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The economic realities of achieving high quality universal broadband in Europe

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High quality broadband connectivity for all is central to the European Union's Digital Single Market objectives. Yet the concept of high quality universal broadband and its relationship to a universal service obligation which includes broadband is ill-defined. In this Insight we set out an economically rational approach for defining and funding universal broadband. This highlights the danger of setting overambitious quality requirements and the need to avoid a one-size-fits-all approach to universal broadband across all member states.

Introduction

There is general agreement on the need for high quality broadband connectivity for all if Europe is to flourish economically and socially. But what form should this universal broadband take? In particular:

- What is the economic rationale for pursuing such a policy?
- How should high quality universal broadband be defined?
- How should it be funded?
- What technologies might be used to deliver it?

The economic rationale for universal broadband

There is strong evidence that the universal **use** of broadband services significantly increases economic and social welfare. An essential precondition for achieving this objective is to make appropriate broadband services available and affordable on a universal basis. This creates an immediate policy challenge:

- Industry policy on the supply of broadband is based on private investment by market players
- The case for private investment in high-quality broadband in high cost, mainly rural, areas is often weak or non-existent
- Public subsidy is then required to bridge the gap between what an end user is willing to pay for broadband and cost of supplying it.

Broadband subsidy of this kind must compete with other possible uses of public funds. This includes spend on security, defence, transport, education, health and social security payments. Finance ministers therefore seek justification for public funding of broadband. This requires the communications sector to show that the external benefits created by providing the subsidy - that is the benefits to the wider economy and society, over and above the private benefits enjoyed by the broadband user - exceed the public financing provided. Such externalities arise from a variety of sources. These include:[1]

- More efficient delivery of social services such as online education and e-health
- Greater efficiency in energy consumption
- Better labour market outcomes through more effective matching of job vacancies to potential employees
- Greater political involvement and public safety.

Clearly it is difficult to quantify these externality effects with any precision. But equally clearly this is the right approach to the efficient allocation of public funds for a universal broadband commitment.

Defining the minimum requirements for high quality universal broadband

A member state government needs to define the minimum commitment to universal broadband on four dimensions:

- A minimum download and upload speed which the connection provides to end-users. The current EU target is for everyone to enjoy a download speed of 30 Mbit/s or more by 2020
- A maximum price which is judged ***affordable***. There is remarkably little discussion of affordability of universal broadband by policymakers - although the UN's Broadband Commission has suggested that entry-

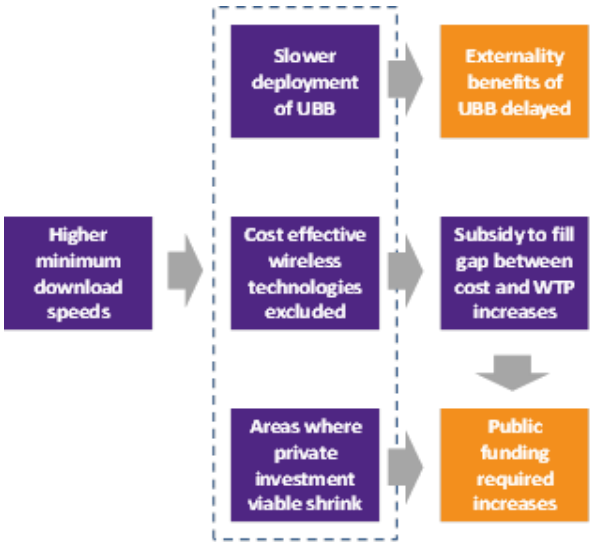
[1] *The digital divide and economic benefits of broadband access*, Council of Economic Advisers to the US Government, March 2016

level broadband services should consume less than 5% of household income while a Plum study for Vodafone[2] proposes the definition shown below:

> *An affordable broadband package is one in which the average household in the lowest income decile…*
>
> *…can download up to N GB of data per month*
>
> *…for less than 6% of net household income*
>
> *… where the minimum monthly commitment is small*[3]

- A minimum download capacity per month. This parameter is important if universal broadband is to remain affordable when delivered over contended wireless access networks where the incremental cost per GB is relatively high and the quality of service varies with the number of simultaneous users
- A minimum population coverage level. How close should this parameter get to 100% given that broadband deployment costs rise steeply when serving the last 1% or 2% of the population? Some might argue that piped water is more important than broadband. Yet piped water is not currently available to 3% of the population in Poland[4].

The way in which these parameters are set fundamentally affects both the scale of public funding required to achieve a universal broadband commitment and how long it will take to achieve this commitment.



[2] *Are telecommunications services universally affordable across the EU?*, Plum for Vodafone, October 2010
[3] Low income households need to be able to reduce broadband spend if their income falls or expenditure rises unexpectedly in a particular month so that they can balance the household budget
[4] WHO/UNICEF joint monitoring programme

In addition, a member state government might want to specify priorities for which types of premise should get universal broadband first. Schools, health centres and SMEs in high costs areas are obvious candidates.

Following the economic crisis of 2008, we know that public finances – whether at EU or member state level – are under considerable pressure. So there is now a distinct danger, highlighted in a recent paper from the Florence School of Regulation,[5] that:

- The minimum download speed for universal broadband is set too high
- The limited public funds which are available constrain population coverage so that universal broadband is not available to (say) the last 2%
- The externality benefits of a universal broadband commitment are significantly reduced and the policy objective remains unrealised.

How might policymakers set the appropriate minimum download speed and monthly data allowance? One promising approach is to assess the download speeds and data generating characteristics of the end-user applications which contribute to the positive externalities of universal broadband. These applications, which are characterised by how they make the economy function more efficiently, might include e-education, e-health and job search. But they might exclude streaming of high-definition videos for entertainment - where end-user benefits are almost entirely private in nature.[6] On this basis an initial review of Ofcom's analysis suggests that minimum download speeds of less than 10 Mbit/s, and minimum data requirements below 10 GB/month, might currently[7] be appropriate.

How should universal broadband be funded?

Should universal broadband deployment be funded by the telecommunications industry or by governments? Our analysis points clearly towards the latter option.

Industry funding has been used in the past to ensure universal provision of voice telephony at a fixed location using the arrangements set out in the Universal Services Directive. But this approach was designed primarily to ensure that ex-monopoly operators did not withdraw from supplying fixed voice telephony to unprofitable areas or customers when the EU's telecommunications market were liberalised in 1998. This approach has proved ineffective - in that prepay mobile telephony services have done a lot

[5] *The future of broadband policy: public targets and private investment*, Valletti, Briglauer, Cambini et al, 2016
[6] There is also the question of whether the minimum set of applications should include voice. If voice is included then this might rule out satellite as a technology for delivering universal broadband, given its high latency
[7] The minimum requirement will undoubtedly rise over time. But it is likely that technology improvements (especially for wireless technologies) will keep pace with these requirements.

more to meet universal service goals than universal service policy.[8] At the same time the cost of administering universal service funding arrangements and verifying universal service costs have been significant when compared with any benefits which the policy might have generated.

Most member states governments have now adopted a public funding approach to universal broadband - by developing a national broadband plan which is then subject to state aid scrutiny. This approach is theoretically sound in that:

- A government's public policy requirement for universal broadband creates the need for subsidy. So, logically, public funds should be used to meet these costs. Otherwise the incentive structure is wrong. If the funding comes from the industry then the government has weaker incentives to set universal broadband requirements efficiently than if the funding comes from its own resources
- Public funding does not increase overall broadband prices. The alternative of industry funding does[9]. Given the importance of maximising take-up of broadband stimulating economic growth, public funding universal broadband is the better option on this measure.

Assuming that member state governments choose the public funding option, what scale of funds should be allocated to universal broadband rather than to other ways of spending public funds?[10] There are a number of questions which need to be answered here:

- Is the funding justified by the scale of the positive externality which it creates (as we discuss at the beginning of this note)?
- Will public funding crowd out private investment? If the government commits to generous public funding then this can seriously distort competition and create a hold-up problem – in which private investors delay broadband investment in commercially viable areas in the hope of receiving public subsidy. In principle state aid guidance on NGA broadband investment, with its definition of white, grey and black areas, deals with this point
- To what extent will the review of the EU regulatory framework for electronic communications, now underway, make fixed broadband access regulation more investment friendly? The European Commission has made it clear that this issue is a central one in the current review. If changes to regulation stimulate private investment in broadband access infrastructure then this will increase the levels of private investment, reduce the need for public subsidy, and increase the probability of achieving the universal broadband policy goal
- What is the appropriate balance between public funding of broadband supply and public funding of initiatives to stimulate broadband use? Universal availability of affordable broadband is, on its own, of little use unless there is high take-up and use of the services available over broadband connections. Often governments focus funding on supply-side measures at the expense of demand-side measures[11] and there is a little discussion on the best way to divide public funding between supply and demand side initiatives so as to maximise economic and social returns.

Which technologies might be used to deliver a universal broadband commitment?

There is a wide range of different technologies which might be used to deliver universal broadband. The table below lists some of the key characteristics of the main candidates.

Technology	Capex per connection (€)		Download speed in Mbit/s	Incremental cost per GB (€ cents)
	Urban	Rural		
FTTC - VDSL	400	1000	15 to 80	1
FTTH – GPON	1500	5000	300	1
LTE mobile	200	300	5 to 10	20
LTE fixed wireless access	400	500	15 to 30	7
Ka-band satellite	300	300	2 to 15	200

Source: Plum analysis for UK Government and European Commission

We can see that:

- Fixed broadband offers the highest speeds and the 0lowest incremental cost per additional GB. But it is relatively expensive to deploy and may require substantial subsidy if deployed in rural areas
- Mobile broadband based on LTE offers lower deployment costs than fixed broadband in rural areas at the expense of lower broadband speeds and higher incremental costs per GB. Use of rooftop mounted,

[8] *Are telecommunications services universally affordable across the EU?*, Plum for Vodafone, October 2010

[9] If the telecommunications industry is required to fund universal broadband then this money will ultimately come from end-users through higher broadband prices for all

[10] Such as education, health, defence and social security

[11] *Demand-side measures to stimulate internet and broadband take-up*, Plum for Vodafone, February 2010

high gain, antennas improves performance significantly at little additional cost. But it still does not match fixed broadband performance

- Satellite broadband is the only technology which offers 100% geographical coverage for broadband at reasonable cost. But, as the table above indicates, the incremental cost per GB is ten times that of mobile broadband and more than a hundred times that of fixed broadband.

If state aid rules are followed it is likely that public funding will be allocated following a competitive bidding process to serve a defined area at lowest subsidy. Which technology is chosen will depend upon:

- How the minimum universal broadband requirements are defined. If for example the minimum download speed is set at 30 Mbit/s then this may rule out technologies using wireless and raise substantially the scale of public funding required
- The pre-existing market conditions in the high cost areas under consideration. In rural areas with pre-existing copper loops, bids based on fibre-to-the-cabinet or fibre-to-the-pole using VDSL technology might offer the most cost-effective solution. But in the rural areas of Central and Eastern Europe, where there may be no pre-existing copper network in rural areas, bids based on wireless technology may be the only realistic approach.

This analysis highlights two important points. Firstly, the scale of public funding required will depend on how the universal broadband requirement is defined. If the definition is too ambitious then the public funding required might exceed the available budget and the universal broadband connectivity policy might fail.

Secondly, the appropriate definition of universal broadband will vary by member state depending upon factors such as the state of its economy, the pre-existence of copper loop access networks in high cost areas, the distribution and density of the population, and the extent to which the terrain raises the costs of rural wireless broadband. If the EU is to maximise the benefits from universal broadband connectivity, it will be important to define minimum requirements using a harmonised process. But it would be a mistake to define the same minimum requirements for universal broadband in all member states.

A universal broadband commitment versus a universal service obligation for broadband

Finally there is a need to distinguish between a universal broadband commitment and a USO which includes broadband as well as voice telephony. We might differentiate between these two concepts as follows:

- A universal broadband commitment sets targets for making some minimum level of affordable broadband connectivity available to all (or nearly all) so as to remove barriers to the development of an e-economy and an e-society. It requires complementary demand-side measures to be successful
- A universal service obligation gives end users the legal right, wherever they might live, to demand a minimum level of affordable broadband connectivity, provided that the cost of supply does not exceed some pre-specified level.

We note that the UK government has consulted recently[12] on proposals for introducing this latter concept. The consultation raises questions about the relationship between the two concepts and the economic rationale for extending the USO to broadband.

Conclusion

Making high-quality universal broadband available to all in the EU is important both economically and socially. Universal broadband needs to be defined in terms of minimum broadband speeds and data transfer volumes, minimum population coverage, and affordability. This definition will vary between member states. If the definition is overambitious then the public finances required to implement the policy may not be forthcoming. One way to overcome this problem is to set the parameters for universal broadband so that the subsidy required is less than the externality generated by deploying high quality universal broadband.

About Plum

Plum has worked extensively for regulators, operators and governments on both commercial and regulatory issues related to the deployment of high-speed broadband services across the world. As part of this work it has considered the commercial and economic case for deployment of high-speed broadband in high cost areas and the affordability broadband services for end-users through work for clients that include Vodafone, Everything Everywhere, and the Governments of Oman and the UK.

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[12] *A new broadband universal service obligation consultation*, March 2016, DCMS