1. This paper provides an introduction to the issues surrounding the roll out of fixed broadband services in the UK and Wales and the use of public funds to facilitate this. Commissioners will recall that the question posed in our 2019 Annual Report is whether "the UK Government’s focus on extending more expensive fibre to the home to every household in the UK will best serve the interests of Welsh citizens, including those who still lack access to superfast broadband."

2. This paper is intended to provide background information which will help Commissioners discuss and consider recommendations. It concludes by summarising the challenges which Wales and the Welsh Government face in relation to fibre to the home broadband, but offers no recommendations. A second paper will be produced which considers options which might be available for the NICW to recommend. A third and final paper will then be produced to reflect input received from consultations with stakeholders and to present specific recommendations for Commissioners to consider.

3. This paper addresses fixed broadband connections. A separate paper or papers will need to be produced to address mobile issues, including rural coverage.

Broadband technology

4. Broadband services were first introduced into the UK (and elsewhere in Europe) in the early 2000s, prior to which households had relied on ‘narrowband’ dial up services to access the internet and other digital services. Broadband offers two important benefits: it provides a more reliable ‘always on’ connection rather than requiring users to first establish a connection themselves, and it allows for the consumption of much higher volumes of data at much faster rates\(^1\). Broadband speeds are generally expressed in terms of bits (the volume of data) transmitted per second. A kilobit (kb) is 1000 bits, a megabit (Mb) is 1 million bits and a gigabit (GB) is 1 trillion bits. Narrowband internet services often ran at 144 kb/s. Today’s fixed broadband services generally run at 20-30 Mb/s and some current and most future broadband connections will be capable of Gigabit speeds.

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\(^1\) The combination of these features also allowed a third feature to emerge, namely the offer of usage-independent charges for broadband connections in which users paid a monthly subscription fee but no usage-related charges.
5. The introduction and subsequent development of broadband services has been enabled by advances in digital technologies. The vast majority of the costs of providing broadband connections relate to the ‘last mile’ connection between a central distribution point and the individual household. The data associated with these individual connections is then aggregated and carried over national and international ‘core’ or ‘backbone’ networks. These have have comprised of optical fibre and digital switching technologies for many years.

6. Until the early 2000s, telecoms operators like BT had relied upon their existing analogue copper telephony networks to support data services. Copper was used throughout the network and offered a connection to almost every household in the country. It represented a large proportion of the assets on BT’s balance sheet and BT spent a significant proportion of its annual revenues and employed tens of thousands of engineers to repair and maintain this infrastructure. Any prospect of replacing it was thought to be prohibitively expensive and unnecessary. Instead of replacing the copper BT and others worked to develop a new ‘Digital Subscriber Line’ (DSL) technology which allowed BT to deliver broadband services over the existing copper network by attaching digital equipment at both ends of the copper connection – a modem in the house and terminating equipment at the local BT exchange. This allowed BT to deliver broadband services, initially at relatively low speeds (typically 2-5 Mb/s but up to 8 Mb/s) and later at 15-20 Mb/s (up to 24 Mb/s) with subsequent generations of the DSL technology.

7. DSL technology had a number of benefits for BT and for consumers. First, the costs of reusing BT’s copper network to provide broadband services were relatively modest, both for BT and for households who were required to purchase a modem. Costs of modems were the same irrespective of the location of the household. The cost of equipment installed by BT was shared amongst the households served and so depended on the number of households served by any particular local exchange, but was estimated to be around £50 per household passed. Costs per household connected (and the total revenues earned by BT) then depended on the proportion of all households taking broadband services. Prices payable by households for broadband services are the same across the UK rather than varying by location or differences in cost.

8. Second, BT could upgrade its network rapidly since it only required the installation of new equipment in the local exchange and left the copper network itself undisturbed. BT was able to upgrade the vast majority of its exchanges by late 2005, making broadband services available to most households in the UK in the process.

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3 Short term discounts, such as on connection fees, can vary by geography for BT, with these discounts generally targeted in areas where BT faces competition.
On the other hand, DSL technology had a number of shortcomings – it did not perform well if the distance between the household and the local exchange was very long or if the copper was in poor condition. Thus, although broadband services were often said by BT to be available in a particular area, the experience of individual households within that area could still vary quite significantly from one households to the next. In 2010, there were still 2 million households in the UK unable to obtain a connection of at least 2 Mb/s, which was considered by the UK Government to be the minimum required at the time. In addition, in order to benefit from further improvements in DSL technology the household would generally have to replace their modem. Nonetheless, adoption of broadband connections was rapid in the UK and by 2010 71% of households subscribed to a broadband connection, compared to 9% in 1998.

9. Demand for broadband services from UK households and businesses meant that BT had incentives to upgrade its network, but UK (and European) telecoms policy had for some years also attached significant weight to the role of competition in driving investment in new infrastructure. In 1991 the UK Government had allowed cable television operators to provide local telephony services in competition to BT and the subsequent competition from cable networks has played an important role in those parts of the UK (representing around 65% of households) where cable infrastructure has been deployed. Developments in cable technologies, and the development of the DOCSIS (Digital Over Cable Service Interface) standard in particular, allowed cable operators to offer broadband services over their existing coaxial cable infrastructure (originally designed to deliver TV signals) at a significantly lower cost and at much higher speeds (100 Mb/s+) without replacing equipment, as BT have needed to do. BT has therefore tended to prioritise the upgrade of its DSL infrastructure in those areas where competition from cable, now operated by Virgin Media, arises.

10. In addition to competition from Virgin Media, the UK Government and regulator, Ofcom, sought to encourage competition in broadband services over the BT network itself. This involved allowing competing firms, such as TalkTalk or Sky, to rent the copper connection between the local exchange and the household and attach their own equipment at either end. This was known as ‘unbundling’ the BT network. The argument was that competition would then encourage firms, including BT, to upgrade their equipment more rapidly (in order to offer higher speeds to households) than BT might otherwise be inclined to do in the absence of such competition. The evidence of the impact of ‘unbundling’ on BT’s investments in broadband is still disputed, in part because the other firms may face the same costs of ‘stranding’ existing assets as BT if they replace them with a newer technology.

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Competition in broadband means that BT has typically provided 40-50% of the DSL broadband connections in the UK, which is a lower share than some of its counterparts elsewhere in Europe.

11. Mobile technologies were also developing during this period. ‘3G’ technology (was the first generation of mobile wireless technology to be specifically designed to support broadband connections, albeit at significantly lower speeds of between 500 kb/s and 5 Mb/s and significantly higher costs per Mb of data consumed, relative to fixed networks at the time. 3G services launched in the UK in 2003, but widespread adoption occurred after the launch of the first touchscreen smartphone, the Apple iPhone, in 2007. (The potential for 4G and 5G mobile technology to meet the future broadband needs of households and businesses in Wales will be addressed in another paper)

12. Between 2010 and 2015, both BT and the UK Government were primarily focussed on the further upgrading of DSL technology to provide faster broadband services in the UK. This involved BT launching, in 2010, and then deploying the next generation of DSL technology (VDSL, or Very High Speed DSL) which supported speeds of at least 24 Mb/s and up to 50 Mb/s or around 10x that generally available to existing users. This was labelled a ‘superfast’ technology, distinguishing it from slower, earlier broadband technologies. Obtaining higher speeds over existing copper wires is achieved by reducing the distance over which the data travels. This involves BT moving its own equipment from the local telephone exchanges into the street cabinets, and replacing the copper connection between the cabinet and the exchange with fibre. This is why VDSL technology is sometimes referred to as Fibre to the Cabinet or FTTC. The replacement of the copper means that VDSL involves significant additional costs beyond those which BT had already incurred to provide broadband services using existing DSL technology – estimates at the time suggested an average cost (before the modem is purchased) of £190 per UK household, or around 4x the cost of previous DSL technology. However, the requirement to install equipment closer to households also accentuates the variation in cost per household between areas with different housing densities. Costs for VDSL technology in remote rural areas are of the order of £350 per household.

13. The roll out of VDSL was also slower, reflecting the additional work to be undertaken by BT. Some of the challenges with DSL also applied to VDSL, so that households with very long copper connections to the nearest cabinet would still experience speeds that were much lower than those available to those nearer the same cabinet (and some households could not be served with VDSL at all). This explains why there has been some controversy about the way in which broadband

http://www.hie.co.uk/common/handlers/download-document.ashx?id=ae811a4f-196a-4806-8bcb-01a89f009bc8, p.8
services are advertised in the UK, since there can be a large discrepancy between the theoretical speed offered by the technology and the actual speed experienced by a particular household\textsuperscript{6}.

\textit{UK Government policy on VDSL or superfast broadband}

14. In 2010 the Coalition Government published a strategy for the UK to achieve ‘the best broadband network in Europe’. This was the first national broadband strategy produced in the UK\textsuperscript{7} and had two elements – to ensure ‘universal’ access to broadband services at speeds of at least 2 Mb/s by 2015 and to extend the reach of new ‘superfast broadband’ technologies capable of higher speeds (24 Mb/s+) to 90\% of households by mid 2015. This deadline was subsequently extended to the end 2016 after delays in obtaining approvals from the European Commission (see below). To support this, the Government allocated £530 million to fund the deployment of superfast broadband in those areas which BT had said it could not serve on a commercial basis, or which it would not reach in the foreseeable future (being the next 3 years). This represented about a third of all households in the UK. Additional funds were contributed by local authorities and the European Regional Development Fund, raising the total public sector contribution to £1.2 billion.

15. This fund was administered by a new DCMS-sponsored body, Broadband Delivery UK (BDUK), which oversaw the allocation of funds and the running of public procurement exercises by local authorities (who were invited to bid for central Government funds provided they agreed to match them). The extension of superfast broadband was, in the process, expected to largely address those households unable to access broadband at speeds of 2 Mb/s. The procurement process itself was the result of negotiations between the UK Government and the European Commission to obtain EC approval of the scheme under the European State Aid rules. BDUK ran a tender process to identify ‘approved suppliers’. It was originally expected that both BT and a consortium led by Fujitsu would qualify, but Fujitsu withdrew, leaving BT as the only supplier with whom the Government then negotiated a framework agreement. Local authorities were then invited to identify areas which would qualify for public funding (being areas which BT or others would not otherwise serve on a commercial basis) and enter into contracts with BT, or negotiate with other suppliers if they could. 44 contracts were entered into in Phase 1, for 33 of which BT


\textsuperscript{7} In 2009, the Brown Government had published a broader ‘digital strategy’ which included a commitment that every household in the UK would be able to obtain broadband at speeds of at least 2 Mb/s by 2012 (at a cost to the public of £200m) and establishing a Next Generation Digital Fund by levying a tax of 50p/month on every existing copper telephone connection. Neither was implemented.
was the only bidder. The other 11 involved some competitive bidding but BT won them all.

16. The Phase 1 BDUK scheme attracted criticism from the National Audit Office and Public Accounts Committee, much of which focussed on concerns that BT had inflated its cost estimates (which local authorities were then unable to benchmark given the lack of competitive options)\(^8\) and underestimated the demand for superfast broadband services. MPs were also concerned that the 90% coverage target left some areas unserved. There were examples where BT had upgraded the network in one half of a village but not the other\(^9\). Nonetheless, the Government announced the 90% target had been achieved by March 2016 (somewhat behind the original date but ahead of the revised target) and total expenditure was actually £127 million lower than expected (some of which was then reinvested to further extend coverage)\(^10\). In addition, take up of superfast broadband connections once the networks were deployed was higher than BT had projected in its original business plans so that a further £490 million was ‘clawed back’ by local authorities and also used to further extend coverage. Compared to some other large public procurement projects, the BDUK Phase 1 programme appears to have been comparatively well managed. The Culture Media and Sport Select Committee concluded in 2016 that “The progress made since 2010 in providing superfast broadband access has on balance demonstrated that the Government was right to go with the BDUK scheme which principally involved BT and deployment of its fibre-to-the-cabinet solution”\(^11\). The Government’s own assessment, undertaken in 2018, broadly agreed\(^12\).

17. In 2013 the Coalition Government announced a Phase 2 BDUK scheme, allocating a further £250 million of funds to extend superfast coverage from 90% to 95% of households by the end of 2017 under the same arrangements as for Phase 1. These were expected to be matched by a further £250 million of funds, primarily from local authorities. Many of these tenders were also won by BT, but some were awarded to other operators, primarily Gigaclear, who had begun to deploy ‘ultrafast broadband’ networks which relied upon ‘fibre to the home’ or FTTH technology rather than VDSL.

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\(^9\) [https://publications.parliament.uk/pa/cm201617/cmselect/cmcumeds/147/147.pdf](https://publications.parliament.uk/pa/cm201617/cmselect/cmcumeds/147/147.pdf), p.11-12


\(^11\) [https://publications.parliament.uk/pa/cm201617/cmselect/cmcumeds/147/147.pdf](https://publications.parliament.uk/pa/cm201617/cmselect/cmcumeds/147/147.pdf), para 29

In 2015 the Coalition Government also announced that it would introduce a ‘universal broadband scheme’ which would ensure that every household in the UK could obtain access to a connection of at least 10 Mb/s. This was in part prompted by the realisation that BT’s near-universal deployment of DSL technology did not translate into universal availability of broadband services at reasonable speeds for the approx. 2% (500k) of UK households which were located at the end of very long copper connections and in part by the realisation that its earlier commitments to universal access of 2 Mb/s no longer met expectations of ‘minimum’ broadband speeds in the UK, which had risen. The Government’s intention is to implement this commitment by 2020. This involves establishing a set of arrangements under which all broadband users in the UK will contribute towards an industry fund which will be used by BT to meet their costs of fulfilling the obligation. Households benefiting from this scheme will make no contribution themselves (beyond the normal charges) provided the cost to BT of serving the household is no more than £3400. Households will be expected to meet costs any above this threshold.

**Comparative performance of the UK in broadband**

The Government (and BT’s) focus on extending broadband in the UK using VDSL technology differed from policies adopted in some other European countries, notably France and Spain (but also parts of former Eastern Europe, Japan, Korea, Australia and New Zealand). In these countries, much greater emphasis was placed on replacing the copper network altogether with FTTH technology. This was for a number of reasons. In some cases the existing copper network was ill-suited to DSL technology. In Spain for example, the main operator, Telefonica, had installed its cabinets in underground chambers rather than in street cabinets, as BT had done. Installing DSL equipment in these chambers, and maintaining it at the required temperature was very difficult. In other countries the length of the copper connection between the cabinet and the household was much longer on average than in the UK, which meant that the speeds that could be obtained from DSL technology were also much lower.

The costs of installing alternative technologies such as FTTH were also significantly lower in some other countries than in the UK. For example, both Spain and Portugal had well maintained and comparatively new but empty duct systems through which new fibre connections could easily and quickly be pulled. In contrast, the UK duct system has been poorly maintained, is often unmapped, and is already full of copper bundles. Installing new fibre under these conditions is more difficult. In Eastern Europe, planning regulations have allowed the installation of fibre lines on poles or off buildings rather than requiring them to be installed underground. This has a very significant impact on costs. Moreover, some European countries have a much greater density of flats and apartments than UK cities, which means that many more households can be served for every kilometre of fibre that is installed. Added to this
FTTH was regarded by some Governments as being the ‘gold standard’ in broadband technology since it could support much higher speeds – of at least 1 Gb/s – than DSL. These Governments considered that the higher costs and slower rate of deployment of FTTH, compared to DSL, were more than offset by the greater benefits that households would obtain once they finally had access to FTTH services. In their view, investments in inferior DSL technology were ill-advised when they would need to be replaced by superior FTTH technology within 10-15 years, even if households had poor broadband services in the meantime.

21. These countries made initially relatively slow progress in the provision of faster broadband services, relative to the UK, because FTTH was much more costly and slower to deploy. At the time, the average cost of FTTH in the UK was estimated at around £900 per household passed, compared to around £190 for VDSL, although FTTH costs were often lower in those other European countries where it was being adopted for the reasons given above. In 2015, the UK had superfast VDSL (and cable) coverage for 79% of households, whereas France had FTTH coverage for only 14% of its households (and 15% for VDSL) and Spain FTTH coverage for 45% of its households (and 11% for VDSL)\(^\text{13}\). In other words, many more UK households had access to broadband speeds above 24 Mb/s in 2015 than in other countries who were waiting for FTTH connections, but on the other hand only 1% of UK households had access to the gigabit speeds enabled by FTTH.

22. The comparison has shifted as time has passed. The rate of increase in VDSL coverage has slowed in the UK as BT is left with the most difficult to serve final 10% of households. At the same time FTTH coverage accelerated in other European countries where large gains in coverage were still relatively easy to make. By late 2018, around 45% of Spanish households were connected to FTTH networks (and over 95% could do so) and over 20% of French households were connected. The comparative lack of focus on FTTH in the UK prior to 2018 meant that only 2% of UK households were connected to FTTH\(^\text{14}\).

Evidence on the economic benefits of broadband

23. Many studies have been produced to measure or predict the economic and other benefits arising from the provision of fixed broadband infrastructure. These benefits arise primarily from the adoption and use of broadband connections, rather than from the deployment of the infrastructure itself\(^\text{15}\). An econometric study for Ofcom of broadband adoption in OECD countries between 2002 and 2016 concluded that if


\(^{15}\) There will also be short term benefits in terms of employment to deploy the infrastructure, as with the apprentice scheme in the Superfast Cymru programme discussed below
broadband adoption increases from 10% to 20%, then GDP grows by 1.4%. If it increases from 20% to 30%, the impact on GDP is 0.82%, and the cumulative impact of the growth in broadband adoption over the entire 14 year period was estimated to be 4.34%\textsuperscript{16}. Similar studies have been undertaken and conclusions drawn by the International Telecommunications Union, the OECD, World Bank and others\textsuperscript{17}.

24. There is therefore good evidence that broadband adoption has positive impacts in terms of productivity, economic output, well being and the environment. At the same time, it is also recognised that the extent to which productivity gains are realised from digital technologies also depend on factors other than the availability of a broadband connection, including the capacity of firms to re-engineer their business processes and strategies in order to take full advantage of the opportunities afforded by digitisation\textsuperscript{18}. In addition, some of the evidence suggests that gains from broadband in some communities may be at the expense of other communities (e.g. as businesses or employees relocate from one to the other), rather than representing a benefit to the nation as a whole.

25. The UK Government commissioned a report from SQW, a consulting firm, in 2013 to estimate the economic and other impacts of broadband for the UK\textsuperscript{19}, which at that time remained focussed on extending VDSL technology. SQW estimated that the roll out and take up of superfast broadband (and the universal availability of basic broadband of at least 2 Mb/s) would contribute to 0.07% growth in real annual GVA over the period from 2008 to 2024, of which 0.03% would be attributed to the BDUK programme (and the remainder to the commercial deployment of VDSL and cable upgrades). It also estimated that it would create 56,000 jobs. This produced a benefit:cost ratio on the BDUK programme of 20:1 over the 10 year period.

26. The vast majority of the economic benefits were expected to come from increased productivity of firms using superfast broadband, with a further small contribution from increased employment (chiefly the greater participation of carers and disabled persons in the economy), increases in teleworker productivity (but as a result of more working hours rather than higher productivity per hour\textsuperscript{20}), savings in travel

\textsuperscript{16} https://www.ofcom.org.uk/_data/assets/pdf_file/0025/113299/economic-broadband-oecd-countries.pdf, p.8
\textsuperscript{18} https://businesswales.gov.wales/superfastbusinesswales/?ga=2.76404053.1190147845.1572534495-912051584.1557734525
\textsuperscript{20} The study assumes that 60% of the travel time saved is devoted to work at home, and rest to additional leisure, op cit, p.17
costs) and some benefits from retaining businesses which would otherwise be displaced to other areas with better broadband. The report also identifies significant environmental benefits arising from reductions in commuting and business travel, and energy savings as locally hosted servers are replaced with cloud services. These savings were estimated to represent 0.3% of the UK’s annual carbon emissions. It is important to note that SQW limit themselves to modelling benefits which are capable of being quantified and for which there is robust evidence, such as time saved by teleworking. Other benefits, such as greater educational participation, are either unsupported by clear evidence or difficult to quantify robustly. This does not mean that such benefits may not arise. Research for BT, for example, has found that the ‘social’ value of being connected to a broadband network for new user is £1064 p.a. (and £3,568 p.a. for a professional user)21.

27. In all these studies a key question is how much of the benefit is attributed to having any form of broadband, and how much to particular speeds. SQW drew on research for the Bank of England which had found that a doubling of broadband speed (e.g. from 20 Mb/s to 40 Mb/s) will yield a 0.3% increase in productivity over the subsequent 3 year period22. But they also noted “as superfast broadband has only been introduced relatively recently, evidence of the relationship between broadband speed and productivity has yet to be fully addressed in the academic literature”23.

28. The UK Government then commissioned a report in 2018 by IPSOS Mori to assess the actual economic impact of the BDUK superfast broadband programme which had been running in the meantime24. This found that superfast adoption had increased business turnover by around 1.2%, employment by 0.8% and productivity by 0.38% over the period of the programme (to mid-2016). These results were obtained by comparing economic performance in postcodes included in the BDUK programme against those with otherwise similar characteristics but excluded from it. The report noted that a significant proportion of the turnover (65%) and employment (86% of total) benefits might be attributed to firms relocating from one area (which lacked access to broadband) to another, rather than representing an increase in total output for the country as a whole25. It found that the largest economic benefits arose in the education and health sectors, where turnover per employee increased

22 Op cit, Annex D-2
25 In addition to standard economic measures, the report estimated an increase in subjective wellbeing which it valued at £222 per household p.a.
by over 3.5%. ‘Health’ excludes the NHS but includes GPs and dentist practices. No other sector achieved turnover gains of more than 1%.

29. The IPSOS Mori report concluded that the economic and public benefits arising from the programme up to 2016 for the UK as a whole were £1.7 billion, compared to public costs of £850 million, a benefit:cost ratio of 1.96:1. It did not find significant differences in economic impact between the regions. The ratio is much lower than the SQW ratio of 20:1 which it forecast in 2013 because the former relates only to benefits derived from public expenditure up to mid 2016 whereas the 2013 estimate projects benefits (and costs) forward to 2024.

30. In terms of the impact of superfast broadband for households, the report noted:

“Qualitative research with 36 households on upgraded and non-upgraded postcodes provided some insight into the factors that may be driving this result. Internet use was similar across both groups of households interviewed, with few appearing to use the internet for purposes that required high bandwidths. Households in upgraded areas that had not opted to move to higher speeds tended to report that their current internet speeds were sufficient for their needs, while those that had upgraded were typically motivated by factors other than a direct need for faster download speeds, such as a feeling of wanting “the best”.”

31. This was reflected in the estimates of the economic benefits which businesses and households derived from superfast broadband. Businesses derived £12.28 from every £1 spent on superfast coverage whereas households derived only £1.18.

32. We therefore have a reasonable body of evidence to show that adoption of superfast broadband services, enabled by VDSL technology, produce significant economic and social benefits to households and businesses in the UK, but with the vast majority of the economic benefits relating to productivity gains at business locations. These benefits will be greater the more extensive the availability of superfast networks and the higher the rate of adoption by those businesses and households who can access them.

*The case for universal broadband*

33. Even if broadband offers benefits to individual households, a separate case needs to be made for making broadband universally available to every household in a country. This is because, whilst benefits increase the more extensive the broadband

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26 Op cit p.38
27 Op cit, p.8
network, variations in the costs of connecting households and businesses mean that the benefit:cost equation becomes ever more challenging as more and more higher cost to serve households and businesses are included. These variations on the cost side of the equation also become significantly more acute as the technology employed shifts from DSL to VDSL and then to FTTH.

34. The UK NIC report, which we discuss in detail later in the paper, makes the case for universal broadband (in its case using FTTH technology) on several grounds:

a. Its research suggests there is widespread popular support for universal availability. This is likely to reflect, at least in part, experience of copper-based networks in the UK which have been provided by BT and its state-owned predecessor on a near universal basis. The public may expect ‘utility’ services such as telecoms, water and energy to be universally available, notwithstanding the fact that these services are now delivered by firms in the private rather than public sector.

b. There is a regional policy case for universal FTTH on the grounds that some areas might otherwise be excluded from participating fully in the UK economy, and households may also be socially and culturally excluded. We have already noted that there is good evidence to suggest that the deployment of faster broadband in some areas may attract businesses to move away from other areas. There is therefore a concern that without universal availability, faster broadband in some areas might contribute to economic and social exclusion and exacerbate depopulation in other areas. The funding provided by the European Regional Development Fund for the BDUK superfast broadband programme is motivated, at least in part, by such regional policy considerations.

c. Some have argued that households and businesses in rural areas may derive greater economic and social benefits from faster broadband connectivity than their counterparts in urban areas, and that these benefits may offset the higher costs of serving rural households. However, there is limited evidence on this (and none relating to Wales that we are aware of), in part because prices of broadband connections in the UK tend to be set on a national basis and data on the take up of broadband services by area is difficult to obtain.

d. The UK NIC also makes a separate point, which is that the delivery of public services in rural areas may benefit more, in terms of cost savings, from broadband access than public services in urban areas where travel times and other costs of delivery may be lower. Some have also argued that universal broadband availability is required if many public services are to move fully
online, since otherwise there is a risk of exclusion\textsuperscript{28}. Without universal access, it is argued, public services will be unable to decommission existing delivery models or realise the cost savings that are otherwise enabled if everything is fully digitised.

35. The case for universal availability of some form of broadband also needs to be distinguished from the case for FTTH, which we consider below. Many of the savings in public service delivery, for example, might be realised with universal access to VDSL or equivalent connections, rather than requiring FTTH. When, in 2015, Prime Minister Cameron announced his intention to introduce a ‘universal broadband service obligation’ that would ensure that every household in the UK had access to an affordable broadband connection of at least 10 Mb/s\textsuperscript{29} he justified this proposal on the same grounds – popular expectations of broadband as a utility, economic and social inclusion and support for public service delivery – as we have listed above\textsuperscript{30}. The threshold of 10 Mb/s was recommended by Ofcom, advising the Government, on the grounds that it was the minimum required for a decent service and that it could be delivered by a number of different technologies\textsuperscript{31}. Ofcom recognised that minimum requirements would be likely to increase over time and that the threshold should therefore be kept under review.

36. A few points can be drawn from this:

\begin{itemize}
\item[a.] The current and proposed universal service arrangements in the UK support the availability of broadband connections at speeds far below anything that requires FTTH. Current UK Government policy appears to take the view that significant variations in the broadband speeds available to households in the UK can persist, at least from some time, provided all households obtain connections of at least 10 Mb/s. Until these provision are implemented in 2020 there have been no broadband universal service obligations of any kind in the UK and households have had no ‘guarantee’ of any form of broadband availability.

\item[b.] Even when universal broadband obligations apply from 2020, households which cost more than £3400 to connect will be required to meet the additional costs themselves.
\end{itemize}


\textsuperscript{29} Subject to the cost per connection being no more than £3400, above which the householder is required to make a separate contribution.


\textsuperscript{31} \url{https://www.ofcom.org.uk/__data/assets/pdf_file/0016/50416/dcr-statement.pdf}, p.27-8
c. There is some tension between the case for universal broadband being made by the Government in relation to the USO and the case made by the UK NIC for universal FTTH (which we consider further below). If 10 Mb/s is sufficient to address concerns about social and economic inclusion in 2020, as the Government has said, then it is not clear why universal access to FTTH would be required 5 or 8 years later. Speeds greater than 10 Mb/s may be required by then, but it is not clear that speeds of 1 Gb/s or more – which require FTTH - would be.

d. An important distinction between the USO arrangements and proposals for universal FTTH is that the former will be funded by the industry itself, through levies on existing broadband customers, whilst the latter would have to be subsidised by the taxpayer. It is not clear, however, why differences in funding arrangements should support different objectives32.

37. In summary, there is relatively little evidence about the benefit of broadband universality, either in relation to superfast broadband or FTTH. The case for ensuring that all households have access to basic or superfast broadband connections of a minimum speed would seem to be a more straightforward one to make, since there is robust evidence of significant economic and social benefits arising from a superfast broadband connection and no evidence to suggest that rural households would benefit less than their urban counterparts (although no evidence that they benefit more either). These benefits then need to be set against the relatively modest costs of extending superfast broadband services to all households in the UK. Ofcom has estimated that if the 10 Mb/s broadband USO were introduced in the ‘early 2020s’ (as is now the case) then around 500,000 households would still lack access to a service of at least 10 Mb/s and that the cost of serving them would be around £1 billion (of which less than £1,000,000 would be attributable to households in Wales)33. The vast majority of these UK households could be served by VDSL technology, and the remaining 10% where the copper connection was too long would be served with FTTH. Ofcom also estimate that the average cost per household of the VDSL connections would be £870-1000, whilst the average cost per household of the FTTH connections would be £3,790.

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32 In both cases, the rationale for public intervention is that there are wider social and economic benefits for society if broadband is available to all, such that all existing broadband users or taxpayers to contribute to the costs of extending access to those members of society who do not currently have it. This is a classic ‘externality’ justification for Government intervention. There is evidence that such externalities do exist, and that existing users of broadband may benefit from having other households connected, not just in order to communicate with them. What is not clear is why these externality benefits should be so much larger if households are connected by FTTH, relative to being connected by VDSL.

38. Given the almost 4x higher cost of FTTH, the case for universal access to FTTH technology would appear to be much more challenging unless households gain very large benefits from the additional speeds it enables. We consider below the evidence that might suggest additional benefits that might be obtained from an FTTH connection relative to a superfast VDSL connection.

_Evidence on benefits of FTTH_

39. The very limited number of FTTH connections in the UK means that evidence of their benefits is necessarily limited today. Some evidence on benefits of ultrafast networks such as FTTH were contained the Government’s 2018 study of the BDUK programme by IPSOS Mori. In Appendix C, entitled ‘Supplementary research on large increases in download speed’, the researchers considered the impact of large (>100 Mb/s) changes in broadband speed such as might result from a household moving from VDSL to FTTH technology. This has occurred in a small number of cities served by alternative FTTH providers such as Cityfibre, Hyperoptic or Virgin Media’s FTTH project, or by Kingston Telecom in Hull. Postcodes experiencing such large increases in speed represent less than 4% of all UK postcodes.

40. The report finds that increased in speed of more than 500 Mb/s led to increases in turnover of 5.8%, whereas increases of 100-200 Mb/s led to turnover increasing only 1.2%. IPSOS Mori also found evidence that FTTH may attract entry by new firms into an area (followed by the exit by some existing firms as competition from more productive entrants increases). They also note that the sample sizes are small and that some of the differences observed could be attributable to other factors.

41. This study is important because it is based on actual outcomes rather than assumptions or inferences about how households or businesses might be expected to behave given what we already know about the transition from basic to superfast broadband. It is also based on UK data rather than evidence from FTTH adoption elsewhere in the world, which may differ from the UK or from Wales. However, the small number of FTTH connections that existed in the UK in the period (2012 to 2016) mean that any results may not be representative of the wider population. One of the few other studies of a similar kind considers evidence from FTTH deployment in the United States. It found that FTTH adoption by at least 50% of premises (likely much higher than that obtained in the postcodes featuring in the UK study just

35 Op cit p.63
discussed) produced an increase in GDP per capita of 1.1\%\textsuperscript{36}, relative to areas in which FTTH was not available.

42. Most other studies on the benefits of FTTH tend to rely on projections rather than observed outcomes. A common approach is to first project demand for data services into the future and conclude that it cannot be met by existing VDSL technologies. This is the approach adopted by WIK, a consulting firm, in a study for Ofcom. WIK forecast that around 40\% of UK households would require speeds of 1 GB/s or more (which can only be obtained from FTTH or DOCSIS technologies) by 2025\textsuperscript{37} and that a further 42\% would require speeds of between 300 Mb/s and 1 Gb/s.

43. WIK also identify a number of studies from other countries, in including Sweden and the US, which suggest that FTTH deployment has delivered economic or social benefits. The Swedish healthcare study cited by WIK illustrates the challenge of distinguishing between the benefits of broadband and benefits that are specifically attributable to FTTH technology. The SWedish study considers the economic benefits of providing broadband connections to elderly households so as to enable video conferencing, other messaging services and the monitoring of patients in their homes via video links\textsuperscript{38}. However, it would appear that all of these services could readily be supported by superfast VDSL broadband connections, rather than requiring FTTH. In contrast, another study cited by WIK finds that home workers using FTTH work for an average of 12.8 days per month, compared to 10 days for DSL users\textsuperscript{39}. Whether FTTH connections induce users to work more from home, or those working from home more tend to take up FTTH connections is, again, unclear. Another study for NESTA shows that there are many other demand projections which suggest that existing VDSL or G.Fast technology would be more than capable of meeting the majority of UK household requirements until at least 2025\textsuperscript{40}.

The UK NIC’s recommendations

44. The UK NIC had previously published a report on 5G mobile infrastructure, but its first recommendations on fixed broadband were offered when it made universal FTTH a central recommendation in its first National Infrastructure Assessment in July 2018\textsuperscript{41}.

\textsuperscript{36} https://pdfs.semanticscholar.org/965e/9b363836a09006229693758d984228714d3f.pdf
\textsuperscript{39} Op cit, p.54
\textsuperscript{40} https://media.nesta.org.uk/documents/exploring_the_costs_and_benefits_of_ftth_in_the_uk_v7.pdf, p.10
\textsuperscript{41} https://www.nic.org.uk/wp-content/uploads/CCS001_CCS0618917350-001_NIC-NIA_ACCESSIBLE.pdf
45. The UK NIC’s recommendations were based on a number of assumptions, most of which were subsequently adopted by the UK Government:

a. FTTH was the next logical evolution of technology after VDSL, the deployment of which had largely been completed by 2017, when 98% of UK households were expected to have access to superfast connections.

b. Since FTTH technology involved the complete replacement and decommissioning of BT’s existing copper network in the UK (or the building a completely new network by other firms), it would take 10-20 years to complete a nationwide deployment of FTTH. This would be much longer than the transition to VDSL or G.Fast. The NIC considered that even if the need for FTTH was not demonstrated today, it was necessary to begin deployment now in order to anticipate future demand and avoid being left behind other countries who had started deploying FTTH much earlier than the UK.

c. Aside from higher speeds, FTTH technology would produce other benefits. It was more consistent and more reliable than VDSL technology (where, as noted earlier, performance could vary depending on the characteristics of each individual copper connection) and involved lower operating costs to maintain (saving £5bn over 30 years). FTTH networks also consume significantly less energy than copper networks.

d. The NIC expected existing firms like BT to deploy FTTH to up to 14 million households by 2025 on a commercial basis. It recommended that steps be taken to reduce the costs of deploying FTTH in the UK and that plans be made to decommission the copper network from 2025. It also proposed that public funds be made available to support FTTH deployment in rural areas (where commercial deployment was not viable) from 2020 onwards.

e. The NIC estimated that the costs of deploying FTTH would be £33 billion, which was £11 billion more than the cost of what it called ‘incremental upgrades’ of the existing copper network (in practice, a transition from VDSL to G.Fast).

46. It is important that Commissioners understand the assumptions behind the UK NIC’s recommendation to target universal FTTH deployment by 2033⁴². The UK NIC relied upon demand forecasts produced by its advisers, Frontier Economics⁴³. Frontier were asked to forecast demand over a 30 year period, significantly longer than the forecast period attempted in many other studies. They approached this task by

identifying a large number of applications and considering how they might develop under a variety of different network technology assumptions. Under some assumptions, such as ‘100% FTTH’, demand would be fully met. Under others, such as the scenario in which BT upgrades 90% of households to the next generation of copper broadband technology G.Fast, the use of some applications will be inhibited. Frontier then produce two forecasts – a ‘moderate evolution’ scenario which assumes that demand for broadband continues to grow as it has in the past, and an ‘ambitious innovation’ scenario in which there is step change in demand as new applications and innovations which rely on ultrafast connections are widely adopted in the UK. The report finds:

a. The benefits of moving to FTTH rather than continuing to upgrade to G.Fast are either small or negative under the ‘moderate evolution’ scenario. In fact, the discounted benefits from G.Fast are greater because they are realised earlier than the (slower to build) FTTH. For this reason, FTTH delivers economic benefits of £-0.8 billion (i.e. negative benefits) over the 30 year period to 2050 (relative to G.Fast).

b. The benefits of moving to FTTH are much greater than continuing to upgrade to G.Fast under the ‘ambitious innovation’ demand scenario. This is primarily because under this scenario there is widespread adoption of 8k TVs, virtual and augmented reality applications, smart home remote monitoring, healthcare (remote diagnosis with very high resolution imaging) and more teleworking. Some of these applications can be delivered to a lesser degree with G.Fast or VDSL, but many are assumed to require FTTH to work properly. In this case, FTTH delivers positive benefits of £15.7 billion.

c. Frontier undertake a very detailed ‘bottom up’ demand forecast, both for each application and for different types of household, some of whom will use the applications and have more devices than others. The demand arising from some applications such as telehealth or online education do not vary greatly between the scenarios and/or do not contribute significantly to the total demand of the household. In contrast, two applications, Virtual Reality applications (online gaming) and 8k TV consumption account for the vast majority of the bandwidth required. These are the activities for which Frontier think FTTH is required, and which would be constrained by G.Fast under the ‘ambitious innovation’ scenario.

44 Households with very long copper lines may never be suitable for G.Fast and are assumed to instead be served with a new DSL technology which BT has developed (LRVDSL) which is intended to provide higher speeds of up to 100 Mb/s to such households. G.Fast involves installing equipment on poles or at other locations very near to the property, further reducing the length of the copper connection (and thereby increasing the speed that can be obtained).

45 Op cit p.11 and p.60. G.Fast takes 6 years to roll out, FTTH 10 years.
47. The UK NIC report itself recognises the possibility that the ‘ambitious innovation’ required to justify the economic case for FTTH ‘may not materialise’. It concludes, however, that ‘the investment in full fibre is a risk worth taking.’ It would appear to do this on the basis that the Frontier ‘ambitious innovation’ scenario proves wrong then the UK will have foregone only £800 million of economic benefits by deploying FTTH instead of G.Fast technology, whereas if the ‘ambitious innovation’ scenario, or some approximation of it, proves correct then the potential economic prize for the UK is over £15 billion. Another way to arrive at the same conclusion is to compare the additional costs of deploying FTTH relative to G.Fast, which the NIC estimates to be £11 billion, with the additional economic benefits which might be achieved under the ‘ambitious innovation’ scenario, which the NIC estimates to be £15 billion.

48. A further point arises from the cost studies that were undertaken by the NIC’s advisers and which needs to be considered in light of the uncertainties about the economic benefits of FTTH and the UK NIC’s conclusion that FTTH is a ‘risk worth taking’. It has been argued, including by BT in the past, that the best path to FTTH was to continue to deploy fibre ever closer to the home until, finally, the last few metres of copper were replaced by fibre. On this view, VDSL, and then G.Fast, would be intermediary technologies in the journey towards FTTH. The decision as to whether to invest in FTTH (and incur the additional £11 billion of expenditure referred to above) could then be deferred until the demand for and economic benefits of FTTH were more certain than they are today. Economists refer to this as retaining an ‘option value’.

49. The UK NIC did not, however, accept this approach, in part because they noted that deploying FTTH to every household in the UK would take between 10 and 20 years even if a decision to start were made today. This means that any further delay would risk depriving some households of access to FTTH technology until well into the 2030s. The NIC’s advisers provide some further evidence on this point by estimating the additional costs which a more incremental approach would involve. The additional costs arise from several sources: a delay in moving to FTTH but eventually doing so does not avoid the capital expenditure that eventually has to be incurred but means that some of the operating cost savings of the more reliable FTTH network are only realised later, whilst some of the costs of G.Fast network equipment which would be deployed in the meantime but then decommissioned.

47. https://www.nic.org.uk/wp-content/uploads/CCS001_CCS0618917350-001_NIC-NIA_Accessible.pdf, p.21. We note that Frontier Economics, in their study for the UK Government’s Future Telecoms Infrastructure Review (discussed below) also estimate the cost of universal FTTH to be £33 billion. These figures are the same because they both rely on costing work commissioned by the NIC, see https://www.nic.org.uk/wp-content/uploads/Cost-analysis.pdf.
would have to be written off. The advisers calculate that delaying the decision to deploy FTTH by 8 or 15 years (e.g. until the future requirements of UK households become clearer) would add £5 or £7 billion of additional costs to the total project (relative to the £33 billion costs if FTTH roll out commences immediately).

50. It is important to note that these conclusions depend on the assumption that FTTH is deployed to every households over a period of 13 years and that no more G.Fast or other technology is deployed in the meantime. This would mean that, in practice, some households would be required to rely on their current VDSL connection until after 2030 without any improvement in their broadband service from today’s levels (which for many households s 50 Mb/s or less). If BT was required to install G.Fast (or some other technology) to improve the service available to at least some of these households in the meantime, then the additional costs of £5-7 billion would be lower. It does seem reasonable to suppose that some, perhaps most, UK households will not be prepared to wait for over 10 years before their existing VDSL service of 50 Mb/s or less was upgraded. Most UK households upgraded from basic DSL to VDSL within a period of around 5 years and, given growth in demand for data, it seems unlikely that many will now be prepared to wait for 10 years or more before experiencing further improvements.

51. The UK NIC proposes that FTTH deployment on a commercial and competitive basis should be encouraged wherever possible but recognises that a substantial number of households will remain unviable on a commercial basis. It proposes a programme similar to the BDUK superfast programme to extend FTTH to these properties, noting:

“Unlike the ‘Broadband Delivery UK’ programme, government should focus initially on the areas least likely to receive full fibre broadband commercially, and which are also most likely to experience unreliable broadband through long distances of copper cables. Communities within these areas should be eligible to get their full fibre sooner if they volunteer to help build their network at community level, as for example Broadband for the Rural North have done. However, a reasonable cost threshold will be necessary: the most expensive premises can cost above £45,000. This threshold should be high enough for the programme to cover the vast majority of premises.”

The shift to FTTH

52. UK Government policy on broadband has undergone a reorientation away from continued focus on VDSL and towards a focus on FTTH in recent years. In the 2017 election the Conservative manifesto proposed a target of having FTTH available for
10 million households by 2027, subsequently revised to 15 million FTTH premises by 2023 and all households by 2033.

53. The primary reason for this shift appears to have been concerns that the UK's broadband infrastructure would begin to fall behind (i.e. would be slower) those of other countries, such as Spain and France, who, as explained earlier (see paras 19-21) had already been deploying FTTH at scale for some years by then. Another important consideration for politicians was that the performance of BT's DSL technologies depended on the length of the copper connection to individual households and businesses, with the result that performance often varied significantly between households and businesses who were otherwise served by the 'same network'. Many constituents complained of receiving broadband speeds which were lower than advertised, or than obtained by their neighbours. An FTTH network – which is not reliant on a copper connection - can deliver the same, consistent, performance to every household that is connected to the network.

54. In the 2016 Autumn Statement, the Chancellor had already announced the creation of a £740 million National Productivity Investment Fund to support 'ultrafast' FTTH and 5G technology deployment. In 2017, the Government allocated a further £400 million to a Digital Infrastructure Investment Fund to 'catalyse the market for alternative full fibre providers'48. The reference to ‘alternative full fibre providers’ related to the emergence, during this period, of a number of new firms with plans to deploy FTTH technology in the UK. Any firm without an existing infrastructure to upgrade (as BT and Virgin Media had) would choose FTTH technology rather than copper-based technologies when building a new network, since the costs of installing either were essentially the same if starting from scratch whilst FTTH networks have much higher performance and are cheaper to operate.

55. Thus, Gigaclear, a firm based in Oxfordshire, had begun deploying FTTH infrastructure in rural areas (where BT had yet to deploy VDSL) in 2011 and had passed around 40k premises in England by 2017 (and around 120k today). Cityfibre had announced plans to deploy FTTH technology in a cities, initially undertaking trials in conjunction with Talk Talk and Sky in York and later concluding a partnership with Vodafone with a target of 5 million households in 50 towns and cities by 2025 (of which around 100k have been passed today).

56. It was also during this period that BT substantially completed its deployment of VDSL technology by fulfilling its various contracts with BDUK. It had begun trialling the next generation of copper-based technology, G.Fast. As with the earlier transition from basic DSL to VDSL, moving to G.Fast would involve the replacement

of more of the existing copper with fibre connections and the installation of 
electronic equipment closer still to the individual property – often on a pole or in a cabinet close by (ie within 500 metres). G.Fast technology was expected deliver speeds of over 100 Mb/s, and upto 1 Gb/s, again depending on the length of the copper connection.

57. BT announced it was launching G.Fast pilots in January 2017. It had initially announced its intention to deploy G.Fast to serve households in most of the UK, representing around 15 million premises, by 2025. This would be in addition to 2 million households to be served by FTTH technology. Subsequently, BT adopted a target to serve 10 million premises with G.Fast by the end of 2020. At the end of 2018, BT had deployed G.Fast to serve a little over 2 million households and is now expected to serve only 2.7 million by 202049.

58. Following the 2017 election, the May Government published the results of its Future Telecoms Infrastructure Review (FTIR) in the same month as the UK NIC’s National Infrastructure Assessment was published50. The review was intended to identify the actions necessary to realise the Government’s FTTH ambitions. It remains the most recent substantive policy document on FTTH to be published by the UK Government.

59. The FTIR broadly endorses the recommendations of the UK NIC. That is, the Government proposes that competition between rival firms should be expected to drive the roll out of FTTH around 80% of UK households provided the Government takes appropriate steps to encourage and facilitate such competition. This is based on modelling by its advisers (again Frontier Economics). The Government expects that 10% of households will be served on a commercial basis by a single provider and that the remaining 10% of households will prove unviable to serve under any conditions and will therefore require public subsidy. The FTIR estimated that £3-5 billion of public subsidy would be required to ensure that the last 10% of households were provided with FTTH.

60. The projection of 90% commercial coverage assumes that the Government implements a range of measures to promote competition which we list below - and that those measures prove effective. If they do not, Frontier estimated that 60% of UK households would be served with FTTH on a commercial basis by 2033, leaving 40% of the UK to be supported with public subsidy51. The measures which the UK

Government are taking to promote competition and hence the commercial deployment of FTTH include:

a. A series of measures to reduce the costs of deploying new FTTH infrastructure, such as simplification of planning and permitting rules when undertaking streetworks, addressing the need to obtain consents from private landlords to install new connections and obligations on developers to install FTTH in new building developments (some of which have been implemented through changes to the 2017 Digital Economy Act and others of which were included in the proposed Telecoms Infrastructure Bill which the Johnson Government announced in the October Queens Speech\(^{52}\)).

b. Application of the policy, already adopted by Ofcom as part of the findings of its own ‘Strategic Review’ which reported in February 2016\(^{53}\), to allow new firms to use BT’s existing ducts and poles to deploy their own FTTH infrastructure, thereby removing the cost and difficulty of digging trenches themselves (this work remains ongoing today).

c. ‘A stable and long term regulatory framework’, which is administered by Ofcom but which the Government reiterated in their first ‘strategic steer’ to Ofcom, a measure which was enabled by the Digital Economy Act 2017\(^{54}\).

d. A ‘switchover process’ for the decommissioning of the existing copper network once FTTH has been deployed that would support demand for FTTH services. These are matters on which BT and Ofcom have since been consulting with the rest of the telecoms industry. It is rumoured that BT is currently proposing to fully decommission its copper network by 2027, subject to certain conditions (including some of the measures listed above) being met by the Government and other industry participants\(^{55}\). The outcome of these negotiations remains uncertain today.

61. Boris Johnson was critical of the May Government’s FTTH plans during the Conservative leadership contest and proposed to accelerate deployment to achieve universal FTTH coverage by 2025, a promise he reiterated at the Conservative Conference in September 2019. His position was widely criticised as being

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\(^{52}\) https://www.bbc.co.uk/news/technology-50042720
impractical and unachievable\(^56\). It was reported that this target had subsequently been abandoned by the Johnson Government in the Queens Speech, where no date was specified\(^57\). The Culture Secretary, Nicky Morgan, has since suggested that the Johnson Government remains committed to achieving ‘universal gigabit capability’ by 2025 – the significance being that ‘gigabit capability’ could be obtained by a combination of FTTH, DOCSIS and 5G availability rather than the relying wholly on FTTH\(^58\).

**Public funding of FTTH**

62. In September 2019 the Chancellor announced that the Johnson Government would allocate £5bn to support its target of universal FTTH by 2025\(^59\). The Chancellor appeared to think that moving the target from 2033 to 2025 would mean that a further 10% of households would not be served on a commercial basis, so that coverage of 20% of households would need to be subsidised. It is unclear whether or not the £5bn estimate of the Chancellor reflects a revised view of the costs of FTTH (relative to the view in July 2018 that £5bn of subsidy might be required for the last 10%). We note that none of this may be very relevant now that the UK is embarked on a general election, and we await publication of the manifestos to see what new commitments might be offered by the parties in relation to broadband in general and FTTH in particular.

63. Since VDSL technology can be deployed at a substantially lower cost per household than FTTH technology, we would expect the commercial opportunity for FTTH (assuming the transition from VDSL to FTTH is not accompanied by a significant increase in revenues) to be more limited than VDSL, all else the same. VDSL coverage of around 65% was achieved in the UK on a commercial basis. The Government’s FTIR assumption that the FTTH could extend, on a commercial basis, to more households than VDSL would, therefore, appear to be ambitious. If the measures to extend FTTH commercially were to fail to achieve their intended outcomes, then the Government’s expectation that universal FTTH would require only £5 billion of public subsidy would likely need to be substantially revised.

64. The NIC’s advisers have estimated the capital expenditure required to achieve varying levels of FTTH coverage across the UK\(^60\). Achieving 100% requires around £22 billion of capital, which contributes to the £33 billion figure of total costs (the

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\(^{57}\) [https://www.bbc.co.uk/news/technology-50042720](https://www.bbc.co.uk/news/technology-50042720)


\(^{59}\) [https://www.bbc.co.uk/news/technology-49881168](https://www.bbc.co.uk/news/technology-49881168)

rest are operating costs) referred to above. However, achieving FTTH coverage of the first 50% of the UK population requires expenditure of only around £5 billion. £17 billion is then required to extend coverage to the remaining 50% of UK households.

65. If FTTH coverage on a commercial basis were to be only 60% (as the Government’s own advisers suggest would be the case in the absence of the Government’s additional measures) then the capital required to serve the remaining 40% would be of the order of £15 billion. If the ‘aid intensity’ were to be around 60% (as it was for the BDUK VDSL programme), then the public funding contribution to serve the remaining 40% would be £9 billion. If the FTTH coverage were to extend to 90% on a commercial basis, as the FTIR suggests, then the public funding requirement would be around £6 billion. Thus, a reasonable range for the public funding requirement for universal FTTH in the UK, based on the UK NIC’s and UK Government’s own sources, would appear to be between £6 and £9 billion. These figures are, of course, subject to a high degree of uncertainty, particularly in relation to the underlying costs of deploying FTTH and in relation to the share of costs or aid intensity which might apply in relation to FTTH.

Current UK Government actions to support FTTH

66. The UK Government, and Ofcom, are have already been proceeding on a number of fronts to promote an accelerated deployment of FTTH in the UK. BT’s target of passing 3 million households with FTTP (having passed around 1.2 million to date) by March 2021 was increased to 4 million households in May 2019. BT’s aim of reaching 10 million households by 2025 was also increased to 15 million (still only half of Boris Johnson’s target of universal coverage of 30 million households by 2025). Investment in FTTH by alternative providers, including firms such as Gigaclear, Cityfibre, Hyperoptic and Virgin Media are also continuing at some pace.

67. In September 2019, Ofcom reported that as of May 2019 8% of UK households could now connect to an FTTH network, representing 2.5 million properties and growth of 1 million households over the previous year. BT also announced a review of its commitment to G.Fast technology and it appears likely that BT Openreach will, in future, devote its resources to the deployment of FTTH rather than extending G.Fast to more households.

68. The UK Government has also directed BDUK to reallocate Phase 2 funds away from support for superfast VDSL broadband and towards FTTH instead. The Government also announced a separate £200 Local Full Fibre Network Challenge Fund, which is

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intended to support FTTH initiatives by local communities (often working in conjunction with established FTTH providers, including BT). These funds were allocated in three phases, with the last announced in March 2019\textsuperscript{62}. The funds allocated are small (awards have been made to over 20 applicants), ranging from £1 million to £15 million. For example, the North Wales Economic Ambition Board successfully bid for £7 million to connect public institutions such as libraries, GP surgeries and schools to FTTH in Denbighshire, Wrexham, Conwy, Flintshire, Anglesey and Gwynedd\textsuperscript{63}. The Gigabit Voucher Scheme has also allocated £67 million to support UK households and SMEs connecting to FTTH networks with grants of up to £2500\textsuperscript{64}.

69. The UK Government’s flagship programme for FTTH is currently the Rural Gigabit Connectivity Programme which was announced in May 2019\textsuperscript{65}. £200 million has been allocated to this fund. The aim is to deliver FTTH to public institutions or ‘hubs’ such as schools and libraries, in the expectation that this will also stimulate commercial investments to extend FTTH to households and businesses in the surrounding area (including with the assistance of the Gigabit Vouchers referred to above). The Government aims to connect 300 rural schools by March 2021. Applications to participate in the programme have been invited by 30 October 2019 and it remains at an early stage. The expectation is that the £5 billion FTTH subsidy programme announced by the Johnson Government, or its successor after the election, would then build upon the Rural Gigabit Connectivity Programme and would be administered by the renamed BDUK unit, now known as ‘Building Digital UK’ rather than ‘Broadband Delivery UK’\textsuperscript{66}. Officials are reported to be planning to award contracts for large FTTH projects from 2021.

\textit{Superfast broadband in Wales}

70. Wales has faced many of the same challenges in relation to the deployment of broadband infrastructure as the rest of the UK. BT remains the dominant provider of fixed broadband services throughout Wales, with Virgin Media providing alternative superfast and ultrafast broadband services in the densely populated Cardiff and Newport areas. More recently, Virgin Media has been extending its network in Wales (Wrexham) as part of its ‘Project Lightening’ programme, which was planned to pass

\textsuperscript{62}https://www.ispreview.co.uk/index.php/2019/03/government-lists-9-winning-uk-bidders-for-wave-3-full-fibre-fund.html
\textsuperscript{64}https://researchbriefings.parliament.uk/ResearchBriefing/Summary/CBP-8392
\textsuperscript{66}https://www.ispreview.co.uk/index.php/2019/10/bduk-possible-build-scenario-for-uk-full-fibre-broadband-rollout.html
another 4 million households across the whole of the UK by the end of 2019 and had passed 1.8 million in the summer of 2019\(^\text{67}\). The combination of the lack of competition and the relatively high costs of serving rural households in Wales initially meant that Welsh superfast broadband availability lagged far behind the rest of the UK as BT deployed VDSL on a commercial basis. In 2011, for example, only 31% of Welsh households had access to superfast broadband, compared to an average of 58% across the UK as a whole\(^\text{68}\). In 2011, the Welsh Government determined that only around 35-40% of Welsh households would be likely to access superfast broadband services on networks built on commercial terms, compared to around two thirds of households who could be served on a commercial basis in the UK as a whole.

71. Despite this, Welsh Government targets for broadband coverage have tended to be more ambitious than those adopted by the UK Government. For example, in 2010 the Welsh Government suggested that all households should have access to superfast broadband, which it defined as being speeds of at least 30 Mb/s rather than the 24 Mb/s threshold used by the UK Government\(^\text{69}\), and capable of 100 Mb/s, by 2020 and all businesses by 2016\(^\text{70}\). In 2012, as part of the UK’s broader BDUK programme, the Welsh Government concluded an agreement with BT for the provision of superfast broadband services to 95% of the households in the ‘intervention area’ which had been identified as being unlikely to otherwise be served on a commercial basis. This represented 690,000 premises\(^\text{71}\), was branded the ‘Superfast Cymru’ programme and was one of the largest of its kind in the UK (principally because the Welsh Government let a single contract for the whole of Wales, rather than delegating the procurement process to local authorities, as was done in England). All of these households were expected to be able to obtain speeds of at least 24 Mb/s, but 40% were expected to be able to obtain speeds of at least 100 Mb/s.

72. In addition, BT committed to make ‘FTTH on demand’ available in Wales on a commercial basis. ‘FTTH on demand’ has been available in the UK to businesses (and households who are prepared to pay thousands of pounds for a FTTH connection) since 2013. BT Openreach has made various changes to its pricing model since then, but costs remain very high. Businesses (but not households) in Wales have been able to apply for a voucher (grant funding) from the Welsh Government to fund a connection of at least 100 Mb/s to the value upto £10,000. As of October 2018, 1700 Welsh businesses had obtained funds totaling £1.2 million under this and another


\(^{68}\) https://www.ofcom.org.uk/__data/assets/pdf_file/0022/53158/fixed_broadband_june_2011.pdf, p.6

\(^{69}\) 30 Mb/s was the threshold for ‘next generation access’ adopted by the European Commission. The UK Government adopted a lower threshold, 24 Mb/s, which was achievable using DSL technology at the time.


scheme. This scheme was replaced by the UK and Welsh Government’s Gigabit Voucher Scheme in March 2019, under which the Welsh Government offers additional funds (over and above those made available by the UK Government) of up to £2500 per business and encourages collective purchasing by villages and groups of households. The map on the UK Government website suggests that some vouchers have been allocated in north and south but very few in mid-Wales. It is unclear whether the additional subsidy offered by the Welsh Government has done anything to contribute to higher FTTH adoption in Wales than in the rest of the UK (but the comparatively low level of community broadband projects in Wales, which we discuss below, suggests not).

73. Consistent with the UK Government’s wider targets, Phase 1 of the Superfast Cymru programme was intended to deliver superfast broadband coverage to 95% of Welsh households by 2015, subsequently revised to 2016 (as it was for the rest of the UK). BT also agreed to employ 100 apprentices as part of the programme. A number of features of the Superfast Cymru phase 1 programme should be noted:

a. The programme had to be large because the proportion of households in Wales requiring public subsidy to obtain access to superfast broadband services was significantly higher than in the rest of the UK, where a higher proportion were expected to be able to be served on a commercial basis.

b. The requirement that at least 40% of households obtain speeds of more than 100 Mb/s, which was unlikely to be achieved using VDSL technology, was relatively unusual at the time and may at least partly explain why the programme supported a higher proportion of FTTH deployment by BT in Wales than the rest of the UK (where BDUK programmes were predominantly VDSL). In 2017, 3% of Welsh households had access to FTTH connections, the same as in the UK as a whole. However, 9% of rural households in Wales had access to FTTH, compared to only 5% in the UK. This may in part reflect the impact of the targets, but may also reflect the challenges of deploying VDSL technology in some parts of rural Wales where the length of the copper lines mean that VDSL technology cannot achieve the

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73 https://gov.wales/go-superfast/gigabit-broadband-voucher-scheme
74 https://gigabitvoucher.culture.gov.uk/home/why-gigabit-2
75 SQW suggest that the Welsh Government initially hoped that BT would use FTTH rather than VDSL for most of the deployment, but it became clear during the procurement phase that this was ‘unaffordable’, http://www.sqw.co.uk/files/8814/7560/5709/160928-next-generation-broadband-wales-programme-en.pdf, p.26-7.
speeds (of at least 24 Mb/s) required by the contract. Today, 10% of Welsh properties can obtain FTTH services, compared to 8% in England.\footnote{https://www.ofcom.org.uk/__data/assets/pdf_file/0024/166650/connected-nations-update-summer-2019.pdf}

c. As a result of both of these factors, the public share of the funding of the Superfast Cymru phase 1 programme, known as the ‘aid intensity’, was significantly higher than in BDUK superfast broadband programmes elsewhere in the UK. Of a total capital funding requirement of £231 million, BT contributed only £26 million. The Welsh Government contributed £58 million, as did the UK Government via BDUK. The balance, of £90 million, was provided by the European Regional Development Fund.\footnote{https://www.audit.wales/system/files/publications/Broadband_2015_English.pdf, p.11} The aid intensity for Superfast Cymru was therefore a little under 90%, which compares to aid intensity for other Phase 1 projects in the UK as a whole of between 60% to 85%. A higher proportion of the cost of broadband infrastructure deployed in Wales has been and is being funded by taxpayers than in the rest of the UK.\footnote{https://www.ofcom.org.uk/__data/assets/pdf_file/0023/108842/wales-connected-nations-2017.pdf, p.10}

d. As with the other BDUK phase 1 schemes, the programme broadly achieved its objectives and the gap in coverage between Wales and the rest of the UK had largely – although not entirely - been eliminated by 2017. At this point 89% of Welsh households could access superfast broadband, compared to 91% across the UK as a whole.\footnote{https://www.ofcom.org.uk/__data/assets/pdf_file/0023/108842/wales-connected-nations-2017.pdf, p.10} By the end of 2018, the Welsh Government announced that the Phase 1 scheme had extended superfast coverage to 730,000 premises and that 95% of households could now obtain ‘broadband’ (but not superfast) services. No statement was made about the target to offer connections to all businesses. The increase from the original 690,000 target was agreed in 2014 following identification of another 40,000 households that would not be served commercially, and the deadline for delivery extended from 2016 to June 2017 to reflect this. As in the rest of the UK, some of the funds to serve these premises came from the ‘claw back’ of excess BT revenues earned because take up of Superfast Cymru connections (almost 50% of households passed by 2018) was substantially higher than BT’s original forecasts.

e. The Welsh Government had a target that 50% of Welsh households should be using superfast broadband services by 2024\footnote{https://gov.wales/written-statement-superfast-cymru-0} and some resources were devoted by BT (£1.7 million, mainly for a website and 3 staff) promoting take

\footnote{It is unclear where this target, announced in 2015, derives from. The European Union has adopted a target of 50% of households using broadband services of at least 100 Mb/s (not 24 Mb/s as provided by Superfast Cymru) by 2020. There is no European or UK target for 2023.}
up as the network was built. Take up (at least amongst households) significantly exceeded expectations at 49% by December 2018\(^2\), and appears to have been amongst the highest of all Phase 1 projects in the UK. However, research also showed that over 30% of businesses and 40% households not connected to the network after 6 months were not aware that they could do so\(^3\).

f. In accordance with the terms of the European State Aid rules, the Welsh Government commissioned reports to assess the performance of the Superfast Cymru programme (the Welsh Audit Office also produced a report in 2015). In 2016, the authors of the report, SQW, concluded that the overall programme had been ‘well managed’ and had delivered significant economic benefits to households and businesses in Wales\(^4\). SQW estimated that the present value of public funds was £205 million, compared to present benefits of £1.35 billion (to 2015), yielding a benefit:cost ratio of 6.7:1\(^5\). This compares with the 1.98:1 ratio to which we referred earlier in this paper and which SQW found for the BDUK Superfast Programme as a whole in the period to mid 2016. It would appear, therefore, that Wales obtained significantly greater economic benefits from the Superfast Cymru programme than did the rest of the UK from the equivalent BDUK programmes. It is not clear why this should be and there are many possible explanations. For example, it may be relevant that the Welsh superfast programme addressed a higher proportion of all households and businesses in the country (over 50%) than did the UK programme (around 35%). It may also be that businesses who could be served on a commercial basis in England derive larger economic benefits from superfast broadband than businesses in areas which require subsidy. If similar businesses were located in subsidy areas in Wales (i.e. the 15% of the population which is served commercially in the UK but requires subsidy in Wales), then they might account for the greater benefits from public funds that are obtained in Wales. Alternatively, differences in costs may account for the differences in the ratios. Welsh households in the Superfast Cymru programme may have been less costly, on average, to serve than those UK households in the BDUK programmes, even if the benefits each obtained from superfast broadband were similar. Finally, the UK results relate to the period to mid-2016 and those in Wales to 2015, whereas a proper comparative assessment would require consideration of

\(^2\) Op cit, p. 21
the present value of both costs and benefits over their lifetime, both past and future.

74. The only other study of which we are aware is research undertaken by Cardiff University in 2018, again based on surveys of SMEs. This found:

a. Around 40% of SMEs surveyed attributed growth in turnover to adoption of either basic or superfast broadband, with a smaller proportion claiming positive employment effects.

b. The assessment of the economic benefits by SMEs appears to diminish over time (between 2017 and 2018), although it is not clear whether this is because SMEs are reappraising their valuation of the benefits, or the benefits themselves are diminishing over time.

c. Extrapolating from these results suggested that SME turnover in Wales could be £166 m p.a. higher as a result of the adoption of broadband and superfast broadband (equivalent to about £60 million p.a of GVA) and that employment might increase by 1,600. Around £90 million of the £166 million of turnover was attributable to superfast rather than basic broadband adoption, but the report provides no indication of whether those SMEs adopting superfast broadband had previously used broadband, nor whether the economic benefit identified could be attributable to the difference in speed between the two. It is reasonable to suppose that at least some of the economic benefit could be attributed to the increase in speed, but impossible to determine how much.

75. So far as we are aware, there are no studies which examine the economic benefits which Welsh businesses or households might derive (or actually have derived) specifically from FTTH connections rather than from superfast broadband in general.

*Current Welsh Government broadband policy*

76. The Welsh Government does not appear to have made any public statement about its plans for Wales following the publication of the UK Government’s Future Telecoms Infrastructure Review of 2018. There is not, therefore, currently a

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87 The Welsh Government website simply refers to efforts to pass a further 26,000 homes, which is a reference to the Phase 2 Superfast Cymru programme.
specific target for FTTH coverage in Wales, other than that implied by the UK Government’s targets for the UK as a whole.

77. The Welsh Government has sought bids for Phase 2 funds to further extend superfast broadband beyond the 93% of the population who could obtain it according to the latest Ofcom data. It identified three areas or Lots on which it sought bids. Although a number of Phase 2 projects in England (and Northern Ireland and Scotland) have been contested, BT was again the only bidder for public funds in Wales.

78. The Superfast Cymru Phase 2 programme had originally allocated £80 million of public funds, £2m from BDUK, £20 million from the European Union, £20 million from the Welsh Government and £37 million of ‘clawed back’ funds from the Phase 1 programme. However, only £22 million of the £80 million has been allocated to projects to serve 26,000 households at the end of the bidding process, 90% with FTTH, by March 2021. The original aim of the Welsh Government was for the Phase 2 programme to provide superfast broadband of at least 30 Mb/s and preferably FTTH for 100 MB/s+ to at least 88,000 households.

79. Announcing the outcome of the tender for the third and final Lot, the Deputy Minister, Lee Walters, said:

“Now, we did put on the table a further £80 million in what is known to Members who correspond regularly as lot 2. We said there was £80 million for the market to bid for, to reach those properties that had not been reached under the Superfast project. And of the £80 million we made available to be bid into, only £26 million has been bid for by Openreach, able to spend by 2021. So, the market itself is not interested in getting public subsidy to reach those premises they’ve yet to reach under the previous programme that we funded.

So, we have a problem. It’s not that the money isn’t there or that we’re not willing to spend it, even though it’s not devolved. It is there. We’ve made that choice, but we simply don’t have the private sector partners willing to spend and reach deep into the areas that we want to reach. Paul Davies has mentioned that, even though Pembrokeshire under Superfast has the third highest level of spending the whole of Wales, with £15 million in Pembrokeshire alone, under the next scheme, only 300 or so premises are going to be included in lot 2, and that is deeply disappointing. It’s certainly not a situation that we want to see.

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But I think that we need to confront the fact that the market's appetite, even with subsidy, for reaching premises with fibre-to-the-premises broadband is coming to an end. And many of these premises—let’s bear in mind, 20 per cent of premises in Wales don’t have a gas connection, and yet we are expecting them to have fibre-to-the-premises superfast broadband, and it’s simply not going to happen in the short-term. Now, if the UK Government is willing to step in and have a genuine universal service obligation, then that could be done, but the Welsh Government alone cannot do that, and I think we need to be honest about that and confront it”

80. It should be noted that the Scottish Government’s Phase 2 ‘Reaching 100%’ (R100) superfast broadband programme appears to have encountered similar challenges. This programme, with a budget of £600 million, was intended to extend superfast VDSL broadband of at least 30 Mb/s to the last 5% of Scottish households by the end of 2021. Contracts are not now expected to be signed until the end of 2020. The Scottish Government had intended the R100 programme to extend coverage to around 180k households, in three Lots. Two of the three were uncontested and have been awarded to BT. Whereas the Welsh Phase 2 awards envisage 90% of households being served with FTTH, the Scottish Government is said to be seeking FTTH connections at only 25% of the households in the third Lot, which is contested and has yet to be awarded. Although details have yet to be published, it seems likely that the Scottish Phase 2 programme will fall some way short of the 180k households originally targeted.

81. The Scottish Government had, since 2012, also established a ‘Community Broadband Scotland’ scheme which provides support to local communities who are seeking to develop and fund their own community broadband schemes in areas which are neither served by BT on a commercial basis nor fell within the Phase 1 scheme (i.e. were within the last 5% of households without any form of superfast broadband). Around £6.5 million was spent by the Government to deliver broadband to fewer than 2000 premises. Audit Scotland concluded that this programme had failed, and the Scottish Government discontinued it, instead inviting existing schemes to be incorporated into the R100 plan discussed above.

82. Both the UK and Welsh Governments have also sought to promote various community broadband schemes in which local communities contribute to the funding of the infrastructure and the UK NIC report, quoted earlier, also suggested

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93 https://www.ispreview.co.uk/index.php/2019/10/scotland-pick-bt-for-part-of-600m-superfast-broadband-rollout.html
that communities who volunteered to contribute should receive preferential access to public funds (see para 51). The highest profile community enterprise (cited as an example by the UK NIC) is B4RN or Broadband for the Rural North, which uses local volunteers to operate an FTTH network passing around 10k households in rural Lancashire and Yorkshire, supported by a combination of crowdfunding and Gigabit Broadband Vouchers. Similar schemes, often involving less than a hundred households, operate in some other rural areas.

83. BT runs a ‘Community Partnership Scheme’ which allows households to co-fund infrastructure alongside BT. BT reports that 850 such agreements have been concluded and that 100k households and businesses have been, or will be, able to obtain access to superfast or FTTH broadband as a result, with economic benefits for 60,000 premises of £340 million over 15 years. 90% of Community Partnerships to date have involved VDSL technology. A significant proportion of the benefits (£1700 per household) have been attributed to the increase in house valuation as superfast broadband became available. A study undertaken by consultants for BT identified benefits in terms of business productivity, access to new markets and innovation, the creation of new businesses in rural areas, and homeworking (where they assume that 20% more households work from home with superfast broadband and that they are 20% more productive when they do so).

84. It is not clear how many community broadband schemes have been undertaken in Wales to date. The Welsh Government cites Michaelston y Fedw, which had developed an FTTH network to serve 200 households during 2018. This claims to be the first community FTTH network in Wales and may still be the only one. It is not clear what proportion, if any, of the 100k households in BT Community Partnerships are located in Wales.

85. A number of points emerge from this:

a. At first sight, Wales starts from a stronger position in relation to FTTH than VDSL, where we noted that coverage had been significantly behind the rest of the UK prior to the Superfast Cymru programme. In contrast, the latest data from Ofcom shows that 10% of Welsh properties could obtain FTTH, an increase from 7% in January 2019 (by way of comparison in England, 8% of properties could obtain FTTH in May 2019, up from 7% in January 2019).

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99 https://www.myfi.wales/home
Wales saw a particularly large growth in FTTH infrastructure in the first half of 2019, based on Ofcom’s data.

b. On the other hand, the same Ofcom data shows that only 93% of Welsh households can now access superfast broadband services (of at least 30 Mb/s) and that 3% still cannot access broadband at speeds of 10 Mb/s (and so will fall within the remit of the broadband USO from 2020). The comparable figures for England are 95% and 1% and for Scotland 93% and 3%. In contrast with the rapid growth in FTTH in Wales, superfast VDSL coverage and DSL coverage has remained unchanged over the past 9 months.\textsuperscript{101} The Phase 2 Superfast Cymru programme will provide FTTH coverage for only 26,000 households. This leaves 5%, or over 65,000 Welsh households, unable to access superfast broadband services unless further action is taken.

c. As the Deputy Minister notes, the fact that Phase 2 funds remain unclaimed suggests that the public funding of FTTH deployment in Wales may already have reached its limits. The same may be true in Scotland. Wales currently has FTTH coverage to around 136,000 premises (or 10%), leaving around 1.2 million premises still to be served. The UK Government anticipates that 80% of premises will be served with FTTH on a commercial basis over the next 6-14 years. As we have explained earlier in this note, there is some competition between BT and alternative providers of FTTH networks developing elsewhere in the UK, but none in Wales so far as we are aware. Competition is therefore limited to that between BT and Virgin Media, predominantly in South Wales.

d. The UK Government expects competition between BT and other providers to extend to around 90% of the country as a result of the measures it adopted in the FTIR but the impact these measures would have on the commercial activities of firms is uncertain at this stage. If they are less effective than the UK Government anticipates, then 60% rather than 90% of the UK might be served with FTTH on a commercial basis, and perhaps less than this. History suggests that the lack of competition in Wales would mean that commercial roll out of FTTH would be significantly less than the rest of the UK. We noted earlier that projections suggested that Wales would achieve VDSL superfast broadband coverage of 35-40% on a commercial basis. Commercial FTTH coverage could exceed this if the UK Government’s measures prove effective, but could be less than this if they are not.

\textsuperscript{101} https://www.ofcom.org.uk/__data/assets/pdf_file/0024/166650/connected-nations-update-summer-2019.pdf, p.17
e. At the same time, it is not clear on the basis of the latest Phase 2 experience, what, if any, level of public subsidy would be necessary to induce BT to serve the remaining 60%+ of households in Wales with FTTH. Even if BT were willing to deploy FTTH infrastructure to the 60-65% of households which it would not serve commercially, it is unclear whether the Welsh Government could commit funds to support FTTH deployment on this scale. The best evidence we have to date as regards costs is the Phase 2 funding, the vast majority of which is applied to FTTH deployment in Wales. In that case, 26,000 homes will be passed at a cost to public funds of £850 per household (BT’s contribution to the cost, and hence the ‘aid intensity’, does not appear to have been disclosed yet). It seems reasonable to assume that households within the intervention area which BT declined to include in the contract would require an even higher level of public subsidy. If we assume that the subsidy per FTTH household passed might average £1000 across the 60% of Welsh households who might remain unserved on a commercial basis, then the public subsidy required is of the order of £800 million. This compares with the £231 million of public funds applied to Phase 1 of the Superfast Cymru programme, of which the Welsh Government contributed less than £60 million.

f. The Welsh Government’s consideration of these issues should also be informed by the position in the rest of the UK, which we discussed above. The current UK Government has committed £200 million to its Rural Gigabit Connectivity Scheme and £67 million to Gigabit vouchers, of which Wales receives a small proportion. The UK Government allocated £58 million of its £530 million BDUK Phase 1 budget to Superfast Cymru (it is not clear whether the UK Government would have found more if the Welsh Government had set a higher budget for them to match), or about 11%. On that basis, Wales might expect to receive around £30 million from current UK Government FTTH funding initiatives. The Johnson Government indicated that further funds, perhaps £5 billion, would be allocated to FTTH schemes in the next budget but at the time of writing we do not know what commitments will be made in the election.

g. There are some indications, partly prompted by the UK NIC’s recommendations and by BT’s ‘Community Partnership Scheme’, that greater reliance might in future be placed on householders themselves making contributions to the costs of FTTH infrastructure, alongside central Government and private sector contributions. We have found no research

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102 It is difficult to extract costs from Phase 1 funding arrangements since these represented a mixture of VDSL and some FTTH connections, but the costs were not apportioned to each nor disclosed.

103 Although Ofcom’s figure of almost £3800 for FTTH households under the USO scheme (para 37) suggests that £1000 per FTTH household could be conservative.
that examines whether such funding models might favour the deployment of FTTH in particular communities, but not in others, thereby potentially exacerbating regional socio-economic divisions. However, if the costs to taxpayers of universal FTTH deployment prove to be significantly higher than current Government estimates, then it seems likely that such ‘co-funding’ models will play a more significant role in UK broadband policy than has been the case to date. Community funding in Wales has been very modest to date.
Conclusions

86. In this section we present some conclusions which Commissioners may wish to consider. We also suggest a number of questions which arise from this paper and which we should seek to answer in consultation with stakeholders and which should inform our further work.

Initial conclusions

87. Realising the economic and social benefits of superfast broadband in Wales over the past 8 years has required significantly higher levels of public subsidy than in the rest of the UK (see para 73). This has reflected the weaker commercial incentives for operators to invest in Wales, including a lack of competition to BT in most of the country and the greater proportion of difficult and costly to serve households. It has also been a result of the Welsh Government’s ambitions in the Superfast Cymru programme, which have aimed to obtain higher speeds than the equivalent programmes in England or Scotland.

88. Although the public costs of superfast broadband have been higher in Wales than in the rest of the UK, there is some evidence to suggest that the economic benefits have been higher still in Wales, so that the benefit to cost ratio for superfast broadband in Wales is higher than the equivalent ratio for the rest of the UK (see para 73). It is not clear why this should be the case but, if correct, we might expect it to lead policymakers in the UK and Wales to come to different policy conclusions on certain matters.

89. When considering benefits from broadband, it is also important to recall that average figures may disguise very large differences between the economic benefits obtained by businesses and those obtained by households, with the former being much larger than the latter (see para 31). However, households may obtain other (social) benefits which businesses do not. There is no evidence to suggest that households in higher cost to reach rural areas obtain higher benefits from broadband than households in low cost areas. This means that the benefit:cost ratio will deteriorate as coverage extends to harder to reach areas and that a positive case needs to be made for universal access to broadband infrastructure.

90. The roll out of superfast broadband infrastructure in Wales under Phase 1 of the Superfast Cymru programme has been successful, as it has in the rest of the UK. It has been largely on time and below budget and has produced significant economic and social benefits. That said, 3% of Welsh households will continue to suffer from
no or very slow broadband until the UK Government’s Universal Broadband Obligation addresses their needs in 2020 and the Phase 2 programme will fall significantly short of its initial targets (see para 78).

91. Although some important insights may be drawn from the experience of superfast broadband deployment in Wales and in the rest of the UK over the past 10 years, our understanding of the additional economic and social benefits that might be obtained from in moving from superfast VDSL technology to ultrafast FTTH broadband technology over the next 10-15 years remains much more limited. The UK NIC recommended a universal FTTH target for the UK on the basis that it is a ‘risk worth taking’ (para 47). It accepts that there is significant uncertainty as to whether many UK households will actually need to bandwidth and speeds which FTTH provides but argues that any delay will mean that the UK will be too late if it does become clear that the demand exists. In coming to this view, the UK NIC also assumes that households will be prepared to wait for FTTH without further improvements in their broadband in the meantime.

92. The differences between VDSL or superfast technology which has been deployed in most of Wales to date and FTTH or ultrafast technology which the UK Government proposes should be deployed to every household in the UK by 2033 (or earlier, depending on the manifesto commitments in the election) are significant. VDSL cost around £200 per household passed to deploy, whereas FTTH technology is expected to cost an average of around £1000 per households, but up to £4000 or more per household in remote areas.

93. The Welsh Government does not appear to have an FTTH target, so Wales is currently included within the UK Government’s target of 100% coverage by 2033. UK Government policy on broadband has changed significantly since the 2017 election, but this does not appear to have prompted policy changes in Wales. Further changes in UK policy are possible after the current general election.

94. The UK Government’s 2033 FTTH ambitions rely heavily on the assumption that 90% of the UK can be served on a commercial basis. BT is currently planning to serve around 50% of UK households with FTTH by 2025. There is reason to doubt assumptions of commercial roll out for the UK as a whole and even more reason to think that Wales will not achieve commercial FTTH coverage to anything like that extent. Wales was expected to achieve coverage of cheaper, easier to deploy VDSL technology of around 35-40% of households on a commercial basis. Measures being taken by the UK Government to promote competition and reduce the costs for FTTH (see para 60) might increase this for FTTH, but the higher costs of FTTH might also reduce it. Either way, the scope for commercial deployment of FTTH in Wales is likely to be significantly less than for the rest of the UK.
95. The UK Government has suggested that to extend FTTH coverage to the 10% of UK households who it does not expect to be served commercially will cost £5 billion. Evidence from the Government's own advisers suggests this is likely to be an understatement, and that a public expenditure of £6-9 billion is more plausible (see para 65). The Welsh Government has not presented any estimates of the funds required for Wales to achieve universal FTTH coverage by 2033, but in this paper we present an estimate of around £800 million (see para 85).

96. An important issue for any FTTH policy, including that proposed by the UK Government and UK NIC, is what households are expected to do in the 10-15 years it will take for FTTH to reach some of them. BT has already reduced its G.Fast targets to avoid investments which it may then subsequently have to write off when FTTH is eventually deployed. This could mean that some UK households will have to continue to rely upon superfast VDSL connections of little more than 24 Mb/s until 2033.

97. When considering the case for FTTH in Wales, the Welsh Government starts with some advantages. The challenges in deploying VDSL to remote households with very long copper connections has meant that a higher proportion of households in Wales – 10% - can obtain an FTTH connection than is the case in the rest of the UK. Most of these have been funded by the Superfast Cymru programme, although some may also have been encouraged by the Welsh Government’s contributions to the Gigabit Broadband Voucher Scheme (see para 72).

98. At the same time, community FTTH schemes are not significant in Wales. This could be important if UK Government FTTH policy were, in future, to place greater emphasis upon financial contributions from local communities (alongside public and private funds) in order to meet any funding gap in its plans.

99. Assuming commercial activities by BT and others will deliver FTTH to around 40% of Welsh households over the next 10 years, the question remains whether and how the Welsh Government should intervene to extend coverage beyond that. The recent experience of the Phase 2 Superfast Cymru programme, which will deliver FTTH to only 26k households at a public cost of £850 per home passed, suggests that either a new delivery model will be required in Wales to achieve the UK target, much higher levels of subsidy will be needed in Wales or a different FTTH target for Wales will be required to reflect the different assumptions and circumstances.

100. In the next paper we will examine each of these options in more detail.
Questions for consultation

101. In addition to the findings outlined above, Commissioners may wish to consider some of the questions which arise from this paper and which should be pursued in consultations with stakeholders:

a. What is the evidence, if any, to explain whether and why the value of economic benefits from the Superfast Cymru programme, relative to costs, exceeded those of equivalent programmes in the rest of the UK?

b. What is the level of take up of Gigabit Broadband Vouchers in Wales and how does this compare with take up in the rest of the UK?

c. Is there any economic evidence of the benefits of FTTH (over and above the benefits of superfast broadband) for businesses or households in Wales?

d. How long will the UK broadband USO threshold of 10 Mb/s remain relevant for households? Should it be increased before 2033, when the UK government expects every household in the UK has FTTH? If so, what technology would be used to meet the revised obligation?

e. Should some households that have superfast broadband of 30 Mb/s today be required to wait until 2033 to obtain faster broadband from an FTTH connection? If not, what technologies should be used in the meantime and what policies are required to ensure that they are used?

f. Why has the Welsh Government not set an FTTH coverage target for Wales after the UK Government did in 2017?

g. How many households in Wales does the Welsh Government think could or will be served with FTTH on a commercial basis? To what extent does this depend on the effective implementation of measures proposed in the UK Government’s FTIR.

h. Has the Welsh Government estimated the cost of extending FTTH to 100% of Welsh households by 2033, as current UK Government policy proposes?

i. What proportion of BT’s 15 million FTTH households for 2025 could be in Wales?

j. How many households will Virgin Media’s ‘Project Lightening’ programme deliver FTTH connections to?
k. Why are there not more community broadband schemes in Wales? What more could be done and how many households could be served with FTTH using this model? Would community broadband schemes favour wealthy communities (and does this matter)?

l. What proportion of the UK Government’s Local Network Full Fibre Challenge fund (£200 million) has been allocated to projects in Wales?

m. What proportion of the UK Government’s Rural Gigabit Connectivity Scheme is expected to be allocated to projects in Wales?