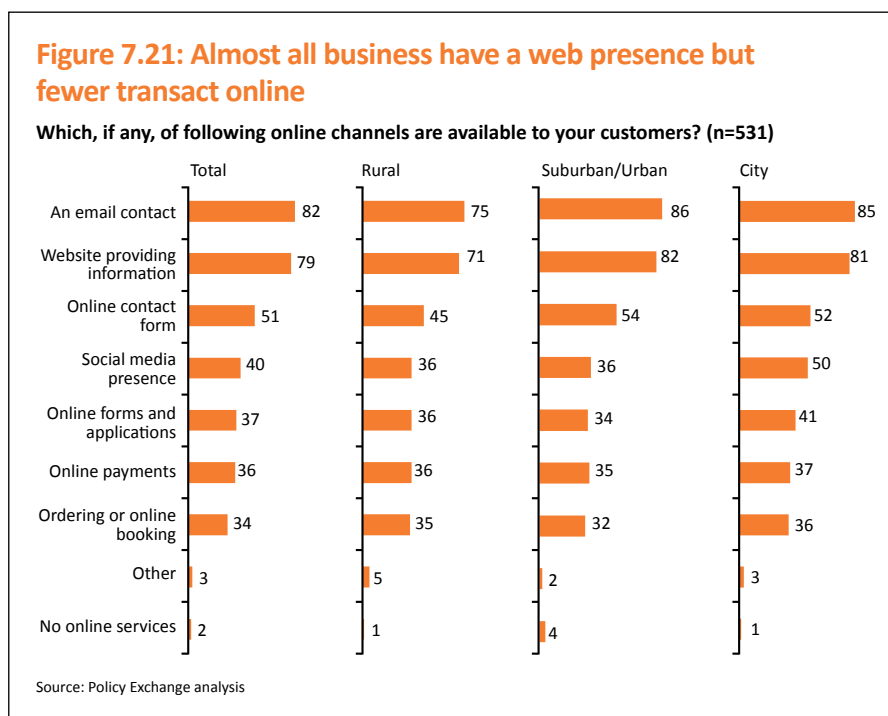|	Negative (net, -2 or -1)	Positive (net, +1 or +2)
All	3	74
Urban	0	70
Rural	7	79
10–50 employees	3	71
51–100 employees	3	78
< £.5 million turnover	3	71
> £10 million turnover	4	77

Source: Policy Exchange analysis

For businesses identifying benefits from better broadband, the main sources were thought to be in efficiency, productivity and the customer experience.
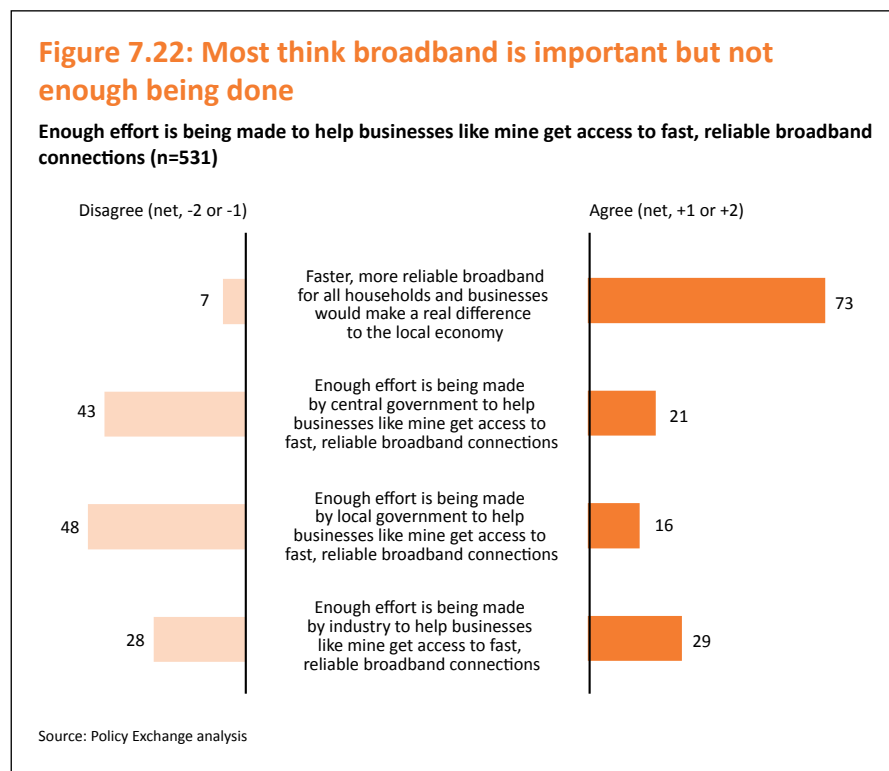
Only a minority selected benefits related to cloud technology, reaching a larger customer base or improving staff morale.

Figure 7.20: Businesses identified a range of benefits

In which of the following ways, if any, would new technologies such as significantly faster and more reliable fixed and wireless broadband have a positive effect on your business? (n=531)

	All	Urban	Rural	10–50 Employees	51–100 Employees	<£.5m Turnover	<£10+m Turnover
Improve operational efficiency	76	74	77	79	72	81	75
Help staff be more productive	60	55	57	60	60	52	60
Improve customer experience	58	54	58	56	61	56	62
Help to move to the cloud	39	36	35	38	42	33	32
Cut costs	39	37	33	37	42	26	51
Increase customer base	34	35	38	31	38	37	40
Improve morale of staff	27	21	34	26	28	19	29
Other	1	3	0	2	0	4	0
Don't know	1	3	0	1	1	0	1

Source: Policy Exchange analysis

The vast majority of businesses have a basic website and email presence. Around half are using online contact forms, and over a third are active on social media. Only a third, however, have facilities for taking online bookings or payments.

Figure 7.21: Almost all business have a web presence but fewer transact online

Which, if any, of following online channels are available to your customers? (n=531)

	Total	Rural	Suburban/Urban	City
An email contact	82	75	86	85
Website providing information	79	71	82	81
Online contact form	51	45	54	52
Social media presence	40	36	36	50
Online forms and applications	37	36	34	41
Online payments	36	36	35	37
Ordering or online booking	34	35	32	36
Other	3	5	2	3
No online services	2	1	4	1

Source: Policy Exchange analysis

Overall three quarters of businesses think that faster, more reliable broadband would make a real difference to their local economy. However only a minority think that government or industry are doing enough to bring this about. Industry is held in slightly higher regard than government, with local government faring particularly badly.

Figure 7.22: Most think broadband is important but not enough being done

Enough effort is being made to help businesses like mine get access to fast, reliable broadband connections (n=531)

Disagree (net, -2 or -1) | Agree (net, +1 or +2)

	Disagree	Agree
Faster, more reliable broadband for all households and businesses would make a real difference to the local economy	7	73
Enough effort is being made by central government to help businesses like mine get access to fast, reliable broadband connections	43	21
Enough effort is being made by local government to help businesses like mine get access to fast, reliable broadband connections	48	16
Enough effort is being made by industry to help businesses like mine get access to fast, reliable broadband connections	28	29

Source: Policy Exchange analysis

Themes and Issues

Taking all of these insights in the round, a number of important themes emerge:

- Generally speaking, men, younger people, the urban and the better off are somewhat more aggressive in their attitudes around the importance of high-spec broadband and connectivity solutions. This is not necessarily surprising, but it is worth remembering – especially in any public or private debates that are dominated by this demographic.
- The general public and businesses report different attitudes to the relative importance of broadband speed and coverage. Individuals are more likely to rate a good basic connection for everyone as the priority, whilst small businesses in our sample were more likely to prioritise high speeds for some people. Similarly, the general public did not prioritise communications relative to other national infrastructure projects, whereas small businesses ranked it second only to major roads.
- Half of people think that most businesses should be online and ready to support bookings, transactions and the like. Only around a third of businesses are actually equipped for this. This suggests there may be a particular opportunity for businesses to extract more value from a connected population. Businesses need the mindsets and capability to act on this. Previous research has shown that online businesses grow faster than their offline peers; our findings show

that most businesses are still conservative in their adoption of new technologies. Where businesses do see benefits from better broadband, many do not cite more recent advances like the potential to adopt cloud technologies.

● Capability is also a critical issue for consumers. Most people do not know how much data they use and are not confident they could choose the best broadband package. People who are offline but otherwise similar are much less likely to think the internet is important or that organisations and services should be online. Some of this group will be offline through informed choice, but others are missing out as a lack of capability or connectivity prevent them from getting the maximum benefits from the internet.

8
A New Framework for Policy

Successive governments have paid attention to communications networks and broadband policy, and the current government's ambitions for progress to 2015 maintain this trend. In our view, however, the government's holistic broadband policy remains underweight compared to its strategic importance for the British economy.

Responsibility for the broadband agenda moved from BIS to DCMS in 2011. It is clear that the move has to some extent been accompanied by a change in focus, with many internet policy discussions now oriented around online safety, copyright and web blocking. These are all important issues and merit serious discussion. Relative to the importance of supporting and sustaining economic growth, however, there seems to be less discussion than perhaps there should be about the role of broadband and the part that connectivity can and should play in the economic recovery.

The proposed "best in Europe" scorecard for UK broadband – and the subsequent narrowing of focus to the "fastest in Europe" – now dominates government contributions to the broadband debate. Whilst we admire the clarity of purpose, we are concerned that the focus is loaded too heavily on public spending to support superfast network build, at the expense of other important aspects of the broadband policy agenda.

To reframe the debate we propose a refreshed three-part framework for thinking about broadband policy. In many respects what follows is a fairly conventional approach, and it does not invalidate the steps the government is currently pursuing to roll out fibre in the final third and to continue to free up spectrum for 4G wireless services. Given the importance of connectivity, however, and the need to anchor the debate beyond the 2015 horizon, we hope that the following principles will serve as a useful touch point for future policy development.

Competition Front and Centre, Backed by Appropriate Regulation

For a market economy, competition is one of the most important drivers of progress. Competition between firms provides a strong incentive to seek efficiencies and reduce costs, and to pass these savings through to consumers. Competition is also a spur to innovation, as firms seek to open up new markets or increase market share by designing and delivering superior products and services.

As outlined in this report, in the context of broadband and communications networks, the policy prescription is not and cannot be as simple as requiring the state simply to stand aside. Unfettered competition is the right prescription for

markets that meet a particular set of conditions (economists talk about markets that are perfectly competitive, complete, with no market failures and perfect information). The structure of communications networks and markets clearly exhibit important features that make full deregulation undesirable.

Instead we need to find an appropriate degree of regulation to complement effective competition in the marketplace. Policy makers should recognise the importance of good, smart regulation, and put it to work in pursuit of enabling competition wherever possible. Where a single provider or purchaser is unavoidable, e.g. a natural monopoly in some parts of the network infrastructure, then relatively stronger regulation may be needed to deliver outcomes for participants that are broadly in line with what we would expect an efficient, competitive market to deliver.

In constructing pro-competition regulation, we also need to be mindful of the need to enable effective, sustainable competition. Experience in other countries shows how some moves to inject competition have a short lifespan – in many European mobile communications markets, for example, provisions were made for new entrants which subsequently merged with incumbent operators. Past experience in the UK is also instructive. The unbundling of copper broadband products was associated with increased competition in the DSL market, and whilst some participants argue that aspects of the market could be improved, overall consumers have benefited significantly.

Of course, politicians in particular will always feel under pressure to make bold, prescriptive announcements and be seen to be acting. It will take more nerve to set the right conditions for a competitive market to flourish over the longer term, but the economic payoff, certainty for industry and benefits to consumers will be far more secure.

In particular, it will be increasingly important for government to find a clear and workable separation between matters of policy and matters of regulatory discretion. There are many advantages to a model with independent regulatory oversight of sectors or industries. There is also, however, a perennial temptation to defer difficult questions of policy to the regulator as a way to avoid implication in sensitive decisions or situations where winners and losers may be particularly vocal. For the avoidance of doubt, this is not good governance. Everyone involved needs to be clear on the boundary between matters of policy, and matters of regulation necessary to implement policy. Politicians should not exert undue influence on matters that fit within the remit of a market regulator. Regulators cannot and should not be expected to push the boundaries of policy design and development.

Communications Networks as Priority Infrastructure

A significant proportion of any government's economic policy will be dedicated to infrastructure. In particular discussions about physical infrastructure are a staple for policymakers. The sheer scale and cost of physical infrastructure build – especially major road and rail infrastructure, energy, water, ports and airports – means that there is almost always a role for government in ensuring these sorts of projects get delivered. The economic uplift – jobs, spending and the like – from infrastructure projects can also be attractive.

Communications networks (both analogue and digital) have been an important part of our national infrastructure since their inception. At the very least, these

networks are used by the vast majority of the population on a daily basis, and much like transport and energy, underpin most (if not all) of our economic and social activity.

In the context of the government's work on open data and digital public services, the Minister for the Cabinet Office, Francis Maude, likes to talk about data being "the raw material of the 21st century".[79] Looking at the future of the economy and the activities powering economic growth, it is hard to disagree.[80] For discussions about broadband and connectivity, we contend that if data is the raw material for modern times then communications networks and the internet are the critical infrastructure for the 21st century. Without good communications networks, data, processing power and information cannot be moved around, transformed and used to generate insights and economic activity. In some of its work the government already talks about communications networks as infrastructure (and as noted earlier, the National Infrastructure Plan contains a chapter devoted to communications).

> "If data is the raw material for modern times then communications networks and the internet are the critical infrastructure for the 21st century"

There are also parallels in the natural resources required to enable infrastructure use. Just as airports require control and organisation of our airspace for flights to proceed efficiently and safely, communications infrastructure also requires frameworks for dealing with common goods. This is particularly important in wireless connectivity, where scarce radio spectrum demands that government play an active role in licensing and enforcing spectrum use.

One important difference between communications networks and other forms of physical infrastructure is the rapid pace of technological progress in the digital arena. In many instances, communications networks are upgradeable in a way that other forms of infrastructure are not. In particular, communications infrastructure benefits from modularity. Whereas a major road or rail connection may be subject to infrequent and major upgrades, the performance of communications networks may sometimes be incrementally improved without needing to replace the entire network. This has been the case with DSL technology, where ongoing improvements in technology have enabled sustained increases in performance over the same copper connections in local access network. Similarly, advances in mobile technology have enabled mast infrastructure designed for previous generations to be swapped out or repurposed for higher performance.

So in thinking about communications networks as infrastructure, it is particularly important to think forward. Spending on communications networks is an investment in infrastructure that should pay back as an enabling technology for general economic activity. And infrastructure with an upgrade path has option value which should be properly accounted for in policy thinking.

Focus Public Policy on Areas of Genuine Market Failure

The old adage that it's not possible to please all of the people all of the time remains as relevant today as ever, and especially so with respect to broadband policy. Government comes under pressure on two particularly difficult fronts:

79   Government Digital Service, The Cabinet Office, "Francis Maude speaks at Intellect Public Services Conference", 2012

80   Policy Exchange, "A Right to Data: Fulfilling the promise of open public data in the UK", 2012

investing to stay ahead of international "competitors" and ensuring universal coverage of broadband networks.

The truth is that neither of these – in and of themselves – should be pursued without paying careful attention to the opportunity cost involved. The appropriate starting point, particularly where public funds are involved, should be to ask which interventions will deliver the best value for money. Benefits should, of course, be thought about in the widest sense, and there will be important social as well as economic benefits from access to communications networks. But as with other areas of public policy, benefits do need to be carefully considered and weighed against costs.

To help build a framework for thinking about broadband policy, we propose rigorously applying the principle of investing public funds where, at the margin, they will have the greatest impact on economic and social welfare. This puts a premium on investing where only the government is able to do so, and where there are likely to be significant external (or spillover) and/or distributional benefits that mean private incentives are unlikely to lead the market to the optimal outcome.

Working from this premise, we may be more likely to see a good social return from focusing on mainstream internet access and use for the majority of the population than from using public money to push the envelope on top speeds in major cities, or connecting the very last remote areas. Diminishing marginal returns on both fronts mean that, in an environment where public resources are scarce, this is unlikely to be the best use of public funds. There is no doubt that measuring inputs like speed and coverage is easier than measuring outcomes, and therefore tempting to use as an anchor for policy. But for citizens, consumers and businesses it is the outcomes in terms of growth, jobs, education and inclusion that ultimately matter.

Of course, it may well be desirable to build in a safety net or minimum acceptable level of provision for the most disadvantaged or at risk of digital and social exclusion (and a universal service obligation does exist for fixed-line telephony, for example). This is a perfectly valid stance to take, and in the broadband debate resonates with the view of many people that access to the internet is something that everyone in today's economy should be able to attain. But care must be taken to articulate both why this matters and how government intervention will protect incentives for competition and innovation.

For in the final analysis, the best network will not be the one that's fastest or that has the most advanced technology. Rather, the best network will be the one that's put to best use by individuals, businesses and the public sector. This may be a simple and obvious message, but it bears repeating.

9
The Way Forward

Having set out the state of play in the market and in government, having established where consumers and businesses sit in their attitudes to broadband and connectivity, and having built a framework for policy making, we are in a position to sketch out a way forward for the UK.

We do not propose to unpick government policies that have already been agreed, that are near completion, or where there is no realistic prospect of altering course without triggering significant and costly delays. Large elements of the BDUK programme to deliver investment in superfast networks fall into the first of these categories. The auction to allocate mobile spectrum in the 800Mhz and 2.6Ghz bands for 4G network deployment falls into the latter.

In fact, based on the policy framework described above, we are broadly supportive of the government's policy to take fibre connectivity up to around 90% of the population, and of its decision to accelerate the release of spectrum for 4G mobile services.

Instead our proposals are designed to fill a strategic gap in how policymakers think about broadband over a longer horizon. The elements outlined below are geared toward building and embedding sustainable and effective competition, ensuring that we translate inputs into the best possible outcomes for society and the economy, and that we do not get sidetracked into short-term measures that undermine our long-term objectives.

At the start of this report we outlined what we described as the British paradox in broadband policy: even though our communications networks are not the fastest or most advanced, the internet accounts for a greater share of GDP in the UK than it does in any other G20 country.

This then is not a conversation about fixing something that's broken. It's a conversation about focusing our efforts to help us go from good to great. We need to push forward the debate on what a realistic, properly prioritised vision for UK broadband policy beyond 2015 looks like, and what it will take to deliver.

We have organised our proposals under five broad headings:

1. Overarching issues to tackle in the way we think about broadband connectivity and our vision for the UK.
2. Practical steps that could be taken to cut red tape, reform regulation and ensure that deployment can keep pace with demand.
3. Practical steps to increase consumer empowerment and ensure people are getting the most benefit from being connected to the internet.

4. Longer term issues to do with the way we think about communications and interdependencies with other infrastructure.
5. Observations and suggestions related to the machinery of government.

1. Vision

In recent years, the delivery of the government's broadband priorities has taken precedence over further development of the government's strategy for the future of broadband in the UK. Shifts of this sort happen in all areas of policy, and putting extra emphasis on delivery is not necessarily a bad thing. We believe, however, that the time has come to devote more policy thinking to where we go next.

Focus on enabling sustainable competition

The UK's experience with both fixed broadband over DSL and mobile broadband over 3G networks demonstrates the fundamental importance of focusing first and foremost on enabling sustainable competition. In both these cases, appropriate regulation was used to correct potential market failures in the retail market, and to establish an environment in which competition between providers could flourish. Over time this resulted in better products, innovation within and across categories, declining prices and rising consumer engagement and take up. This aligns with our findings that price, reliability and speed all matter to consumers when thinking about broadband connectivity.

Vigorous competition is particularly important because this provides a strong incentive for internet service providers and mobile network operators to articulate the benefits of their products to current and potential consumers. Customer insight is a natural area of comparative advantage for industry – businesses that are designed primarily to sell broadband to consumers are by definition well placed to know what will excite and engage people.

This matters because take up is a critical factor in determining whether there is a commercial case for designing and deploying improved broadband networks. If demand for new products is expected to be weak, then the commercial case for investment suffers and policymakers need to consider how far government is prepared to invest if it deems connectivity important. As outlined above, previous analysis on the business case for broadband deployment is what led to the current position of a government subsidy designed to take superfast connections to 90% of the population by 2015.

As a measure to break the deadlock in broadband deployment this approach makes sense (even if some commentators have had doubts about its execution). But to the extent that the fundamental problem is really one of information asymmetry – people do not properly understand the potential upsides for them from better connectivity, so ex ante are unwilling to pay for it – then ongoing rounds of public subsidy will not be an efficient or sustainable solution. It is far better to take whatever steps are necessary to ensure that competition can work effectively, so that the market determines which products, services and technologies best match the needs of consumers.

In practical terms, and in line with previous policy in this area, this means taking a pragmatic approach to areas where there is a natural monopoly in network infrastructure (be that in fibre networks or mobile infrastructure sharing), and

applying maximum effort to deliver competition in the retail market. This puts a premium on continuing to protect access to infrastructure on an equivalence of inputs basis, paying close attention to regulated input prices for both fibre and copper products, ensuring there is enough flexibility for innovation and for different providers to differentiate their offerings, and ensuring there are no artificial barriers to switching from one provider to another. Government will need to watch closely that the competitive outcomes hoped for from future superfast broadband and wireless broadband are attained, and be ready to modify regulation where necessary.

When the government's current broadband strategy was first articulated, it included a requirement for Ofcom to develop and report on a "best in Europe" scorecard for UK superfast broadband.[81] Precisely what measures this scorecard would include was a matter of much debate, with working drafts suggesting a bundle of measures across fixed and mobile and across coverage, speed, price, take up and choice.

As outlined earlier, the right measures to target are outcomes. The government should further refine its scorecard, focusing closer on what really matters to people and businesses. A potential framework that captures these themes is sketched out below.
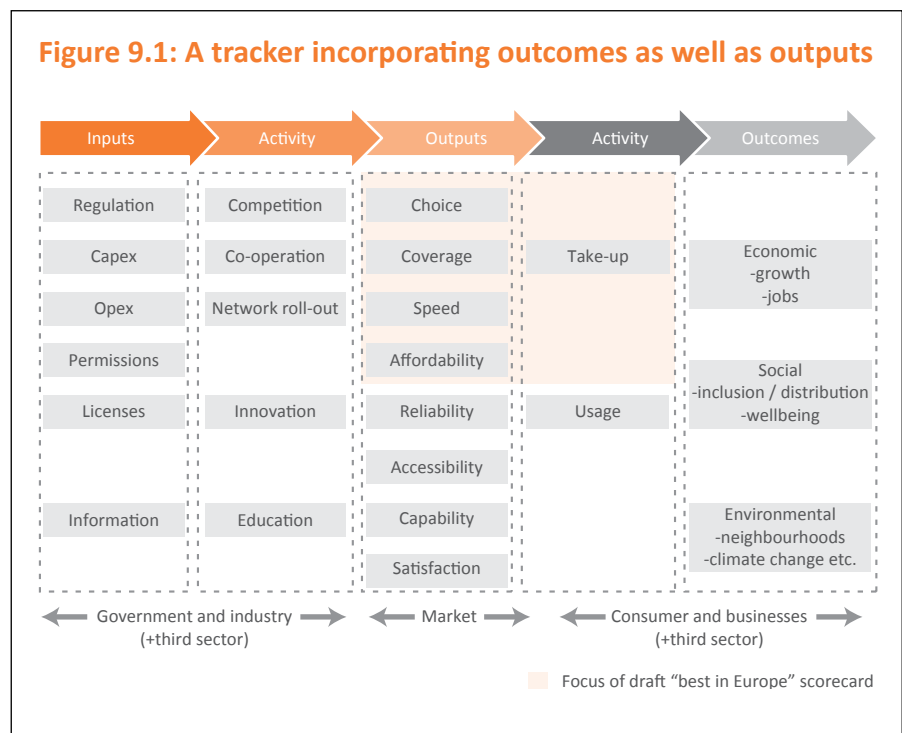
Figure 9.1: A tracker incorporating outcomes as well as outputs

In this world, **whether or not the UK has the fastest superfast broadband relative to other countries is a redundant question.** Similarly whether or not we meet the European Commission's targets for superfast coverage and take up will be secondary, provided that a properly functioning market has balanced the needs of everyone involved.

For the avoidance of doubt, we are not saying that speed does not matter. Rather we think that, when competition is operating effectively, the market is the best mechanism to arbitrate between speed and the other dimensions that matter to consumers.

81 Department for Culture, Media and Sport, "BDUK Delivery Programme: Delivery Model", September 2011

A smarter way of thinking about basic provision

The government's objectives for 2015 include access to basic broadband at 2Mbps for the 10% of households that will not be passed by the superfast fibre networks currently being funded. This universal service commitment is primarily a political device, and is not backed by a specific project or initiative.

Nevertheless, technologically the objective is quite feasible. Traditional DSL technology already passes over 99% of premises, and in many cases should be able to meet this minimum speed already or with upgraded technology. One of the licences to be awarded for 800Mhz mobile spectrum will come with an obligation to provide a mobile broadband service for indoor reception to at least 98% of the population by the end of 2017 at the latest. And advances in satellite broadband technology should be able to provide infill for areas too remote for either fixed or wireless terrestrial networks.

This coverage is at least as good as, and in many cases exceeds, other utilities.

Figure 9.2: Access to broadband and other utilities

Households with access, nearest %

Utility	%
ADSL enabled BT exchange	100
Electricity	100
Telephone access	100
Mains water	99
Digital Television	97
Mains sewerage	95
Gas	96
Local loop unbundled BT exchange	92

Source: Ofcom 2012, Consumer Focus 2011, Northern Ireland Assembly Research and Library Service 2010, European Commission 2012, data.worldbank.org

It is also a reasonable objective for policymakers to pursue. The results reported in this document from our fieldwork with consumers show that people put a strong emphasis on internet access. Four in five people think that access to the internet is something that everyone should be able to get, and two thirds of people think that ensuring that everyone has access to a good basic broadband connection is more important than pushing the envelope on the very fastest connections.

As currently phrased, however, a target for universal coverage at 2Mpbs has one important drawback. Framed as an absolute speed, it may quickly get overtaken by events, particularly in an environment that moves as fast as internet technology. In fact, the original Digital Britain report envisaged universal coverage at 2Mbps by 2012. Today, 2Mbps is the minimum requirement to access on-demand television via BBC iPlayer. It is unlikely to remain a sustainable baseline metric for basic broadband services over the coming years.

We therefore propose an alternative approach for thinking about connectivity for the 10% of the population that are currently off the superfast broadband plan. To maintain a baseline level of connectivity consistent with rising expectations and internet use in the general population**, the government should develop and begin tracking a universal service commitment cast in relative rather than absolute terms.**

One option might be to track a measure of broadband poverty, constructed to identify the number of households where the best performing broadband option runs below a certain percentage of the median UK connection. This way our notion of what constitutes a reasonable minimum standard of broadband access would keep pace with broader developments in technology and internet use (in much the same way that we sometimes use a notion of relative income poverty to reflect increases in general living standards).

Prioritise any further spending according to outcomes

As described above, we are broadly supportive of the steps the government is taking to drive out fibre optic networks to the majority (but not all) of the population. Getting the core infrastructure in place will be important for future competition and innovation, and will be necessary to support mainstream take up.

When it comes to any further spending in this arena, however, we think policymakers need to reflect very carefully before allocating any further cash to direct infrastructure subsidies.

Our research shows that there are significant gaps in capability, for both consumers and small businesses, which may be preventing them from making the best decisions and getting the maximum benefit from internet connectivity, irrespective of the speed of their connection. This suggests that, at the margin, **the government may do better to invest public money in raising capability and engagement than to invest in further extensions of superfast infrastructure**. We develop this line of thinking further in the section below on consumer empowerment.

Our research also shows that people are split about 50:50 on whether taxpayers should be investing in broadband infrastructure. And on whether it is fair for people in remote areas to pay more for connectivity, people are split 2:1 against. The truth is, of course, that it does cost more to deliver broadband to remote areas – so even if capability is raised significantly, there may be a residual fairness issue if the market prices for broadband access reflect local conditions. If the government wants to address this then the approach most consistent with supporting competition would be to pass any new funds through to local communities (or individuals) to help meet the cost of privately provided broadband subscriptions. As with the initial phases of DSL and fibre roll out, an appropriate mechanism to aggregate demand and provide certainty over the flow of future payments may be necessary.

2. Red Tape and Regulation

Cutting red tape is a general priority for this government, and recent announcements in the broadband arena highlighted measures to remove barriers impeding the roll out of next generation networks. Nevertheless, to foster increased competition and ensure that services reach consumers with minimal unnecessary delay, more could be done.

Fast-track action following the Law Commission's review of the ECC

A thorough review of the Electronic Communications Code was long overdue, and it is encouraging to see the matter being handled by the Law Commission with input from a wide range of stakeholders including industry, government and civil society.

Whilst we await the Law Commission's conclusions, it seems clear that they will identify areas where the Code needs to be updated or amended. Delivering these changes as quickly and efficiently as possible will ensure that the benefits flow through to consumers and businesses sooner rather than later.

We discussed the current shortcomings in the Code in an earlier section of this report. From our perspective, and taking into account the wide range of perspectives that we heard whilst conducting research for this report, we think the main areas for action are:

- Stronger rights for operators under the code, alongside rights for landowners, on the grounds that communications infrastructure should be viewed as a public good, much in the same way utilities already are
- Clear and proactive steps to facilitate faster agreements between parties when infrastructure is being deployed. Delays and lengthy processes are the overarching problem in deploying communications infrastructure efficiently
- Finding an acceptable way to determine compensation for landowners, based primarily on the value of the land and cost of access. Broadly speaking this is the approach taken for utilities. In communications, landowners have a strong incentive to hold out and seek rents related to the potential future profits for the operator. This is difficult to determine ex ante, and the delay this causes has a material impact on end-users.

A pro-communications planning regime for forward-thinking councils

The intricacies of obtaining planning permission for network infrastructure can still be a bottleneck for the deployment of improved broadband services. For mobile network infrastructure in particular, we know that the approval rate for new base stations is currently running at around two in three. Where these applications are initially rejected and appealed, the win rate for is also around two in three (against one in three across all appeals).[82] In practice, then, we have a situation where much of the proposed infrastructure does eventually obtain permission, but often only after a far more lengthy process than is necessary.

A key driver for this sort of scenario is the lack of consensus on the interaction between improved communications networks and connectivity, and the impact this may have on neighbourhoods and the local environment. Our research shows that the public are, to all intents and purposes, split 50:50 on whether communications or the local environment should take priority. In the meantime, many councils talk up their desire for better connectivity and broadband, without having properly developed mechanisms to efficiently navigate this through the planning process.

We therefore propose **the introduction of a pro-communications planning regime for those councils wanting to make faster progress on connectivity**. This would set out a basic framework for industry and local authorities to sign up to. Industry might be required to give stronger assurances about the speed

of works, impact on the local environment, and benefits to local residents and businesses (and perhaps post a bond if further commitment is needed). In exchange, participating councils might give assurances of a presumption in favour of development, and void classes of objections that are known not to stand up to scrutiny.

No councils would be obliged to adopt such a regime. But for those who want to make faster progress on communications network rollout, this could be an important tool for attracting investment and industry focus. There are parallels with the Google Fiber project in the US, where competition between cities to attract investment has resulted in local legislators clearing the way for rapid deployment of next-generation networks. An approach of this sort would be in line with previous Policy Exchange research on planning reform, which has called for a more liberal and competitive system.[83]

Better exploitation of local authority land and buildings

Building on our proposal to extend more freedom on planning consents to forward-thinking councils, there may also be scope to make better use of public sector assets to speed up the deployment of communications networks.

For mobile networks in particular, the requirement to put infrastructure above ground (and ideally at good vantage points to maximise coverage) can lead to some of the most protracted objections to development. Industry experts will almost always have the best technical perspective on the optimal location of masts and related infrastructure. In some cases, however, getting on with deployment in a good enough location may be preferable to spending too long securing the very best location.

On this basis, some local authorities may find themselves in a particularly interesting situation. In many cases, particularly in smaller towns, council buildings or other public structures may be attractive sites – relatively tall, relatively central, and with reliable power infrastructure. **Councils with an appetite for imaginative approaches to speeding up communications network roll out should consider whether and how their own assets could be used as part of the solution.**

Of course it won't always be possible to site a mast on the roof of a council building or hang equipment off existing structures. But where it is possible, it may be a faster way through to a good enough solution than trying to break a planning deadlock between multiple parties and a private landowner.

As with our proposals on fast-track planning, and in line with the government's localism agenda, this is not a measure that central government should be mandating. For some councils, it may be right and legitimate to conclude that this approach is not appropriate for the local environment or population. But for others, government may do well to nudge local leaders to think more creatively about leveraging the assets at their disposal to accelerate better local connectivity.

Unlock synergies with transport infrastructures and assets

Transport and communications infrastructures are particularly interesting to consider together. They both complement and substitute each other (better communications on the move makes long journeys more pleasant and more productive, whereas better communications infrastructure overall means less

83 Policy Exchange, "More Homes, Fewer Empty Buildings", 2011

need to move people around). The interaction between the two therefore merits special attention from policymakers.

Better connectivity in transit, and on the rail network in a particular, is an area where progress could unlock significant economic potential. A large number of people make train journeys for business purposes, and modern rolling stock provides a reasonable environment from which to work using a laptop or tablet. For many people, however, poor connectivity is a constraint on productivity – and this is likely to increase as more enterprises move to cloud services and people rely more intensively on the internet as a platform to do business.

Of course it is not surprising that mobile connectivity is poor – the masts we use today were never designed to cope well with penetrating fast-moving moving train carriages. And although technological solutions do exist, the economic incentives are rarely aligned well enough for them to be implemented. At the most basic level, there is a disconnect between passengers (the end-users of connectivity), train operators (who run the service and sell tickets), asset owners (the banks and others who own the rolling stock) and network operators (who operate mobile networks). Improved infrastructure might also have a spillover effect for the system as a whole, if it enhances the ability to use information to optimise services in real time.

One way through may be to start explicitly building connectivity into the requirement set as future rail franchises are competed and allocated. Alternatively, a more sophisticated approach to competition on the rails may provide the incentive for at least one train operator to break ranks in an attempt to differentiate itself from its competitors.[84] In the meantime, and in keeping with the spirit of the proposal above on local authority buildings, councils might take a more permissive approach to network infrastructure being installed at stations and other areas where passengers congregate.

3. Consumer Empowerment

In addition to supply-side measures, the demand side of the market needs to function well for competition to be effective. Basic responsibility for shopping around and choosing the best package should rest with consumers, with the market providing incentives to engage in the form of better products and lower prices. Where frictions are still present or capability is a constraining factor, however, action needs to be taken.

Capability for consumers

Only around one in five people is confident estimating how much data their household uses in a typical month (and this figure falls to fewer than one in ten for the over-65s). Only around a third of people are confident that they can choose the best broadband package for their household's needs (again falling to below one in five for the over-65s). For competition to work effectively, consumers need to be confident in their interactions with broadband providers.

For many people the incentive to enhance their digital skills (including through retraining if necessary) should be provided by the labour market. And in many instances individuals will pick up some basic digital literacy during the course of their working lives. Previous research by Policy Exchange identified a particular issue for older offline people, where it is less clear that the majority will choose to

move online of their own volition.[85] We recommended that government explore a more direct approach to supporting this group, building on existing volunteering efforts with a concerted programme of outreach and assistance. This remains something that the government should give serious consideration to.

More generally, as with other areas where the government backs public information and education efforts, there may be a legitimate case for intervention to raise basic levels of capability. In addition to increasing competitive discipline, improved levels of internet capability and engagement will ensure that people are realising for themselves the best economic and social outcomes from connectivity. They should also help to stimulate demand for broadband services – both fixed and wireless – which in turn will improve the commercial case for investment.

The government is already backing work led by Go ON UK to get people connected and to boost their capability once they are online. This initiative has a wide range of founder partners, and recently announced plans including a digital skills drive to help the 16 million people in the UK who lack basic digital skills achieve a standard of digital literacy that helps them communicate online, find information and use the internet safely.[86]

As outlined above, capability should be a key focus should any incremental spending in pursuit of good broadband outcomes be unlocked. In this scenario we propose that any additional funding for capability be directed in support of Go ON UK as the de facto umbrella initiative in this space.

Capability for small businesses

About half of people think that most businesses should be ready to take bookings or orders online. Only about a third of small businesses, however, report that they have the capability to manage online transactions. This is particularly concerning for policymakers as we know that small businesses that embrace the internet grow substantially faster than their offline peers – so even accounting for some selection bias, many are passing up a major opportunity.

Our research also showed that the majority of small businesses are relatively conservative when it comes to adopting new technology. For those that see benefits in better broadband connectivity, views were more heavily weighted to reducing the cost of doing business, increasing productivity and delivering a better experience for customers. Only a minority of respondents talked about taking advantage of new cloud services, or using the internet to reach a bigger market.

This suggests that **the focus for digital engagement needs to extend to cover capability for small businesses**. This is already on the Go ON UK agenda, including the digital skills drive mentioned above. Of the 16 million people in the UK who lack basic online skills, 4.5 million are in the UK workforce. Go ON UK's partners and other businesses have committed to training their staff to have the aforementioned standard of digital literacy.[87] Again it should be a priority for further activity if and when further funding becomes available.

Information and switching

In the mobile telephony arena, the introduction of number portability made it easier for consumers to exercise choice by switching providers. In the context of modern broadband, a more streamlined process for switching suppliers might

85 Policy Exchange, "Simple Things, Done Well: Making practical progress on digital inclusion and digital engagement", 2012

86 Go-on.co.uk

87 Go-on.co.uk

help to stimulate competition. Ofcom is currently reviewing the switching process for customers of fixed broadband providers.[88] Given the rapid pace of change in a market like broadband, and the known problems arising from multiple processes and legacy systems, where there are straightforward changes to the switching process that would benefit consumers and competition it will be important for the regulator to work with industry to push them through quickly. This should not preclude more fundamental changes over a longer horizon, following the conclusion of more detailed analysis. The findings of this work may have long-lasting and wider relevance, particularly given the rapid convergence we are seeing in the market.

Industry-led action on switching is already underway in other sectors. In retail financial services, for example, the industry is working on a new process that would allow consumers to make a single request to switch current account provider, with a faster process and assurances about service continuity.[89] In the energy sector, the government has taken steps to ensure that consumers have good access to information that would help them find the best deal.[90] Of course any reforms to the switching process – in any industry – should be designed to put customers first and protect them from unscrupulous behaviour (from both their existing and potential providers).

In addition to the ease of the switching process, consumers also need to be able to search out and choose the right package. As highlighted above, our research shows that relatively few people feel confident when selecting broadband packages (and this is a particular issue for older groups). Although it is possible for consumers to monitor their own connection speed and data use, the steps involved can be technical and may be difficult for those who would benefit most. Providers meanwhile have less incentive to provide comparable data that might trigger their customers to think about switching away.

In the spirit of open data and informed choice, we are supportive of any initiatives that provide consumers with data relevant to making more informed decisions. There is clearly an important role for industry to play in taking this forward. This would build on progress already made by major players to provide more information and dashboards for consumers.

Leverage public services to get people online

Although we think that industry is generally best placed to articulate the benefits of broadband and to drive consumer engagement, there is still an important role for government. The government is currently in the process of a major shift to digital delivery of public services. A single government domain went live in October 2012, and over the coming months will be used to consolidate disparate departmental websites and online government transactions.

For most people, the prospect of interacting with government online may not be the most compelling reason to get online. Indeed, in research previously published by Policy Exchange, we found that for older people the primary attraction of getting online was highly personal, and included drivers such as communicating with dispersed family or seeing photographs of loved ones.[91]

Nevertheless, there may be more practical steps that government can take to deliver services over broadband that people attach a high value to. This might include for example:

88 Ofcom, "Consumer Switching", 2012

89 Response from Payments Council to HM Treasury Consulation, "Setting the strategy for UK payments", October 2012

90 Policy Exchange, "Retail Market Reform and the Future Shape of the Domestic Energy Retail Market", 2012

91 Policy Exchange, "Simple Things, Done Well: Making Practical Progress on Digital Inclusion and Digital Engagement", 2012

● Leveraging mobile broadband and mobile devices to replace paperwork and cut out journeys for e.g. repeat prescriptions, tax disc applications
● Taking advantage of video technology to increase convenience for public service users e.g. parents' evenings, some medical consultations
● Human or automated assistance with forms that are complex or need to be completed at difficult times, e.g. lasting power of attorney, probate

Where digitisation of services delivers practical benefits for citizens it will stand a much better chance of engaging the general public and, for some, will be the catalyst to explore other activities online.

For this agenda to gain traction, government needs to be prepared to push ahead with the digital-by-default agenda. In particular, government should drive forward delivery where it will be accessible by most people, even if some people will not be able to benefit (either because good broadband infrastructure is absent or because they are not confident going online). There is a risk that innovative services are held up indefinitely to avoid delivering a service that fails on universal accessibility – even though complete universality is something that we may never achieve. This would be a huge wasted opportunity. **The government should be more relaxed about prioritising broadband-enabled digital services for the vast majority**, as part of a concerted effort to get people engaged with life online.

And for those who do remain offline, digitisation may still have important ancillary benefits. By innovating and driving the majority of interactions online, efficiency savings can be unlocked and used to enhance the offline service for the (decreasing) minority of people who are not able to access online content.

4. The Long View

Small businesses rank communications second only to major roads when asked to prioritise different areas for infrastructure improvements. As outlined above, we advocate a market-led approach to connectivity, with demand pulling through the appropriate amount of investment and provision. As the government sets the parameters for this market to operate, it should keep a close eye on potential synergies with other aspects of its national infrastructure agenda.

Spectrum

One key constraint over the medium to long term will be radio spectrum. As this is a common good it is necessarily allocated by government – and in a capacity-constrained future, there is likely to be a particular premium on freeing up additional spectrum for wireless communications. We know that mobile data use in particular is growing rapidly, that data outstrips voice on mobile networks and that (on some measures) more web pages are already accessed from mobile devices than from desktop browsers.[92] Under a mid-level growth scenario, mobile data capacity demand will experience an 80-fold increase between now and 2030.[93]

Ofcom is currently managing the process to award spectrum in the 800Mhz and 2.6Ghz bands for 4G mobile services. It is also developing a long-term strategy for UHF spectrum bands in the 470–862Mhz range, which includes consideration of future 700Mhz spectrum release.

We saw from the international examples described earlier that there can be significant benefits from freeing up low frequency spectrum, as it has good

92 The Financial Times, "Data traffic outstrips mobile voice calls", 2011

93 Ofcom, "Securing long term benefits from scarce spectrum resources", March 2012

propagation characteristics to enhance coverage. We also know that widespread use of technology is putting pressure on other spectrum applications, including bands reserved for WiFi and for white space technologies.

Pressure on spectrum is only likely to increase. Therefore, continued work on spectrum reform, liberalisation and clearance remains an important public policy priority. There is a particular risk that, given the long lead times to coordinate clearance of spectrum already in use, an increase in demand beyond central planning scenarios results in a spectrum crunch. In its recent consultation document, for example, Ofcom argues that switching terrestrial television to IPTV (i.e. delivered over broadband rather than broadcast) is not a realistic option before 2030.[94] Given current rates of growth for iPlayer, other streaming TV platforms and the introduction of YouView, however, it may be reasonable to expect to move considerably sooner and plan accordingly.

> "Widespread use of technology is putting pressure on other spectrum applications, including bands reserved for WiFi and for white space technologies"

5. Joining Up Government

The internet is a pervasive, general purpose technology whose importance to the economy extends far beyond the creative industries. It is clear from the research reported in this paper than we need to reframe the broadband debate around achieving the best economic and social outcomes for the UK. Overall our proposals make the case for a refreshed way of thinking about broadband strategy. This would focus on enabling competition and markets to navigate us rather than aiming unflinchingly at speed targets. It would mean investing any new funds into capability and local communities, to make the most impact in terms of economic and social outcomes. It would mean clearing obstacles to private roll out of infrastructure in the short term, and careful consideration of issues like spectrum licensing in the long term.

Although responsibility for internet and broadband issues currently sits with DCMS, it is immediately apparent that a large number of central and local government bodies need to be a part of this agenda. Up to this point, much of the policy debate has been – either explicitly or implicitly – about retail and consumers. This is important, but needs to be seen alongside putting broadband to best use to support enterprise and growth, and taking advantage of connectivity to reform public services.

There are also too many conversations focused on the issues as they relate just to fixed broadband or just to wireless broadband provision. However, the rapid convergence of technologies and services means that more attention must be paid to how fixed and wireless can work together to achieve good outcomes for the economy and society.

In practice this means embedding connectivity far more firmly into mainstream government business. In Whitehall this covers everything from the advice for small businesses developed for GOV.UK through to the government's growth strategy, infrastructure reviews and beyond. It also cuts across policy for the regions, for rural areas, for communities and local authorities.

94 Ofcom, "Securing long term benefits from scarce spectrum resources", March 2012

As a starting point, **the ministerial role responsible for broadband in DCMS should be strengthened with an explicit remit to promote economic growth opportunities from mainstream use of communications technology and the internet**. Over a longer horizon, more radical changes to the machinery of government could be considered if structural changes are deemed necessary to give this agenda the locus it needs to shape policy across government.

10
Concluding Remarks

Overall, the British broadband story is a positive one. The internet has made a huge difference to our economy and society, and on balance the impact has been far more positive than negative. As we noted at the start of this report, when we think about the future of broadband for the UK it's not about fixing something that's broken. It's about finding the best way to move from good to great.

There is no doubt that the next generation of superfast broadband technologies, both fixed and wireless, will make a significant contribution to the economy. The direct impact of capital expenditure to upgrade infrastructure, and the indirect impact for consumers and businesses of better connectivity, will make a material contribution to output and growth. The public funds already allocated to support superfast fixed broadband roll-out, and the forthcoming allocation of additional spectrum for 4G wireless services, will both help enhance mainstream connectivity.

Looking beyond the government's aspirations for 2015, the emphasis must be on achieving sustainable, effective competition, supported by appropriate regulation. Pushing the envelope on superfast connectivity is expensive, and unlikely to unlock the sorts of spillover benefits we saw when basic broadband first arrived. So at the margin, any further public spending in this area should be focused on raising capability among both consumers and businesses – this will ensure we are making the best use of the connectivity at our disposal, and help generate the right demand signals for industry to respond to using whatever mix of technologies works best.

So as we think about broadband and how it fits in the economy, speed does still matter. But when it comes to deciding how fast is fast enough, strong consumers in a properly functioning, competitive market should be the judge.

Annex A: Connectivity

This report is about digital communications and connectivity – and in particular the role that access to the internet will continue to play in our economy and society. For practical purposes this is a discussion about broadband: what we've got, what we need and how best to organise it.

The technologies relevant to this discussion are many and varied. For most consumers, broadband has become synonymous with a modern home internet connection, delivered over a copper telephone cable. But broadband brings a far wider range of technologies into play, including fixed connections over copper and optical fibre links, terrestrial wireless connections and satellite delivery.

For both historic and pragmatic reasons, the broadband debate in the UK has often (though not entirely) tended to deal with fixed and wireless broadband markets separately. For this report we have elected to deal with the issues as a whole. Fixed and wireless products are converging on many important dimensions, including price and performance. They are also increasingly complementary, with consumers and businesses both demanding access to the internet across a range of locations.

Internet 101

The world-wide connected computer network that enables users to communicate through instant messaging, shop online and stream television is a system of Internet Protocol (IP) networks. The Internet Protocol Suite, commonly known as TCP/IP, specifies how data should be arranged, moved and received and is made up of layers.

The application layer includes, for example, Hypertext Transfer Protocol (HTTP), which is the application for accessing the World Wide Web. It is the protocol used by web browsers and serves to communicate to one another.

The transport layer is responsible for handling connections between internet hosts. This includes, for example, Transmission Control Protocol (TCP), which delivers units of digital information from a program on one computer to another. TCP routes the application protocols to the correct destination on your device. This is what allows you to, for example, receive an email while surfing the web at the same time.

The internet layer connects local networks through Internet Protocol (IP), which relays information via network packets across the internet. An IP address identifies any device connected to the internet. It is a numerical label that makes it possible for connected devices to locate and communicate with one another.

The link layer contains communication technologies that link devices in a limited area.

Modes of Connectivity

There are a wide variety of connection types for accessing the internet. Over the following pages we briefly describe the key elements of fixed, wireless and satellite technologies.

Fixed connectivity

Before broadband technology was introduced, a dial-up connection was used and is now the slowest method for connecting to the internet. Dial-up doesn't require additional infrastructure beyond the existing telephone network, and works by having a modem dial the telephone number of an internet service provider (ISP). Now largely obsolete, only 1% of connections in the UK are dial-up.[95] An Integrated Services Digital Network (ISDN), like dial-up, provided a method for connecting to the internet over copper wires that is now largely obsolete, but can reach 128kbps up and dowstream.

A Digital Subscriber Line (DSL), like dial-up, provides internet access through a copper telephone line. Unlike dial-up, it still allows for a telephone call while in use for internet access. There are several different DSL technologies, but to most consumers is an Asymmetric Digital Subscriber Line (ADSL), which range from 256 kbps to 20Mbps down, but lower upstream. With a symmetric digital subscriber line (SDSL), these are equal. Additionally, a Very-high-bit-rate digital subscriber line (VDSL) provides data rates up to 52Mbps downstream and 16Mbps upstream over copper wires. VDSL2 is able to provide data rates exceeding 100Mbps simultaneously in both the upstream and downstream directions, however the maximum data rate is achieved at a range of about 300 meters. This rate degrades as the distance increases.

FTTx is the generic term for networks that use optical fibre in replacement of the copper line (also called local loop). For example, "fibre to the premise" (FTTP) means that the fibre in the ground extends from the exchange to the home or business. "Fibre to the cabinet" (FTTC) refers to when fibre is connected as far as the exchange to street cabinet, which is located within a particular distance of the premises to which the network is connected. FTTP sees speeds up to 300Mbps. FTTC sees up to 80Mbps down and 20Mbps up, but costs less to deploy.

Wireless connectivity

Internet access through wireless technology can also take a range of forms.

WiFi, a contraction of "wireless fidelity", is the common name for any wireless local area network. WiFi is the standard way devices connect to local wireless networks, and it allows them to communicate over a wireless signal. Worldwide Interoperability for Microwave Access (WiMAX) is a wireless communications standard that although like WiFi, can cover a much greater area than a WiFi signal.

Wireless or mobile broadband provides internet access over radio frequencies through devices such as a mobile phone or Universal Serial Bus (USB) dongle plugged into a laptop or computer. A standard third-generation (3G) mobile broadband connection in the UK delivers average speeds of 3Mbps downstream. 4G technologies – for our purposes using the Long Term Evolution (LTE) basket of standards – are currently able to deliver performance up to 12Mbps down, but there is potential for 4G speeds to increase dramatically. LTE standards provide not only increased speeds, but reduced latency (which will be discussed in greater detail later) and increased spectrum flexibility, among other features.

A mode of wireless connectivity known as fixed wireless can be used to provide internet access at a single location, such as a home or office. Unlike fixed-line broadband, fixed wireless provides internet access over radio frequency rather

than copper or fibre cables. By taking advantage of high ground, access to mains power and larger antennas, fixed wireless can deliver superior performance compared to mobile alternatives.

Because mobile broadband and fixed wireless operate over radio frequencies, it is important to understand the use of spectrum and its role in broadband policy. As explained in the body of this report, Ofcom are responsible for managing the use of spectrum and the auctioning of additional spectrum. Spectrum is, however, a scarce resource. To use it effectively and efficiently, broadcast television, radio, mobile phones, etc. are allocated ranges of corresponding radio frequencies that do not overlap one another. Ofcom released spectrum for 3G in an auction in 2000, The spectrum allocated for 4G (made available largely because of the digital TV switchover) will be auctioned off in January 2013.

Satellite can provide internet access, and although it can be relatively expensive, because it doesn't require connection to a fixed-line network, it can be an option for remote areas. Speeds tend to be around 10Mbps down and 2Mbps up. However, satellite connections can be less reliable depending on conditions.

Measuring Performance

The performance of a broadband internet connection can be measured on a number of dimensions. The most commonly used are described briefly below.

Bandwidth

Bandwidth refers to measurements expressed in bits or multiples of bits per second, which represent how much data is available or consumed in this particular amount of time. This means that a higher amount of bandwidth allows for a faster download then a lower amount of bandwidth. For example, an internet service provider may advertise superfast broadband download speeds at 30Mbps, meaning 30 Megabits per second (this may also be written as 30 Mbit/s).

Latency

Latency, in addition to bandwidth, determines network connection speed. It refers to how quickly packets of data to move across a network connection. When the computer that sent the packet waits for confirmation that the packet has been received, this is referred to as the "latent" time.

Jitter

Jitter is the difference between the minimum and maximum latency.

Reliability/uptime

The uptime of a device, such as a server or router, refers to a measure of reliability, meaning how long something can run without crashing or needing to be rebooted.

Contention

Contention refers to the number of people connected to an ISP who share a set amount of bandwidth. A typical ratio might be 50:1 for residential users. This can be a reason as to why access speeds may vary.

Annex B: Markets

The economics of broadband, and communications infrastructure more generally, are both complex and critically important for our analysis. Whilst we rely on private sector organisations to build communications networks and deliver communications services to end users, there is a clear role for government policy to deliver a socially and economically optimal outcome. In particular, some specific characteristics of communications technologies and networks may mean that policies designed for other markets may be inappropriate (or worse, positively damaging).

In this section we provide a brief and non-technical overview of the issues and their implications for policymakers. Our primary interest is in internet access, i.e. the final stage of connectivity provided by an internet service provider or mobile network operator to the end user (though we range wider where necessary). Nevertheless, to keep things tractable this remains a relatively brief tour through the issues.

Structure

At its most basic level, the broadband market might be viewed as one with many buyers (consumers and businesses) and a natural monopoly in supply. This flows from the nature of the production function for digital communications. As providing connectivity relies on an extensive infrastructure, producers tend to face high fixed costs from infrastructure build. In contrast, the marginal cost of providing services – i.e. transmitting signals – over the network tend to be low.

The reality is, of course, many orders of magnitude more complicated. The infrastructure required has many different layers and components, from the core network and internet backbone, to exchanges, masts and hubs, and switching or terminating equipment at various points along the way. Reflecting the special complexity of communications markets, the industry has its own sector regulator in the form of Ofcom.[96]

In practice, the primary natural monopoly problem in fixed broadband was isolated in Ofcom's 2004–05 review of the telecommunications market.[97] This concluded that competition was restricted in the access and backhaul networks, and that BT (a) had substantial wholesale market power and (b) was a vertically integrated provider in directly related retail markets. Ofcom believed that this gave BT the ability and incentive to discriminate against its downstream retail competitors, who were also wholesale customers. In lieu of an enterprise act referral, BT made a number of voluntary but legally binding commitments designed to deliver an effective and competitive market.[98] These included:
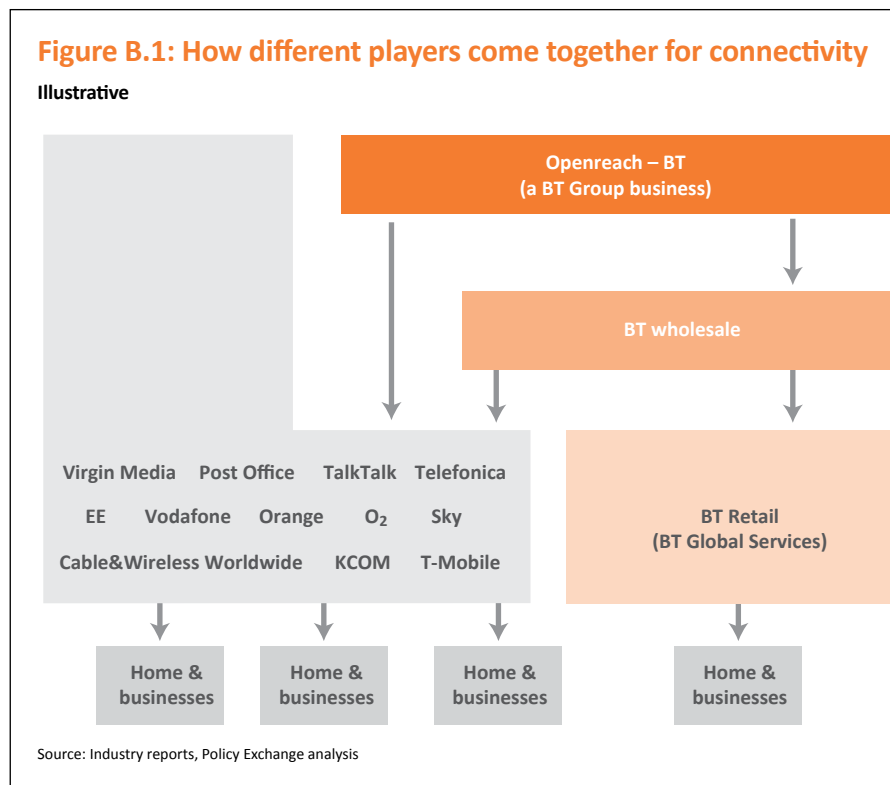
- Establishing a functionally separate Openreach division
- Provision of services on an equivalence of inputs basis
- Independent oversight and enforcement

96 Office of Communications Act 2002

97 House of Commons Trade and Industry Committee, "Ofcom's Strategic Review of Telecommunications: Ofcom's Response to the Committee's Thirteenth Report of 2004 – 2005", October 2005

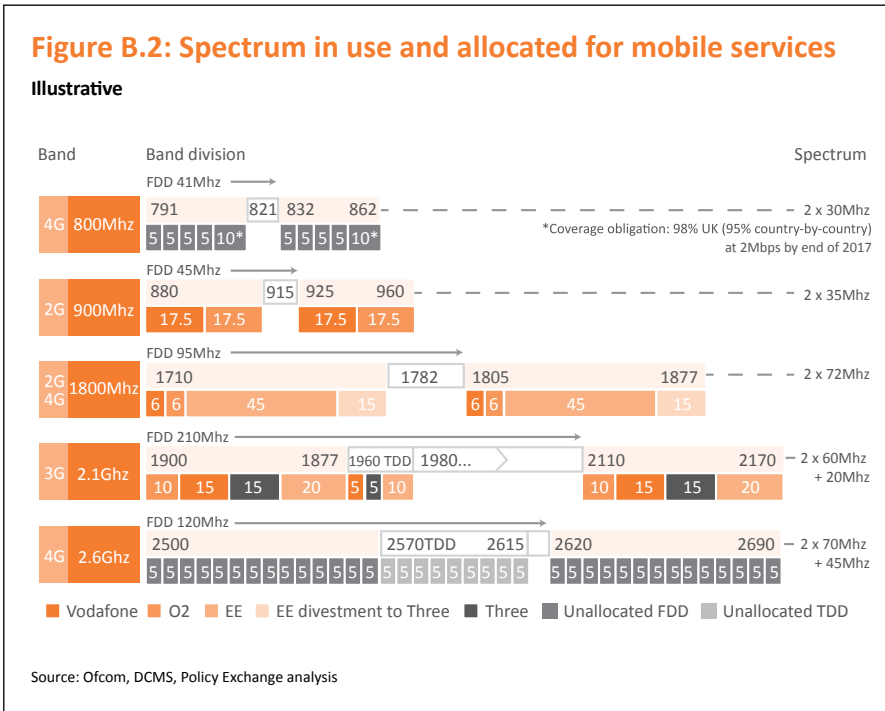98 Ofcom, "Strategic Review of Telecommunications", 2005

Today, we have a national fixed broadband infrastructure delivered primarily by Openreach, with provision to its wholesale and retail partners delivered over a combination of copper and fibre optic infrastructure. In some parts of the country, there is a parallel network owned and operated by Virgin Media.

Figure B.1: How different players come together for connectivity

Illustrative

Source: Industry reports, Policy Exchange analysis

In the wireless space, the scarcity of electromagnetic spectrum adds a further complicating factor. As spectrum is a public resource, successive governments have licensed the use of spectrum to individual mobile network operators, to prevent interference and support other policy objectives such as revenue raising and competition. Wireless connectivity also requires its own supporting infrastructure of masts and towers. There are also instances of infrastructure sharing. EE and Three share a 3G network (MBNL), whilst O2 and Vodafone are working on their own plans for infrastructure sharing (Cornerstone).[99] Many of the sites and equipment are provided by Arqiva.[100]

99 The Independent, "Vodafone and O2 to save 'hundreds of millions of pounds' by sharing infrastructure" June 2012, and MBNL.co.uk

100 Arqiva.com

Figure B.2: Spectrum in use and allocated for mobile services

Illustrative

Source: Ofcom, DCMS, Policy Exchange analysis

From the end-user perspective there are a range of fixed broadband internet service providers, a range of mobile network operators, and some businesses that do both. Following a wave of consolidations over the past decade, major players now include BT Retail, Sky, TalkTalk, Virgin Media, Plusnet, Telefonica (O2), Vodafone, Three, EE (including T-Mobile and Orange), the Post Office, and Cable & Wireless.

Figure B.3: Fixed ISP market shares

Source: Ofcom 2012
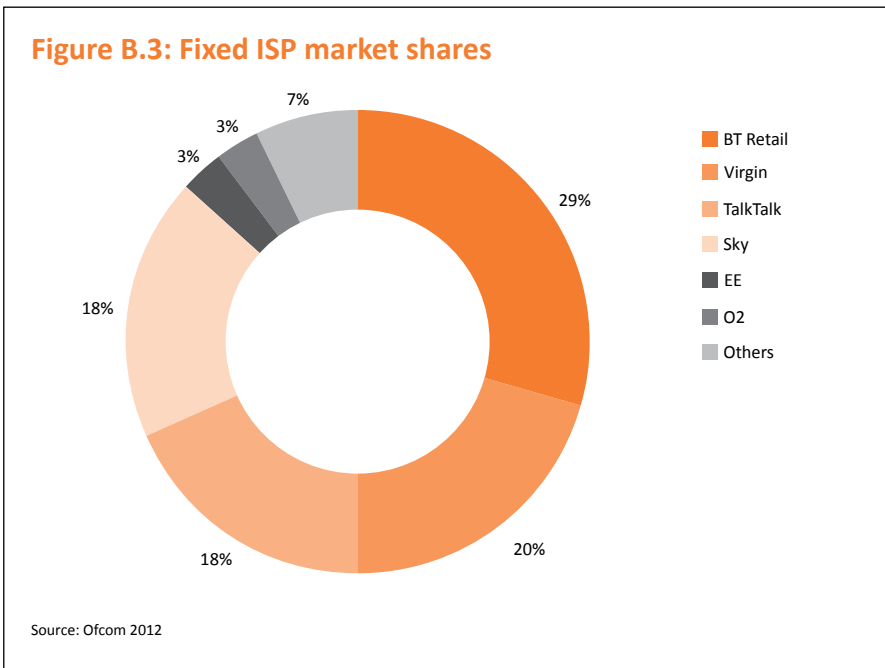
In both fixed and wireless access markets, there are barriers to entry in the form of fixed costs of operation. Overall one might reasonably conclude that the requirement to hold a spectrum licence makes barriers to entry higher in the mobile part of the broadband access market.

Conduct

The market for broadband access is generally competitive. Consumers typically have a choice of service providers and packages, and face relatively low (though non-zero) costs of switching from one provider to another. Consequently the dispersion of prices for similar product/service bundles is typically low. The chart below provides some illustrative price comparisons – though as this is a fast-moving industry the precise figures are necessarily only a snapshot.

### Table B.4: Price comparisons for key fixed products

Provider	Fixed broad-band only	Fixed broad-band and calls	Fixed broad-band and fixed line	Fixed broad-band and mobile	Fixed broad-band and pay-TV	Fixed broad-band, fixed line and mobile	Fixed broad-band, fixed line and pay-TV
AOL	£15.31	10.20[1]	£20.30	–	–	–	–
BT	–	–	£28.60 (£24.75)	–	–	–	£28.60 (£24.75)
O2	£13.50[1]	–	£26.50	£8.50[1,2]	–	£21.50[2]	–
Orange	–	–	£23.50	–	–	£18.50[2]	–
Plusnet	–	£6.49[1]	£19.48 (£15.98)	–	–	–	–
Sky	–	–	£22.25 (£19.95)	–	–	–	£32.25 (£29.95)
TalkTalk	–	–	£20.30 (£16.00)	–	–	–	–
Virgin Media	£22.50	–	£28.40	£22.50[2]	£36.50	£28.40[2]	£33.90

Source: Ofcom based on Pure Pricing UK Broadband Pricing Briefing, March, 2012
Notes: All tariffs exclude activation charges and promotional discounts and include VAT; all tariffs are the lowest price available, contract length vary; allowances for fixed-line and mobile call, plus availability of TV channels included within packages may differ by operator and option; figures in brackets require pre-payment of twelve month's line rental; [1] also requires BT fixed line rental at £14.60 a month/ £129 pre-payment for a year; [2] plus cost of mobile tariff.

Many broadband connections are provided to end users on a contract basis. This enables providers to subsidise the cost of related equipment such as routers or handsets. It may also help reinforce customer loyalty. In some instances, broadband is bundled together with other products in so called triple-play (telephone, TV and broadband) or quad-play (telephone, TV, broadband and mobile) deals. In other cases, broadband access may be provided without contract on a pay-as-you-go basis.

Overall, providers appear to be increasingly attempting to compete on non-price dimensions. Whilst some recent advertising campaigns have focused on value, others have highlighted policies on data caps/allowances, customer service, reliability and content offerings such as sports and premium programming.

Part of this competitive pressure has manifested in significant capital expenditure to upgrade, extend and enhance existing communications infrastructure. Globally, around three quarters of capital expenditures in the internet economy value chain are related to connectivity (core network, interchange and internet access).

Figure B.5: Three quarters of internet capex is in connectivity

Global capital expenditures in the internet value chain

Source: AT Kearney
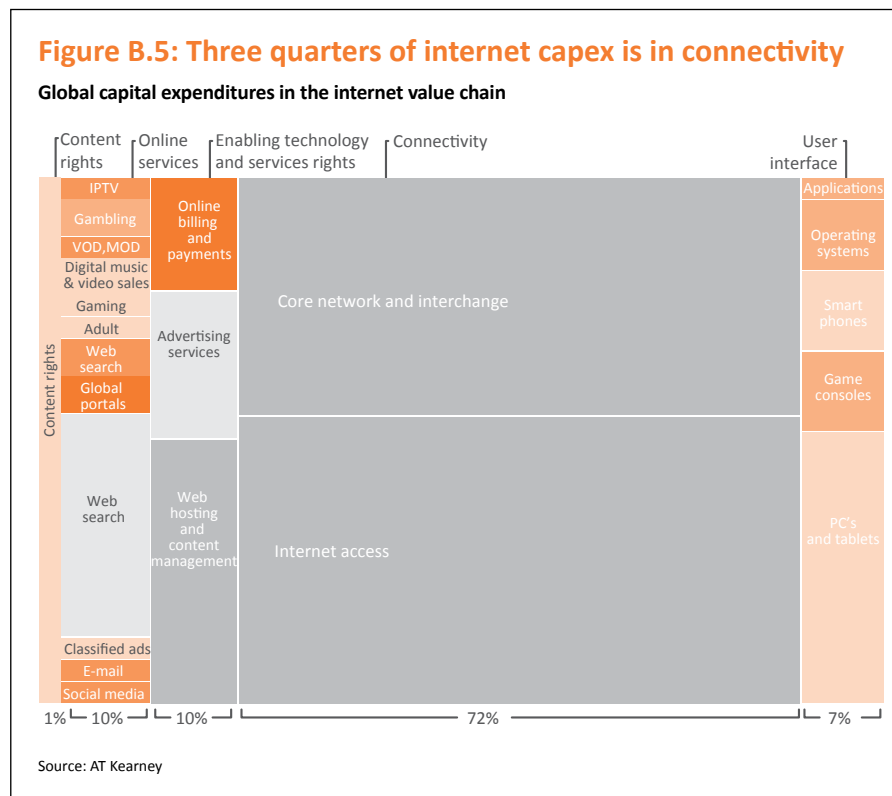
Strong competitive pressure has also resulted in periods of protracted legal action, as providers sought to restrict their competitors behaviour or block potentially disadvantageous actions by the regulator. These actions have been (quite correctly) driven by self-interest, and opinions about their relevance unsurprisingly differ from one provider to another.

Performance

In line with the competitive pressure described above, internet service providers and mobile network operators have experienced commercial challenges in recent years. Like other sectors of the economy, most industry players were impacted by the credit crunch and subsequent recession. In addition, some players are bearing additional strain from overseas operations and/or an overhang from sizeable bids for current generation spectrum and related infrastructure.

Table B.6: Total telecoms industry revenue has been flat recently

UK Telecoms industry: key statistics

	2006	2007	2008	2009	2010	2011
Total operator-reported revenue (£bn)	40.7	42.0	42.5	41.2	40.5	39.7
Operator-reported retail revenue (£bn)	30.6	31.7	32.0	31.1	30.9	31.0
Operator-reported wholesale revenue (£bn)	10.1	10.3	10.4	10.1	9.6	8.8
Average monthly household telecoms spend (£2011 prices)	78.46	76.00	73.04	70.81	68.06	65.04
Fixed access and call revenues (£bn)	10.5	10.4	10.2	9.7	9.4	8.9
Fixed voice call minutes (billions)	154	149	141	132	129	116
BT share of fixed call minutes (%)	47.1	46.6	43.8	40.1	36.5	35.9
Fixed lines (millions)	34.5	34.5	34.2	33.5	33.4	33.2
Fixed internet revenues (£bn)	3.2	3.2	3.2	3.3	3.2	3.4
Fixed internet connections per 100 population	28.0	29.3	29.5	30.3	32.1	33.2
Fixed broadband connections per 100 population	21.3	24.9	27.4	28.7	30.6	32.5
Proportion of premises connected to an unbundled exchange (%)	66.6	80.2	84.2	84.5	89.0	91.9
Mobile retail revenues (£bn)	13.9	15.0	15.5	14.9	14.9	15.1
Mobile voice call minutes (billions)	88	105	115	121	125	124
Active mobile connections per 100 population	114.7	120.1	123.8	129.1	129.8	129.8

Source: Pure Pricing UK Broadband Pricing Briefings
Note: Date as at March of each year
Source: Ofcom/ operators

As noted earlier, on the pace of technological progress the UK's broadband market and infrastructure is behind many other developed economies. In fixed networks, Openreach and Virgin Media are in the process of extending next-generation access to an increasing number of households, with superfast infrastructure currently passing around 60% of households.[101] Across the UK, 99% of premises have outdoor coverage from at least one operator.[102] EE have already received regulatory approval and repurposed some of their existing spectrum holdings, and offer fourth generation mobile services. Other mobile network operators are expected to deliver 4G services in 2013.

101 Ofcom, "Communications Market Report", 2012

102 Ofcom, "Communications Market Report", 2012

Annex C: Electronic Communications Code

The Electronic Communications Code enables electronic communications network providers to construct infrastructure on public land or to take rights over private land. The code was frequently cited throughout the course of our research as insufficient for dealing with subsequent issues.

Procedures related to the Electronic Communications Code are problematic, most notably because it can take too long to agree to terms and conditions, and disputes are resolved in different forms that aren't necessarily appropriate. Poor procedures and delays aren't just a problem for landowners and network providers, but for the public as well due to the delay of services. This industry moves so quickly that commercial pressures keep the network providers from addressing them, falling back on compensation, in turn affecting the price for consumers.

The Law Commission is reviewing the code as a part of the Government's wider review of UK communications framework,[103] with updated legislation expected in 2015. DCMS referred the review of the code to the Law Commission in September 2011, with recommendations expected by Spring 2013.

The Law Commission's consultation paper offers insight into the importance of electronic communications, and points out the need to recognise their benefit to society, much in the same way as other utilities. They state that they approach this project on the basis that there must be, where necessary, power for a network operator to install apparatus against a person's wishes in return for payment. The Law Commission states that the revised code will address the rights and obligations between code operators and landowners. It won't be able to take control over the time taken, but should facilitate a better process.

Some of the most notable issues up for review include balancing the rights of landowners and network providers (and third parties where necessary). The Commission is also looking at the obligations of network providers, financial awards involved, and when to give rights to a network provider when a landowner objects.

The Law Commission takes the point of view that it may be necessary in some cases to have legal means to compel landowners to grant access to their land – otherwise potential issues can arise of landowners refusing to grant access or holding out for payment at a 'ransom' level ("based purely on the value of the right to the code operator: it is linked to the level of profit which the Code Operator anticipates from the acquisition of the right and hence development of its network.").

The Commission point out that they spoke with various operators in this space who said they have a great deal of difficulty in agreeing access or price, and either end up abandoning the preferred route or paying an unrealistic price to the landowner. This is consistent with our findings. When we spoke with organisations in this space some suggested that landowners are used to people

103   The Electronic Communications Code - A Consultation Paper, Law Commission Consultation Paper No. 205

looking for access to their land, such as water, gas and electric companies. Although their attitudes are shifting towards seeing broadband as more similar to a traditional utility, landowners appear to have a different relationship with big telecommunications companies, and might see this process in terms of how much the companies have to gain. Some suggested that landowners are more willing to work with or are less hostile towards community broadband programmes.

According to the Law Commission, a need for standardised form agreements has been suggested to them, and this is reflected in the consultation document. However they note that it is not practical to propose mandatory forms of agreement, but a voluntary form could serve as a flexible starting point (e.g. NFU & CLBA with BT Openreach have worked on producing an agreed form of wayleaves). Broadband could potentially learn from the process of other utilities.

Electricity, gas and water providers can typically pursue two forms of powers – statutory easements and statutory wayleaves. These terms are not precise and are not always a helpful categorisation. Generally statutory easements are considered a non-ownership right through compulsory purchase legislation. Wayleaves are consent for a purpose rather than a property right, however the practical difference is difficult to determine. For example:

- Water providers may lay, inspect, maintain, adjust or repair pipes if reasonable notice is given to the landowner. Permission is not needed and there is no right held by the landowner to object to the works, but the Water Regulation Services Authority must investigate any complaints. There is no test to consider before a water pipe is installed, although a financial sanction not exceeding £5,000 may be applied if the water provider inappropriately exercises these powers or causes a loss or any damages.
- Electricity providers may apply to the Secretary of State for the grant of a wayleave where they cannot secure an agreement with the landowner. The overall process usually takes a minimum of one year, and carries uncertainty. However it does set out a test where the electricity provider must show it is necessary or expedient to install and keep installed an electric line through or over land.

The prevailing view noted by the Law Commission is that the financial award payable by electricity, gas or water provider following the acquisition of a new right is based on the value of the land or any damage caused (there are also cases where compensation for disturbance is provided).

The Commission has made a series of provisional recommendations. The following are some of the most integral to the conversations we had with those in this space:

- Code rights should include rights for network operators, including the right to install and maintain apparatus, keep it installed, and enter land for inspection.
- Street works should be incorporated into a revised code.
- A single entitlement to compensation for loss or damage to landowner's property.
- Code rights could be discussed early on, pending the resolution of payment disputes.
- A revised code should prescribe consistent notice procedures.

The Law Commission is expected to deliver its recommendations to government in spring 2013.

Annex D: Glossary

Bandwidth refers to measurements expressed in bits or multiples of bits per second, which represent the how much data is available or consumed in this particular amount of time.

Bit is the smallest unit of measurement of information on the internet.

Kbps – a kilobit per second or 1,000 bits per second, refers to the rate at which information is transferred

Mbps – a megabit per second or 1,000,000 bits per second

Gbps – a gigabit per second or 1,000,000,000 bits per second

Broadband – for this report we have defined broadband as an internet connection rated at 2Mbps down or faster. The term is sometimes used to mean internet access more generally

Superfast broadband – we have defined superfast as 24Mpbs downstream or faster, but superfast definitions generally vary

Ultrafast broadband – we have defined ultrafast as 80Mbps downstream or faster

Contention ratio is the number of people connected to an ISP who share a set amount of bandwidth

Dark fibre – fibre that is unlit/has no active equipment connected

Dial-up – is now the slowest method for connecting to the internet and works by having a modem dial the telephone number of an internet service provider

Dongle – a piece of hardware that plugs into a USB port

DSL – Digital Subscriber Line, which provides a broadband connection over copper telephone lines using frequencies unused by a voice call

ADSL – Asymmetric Digital Subscriber line, a type of broadband that uses copper telephones lines and provides faster download speeds than upload speeds

SDSL –Symmetric Digital Subscriber Line, broadband that uses copper

telephones lines and provides symmetrical speeds

VDSL – Very high bit rate Digital Subscriber Line, provides data rates up to 52Mbps downstream and 16Mbps upstream over copper wires. VDSL2 is able to provide data rates exceeding 100Mbps in both directions

FTTC – Fibre to the Cabinet is when fibre is laid as far as a street cabinet located within a particular distance of a premise. Copper (or sometimes coaxial cable) then provides the connection for the remaining distance to the premise

FTTH – Fibre to the Home refers to a residential fibre connection that extends to the customer's home

FTTP – Fibre to the Premise means that the fibre broadband connection extends to the end user location.

HTTP Hypertext Transfer Protocol (HTTP), which is the application for accessing the World Wide Web. It is the protocol used by web browsers and servers to communicate to one another

IP – Internet Protocol specifies how data should be arranged, moved and received over the internet

IPTV – Internet Protocol Television, which means television is delivered over the internet. This includes live television as well as catch up and on demand television

ISDN – Integrated Services Digital Network, like dial-up, provided a method for connecting to the internet over copper wires that is now largely obsolete, but can reach 128 kbps up and downstream

ISP – Internet Service Provider

Jitter is the difference between the minimum and maximum latency

Latency in addition to bandwidth, determines network connection speed. It refers to how quickly packets of data to move across a network connection

LTE – Long Term Evolution is a standard that is seen as the successor to previous mobile technology in order to provide faster data transfer speeds

MNO – Mobile Network Operator

NGA – Next Generation Access describes a significant upgrade to broadband in terms of speed and quality

Reliability/uptime – the uptime of a device, such as a server or router, refers to a measure of reliability, meaning how long can something run without

crashing or need to be rebooted

Spectrum – a frequency band or range, and in this case, specifically radio frequencies

TCP – Transmission Control Protocol delivers units of digital information from a programme on one computer to another

USB – a Universal Serial Bus is an industry developed standard for cables, connectors, etc. For example, a dongle uses USB standards to plug into a device.

Wifi is a contraction of "wireless fidelity", and is the common name for any "wireless local area network"

WiMAX Worldwide Interoperability for Microwave Access (WiMAX) is a wireless communications standard that although like WiFi, can cover a much greater area than a WiFi signal

3G – Third generation of mobile telecommunications technology, faster than 2G

4G – The fourth generation of mobile telecommunications technology, faster than 3G

Annex E: Organisations

We spoke and corresponded with a wide range of individuals and organisations in the course of our research. This included the organisations listed below; we also spoke to a number of individual experts in a personal capacity.

- Arqiva
- B4RN
- Broadband Stakeholder Group
- BT Group
- Cabinet Office
- Coadec
- Consumer Focus
- Countryside Alliance
- Department for Business, Innovation and Skills
- Department for Communities and Local Government
- Department for Culture, Media and Sport
- Department for Environment, Food and Rural Affairs
- Department for Transport
- EE
- Facebook
- Fujitsu
- Go ON UK
- Google
- HM Treasury
- Hyperoptic
- Intellect
- London Business School
- Mobile Operators Association
- National Farmers Union
- O2
- Ofcom
- Sky
- TalkTalk
- Three UK
- Virgin Media
- Vodafone
- Which?

The internet has had a huge positive impact on our lives, and there is no doubt that the next generation of superfast broadband technologies, both fixed and wireless, will make a significant contribution to the economy.

The government has a number of measures in place to help support better broadband, with a view to extending superfast broadband availability to the majority of the population and basic broadband availability to everyone by 2015. Looking further ahead, this report argues that the emphasis must be on sustaining effective competition, providing flexibility for infrastructure deployment, and ensuring consumers and businesses alike have the capability to get the most benefit from connectivity.