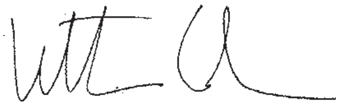
Developing Government objectives for broadband

Welcome

I hope you enjoy our tenth Vodafone Policy Paper. Our aim in these papers is to provide a platform for leading experts to write on issues in public policy that are important to us at Vodafone. These are the people that we listen to, even if we do not always agree with them. These are their views, not ours. We think that they have important things to say that should be of interest to anybody concerned with good public policy.

Vittorio Colao, Chief Executive, Vodafone Group



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Richard Feasey

Introduction

The recent global financial crisis has seen an increase in intervention by public authorities in many areas of activity we had previously thought reserved for the private sector. Telecommunications markets have been no exception. The past few years have seen policymakers committing billions of euros (and billions of dollars) of taxpayers' money - if not yet actually spending it – towards the funding of new telecoms infrastructure, particularly high speed broadband networks. These funds are intended not only to deliver short term stimulus and create jobs, but also to lay the foundations for future competitiveness, sustainability and social cohesion. Such aims are shared by most policymakers (and by many in industry). Achieving them has meant that Governments are now more directly engaged in telecommunications markets than at any time since privatisation swept the world almost twenty years ago.

The initiatives taken by Governments around the world have not, however, been informed by a common view about how or where public funds should best be allocated. Policymakers appeared to be setting a range of different targets with very different aspirations in terms of the coverage, speed and timing of the networks they proposed to support. This implied either that each country had very different conditions which justified very different goals or, more plausibly in our view, that there was really no analytical underpinning for the way in which most of these targets were being set. We therefore asked Ingenious Consulting to think about what such an analytical framework might look like, and to assess some of the existing schemes against their benchmarks.

Ingenious find that there is a strong case for using public funds to extend basic broadband infrastructure – ADSL or possibly wireless – to as much of the population as possible. This suggests that there may be a case for a 'Mobility Fund' to extend wireless coverage, as the FCC's much anticipated National Broadband Plan is expected to propose or as the Irish Government have implemented. However, Ingenious find that the case for public funding of higher bandwidth fibre to the home or fibre to the curb is much less clear. Policymakers would need to make implausibly ambitious assumptions about the public benefits, or externalities, associated with very high speed broadband networks to justify the level of public subsidy which is proposed, for example, by the Australian Government today.

Given the difficulty of making a case for wide public intervention to support fibre if there is already extensive basic broadband deployment, we were also interested in how public resources had been used, or could be used, to boost demand over those networks that already exist. Our hypothesis was that Governments can do a lot to stimulate demand amongst groups who have so far proven immune to the marketing activities of private firms. If demand could be expanded in this way, then the prospects for further investment on the supply side might also improve.

We asked Plum to assess which Europeans used the internet today and what might be done to get more of them using it in future. This kind of work has been done by some agencies – most notably the FCC in their very comprehensive Broadband Plan preparations – but not by others. We also wondered whether previous Government attempts to boost use of the internet could teach us anything about how public funds should be applied – or not - in future. The results here are worrying. A great deal of public money has been spent on what we might loosely call demand side initiatives in Europe but Plum find that much of it appears to have been wasted. Notable exceptions include Portugal's initiative to increase student adoption of the internet in schools and at home.

Plum are optimistic about the prospects for increased internet adoption in Europe as innovation by the private sector continues to break down many of the remaining barriers to adoption. But we should be worried about anyone under 25 in Europe who does not use the internet today. Almost half of these are to be found in Italy. There are also over 30 million adults between 25 and 55 who are more evenly distributed across Europe, some of whom will not use the internet until 2018 without some form of additional assistance. Plum suggest how European Governments might use public funds to bring forward this date.

These papers do not provide country by country recommendations for Governments. But they remind us that having a clear analytical framework and a good understanding of what the existing data tells us is a good basis from which to begin to set ambitious targets or to decide how to allocate large sums of taxpayers' money.

These papers present the key findings arising from the work of Ingenious and Plum but do not include extensive annexes which accompany both documents. These are available at http://www.vodafone.com/start/misc/public_policy.html

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Optimal Investment in Broadband : The Trade-Off Between Coverage and Network Capability

Executive summary

Governments around the world are announcing and implementing substantial plans to support high speed broadband roll-out. However, in many countries there is little evidence that these plans are based on a thoughtful consideration of the pros and cons of different potential market interventions, and certainly the plans are widely divergent in their scale and objectives.

Given the multi-billion Euro sums being spent on these projects, we believe an analytical framework to support decision making in this area could be highly valuable. This paper seeks to provide such a framework.

The decisions are undoubtedly complex. While costs can be relatively accurately assessed, consumer demand for higher speed is far less certain, and the associated externalities are even harder to quantify (though many government investment plans are based on the idea that they will be significant)[1]. Moreover, given that most countries now have relatively wide availability of standard broadband, any rationale for high speed investment must consider the incremental benefits and costs, not the absolute benefits and costs.

Nonetheless, we believe these decisions can be usefully supported by quantitative analysis. Core to our work is a flexible model allowing for assessment of the incremental benefits of broadband investment, by technology, country and region.[2]

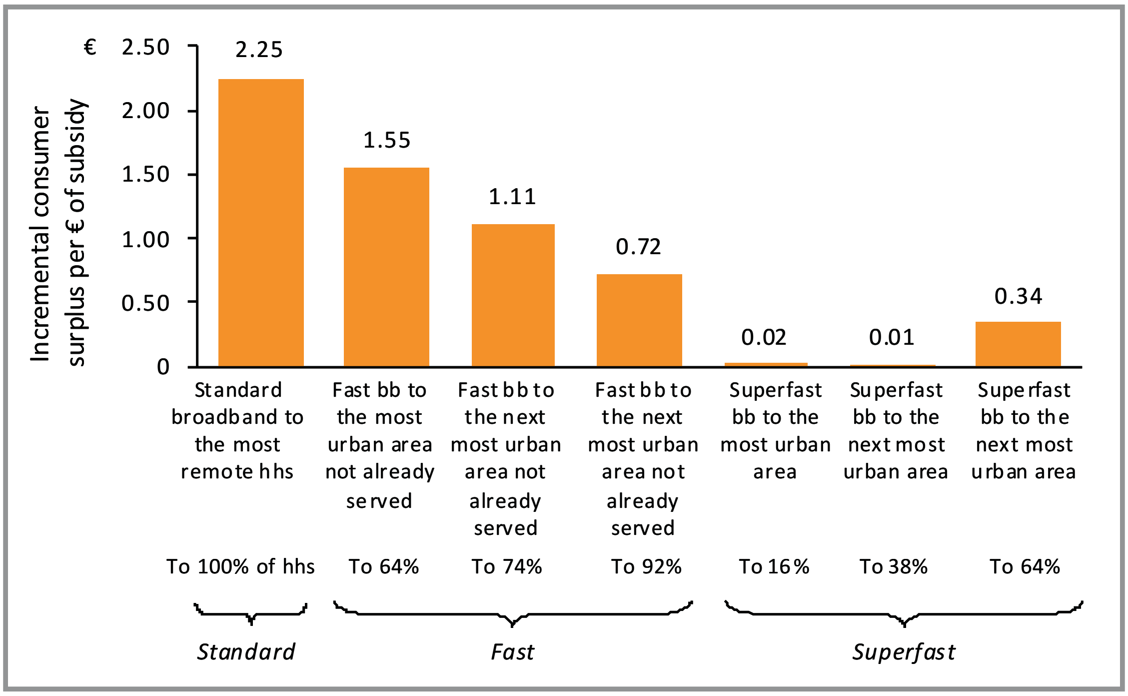
areas would be more effectively employed in encouraging deployment of fast broadband services in areas not already served (starting with the most urban, to 64% coverage).

Of course, this analysis ignores the impact of externalities. The question of which approach has the greatest overall societal benefit therefore depends on your perception of the value of externalities under each option.

Our analysis also explores the scale of the externalities required to justify current broadband deployment plans in a range of illustrative countries, ranging from Australia's commitment to 90% superfast deployment to Germany's subsidised roll-out of standard broadband to 100% coverage. We focus on the remotest region planned to be covered, since the greater expense here will require the most optimistic view of externalities. illustrates these results.

Policies for ubiquitous standard broadband in Italy, the UK and Germany can be justified based on the increased consumer surplus alone (which more than offsets the producer deficit). At the other extreme, Australia's ambitions for 90% coverage of superfast FTTH broadband means that the *incremental* externalities of superfast broadband would need to be around €90 per

Figure 1 : Relative effectiveness of each € of subsidy for a range of deployment options based on expected UK infrastructure [4 5]



Our analysis focuses on three types of broadband technology: standard (up to 15 Mbps download), fast (up to 50 Mbps download) and superfast (over 50 Mbps download)[3]. We consider the incremental costs and benefits of each, acknowledging that the trade-offs are complex. For example, there are a range of local market differences including variations in the 'counterfactual' (the likely broadband infrastructure in a given country absent intervention), uncertainties exist over consumer demand and there are severe difficulties in modelling externalities.

Our analysis allows us to consider the relative merits of a range of deployment strategies. For example, based on assumptions for the UK, we can contrast sudsidising the deployment of standard broadband to the final group of households (and achieving 100% coverage), subsidising fast broadband to areas where BT and Virgin do not already supply, and subsidising superfast broadband to the urban core. below illustrates the relative effectiveness of each approach in terms of the value of consumer benefit realised per € of subsidy.

Based on our assumptions, the most effective approach (before considering externalities) is to extend the coverage of standard broadband to the final 3% of households. For each €1 of subsidy, €2.25 of incremental consumer value is created.

Given the existing provision of fast broadband services in the urban core, the case for investing in superfast broadband services in these regions is very weak. Competition from existing services reduces the number of customers for superfast broadband, and moreover reduces the incremental consumer value for those customers. Therefore, any remaining subsidy after supporting standard broadband in the most remote connected household per month to justify a roll out this extensive.

A fundamental issue when assessing broadband policy is therefore the value of the *incremental* externality resulting from network deployment.

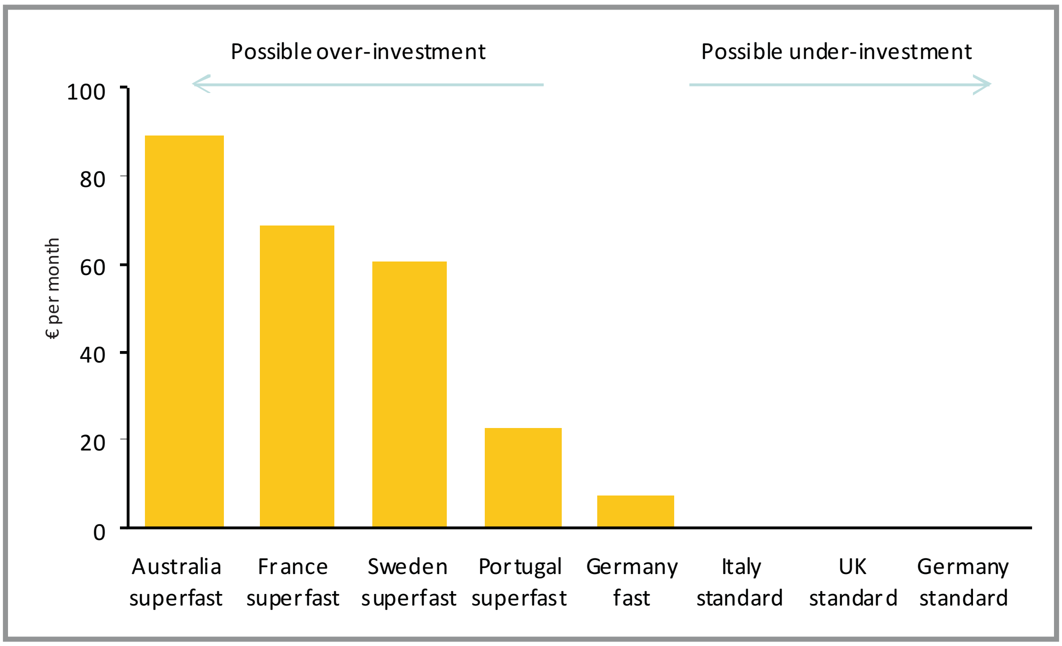
By considering different levels of incremental externality, we can estimate the potential loss from some of the more aggressive broadband policies. For instance, if you believe the incremental externality of superfast broadband is €10 per connected household per month, then France's proposed roll-out of fibre to 70% of the population could lead to annualised loss of over €3bn, compared to a plan focused on regions where the benefits exceeded the costs.[6]

Note that we are not suggesting that the policies of countries such as France are in aggregate value destructive, only that the extent of the proposed roll-out is such that in the more rural areas covered, the cost is likely to far exceed the benefits, and thus a more limited roll-out would be much better. In more rural areas, a government must believe in extremely high incremental externality benefits to justify current plans.

Overall, our analysis suggests that a range of general lessons can be drawn:

- There is a strong case for subsidising the roll-out of standard speed broadband to all households, and generally this should be the first priority for governments (subject to any market specific issues)
- If funds are still available thereafter, there is also a case for subsidising fast FTTC[7] or cable broadband (in those areas where the market is not already providing). However, in areas with lower population

Figure 2 : National broadband plans – incremental externalities per month per connected household required to justify proposed investment in remotest region covered



density the case becomes highly dependent on the incremental externalities of fast over standard broadband

- The case for subsidising superfast (FTTH or FTTB[8]) broadband is weaker. To believe it can create greater societal value than fast broadband requires an aggressive assumption about incremental externalities of superfast over fast broadband, but even then the societal benefits will be much less evenly distributed
- Geography is an important consideration in broadband policy. In some regions, the market is likely to deliver without intervention. In other areas, there are clear arguments for government subsidy. In many of the most rural locations, the case for subsidy of superfast broadband deployment is weak unless aggressive assumptions are made about the value of externalities. Despite this, regional targeting is, at best, peripheral in many centralised broadband policies. We suggest it should play a greater role.

We recognise that this paper is only a small first step towards a more rigorous framework for decision making, and we would welcome your comments.

We would like to thank Vodafone for their funding of this work. However, the views and opinions expressed in this study are solely those of the authors and do not necessarily reflect the views and opinions of Vodafone.

Introduction

Governments around the world have been announcing ambitious plans to support broadband investment. However, there is no consensus on the focus of these plans. Some governments have emphasised high capacity connectivity. Others are more concerned with assuring the availability of basic broadband to the greatest number. Some countries have announced twin targets of both: increasing network capability and broadband access.

The expenditure involved in deploying broadband networks is significant and therefore even the wealthiest countries must make trade-offs between depth of coverage (the proportion of the population with access) and network capabilities (access speed, technology, latency, etc.). However, to date the process by which governments have made these trade-offs might generously be described as opaque. There is often little or no discussion as to why a particular broadband plan has been chosen over the almost endless range of alternatives. Indeed in some cases policy makers have actively rejected applying cost-benefit analyses.[9]

There is no question that the issues involved are complex, and that there are gaps in relevant data (for example, the incremental benefits to society of higher speed broadband). However, the sums being put at risk by broadband are far too large to be spent without rigorous consideration of the alternatives. Therefore the ambition of this report is to provide an analytical framework that policy makers can use to inform the debate.

At the heart of our analysis is a quantitative model which estimates the value created for consumers and providers of broadband services in a range of scenarios. We do not aim to provide a definitive answer as to the 'right' form of broadband subsidy and the manner in which infrastructure should be deployed. Rather, we seek to explore the trade-offs between different broadband investment approaches in a quantitative manner.

Specifically, we have sought to develop a framework which will allow us to understand:

- The trade-offs between depth of coverage and network capabilities, including speed;
- How these trade-offs are affected by country-specific variables;
- The appropriateness of current broadband policy; and
- The questions that should be asked by governments, regulators and investors when developing a coherent and socially beneficial strategy for broadband deployment.

In the report we note the importance of different geographic regions, and make reference to different 'geotypes'[10].

Broadband and government policy

Many governments have stated their intent to stimulate the provision, or directly provide, fast and superfast broadband networks. However, the details of these plans vary significantly between countries.

Types of broadband infrastructure

One question for governments is which type of broadband technology they wish to support. Governments frequently articulate this in terms of a particular speed.[11] However, given significant discrepancies between headline and actual speeds, and differences in upload and download characteristics, reference to speed alone can be ambiguous.

In practical terms, the decision is to invest in a particular technology rather than a specific speed. Therefore, in this report we refer to the type of technology, and the speed and characteristics of that technology, rather than simply the headline download speed. We consider three categories, 'standard', 'fast' and 'superfast' broadband:

- **Standard** broadband is capable of achieving access speeds of up to 15 Mbps download and 1.5 Mbps upload. It includes both wireless (e.g. 3G, 4G) and wireline technologies, the most notable fixed technology being asymmetric digital subscriber line (ADSL), currently the most widespread form of broadband. Although ADSL connections can theoretically achieve higher download speeds of up to 24Mbps, actual speeds are generally considerably lower than this.[12]

- **Fast** broadband is capable of achieving download speeds of up to 50Mbps and upload speeds of up to 10Mbps. Key technologies includes fibre to the cabinet (FTTC) and cable. FTTC involves laying fibre-optic cables to street cabinets typically located within a few hundred metres of the customer premises. Households are then connected from the cabinet by copper lines. Cable networks often have a similar architecture, with fibre to the cabinet and coax cable from there to the home. FTTC and cable speeds are higher than ADSL, but are often not fully symmetric and are determined, in part, by a household's distance from the cabinet.

- **Superfast** broadband connections can achieve upload and download speed of over 50Mbps. Main technologies include fibre to the home (FTTH) and fibre to the building (FTTB), which involve laying fibre-optic cables directly to the customer premises, either through a gigabit passive optical network (GPON) or point-to-point fibre (PTP). FTTH and FTTB connections typically allow the highest speeds, lowest latency, greatest reliability and truly symmetric connections when contrasted against FTTC and ADSL.

While our discussions of broadband networks primarily related to wireline networks, wireless technologies (mobile, fixed wireless and satellite) are increasingly prevalent means of broadband delivery.[13] For example, the Irish government has awarded a contract to Hutchison 3G to provide broadband to the final 10% of population through a hybrid wireless/satellite approach.[14]

Policy objectives

Some governments focus on supplying high capacity superfast broadband for a proportion of the population, whereas others stress the importance of ubiquitous broadband at lower speeds. For example, Germany intends to reach its entire territory with a 1Mbps service and 75% coverage of the country with a 50Mbps service. The United Kingdom has set a target of 2Mbps for ubiquitous access and expects a 50Mbps services to be deployed to around 40% of the country. Australia has stated its ambition to provide high speed 100Mbps services to 90% of the country.

As might be expected given the different objectives, the level of planned government spend also varies significantly. At one extreme, the government of Australia has announced plans for a superfast broadband network costing A$43bn/€28bn (with the government to provide at least A$4.7bn), estimated to take more than eight years to build and requiring roughly 25,000 full-time workers. Conversely Germany, with a population roughly four times as large as Australia's, is planning to spend €150m, or roughly 5% of Australia's minimum subsidy.

below illustrates the disparity in policy objectives (and plans of commercial operators). Further detail on broadband policy by country (and sources) is provided in appendix A.

Manner of intervention

The manner of government intervention also varies. In some countries, governments are providing direct financial assistance. In others, intervention focuses on encouraging consumer demand. Elsewhere, more market led approaches have been adopted, facilitated by a regulatory framework which seeks to develop competition, encourage efficient investment in infrastructure and ultimately let market dynamics decide.

In Europe EU restrictions on state aid (put in place originally to prevent national governments from using their funds to aid local industries in contravention of the single market) has constrained intervention. There has been an emphasis either on underserved populations or on company- and technology-neutral public tenders.

Table 1: Summary of planned investment in broadband infrastructure by country

Country	Investment plan
Australia	Superfast FTTH broadband to cover 90% of the country over the next eight years
Austria	Universal coverage of 25Mbits by 2013
Belgium	Cover 80% of the population by 2011 with a fast FTTC (VDSL2) broadband network
Brazil	As of Aug 2009, the telephony carriers stated that they aim to deploy broadband to 150m people (75% of the population) by 2014 if the Brazilian government updates regulation in their favor
Canada	Broadband of at least 1.5Mbits to as many of the currently unserved and underserved households as possible
Denmark	Universal broadband access (of at least 2Mbits) by the end of 2010
Finland	Universal coverage for all permanent residences, businesses and government bodies with an average download rate of 1Mbits by 2010, and superfast networks permitting 100Mbits connection to 99% by 2015
France	Ambitions for 100Mbps superfast broadband to cover 70% of households by 2020 Universal broadband access by 2010, with minimum broadband speed has been designated at 0.5Mbps
Germany	The government's Broadband Strategy adopts a two-step strategic goal, with universal availability of at least 1Mbits by the end of 2010 (based on a mix of technologies), and availability of 50Mbits to 75% of households by 2014 (50% of households with fast FTTC (VDSL) service and 25% with superfast FTTH)
Greece	Over the next seven years the network is intended to reach 2m (c. 52% of all households) homes with a superfast FTTH 100Mbits service
Hong Kong	Superfast FTTH has already reached virtually 100% of residential buildings
Japan	The 2008 "Strategy on the Digital Divide" seeks to provide universal broadband coverage based on a mix of technologies The incumbent, NTT has pledged to provide superfast FTTH service to 30m users (24% of the total population) by 2010
Netherlands	Currently has close to 100% coverage Aims to achieve the highest broadband penetration rates in the world by 2010
New Zealand	The government's goal is to accelerate the roll-out of superfast FTTH broadband (50-100Mbits) to 75% of households 97% percent of households and enterprises should be able to access fast broadband of 5Mbits or better
Poland	Goal is to ensure that 100% of households and businesses are within the coverage of broadband infrastructure by 2013 or 2014
Portugal	Aim of the latest programme is for 1.5m homes and businesses to be connected to new fibre networks
South Korea	KT is required to provide broadband access of 1 Mbps or higher to all homes in villages (presumably allowing for near universal coverage) The Korea Communications Commission has committed to a national superfast FTTH broadband network offering speeds of around 1Gbits by 2012 on the fixed-line network and 10Mbits on wireless broadband
Slovak Republic	Goal is to achieve the level of coverage available to developed European countries by 2014 Broadband speed target of 2Mbits (symmetrical)
Sweden	40% and 90% of households and businesses to have access to broadband at minimum speeds of 100Mbits by 2015 and 2020 respectively
Switzerland	Currently has near universal standard (ADSL) broadband coverage In 2008, Swisscom announced plans to bring FTTH to 100,000 homes by the end of 2009
United Kingdom	Universal 2Mbits broadband to all citizens by 2012 based on a mix of technologies BT announced plans to build a fast broadband network covering 40% of UK households by 2012
United States	FCC's national broadband plan includes an initiative to equip 100m households (c. 85% of all households) with 100Mbits service by 2020 FCC also aims to improve broadband coverage in unserved and underserved areas

Pricing regulation is another important aspect of intervention. While examples of geographically de-averaged prices are rare, in Finland regulation around price discrimination has been relaxed as a method of stimulating roll-out.

The lack of a clear decision making framework

There are a number of reasons why we would expect government broadband policy to vary: local market considerations including the existing fixed infrastructure, the likelihood of commercial provision, consumer demand for fast and superfast broadband technologies, topography, laissez-faire or interventionist government philosophy and so on.

However, the wide variation in policies suggests that there may a further reason: a lack of a structured approach for making policy decisions. In the remainder of this report, we introduce such an approach and assess various national policies through this prism.

A framework for assessing broadband policy

Investment trade-offs

Broadband investment covers a number of dimensions and even the most affluent of nations are likely to need to make trade-offs between them. These dimensions include:

- **Coverage**, with costs per household passed generally increasing with roll-out
- **Speed**, driven by both the underlying technology (standard, fast, superfast) and network characteristics (network architecture, distance from the exchange, etc.)
- **Take-up**, often achieved through demand side stimuli (training, awareness, pricing subsidies, etc.)
- **Mobility**, with wireless networks increasingly viable as a means of broadband delivery

There is little evidence that broadband policy is being based on a thoughtful consideration of the trade-offs between these investment alternatives. Given the multi-billion Euro sums being spent by governments on broadband projects, we believe an analytical framework is needed to support decision making in this area. We have therefore developed a quantitative model which focuses, in particular, on the first two of the above dimensions: coverage and speed (proxied by network type).

Overview of the modelling approach

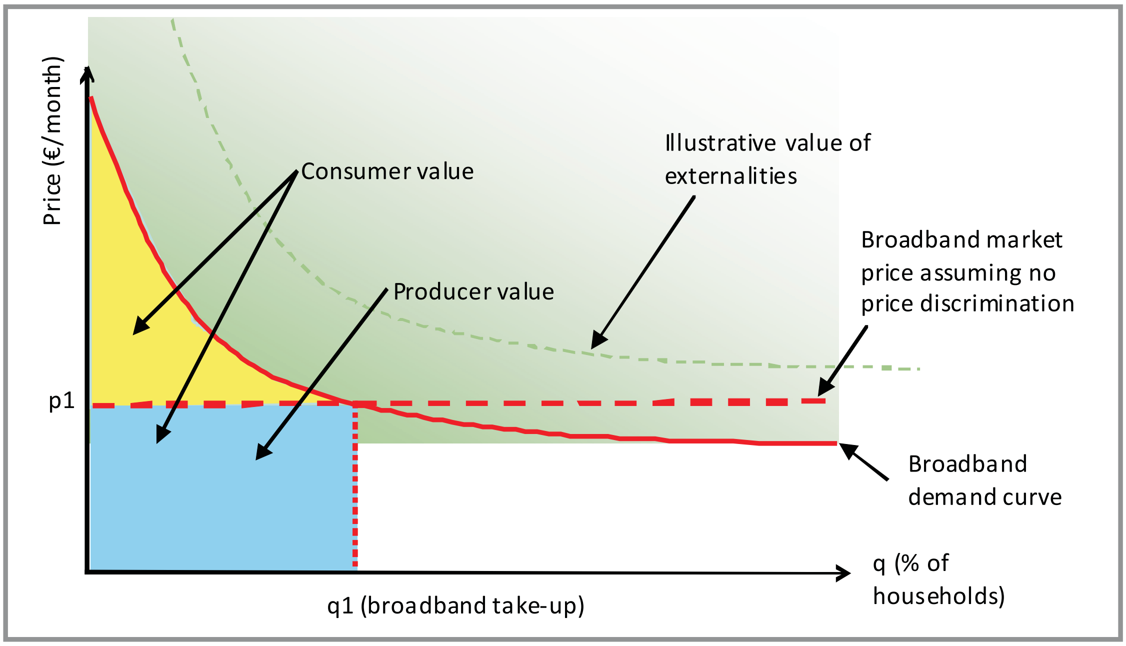
To develop a practical framework for assessing broadband trade-offs, we have considered the value of broadband against the classical economic concepts of consumer value, producer value and externalities. These are illustrated below.

Consumer and producer value are the most direct measures of economic benefit from the consumption of broadband. The (limited) set of literature exists which measures these types of value[15] forms the basis of our analysis of consumer and producer value.

It is generally believed that broadband has significant positive externalities, and indeed this is a critical underpinning assumption for the consensus that government intervention to support broadband may be justified. Positive externalities are represented (illustratively) by the green shaded area above the broadband demand curve. Positive externalities brought about by different types of broadband may include the following:

However, it is worth noting that not all externalities associated with high speed broadband are necessarily positive. Some have pointed to the increased carbon emissions likely to result from deployment, and others have posited that high speed networks will increase digital content piracy. Plum for BSG (2008) also note

Figure 3 : Illustrative value created by broadband



negative externalities associated with intervention itself: *"if public funds rather than voluntary user payments are used to fund next generation broadband, then an additional cost is incurred in terms of the economic cost of raising taxes"*.

Externalities associated with broadband are hard to measure and there is no quantitatively rigorous, comprehensive estimation of the value of the externalities from broadband, particularly when considering the *incremental* value of externalities relating to fast and superfast broadband. Thus any point-prediction of the value of externalities associated with particular broadband coverage and network capability will be subject to a large degree of uncertainty.

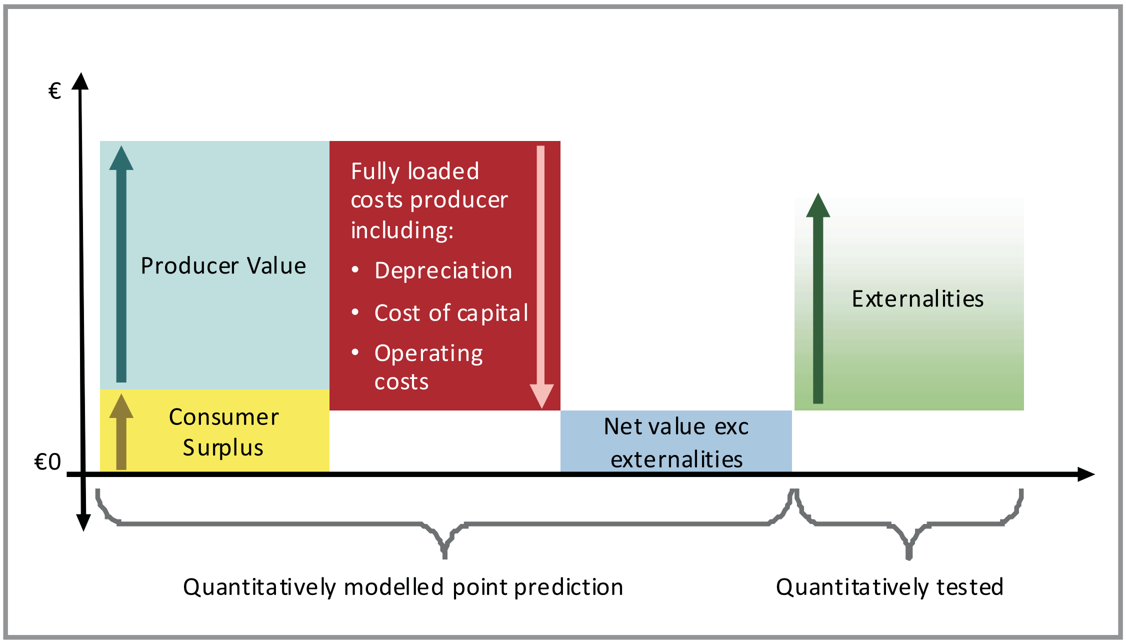
Our modelling approach is therefore to:

- Quantitatively focus on estimating consumer and producer value / surplus, where a more consistent body of quantitative literature exists
- Discuss the scale of externalities that would be required to materially change the conclusions, drawing on existing research to assess the likelihood of this outcome

Figure 4 : Sample externalities

Societal value	• Improvements to education such as greater collaboration • Improvements to health services such as remote diagnostics • High definition video communication and collaboration • More effective energy usage, reduced travel and lower power consumption • Improving economic participation among the elderly and disenfranchised
Productivity improvements and efficiencies	• Cloud computing and efficiencies not reflected in private demand curves • Freeing of resources (e.g. IT support staff) which can be employed elsewhere in the economy • eGovernment and migrating administrative functions online • Improved business connectivity
Innovation	• New services enabled by high speed BB critical mass

Figure 5 : Overview of modelling approach adopted



This approach is illustrated in below.

The model performs the above calculation for each of 8 geographic regions (geotypes) in the country in question. Broadly speaking, if for a given geotype the producer value is greater than the costs (that is, the producer surplus is positive), then that geotype will be served by commercial players without the need for intervention.

If however the producer surplus is negative (i.e. producer value is less than costs) but the net value is positive, then a subsidy may be needed to support roll-out, but that subsidy can be justified purely on the basis of private value. This is the case illustrated above, where total value is greater than costs, but producer costs are greater than producer value.

Note that we do not imply that as a general rule governments should intervene purely to create consumer surpluses; rather, we believe that the risk of intervention is much less when its cost is exceeded by such surpluses, before bringing into account externalities.

If the net value is negative, a subsidy may still be justified, but a government would need to believe firmly in the value of sufficient externalities to offset the negative net value.

Scope of the modelling approach

We do not seek to provide a definitive answer to the value of broadband and the manner in which infrastructure should be deployed; rather, we aim to provide a framework to inform policy debate. A full discussion of the approach is provided in the appendices to this report.

The model estimates the incremental value created for consumers and providers of broadband services under a range of scenarios relating to coverage and technology. The model also allows us to explore the relationships between other variables, in particular country-specific factors such as pricing, penetration and geographic profile. The costs and benefits of broadband roll-out in a country will depend on such variables, and our model takes these into account where possible.

Analysis and findings

In this section we explore the case for any government intervention, how intervention should be targetted (particularly in terms of higher speeds vs wider coverage) and how our analysis compares to actual government plans.

The case for government intervention

Much of the discussion of the value of higher speed broadband compares *total* costs and benefits. However, the critical question for a given government intervention is whether the *incremental* gains from the investment (the value derived from the upgrade to the base case network in the 'counterfactual') exceed the associated incremental costs. Put another way, even if the total benefits (as measured by aggregate consumer and producer value) exceed total costs, this says nothing about whether society gains, as the project's incremental benefits (over the counterfactual) might be less than its incremental costs. This therefore requires us to develop a robust understanding of what the market will deliver by itself.

A new infrastructure provider is unlikely to deliver widespread high speed broadband without intervention

The cost of deploying broadband varies significantly within a country. More remote and less dense areas will be more expensive to serve than urban, highly populated regions. Given that broadband prices are generally flat nationwide, this means that returns for higher speed broadband investment fall rapidly outside urban areas.

For instance, based on an Australian profile of household mix by geography, there is unlikely to be a significant commercial motivation for a *new* infrastructure provider to invest in widespread roll-out of fast or superfast broadband (note that we discuss the comparative incentive for an incumbent provider in the following section). This is illustrated below.

A positive producer surplus (expected revenue from the sale of broadband access services less costs) exists only in first three geographic areas (or, geotypes 1-3), which represent approximately 30% of households. For the remaining 70% of households (geotypes 4-8), the producer surplus is negative.

In European countries with less population living in dense urban areas, such as Sweden and France, the case for extended roll-out is similarly weak. In these countries, a direct commercial incentive exists for less than 20% of households.

We note that in Sweden and France the availability of fast and superfast broadband is already higher than that predicted to be delivered by the model in 2020 (currently 21% and 16% respectively). However, this has been driven by a combination of government intervention, historical artifact and non-financial drivers, rather than the existence of direct commercial incentives. In France, for example, superfast (FTTH) roll-out by non-incumbent operators such as Iliad and NeufCegetel has been fuelled by the bundling of higher value IPTV services with broadband access in urban

Figure 6 : Market incentives to provide high speed broadband for a new monopolist infrastructure provider in Australia (2020)[16]

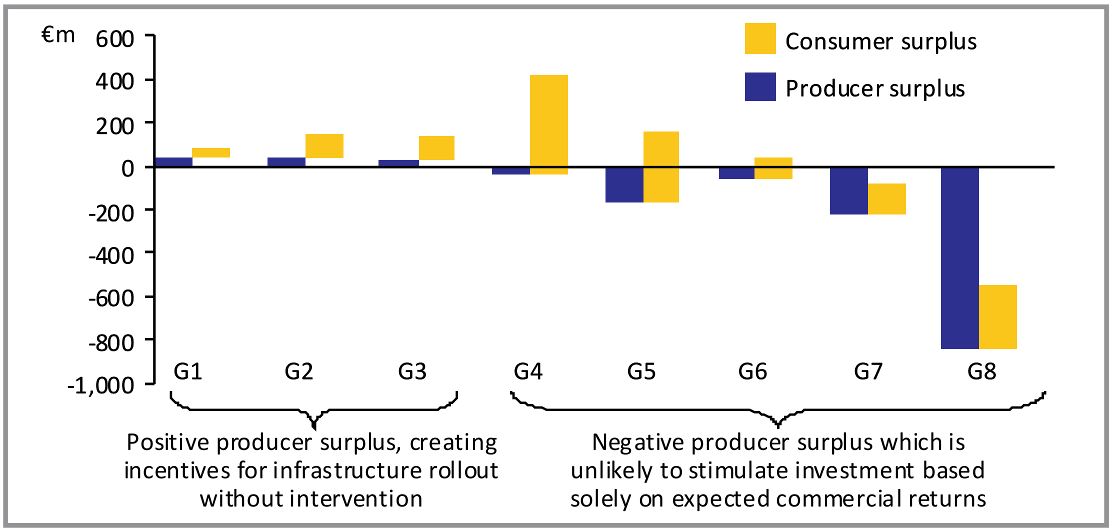
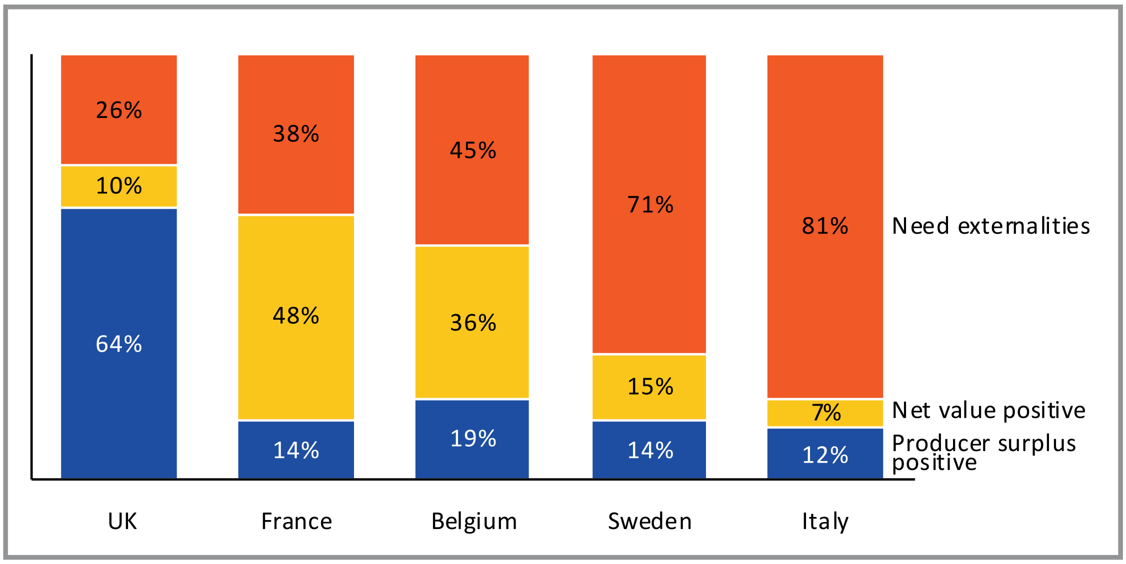


Figure 7 : Market incentives to provide high speed broadband for a new monopolist infrastructure provider in various EU countries – percent of population (2020)[17]



areas. In Sweden, innovative municipality-sponsored roll-out schemes have subsidised open access superfast networks in towns such as Västerås.

We should note that this result is dependent on certain assumptions that may be optimistic:

- That the new entrant has a broadly similar cost base to the incumbent, and in particular has access to ducts on favourable terms
- That the new entrant can rely on no competitive response from the incumbent (duplicated high speed networks would significantly reduce the new entrant's returns in geotypes 2 to 3)
- That the moderately positive returns available are sufficient to justify the capital put at risk (though note that a cost of capital has been included).[18]

Thus overall it seems unlikely that, without intervention, roll-out would go beyond the first three geotypes, and indeed could be appreciably narrower. A new infrastructure provider is unlikely to deliver widespread roll-out of fast or superfast broadband based purely on commercial incentives.

Incentives for investment are extremely weak for incumbents

The incentives for widespread deployment of high speed broadband are weak for new infrastructure providers, but are even weaker for incumbents who already operate standard speed broadband networks. For these incumbents, roll-out of high speed broadband services to areas already served by standard speed broadband will result in cannibalisation of revenues, further eroding incentives to invest (unless, of course, a third party is already threatening those standard broadband revenues by building its own fibre network).

This is illustrated in figure 8 below. Based on a Portuguese geographic profile and infrastructure, an incumbent will realise a producer surplus of around €472m per annum through its standard broadband network. Given costs of deployment and cannibalisation of revenues (either wholesale or retail), providing a fast broadband network will erode this surplus, even at a price premium.

For example, if the incumbent were to deploy a fast FTTC network in geotype 1, producer surplus would fall by around €18m per annum. If an incumbent deployed fast broadband to the whole country, the model suggests that producer surplus would fall by €285m per annum, or 60%.

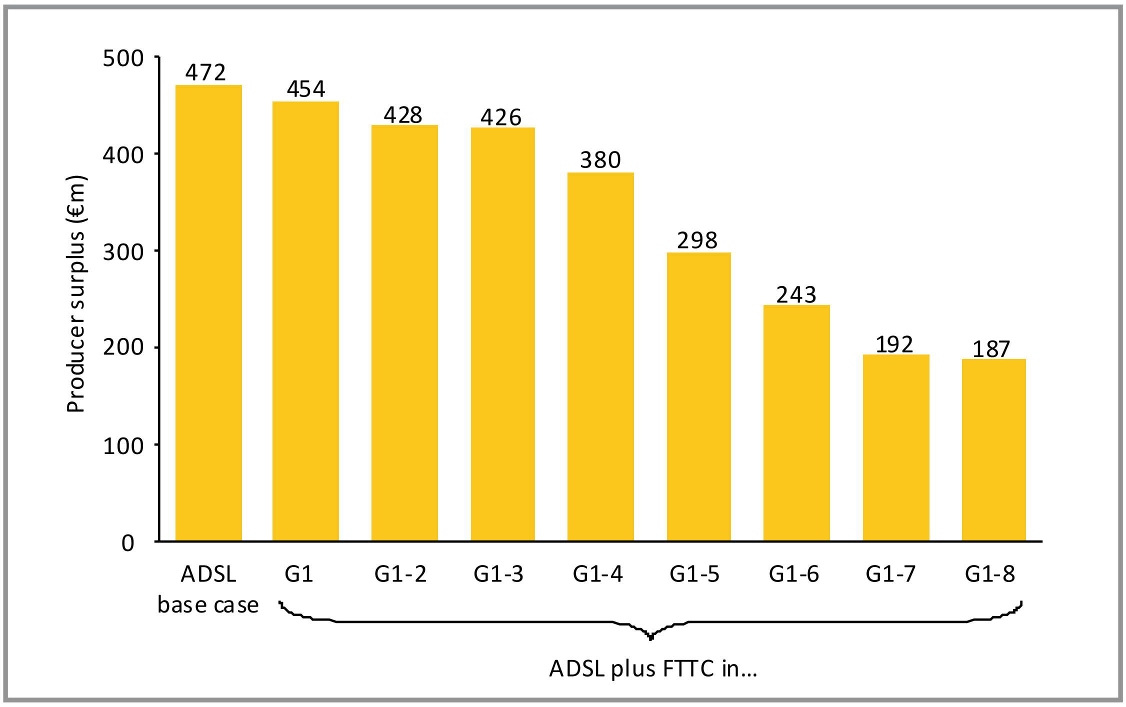
Contrast this to the results in , where a market incentive for a new entrant exists to provide fast broadband to 26% of households. The incentives for a new entrant are greater than for an incumbent as they will not be concerned with cannibalisation of standard broadband revenues.

Indeed, the very presence of incentives for a new entrant may result in deployment of competitive high speed broadband networks for the most urban regions. This has certainly been the case in countries such as the UK, where Virgin Media have deployed fast cable networks in the first two geotypes, in part to cannibalise revenues from the incumbent BT. BT has attempted to counter the threat by announcing its own plans to deploy a fibre network (to a broadly similar geographic footprint).

The benefits of copper switch off will help the deployment of broadband, but initially only in urban areas

Commentators have pointed to the benefits of copper switch off (CSO) as an incentive for upgrading

Figure 8 : Producer surplus from fast FTTC broadband deployment, versus base case in Portugal[19]



broadband networks. Migrating all consumers to a high speed (fibre) network and switching off the standard copper network would allow an incumbent to enjoy reduced operating costs and release value from the copper itself, land and buildings.

Based on our analysis, a monopolistic incumbent in a country with, say, a Portuguese topography will have no direct commercial incentives to invest in *parallel build* of a superfast broadband network. This is illustrated in below, where the incremental producer surplus for parallel build is negative for all geotypes.

If the benefits of CSO are taken into account, and consumers are migrated to the new high speed network on a geotype by geotype basis, the commercial incentives for the incumbent improve. However, the improvement is sufficient to flip the producer surplus positive only for geotype 1 (11% of households in Portugal). In this most dense region an incumbent may be incentivised to roll-out superfast broadband and to transition customers onto a superfast network, but elsewhere the prospect of CSO is insufficient to turn the fibre business case positive.

Competition from multiple networks is likely to adversely impact on total value

Multiple providers within a geographic region are likely to erode aggregate producer surplus, since network duplication provides additional cost without direct additional value for the providers. (Note that we have not sought to quantify the impact of competition leading to greater adoption through, for instance, greater marketing). This is illustrated in below, based on Germany's geographic profile.

Fast broadband roll-out generates a negative producer surplus for all geotypes even if there is only a single fibre network, but that loss increases significantly if a second network is added. Put another way, the necessary subsidy to incentivise fast broadband roll-out would be much larger.

Of course, in most circumstances it is axiomatic that more competition will ultimately lead to a better outcome for consumers. However, if the effect of competition is to create or increase a negative producer surplus, then in this context it simply increases the subsidy necessary to enable roll-out. Moreover, regulators with an eye to the long term should be seeking to maximise consumer *and* producer surplus, not just the former.

In different ways, Australia and Singapore's broadband plans recognise the impact of competition on potential fibre roll-out, essentially by creating (to a greater or lesser extent) de-facto monopoly providers of infrastructure, with retail providers riding on top.

Given the lack of clear market incentives, government subsidy may be required to stimulate deployment

Government policies broadly fall into the two main categories: supply side and demand side policies. Our focus in this report is on the supply side - where governments invest in infrastructure or tailor their regulatory action so as to improve provision.[22]

Figure 9 : Change in producer surplus with and without the benefits of CSO (Portugal)[20]

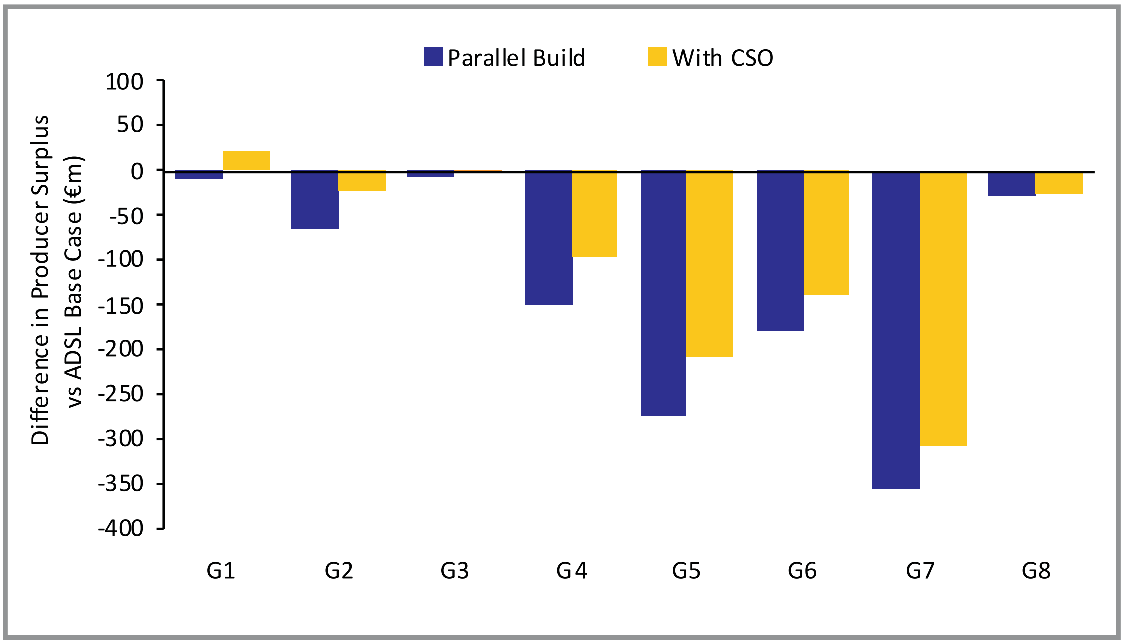
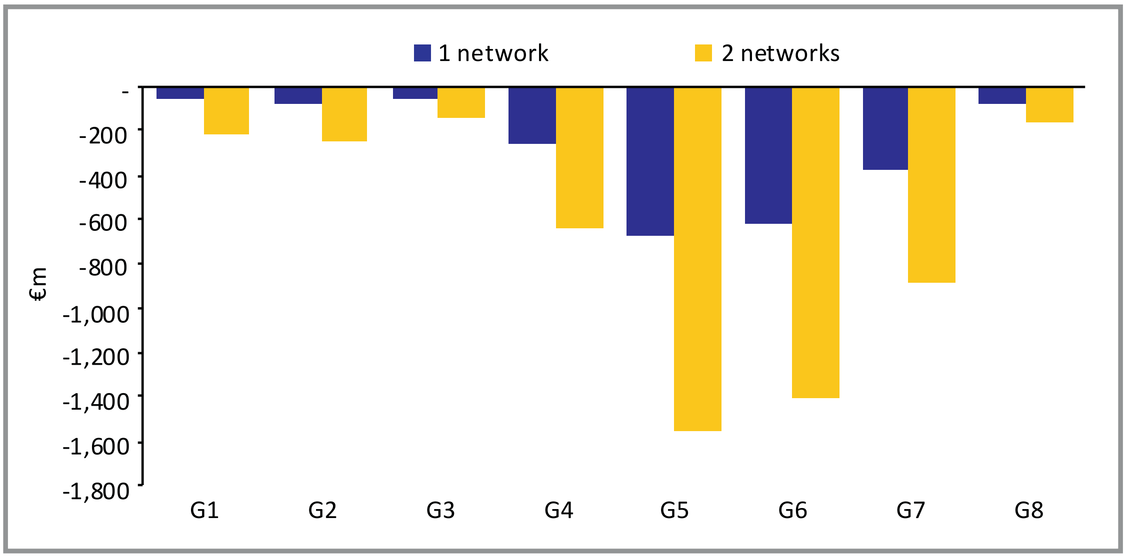


Figure 10 : Incremental producer surplus over standard broadband only, one or two fast broadband networks, based on German household geotype mix[21]



Given that in most geotypes deployment of higher speed broadband infrastructure results in a producer deficit, particularly for the incumbent, a supply side subsidy may be required to offset the net loss.

The case for subsidy varies by region

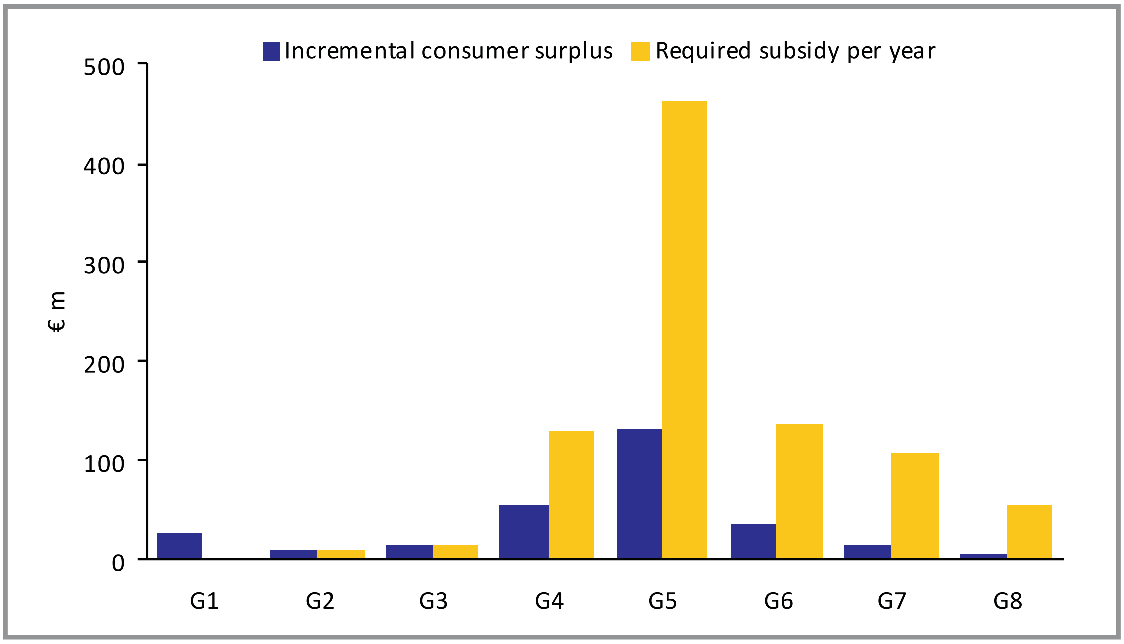
In many geotypes, deployment of high speed broadband results in a net producer deficit. To provide a commercial stimulus to infrastructure providers for these regions, a subsidy may be required to offset these deficits. The per-household subsidy requirement will increase for less dense populations.

This is illustrated in Figure 11 below, where the annual subsidy required to offset the producer deficit increases, relative to the producer surplus, as coverage of superfast broadband increases.

Given that the case for subsidy varies by region, government intervention through subsidy should therefore, at the very least, be targeted to those regions where the case is strongest:

- In regions where the consumer surplus exceeds the producer deficit, there is a case for subsidy based on consumer surplus alone. In other words, if only private value (consumer and producer surplus) is considered, society would still benefit from government subsidy. In the example above (based on a Belgian geotype profile in 2020) this private value subsidy case applies for the first two geotypes

Figure 11 : Consumer surplus and subsidy requirement for superfast broadband, Belgian geotype profile[23]



only. Thereafter the required subsidy is greater than the consumer value.

- Beyond this point, consumer surplus alone does not justify the subsidy investment. To justify further subsidy to stimulate wider roll-out, a government must believe there are additional benefits which are not captured in the private transaction – externalities. From an aggregate societal perspective, the wider the deployment is, the greater the externality value that is required to justify the subsidy in each region. In the example above, externalities per connected households in the final, most remote area would have to be €145 per month to justify subsidising roll-out.

Overall, our analysis illustrates the importance of geography in broadband policy. Despite this, regional targeting is, at best, peripheral the broadband policies of most central governments. The European Commission refers to "white", "black" and "grey" zones based on the number of existing broadband providers, but we believe a more geographically targeted approach should play a much greater role.

De-averaged prices may provide further investment incentives

Once a decision has been made to roll out to a particular area (either with or without subsidy), societal value will be maximised by signing up all households for whom externalities plus consumer value is greater than the marginal cost to serve. Given the low variable costs of telecoms, this may be virtually all customers. However, to persuade the tail of customers (those with low consumer value) to sign up would require aggressive pricing, which, if applied on a flat rate basis, would likely severely damage the producer surplus. This points to the importance of pricing flexibility or targeted consumer subsidies as tools for maximising societal value.

In our model we assume a flat national price for broadband. This assumption is consistent with actual practice in most countries, with price discrimination very rarely permitted by regulators. However, our analysis implies that in rural areas where the market is unlikely to provide on its own, it may be possible to offset negative producer surplus through higher prices. In other words, allowing higher retail prices in less densely populated areas could act as a partial alternative to government subsidy. This is supported by evidence from Finland, where broadband providers will be expected to fund ubiquitous roll-out without government assistance, but will not be subject to the prohibition of geographic price de-averaging that is prevalent elsewhere.

Whether or not geographic de-averaging is likely to improve market incentives to deploy broadband networks will depend, in part, on the consumer demand curve and whether rural users have higher valuations of broadband. We believe that further research in this area would be beneficial.

Trade-offs between coverage and network capability

Given the costs of deploying broadband infrastructure, trade-offs between breadth of coverage and network capability typically need to be made. From a government's perspective, an important question is therefore what combination of roll-out and network capability maximises value. [24]

There are benefits to ubiquitous rollout of standard broadband, but the case for investment without intervention is unclear

In most EU countries there has been widespread deployment of standard (typically ADSL) broadband. However, there remains a material number of households who do not have broadband coverage of any speed, particularly in rural areas (those above the blue shaded areas) but even in some urban areas (those above the yellow shaded areas).

Policy makers frequently stress the importance of universality of broadband access. Germany intends to reach its entire territory with a 1Mbps service. The United Kingdom has set a target of 2Mbps for ubiquitous access. Last year, Finland passed a law making access to broadband a legal right for its citizens, guaranteeing every person access to a 1Mbps broadband connection.[26] The question this raises is what the relative cost and benefits of fulfilling such universal service ambitions are.

Based on a UK infrastructure where broadband is available for 97% of households, we consider the consumer and producer benefits of ubiquitous (100%) deployment of standard broadband. This is illustrated in Figure 13 above.

Our analysis shows that considerable consumer surplus is realised by roll-out to the final 3% of households (before considering externalities). The incremental consumer value also increases over time, driven by falling access prices, crystallisation of demand and increased take-up. Between 2015 and 2020 the total consumer surplus accruing from the final geotype increases from €64m to €70m.

However, whether universal standard speed broadband deployment will be delivered by the market without intervention is less clear.

In 2015, providing standard broadband to the final tranche of the most remote households results in a net loss of €29m per year for a monopolistic supplier. By 2020, producer value increases to a nominal €5m per year thanks to decreased costs and increased demand, but given the certain roll-out costs required (around €435m in total capital expenditure to serve the final 3%[28] under a fixed infrastructure) and uncertain demand, it is questionable whether such an approach would be seen as viable by an infrastructure provider.

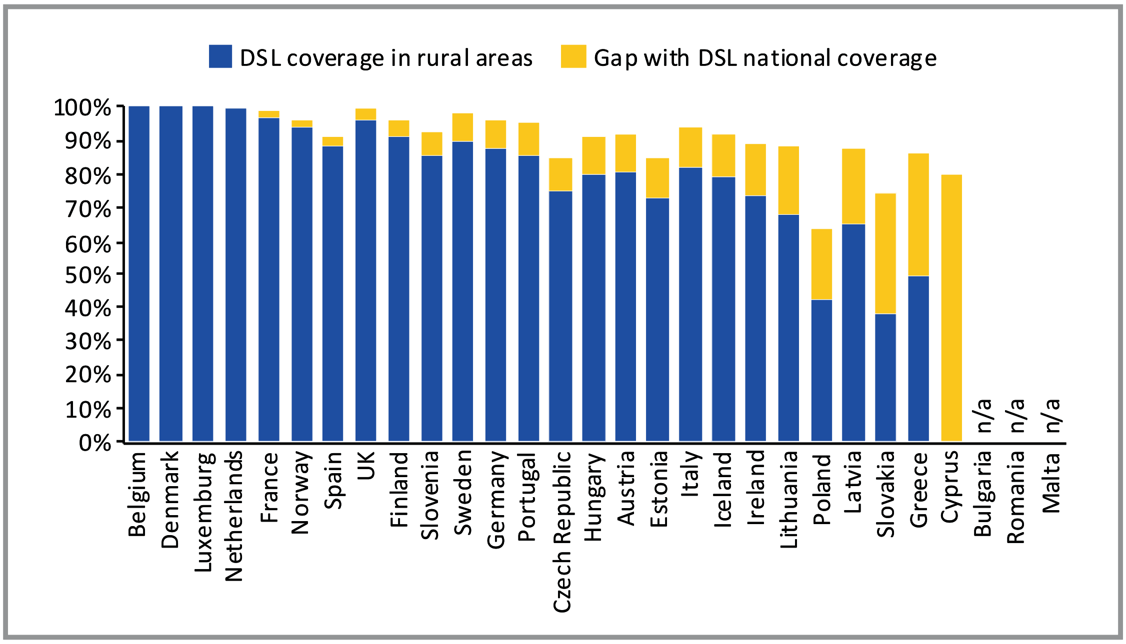
There is a subsidy case for universal roll-out of standard speed broadband, irrespective of the perceived value of externalities

Given that the producer loss in 2015 is more than offset by the increase in consumer surplus, there is a case for government subsidy in the final 3% based on private value alone. Naturally the case would be even stronger if externalities were factored in, and there may be felt to be particular societal value from enabling universal availability of broadband (e.g. increased social inclusion).

If the combination of consumer benefit and externality value made a compelling case for government intervention to support universality, there remains the question of how it would be most effectively achieved.

Given the significant costs in connecting the most remote households to a fixed broadband infrastructure, alternative wireless technologies may be a more viable mechanism for reaching universality. The Irish

Figure 12 : Standard broadband coverage in rural areas by European country, 2008[25]



government, for example, has awarded a contract to Hutchison 3G to provide broadband to the final 10% of population. 3 are adopting a hybrid wireless/satellite approach, rolling out HSDPA services to the majority of this 10% and partnering with satellite provider Avanti Communications for the remainder.

Based on the UK infrastructure, providing broadband to the final 3% will yield a higher return than extending fast and superfast broadband coverage

Although the benefits of rolling-out standard broadband to the final group of households outweigh the costs, this does not necessarily mean that subsidising basic broadband universality is the value maximizing approach. To test this, it needs to be considered against a range of alternative policies, including further deployment of fast and superfast services.

We compare the required level of subsidy and the corresponding incremental consumer surplus for a range of deployment options, based on a UK infrastructure profile in 2015. We assume the market has already provided fast broadband to the first 38% of households (geotypes 1 and 2).[29]

The results are illustrated in Figure 14 below for the following subsidy options :

- Standard broadband to the final 3%
- Fast broadband to the areas where it is not already available, namely geotypes 3, 4 or 5 (where we assume that existing infrastructure providers BT and Virgin Media will not deploy fast broadband services)
- Superfast broadband to the three most urban geotypes (1, 2 or 3)

Based on the analysis, we find that:

- The most effective approach is to extend the coverage of standard broadband to the final 3% of households. For each €1 of subsidy, €2.25 of incremental consumer value is created.
- Given the existing provision of fast broadband services in the most urban areas (geotypes 1 and 2), the case for investing in superfast broadband services in these regions is very weak. Competition from fast broadband reduces the number of customers for superfast, and moreover reduces the incremental consumer value for those customers (who would otherwise receive the benefits of fast broadband).
- Any remaining subsidy after support for universal standard broadband deployment would be most effectively employed in encouraging deployment of fast broadband services to the most densely populated areas in which it is not already available.

Of course, this analysis ignores the impact of externalities. The question of which approach has the greatest overall societal benefit therefore depends on your perception of the value of externalities under each option. A government would need to believe that the externalities resulting from fast broadband are approximately €5/connected household per month

Figure 13 : Producer and consumer surplus per year from deployment of standard broadband to the final geotype[27]

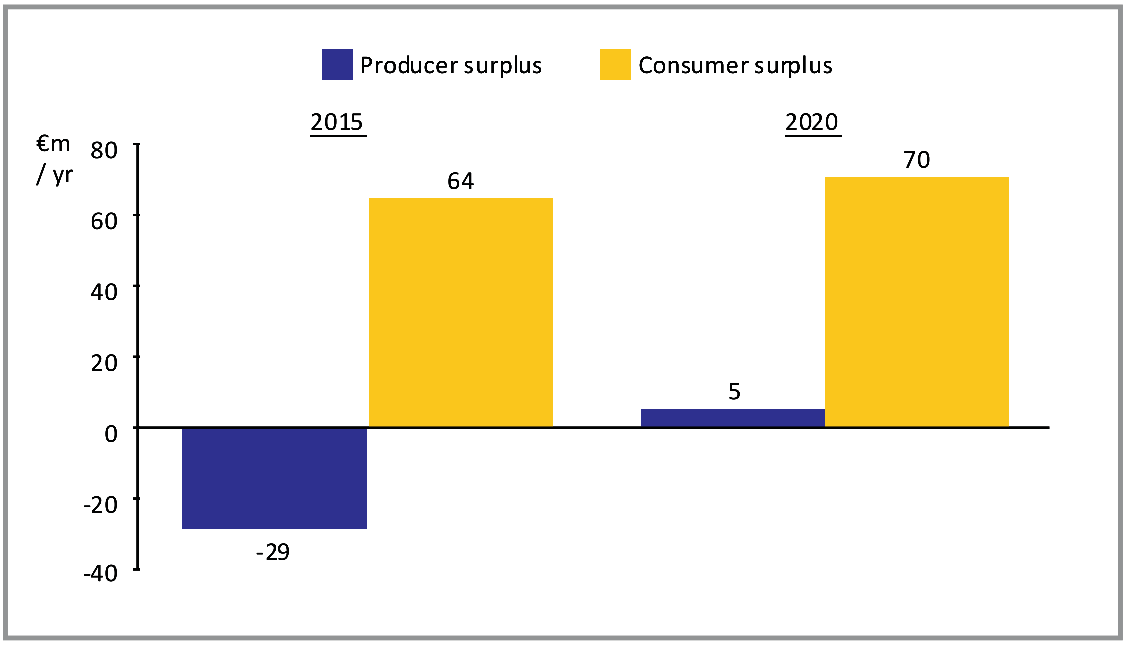
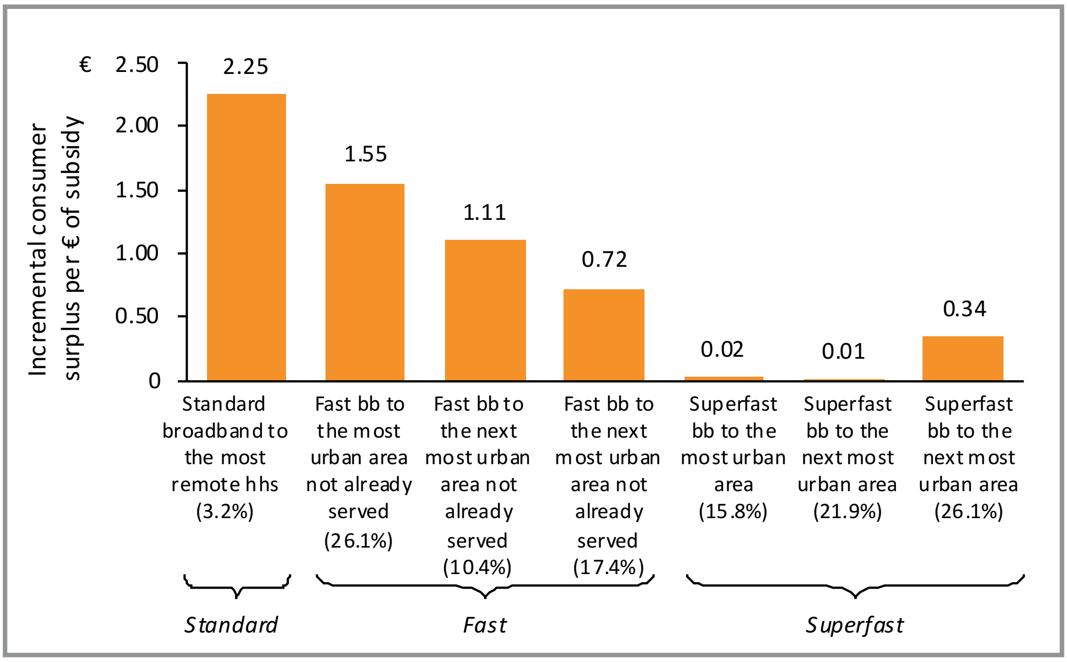


Figure 14 : Relative effectiveness of each € of subsidy for a range of deployment options based on expected UK infrastructure[30 31]



higher than from standard broadband in order to prefer fast broadband to G3 rather than basic to G8. This figure does not seem excessive, suggesting that while the UK's investment is likely to pay societal dividends there maybe other options that are at least as attractive.

Any analysis should also take into account the longer term benefits (and costs) of intervention. For example, it is argued that superfast broadband provides a more 'future proofed' solution than other options. However, this, in itself, is not an argument for deployment of superfast networks. Rather, the assumed future benefits need to analysed and considered in reference to a cost-benefit framework such as that previously discussed.

Distribution of value varies based on the technology adopted

In the example above, subsidising the deployment of superfast broadband to the first geotype releases less consumer surplus, € for €, than deploying fast broadband to the next underserved regions. However, in addition to considering the absolute value of the consumer surplus, governments may well be interested in how evenly and fairly a given consumer surplus is distributed.

For example, Figure 15 illustrates the choice for the Portuguese government facing the choice between spending approximately €225m on either superfast or fast broadband.

A government investing a subsidy of €217m per year in fast broadband would generate over €150m of incremental consumer benefit, whereas investing €231m per year in a superfast network generates less (c. €100m) additional consumer surplus. Ignoring any discussion of externalities, this suggests that if this government is considering subsidising a single technology, investment in fast broadband, rather than superfast broadband, is most cost effective.

However, what makes the case for fast rather than superfast broadband even stronger is that the benefits are much more evenly distributed:

- The subsidy of fast broadband supports roll-out to geotypes 1-6.
- The superfast broadband subsidy only reaches geotypes 1-4.
- Moreover, superfast broadband is used by a smaller group within covered areas – those with the highest willingness-to-pay.
- The net result is that the benefit of the fast broadband subsidy is shared by 1.7m users, as opposed to superfast broadband, which is confined to 1m users.

Thus in order to prefer a superfast investment, our hypothetical Portuguese policy maker would have to believe that the externalities per superfast line were sufficiently greater than the fast externalities to compensate for:

- The fact that those externalities will be received from only 1.0m superfast lines, as opposed to the potential 1.7m fast lines

- The €50m greater consumer surplus created by fast broadband

The greater equity in distribution of the fast broadband benefits

Assessment of current broadband policy in selected countries

In this section of the report, we compare and contrast actual broadband policy from a selected range of countries with outputs (admittedly indicative) from the model, considering countries with ambitions for superfast, fast and standard broadband deployment in turn.

Overview of subsidy requirements, by country

Governments around the world have been addressing the question of broadband roll-out through national broadband policies, which combine coverage targets with regulatory concessions and public subsidy. Based on our model, Figure 16 illustrates the scale of subsidy required to offset the producer deficit created by national broadband plans in the final geographic region served. Countries modelled range from Australia's commitment to 90% super-fast deployment down to Germany's subsidised roll-out of standard broadband to 100% coverage.

In some of the above countries, our model suggests that the incremental consumer surplus created offsets the producer deficit. Therefore, a societally beneficial case for subsidy can be made without recourse to externalities.

For other national broadband plans, consumer surplus alone does not justify the subsidy investment. In such cases, a government must believe there are additional benefits which are not captured in the private transaction – externalities - to justify further subsidy to stimulate wider roll-out.

Through our analysis we have estimated the minimum value of externalities required to justify subsidy investment. This is based on the differential between total value created (producer value plus all consumer value) less all producer costs, as illustrated below.

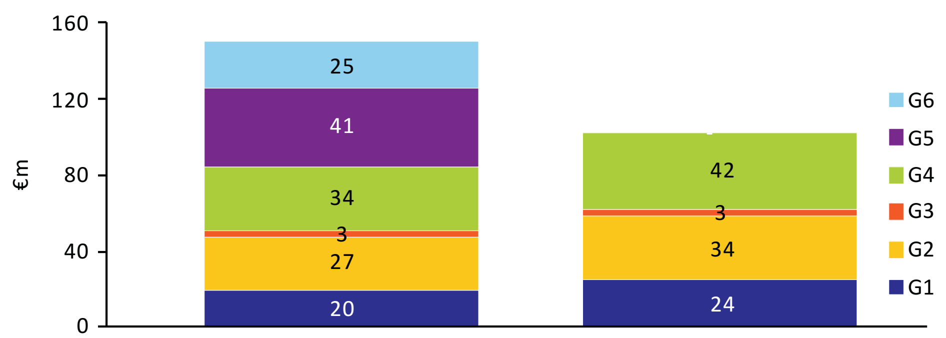
Figure 18 illustrates the value of externalities required to justify subsidy in the last connected geographic area.

At one extreme, Australia's ambitions for 90% coverage of superfast broadband mean that the *incremental* externalities of superfast broadband would need to be around €90 per connected household per month to justify a roll out this extensive.[35] Given the vast range of capabilities of a standard broadband connection, this seems a very high figure for the further value of superfast broadband.

At the other extreme, the broadband policies for ubiquitous basic broadband roll-out in Italy, the UK and Germany can be justified based on a belief of increased consumer surplus alone (which more than offsets the producer deficit). Indeed, the policies of Italy and the UK, which in the short term focus on the deployment of ubiquitous standard broadband, may be an underinvestment[36]. While the externalities are hard to quantify, there is little debate that they exist, and one would expect an optimal level of investment to be associated with an assumption of at least some externalities.

Policies for ubiquitous standard broadband in Italy, the UK and Germany can be justified based on the increased consumer surplus alone (which more than offsets the

Figure 15 : Comparison of consumer surplus generated by government subsidy towards fast and superfast broadband infrastructures in Portugal[32]



Infrastructure	Fast broadband to geotypes 1-6	Superfast broadband to geotypes 1-4
Required subsidy per year	€217m	€231m
Coverage	4.1m (83%)	2.3m (47%)
Estimated take-up of all hhs	Fast bb: 1.7m (35%)	Superfast bb: 1.0m (20%)

producer deficit). At the other extreme, Australia's ambitions for 90% coverage of superfast FTTH broadband means that the *incremental* externalities of superfast broadband would need to be around €90 per connected household per month to justify a roll out this extensive.

A fundamental issue when assessing broadband policy is therefore the value of the *incremental* externality resulting from network deployment.

By considering different levels of incremental externality, we can estimate the potential loss from some of the more aggressive broadband policies. For instance, if you believe the incremental externality of superfast broadband is €10 per connected household per month, then France's proposed roll-out of fibre to 70% of the population could lead to annualised loss of over €3bn, compared to a plan focused on regions where the benefits exceeded the costs.[37]

Note that we are not suggesting that the policies of countries such as France are in aggregate value destructive, only that the extent of the proposed roll-out is such that in the more rural areas covered, the cost is likely to far exceed the benefits, and thus a more limited roll-out would be much better. In more rural areas, a government must believe in extremely high incremental externality benefits to justify current plans.

Assessment of broadband policy for countries with superfast broadband plans

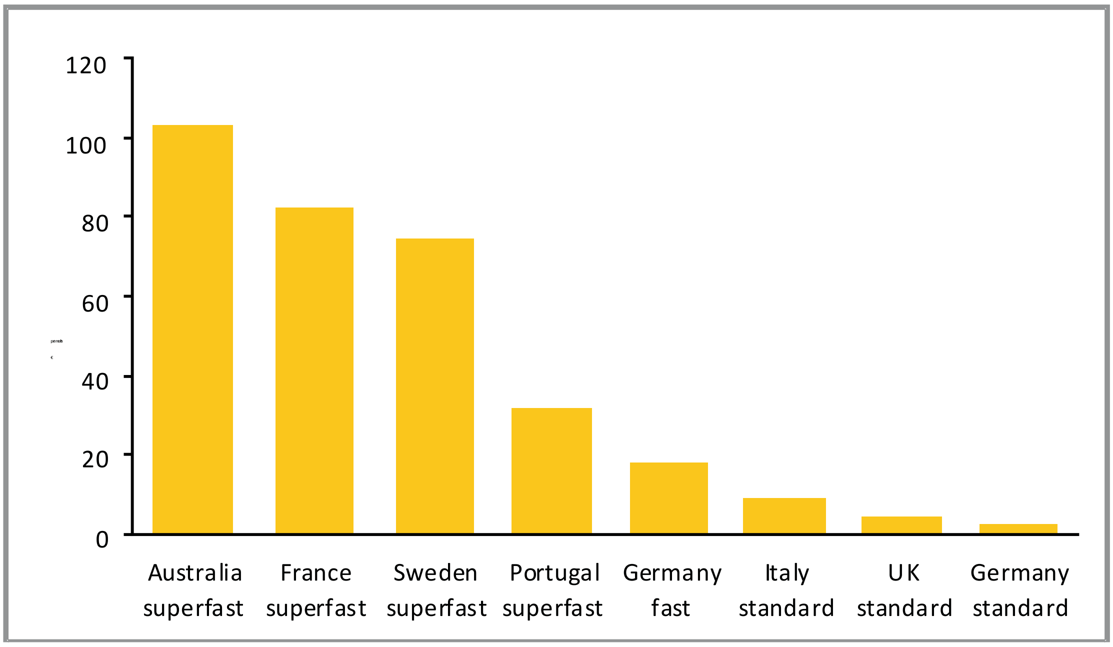
Several countries have committed large sums of money to extensive superfast FTTH roll-outs. As we have noted, the Australian approach requires subsidy of over €100 per month per connected household to offset producer losses in the most remote geographic area. France, Sweden and Portugal have also committed to ambitious superfast broadband targets which will require considerable subsidy. Absent of consideration of externalities, our analysis suggests that this money might be better deployed in the short term by extending standard broadband coverage to 100% of households, before deploying fast networks to areas not already served.

That said, this does not necessarily mean that superfast networks are suboptimal from a net value perspective. Firstly, as we have noted, significant incremental externalities may make superfast FTTH rational (although we suggest the incremental externalities would need to be extremely large). Secondly, in countries with high levels of population density, superfast networks may be the optimal broadband infrastructures. For example, in Hong Kong, where 84% of the population is within the first two geotypes, our analysis suggests that the market can support four or more parallel super-fast networks without the need for subsidy.

Assessment of broadband policy for countries with fast broadband plans

A further group of countries have centered their broadband ambitions on the provision of fast FTTC or cable networks. For example, Germany has announced plans to deploy fast FTTC broadband to 75% of the population by 2015, and the UK has referred to plans to support roll-out to the "final third" through a part subsidy.

Figure 16 : National broadband plans – necessary subsidy per month per connected household in the final geotype[33]



Based on our analysis, this will required subsidy of around €20 per month per connected line in the most remote geographic areas. Given the incremental consumer surplus released, this plan requires policy makers to believe in externalities worth €7 per month per connected household in the final geotype.

Existing research into next generation network externalities seems to suggest that this is not unreasonable. For example, Plum for BSG (2008) estimate £500m/year from spectrum efficiency (though admittedly in the long term), which equates to just over €4 per connected household per month.[38 39]

Other countries are relying on the market to deliver fast broadband networks, such as Belgium and, in part, the UK. While, evidently, such an approach does not require public subsidy, it may be overly conservative, constraining the realization of consumer surplus and positive externalities.

Figure 17 : Overview of approach used to calculate externalities required[34]

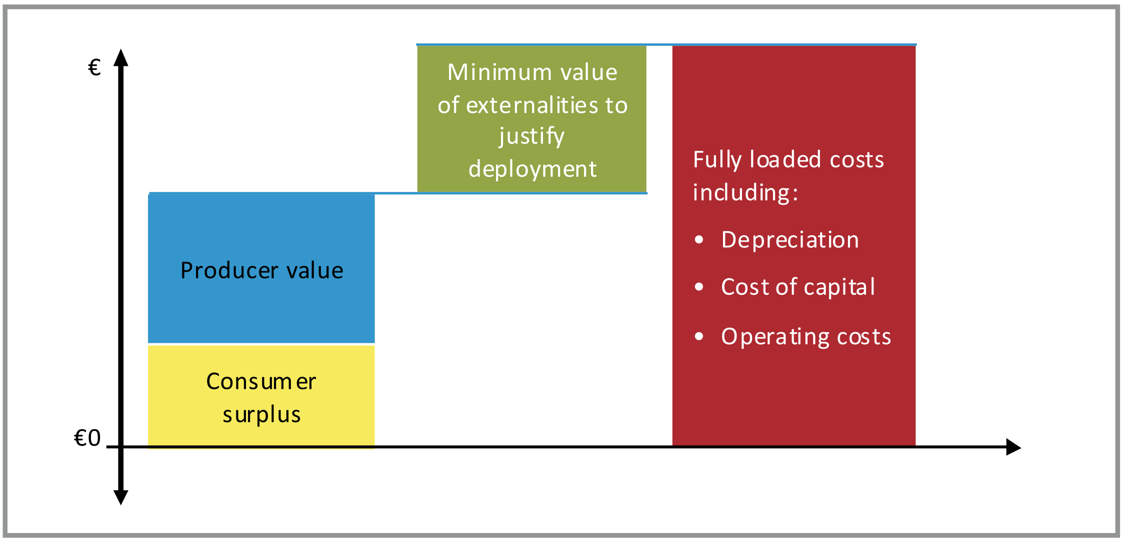
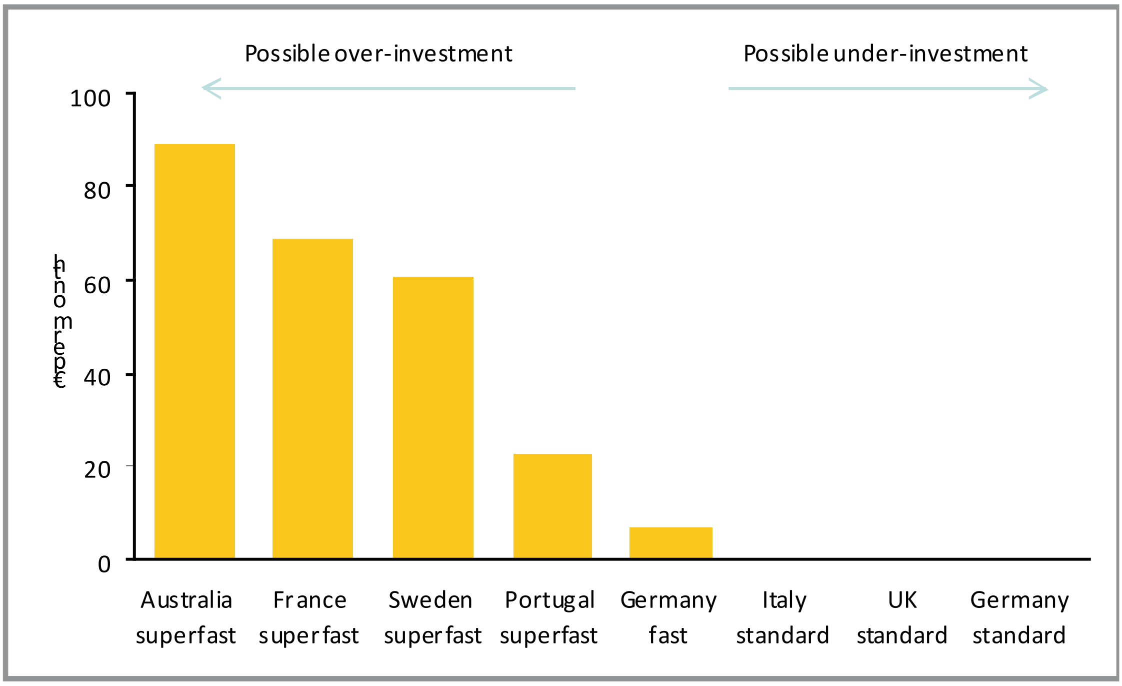


Figure 18 : National broadband plans – required externalities per month per connected household



Assessment of broadband policy for countries with standard broadband plans

Countries aiming to reach standard speed broadband ubiquity include UK, Germany, Italy, Finland, Ireland and many others.

Based on our models, the increase in consumer surplus created by deploying standard broadband to the final underserved or unserved areas more than offsets the producer deficit. This suggests there is a clear case for subsidy, irrespective of whether policy makers believe in externalities resulting from the deployment.

Furthermore, as our previous analysis based on the UK has illustrated, investment in providing broadband to the final geotypes may actually the most effective approach to deployment.

Conclusions

We believe there is a strong case for subsidising the roll-out of basic broadband to all households, and generally this should be the first priority for governments (subject to any market specific issues). We note that in many countries policy makers are instead focused on fibre as the prime recipient of government support.

However, if funds are still available after supporting basic broadband, there is also a case for subsidising fast broadband (whether this be FTTC, cable or even mobile) in those areas where the market is not already providing. That said, in areas with lower population density the case becomes highly dependent on the incremental externalities of fast over standard broadband.

While many countries are supporting fast broadband, frequently this does not appear to be targetted to the areas that most need support, and in certain cases the scale of support is such that it is likely pushing into areas with rapidly diminishing returns.

The case for subsidising superfast FTTH or FTTB broadband is weak. To believe it can create greater societal value than fast FTTC broadband requires an aggressive assumption about incremental externalities of superfast over fast broadband, but even then the societal benefits will be much less evenly distributed. Australia is an example of a country that is nonetheless putting massive sums to work to roll FTTH out to 90% of the country.

Based on our analysis, the *incremental* externalities of superfast over standard broadband in Australia would need to be around €90 per connected household per month to justify a roll out this extensive.[40] Given the vast range of capabilities of a standard broadband connection, this seems a very high figure for the further value of superfast broadband.

These are general conclusions that would need to be considered in more detail by individual countries, taking into account their local circumstances. However, we believe all policy makers should incorporate into their thinking:

- *Consideration of the counterfactual*. The market is likely to provide improved broadband to at least some parts of the country – these areas should not be the focus of subsidy
- *The time dimension*. Both declining costs and maturing consumer demand will expand the number of geotypes for which there is a commercial case to roll out fibre. Immediate subsidy to these areas will accelerate roll-out rather than absolutely enable it, and should be considered in that light
- *The* incremental *benefits and costs*. Basic broadband already provides substantial consumer value and externalities. Investment in overlay fibre networks needs to be justified by the *uplift* in value and externalities from better speed and performance
- *Alternative uses of government funds and potential returns* – For instance, even within the broadband arena, demand side stimulus may yield greater value

We recognise that our modelling framework and the analysis provided in this report is only a small first step towards a more rigorous framework for decision making. We believe there are a range of areas where additional analysis could shed further light on broadband policy and the choices faced, some of which are outlined in the appendices to this report.

Overall, we hope that this report has illustrated the value in using a framework for exploring the trade-offs that typically need to be made when formulating broadband policy. We argue that a more structured approach, and greater transparency in setting broadband objectives, will make significant contributions to the debate on optimal broadband deployment.

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Notes

1. Julius Genachowski, chairman of the Federal Communications Commission, stated: "broadband is essential to fostering 21st century jobs, investment and economic growth. It's also so important because of the vital role broadband must play in advancing key societal goals in areas like education, health care, energy, public safety, democracy, and small business opportunity." (February 2010)
2. In our model, regions are proxied by 8 different geographic types ("geotypes"), split primarily by population density
3. We note that the majority of analysis to date has been on fixed networks, and do not therefore explicitly consider any incremental benefits of mobile broadband. Given the growing importance of mobile as a complementary means of broadband delivery, we believe this is an important omission in the current body of literature.
4. Geographic areas are referred to in terms of eight 'geotypes', from geotype 1 (the most urban) to geotype 8 (the most rural)
5. Compared to a counterfactual of standard broadband coverage to 97% of households and fast broadband to 38% of household. Assumes that subsidy is equivalent to the producer deficit associated with the infrastructure deployment.
6. The value of annualised loss falls as the assumed externality rises, but does not drop to zero until the externality rises to €70 per connected household per month for France, and around €90 for Australia
7. Fibre to the cabinet
8. FTTH: Fibre to the home. FTTB: Fibre to the building
9. See for instance "Govt rejects cost-benefit analysis in NBN report", *The Age*, November 27, 2009 at http://www.theage.com.au/technology/technology-news/govt-rejects-costbenefit-analysis-in-nbn-report-20091127-jvm5.html
10. Geotypes range from G1: 'major urban' (most dense) through to G8: 'very small exchanges with long lines' (least dense)
11. For example, Australia (100Mbps), Austria (25Mbps), Finland (1 Mbps by 2010, 100 Mbps by 2015), Germany (50 Mbps), Spain (30Mbps), UK (2Mbps, 40-50Mbps).
12. Achieved standard ADSL speed in the UK is typically 45% of the advertised headline speed, which in turn is usually lower than the theoretical maximum; source: Ofcom (2009)
13. The FCC estimates that satellite, mobile and fixed wireless accounted for 36% of "high speed lines" in 2008 and 69% of *new* lines created between June 2006 and June 2007; source: Ehrlich (2008)
14. Despite this, we note that the majority of analysis of broadband investment has been on wireline rather than wireless networks. We believe this is an important omission in the literature and should be considered a priority for further research, in order to support the investment debate.
15. Discussion of the *incremental* consumer and producer value associated with fast and superfast broadband is particularly limited, though see Plum for BSG (2008)
16. Assumes aggressive pricing such that the retail price of superfast broadband reflects only a small premium over standard ADSL broadband in 2020. ADSL assumed to be universally available
17. Assumptions as for Figure 6
18. In our model we have assumed a cost of capital of 12% for all broadband deployment. We have not adjusted the cost of capital to reflect higher risk premiums for fast and superfast broadband networks
19. Based on Portuguese geotype profile and infrastructure in 2020. Base case assumes 100% coverage from one standard ADSL broadband network.
20. Based on geotype profile of Portugal and deployment of superfast FTTH in 2020
21. Based on fast broadband retail prices and take-up in 2020, in a country with German geotype profile and deployed alongside one ubiquitous standard ADSL broadband network.
22. We note, however a range of demand side options also exist (for example, improving skills or awareness, subsidising equipment and so on). See Plum (2010) for a more detailed discussion.
23. Based on Belgian geotype profile and infrastructure. Subsidy requirement equivalent to producer deficit for superfast FTTH broadband deployment within each geotype in 2020.
24. There is an argument that broadband can be viewed as a public utility like street lighting, where low variable costs and high externalities argue for it to be funded directly from tax revenues.
25. Source: IDATE, Broadband Coverage in Europe 2008. Note that DSL coverage refers of the percentage of households dependent on an exchange which is equipped with a DSLAM. This figure therefore over-counts broadband availability (some of these homes may be too far from the exchange to obtain a standard ADSL broadband connection)
26. The Finnish example is unusual in that no public funds have been allocated to subsidise the USO roll-out. Instead, Finnish operators are not required to geographically average their retail prices, as is the case in the rest of Europe. As a result, providers such as Sonera, the incumbent, may vary their fees in rural areas in order to charge the value-maximising price that best offsets the costs of roll-out to the final 4% of households
27. Based on a UK geotype profile and infrastructure in 2015 and 2020. Assumes no fast or superfast broadband is available to the final 3% of households.
28. Source: Ingenious Consulting Network estimate based on Analysys Mason (2008) cost forecasts. Our analysis assumes costs that are equivalent to FTTC broadband since these locations are typically too far from exchanges to receive standard ADSL services. The 2009 Digital Britain report states that "to address these remaining homes [those without 2Mbps connections] will require a mix of professionally assisted consumer home solutions, professional home engineered solutions, fixed network engineered solutions, and wireless network engineered solutions (including satellite)" and that approximately 420k UK homes could be connected by "long telephone line resolved by FTTC upgrade".
29. This broadly represents the expected broadband infrastructure in the UK in 2015 given BT and Virgin Media deployment plans for higher speed broadband services
30. Based on a UK geotype profile in 2015. Compared to a counterfactual of standard broadband coverage to geotype 7 (available to 97% of households) and fast broadband to geotype 2 (available to 38% of households). Assumes that subsidy is equivalent to the producer deficit associated with the infrastructure deployment.
31. For any broadband policy where the incremental consumer surplus per € of subsidy is greater than one, there is a case for subsidy without the need to consider the value of externalities. Where the value is less than one, you need to believe in the presence of externalities to justify the subsidy investment.
32. Based on a Portuguese geotype profile in 2020. Compared to a counterfactual of standard broadband only (i.e. assumes that there is no existing fast or superfast broadband available). Assumes that subsidy is equivalent to the producer deficit associated with infrastructure deployment.
33. Assumed to be equivalent to the value of the producer deficit in the final connected geotype; in other words, the subsidy required to provide a commercial incentive for deployment, absent of additional motivations (competitive advantage) or a "deadweight loss" to intervention.

34. Note that our analysis does not take into account non-financial consumer costs or any "deadweight" loss resulting from intervention.

35. The deficit includes the loss of contribution from standard broadband subscribers, resulting from their migration to the new superfast broadband network

36. We recognise the UK's longer term policies to support fast broadband to more rural locations (the UK government's Final Third Project).

37. The value of annualised loss falls as the assumed externality rises, but does not drop to zero until the externality rises to €70 per connected household per month for France, and around €90 for Australia

38. Assuming take-up by 40% of household who have access to the superfast network

39. Although we should note that these potential benefits of spectrum release could also be obtained through other means, and not solely broadband deployment (e.g. the growth of satellite broadcasting alongside digital terrestrial)

40. Taking into account the loss of revenue from the migration of standard ADSL broadband households to the new network

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Demand-side measures to stimulate Internet and broadband take-up

Executive Summary

What can governments do to get non-Internet users online and how can it be done as cost-effectively and quickly as possible?

Current levels of Internet use vary substantially by age, educ ation, income, and work force participation in developed countries. In the EU15[1] 90% of young people are Internet users but fewer than 30% among the 65 to 74 age group use the Internet. There are also substantial variations among countries.

These differences largely reflect demand-side rather than supply-side effects. The supply-side factors most likely to influence Internet use - the price and availability of broadband - have had only a modest impact on cross-country variation in levels of Internet use, while there is continued Government interest in setting targets for broadband roll out rather than internet adoption.

Today there are still a large number of non-users in Europe. On current trends, and with current demand-side policies, we are unlikely to see significantly reductions. For ex ample in the EU 15 we expect that:

- The 60 million non-Internet users among poorly educated older people will decline by only 8 million between 2009 and 2014
- It will take nearly 30 years to reduce this population of non-users from 60 million to 20 million
- It will take eight years for the 25-54 year old group, who make up most of the workforce, to reach 90% penetration of Internet users.

On current trends, most of these changes will come about because of cohort effects[2] rather than because of effective demand-side measures by Government.

There is a large number of existing Government-funded demand-side measures in the study countries. But it is difficult to draw any firm conclusions about their effectiveness becaus e of a lack of rigorous ex -post analysis of their impacts. It appears that much of the public money currently spent in this way is wasted.

Policy changes are needed to accelerate internet usage amongst key groups in European society and to provide a better return on the public funds that are invested in this area. In particular, we recommend that:

- Governments should target incentives in a more systematic and rigorous way. Above all they need to make rigorous, ex -post evaluations of effectiveness a condition for funding programmes of demand-side measures.

- They should look critically at programmes of demand-side measures aimed at the over 25s who are poorly educated before funding them. When based around traditional technologies such programmes are costly and slow to take effect.

- In dealing with this group Governments should take advantage of current market trends such as the take-up of mobile broadband and smartphones, the introduction of Internet access via televisions and e-book readers, the move from browsers to applications, and the trend towards cloud computing. These all reduce the skills needed to use the Internet and the cost to end users of doing so. They should refuse to fund programmes which fail to take account of these trends

- In general they should give the 25 to 54 year age group higher priority than the over 55s. The former group will be Internet users for longer and, once users themselves, can potentially support their parents to become Internet users

- To deal with affordability barriers, governments should design universal broadband policies which allow non-users to choose appropriate broadband packages from fixed and mobile offerings. This may mean switching subsidies from the supply-side to the demand-side

- Governments should encourage the development of services which allow those currently without debit or credit cards to carry out e-transactions.

Introduction

The Internet is now used by the majority of people in most developed countries. As countries have reached this milestone, governments have turned their attention to the goal of full e-inclusion[3] and to the measures which are required to reach this goal. Measures to stimulate demand for the Internet are increasingly the focus of public policy on both sides of the Atlantic[4] and it is likely that governments in the developed world will invest significantly in such measures over the next decade. Given this situation we seek to answer five basic questions in this report:

- Who does and does not use the Internet?
- What are the main barriers to Internet use?
- What have governments done so far to stimulate demand?
- What will happen if nothing more is done?
- What should governments do now to stimulate demand in a cost-effective way?

The aim of the study, commissioned by Vodafone, is to provide an independent and critical examination of available data and studies before reaching evidence-based answers to these questions.

We focus our analysis on ***Internet use by individuals*** rather than on ***Internet access*** or ***broadband take-up by households***. There are two main reasons for this:

- The economic and social value of e-inclusion comes from getting everyone (or nearly everyone) online. Internet use by individuals measures how far we are from achieving this goal. Household Internet access does not always accurately reflect use by individuals. Nor does it measure the extent to which people use the Internet outside the home (eg on mobiles) or in cafes
- The rate at which the penetration of Internet users grows gives a better measure of how quickly we are moving towards full e-inclusion than the rate of broadband take-up. Much of the growth in consumer broadband take-up observed over the past few years reflects a switch by existing Internet users from dial-up to broadband access rather than a growth in new Internet users.

What does existing data tell us about Internet use?

Key findings

In this section, we examine patterns of Internet use[5] by region for the EU15, the US and South Korea and by population segment. We consider segments defined by age, education, income, employment status, household composition, location and gender.

From our analysis, we identify the following key points:

- There are common significant variations by demographic segment – most prominently by age, education, income, and employment status – in the levels of Internet use across the studied developed world.
- There are also significant differences between countries in these patterns of Internet use. For example, the gap between the young and old in Korea is much larger than that in the US. Even within the EU15, there are big differences between the Mediterranean and Nordic countries in levels of Internet use across all age groups.
- These cross-country differences are less marked for younger people. But even here they can be substantial, especially when we look at those who received little education.
- Many of these cross-country differences can be partially explained by historic differences in education and literacy levels and in participation and ICT use in the workforce.
- The supply-side factors most likely to influence Internet use - the price and availability of broadband - appear to have had only a modest impact on cross-country variation in levels of Internet use.
- English literacy levels and cultural differences may have some impact on Internet use, but the extent to which they do so is difficult to quantify and most likely not hugely significant.
- There are three main barriers to Internet use identified by surveys. Non-users do not see its relevance, do not have the skills to use it, and/or cannot afford to do so.
- There is an additional significant barrier unidentified by surveys, which is the lack of a bank account or credit/debit card. Up to half of current non-Internet users may not be able to carry out transactions on the Internet because they lack a debit or credit card, although there are some alternatives such as prepaid cards.
- Market trends will lower these barriers to Internet use. For example, requirements for digital skills will lessen as users switch from using PCs and browsers to using *apps* on smart phones and tablets to view information on the web. At the same time affordability barriers should reduce as LTE-based mobile packages offer significantly lower broadband prices to people with modest download requirements.

We set out the analysis on which these tentative conclusions are based below

Common patterns of Internet use across countries

Our analysis of levels of Internet use, set out in detail in Annex A, suggests that the patterns of Internet use by population segment are common across all developed countries. We find that, in all the study regions:

- There are big variations in Internet use by ***age, education, income,*** and ***employment status.*** It is important to recognise that there are correlations between all of these categories and that variation can reflect a combination of reasons.
- There are much smaller variations by ***location, gender*** and ***household composition.***

Figure 2-1

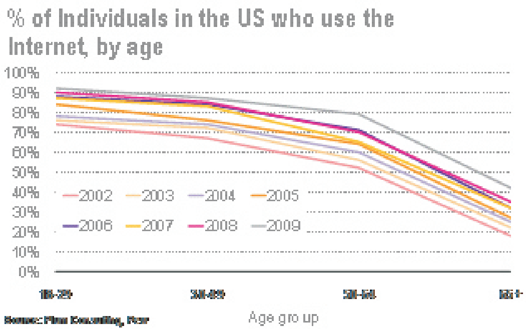


Figure 2-2

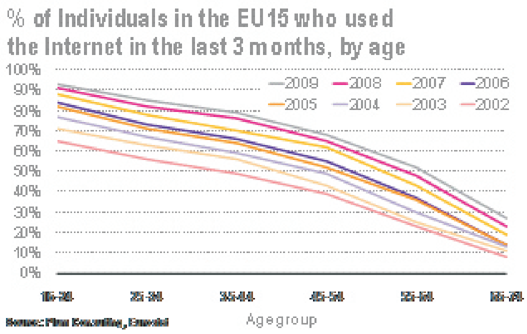


Figure 2-3

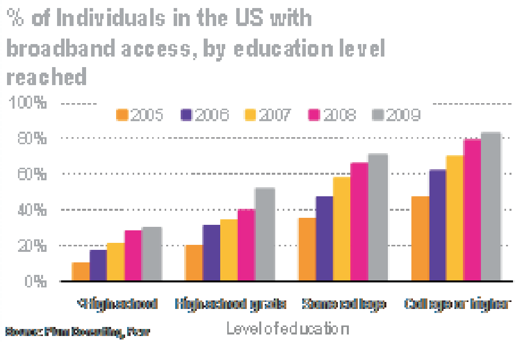


Figure 2-4

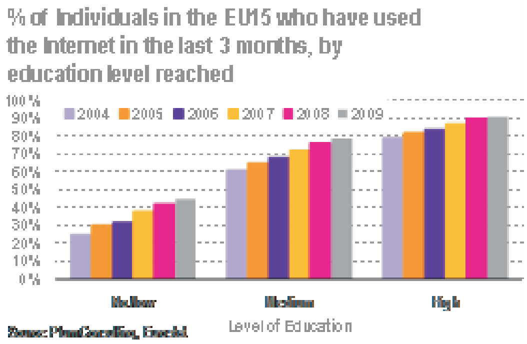
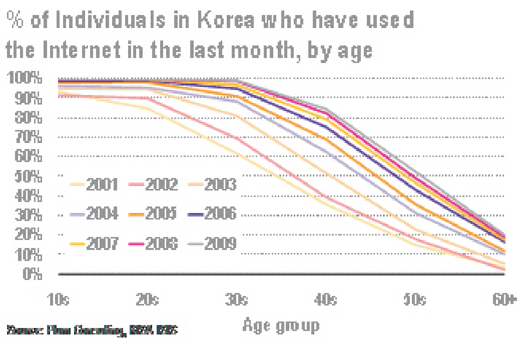


Figure 2-1 to Figure 2-4 illustrate the variation by age and education for the EU15 and the US.

Income and education are strongly correlated and it is uncertain which does more to explain variations in levels of Internet use. On balance, published econometric studies which focus on Internet use rather than broadband take-up suggest that education is more important than income.[6]

In practice it makes sense for governments to analyse national levels of Internet use by age, education,

Figure 2-5



employment status ***and*** income[7] before setting priorities for targeted funding of demand-side measures. It is also important to analyse Internet use by combined categories such as age and education,[8] as the analysis set out below demonstrates.

What can we learn from cross-country differences in Internet use?

There are common patterns in the levels of Internet use by age, education, income, and workforce participation across developed countries, but there are also significant differences among countries in these patterns of use. Why do these differences exist and what do they tell us about the drivers for, and barriers to, Internet use? Our analysis is as follows.

Finding 1 *The level of Internet use across ages varies significantly from region to region.*

In both Korea and the US, Internet use is consistently higher for young people than for older people, but there are significant differences. Use by younger people is higher in Korea than the US but use by older people is higher in the US as Figure 2-5 and 2-6 illustrate. Within Europe, the level of Internet use across all ages is much higher in the Nordic countries than in Mediterranean countries. Figure 2-7 illustrates.

Finding 2 *These cross-country differences are less marked for the 16-24 age group than for those over 25.*

Figure 2-6

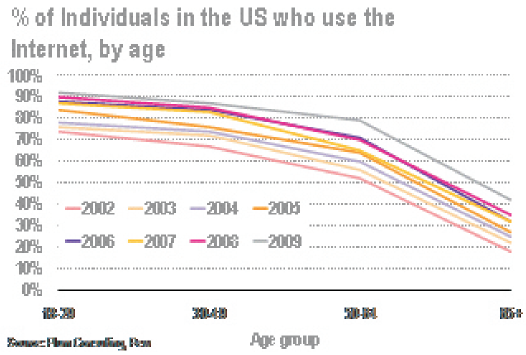


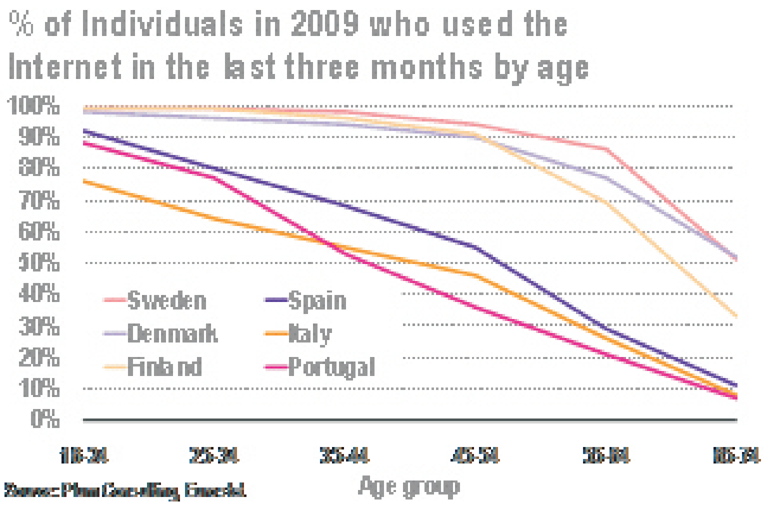
Figure 2-7 illustrates. But, even for people under 25, there are big differences between some countries - especially when we consider young people with little education. Figure 2-8 and 2-9 illustrate these differences for Denmark and Italy.

We can see that education makes no difference to levels of Internet use among young people in Denmark but has a significant effect in Italy. This difference may indicate variations in the way ICT skills are taught in Denmark and Italy.

Finding 3 *The level of formal education and literacy is not necessarily a barrier to Internet use for young people.*

Figure 2-8 and Figure 2-10 illustrate. From Figure 2-8 we can see that, in Denmark, there is almost 100% Internet take-up irrespective of educational attainment for this age group. We can see from Figure 2-10 that, while there is a general distinction between literacy test scores for

Figure 2-7



15 year olds between Nordic and Mediterranean countries,[9] Denmark's young people have relatively low literacy levels – with 15% of its 15 year olds scoring at Level 1 or below.

Finding 4 *Some cross-country differences may relate largely to historic differences in levels of education.*

As Figure 2-5 and Figure 2-6 show, older people in the US are twice as likely to use the Internet as older people in Korea. Figure 2-11 provides a possible explanation. The level of education of older people in the US is significantly higher than in Korea. This effect could explain a substantial proportion of the differences in Internet use by older people in the US and Korea.

Finding 5 *Workforce participation may be a significant factor in explaining cross-country variations in Internet use.*

Figure 2-12 illustrates. It shows that:

- Some of the lowest rates of workforce participation occur for women and seniors
- In the high Internet-use Nordic countries, over 60% of 55 to 64-year-olds, and nearly 75% of women are in employment
- In contrast, in the Mediterranean countries, where Internet use is low, these proportions drop to just over 40%, and just under 60%, respectively.

This finding is also supported when we look at gender differences in Internet use. Internet use is virtually identical for males and females in Denmark, where female workforce participation approaches that of males. In contrast female Internet use is 10% points below that of males in Italy, where female workforce participation is only half that of males.

Finding 6 *The intensity of ICT use within a country's workforce may also help explain cross-country differences in Internet use, but evidence is mixed.*

The theoretical argument is as follows. Workforce participation acts as a stimulus to Internet adoption when workers are exposed to ICT in the workplace. So in those countries which have high levels of ICT use in the workplace, we might expect to see high levels of Internet use in the population as a whole - as those who use ICT skills in the workplace are likely to also use the Internet at home and to transfer their skills to friends and family.

Figure 2-8

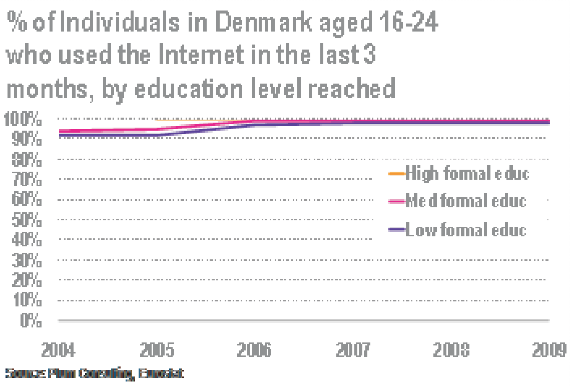


Figure 2-9

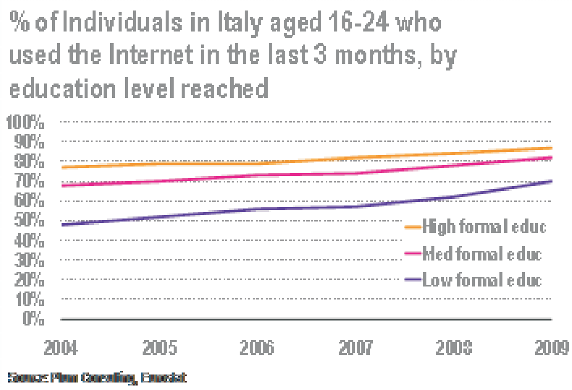


Figure 2-10

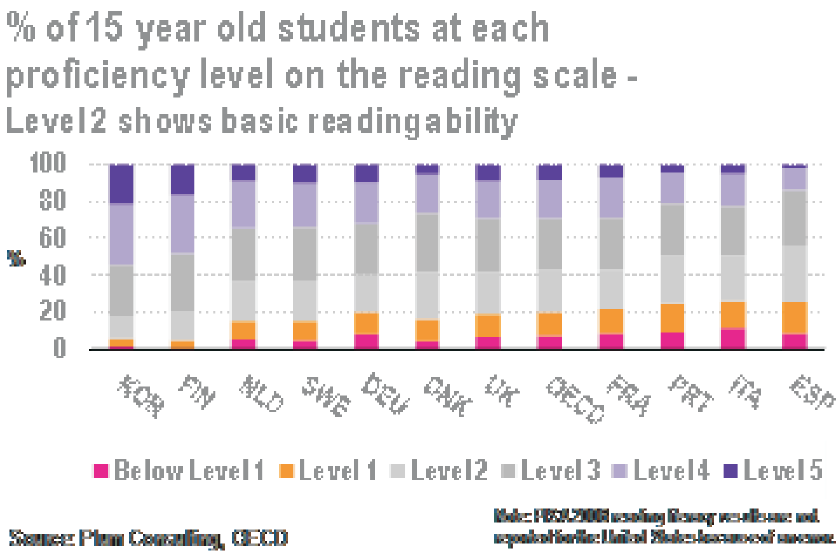
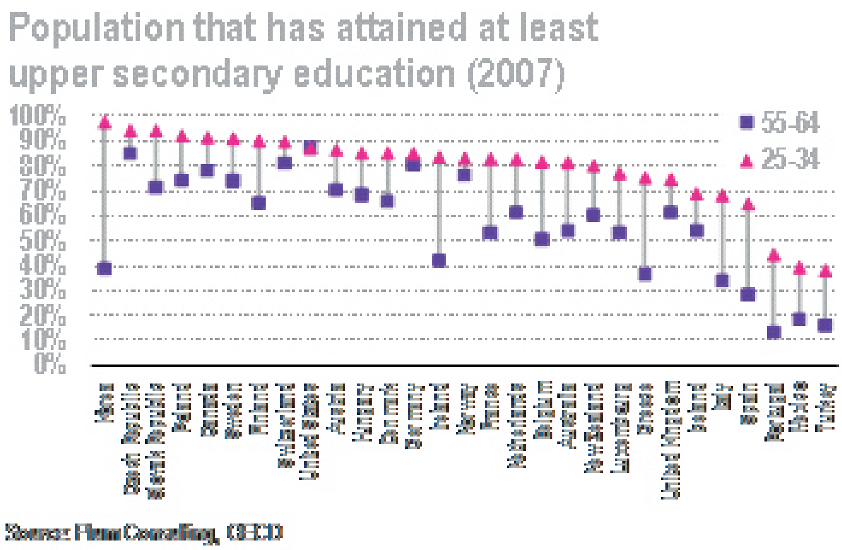


Figure 2-11



The empirical evidence is presented in Figure 2-13, with mixed results. The graph plots the proportion of persons employed with ICT user skills[10] and shows that this proportion is generally higher in the Nordic countries than in the Mediterranean countries. However, there are exceptions: Italy has high percentages of people with ICT user skills, on par with the Nordic countries, while it has much lower levels of Internet use, as demonstrated in Findings 1 and 2.

Finding 7 *The supply-side factors most likely to influence Internet use - the price and availability of broadband - appear to have had only a modest impact on cross-country variation in levels of Internet use.*

Figure 2-14 plots the ratio of the price of broadband to GDP per head - a reasonable measure of the affordability of broadband – against broadband penetration[11] for OECD countries and for some EU member states from central Europe. This price to GDP ratio appears to bear little relationship to broadband take-up (or levels of Internet use) for the wealthier countries[12] but to have a significant impact on the poorer countries.

It is more difficult to analyse the impact of ***broadband availability*** on levels of Internet use because the reported data do not include reliable measures of broadband availability.[13] But we note that:

- Internet use is relatively high in the US where surveys report that the lack of available broadband is the main barrier to take-up for 16% of non-users.
- Internet use in Korea is below Nordic levels despite significantly higher levels of broadband take-up,[14] which we understand are the result of intensive supply-side measures by the Korean government from the mid 1990s on.

Figure 2-12

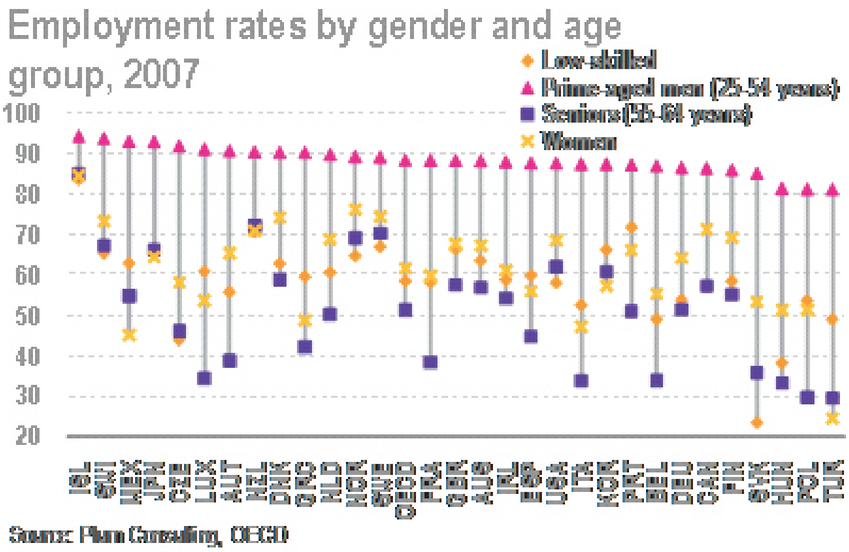
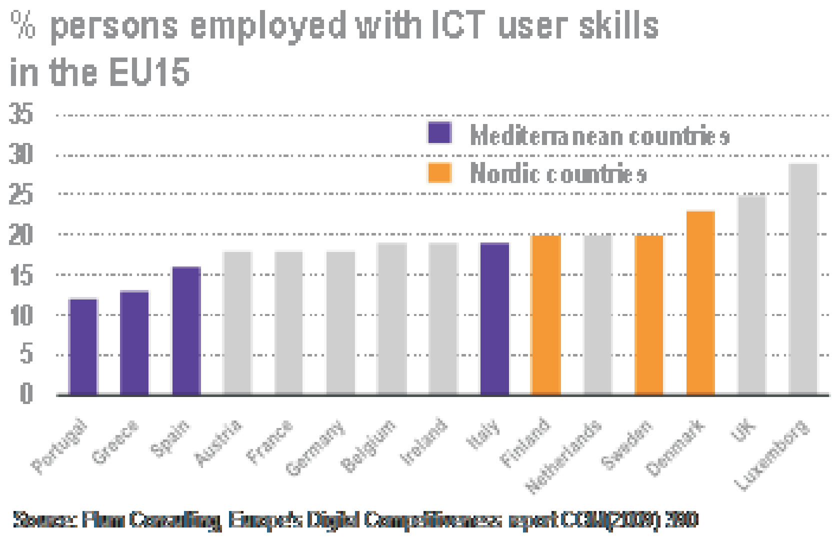


Figure 2-13



Together these observations suggest that the relationship between the level of Internet use and broadband availability or price is relatively weak – at least for the wealthier countries of the OECD and EU.

Finding 8 *The proportion of the population who speak English may have played a role in shaping the level of Internet use in the past. But English language capability as a factor determining Internet use is now likely to be diminishing fast.*

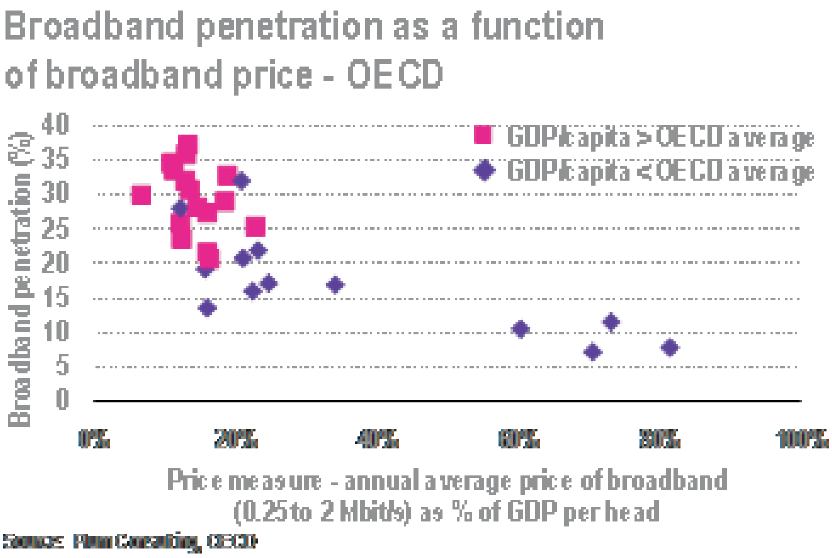
English language capability might in part explain historic differences in Internet use given the relatively large amount of material in English on the Internet. English is more widely understood in the US than in the EU15 and, within the EU, in the UK and Ireland followed by the Nordic countries. In contrast English is less widely spoken in Italy and Spain.[15] These differences fit some of the observed variations in levels of Internet use, but English language capability is diminishing quickly as a determinant of Internet use for two main reasons:

- While there may be a lag in localising new applications which originate in English to other languages, those that are successful tend to be localised first. So the base of local language content is growing quickly.
- Social websites with user generated content, like Facebook and YouTube, allow participation by all language groups. Such social networking websites are now in the top five most popular websites in virtually every developed country.[16]

Finding 9: *There are a number of other cultural factors which might affect levels of Internet use.*

The Internet is a global phenomenon, but its take-up and use, rather like that of mobile phones, is influenced

Figure 2-14



by the cultural values of individual countries. In the case of the Internet, an obvious candidate is the extent to which the society is based around the home or around public meeting places such as cafes, bars or restaurants. Such differences may account for some of the differences in level of Internet use between the North European and Mediterranean countries. But there are counter arguments.[17] And there may now be a trend towards a common digital culture which reduces differences in levels of Internet take-up by country - especially amongst the young.[18] For example, Portugal is a country with relatively low levels of Internet use overall, but its young people are moving quickly towards the 100% Internet take-up already achieved in many countries of northern Europe.

Why do some people not use the Internet?

Surveys of non-users

There are surveys of people who do not use the Internet in the EU, US, and Korea.[19] It is difficult to interpret and compare the surveys, given that they do not offer a comprehensive list of barriers to Internet use.[20] But the surveys suggest that there are three main demand-side barriers to Internet use:

- Non-users do not see the relevance of the Internet to their lives (*Not needed*).
- Non-users do not have the skills to use the Internet (*Lack of skills*).
- Non-users cannot afford the equipment and/or telecommunications connection charges required to use the Internet (*Expense – Equipment and Access costs*).

Not needed is currently the biggest barrier. But, as - shows for the EU15:

- *Expense* and *Lack of skills* grow as reported barriers to Internet adoption as incomes fall.
- *Expense* is probably the most important barrier to Internet use amongst those in the poorest households. This group also tends to have the lowest education which, as we show later, is the population segment which makes up the biggest group of persistent non-Internet users.

The survey finding that *Expense* is a significant barrier to Internet use appears to contradict Finding 7 in Section 2.3 that the price of broadband as a % of income has little impact on current levels of Internet use. This apparent contradiction is, at least partly, resolved when we note that these findings apply to different groups. Current Internet users are not as affected by the price of broadband as they tend to be the wealthier members of the population. In contrast, expense may be a significant barrier for non-Internet users who tend to be the poorer members of the population.

We might reasonably expect the barriers to Internet use to change over time as the population of non-users shrinks. We can observe such changes already in the data. In the US for example the frequency of the response *Not needed* fell from 45% to around 30% between 2007 and 2009, as the proportion of non-users shrank from 29% to 21% of the population. In the EU it fell rather less. Over time *Expense* might also grow in importance as a barrier, given that the proportion of non-users on lower incomes – where *Expense* is a more important barrier – will tend to grow over time.

Literature on adoption of Information Communication Technologies (ICTs)

It is useful to compare the barriers to Internet use with the findings from the literature on how consumers and businesses adopt ICT. For example Davis (1989)[21] developed the Technology Acceptance Model (TAM) and subsequent work by Mathieson (1991)[22], and Szajna (1996)[23], which evaluated the TAM against rival theories, concluded that the TAM was superior. The TAM predicts that, within the workplace, ICT adoption depends primarily on:

- *Perceived usefulness* - the extent to which an ICT enhances performance.
- *Perceived ease-of-use* - the extent to which using an ICT is free of effort.

Later work also shows that *Enjoyment* has a significant impact on consumer ICT adoption. In 2004 Pagani[24] considered consumer, rather than workplace, ICT adoption for mobile broadband services. She reached conclusions which are consistent with the TAM while adding *Price* and *Speed of use* as subsidiary determinants of adoption.

In combination, the findings of this literature are broadly consistent with the Internet barriers to use identified in the surveys. *Not needed*, *Lack of skills*, and *Affordability* map across as the opposite of *Perceived usefulness*, *Perceived ease-of-use*, and *Price* respectively.

Financial exclusion as a barrier to Internet use

Although not considered in the surveys, lack of a debit or credit card is also likely to be a significant barrier to Internet use. An important driver of Internet use is the ability to make purchases over the Internet. Some analysts,[25] and some of our interviewees, even argue that such transactions can generate savings which more than offset the equipment and service costs incurred in using the broadband Internet.

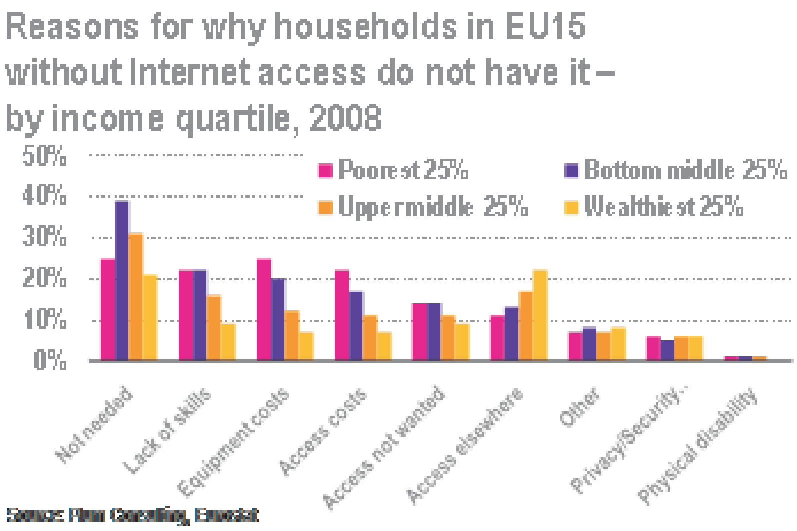
Such e-transactions are currently difficult without the use of a debit or credit card. According to a European Commission report,[26] around 18% of the EU15 population did not have such a card at the end of 2003. Moreover these people are, according to the Commission's report, *"very often in a vulnerable position in society - living on low incomes, unemployed, single people, recipients of social assistance, retirees, or immigrants."* These are precisely the groups most likely to be in the 35% of the EU15 population who currently are not Internet users. In other words, a substantial minority of current non-Internet users are unable to carry out e-transactions on the Internet because they lack a debit or credit card. This significantly reduces the value of the Internet to many potential users and makes it more likely that demand-side measures will be ineffective.

How market trends are changing barriers to Internet use

After a relatively long period of stability, in which the Internet was accessed through a fixed connection and on a PC using local software and a browser, we now appear to be in a period of rapid change in the way consumers use the Internet. The following changes, which are now clearly evident but not yet widespread, may fundamentally change what it means to adopt broadband, use a computer and go online:

- A proliferation of devices with Internet connectivity, including smartphones, netbooks, tablets and single purpose devices such eBooks and Skype all-in-one video cameras, are changing what it means to "go online".
- New interfaces and operating systems provide relatively simple, intuitive and powerful means of interacting with devices/services.
- Mobile broadband adoption, whilst still limited as a substitute for fixed broadband, is growing rapidly in a number of countries and now dominates new additions in countries such as Finland and Austria.

Figure 2-15



- Cloud computing is moving software and software updates away from the user to a server on the Internet, thereby reducing the skills required. Cloud computing is also lowering the processing power and memory requirements of devices.

- Applications (Apps), such as those provided by Apple, Google and Nokia, are making the Internet easier to use. End users no longer need to navigate via a browser and URL but can go directly to a specific application whose function is transparent.

- Accessibility barriers by those with disabilities are also reducing. In particular, the addition of Braille readers, sign language, touch screens and voice recognition features to mass market devices and software is improving access for those with visual, hearing, physical and motor skill impairments; and for those with low literacy levels .

Other market trends are making it possible for those who are financially excluded to carry out e-transactions. For example:

- Credit card companies such as Visa, Maestro, Paypal and Mastercard have begun to offer prepaid credit/debit cards which do not require a bank account or credit check and can be used the same way as a standard credit/debit card for online or regular shopping

- Mobile phone companies now offer subscribers with prepay credits the opportunity to use them to pay for goods and services on-line

These changes may significantly improve the prospects for achieving high levels of Internet use among particular population segments. For example:

- In future it may not be necessary to teach people computer skills or even how to go online in order for them to benefit from online services. Some prospective Internet users might go online using an e-book reader while others might use a smartphone to access applications directly - rather than using a PC and browser to access the Internet.

- Market players might raise awareness of the benefits of using the Internet amongst non-users. For example, current advertisements in the press stress the applications which smartphones offer, rather than their general functionality.

- Affordability barriers might be significantly reduced. For example:

  – Open source software, including Linux and Google Chrome Operating System, will lower the overall costs of devices.

  – The move towards WiFi in hotels, cafes and public places offers an opportunity for free broadband access.

  – The costs of mobile broadband per Megabyte will reduce very substantially as LTE-based networks are rolled out.

  – Given their different cost structures mobile operators can offer substantially lower prices than fixed operators to people who want low volume broadband Internet use but have a restricted budget.

These trends have important implications for how governments spend money on programmes to stimulate Internet take-up, which we consider further below.

What have Governments done so far to stimulate demand?

Key findings

There are a large number of existing government-funded demand-side measures in the study countries.

There are relatively few measures which specifically aim to raise awareness of the relevance of the Internet to non-users, even though this is currently the biggest barrier to Internet use.

It is difficult to draw any firm conclusions about cost-effectiveness or effectiveness in stimulating take-up of government- funded measures because of a lack of rigorous ex-post analysis of their impacts.

When we look at specific government-funded programmes, the evidence is mixed. Some measures, such as the *Million Housewives* programme in Korea and measures in Portugal to stimulate Internet use among younger age groups, appear to have had a significant impact. Others have not.

Targeted, multi-measure programmes with strong local involvement are more likely to be effective in increasing Internet use than demand-side measures which do not exhibit these characteristics. However, they may not necessarily be the most cost-effective programmes.

The different types of government-funded measures

Alongside measures undertaken by market players, a large number of government-funded demand-side measures are already in place to stimulate Internet take-up. Annex B provides a partial list of recent demand-side measures in the study countries. These measures fall mainly into three categories:

- Measures to raise ICT skills through ***digital literacy*** initiatives. One recent study[38] identified 464 such initiatives in Europe, the US, Canada, and India.
- Measures to make services, equipment and training more ***affordable***. The focus is on providing cheap or free equipment to individuals and/or communities, and on improving the affordability of broadband access at schools, libraries and community centres. So far, there are very few measures to deal with the affordability of broadband services at home.
- Measures to increase the ***relevance of the Internet***. Most frequently this involves governments providing new e-services

Although surveys show that the biggest barrier to Internet use is *Not needed* (Section 2.4), we struggled to find many demand-side measures designed specifically to raise awareness and demonstrate the relevance of the Internet to non-users.

Evidence of effectiveness - existing studies

We started our assessment of the effectiveness of existing demand-side measures with a review of the literature. We quickly focussed on four studies that provide recent reviews of government initiatives in this area:

- The Berkman Centre for Internet and Society at Harvard University (October 2009) study.[39] This project looks at both demand-side and supply-side measures to stimulate broadband Internet use, and it is an input to the National Broadband Plan being developed by the FCC.
- The Danish Technological Institute (2008-2009) study for the European Commission[40]. This project focuses on assessing best practice in digital literacy programmes across the developed world.
- A study by Hauge and Prieger (October 2009)[41] which is also an input to the FCC's National Broadband Plan. Here the authors focus on government-funded demand-side measures intended to stimulate broadband take-up in the developed world.
- A study commissioned by the European Commission on e-Inclusion public policies in Europe (September 2009)[42]. The objectives of the study were to illustrate "where and how public intervention has made a clear difference in terms of reducing digital divide" and to classify the "ways for a public authority to design, launch and follow up e-Inclusion policies".

In summary, these studies conclude that:

- There is virtually no evidence on the effectiveness of demand-side measures - primarily because there has been no proper evaluation of the measures. **Most programmes e**valuate the measures in qualitative terms or assess how well a programme was ***implemented***. But there is almost no attempt to quantify ***effectiveness*** in terms of ***outcomes*** achieved. And when such assessments are made, costs are typically incomplete[43], benefits ignored and the counterfactual is not properly defined.
- Targeted rather than general programmes are more likely to meet the divergent needs, attitudes and adoption processes of non-users.
- Local[44] rather than national programmes are more likely to be effective. They may be better supervised, have a better understanding of the

needs of the target group, be better able to reach the target group and make it easier to establish a control group.

- Multiple-measure rather than single-measure programmes[45] are more likely to be effective given that non-users often face multiple barriers to going online.

We note that the last three conclusions help identify programmes which may be more effective in promoting take-up, but do not necessarily point to programmes that are most cost-effective

However, there is no clear evidence that the Avanza programme resulted in faster rates of adoption in Spain (Figure 3-2) than in Finland, except among young people where Internet use is already close to 100% in Finland.

Demand-side measures in Korea

We have also looked at initiatives in Korea. Here there is reasonably good evidence of effective demand-side measures. An early period of rapid growth in Internet adoption followed a series of demand-side stimulation initiatives by the Korean government. Two specific initiatives in the period 2000 to 2002 were the *Million*

Figure 3.1

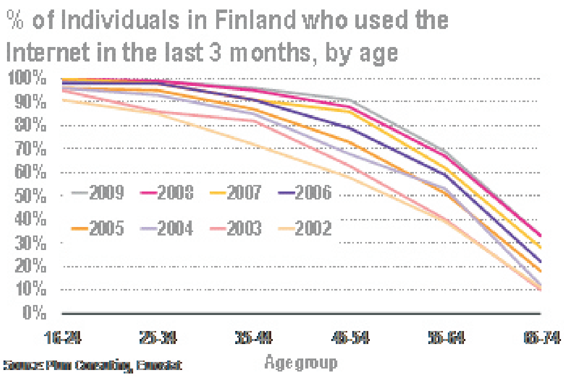
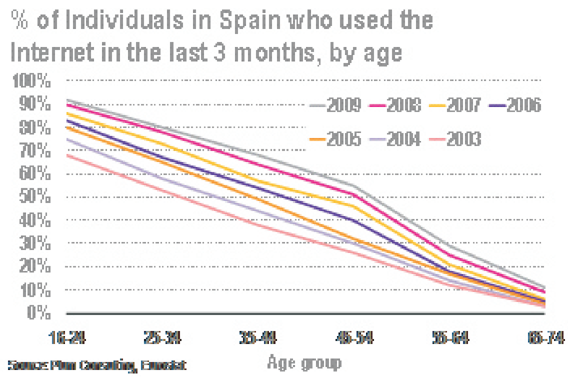


Figure 3.2



Evidence of effectiveness from specific countries

Spain versus Finland

We have also looked at how known country initiatives might impact Internet adoption. We found that the Finnish government has spent very little on demand-side measures and, in particular, on measures targeted at older people. Despite this, Internet adoption in Finland, including adoption by older users, is relatively high and increasing (Figure 3-1). In contrast the Spanish government has reportedly spent over €5 billion[46] under the first Avanza programme between 2005 and 2008 in order to stimulate Internet and broadband use, with much of the expenditure on demand-side measures, and is embarking on the second stage of the programme.[47]

Housewives project and the *PC for Everyone* initiative which was targeted at low income earners. These initiatives are indicated in Figure 3-3 and 3-4. When compared with take-up of the Internet across the population as a whole, the *PC for Everyone* initiative appears to have had no impact at all. In contrast, the *Million Housewives* initiative coincided with increased Internet take-up by housewives in the period 2001 to 2003 which was more rapid than take-up by other groups.

The case of Portugal

Finally, we consider Portugal, which in contrast to Italy, has seen a rapid and sustained increase in Internet use by the young. Figure 3-5 and Figure 3-6 illustrate

The Portuguese government had completed

Figure 3.3

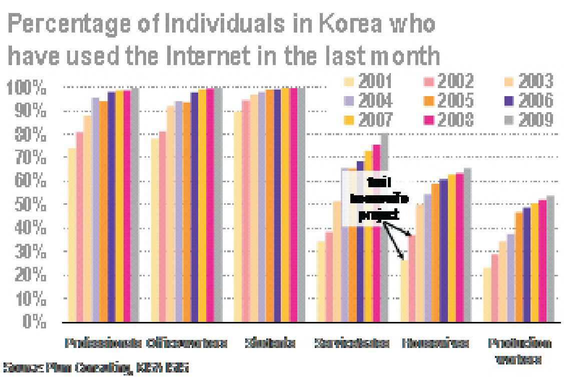


Figure 3.4

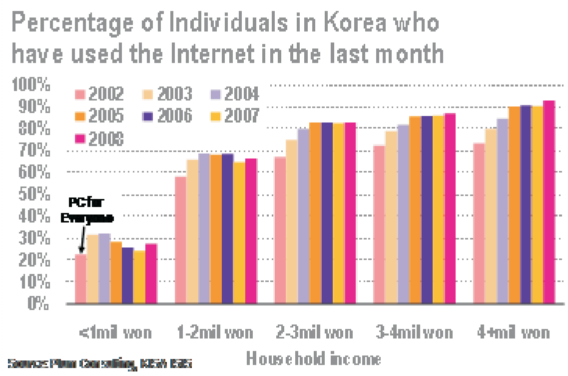


Figure 3.5

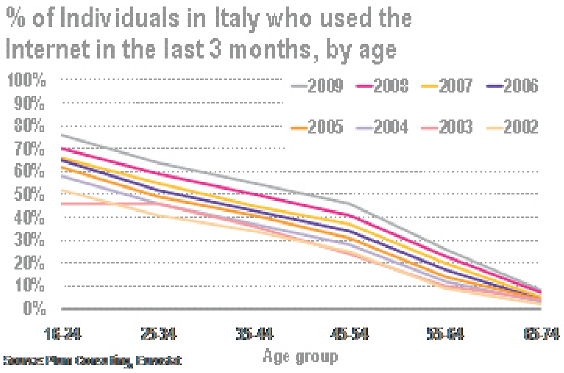
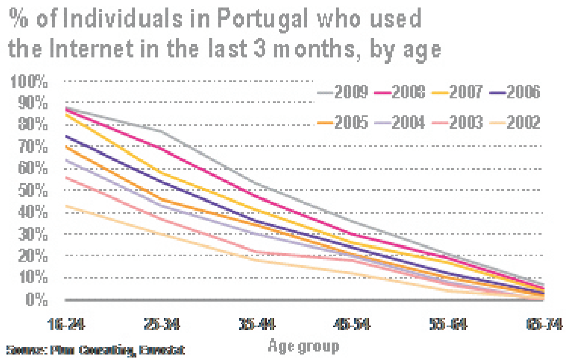


Figure 3.6



implementation broadband connectivity to schools by January 2006, and in addition there is a relatively high level of public WiFi provision and mobile broadband adoption in Portugal.[48] These factors, perhaps alongside others, may explain the difference in outcomes between Portugal and Italy. We note that the Portuguese outcome was achieved even though Portugal has the lowest proportion of 25-34 year olds, among all the study countries, to achieve at least upper secondary education. This example shows that significant change can occur relatively quickly, at least for young people.

What will happen if there is no change of policy?

Key findings

If policymakers believe that current policies will lead to significant progress towards inclusion over the next five years, then they could be disappointed. On current trends:

- The population of non-Internet users among poorly educated older people will decline only from 60 million to 52 million in the EU15 between 2009 and 2014.
- It will take nearly 30 years to reduce the percentage of non-users among poorly educated 55-74 years old to 10%.
- It will take eight years for the 25-54 year old group, who make up most of the workforce, to reach 90% penetration of Internet users.

around 42 million 55 to 74-year-olds with only minimal education are non-users and that this group will take 29 years to reach 90% Internet use on current trends (ie Italy is five years behind Finland).[49]

This graph raises a number of issues for policymakers:

- What should be done to stimulate Internet use among 55 to 74-year-olds with little formal education? As the biggest group of non-users in the EU, they will take around 30 years to reach 90% use if nothing more is done to stimulate take-up. - shows the slow pace by which this age group begins to use the Internet, even in a country with high Internet use like Denmark.
- Is there a need for demand-side measures to stimulate Internet take-up among poorly educated 25 to 55-year-olds? In the average EU member state

Figure 4.1

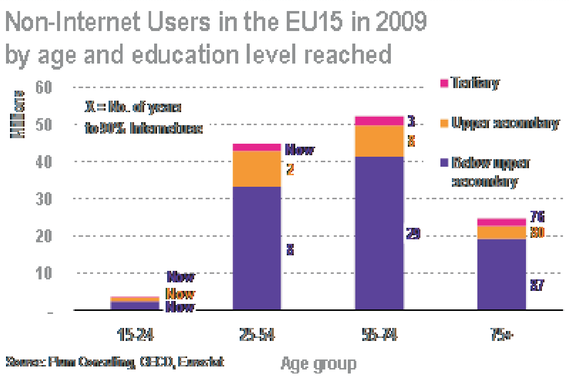
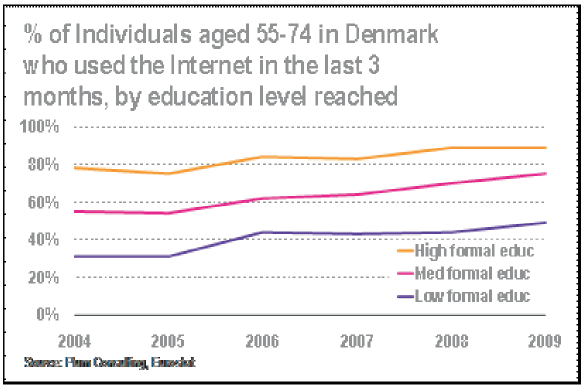


Figure 4.2



Almost all of this change will occur because of cohort effects rather than because of effective demand-side measures. The analysis which leads us to this conclusion is set out below.

How quickly is the level of Internet use growing?

How quickly is the level of Internet use growing? Will market forces combined with current policies close this gap relatively quickly, or is it appropriate to consider additional government-funded demand-side measures to stimulate Internet use?

Figure 4-1 shows the number of non-Internet users in the EU15 by age and education. It also shows how quickly each age/education group will reach 90% Internet use on current trends. For example, it shows that

this group, a key part of the labour force, will reach 90% use after eight years on current trends.

- Should governments aim demand-side measures at the over 75s or should they rely on the aging of younger people with higher levels of Internet use to deal with low use by this age group?

Figure 4-1 highlights the main problems in the EU15. But will a corresponding analysis for individual member states highlight similar problems and priorities? Figure 4-1 suggests that there is virtually no problem of Internet use amongst young people. But if we look at individual countries like Italy, rather than the EU15 as a whole, we find that there are problems. Figure 4-3 illustrates. It shows that young Italians with basic education will take another five years to reach 90% Internet use on current trends.

Figure 4.3

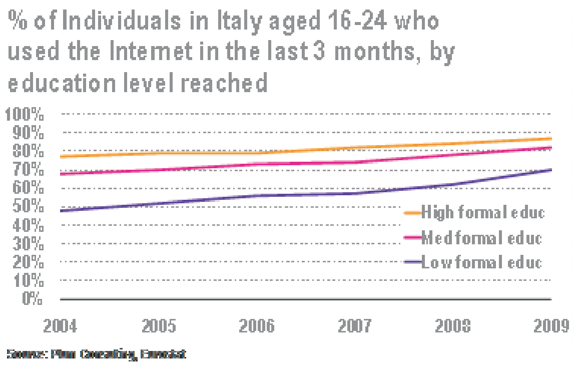
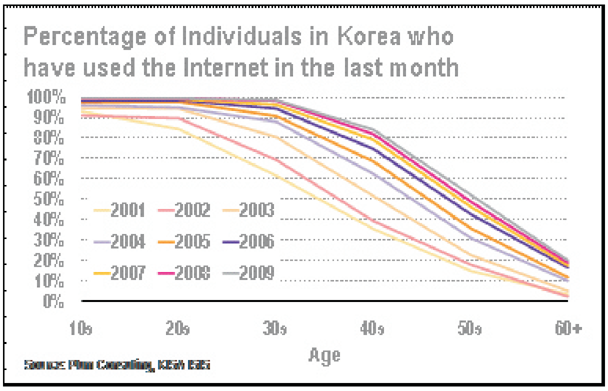


Figure 4.4



How much of this change is due to cohort effects?

Figure 4-1suggests that the biggest challenge to increasing broadband take-up to 100% lies in persuading older people with only basic education to use the Internet. In this group there are two main effects driving increased Internet use:

- ***Cohort*** effects. With each year that passes, an annual cohort leaves a younger age group to join an older one. This cohort has a higher average level of Internet use than the age group it joins, and this raises the average level of Internet use in the older age group.

- ***Diffusion*** effects. These arise through some combination of word-of-mouth recommendation, on-the-job transfer of ICT skills, market initiatives by private suppliers, and government-funded demand-side measures.

Our analysis indicates that the bulk of the increase in the level of Internet use amongst older people is currently generated by cohort rather than diffusion effects. Figure 4-4 the age profile of Internet use over time in Korea - illustrates this point.

When we look at this figure we can see that:

- The level of Internet use by the over 60s in Korea has risen by 20 percentage points over the last eight years, i.e. by an average of 2.5 percentage points each year.

- The level of Internet use falls by two percentage points for each successively older annual cohort over the age range of 40 to 60-years-old.

If we assume that, once they become Internet users, people do not give it up, then this tells us that 80%[50] of the annual increase in Internet use by the over-60s is driven by cohort effects, and only 20% by diffusion effects (which include demand-side measures). When we repeat this analysis for the EU15, we find that around 65% of the increase in Internet use by older people is driven by cohort effects, with the balance driven by diffusion effects.

This analysis shows that demand-side measures so far have done very little to increase Internet use among older people, a conclusion which policymakers need to keep in mind when considering how to design and fund demand-side measures aimed at older people.

What should Governments do now?

Key findings

We have identified four main ways in which governments might make the demand-side measures they fund more effective. They might:

- Set funding priorities in a more systematic way.
- Establish a rigorous funding and evaluation process.
- Take advantage of recent market trends.
- Address specific known barriers to Internet use.

Our analysis also indicates that the level of Internet use may be related to workforce participation and the use of ICTs within the workforce. This suggests that governments might take steps to improve these aspects of their economies - for example through changes to retirement policy and reform of labour and product markets. Such measures will take time and will be pursued (or not) to improve economic performance in general, rather than to increase Internet take-up per se. Hence we do not consider them further.

5.2 Set funding priorities in a more systematic way

The appropriate way to target demand-side measures will vary by country. It is therefore important for governments to carry out analyses, similar to those set out in Section 2, before establishing priorities for funding. To do this, governments will need to continue to undertake surveys to monitor broadband take-up, Internet use, and barriers to use.

This requires adaptations to the surveys to take account of changing consumer behaviour. There will be increasing measurement challenges which will require modified survey approaches. Changes that surveys will need to take into account include:

- Use of mobile broadband. This is now growing rapidly and may in future be bundled with services such as eBooks
- Use of WiFi in many locations
- Use of many different devices to access the Internet including smartphones, TVs, games consoles, netbooks and so forth
- Access to the Internet in different ways. Internet users may no longer need to consciously "go online" but instead may access specialist online applications directly.

Governments can then analyse the trends revealed by survey data on Internet use and barriers so as to assess the scale and persistence of low Internet use among different socio-economic groups before deciding on overall spending priorities.

There is also the bigger question of how much governments should spend in future on supply-side measures, such as subsidising broadband provision in rural areas, rather than demand-side measures. Serious consideration of this issue is beyond the scope of this report. But there does seem to be a strong case for governments to now consider explicitly the balance between the funding allocated for demand-side and supply-side measures in a way which takes account of the following factors:

- While availability of broadband is approaching 100% in many countries, take-up of broadband Internet remains well below this level
- Cross-country variations in levels of Internet use appear to be more strongly related to demand-side than supply-side factors
- Demand-side measures have had limited impact to date
- Market trends could have a significant impact on both the availability of, and demand for, broadband Internet over the next few years.

Establish a rigorous funding and evaluation process

Setting funding criteria

Evidence on the cost-effectiveness of past and current demand-side measures is poor. As Hauge and Prieger note (October 2009):[51]

> *"What we do is examine how well policymakers have evaluated the many current and past programs designed to advance broadband adoption. Unfortunately, the answer is that this has happened all too infrequently."*

A priority in future, and potentially a condition attached to funding, should be that programmes incorporate rigorous appraisal of effectiveness. Further, programmes should be designed around a clear view of the process by which a target group might adopt the Internet. They should also consider how technological and market change may be altering existing barriers. This can be seen as a three step process.

- Step 1: Develop guidelines for assessing applications for government funding and fund the demand-side stimulation programmes which best meet these guidelines.

Table 5-1: A checklist for programmes of demand-side measures which are likely to be cost effective

Question
Does the proposed programme demonstrate a good understanding of the motivation, needs and adoption processes of its target group?
Is that understanding consistent with the available statistics on gaps in Internet use and stated barriers to Internet use?
Has the applicant attempted to learn from others offering demand-side measures to the same target group and, in future, from published evaluations of the effectiveness of previous demand-side measures programmes?
Is the proposed programme scalable and/or replicable?
Has the applicant committed to (say) an ex post evaluation of effectiveness? Is that evaluation sound?
Does the proposed programme complement rather than compete with market initiatives?
Has the proposed programme taken account of the changing context of Internet use – as set out in Section 8.2?

Table 5-2: A sound evaluation process

Question
Is an ex-post evaluation of effectiveness built into the proposal?
Are its objectives clearly specified?
Is a credible proportion of the budget allocated to the evaluation?
Before recruiting them will the applicant seek a commitment from programme participants to cooperate in a long-term follow-up?
Do the evaluators have the necessary skills?
Is the proposed process rigorous and independent?
Does the evaluation show how the outcomes will be compared with a valid control group?

- Step 2: Analyse and disseminate evaluations of the effectiveness of the funded programmes.
- Step 3: Revise priorities and guidelines in the light of these evaluations.

The guidance described in Step 1 might look like Table 5-1 and the evaluation process might have the characteristics of Table 5-2.

Using the Internet adoption process to decide on funding

We suggest that governments should only fund demand-side measures which are consistent with the likely adoption process of the target group. The analysis of Section 2.4 suggests that policymakers need to consider the following questions before designing or funding measures to increase Internet take-up:

- Is the potential user aware of the Internet and its relevance to his or her life? Such awareness lowers the *Not needed* barrier identified in the surveys of non-users. There is evidence that there is still widespread ignorance of the Internet amongst non-users. For example, according to a recent Ofcom survey[52] *"Only 3% of respondents said they had never heard of the Internet"* but, among those who gave *Not needed* as the main barrier to Internet use, *"knowledge of the Internet was low, with 95% confessing little or no knowledge of it".* Demand-side measures to overcome this lack of awareness could be an important first step towards adoption or use

- Is the potential user in frequent contact with someone who can provide support when needed? People who are in frequent contact with regular Internet users - whether in education, at work, or simply through ICT-literate friends or family members - are more likely to take up the Internet

- simply through ICT-literate friends or family members[53] - are more likely to take up the Internet than others. The FCC refers to the need for a social infrastructure to support Internet use. Demand-side measures which create this social infrastructure may be more effective than those which do not.

- Does the potential user have the skills and confidence to use the Internet? Appropriate digital literacy initiatives may be important here. Access to and use of the Internet outside the home could give non-users a good way to assess its value and to give them confidence in their ability to use it before they commit to a broadband subscription and the possible purchase of a PC or other device. In a recent UK survey[54] for example, over seven in 10 (72%) of those who intend to get the Internet at home over the next six months are already Internet users outside the home.

Table 5-3: The possible cost of an older person becoming a regular Internet user

Cost item	Now	Future	Why the difference?
Internet access device	€400	€250	Falling device and software prices
Broadband service for three years	€700	€350	Switch from fixed to mobile broadband package for a low volume Internet user
One-to-one tuition[55]	€300	€50	Simpler use of the Internet via applications rather than browser
Support service for three years	€150	€0	Simpler use of the Internet via applications rather than browser
Total	€1550	€650	

Plum estimates for illustrative purposes only

- Can the potential user afford the equipment, broadband subscription and digital literacy training required to be able to use the Internet at home?

Only if the potential user has positive answers to these four questions is the probability of Internet adoption at home high. But the answers to these questions will vary - especially by age and level of education. So demand-side measures will need to be tailored to specific target groups to meet their particular needs. We consider this point further in the sections which follow.

It is especially important to carry out research to understand the adoption processes of older and poorly educated people for becoming regular Internet users. This group is currently the largest and most persistent group of non-users in the developed world.

Take advantage of recent market trends

In Section 2.4 we discuss current market trends and their impact on barriers to Internet use. This analysis suggests that governments should:

- Avoid putting obstacles in the way of these market trends wherever possible.
- Refuse to fund programmes which fail to take account of changing market trends such as the move from Internet browsers to Internet applications, from PCs to tablets, e-books and smartphones, and from fixed to mobile broadband.
- Design universal broadband policies which allow non-Internet users to choose between fixed and mobile broadband services, so as to match their requirements in terms of speed, download volume per month and budget. Such policies might best be achieved by focusing subsidies on the end user, rather than by following the traditional universal service route and subsidising the supplier.

Consider the option of waiting for these trends to become clearer and then leveraging them so as to fund more cost-effective demand-side measures. Delaying implementation by one or two years, during which Internet devices and services become more user-friendly, might lead to more cost-effective measures. Table 5-3 shows how the cost of getting many older people to become regular Internet users might fall substantially over the next five years from current costs of well over €1000 per person to €650.

Address specific known barriers to Internet use

There are four main barriers to Internet use – lack of affordability, lack of awareness of relevance, lack of appropriate skills, and lack of the means to conduct online transactions.

Lack of affordability

Here governments might focus on enabling markets to work effectively by implementing the measures which respond to market developments as set out in Section 2.5.

Lack of awareness of the relevance of the Internet

We have struggled to identify many demand-side measures which demonstrate the relevance of the Internet to non-users. To date governments have focused efforts largely on funding the development of new e-public services so as to make the Internet more relevant. Yet our interviews reveal general scepticism about the effectiveness of such measures in stimulating Internet use. In addition, the evidence on ICT adoption suggests that most e-government services exhibit few of the qualities required to drive Internet adoption – such as perceived usefulness and enjoyment. According to Hauge and Prieger:[56]

> *"The extent to which such initiatives [for Government provided e-services] by themselves actually entice potential adopters to begin broadband service in their household is likely to be minuscule, particularly if the content is already available in other forms"*

This suggests that governments should not spend significant public funding on launching e-public services solely as a way to stimulate broadband take-up. Instead they should launch only those services which are valuable in their own right.

Governments might use their resources more effectively if they:

- Open up their data for third-party use. This action exploits the fact that market players are generally better able to develop online services which people want than civil servants. Both the US and UK have initiatives along these lines.[57 58] The review of the European Commission Public Service Information Directive in 2012 will provide an opportunity to strengthen initiatives towards open information across Europe.[59]
- Ensure that existing and frequently used e-government services work effectively on mobile devices as well as on PCs in future. Many of today's non-Internet users may not use PCs for online access in future.

They might also raise awareness of the relevance of the Internet through social marketing initiatives. For example, TV companies might develop storylines which involve Internet use in drama programmes which are popular with the main groups of non-Internet users. In the UK, the government has given Ofcom £12 million to fund a Social Marketing Campaign which includes such ideas.[60]

Lack of appropriate skills

There are a large number of existing government-funded initiatives designed to improve the digital literacy of those who do not use the Internet. Many of these are focused on enabling people to use a PC and web browser. The likely effectiveness of these initiatives varies by the age of the target group.

In the case of ***young people***, effective ICT education in schools and universities has a number of beneficial effects:

- It can raise levels of Internet use among the young (as illustrated by Portugal).
- It then can subsequently increase Internet use among older age groups through cohort and diffusion effects.
- It can provide a more ICT-skilled workforce which may improve economic performance.

So there are strong reasons to implement traditional digital literacy initiatives for young people in those countries where Internet use for this age group is still some way short of 100%.

The case for improving the digital literacy of non users ***over 55*** is less clear-cut. To be effective, such initiatives should be delivered in an environment where older people feel comfortable and in a manner which is designed to overcome the fear of failure. But such initiatives, especially when they aim to provide traditional PC and browser skills, are expensive. Governments need to assess the effectiveness of such measures with special care and to consider instead digital literacy courses which are reoriented so that they are based around the simpler and more robust devices for Internet use which are now coming to market.

Those in the 25 to 54 year age group who are currently non-users are likely to have basic education, and to be unemployed or to work in jobs which neither use ICT nor give them access to colleagues who do. Given these characteristics it may cost as much to get this group on line as the over 55s.[61] But members of this group will use the Internet for longer than the over 55s and, once they are on-line, can potentially help their parents become Internet users. So it makes sense to give this group higher priority than the over 55s. But again governments should consider funding courses which are reoriented so that they are based around simple and robust devices for Internet use rather than around PCs.

Some public bodies have suggested putting resources into improving the digital literacy of regular Internet users so that they are capable of carrying out more advanced Internet applications. Without evidence to demonstrate their value, we believe such funding initiatives may be misplaced. Our research suggests that the biggest step in adopting the Internet is for non-users to commit to buying broadband service and an Internet access device and to then maintaining this system. Once consumers have taken this step, they have access to a wide range of online training products to improve their Internet skills, should they wish.

Lack of a means to transact online

A serious impediment to Internet use, and one which is not picked up in surveys, is the lack of any debit/credit card with which to make e-transactions. The market is beginning to respond to this need already. But governments should encourage the development of services which allow those currently without debit or credit cards to carry out e-transactions. A significant minority of non-Internet users lack such cards, even though e-transactions are a powerful incentive for Internet use.

Recommendations to Governments

It is clear from our analysis so far that, for certain segments of the population, progress towards 100% Internet use is painfully slow and existing demand-side measures are not effective. If governments want to fund effective demand-side measures which will accelerate Internet take-up among non-users, then we recommend that they implement the following measures.

Governments should ***set priorities*** for future demand side measures in a more ***systematic way***. They should:

- Review explicitly the balance between the funding allocated for demand-side and supply-side measures.
- Analyse the trends revealed by survey data on Internet use and barriers so as to assess the scale and persistence of low Internet use among different socio-economic groups before deciding on overall spending priorities.
- Continue to undertake surveys to monitor broadband take-up, Internet use, and barriers to use, but modify the surveys to take account of changing consumer behaviour. For example, the surveys should include questions that capture mobile broadband use, Internet use outside the home and the move from a general purpose browser to specific applications when consumers use the Internet.
- Give top priority to measures which stimulate demand among young people if survey analysis reveals this is a problem. Such measures produce a more ICT literate future workforce. Survey data shows that it is possible to achieve near 100% Internet use among young people (Denmark) and it is possible to make a significant difference quickly (Portugal).
- Give second priority to non-users aged 25 to 54
- Carry out research to understand better the process by which poorly educated people over 55 might become regular Internet users. This group is currently the largest and most persistent group of non-users in the developed world.
- Make rigorous, ex-post, evaluations of effectiveness a condition for funding programmes of demand-side measures from now on. Governments then need to disseminate the findings of these evaluations and learn from them before funding subsequent programmes.

Governments should ***take advantage of market trends*** to make demand side measures as cost effective as possible. They should:

- Refuse to fund programmes which fail to take account of changing market trends such as the move from Internet browsers to Internet applications, from PCs to tablets, e-books and smartphones, and from fixed to mobile broadband.
- Look critically at programmes of demand-side measures aimed at poorly educated people over 25 before funding them. There is considerable evidence that such programmes could be costly and slow to take effect. Reorienting such programmes to use the more robust and user-friendly Internet access devices which are now becoming available might lead to more cost-effective measures for this group.
- Ensure that existing, frequently used, e-government services work effectively on mobile devices as well as on PCs in future. Many of today's non-Internet users may not use PCs for online access in future.

To deal with the growing problem of ***affordability*** governments should design universal broadband policies which allow non-users to choose the appropriate broadband package from fixed and mobile offerings. One way to do this is to move any government subsidies from the supply-side to the demand-side.

In terms of ***removing other specific barriers*** to Internet use, governments should:

- Encourage the development of services which allow those currently without debit or credit cards to carry out e-transactions. A significant minority of non-Internet users lack such cards, while e-transactions are a powerful incentive for Internet use.
- Encourage social marketing campaigns by media companies to raise awareness of the benefits of the Internet. For example TV companies might produce more dramas which involve Internet use.

Governments ***should not***:

- Spend significant funds on launching e-public services as a way to stimulate broadband take-up. Instead they should launch only those services which are valuable in their own right.
- Fund measures which attempt to increase the digital literacy of those already online without specifying clear goals for this policy and collecting evidence that such measures are likely to be effective.
- Fund programmes which are not consistent with an evidence-based adoption model for each target group.

Notes

1. The 15 EU member states before expansion in 2004
2. With each year that passes an annual cohort leaves a younger age group to join an older one. This cohort has a higher average level of Internet use than the age group it joins, and this raises the average level of Internet use in the older age group
3. Getting the full population online
4. For example the FCC is developing a series of government-funded demand-side measures as part of its National Broadband Plan, due for publication in March 2010. The European Commission is carrying out similar analysis
5. The data comes from the Pew Institute for the US, Eurostat for the EU, and the Korea Communications Commission and the Korea Internet and Security Agency (KISA) for Korea. In addition to measuring Internet use across different population segments, these surveys also provide analysis on why people do not use the Internet. Annex A describes the data sources in more detail.
6. See for example the findings of econometric studies published in *Europe's Digital Competitiveness Report*, the European Commission, COM (2009)390, 2009, for the EU, in *Internet un quotidien: un Francais sur Quatre*, Y Frydel, May 2006. INSEE Premier no 1076 for France ,and in *Communications Usage Trends Survey*, Minister of Internal Affairs and Communications of Japan, 2006 for Japan
7. They might also want to monitor progress in their own country against other benchmarked countries or regions on each of these factors
8. Data on level of Internet use by age ***and*** income does not exist because, while age and education are associated with individuals, income is associated with households
9. OECD. PISA 2006 Results. Note that whilst comparable US data is not available, the US appears comparable with the OECD average. http://www.pisa.oecd.org/document/2/0,3343,en_32252351_32236191_39718850_1_1_1_1,00.html
10. Basic and advanced skills combined as defined by the OECD. There are other measures of ICT use, such as the contribution of ICT investment to GDP growth, which lead us to the same finding with less ambiguity.
11. We use *Broadband penetration* rather than *Household broadband penetration* or *Internet use* because we then have access to a substantially bigger data set
12. Countries with an annual GDP per head in excess of the OECD average of US$32,000
13. Most countries report the proportion of people served by DSL enabled exchanges. This measure significantly overestimates the proportion of the population for whom broadband is available at download speeds of (say) 0.5 Mbit/s or more
14. In the Nordic countries there is over 80% Internet use while household broadband penetration is at around 70%. By contrast Korean Internet use is at 78% despite household broadband penetration being at 94%
15. http://en.wikipedia.org/wiki/List_of_countries_by_English-speaking_population
16. *Europe's Digital Competitiveness Report,* 2009, which covers the EU plus US, Japan and China
17. For example people in Mediterranean countries have less leisure time than people in Nordic countries and the Internet might be of greater value to them (see OECD http://www.sourceoecd.org/pdf/societyataglance2009/812009011e-02.pdf)
18. Most research on this effect is focused on mobile phones rather than use of the Internet. See for example *The Apparatgeist calls*, the Economist, 30/12/09
19. For example by the Pew Institute in the US, by Eurostat in the EU, and KISA in Korea
20. In addition the EU survey asks for ***reasons*** for non-Internet use which sum to well over 100%, rather than asking for the ***main reason*** for non-use, as in the US, or asking respondents to rank or scale reasons for non-use
21. *Perceived usefulness, perceived ease-of-use, and user acceptance of information technology*, Davis, FD, 1989, MIS Quarterly, 13(3), 319-340
22. *Predicting user intentions: comparing the technology acceptance model with theory plan behaviour*, Mathieson K, 1991, Information Systems Research, 2(3), 192-222
23. *Empirical evaluation of the revised technology acceptance model*, Szajna B, 1996, Management Science, 42(1), 85-92
24. *Determinants of adoption of third-generation mobile multimedia services*, Pagani M, Summer 2004, Journal of Interactive Marketing, 18(3), 46-59
25. See for example *The Economic Case for Digital Inclusion*, Price Waterhouse Coopers, October 2009
26. *Financial inclusion: ensuring access to a basic bank account*, European Commission, MARKT/H3/MID(2009), February 2009
27. For example to maintain software for use on a PC
28. The Apple Snow Leopard OS which includes support for those with visual impairment including brail le support. http://www.apple.com/macosx/universal-access/
29. *YouTube videos which will include automatic captioning*. http://news.bbc.co.uk/1/hi/technology/8369941.stm
30. iPhone"voice over" gesture based screen reader and 3rd party applications including sign-language. http://www.apple.com/accessibility/iphone/vision.html
31. http://www.visaeurope.com/personal/choosing/payinadvance.jsp
32. http://www.splashplastic.com/
33. http://www.mycashplus.co.uk/
34. The FCC has recognised these trends in developing its national broadband plan. According to FCC Commissioner Meredith Attwell Baker, 4 December 2009 "*Encouragingly, there are signs that mobile devices—smartphones and increasingly netbooks—are empowering people, particularly older Americans, lower income households and other underserved communities, to go online for the first time."*
35. Anticipated in 2010
36. Entertainment in the UK in 2028, Plum for Ofcom, February 2009, http://www.ofcom.org.uk/research/technology/research/sectorstudies/entertainment/entertain2028.pdf
37. The costs of fixed broadband are dominated by the fixed costs of installing and maintaining the line to the user's home. The costs of mobile broadband are dominated by the traffic volumes generated by the end user. So it is possible to offer a low volume user a cost based price which is significantly lower with mobile than with fixed broadband
38. Supporting Digital Literacy Public Policies and Stakeholder Initiatives, Danish Technological Institute. Centre for Policy and Business Analysis.. 2008-2009. http://www.digital-literacy.eu/20776
39. The Berkman Centre for Internet and Society at Harvard University. *Next Generation Connectivity: A review of broadband Internet transitions and policy from around the world*. October 2009. http://www.fcc.gov/stage/pdf/Berkman_Center_Broadband_Study_13Oct09.pdf
40. Danish Technological Institute. Centre for Policy and Business Analysis. *Supporting Digital Literacy Public Policies and Stakeholder Initiatives*. 2008-2009. http://www.digital-literacy.eu/20776
41. Hauge and Prieger. *Demand-Side Programs to Stimulate Adoption of Broadband: What Works?* October 2009. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1492342

42. Guyader, Herve le. *e-Inclusion public policies in Europe.* September 2009. http://ec.europa.eu/information_society/activities/einclusion/library/studies/docs/einclusion_policies_in_europe.pdf

43. For example the time of volunteers is not included as a cost

44. Or national programmes which leverage local knowledge and expertise

45. For example the FCC's e-rate programme to provide cheap broadband to schools

46. http://www.planavanza.es/InformacionGeneral/Executive/Paginas/ExecutiveSummary.aspx

47. We understand that not all of the expenditure attributed to the Avanza programme necessarily represented additional expenditure – though it may have been reprioritised

48. Broadband experience in Portugal José Amado da Silva (Anacom). October 2009. http://www.anacom.pt/streaming/Amado_da_Silva_present_broadband_experience.pdf?contentId=987561&field=ATTACHED_FILE EC. Overview on eExclusion policies in Portugal. http://www.einclusion-eu.org/ShowCase.asp?CaseTitleID=1665 Ministry of Science Technology and Higher Education. Mobilizing the Information and Knowledge Society. http://www.infosociety.gov.pt/

    Re WIFi see: The Berkman Centre for Internet and Society at Harvard University. October 2009. “Next Generation Connectivity: A review of broadband Internet transitions and policy from around the world.” http://www.fcc.gov/stage/pdf/Berkman_Center_Broadband_Study_13Oct09.pdf

49. The current levels of Internet use for individual Member States is tabulated for the 15-24 and 25-54 age groups in Annex C

50. 2%/2.5%

51. *Demand-Side Programs to Stimulate Adoption of Broadband:: What Works?* Hauge and Prieger. October 2009. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1492342

52. Accessing the Internet at Home, Ofcom, June 2009

53. In the UK there are also cross-generational schemes in which schoolchildren pair up with old people to transfer their ICT skills.

54. Accessing the Internet at Home, Ofcom, June 2009

55. Our research suggests that many older people require up to 10 one hour one-to-one sessions (at €30 each) to become competent users of the PC and browser. They then require significant support to continue as regular users

56. Demand-side programs to stimulate adoption of broadband: what works? Janice Hauge and James Prieger, October 2009

57. http://www.data.gov/

58. Data.gov.uk initiative (under development and currently requires authentication). It is proposed, for example, that Ordinance Survey mappin and postcode data be made freely available.

59. http://ec.europa.eu/information_society/newsroom/cf/itemlongdetail.cfm?item_id=4891

60. See for example http://www.ofcom.org.uk/media/news/2009/10/nr_20091015

61. There may of course be exceptions to this rule - for example digital inclusion of those over 55 who require telecare at home