

Title: Directive (EU) 2018/1972 establishing the European Electronic Communications Code - Access Regulation IA No: N/A RPC Reference No: N/A Lead department or agency: DCMS	Impact Assessment (IA)
	Date: 08/50/2019
	Stage: Consultation
	Source of intervention: European Directive
	Type of measure: Secondary Legislations
	Contact for enquiries: eecc@culture.gov.uk
Summary: Intervention and Options	RPC Opinion: Not required at consultation stage

Cost of Preferred (or more likely) Option					
Total Present Value	Net Social Value	Business Net Present Value	Net cost to business per year (EANDCB in 2014 prices)	One-In, Three-Out	Business Impact Target Status
£2,419.0m		£0.6m	-£0.3m	N/A	-1.6

What is the problem under consideration? Why is government intervention necessary?

The UK is a world leader in superfast fixed and mobile broadband coverage, but we currently lag behind our international counterparts on full fibre rollout. This lag also has implications for 5G coverage, which will rely on fibre to provide the backhaul infrastructure that will underpin these new technologies.

The Future Telecoms Infrastructure Review¹ (FTIR) published in 2018 set out the Government's long term strategy for achieving our objectives for increasing the availability of full fibre and 5G networks. The European Electronic Communications Code Directive (EECC) updates the EU's existing regulatory framework for electronic communications. The EECC aims to drive investment in networks through competition. The provisions considered in this impact assessment aim to incentivise investment in very high capacity networks, including backhaul for 5G, by updating regulatory objectives and improving transparency of operators' build plans.

What are the policy objectives and the intended effects?

The Government intends to implement the EECC in a way which will support the UK's domestic policy objectives set out in the FTIR. The intended effects are to reduce the cost of deploying networks, promote market entry and expansion for new market operators, and incentivise competitive network investment via stable and long-term regulation.

What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)

¹ DCMS (2018), Future Telecoms Infrastructure Review. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/732496/Future_Telecoms_Infrastructure_Review.pdf

1. Do nothing
2. Transpose verbatim and align with existing conventions where there is a choice (transposing the minimum requirements of the directive) - **preferred option**
3. Transpose to align with the Future Telecoms Infrastructure Review (FTIR) (Alternative approach to transposition)

Per the UK Government's transposition guidance², and in line with the UK's ongoing commitments to the European Union for as long as it remains a member or is within an implementation period³ of the exit agreement after leaving the EU, Government's preferred option from the outset is to take a minimal approach to transposition of the EECC.

Will the policy be reviewed? It will be reviewed. **If applicable, set review date:** 2025/2026

Does implementation go beyond minimum EU requirements?	No			
Are any of these organisations in scope?	Micro Yes	Small Yes	Medium Yes	Large Yes
What is the CO ₂ equivalent change in greenhouse gas emissions? (Million tonnes CO ₂ equivalent)	Traded: N/A		Non-traded: N/A	

I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.

Signed by the responsible :		Date:	
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² TRANSPOSITION GUIDANCE How to implement European Directives effectively, p3
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/682752/eu-transposition-guidance.pdf

³ Legislating for the Withdrawal Agreement between the United Kingdom and the European Union, Chapter 3: The Implementation Period
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/728757/6.4737_Cm9674_Legislating_for_the_withdrawal_agreement_FINAL_230718_v3a_WEB_PM.pdf

Summary: Analysis & Evidence Policy Option 1

Description: Do nothing

FULL ECONOMIC ASSESSMENT

Price Base Year	PV Base Year	Time Period Years	Net Benefit (Present Value (PV)) (£m)		
2016	2016	15	Low: Optional	High: Optional	Best Estimate: 0.0

COSTS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	Optional	Optional	Optional
High	Optional	Optional	Optional
Best Estimate	...	0.0	0.0

Description and scale of key monetised costs by 'main affected groups'

We have assumed that in a do nothing scenario there will not be a change in the access regulations and regulatory incentives at a UK level. For this reason monetised costs will be zero for industry, Ofcom and Government. Ofcom might decide to implement some of the provisions present in these articles where it sees fit and has the power to do so. However for the simplicity of the Impact Assessment we have assumed that, in a do-nothing scenario, Ofcom will not amend its current approach to access regulation, where Ofcom is not already on course to do so.

Other key non-monetised costs by 'main affected groups'

We have assumed that in a do nothing scenario there will not be a change in the course of access regulations and regulatory incentives at a UK level. For this reason non-monetised costs will be zero for industry, Ofcom, Government, end-users and society at large. Ofcom might decide to implement some of the provisions present in these articles where it sees fit and has the power to do so, and the industry might independently decide to deploy in the intervention areas (eg the hold-up areas identified in the FTIR) considered for this Impact Assessment. However for the simplicity of the Impact Assessment we have assumed that, in a do-nothing scenario, Ofcom will not change its approach to access regulation and industry will not deploy in the intervention areas.

BENEFITS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	Optional	Optional	Optional
High	Optional	Optional	Optional
Best Estimate	...	0.0	0.0

Description and scale of key monetised benefits by 'main affected groups'

We have assumed that in a do nothing scenario there will not be a change in the course of access regulations at UK level. For this reason monetised benefits are zero. Ofcom might decide to implement provisions present in these articles where it sees fit and has the power to do so, and the industry might independently decide to deploy in the intervention areas considered for this Impact Assessment. However for the simplicity of the Impact Assessment we have assumed that, in a do-nothing scenario, Ofcom will not amend its current approach to access regulation and industry will not deploy in the interested areas.

Other key non-monetised benefits by 'main affected groups'

We have assumed that in a do nothing scenario there will not be a change in the access regulations at UK level. For this reason non-monetised benefits will be zero.

Key assumptions/sensitivities/risks	Discount rate	3.5%
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A key risk to this economic appraisal is the cost of installing digital networks. We have accounted for some of this risk by including an optimism bias of 35% (in line with HM Treasury Green Book guidance) though, as telecoms operators are already installing these technologies meaning the costs are relatively known, the bias could arguably be much lower than this. This, and other assumptions like the level of house building per annum, are tested through sensitivity analysis. In addition, as noted above, some wider benefits are backed by less robust evidence. To account for this, we have presented the appraisal including and excluding these wider benefits.

BUSINESS ASSESSMENT (Option 1)

Direct impact on business (Equivalent Annual) £m:			Score for Business Impact Target (qualifying provisions only) £m:
Costs:	Benefits:	Net:	
0.0	0.0	0.0	0.0

Summary: Analysis & Evidence Policy Option 2

Description: Transposing the minimum requirements of the directive - Preferred Option

FULL ECONOMIC ASSESSMENT

Price Base Year	PV Base Year	Time Period Years	Net Benefit (Present Value (PV)) (£m)		
2016	2017	15	Low: 238.0	High: 6,308.0	Best Estimate: 2,593.5

COSTS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	1.1	62.1	712.1
High	1.4	180.2	2,070.7
Best Estimate	1.3	95.4	1,096.9

Description and scale of key monetised costs by 'main affected groups'

Under option 2 we assume the industry will deploy in a portion (around 61% with applied sensitivity analysis) of the areas of the UK that the FTIR identified can support commercial roll out of single fibre networks (the intervention area considered for the Impact Assessment), which are estimated to be 6.1%-18.8% of total UK households. This option should help to address the hold-up problem within these areas of the UK. 'Hold-up areas' are defined as areas in which premises will be in harder to reach, rural or other costly areas where investment in Fibre To The Premises (FTTP) may be able to support at least one commercially funded network but suffer from operators holding off their investments due to strategic uncertainties⁴. The industry will face a capital and operational expenditure cost for deploying in the intervention area, which will be indirect costs. There are also likely to be some familiarisation costs as businesses understand and implement the interested articles. Ofcom and the Government will also incur the cost of implementing the EECC.

Other key non-monetised costs by 'main affected groups'

As we assume industry will deploy only in a portion of the areas of the UK that the FTIR identified can support commercial roll out of single fibre networks, industry will forego potential revenues of fully deploying in these areas. There can also be administrative costs such as the time it takes to arrange a full fibre connection, which we have not included in the model.

BENEFITS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	0.0	212.0	2,308.7
High	0.0	644.3	7,020.2
Best Estimate	0.0	338.6	3,690.4

Description and scale of key monetised benefits by 'main affected groups'

The main benefits that have been monetised are around increased labour force participation and increased productivity of teleworkers. Wider benefits have also been included around the wellbeing gain to households and

⁴ DCMS (2018), Future Telecoms Infrastructure Review. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/732496/Future_Telecoms_Infrastructure_Review.pdf

potential spillover effects from connecting nearby premises. Overall, the total benefit of this policy option in comparison to the do nothing scenario is estimated in a range of £2.4-7.1bn with a £3.8bn best estimate, over a 15 year appraisal period. There will also be a direct benefit to industry and Ofcom as market reviews will happen every five years instead of three.

Other key non-monetised benefits by 'main affected groups'

There can be wider benefits to households that have not been quantified. This includes access to public services like education and healthcare, the ability to shop online and a reduction in travel.

Key assumptions/sensitivities/risks

Discount rate

3.5

A key risk to this economic appraisal is the cost of installing digital networks. We have accounted for some of this risk by including an optimism bias of 35% (in line with HM Treasury Green Book guidance) though, as telecoms operators are already installing these technologies meaning the costs are relatively known, the bias could arguably be much lower than this. This, and other assumptions like the level of house building per annum, are tested as part of sensitivity. In addition, as noted above, some wider benefits are backed by less robust evidence. To account for this, we have presented the appraisal including and excluding these wider benefits.

%

BUSINESS ASSESSMENT (Option 2)

Direct impact on business (Equivalent Annual) £m:			Score for Business Impact Target (qualifying provisions only) £m:
Costs:	Benefits:	Net:	
0.1	0.5	-0.4	-1.6

Summary: Analysis & Evidence Policy Option 3

Description: Alternative approach to transposition

FULL ECONOMIC ASSESSMENT

Price Base Year	PV Base Year	Time Period Years	Net Benefit (Present Value (PV)) (£m)		
2016	2017	15	Low: 165.5	High: 6,778.5	Best Estimate: 2,755.2

COSTS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	1.6	66.1	810.3
High	1.9	191.1	2,346.3
Best Estimate	1.8	101.5	1,246.8

Description and scale of key monetised costs by 'main affected groups'

Under option 3 we assume the industry will start deploying new networks earlier than in option 2 in areas of the UK that the FTIR identified can support commercial roll out of single fibre networks (the intervention area considered for the Impact Assessment), which are estimated to be 6.1%-18.8% of total UK households. This will result in higher benefits, as benefits will be taken forward and they will be discounted less than in option 2. This option should help to address the hold-up problem within these areas of the UK. Hold-up areas are defined as areas in which premises will be in harder to reach, rural or other costly areas where investment in FTTP may be able to support at least one commercially funded network but suffer from operators holding off their investments due to strategic uncertainties⁵. The industry will face a capital and operational expenditure cost for deploying in the intervention area, these are going to be indirect costs. There are also likely to be direct costs for businesses: (i) familiarisation costs as businesses understand and implement the interested articles and (ii) a cost related to conduct geographic surveys of the current and future reach of electronic communications networks capable of delivering broadband via fixed and / or wireless channels. Ofcom and the Government will also incur the cost of implementing the EECC.

Other key non-monetised costs by 'main affected groups'

As we assume industry will deploy only in a portion of the areas of the UK that the FTIR identified can support commercial roll out of single fibre networks, industry will forego potential revenues of fully deploying in the these areas. There can also be administrative costs such as the time it takes to arrange a full fibre connection, which we have not included in the model.

BENEFITS (£m)	Total Transition (Constant Price) Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low	0.0	220.4	2,511.8
High	0.0	665.2	7,558.8
Best Estimate	0.0	350.9	4,002.0

⁵ DCMS (2018), Future Telecoms Infrastructure Review. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/732496/Future_Telecoms_Infrastructure_Review.pdf

Description and scale of key monetised benefits by ‘main affected groups’

The main benefits that have been monetised are around increased labour force participation and increased productivity of teleworkers. Wider benefits have also been included around the wellbeing gain to households and potential spillover effects from connecting nearby premises. Overall, the total benefit of this policy option in comparison to the do nothing scenario is estimated in a range of £3.5-10.7bn with a £7.4bn best estimate, over a 15 year appraisal period. There will also be a direct benefit to industry and Ofcom as (i) market reviews will happen every five years instead of three and as (ii) requests to industry for providing data related to current reach of electronic communications networks capable of delivering broadband via fixed and / or wireless channels will be streamlined and consolidated into a single request.

Other key non-monetised benefits by ‘main affected groups’

There can be wider benefits to households that have not been quantified. This includes access to public services like education and healthcare, the ability to shop online and a reduction in travel.

Key assumptions/sensitivities/risks

Discount rate

3.5

A key risk to this economic appraisal is the cost of installing digital networks. We have accounted for some of this risk by including an optimism bias of 35% (in line with HM Treasury Green Book guidance) though, as telecoms operators are already installing these technologies meaning the costs are relatively known, the bias could arguably be much lower than this. This, and other assumptions like the level of house building per annum, are tested as part of sensitivity. In addition, as noted above, some wider benefits are backed by less robust evidence. To account for this, we have presented the appraisal including and excluding these wider benefits.

%

BUSINESS ASSESSMENT (Option 3)

Direct impact on business (Equivalent Annual) £m:			Score for Business Impact Target (qualifying provisions only) £m:
Costs:	Benefits:	Net:	
0.7	0.6	0.2	0.8

Evidence Base (for summary sheets)

Problem under consideration

1. In the past few years, the UK has made significant progress in both fixed and mobile connectivity. In December 2017, the UK met the Government's target to extend superfast coverage to 95% of premises. The Government expects superfast coverage to reach at least 97% by 2020. 4G mobile coverage has increased to 91% of UK landmass having a 4G signal⁶ from at least one operator⁷.
2. Ofcom's Connected Nations report 2018⁸ puts current full fibre coverage at 6%, or 1.8 million premises (up from 5%, 1.4 million premises in the October 2018 update). This is below the EU28 average where, by July 2017, coverage had already reached 26.8% overall, and 11.3% in rural areas⁹ – with some countries achieving 95% coverage. The UK is also lagging globally, with Asian countries such as South Korea and Japan at near-ubiquitous coverage.
3. Mobile operators are extending their 4G network coverage and turning attention towards 5G. Similar to other technologically advanced countries, the UK Government has been encouraging and funding the creation of a series of 5G testbeds and trials, to explore the benefits and challenges of deploying 5G technologies. And like other countries, Ofcom is releasing radio spectrum bands to support 5G¹⁰. Countries leading on full fibre deployment will have a faster network of backhaul available to support these new technologies.
4. Despite progress, the Government is committed to improving the UK's connectivity. In the coming decades, fixed and mobile networks will be the enabling infrastructure that drives economic growth. For the UK to be the best place to start and grow digital businesses, it needs greater investment to build fixed and wireless networks that are fit for the future, and take advantage of the benefits of fixed and mobile convergence. The wide-scale deployment of these next generation technologies will underpin the UK's modern Industrial Strategy and the Grand Challenges in areas where the UK can lead the global technological revolution. The Government wants every part of the UK to be able to benefit from the significant economic developments that digital connectivity brings. When looking at the speed, resilience and reliability that consumers want and businesses need in order to grow, it is clear that full fibre and 5G are the long-term answer. These technologies have the potential to transform productivity, and to open up new business models. This is why the Government published its

⁶ OFCOM (2018) Connected Nations 2018: Main report. Available at:

https://www.ofcom.org.uk/__data/assets/pdf_file/0020/130736/Connected-Nations-2018-main-report.pdf

⁷ This puts the UK seventh in the EU for superfast fixed coverage, and fourth in the world for 4G. See more at Ofcom (2017) International Communications Market Report. Available at:

https://www.ofcom.org.uk/__data/assets/pdf_file/0032/108896/icmr-2017.pdf

⁸ OFCOM (2018) Connected Nations: Main report. Available at:

https://www.ofcom.org.uk/__data/assets/pdf_file/0020/130736/Connected-Nations-2018-main-report.pdf

⁹ European Commission (2018), Broadband Coverage in Europe. Available at:

<https://ec.europa.eu/digital-single-market/en/news/study-broadband-coverage-europe-2017>

¹⁰ See more at OFCOM (2018) Connected Nations: Main report. Available at:

https://www.ofcom.org.uk/__data/assets/pdf_file/0020/130736/Connected-Nations-2018-main-report.pdf

Future Telecoms Infrastructure Review (FTIR)¹¹ in July 2018, making a clear statement of its full fibre and 5G aspirations. The FTIR set out ambitious targets for the availability of new digital networks in the UK. Those targets include:

- Making gigabit-capable networks available to 15 million premises by 2025, with nationwide coverage by 2033;
 - Increasing mobile coverage to 95% of the UK by 2022 to address ‘not-spots’ and improving the connectivity on the UK’s main roads and railways; and
 - Becoming a world leader in the next generation of 5G mobile technology, with deployment to the majority of the country by 2027.
5. The FTIR estimated that current market and policy conditions could, at best, support full fibre rollout to three-quarters of the country, and that this would take more than 20 years.
 6. Many of the remaining premises, which would be left without access to full fibre networks, would likely be in harder-to-reach rural, or other costly, areas where investment in full fibre is not commercially viable. Some of these areas may be able to support at least one commercially funded network but suffer from operators holding off their investments due to strategic uncertainties¹². The FTIR identified this as a “hold-up problem”.
 7. In future, we anticipate that demand uncertainty, combined with the overall high costs of investing in new infrastructure, could result in a stall of deployment, as a hold-up problem begins to emerge. This may happen in areas where competing with other providers may not be profitable. The FTIR described the strategic uncertainties that could lead to this hold-up problem: *“In these areas the existing copper provider has little incentive to invest in FTTP unless it faces losing customers to a rival FTTP network. However, a rival network contemplating investment in these areas will anticipate that if it invests the incumbent will follow, with a headstart on existing infrastructure and customers. The incumbent, in turn, will be aware that this risk will be sufficient to deter new providers from entering the area. As a result, there is no investment.”*¹³
 8. Under these conditions, we anticipate that harder-to-reach areas and / or those where demographic characteristics are such that providers do not find it attractive to invest, may lose out on investment – thereby entrenching a digital divide for the next generation of technology.

¹¹ DCMS (2018), Future Telecoms Infrastructure Review. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/732496/Future_Telecoms_Infrastructure_Review.pdf

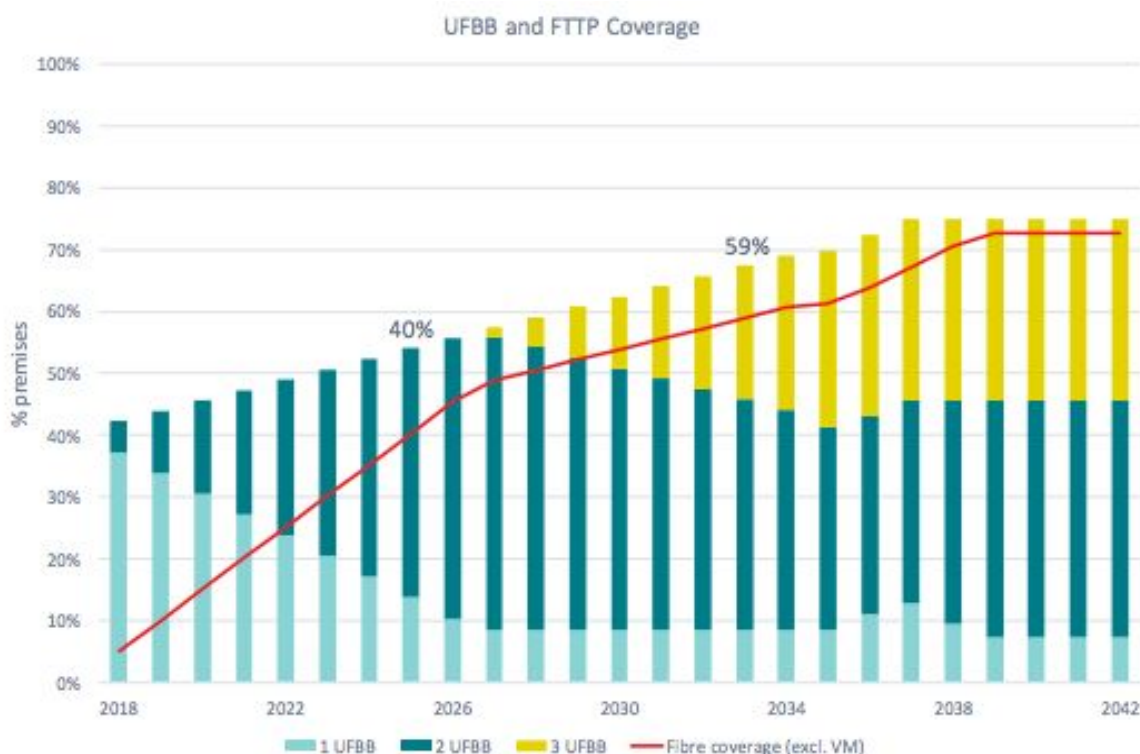
¹² The analysis further suggests that 30% of the country will be able to support competition between at least three ultrafast networks, whilst 40% will have a choice between two (likely the current two largest players, Virgin and Openreach).

Frontier Economics (2018), UK Telecoms Market Dynamics, Future Telecoms Infrastructure Review Annex A. Available online at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/727890/FTIR_Annex_A_-_FF_Report.pdf

¹³ Page 41, DCMS (2018), Future Telecoms Infrastructure Review

Figure A: Ultrafast broadband and penetration anticipated without additional Government intervention¹⁴



Source: Frontier Economics

Note: The % figures above the bars show the overall level of unique fibre coverage in 2025 and 2033

9. This scenario identified in the FTIR falls short of the UK’s full fibre coverage targets. As convergence increases, this scenario would also act as a constraint on the supply of backhaul fibre needed to support 5G rollout. Therefore, to achieve the Government’s targets of gigabit capable connections to 15 million premises by 2025, and nationwide coverage by 2033, the FTIR set out a number of strategic priorities, including:

- a. Making the cost of deploying fibre networks as low as possible by addressing barriers to deployment, which both increase costs and cause delays;
- b. Supporting market entry and expansion by alternative network operators through easy access to Openreach’s ducts and poles, complemented by access to other utilities’ infrastructure (for example, sewers);
- c. Stable and long-term regulation that incentivises competitive network investment;
- d. An ‘outside in’ approach to deployment that means gigabit-capable connectivity across all areas of the UK is achieved at the same time, and no areas are systematically left behind; and
- e. A switchover process to increase demand for full fibre services.

10. The FTIR also set out the Government’s strategic priorities for delivering its mobile coverage and 5G targets.

¹⁴ The chart shows how new fibre (FTTP) will be rolled out (represented by the red line) and how the level of Ultrafast competition (total of stacked bars) will change over time. Each coloured stack represents a different network provider, with the total number shifting from 2 to 3 providers from 2027 onwards.

11. A shift in policy and regulatory approaches, as well as voluntary commitments from the incumbent, in line with these strategic priorities will support further commercial deployment of full fibre and 5G – including in hold-up areas. Current regulatory measures to address cost and barriers to deployment include Ofcom’s new duct and pole obligation, along with proposed updates¹⁵. Pricing freedom on broadband products with download speeds of 40Mbps+ can make investment in higher-capacity networks more attractive¹⁶. Ofcom is also consulting on measures to encourage network competition, through reduced regulation in geographies that can support this¹⁷. Voluntary commitments from Openreach to share its build plans can serve to mitigate demand uncertainty and the risk of overbuild. Government’s BDUK programme includes measures to address demand uncertainty, such as consumer vouchers and public procurement programmes¹⁸.

12. The FTIR presented a set of further recommendations, including changes to the policy and regulatory framework in order to achieve the connectivity targets. The Government and Parliament are responsible for setting the overall policy and regulatory framework for telecoms, consistent with relevant EU law. Ofcom, as the UK’s independent regulatory authority, is responsible for implementing the framework, and for making regulatory decisions under its statutory duties. The FTIR states that, where Ofcom is unable to consider certain regulatory options due to existing statutory duties, Government will consider legislation to allow it to do so. Transposition of the EECC into UK law presents an opportunity to enhance the regulatory framework to support the Government and Ofcom to deliver on the recommendations and targets published in the FTIR.

Rationale for intervention

13. The FTIR identified specific measures in the European Electronic Communications Code Directive (EECC) that would contribute to the Government’s strategic priorities when implemented into UK law. The EECC shares the FTIR’s strategic priority to creating stable and long-term regulation that incentivises competitive network investment. Specific measures in the EECC will make a clear and direct contribution to the following FTIR recommendations:
 - a. Moving to longer, five year review periods could provide greater regulatory stability and promote investment.

¹⁵ Ofcom (2018), Supporting fibre investment: unrestricted duct and pole access, and the BCMR. Available at: <https://www.ofcom.org.uk/about-ofcom/latest/media/media-releases/2018/fibre-investment-bcmr>

¹⁶ Ofcom’s view is that lower-speed product “still likely to be a reasonable option for a large proportion of retail superfast subscribers”. It notes that the price cap on the lower speed can act as an anchor for lower-speed products, and greater demand for higher-speed products would strengthen incentives to compete to provide faster services at lower prices

¹⁷ Ofcom (2018), Promoting investment and competition in fibre networks. Available at: https://www.ofcom.org.uk/__data/assets/pdf_file/0005/130001/Consultation-Promoting-investment-and-competition-in-fibre-networks.pdf

¹⁸ More information available at <https://gigabitvoucher.culture.gov.uk/>

- b. For areas where there may not be commercial investment, even when commercially viable the Government will consider using ‘competition for the market’ mechanisms to secure deployment, including new powers under the EECC.

14. On a broader scale, the updated objectives and principles of the EECC align with the strategic priorities of the FTIR. The Government therefore considers transposition of the EECC into UK law as an opportunity to update the UK’s regulatory framework to further support the Government and Ofcom to deliver on the FTIR’s targets. The strategy set out in the FTIR has guided the Government’s approach to transposition of the measures assessed in this impact assessment.

15. The EECC also updates a regulatory framework that was introduced in 2002 to address market and information failures in telecoms markets. These failures persist and are detailed below. The EECC updates the framework to better accommodate changes in these market and information failures, which strengthens our rationale for implementing this directive

Legal requirement: Implementing an EU Directive

16. The EECC was adopted by the EU’s Telecoms, Transport and Energy Council on 4 December 2018 and was published in the Official Journal of the European Union on 17 December 2018.¹⁹ The EECC Directive has a two-year transposition deadline, meaning it must be implemented into all Member States’ domestic law by 20 December 2020.

17. Dependent on the terms of any agreed implementation period, we expect the UK to remain subject to the rights and obligations under the Treaties of the EU, which include transposing EU directives. We expect the implementation period will be a two-year transitional period, starting from exit day. The transposition deadline for the EECC will fall within the implementation period; therefore, the EECC must be transposed into UK law.

Market failures

Natural Monopoly

18. The broadband infrastructure market, particularly the provision of some ducts and poles and the existing copper network, has some of the characteristics of a natural monopoly: very high fixed costs, low marginal costs, and high barriers to entry. The provision of broadband infrastructure requires the construction and maintenance of a large, extensive, and diverse network – with high fixed capital costs. The majority of fixed infrastructure in the UK is owned by the BT Group, with fixed services provided over Openreach’s network. Where Ofcom has found Openreach and KCOM to have significant market power (SMP), it has applied network access regulation according to the regulatory framework. Consequently Openreach is subject to regulation of its wholesale products, including obligations on it to offer access to its local access infrastructure to other operators, and price controls.

¹⁹ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L:2018:321:FULL&from=EN>

19. Regulation has to an extent been successful in mitigating potential adverse effects of the monopoly power available, and ensuring an efficient and competitive retail market in parts of the country that network competition is commercially viable. In these areas, the provision of full fibre networks is becoming more competitive, and commercial investment in full fibre networks is gaining momentum with major investments by established and alternative network operators. The broadband retail market is largely a well-functioning and competitive market, with a choice of services for consumers available.
20. FTIR analysis²⁰ suggests that FTTP coverage will, at best, only ever reach three quarters of the country, and take more than 20 years to do so. The remaining premises would be left without access to full fibre networks. Many of these premises will be in harder to reach, rural or other costly areas where investment in FTTP is not commercially viable. Some of these areas may be able to support at least one commercially funded network but suffer from operators holding off their investments due to strategic uncertainties (so-called 'hold-up' problem). These areas is where the natural monopoly issue is most acute.

Market structure

21. There are currently four main players in the retail fixed broadband market: BT, Sky, Virgin Media and TalkTalk. In 2017 BT's market share was 37%²¹, Sky – 23%, Virgin Media – 20%, TalkTalk – 16%, and the remaining players (e.g. KCOM, Vodafone) represent around 4%²². Sky and TalkTalk largely rely on regulated wholesale access to Openreach's network, and offer services primarily based on copper and copper/fibre hybrid (as opposed to 'full fibre') technologies. Virgin Media, on the other hand, offers services over its own cable and fibre network. In recent years, alternative providers have started to deploy their own fibre networks in certain parts of the country. These include vertically integrated fibre providers Gigaclear and Hyperoptic, and the wholesale-only operator CityFibre. These alternative providers currently account for a small portion of the broadband market but have ambitions to expand significantly over the next few years²³.
22. Several models of broadband competition have been identified over the years, including a single wholesale national network, and market-based infrastructure competition. As the current network competition is considerably lower than what is outlined in the evaluation, efforts

²⁰ DCMS (2018), Future Telecoms Infrastructure Review. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/732496/Future_Telecoms_Infrastructure_Review.pdf

²¹ According to a more updated publication by Ofcom, BT share in Q2 has decreased to 35.5%. See more at Ofcom (2018), Telecommunications Market Data Update Q2 2018. Available online at: <https://www.ofcom.org.uk/research-and-data/telecoms-research/data-updates/telecommunications-market-data-update-q2-2018>

²² Frontier Economics (2018), Future Telecoms Infrastructure Review: Annex A. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/727890/FTIR_Annex_A_-_FE_Report.pdf

²³ According to a report for the Independent Networks Cooperative Association (INCA), as of April 2018, there were 207,000 connections to alternative fibre networks, which represents less than 1% of all broadband connections. See more at Point Topic (2018), Metrics for the UK altnet sector: Scale, coverage, ambitions, concerns (a report for INCA). Available online at: <https://www.inca.coop/sites/default/files/Altnet-report-INCA%20April-2018.pdf>

continue to correct the market failure. This translates into efforts to boost not only retail level market, but also network infrastructure level competition in the UK, such as encouraging alternative providers to investing into their own networks, and increasing the network coverage of wholesale providers. In the FTIR, DCMS identifies the latter as the preferred approach: “The most effective way to deliver nationwide full fibre connectivity at pace is to promote competition and commercial investment where possible, and to intervene where necessary.

We estimate that:

- At least a third (with the potential to be substantially higher) of UK premises are likely to be able to support three or more competing gigabit-capable networks
- Up to half (or lower if there are more than three network areas) of premises are likely to be in areas that can support competition between two gigabit-capable networks
- There are likely to be parts of the country (c.10% of premises) that, while commercially viable for at least one operator, may not benefit from investment. The Government will use ‘competition for the market’ mechanisms to secure investment in areas. The proposed new Electronic Communications Code (EECC), for example, provides powers to designate areas where no operator has indicated plans to deploy; and
- In the final c.10% of premises, the market alone is unlikely to support network deployment and additional funding of some description will be required to ensure national coverage”.

Barriers to entry

23. Operators have highlighted the high costs associated with civil works as a key factor which can undermine the business case for investing in their own FTTP infrastructure. This has been recognised by Ofcom, which has recently introduced a number of policy measures to reduce deployment costs for new entrants (introduced as part of its 2017 WLA market review²⁴).

Information failure

Demand Uncertainty

24. A number of stakeholders have highlighted significant uncertainty around the inherent demand for fibre – in particular, the premium people would be willing to pay for FTTP over-and-above the services that can be delivered using legacy infrastructure. This is not because the consumers are actively hiding this information from the operators, but because their need for higher speed is usually unknown to them from the outset. This is especially the case for less tech-savvy consumers. As a consequence operators might supply speed at a level below the optimal without consumers realising the missed opportunity for higher speed.
25. Households are not fully aware of the extent of the benefits that improved broadband brings them, and therefore do not make optimal choices about purchasing a broadband connection. For example, common drivers for residential broadband consumers to upgrade were faster download speeds for entertainment services or facilitating home working. A key improvement not fully taken account of by these consumers before upgrading is increased reliability. Better

²⁴ Ofcom (2017) Wholesale local access market review. See online at: <https://www.ofcom.org.uk/consultations-and-statements/category-1/wholesale-local-access-market-review>

reliability tends to lead to more frequent use of online services²⁵, for example, as a result of increased confidence that disruption to their broadband connection is less likely to arise whilst using online shopping or banking services.

26. Demand uncertainty is also an impediment to future proofing the network for increased data usage. While consumers might often find sufficient superfast broadband uses, there is ample evidence that fixed data traffic is rapidly increasing every year²⁶ as customers become more accustomed to using high speed broadband services, while also new use cases appear in the market, i.e. virtual reality. Ensuring that networks remain resilient and capable of handling rapidly growing usage requires coordinating market demand with supply in advance of increase in demand; the investment required to achieve that often needs to be planned well in advance, i.e. usually up to 10 years, while consumers are likely to delay their demand until their existing service has reached its limits, deterring investment in networks.

Incomplete Markets

27. An incomplete market possesses only some of the necessary conditions for full market formation. Some firms may enter this type of market because profits are possible. However, the firms that do start-up will only satisfy a small proportion of potential consumer demand and the market will fail to develop completely. The “hold-up areas” identified by the FTIR have many of the characteristics of an incomplete market. These hold-up areas may be able to support at least one commercially funded full fibre network but suffer from operators holding off their investments due to strategic uncertainties.

The European Regulatory Framework for Electronic Communications

The European Electronic Communications Code Directive (EECC)

28. The EECC updates the EU’s electronic communications networks and services regulatory framework²⁷. It recasts four existing directives, that were originally adopted in 2002 and updated in 2009. This recast, first proposed by the European Commission in September 2016²⁸, is part of the European Commission’s Digital Single Market Strategy²⁹. The EECC broadly

²⁵ Ipsos Mori (2018), Evaluation of the Economic Impact and Public Value of the Superfast Broadband Programme. Available online at:

<https://www.gov.uk/government/publications/evaluation-of-the-economic-impact-and-public-value-of-the-superfast-broadband-programme>

²⁶ BEREC and PWC (2015), Desk research on the demand side of Internet use. Available online at: https://berec.europa.eu/eng/document_register/subject_matter/berec/download/1/5024-berec-report-on-how-consumers-value-net-_1.pdf

²⁷ Some electronic communications framework matters are dealt with through regulations.

The EECC recitals specify that the EECC does not cover content delivered over these networks - such as broadcasting content, financial services, and certain information society services.

²⁸ European Commission (2016), Proposed directive establishing the European Electronic Communications Code. Available online at:

<https://ec.europa.eu/digital-single-market/en/news/proposed-directive-establishing-european-electronic-communications-code>

²⁹ See European Commission (2018), Digital Single Market. Available online at:

https://ec.europa.eu/commission/priorities/digital-single-market_en

aligns with the principles of the current EU telecoms regulatory framework, with a few key differences:

- Increased focus on investment in very high capacity networks (VHCNs), which includes full fibre, and in 5G networks, including through spectrum management.
- Number-independent communications services (NIICS; eg WhatsApp) are brought into scope of telecoms regulation.
- Increased emphasis on promoting infrastructure competition.

This impact assessment is mainly concerned with support for VHCNs through the approach to infrastructure competition supported by access regulation.

Framework evolution

29. The current framework - comprising the Framework Directive³⁰, Access Directive³¹, Authorisation Directive³² and Universal Service Directive³³ - has been transposed into UK law predominantly via the Communications Act 2003³⁴. Some smaller sections of the existing framework have also been transposed via the Wireless Telegraphy Act 2006³⁵ (spectrum related provisions), the Office of Communications Act 2002³⁶ (relating to Ofcom's governance and establishment) and Ofcom's General Conditions of Entitlement (some end-user rights provisions).

- The **Framework Directive 2002/21/EC** establishes a harmonised framework for regulation of electronic communications networks and services and lays down the objectives of national regulators, such as Ofcom. This Directive also set out the framework for assessing SMP in telecoms markets.
- The **Access Directive 2002/19/EC** harmonises regulation of access to, and interconnection of, electronic communications networks and associated facilities and to promote competition, interoperability and consumer benefits. This Directive empowers regulators to impose access and interconnection obligations and, under certain circumstances, to impose as a last resort the functional separation of a vertically integrated operator (for example, BT and Openreach).
- The **Authorisation Directive 2002/20/EC** introduces a general authorisation system for electronic communications networks and services by removing the need for individual electronic communications operator licences.

³⁰ Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services (Framework Directive). Available at: <https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A32002L0021>

³¹ Directive 2002/19/EC of the European Parliament and of the Council of 7 March 2002 on access to, and interconnection of, electronic communications networks and associated facilities (Access Directive). Available at: <https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A32002L0019>

³² Directive 2002/20/EC of the European Parliament and of the Council of 7 March 2002 on the authorisation of electronic communications networks and services (Authorisation Directive). Available at: <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32002L0020>

³³ Directive 2002/22/EC of the European Parliament and of the Council of 7 March 2002 on universal service and users' rights relating to electronic communications networks and services (Universal Service Directive). Available at: <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32002L0022>

³⁴ The Communications Act of 2003 is available at: <https://www.legislation.gov.uk/ukpga/2003/21/contents>

³⁵ The Wireless Telegraphy Act 2006 is available at: <https://www.legislation.gov.uk/ukpga/2006/36/contents>

³⁶ The Office of Communications Act 2002 is available at: <https://www.legislation.gov.uk/ukpga/2002/11/contents>

- The **Universal Service Directive 2002/22/EC** sets out end-users' rights relating to the availability, affordability and accessibility of electronic communications networks and services.

30. The existing framework comprising of the four directives above established a number of longstanding key principles that are consistent with UK Government policy. Indeed, the original 2002 EU framework was closely based on the UK's regulatory approach. These include:

- *Technology neutrality* - Regulation should not discriminate against a particular type of technology.
- *Competition* - Competitive markets should be the main driver of investment and consumer choice. Regulation should be consistent with the principles of European competition law.
- *Spectrum* - Member States should make *efficient and effective use of spectrum* for electronic communications services.
- *Regulation free from interference from commercial interests* - Member States should have an independent national regulator (Ofcom in the UK).
- *Removing barriers to the single market* - The framework forbids any kind of licensing regime required to operate a service or network. It promotes interoperability and gives operators a right to request network access and interconnection in any EU Member State.
- *A flexible and deregulatory framework* - Market regulation should only be imposed where necessary and proportionate to support competition or to protect consumers. It should be removed when no longer needed.

Scope of this impact assessment

31. Given the breadth of the EECC, we have assessed the impact on business in two impact assessments and one de minimis assessment. This impact assessment will focus on specific updates to the Framework Directive and the Access Directive that support competition and investment through regulated network access and transparency. This part of the regulatory framework, updated by the EECC, is based on long-standing principles that are consistent with the UK's preferred approach - namely:

- **Market-driven:** Well-functioning markets, free of interference, are the most effective way to deliver good outcomes for end users;
- **Regulatory independence:** the regulator is protected from commercial interests - that could jeopardise its independent assessment; and
- **Technological neutrality:** regulation should not discriminate in favour of or against the use of a particular type of technology.

32. The concept of significant market power has been at the heart of the regulatory framework governing network access since its inception in 2002. National regulatory authorities, such as Ofcom in the UK, are equipped with a suite of tools to apply where SMP is found following market analysis in order to support competitive outcomes. In addition, this part of the framework includes a number of other regulatory powers to incentivise investment through competition.

33. The changes made to this part of the EECC update the regulatory framework with an increased emphasis on promoting infrastructure competition and investment in very high capacity networks. The EECC introduces an additional objective to the regulatory framework that reflects changes in technology and the desire to improve digital connectivity across the EU. This objective is to “promote connectivity and access to, and take-up of, very high capacity networks, including fixed, mobile and wireless networks, by all Union citizens and businesses”³⁷. The EECC also strengthens the existing principle that competition can best be fostered through an economically efficient level of investment in infrastructure, and regulation should only be used where necessary to achieve effective competition³⁸.

Transposition options

34. In line with the purpose of an impact assessment, we have included the articles with a potentially higher direct impact on business that relate to network access, competition and investment, which include General Objectives of the framework. The measures included consist of new provisions and amendments to existing regulatory tools in line with the updated objectives and principles. The impact on business of the remaining access articles is considered in a separate de minimis assessment. The articles that we have considered are:
- **Article 3 (‘General objectives’)** sets out the objectives that the relevant authorities should pursue when carrying out the regulatory tasks in the EECC, adding the objective to promote the deployment of VHCNs;
 - **Article 22 (‘Geographical surveys of network deployments’)** sets the requirement to conduct a geographical survey of network reach, with the option to conduct a forecast and a process to further clarify future build plans;
 - **Article 29 - Penalties:** Provides for a penalty regime to accompany the designation process in Article 22.
 - **Article 61 - Powers and responsibilities of the national regulatory and other competent authorities with regard to access and interconnection:** Updates powers on non-SMP access and interconnection requirements.
 - **Article 67 (‘Market analysis procedure’)** sets out how regularly the regulator must review markets - increasing maximum review cycles from three to five years;
 - **Article 73 - Obligations of access to, and use of, specific network elements and associated facilities:** Enables the regulator to require the SMP operator to meet reasonable requests from competitors for access to and use of specific elements of the SMP operator’s network.
 - **Article 74 - Price control and accounting obligations:** Enables the regulator to place controls on the SMP operator’s pricing for access and interconnection to their network by competitors.
 - **Article 76 (‘Regulatory treatment of new very high capacity network elements’)** requires the regulator to refrain from imposing SMP obligations on new network deployments that form part of a co-investment that meet certain criteria

³⁷ Article 3, EECC.

³⁸ As set out in the EECC recitals.

- **Article 79 ('Commitments procedure')** sets out new powers for the regulator to make access and co-investment offers made by an SMP provider binding, which could be in lieu of SMP obligations.
- **Article 81 ('Migration from legacy infrastructure')** requires the regulator to ensure that migration from copper to fibre networks carries a transparent timetable and conditions, and that consumers will continue to have access to broadband and telephony products at least as good as those they had before migration, if necessary to safeguard competition and the rights of end-users.

35. The changes introduced by these articles broadly align with the policy objectives outlined in the FTIR. New measures introduced by these articles can be summarised as:

- New and revised regulatory objectives focussed on promoting rollout of very high capacity networks, including fixed, mobile and wireless networks.
- New processes for the regulator to make binding voluntary commitments by operators as alternatives to ex ante SMP obligations³⁹ where appropriate – to incentivise new network deployment as far as possible;
- Longer maximum periods between market reviews⁴⁰ – up from three to five years – to provide investors with greater certainty on the returns of their investments;
- Pro-competitive transparency around build plans – to accelerate network rollout, in particular in hold-up areas; and
- Easier and better information sharing with Government – to improve targeting of policy interventions to support rollout.

36. A description of the specific changes introduced by each of these articles is provided below.

Articles mandating regulatory support for VHCN

37. **Article 3** of the EECC updates the General Objectives of the current regulatory framework as follows:

- It introduces a new primary objective to “promote connectivity and access to, and take-up of, very high capacity networks, including fixed, mobile and wireless networks, by all Union citizens and businesses”.
- It updates the end-user interests objective to clarify that this entails “ensuring connectivity and the widespread availability and take-up of very high capacity networks, including fixed, mobile and wireless networks, and of electronic communications services, by enabling maximum benefits in terms of choice, price and quality on the basis of effective competition”.
- It adds to the internal market objective by clarifying that this entails “...removing any obstacles to, and facilitating convergent conditions for, investment in, and the provision

³⁹ Regulatory forbearance allows the regulator to refrain from applying certain regulations on the market in particular circumstances.

⁴⁰ The EECC defines a market review as the point when the national regulatory authority has issued a notification including a new assessment of the definition of a market and of significant market power.

of, electronic communications networks⁴¹, electronic communications services, associated facilities and associated services”.

38. In pursuit of these objectives, the General Objectives state that the relevant authority, which is Ofcom in the UK, must do the following:
- “Promote regulatory predictability by ensuring a consistent regulatory approach over appropriate review periods”;
 - “Promote efficient investment and innovation in new and enhanced infrastructures”;
 - “Take due account of the variety of conditions relating to infrastructure, competition, the circumstances of end-users and, in particular, consumers that exist in the various geographic areas”; and
 - “Impose ex-ante regulatory obligations only to the extent necessary to secure where there is no effective and sustainable competition in the interest of end-users and relaxing or lifting such obligations as soon as that condition is fulfilled”.
39. The accompanying EECC recitals specify “that connectivity objective translates, on the one hand, into aiming for the highest capacity networks and services economically sustainable in a given area, and, on the other hand, into pursuing territorial cohesion, in the sense of convergence in capacity available in different areas”.
40. Several access articles from the existing regulatory tool kit have been amended to complement the new and revised objectives on VHCN in article 3. With regards to SMP and symmetric⁴² access obligations, **Articles 61, 73, and 74** require the regulator to do the following:
- **Article 61 on symmetric access and interconnection:** “...encourage and, where appropriate, ensure... adequate access and interconnection, and the interoperability of services, exercising their responsibility in a way that promotes efficiency, sustainable competition, the deployment of very high capacity networks, efficient investment and innovation, and gives the maximum benefit to end-users.”
 - **Article 73 on SMP network access obligations:** “...consider the appropriateness of imposing any of the possible specific obligations... ...[and] take particular account of... the risks involved in making the investment, with particular regard to investments in, and risk levels associated with, very high capacity networks”.
 - **Article 74 on SMP price controls:** “In determining whether price control obligations would be appropriate... take into account the need to promote competition and long

⁴¹ The EECC defines “electronic communications network” as transmission systems, whether or not based on a permanent infrastructure or centralised administration capacity, and, where applicable, switching or routing equipment and other resources, including network elements which are not active, which permit the conveyance of signals by wire, radio, optical or other electromagnetic means, including satellite networks, fixed (circuit- and packet-switched, including internet) and mobile networks, electricity cable systems, to the extent that they are used for the purpose of transmitting signals, networks used for radio and television broadcasting, and cable television networks, irrespective of the type of information conveyed.

⁴² Symmetric access obligations may be assigned to all providers subject to General Authorisation in a particular market, regardless of whether or not they have been found to have Significant Market Power.

term end-user interests related to the deployment and take-up of next-generation networks, and in particular of very high capacity networks.”

41. Two new articles in the EECC designed to incentivise investment are aligned with the new and revised objectives:
- **Article 76:** This article makes special provisions for forbearance in the regulatory treatment of networks comprising fibre to the premise or base station, where an SMP co-investment deal meets certain criteria.
 - **Article 22:** Sets out forward-looking transparency measures on the rollout of VHCN, as a means of supporting faster and further rollout. This article introduces an obligation on the competent authority to survey, at least every three years, the reach of telecoms networks capable of delivering broadband, with the option to conduct a forecast of future network reach. Ofcom already conducts and publishes regular surveys of network reach and in practice often gathers information from operators on investment forecasts. The article introduces new requirements to make directly accessible to the public all non-confidential information included in the survey, and a requirement to provide relevant information (including confidential survey and forecast information) to public bodies for the purposes of fulfilling specific connectivity policy functions. The article also sets out a new process for the competent authority to designate and publish areas where there is no expected coverage by VHCNs within the survey forecast period and a subsequent process to invite expressions of interest from operators to invest in VHCN in the designated area. These provisions were not designed to encroach on regulatory discretion over technologies that are non substitutable with VHCNs. **Article 29** provides for a penalty regime to accompany the designation process in Article 22.

Articles supporting voluntary alternatives to ex ante regulation

42. Some access articles update the regulatory framework to promote investment by targeting ex ante⁴³ regulation to where it is necessary. These include:
- **Articles 76 and 79:** These articles detail voluntary access and co-investment commitments that an SMP provider may be able to make in order to access forbearance on some or all SMP obligations, if Ofcom makes these commitments binding. Ofcom currently takes into account all such commitments when making regulatory decisions, but is unable to enforce them.

Article increasing regulatory stability

⁴³ Ex ante regulation is “before the event” market intervention by a regulatory body – designed to avoid predicted outcomes resulting from market failures. It includes measures such as pricing regulation and placing obligations on a provider or providers to offer wholesale products. By contrast, ex post or “after the event” interventions – designed to address observed outcomes resulting from market failure – includes tools such as competition law, arbitration and penalty processes.

43. **Article 67** extends the maximum period between market reviews⁴⁴ from three to five years, provided market changes in the intervening period do not require a new analysis. This will give Ofcom the power to switch to a five-year market review cycle, per its July 2018 announcement. It is designed to support investor confidence by promoting greater regulatory stability and predictability. The article provides the option of a one-year extension to the five-year maximum period.

Articles locking new processes into law

44. In addition to the collective impact of the articles outlined above, we have considered the specific impact of changes introduced by some brand-new **Articles** introduced to the framework, summarised below.

Article 22 - Geographical surveys of network deployments,

Article 76 - Regulatory treatment of new VHCN elements, and

Article 79 - Commitments procedure.

Article 22: Geographical surveys of network deployments

45. Article 22 of the EECC creates powers related to geographical surveys of the current and future reach of telecoms networks capable of delivering fixed and/or wireless broadband. The article has the potential to:

- promote faster initial spread of commercial roll-out;
- improve transparency to help unlock private investment held up by uncertainty in approximately 10% of the UK;
- improve regulatory and policy decision-making, including decisions as to whether public funding for broadband is appropriate.

46. Ofcom already conducts and publishes regular surveys of network reach and in practice often gathers information from operators on investment forecasts. This article provides greater transparency of current and future network reach by providing a clearer framework for Ofcom's surveys, including forecasts of future network reach, and new obligations to share the information gathered with Government and industry. The article also introduces new processes for the clarification of rollout plans in areas of commercial uncertainty. The article can achieve these outcomes by introducing new powers, which could be assigned to Ofcom or another competent authority⁴⁵, or be shared between Ofcom and a competent authority. These include:

a requirement to conduct a survey, at least every three years, of the reach of telecoms networks capable of delivering broadband (including both fixed and mobile);
the option to conduct a forecast of future network reach (considering VHCNs specifically), to the extent that this information is available and can be provided with reasonable effort;

⁴⁴ The EECC defines a market review as the adoption of a previous measure where the national regulatory authority has defined the relevant market and determined which undertakings have SMP.

⁴⁵ A competent authority is a person or organisation that has the capacity and legally delegated authority to perform functions, such as those set out in the EECC.

a requirement to make directly accessible to the public all non-confidential information included in the survey, and in the forecast if this has been conducted;
a requirement to provide relevant information (including confidential survey and forecast information) to public bodies for the purposes of fulfilling specific connectivity policy⁴⁶ functions; and
the option for Ofcom or another authority to further clarify deployment plans by:

- i. designating and publishing areas where there is no expected coverage by VHCNs within the survey forecast period; then
- ii. inviting providers to declare an intention to deploy or upgrade to VHCNs in these areas, and requiring other undertakings to declare their intentions to deploy in those areas if at least one provider has declared an intention to deploy⁴⁷; then
- iii. sharing information with those expressing an interest in expected network coverage in the area in question.

47. Under this Article, the level of detail of the information collected would be at the discretion of the relevant authority – provided the information is:

Of the geographic reach of electronic communications networks capable of delivering broadband, as defined under the EECC;

Required for tasks under the EECC or for surveys required for the application of state aid rules;

Available and can be provided with reasonable effort; and

At an appropriate level of detail and include sufficient information on the quality of service and parameters thereof.

48. All providers would have to be treated equally under the process outlined in the article. This means that, when carrying out the processes in this article, the relevant authority would have to request and make available to others the same information in the same context⁴⁸.

49. Articles 20 and 29 of the EECC support this provision by giving the relevant authority the power to require the provision of information under article 22, and to impose a penalty - including in relation to the designation process, if a provider knowingly or grossly negligently provides misleading, erroneous or incomplete information. When determining the amount of any fine, if any, the relevant authority will have to consider whether there is a justification for

⁴⁶ Specific connectivity policy functions include those by local, regional and national authorities with responsibility for the allocation of public funds for the deployment of electronic communications networks, for the design of national broadband plans, for defining coverage obligations attached to rights of use for radio spectrum and for verifying availability of services falling within the universal service obligation in their territory. The EECC recitals specify that undertakings should be aware of the intended use of the information sought by Ofcom, and should be limited to that which is relevant and proportionate.

⁴⁷ Information on other providers' deployment plans would not have to be made public but the relevant authority would be able to share with other providers that have declared an intention to deploy in specific areas whether they are likely to face competition.

⁴⁸ Providers' internal decision-making and record-keeping processes mean that there may be variation in the responses submitted to the same data requests.

the change in the network provider's deployment plans, and whether this has resulted in detriment to competition.

Article 76: Regulatory treatment of new VHCN elements

50. This article mandates forbearance on SMP obligations on new elements of full-fibre or fibre-to-the-base-station networks where a co-investment offer made by the SMP operator meets specific criteria set out in the EECC. It has the potential to promote VHCN investment by the SMP provider and its competitors by supporting cost and risk sharing initiatives.

51. Although Ofcom may already consider the impact of co-investment proposals and agreements when reviewing the need for regulatory intervention in telecoms markets, this article provides a legal framework for doing so, which may lead to greater investment certainty. This article creates a framework for SMP providers to offer commitments for co-investment opportunities for rollout of fibre to the premise or base station. Ofcom would assess proposals from the SMP operator for co-investment commitments against specified criteria, and may consider additional criteria to the extent they are necessary to "ensure accessibility of potential investors of the co-investment". To qualify for forbearance, the commitments accompanying co-investment offer must, at a minimum:

Be open to any provider at any point during the lifetime of the network;

Allow all co-investors to compete "effectively and sustainably in the long term" in downstream markets;

Allow access seekers not part of the co-investment to benefit from the outset from the same "quality, speed, conditions and end-user reach" as was available before the new network was rolled out. This access could be adapted over time in a way that "maintains the incentives to participate in the co-investment";

Be made in good faith; and

Be made public "in a timely manner", at least six months before the start of deployment if the SMP provider is not classified under the EECC as wholesale-only.

The co-investment offer must also be taken up by at least one potential co-investor, who has entered into an agreement with the SMP provider.

52. If Ofcom considers that the criteria are met, Ofcom would have to make the commitments binding – for any period from seven years up to the duration of the commitments – and not impose any additional SMP obligations. However, Ofcom would have the option to impose, maintain or adapt regulatory remedies in order to address "significant competition problems... that would not otherwise be addressed".

Article 79: Commitments procedure

53. This article complements the procedure for assessing commitments provided for in article 76. This article also allows Ofcom to make binding commitments proposed by an SMP provider on network access and consider these in lieu of some or all SMP obligations in the relevant market. Ofcom currently considers the impact on competition of commercial access agreements with the SMP operator when assessing whether to impose obligations.

54. Under this article, Ofcom would generally perform a market test – including consultation – on any commitments proposed. The SMP provider will be able to revise commitments after Ofcom issues an initial assessment, after which Ofcom could make the commitments binding as described above – for a period up to the full duration of the commitments.

Transposition options

55. For the UK to meet its obligations to transpose the EECC, it has a choice between implementing the articles as set out in the directive, or transposing an alternative approach to transposition that still meets the minimum requirements introduced by the Framework. The Government's policy⁴⁹ on transposition is to not go beyond the minimum requirements of European Directives, unless there are exceptional circumstances, justified by a cost/benefit analysis and consultation with stakeholders. The guiding principle to this impact assessment and accompanying consultation is to endeavour to ensure that UK businesses are not put at a competitive disadvantage compared with their European counterparts.
56. Per the UK Government's principle of minimal regulation, transposing the minimum requirements of the directive is the preferred option and is now subject to consultation alongside alternative options. We have considered three transposition scenarios in this impact assessment – no transposition, transposing the minimum requirements of the directive, and an alternative approach to transposition. We would transpose each option as follows:

Option 1: Do nothing: The UK telecoms access regulatory framework – as set out in the Communications Act – remains as is.

Option 2: Transposing the minimum requirements of the directive - (preferred) : Transpose text as adopted at European level, in line with existing convention where there is discretion. This means assigning all new powers to Ofcom (rather than another competent authority), and allowing Ofcom full discretion over exercising these powers, to the extent allowed by the EECC. Under option 2 transposition scenario, which is our preferred option because of lower direct costs to businesses and government guidance on European directives implementation, the articles would be transposed as described in the section above.

Option 3: Alternative approach to transposition: Clarify and supplement EECC text to further support delivery of the FTIR strategy by supporting opportunities whilst minimising risks. This option also has the potential to increase benefits to business, which is described in the economic impact analysis below.

Additional detail on Option 3

57. To support opportunities whilst minimising risks for the measures introduced by **Articles 22 and 76**, we have considered some clarifications to the text. We have also considered clarifying the General Objective under **Article 3** to promote the deployment of VHCN. We would transpose all other articles as described in option 2.

⁴⁹ TRANSPOSITION GUIDANCE How to implement European Directives effectively, p3 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/682752/eu-transposition-guidance.pdf

Article 3

58. Chiming with Ofcom's stated approach to promote the deployment of full fibre networks, this option proposes to strengthen the General Objective to promote the deployment of VHCN by clarifying, per the EECC recitals, as follows:

- **Ofcom must aim for the highest capacity networks and services economically sustainable in a given area** – balancing this with the pursuit of convergence in capacity between different areas;
- **Certain technologies have physical characteristics and architectural features that can be superior** in terms of quality of service, capacity, maintenance cost, energy efficiency, management flexibility, reliability, robustness and scalability, and performance – which must be reflected in regulatory actions;
- **Ofcom's regulatory actions related to fixed and wireless networks must aim to further increase the capabilities of networks** and pave the way for the roll-out of future wireless network generations based on enhanced air interfaces and a more densified network architecture⁵⁰.

Article 22

59. This option would strengthen Article 22 in the following ways:

- **Ofcom must publish survey and forecast information, disaggregated** to the extent permitted by commercial confidentiality. The aim is to ensure that public information on network reach is granular enough to support meaningful decisions on future build plans, to accelerate the spread of commercial rollout.
- **Ofcom must share all data collected by the survey with national and local Government**, to support effective policy decision-making. The aim is to support barrier-removal, the designation and build plan clarification process provided for in this article, and other Government intervention to support investment in full-fibre networks. DCMS will consult the Devolved Administrations and local government on the extent that data collected by the survey should be shared with them to support local broadband roll-out strategies; and
- **Ofcom must avoid duplicating regulatory data requests** on network reach wherever possible to minimise the administrative burden on industry.
- **Give Government (rather than Ofcom) the power to conduct the designation process**, with the aim of ensuring the effective use of Government support; and
- **Ensure that Government can designate areas where there is no planned deployment of specific kinds of network, such as gigabit-capable networks**. The aim is to allow Government to designate areas where there is no planned deployment of, for example, gigabit-capable networks - even where there is deployment or planned deployment of other broadband networks.
- **Require providers to submit evidenced justification where network rollout deviates** from that declared during the designation and clarification process. The aim is to give providers an opportunity to ensure that all evidence is taken into account when deciding whether the change of plans was justified, and ensure that the prospect of penalties is sufficiently dissuasive in view of the negative impact caused on competition and to publicly funded projects.

⁵⁰ This could imply, for example, that Ofcom would regulate fixed networks in a way that supports the rollout of 5G networks - ie, promote the deployment of full fibre capable of providing backhaul for 5G.

Article 76

60. We propose to strengthen Article 76 by clarifying that Ofcom has the power to publish advance guidance on how it would interpret the threshold for SMP co-investments to qualify for forbearance on SMP obligations. Where Ofcom exercises its power to add additional criteria, we propose that Ofcom has to provide advance public notification of these criteria⁵¹. The aim of this clarification is to promote greater take-up of this opportunity for cost and risk sharing to **support incentives for full fibre investment**, whilst **limiting the risk for strategic use** of measures under this Article to circumvent necessary regulatory action.

Rationale for preferred option 2

61. The preferred option is to recommend option 2) transposition of the access articles of the EECC. We will use the consultation period and subsequently, the responses to the consultation, to continue to refine the proposal. The rationale for preferring option 2 can be broken down into the following areas:

Promote deployment of full fibre and 5G

62. Option 2 chimes with Government's deployment targets, by strengthening the current emphasis on competition, investment and regulation only where necessary, and by introducing the new objective to promote the deployment of VHCNs – which would include full fibre and 5G, in addition to upgraded legacy networks. This is set out in the **Article 3** General Objectives, and elaborated in specific provisions in **Articles 61, 73, 74, and 76**, and other articles geared towards targeted regulation. These include specific measures that have the potential to make it more desirable to use and invest in new full fibre networks than rely on access to the legacy copper network.

Promote investor confidence

63. The extension of maximum periods between market reviews, introduced by **Article 67** under option 2, adds to the regulatory stability and predictability needed for investment in infrastructure with long payback periods – per recommendations in the FTIR.

Business impact

64. Option 2 has a number of advantages over option 3, despite having a lower estimate of social net benefits:
- Positive net direct benefits for businesses, which will be bearing the full costs of implementing the legislation.
 - Option 2 can unlock investments of a similar scale to option 3 without the associated costs, as long as operators familiarise themselves with the legislation and it is implemented efficiently by the regulator.

⁵¹ Ofcom would not be required to publish advance guidance on how it would interpret any threshold.

Areas to explore at consultation

65. We will use the consultation process to refine our analysis. Potential benefits of option 3 that we wish to explore at consultation include the impact on commercial network rollout, resolution of the hold-up problem, the targeting of Government interventions, and the time and money spent on data requests.

Impact Analysis

Assumptions and methodology

Baseline scenario

66. The underlying model for which the costs and benefits have been estimated is based on the Future Telecoms Infrastructure Review (FTIR) and its own underlying model. This includes information about the type of existing broadband connections in different parts of the UK, distributed into different areas based on the physical characteristics of the land itself (such as terrain and geological composition) as well as the development and type of settlement on it.

67. The data from FTIR provides estimates on the costs of rolling out broadband in each different area as well as the viability of commercial rollout with intervention. According to the FTIR approximately 80% of households are considered commercially viable to roll out high speed broadband connectivity and about 10% will remain commercially unviable and for which government intervention will be required to cover with high speed connectivity. As part of the drive to provide nationwide fibre coverage, DCMS estimates that for the aforementioned 80% of the country little to no government intervention will be required due to the commercial viability of fibre rollouts, while for the uncommercial 10% it has announced its “Outside in”⁵² approach which will see public funds used to provide coverage in these areas. Our focus was on the remaining 10% that, while defined in the FTIR⁵³ as being commercially viable for at least one operator, may not benefit from investment.

68. The “hold-up” areas are harder to reach, and usually more costly. While these areas may be able to support at least one commercially funded FTTP network they suffer from operators

⁵² DCMS(2018), £200 million to kickstart full fibre broadband across UK. Available at: <https://www.gov.uk/government/news/200-million-to-kickstart-full-fibre-broadband-across-uk>

⁵³ DCMS(2018), Future Telecoms Infrastructure Review . Available at: <https://www.gov.uk/government/publications/future-telecoms-infrastructure-review>

holding off their investments due to strategic uncertainties. Such an uncertainty is the possibility of the incumbent overbuilding key locations in such an area but without connecting all households, driving out competitors but also without providing the required connectivity coverage. As outlined in the document, the proposed EECC measures will be instrumental in unlocking investment in these areas by providing a more predictable investment regime by:

introducing a new regulatory objective for Ofcom to promote deployment and take-up of VHCNs,

providing a clearer framework for Ofcom to survey and share information on existing network reach and planned deployment,

providing new powers to designate areas where no operator has indicated plans to deploy,

reducing the frequency of Ofcom's market reviews from at least every 3 to at least every 5 years, and

enabling co-investment projects between the incumbent and alternative operators.

69. The counterfactual employed is that there will be no FTTP rollout in these areas without implementing the legislation.

Modelling approach and assumptions

Costs and benefits

70. As part of the analysis the focus of the impact assessment is on those households that according to FTIR are commercially viable but will likely remain uncovered without intervention ("hold-up areas"). Identifying the exact number of households is challenging and several models have been used to identify these across government organisations. These range from 1.79m households (6% of total UK households), to 5.5m households (19% of total households), with costs differing in each scenario reflecting the different geological, urbanisation, and existing infrastructure characteristics; expected costs ranged from £1.31bn to £3.81bn in total. The different estimates on the exact size and nature of the deadlocked areas formed the core of the impact assessment and were incorporated into the model as different scenarios to provide a low, best, and high estimate.

71. The model estimates the cost of installing a full fibre connection to each dwelling by density decile (10 deciles of UK households, from most remote to mostly densely populated areas). The cost estimates (by density decile) are informed by the median of BDUK approximations of the cost of delivery experienced by different suppliers and in different areas. This information predominantly relates to the Superfast Broadband Programme and other programmes that BDUK manages. Broadly, costs are estimated to be progressively higher the less urbanised an area is, making the least densely populated areas more expensive to cover than the more densely ones.

72. The cost output of the EECC model is the relative cost to upgrade a telecoms connection. However, the absolute (or base) costs can nonetheless be inferred. Openreach has previously shared with DCMS the average cost of installing an ADSL line. The BDUK approximations suggest that the average cost to install FTTC is roughly £1,250 and full fibre is around £1,700

on average. This does vary between rural and urban areas, and between different suppliers though.

73. These cost estimates have been previously benchmarked against estimates from other studies, informing the existing model and reused in this analysis. However, these estimates generally assume that an ADSL connection will already be in place, so they are more representative of the ‘upgrade’ rather than the ‘absolute’ cost. This is especially true in the types of areas investigated in the EECC model, as the premises in the “hold-up” areas we investigated generally already had ADSL but commercial challenges remained in upgrading them. These benchmarks include:
- **Tactis and Prism estimates for the National Infrastructure Commission.** Tactis and Prism estimated the costs for installing full fibre as part of their work for the National Infrastructure Commission⁵⁴. They estimate the capex per premise passed (i.e. to install the network) and the capex per premise connected (i.e. premises that take up the service) for six geotypes that vary from rural to urban areas.
 - **Frontier Economics estimates for the FTIR.** For the FTIR, Frontier Economics modelled the potential rollout of full fibre across the UK⁵⁵. As part of this, they also looked at the cost to roll out full fibre, which is loosely based on the Tactis and Prism estimates discussed above that informed their own estimates. The capex costs were broken down into duct, fibre and equipment per home passed (similar to the New Builds model approach) and cost per home connected. They did this for 13 geotypes ranging from whether it is a low or high cost area, and existing competitive market conditions.
74. Overall, the BDUK estimates are in line with the benchmarks. They are within the range for the various geotypes and in line with previous analysis conducted, such as for the New Builds model⁵⁶. The main explanation for any divergence between the estimates is a difference in approach. For instance, both the Tactis and Prism and the Frontier models estimate the cost for a geo-type as a whole, whereas the BDUK model is more granular and can look at the individual components of cost within a specific density decile. Nonetheless, the relative difference between technologies is reasonably in line.
75. Over time, there may be some cost efficiencies from installing connectivity to these “hold-up” areas that could lower these estimates. For example, operators may become more efficient at installing digital networks across urban and rural areas over time, which could help reduce the overall installation cost. Similarly, developers and authorities could coordinate construction further leading to efficiency gains, such as coordinating civil work so that dig costs only occur

⁵⁴ Tactis & Prism (2017), A Cost Analysis of the UK’s Digital Communications Infrastructure options 2017- 2050. Available online at: <https://www.nic.org.uk/wp-content/uploads/Cost-analysis.pdf>

⁵⁵ Frontier Economics (2018), Future Telecoms Infrastructure Review, Annex A. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/727890/FTIR_Annex_A_-_FE_Report.pdf

⁵⁶ DCMS (2018), New Build Developments: Delivering gigabit-capable connections. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/752146/New_Build_Developments_Impact_Assessment_FINAL.pdf

once. However, the extent of these cost efficiencies is highly uncertain and, therefore, not accounted for in the model.

Indirect costs: operating expenditure

76. The above relates to the capital expenditure associated with installing telecoms connectivity. In addition to this, there are also ongoing operating costs to maintain the network. These costs are indirect, as the legislation is not mandating operators to deploy, however it is facilitating them to. In our analysis we have assumed that operators would deploy and that the costs incurred by them would be an indirect impact of these provisions. In previous studies, such as the studies by Frontier Economics for the FTIR, it has been assumed that these operating costs are recovered by telecoms operators through wholesale and retail revenue. Nonetheless, in this analysis operating expenditure is included to provide a more conservative estimation of total benefits. This is in line with both the reasonable uncertainty on the actual size of the hold-up areas and their commercial viability.
77. Additionally, evidence suggests fibre networks have lower ongoing costs than copper networks, meaning meaning there can be some genuine cost savings from upgrading to fibre. For instance, the NIC⁵⁷ estimated that running a fibre network can save up to £5 billion in operating costs compared with copper. The potential potential cost saving has not been estimated in this analysis due to uncertainty around its likely magnitude, especially as operators are likely to run both a fibre and copper network in the short to medium run, but we plan to use the consultation to understand this potential potential saving better. For the purposes of this model an approximation of operating expenditures forming about 10% of total network costs is used, which is benchmarked against the reported costs of running a majority copper-based network⁵⁸.

Direct costs: familiarisation costs

78. In addition to the capital expenditure, there will likely be some familiarisation costs as operators get ready for the policies. This includes reading the regulations and planning how to meet them. It is hard to estimate the potential time it will take to do this, but a broad assumption could be that 5% of the staff at operators (around 4,400 employees) will spend ten hours each reading and implementing the policy in option 2 and fourteen hours in option 3, as more documents will be produced by Government and Ofcom to explain how the option 3 transposition will be transposed in practice. The median hourly pay for Private, Information Technology and Telecommunications Professionals in the Annual Survey of Hours and Earning⁵⁹ was £21.90 in 2016. A 30% overhead rate (i.e. the additional costs of employment

⁵⁷ NIC (2018), National Infrastructure Assessment. Available online at:

https://www.nic.org.uk/wp-content/uploads/CCS001_CCS0618917350-001_NIC-NIA_Accessible.pdf

⁵⁸ This includes both the FTIR analysis for UK-related network costs, as well as a broader view of European operators. See more at: NIC (2018), National Infrastructure Assessment. Available online at:

https://www.nic.org.uk/wp-content/uploads/CCS001_CCS0618917350-001_NIC-NIA_Accessible.pdf and https://www.cnmc.es/sites/default/files/editor_contenidos/Telecomunicaciones/Modelos%20de%20coste/20180221_Descripci%C3%B3n%20modelo%20BU_LRIC%20red%20de%20acceso.pdf

⁵⁹ ONS (2018), Employee earnings in the UK: 2018. Available online:

<https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/bulletins/annualsurveyofhoursandearnings/2018>

borne by business) was applied in line with UK accounting practice⁶⁰. Consequently, the overall familiarisation cost is estimated at approximately £1.1m in option 2 and £1.6m in option 3 (in 2016 prices).

Other direct costs considered

79. For option 3, additional costs were considered on both the regulator and operators arising from the periodical requirement to conduct surveys of their networks and provide granular forecasts on their expansions over a 3 year period. This process requires a coordinated effort on the side of operators and the regulator, as well as between the staff within these organisations and stakeholders were asked to provide estimates on existing and predicted forecast costs - limited forecasts are already conducted and data is provided to Ofcom as part of its Connected Nations periodical research survey. Based on stakeholders' responses an estimate of £0.6m yearly for all operators was included, marginally decreased by £0.1m yearly for streamlining all existing Government and regulatory information collection processes (BDUK, DCMS, Ofcom), and thus reducing time and money spent on data requests.
80. The proposed legislation includes the power of the regulator to impose fines (article 29) for operators that misreport information as part of the mapping exercises of article 22. These fines are provided to minimise any potential deliberate misreporting of information and avoid gaming of the rules, such as purposely misreporting information to undercut competitors. The highest fine Ofcom currently can impose in the case of misreporting information (Comms Act, section 139) in violation of article 22 is £2m. While these potential costs are not included in our analysis, as we assume that operators will be compliant with Article 22, they were taken in consideration as part of designing policy.

Indirect Benefits

81. High speed fibre connectivity is increasingly becoming the infrastructure underpinning all technology sectors, either indirectly by facilitating communications or by directly enabling new technologies. Industry experts have repeatedly pointed out sectors that are likely to be enabled and/or created on the back of high speed connectivity, such as cloud services, virtual reality technology and others. As part of the European Commission EECC impact assessment, the European Commission⁶¹ argued that the technology sectors of countries like Japan and South Korea benefitted from the early presence of fibre networks and boosted their competitiveness. On that basis, the commission predicted that the reforms (EECC as a whole) will increase labour productivity and bring it closer to the growth levels observed in some of the more technologically advanced international competitors such as Japan, South Korea, and the USA. This should provide a boost to the UK and the EU competitiveness. In the absence of knowing what benefits fibre will ultimately bring in terms of new technologies, we focused on more empirical evidence currently available, making assumptions around the marginal benefit of additional internet speed using the SQW study; in this study benefits are calculated on the basis of absolute broadband speed increases. Since these marginal benefits are on the basis of current usage and reflect the experience largely of the migration from xDSL to fibre networks, these are likely to be an overestimate of the marginal benefit of boosting further fibre

⁶⁰ OECD, International Standard Cost Model Manual . Available at: <https://www.oecd.org/regreform/regulatory-policy/34227698.pdf>

⁶¹ See footnote 29

networks. Over the longer-term, and as technology develops, the benefits are likely to be much bigger however. For this reason the operating costs were also included in the analysis; to provide a more conservative estimation on the cost side and countermand the optimism on the benefits side.

82. The benefits of this policy proposal are primarily based on those included in the UK Broadband Impact Study model developed by SQW⁶². This include increased labour force participation from disabled people and carers (made possible by teleworking), improved productivity from commuting time savings (again made possible by teleworking), productivity growth of broadband-using businesses, employment growth and safeguarded employment amongst firms benefiting from enhanced access. For the purposes of this analysis the benefits are summarised and provided as total GVA (Gross Value Added) impact. This has been done for simplicity and due to revisions that are taking place to the benefits model to better reflect the latest empirical evidence being collected for the programme. The latest estimates on the detailed breakdown of different benefits by source can be found in the UK Broadband Impact Study.
83. The UK Broadband Impact Study also identified several non-monetised social benefits like improved sense of wellbeing, improved access to education and health services and increased civic participation. Since that publication, some work has been undertaken to try and monetise these benefits, most notably the Superfast Broadband evaluation has estimated the monetary impact of broadband on wellbeing. These have been included to supplement the benefits model.

Monetised benefits

Decreased market review savings - direct benefits

84. The direct compliance costs on operators and Ofcom associated with market review cycles are expected to decrease due to the extension of review cycles from 3 to 5 years. Estimates on the extent of the cost reduction were collected from Ofcom and operators and are included in the analysis. However, it should be noted that telecom operators and their trade associations observed in the course of interviews for this study that they consider the indirect costs (especially in the case of SMP operators) or benefits (in the case of operators making use of regulated access) significantly exceed the direct costs, given the overall scale of the sector and its impact on the economy. In this context, the direct costs per se are not considered to present the main 'problem' as regards regulation of the electronic communications sector.
85. Indirect costs of 'overregulation' cited by operators subject to SMP regulation include the opportunity cost of reduced investment in high speed broadband infrastructure and the consequent impacts on the quality of service to consumers. However, there are different views amongst the industry and analysts as regards the existence and scale of these costs, and the

⁶² SQW (2013), UK broadband impact study. Available online at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/257006/UK_Broadband_Impact_Study_-_Impact_Report_-_Nov_2013_-_Final.pdf

public consultation is expected to serve as a forum to identify these further. This cost may be mitigated by the proposal in the 'continuity and simplification option' to require Ofcom to first identify a market failure at retail level before intervening. Another cost which stakeholders and some NRAs have identified with the current set-up is the uncertainty created by short review cycles and obligations which are reviewed (and prices revised) on a frequent basis. This problem will be addressed under both options 2 and 3, and should reduce procedural costs as well as increasing regulatory certainty⁶³.

Local enterprise and labour productivity growth - Indirect Benefits

86. Evidence suggests that making superfast broadband available improves local economic performance⁶⁴. Firms located on postcodes receiving enhanced access can see their efficiency improved, either by enabling faster processing or exchange of digital information, or indirectly by encouraging product and process innovation or increasing the productivity of teleworkers. The adoption of superfast broadband may also aid firms in expanding their sales by opening new channels to market. Sales may also grow indirectly if any productivity gains enable them to lower their prices or raise quality, and claim market share from their competitors. Firms expanding may increase the size of their workforce to meet additional demand, creating jobs in the local economy. Local economies may also see employment growth if firms choose to relocate to areas newly enabled with superfast broadband services, or if incumbent firms are encouraged to remain.
87. Based on comparison of postcodes that received subsidised superfast broadband and neighbouring ones that did not, the UK Broadband Impact Study⁶⁵ estimated that local firm employment rose by 0.8% and turnover grew by 1.2% in response to improved infrastructure. This was a result of both creation and retention of existing jobs, while total firm turnover increased substantially raising estimated local productivity levels, defined as turnover per employee, by approximately 0.32% as a result of increased broadband speeds. There was evidence, however, that over 80% of these impacts were driven by the relocation of firms to postcodes receiving subsidised coverage, and this impact was taken into account in the study. As such, only impacts in terms of raising productivity can be considered to qualify as an economic benefit at the national level. The impact on firms that did not change location while the programme was delivered was estimated at 0.38%. This gives assurance that the economic impacts of the programme were not purely driven by the relocation of firms.

Teleworker productivity - Indirect Benefits

⁶³ Further analysis on the benefits of increased timescales for market reviews can be found in SMART 2015/0002. European Commission (2015), Regulatory, in particular access, regimes for network investment models in Europe" (SMART 2015/0002). Available online at: <https://ec.europa.eu/digital-single-market/en/news/access-regimes-network-investment-and-business-models-europe-smart-20150002>

⁶⁴ See for example "The Economic Impact of Broadband: Evidence from OECD countries, Pantelis Koutroumpis for Ofcom, April 2018". Available at: <https://www.ofcom.org.uk/research-and-data/telecomsresearch/broadband-research/economic-impact-broadband>

⁶⁵ DCMS, (2018), Evaluation of the Economic Impact and Public Value of the Superfast Broadband Programme. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/734855/Superfast_Integrated_Report.pdf

88. The monetised benefits are estimated using the UK Broadband Impact Study adjusted to fit to the current analysis. In all cases, it is assumed that interventions such as the Superfast Programme and the Local Full Fibre Network will continue, which feeds into our wider assumption that the rollout of full fibre will continue and gather pace affecting the baseline.
89. The UK Broadband Impact Study reported that “as levels of connectivity at home improve, this will tend to encourage higher levels of working from home” . The time that these teleworkers save by not commuting could be put to more productive use, which is assumed here to be split between leisure and business in a ratio of 40:60. There is also some evidence that teleworkers may also be more efficient, but this is not accounted for.
90. To quantify the impact of improved internet connectivity, the model first estimates the proportion of home workers by standard occupational classification (SOC) and by density decile using ONS Census 2011 data⁶⁶. Then, a function (i.e. a curve) of internet speed use and the number of days worked from home is calculated - within reasonable limits (there is no point in which there will be exclusive home working). Given that not everyone will work from home, the relative propensity to do so is also estimated using Census data. Overall, combining an increase in internet speed, which translates into number of days working at home and multiplied with the propensity to do so produces an estimate of total number of days worked from home attributed to a change in speed. The benefit itself is the time saved from commuting. This is estimated by combining Census data that shows the average distance travelled to work (9 to 16 km) and the National Travel Survey⁶⁷ that reports the average commuting travel time (49 to 87 minutes) for each density decile.
91. Displacement has also been included. This refers to the case where a policy may lead to an increase in outputs in one area, but also a reduction in outputs elsewhere. In this specific case, this could include a change in the use of transport modes, or more widely, the effect on other businesses providing similar telecoms services. SQW estimated displacement using ready-estimates and tested these using Monte Carlo analysis⁶⁸. Overall, they judged displacement for teleworkers’ productivity to be 50%.
92. The time savings can be converted into monetary units by multiplying the number of hours saved with the gross value added (GVA) per hour worked. Using the latest data⁶⁹, GVA per

⁶⁶ SQW analysis of ONS Census data. See: SQW (2013), UK Broadband Impact Study. Available online at: <https://www.gov.uk/government/publications/uk-broadband-impact-study--2>

⁶⁷ Department for Transport (2018). National travel survey 2017. Available online at: <https://www.gov.uk/government/statistics/national-travel-survey-2017>

⁶⁸ For example: English Partnerships (2008), Additionality Guide. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/191511/Additionality_Guide_0.pdf; and BIS (2009), ‘Research to improve the assessment of additionality’ <http://webarchive.nationalarchives.gov.uk/20121106103730/http://www.bis.gov.uk/assets/biscore/economics-and-statistics/docs/09-1302-bis-occasional-paper-01>

⁶⁹ ONS (2018), Employee earnings in the UK: 2018. Available online: <https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/bulletins/annualsurveyofhoursandearnings/2018>

hour was estimated at £33 in 2016 (and in 2016 prices). Only private sector workers have been included as SQW argued that any time saved by public sector employees would lead to improved public services rather than an increase in GVA. Acknowledging this, private sector workers represented around 83% of all jobs in 2016 based on ONS Labour Force Survey data.

Labour force participation - disabled people and carers - Indirect Benefits

93. Similarly, the UK Broadband Impact Study identified that “the ability to work from home, using improved levels of connectivity, also reduces the barriers to employment for certain parts of the working age population”⁷⁰. In particular, they identified carers who would otherwise be economically inactive looking after the home or family, and disabled people who would otherwise potentially find it difficult to find suitable work environments.
94. Like above, the model estimates the proportion of disabled people and carers who are unemployed/economically inactive, want a job and are able to work from home as a function (i.e. curve) of internet speed use. There is an assumption that new entrants to⁷¹ the labour market can sustain work. Displacement, which here can include other interventions to support disabled people and carers into work, has been estimated by SQW using the same approach as that described previously to be 40%.⁷³
95. To convert this into a monetary value, the number of people entering the labour market because of improved connectivity is multiplied with the average GVA per worker. Disabled people are assumed to work full time, while carers are assumed to work part time. The latest estimate of GVA per worker is £55,100 for full-time workers and £18,100 for part-time workers in 2016 (and in 2016 prices)⁷⁴.

Wellbeing - Indirect benefits

96. As noted earlier, the UK Broadband Impact Study reported that higher internet speeds can lead to an improved sense of wellbeing. This is in line with other studies that showed a higher subjectively felt sense of wellbeing because of: communicating with friends and family; using social media and online communication tools⁷⁵; reducing the need to travel to work⁷⁶; and a

⁷⁰ Ibid.

⁷¹ Jones, M (2010) SQW analysis of ONS Annual Population Survey data and estimates, Disability, education and training, Economics and Labour Market Review, 4, 4. Available online at: <https://www.researchonline.org.uk/sds/search/download.do;jsessionid=DECBBBECE480F0935A63389F1C8A8FAE?ref=A27862>. See: SQW (2013), ‘UK Broadband Impact Study’.

⁷² The DCMS (2018) Superfast Broadband Programme evaluation sets out a different approach to measuring this benefit by looking at the impact on local (long-term) unemployment and out of work benefits. However, this has not been used here given the fact that the evaluation looks at the impact on both residential and commercial premises

⁷³ Ibid

⁷⁴ ONS Regional GVA (balanced estimates) and ONS Labour Force Survey

⁷⁵ Townsend, L, Wallace, C & Fairhurst, G (2015), ‘Stuck out here’: the critical role of Broadband for remote rural places’, Scottish Geographical Journal, 131, 3-4. Available at: <http://dx.doi.org/10.1080/14702541.2014.978807>; Kraut, R & Burke, M (2015), Internet use and psychological well-being, Communications of the ACM, 58, 12. Available at:

<https://cacm.acm.org/magazines/2015/12/194633-internet-use-and-psychological-well-being/fulltext>; and

general feeling of empowerment⁷⁷. However, while most studies have shown the impact of the internet on wellbeing as being positive, some suggest that the impact could be negative⁷⁸ or non-existent⁷⁹.

97. Acknowledging the above, the UK Broadband Impact Study benefit model did not quantify or monetise the potential impact on wellbeing at the time. However, more recently, the evaluation of the Superfast Broadband Programme did attempt this in line with HM Treasury Green Book guidance⁸⁰. It suggested that the wellbeing improvement to households with a superfast connection - an average of those taking up a superfast service and those that do not - was £222 per year excluding any impact associated with household incomes. The evaluation noted “this benefit [is expected] to increase over time as consumer demand for superfast broadband increases”.
98. This wellbeing benefit has been included in this model. While it could be argued that an increase in wellbeing could capture some of the benefits of being able to work remotely or entering the labour market - and therefore includes an element of double counting - it also captures wider wellbeing benefits of being able to access online entertainment, communicate with friends and family and shopping online for instance. The risk of double counting is also minimised given that the wellbeing value from the Superfast Broadband Programme excludes the wellbeing effect associated with household incomes (i.e. an increase in wages).
99. Nonetheless, as there is nothing to compare this wellbeing value with, especially given the relatively early stage of including wellbeing in cost benefit analysis, this benefit is only included as part of sensitivity. It has also only been applied to households with a FTTC or FTTP connection to illustrate those with at least a superfast connection compared with an ADSL line. Whilst it is possible that the wellbeing gains last more than a year, we have also only counted it once (in the year of connection).

Non-monetised benefits

100. The UK Broadband Impact Study surmised that “beyond its economic impacts, broadband has, of course, become an integral part of modern life, affecting various aspects of our

Valkenburg, P & Peter, J (2007), Internet communication and its relation to well-being, *Media Psychology*, 9, 1. Available online at: <https://doi.org/10.1080/15213260709336802>

⁷⁶ Deloitte (2013), Benefits of high-speed broadband for Australian Household'. Available online at: <https://www2.deloitte.com/content/dam/Deloitte/au/Documents/finance/deloitte-au-fas-benefitshighspeed-broadband-v2-2-40914.pdf>

⁷⁷ Ashmore, F, Farrington, J & Skerratt, S (2015), Superfast Broadband and Rural Community Resilience, *Scottish Geographical Journal*, 131, 3-4. Available online at: <https://doi.org/10.1080/14702541.2014.978808>

⁷⁸ Kraut, R et al (2002), Internet paradox revisited, *Social Issues*, 58, 1. Available online at: <https://spssi.onlinelibrary.wiley.com/doi/10.1111/1540-4560.00248>

⁷⁹ Huang, C (2010), Internet use and psychological well-being: a meta-analysis, *Cyberpsychology, Behaviour and Social Networking*, 13, 3. Available online at: <https://doi.org/10.1089/cyber.2009.0217>

⁸⁰ HMT (2018), Evaluation of the Economic Impact and Public Value of the Superfast Broadband Programme. Available at:

<https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-government>

day-to-day activities as individuals, families and communities” . This is supported by similar findings⁸¹ by the Superfast Broadband Programme evaluation and a report by Regeneris looking at the economic impact of full fibre infrastructure⁸² among others. Many are social benefits which are difficult to measure and value, take some time to materialise and depend on the take up of the service. Nonetheless, they should be considered alongside the quantitative cost benefit analysis.

Reduction in travel

101. A number of sources highlight the benefits for many (especially those in rural or remote areas) through a reduction in the need to travel. Examples given include areas such as e-government, for example; filing taxes and conducting other business with local and national governments⁸³, online shopping and employment⁸⁴. The rise of teleworking gives rise to economic benefits as described above, and it also has social benefits related to reduced travelling.

102. The benefits from avoiding travel can potentially be measured in two ways – firstly through the monetary savings that can be made by not travelling (e.g. on petrol, parking, other costs), and secondly through being able to use the time that would have been spent travelling on leisure, or another purpose entirely. Ashmore, Farrington and Skerratt (2015) note that the ability to get banking and other shopping activities organised online meant that the participants they spoke to were afforded “greater control over how they planned their physical shopping excursions”⁸⁵.

Access to education

103. Improved broadband is seen as making the provision of education and remote training more successful. Citing the increasing availability of the option to gain formal qualifications entirely remotely through the use of video conferencing for lectures and tutorials, Meador (2016) notes that the provision of superfast broadband to those areas in Dumfries and Galloway currently without it would allow residents to participate in formal and informal distance education⁸⁶. This

⁸¹ Ibid.

⁸² Regeneris (2018), The economic impact of full fibre infrastructure in 100 UK towns and cities. Available online at:

<https://www.cityfibre.com/wp-content/uploads/2018/03/The-Economic-Impact-of-Full-Fibre-Infrastructure-in-100-UK-Towns-and-Cities-12.03.18.pdf>

⁸³ Van de Wee, M., S. Verbrugge, B Sadowski, M. Driesse & M. Pickavet (2015), Identifying and quantifying the indirect benefits of broadband networks for e-government and e-business: a bottom-up approach, Telecommunications Policy, 39, 3-4, pg.176-191. Available online at:

<http://www.sciencedirect.com/science/article/pii/S030859611300205X>

⁸⁴ Philip, L, Cottrill, C, Farrington, J, Williams, F & Ashmore, F (2017), The digital divide: patterns, policy and scenarios for connecting the ‘final few’ in rural communities across Great Britain, Journal of Rural Studies, pg.1-13. Available online at: <https://www.sciencedirect.com/science/article/pii/S0743016716306799>

⁸⁵ Ashmore, F, Farrington, J & Skerratt, S (2015), Superfast broadband and rural community resilience: examining the rural need for speed. Available at:

<https://www.tandfonline.com/doi/full/10.1080/14702541.2014.978808>

⁸⁶ Meador, E (2016), Superfast broadband in Scotland: implications for Dumfries and Galloway. Available at: https://www.researchgate.net/profile/John_Meador/publication/308163239_Policy_Briefing_10_Superfast_Broadband_in_Scotland_Implications_for_Dumfries_and_Galloway/links/57dbad6808ae5292a376bd14.pdf

could raise educational attainment in an area of Scotland where the proportion with tertiary education is lower than the national (Scottish) average.

Access to health and social services

104. There is a large potential for remote services to improve health and social services. Telemedicine applications that enable remote screening, diagnosis, treatment and monitoring allow people to receive quality care in the communities in which they work and live. There are challenges associated with fully realising the potential of telemedicine benefits. More vulnerable people who might benefit most from telemedicine may be least likely to have interest in using the internet or taking up better broadband should it become available. Additionally, a literature review from 2013 notes that this sort of benefit relies on local health services being structured to provide telemedicine, which was not the case at that time, and seems unlikely to be the case now⁸⁷. However, in recent years remote GP services accessed through video-conferencing have started to reach the mainstream market.

Consumer access benefits

105. Another similar benefit relates to savings more generally through increased availability of online shopping. This operates at both ends; consumers will be better able to use online shopping platforms to shop around and find cheaper goods and services, saving money that can be used elsewhere, while rural-based businesses may be able to offer more competitive prices through a reduction in the business costs of physical isolation⁸⁸.

106. More broadly, those without good quality broadband are unable to reliably access some online services that others take for granted. The UK Government assumes 'digital by default' in the provision of public services. Currently all public services can be accessed with a 2Mbps download speed, but should the bandwidth requirements of government websites increase (in line with the general growth in the size of websites), then faster broadband may become necessary for universal reliable access to public services. A number of articles cite a longer-term concern that the withdrawal of commercial and public organisations from physical locations to being solely available online will be damaging to non-users of the internet, with the suggestion that an inability to access online services may "generate a new dimension of social exclusion that transcends conventional 'causes' of disadvantage such as low income"⁸⁹. A report by Deloitte from 2013 outlines that "there is some evidence that these greater impacts [of good quality broadband] are where households face difficult circumstances, such as needing to find employment, move residence or where additional education is of significant benefit"⁹⁰.

⁸⁷ SQW (2013), UK broadband impact study. Available at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/85961/UK_Broadband_Impact_Study_-_Literature_Review_-_Final_-_February_2013.pdf

⁸⁸ Philip, L, Cottrill, C, Farrington, J, Williams, F & Ashmore, F (2017), The digital divide: patterns, policy and scenarios for connecting the 'final few' in rural communities across Great Britain, *Journal of Rural Studies*, pg.1-13. Available online at: <https://www.sciencedirect.com/science/article/pii/S0743016716306799>

⁸⁹ Ibid.

⁹⁰ Deloitte Access Economics (2013), Benefits of high-speed broadband for Australian Households. Available online at:

Community resilience

107. A number of academic sources use the framework of ‘enhancing resilience’ as a measure of the impacts of better broadband. In the literature this operates mostly within a rural context, where community resilience is highlighted as a particular issue. Ashmore, Farrington & Skerratt (2015) describe resilience as⁹¹:

“Social–ecological resilience builds upon this understanding to represent the ability of a community to withstand shocks due to external, ecological factors (Adger 2000). In relation to rural areas, shocks, or changes, can include depopulation, a loss of, or a disinclination to develop, public services for small populations and demographic ageing (see Delfmann et al. 2014), which require individuals and communities to be able to adapt and adopt new practices (i.e. be resilient) to address such changes to their community structure and livelihood.”

108. Recent papers define a framework for assessing the impact of better broadband on individual and community resilience. Heesen, Farrington & Skerratt (2013)⁹² identify the impact on technological engagement (for instance through improving unreliable internet connections), the ability to live and work in a rural setting (the use of superfast in maintaining a rural life), and the capability for the local community to act together as key parts of community resilience that could be affected by a Universal Service Obligation.

Environmental benefits

109. The UK Broadband Impact Report identified three routes to environmental saving as a result of improved broadband: the effect of reduced commuting as teleworking becomes more viable, the fall in business travel due to similar reasons, and the reduction in energy consumption as cloud storage becomes more viable⁹³. Environmental benefits are not included in the quantified benefits below.

Productivity gains from home businesses

110. Home businesses can also benefit from having improved broadband. For example, it can lead to more productive and efficient ways of working and enabling access to larger markets. This includes taking advantage of cloud services, having an online presence on websites and social media, interacting with suppliers and customers, and offering e-commerce⁹⁴. It is also a similar argument used in the UK Broadband Impact Study for all businesses⁹⁵. However, quantifying this impact is difficult as there is no reliable information describing the number of home

<https://www2.deloitte.com/content/dam/Deloitte/au/Documents/finance/deloitte-au-fas-benefits-highspeed-broadband-v2-240914.pdf>

⁹¹ Ibid.

⁹² Heesen, F, Farrington, J & Skerratt, S (2013), Analysing the role of superfast broadband in enhancing rural community resilience. Available online at:
http://aura.abdn.ac.uk/bitstream/handle/2164/4002/FHeesen_ESRS_Analysing_sfbb_in_enhancing_rural_community_resilience_ShortPaper_ESRS2013.pdf?sequence=1

⁹³ Ibid.

⁹⁴ SBA (2010), Impact of broadband speeds and price on small business. Available at:
https://www.sba.gov/sites/default/files/rs373tot_0.pdf

⁹⁵ Ibid.

businesses (though some estimates suggest that there were approximately 2.7 million home businesses in the UK in 2017⁹⁶) or what the likely magnitude of impact could be.

Optimism Bias, rollout profiles, and multipliers

111. An optimism bias of 35% has been applied to both the costs and expected rollout targets associated with the various policy options. This is based on the suggested upper bound optimism bias for non-standard civil engineering projects included in HM Treasury Green Book guidance. This is within the range of optimism biases used in the past for the assessment models mentioned above, such as the UK Broadband Impact Study. The technology and installation processes are already proven reducing some uncertainty, while the costs used in the model are based on actual past experience of delivery. These costs are generally higher than other benchmarks, suggesting that they have the potential to be lower, especially considering that operating expenditure has been included in this study. Altogether, we have later tested the analysis using different levels of bias.

112. To produce the cost and benefit structures, network rollout profiles were forecasted. These profiles are based follow the same sigmoid function (S-shaped curve); this function often characterises the evolution of technology models⁹⁷ and similar forecast profiles were estimated both in the FTIR⁹⁸ and the European Commission as part of its impact assessment⁹⁹. The forecast profiles were constructed to reflect the expected coverage of the new networks under each option in 2034; Options 2 and 3 forecasted to cover the total hold-up areas, however at different pace (i.e. with a two year delay for option B over option C). The differences in the achieved extent of rollouts between profiles stems largely from the requirements placed on the regulator to conduct geographical mapping exercises sooner in option 3 than in option 2, with intervention zones being designated by the government to achieve broader connectivity results. This leads to a two year delay in network rollouts in option 2, but the overall coverage is expected to be similar in both options by 2034, which leads to different discount rates and thus different present values of benefits and costs. This is largely due to the bulk of the rollouts being expected to take place after the first two mapping exercises take place, with network rollouts slowing down afterwards and resulting in the two trend-lines converging to one another. Furthermore the optimism bias was applied on total coverage achieved in both options¹⁰⁰, leading to a total coverage of approximately 65% by 2034 for both options (see

⁹⁶ Vonage (2018), Unlocking the UK's home business potential. Available at:

<http://www.homebusiness100.co.uk/wp-content/uploads/2017/09/StepUps-Report-FINAL-DIGITAL.pdf>

⁹⁷ For a detailed analysis, see Kucharavy, De Guio (2007), Application of S-shaped curves. Available at https://ac.els-cdn.com/S1877705811001597/1-s2.0-S1877705811001597-main.pdf?_tid=3e6631c9-a6cb-4f35-9129-6e373a3a5f8e&acdnat=1547831468_b6e2f5d955a0fec418c8972c524b0bbe

⁹⁸ Frontier Economics (2018), UK Telecoms Market Dynamics, Future Telecoms Infrastructure Review Annex A. Available at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/727890/FTIR_Annex_A_-_FE_Report.pdf

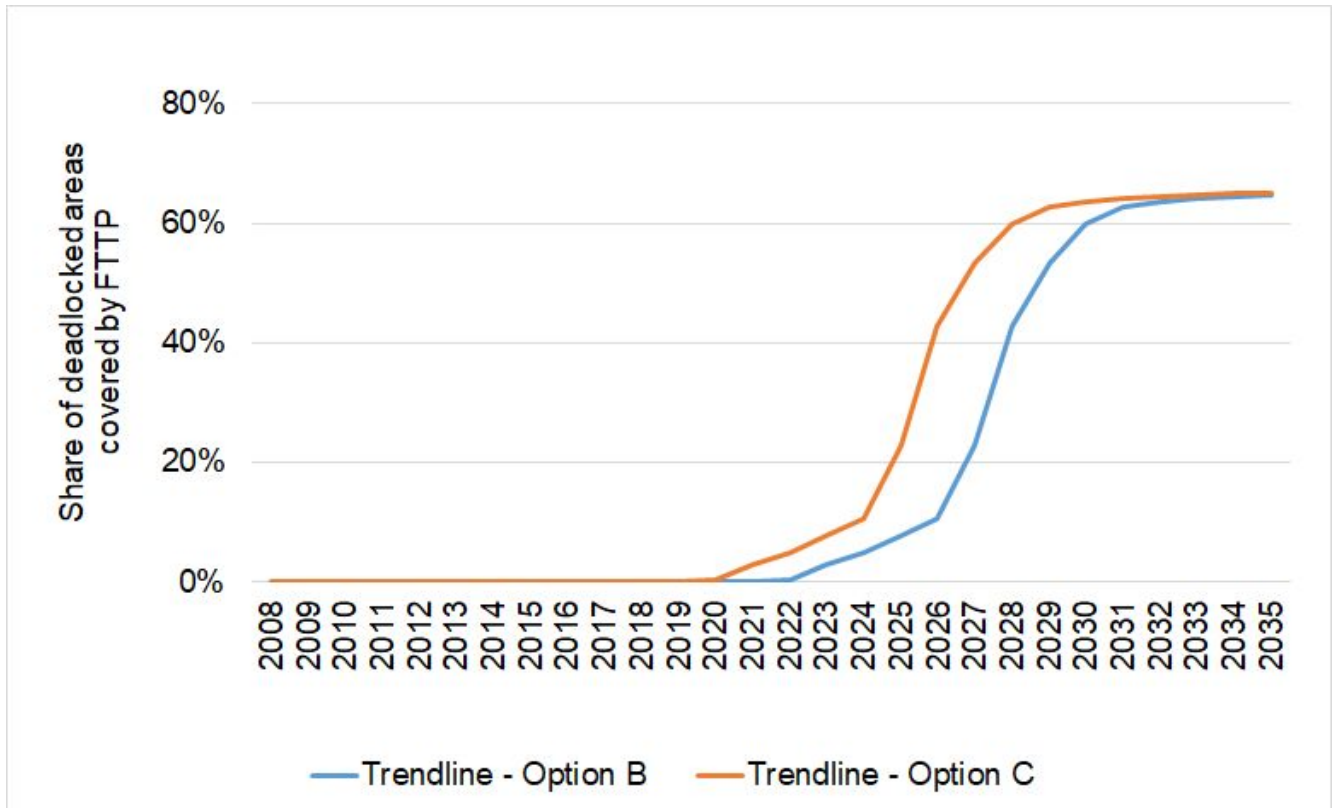
⁹⁹ European Commission (2016), EECC Impact Assessment. Available online at:

<https://ec.europa.eu/digital-single-market/en/news/proposed-directive-establishing-european-electronic-communications-code>

¹⁰⁰ According to government guidelines an optimism bias relevant to non-standard civil engineering projects was used. See more at HMT (2018), The Green Book central government guidance on appraisal and evaluation. Available at:

chart below). The different rollout profiles are combined with an assumption of earlier rollout to urban over rural areas, due to the more favourable economics associated with covering urban areas over more remote areas; the majority of poorly serviced households in terms of connectivity in the UK remain overwhelmingly in rural areas¹⁰¹.

Figure B: Estimated network rollout profiles for Options 2 and 3



Source: DCMS own analysis based on SQW model

113. Other parameters and assumptions used include the cost distribution parameter. Capital investment in networks is generally assumed to be front loaded¹⁰², and this trend is captured in this model, using a decreasing exponential function. The cost curve (ie, the decreasing exponential function) utilises a parameter that determines the extent of the front-loading of costs, for the purpose of which the value was set at 2%.

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/685903/The_Green_Book.pdf

¹⁰¹ Ofcom (2018) Connected Nations. Available online at:

<https://www.ofcom.org.uk/about-ofcom/latest/media/media-releases/2018/getting-rural-areas-connected>.

Eurostat provides a detailed view on the share of broadband coverage in rural and urban households in the UK, available at: <https://ec.europa.eu/digital-single-market/en/news/study-broadband-coverage-europe-2017>

¹⁰² This is often cited by network operators themselves, such as by Vodafone

https://www.vodafone.com/content/dam/vodafone/about/public_policy/position_papers/vodafone_report_final_wkconsult.pdf, but is largely a documented fact in the industry. For more information on CAPEX structures in fibre technologies see Ventura Team (2017), Financing Stimulus for FTTH, Fibre to the Home Council Europe.

Available online at: https://www.ftthcouncil.eu/documents/Reports/FTTH_Finance_Report.pdf

Summary of costs and benefits

114. This section summarises the costs and benefits identified above for the three policy options. A starting point is to illustrate the impact the policy options have on the actual number of households expected to receive high speed connectivity. Table A provides this breakdown over 15 years using different scenarios of the expected size of the “hold-up” areas.

Table A: Forecasted share of UK households (HHs) covered by FTTP services as a share of all households in 2034

Scenario	Option 1	Option 2	Option 3
A - low scenario (6% of UK HHs)	21.7%	24.6%	24.7%
B - high scenario (19% of UK HHs)		30.0%	30.8%
C - best scenario (10% of UK HHs)		26.0%	26.6%

Source: DCMS own analysis

115. The costs are essentially estimated by multiplying the unit costs of installing a connection with the number of new households connected. This is done on a per decile basis. The costs also include an optimism bias of 34.85%. Using a 15 year appraisal period, we have discounted values using a rate of 3.5%.

116. The benefits are estimated using the approach outlined in the previous section. Given that the evidence supporting some benefits is more robust than others, we have separated them out. The more robust benefits includes the uplift in Gross Value Added, which is consisted by the uplift in enterprise growth, boosted labour force participation of carers and disabled people, and increased productivity from teleworkers. The less robust benefits also include wellbeing effects. Like above, the benefits have been analysed over a 15 year period and discounted using a 3.5% rate. There are also a number of non-quantified benefits that should be considered alongside these monetised ones.

117. Table B summarises the social costs and benefits and presents the net present value relative to the do nothing scenario. However, it should be considered against the fact that: the unit costs are relatively high in comparison with other benchmarks (also including OPEX); and there are several non-quantified benefits that need considering as well. Acknowledging this, no policy options have a chance of a negative net impact¹⁰³ even when only looking at the main monetised benefits (GVA). When the welfare benefit estimates (summary compared to

¹⁰³ For option 3, that is in the case of the high cost and the low benefit realisation (see summary tables at the start of the document).

summary with welfare, see table below) are also included in the calculations then the net present value increases further for all options.

Table B: Social cost benefit analysis over 15 years relative to do nothing, constant 2018 prices, £m

£m	Option 2			Option 3		
Costs	Best	Low	High	Best	Low	High
Familiarisation costs	1.3	1.1	1.4	1.8	1.6	1.9
Implementation costs	2.3	2.0	2.5	2.3	2.0	2.5
Network CAPEX/OPEX	1,428.7	929.3	2,700.4	1,511.1	983.7	2,856.0
Network mapping forecast costs	-	-	-	8.8	6.1	7.5
Total - undiscounted	1,432.3	932.4	2,704.3	1,523.9	993.4	2,867.9
Total - discounted	1,096.9	712.1	2,070.7	1,246.8	810.3	2,346.3
Benefits	Best	Low	High	Best	Low	High
Market review savings - operators	6.8	0.6	12.2	6.8	0.6	12.2
Market review savings - Ofcom	7.5	6.0	9.0	7.5	6.0	9.0
GVA impact	1,571.5	1,022.3	3,063.6	1,726.8	1,130.5	3,325.0
Network mapping efforts consolidation	-	-	-	1.7	1.5	1.9
Total - undiscounted	1,585.9	1,029.0	3,084.8	1,742.8	1,138.6	3,348.1
Total - discounted	1,101.4	714.0	2,144.6	1,264.5	825.5	2,433.7
Welfare benefits	3,493.7	2,151.2	6,579.4	3,520.7	2,167.8	6,630.2
Total - discounted	2,589.0	1,594.6	4,875.6	2,737.4	1,686.3	5,155.1
Summary	Best	Low	High	Best	Low	High
Net present value	4.5	1.9	73.9	17.7	15.2	87.4
Summary with welfare	Best	Low	High	Best	Low	High
Net present value	2,593.5	1,596.5	4,949.5	2,755.1	1,701.5	5,242.5

Source: DCMS own analysis based on SQW model

118. The impact on businesses only is shown in Table C. While the costs are expected to be incurred entirely by businesses (telecoms operators) and the government, benefits are expected to be spread both between businesses in the form of increased productivity and turnover as well as for consumers (including welfare which is largely due to an increase in public welfare). Exceptions are the increased savings to operators from the reduction of market reviews and the productivity from teleworkers which can impact both residential and commercial premises but this cannot be separated out. While acknowledging that not all the direct benefits can be included, and also the optimism bias and relatively high costs listed above, the net present value for businesses is positive across all policy options.

Table C: Business NPV over 15 years relative to do nothing, constant 2018 prices, £ m

£m	Option 2	Option 3
Total Business Costs	1,021.2	1,161.0
Total Business Benefits	1,021.7	1,173.9
Net Total Business Impact	0.6	12.9

Source: DCMS own analysis based on SQW model

119. The estimated annual net direct cost to businesses (EANDCB) is based on the total discounted cost (including optimism bias) shown above. The total cost is divided by the annuity rate of 11.9 associated with the 15 year appraisal period and the discount rate of 3.5%. Overall, the EANDCB is expected to be less than £5 million per annum across all policy options, while the direct costs to businesses are positive for policy option 2 and negative for policy option 3 (Table D).

Table D: Estimated annual net direct cost to businesses (EANDCB), constant 2018 prices, £ m

£m	Option 2	Option 3
EANDCB	-0.3	0.2

Source: DCMS own analysis based on SQW model

120. Based on the above, the preferred option is option 2. While option 3 delivers the largest positive net present value, the net direct costs to businesses are likely to be negative. It is also against the backdrop that these net present values and benefit cost ratios are likely to be optimistic despite the modest optimism bias and relatively high costs, as the uncertainty over the full impact of the new regulation on actual business plans cannot be eliminated.

Small and Micro Business Assessment (SaMBA)

121. The recommended policy is designed to deliver a Gigabit capable connection to residential and business properties in hold-up areas. The recommended policy option will only affect small and micro businesses indirectly, in that they will be able to benefit from the deployment of digital infrastructure.

122. We have not identified any small or micro telecommunications operators that would fall in scope of this policy and therefore be relevant in our analysis. On the telecoms operator side, most exceed the SaMB definition of fewer than 50 employees. For instance, even some of the smaller (compared to Openreach and Virgin Media) operators installing full fibre like Gigaclear¹⁰⁴, CityFibre¹⁰⁵ and Hyperoptic¹⁰⁶ have more than 100 employees and over 300 in some cases.

Distributional analysis

123. The proposed policy is likely to have three main distributional impacts: the effect on disabled people; carers; and urban and rural areas. In all cases, we expect to use the consultation to identify other groups that might be affected by this policy and to estimate the likely impact.

Disabled people and carers

124. Improved broadband connections will help disabled people and carers to enter the labour market through the prospects of teleworking. The employment rate for disabled people aged 16-64 is statistically lower than for non-disabled people across the UK¹⁰⁷; in 2017, the employment rate was 53.3% for disabled people compared with 75.1% for the general population¹⁰⁸. Instead, disabled people were more likely to be unemployed. There were approximately 362,000 unemployed disabled people aged 16-64 who want and are looking for a job in the UK in June 2018, giving an unemployment rate of 8.4%. That compared with an unemployment rate of 4.3% for the UK as a whole. Consequently, this policy has the potential to reduce these inequalities.

125. In comparison with the do nothing scenario, the (gross) number of disabled people and carers that enter employment can be up by 3,800 over 15 years (for option 2). Displacement¹⁰⁹ - which refers to the policy also having a reduction in the number of employed disabled people elsewhere due to displacement (i.e. reduced jobs for disabled people outside the impacted

¹⁰⁴ Gigaclear (2018), Annual report and accounts 2016. Available online at:

<https://www.gigaclear.com/wp-content/uploads/2016-Annual-Report-Gigaclear-Plc-FINAL-Companies-House.pdf>

¹⁰⁵ CityFibre (2018), Audited full-year results for the year ending 31 December 2017. Available online at:

https://irpages2.equitystory.com/websites/rns_news/English/1100/news-tool---rns---eqs-group.html?article=27370120&company=city

¹⁰⁶ Hyperoptic (2018), Report and financial statement: year ended 31 December 2017. Available online at: <https://beta.companieshouse.gov.uk/company/07222543/filing-history>

¹⁰⁷ ONS (2018), Employee earnings in the UK: 2018. Available at:

<https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/bulletins/annualsurveyofhoursandearnings/2018>

¹⁰⁸ People reporting having an Equality Act core and/or work-limiting disability

¹⁰⁹ This refers to the case where a policy may lead to an increase in outputs in one area, but also a reduction in outputs elsewhere. See previous section for a discussion on the topic

areas) - was estimated at 40% by SQW¹¹⁰. So, even after accounting for this, the policy is expected to have a positive, albeit small, effect on the number of employed disabled people overall.

Rural and urban areas

126. The present model has been developed in such a way that the analysis can be broken down into decile groups based on housing density and local authority. Due to the use of confidential data, local authority breakdowns were aggregated to NUTS1¹¹¹ regions. As is expected, the cost of installing a connection is generally higher in low density areas and lower in high density areas.

127. The estimated size of the hold-up area, as discussed above, varies depending on each model used. However the current estimates regarding it seem to indicate an even mix of urban/suburban (approximately 60%) and more rural areas (about 40%). This varies by geography as well, with England having the highest share of densely populated areas and Northern Ireland, Scotland, and Wales having a higher share of rural areas. With that in mind, the GVA impact at a nation level, as well as for urban/rural areas were estimated using the SQW model and are provided below.

Table E: Nation-level net GVA impacts in the best estimate scenario over 15 years in comparison to doing nothing, constant 2018 prices, £m

£m	Option 2	Option 3	Share%
England	1,606.6	1,702.0	79%
Northern Ireland	82.0	87.0	4%
Scotland	207.0	219.0	10%
Wales	151.0	160.0	7%
Total	2,046.0	2,169.0	100%
Urban	839.0	887.0	42%
Rural	1,127.0	1,201.0	58%
Total	1,966.0	2,088.0	100%

Source: DCMS own analysis based on SQW model

¹¹⁰ SQW (2013), UK Broadband Impact Study. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/85961/UK_Broadband_Impact_Study_-_Literature_Review_-_Final_-_February_2013.pdf

¹¹¹ Nomenclature of Territorial Units for Statistics (NUTS) are standard definitions of geographical areas used in statistics in Europe. The NUTS1 regions for the UK include: North East, North West, Yorkshire & Humber, East Midlands, West Midlands, South East, South West, Wales, Scotland and Northern Ireland.

128. The higher deployment costs for rural and remote areas, as well as areas with challenging geographies, is widely known. For example, the FTIR noted that these factors “increase the costs of deployment and reduce returns from fewer premises... [and] means the market is unlikely to reach them” . The Review will adopt an ‘outside in’ approach¹¹² to try and reach these, predominantly rural, areas which could involve using wireless and fixed technologies. The proposed EECC policy is planned to be able to work with other programmes - potentially including ‘outside in’.

Sensitivity analysis

129. This section looks at the sensitivity of the cost benefit analysis by adjusting some of the key assumptions. Of which, the main assumptions are around the level of the cost to install/upgrade connectivity, the optimism bias, and the rollout scenarios. The optimism bias and rollout scenarios can be shown to have the biggest impact on the costs benefit analysis.

Different cost estimates

130. Comparisons between the modelled cost estimates and those from other studies suggest that, while they are in line with the range for the various local geologies, they are often higher than the average figures. Consequently, the net present values and benefit cost ratios are likely to be understated. Several sensitivity analyses on cost benchmarks have been previously conducted, such as for the New builds assessment¹¹³, and the outputs have been reused here as well. Therefore no additional sensitivity analysis has been conducted here.

131. As part of the analysis, different front-loaded cost parameter values were used to forecast costs for network rollouts. Costs are largely derived from the rollout profiles, with different population density deciles being composed of different geographical characteristics and therefore costs (as described previously); gradual network roll-out completion by density decile informs the cost estimates. Therefore total costs are structured around the rollout profiles, providing a bottom-up view of the cost curves. This approach was preferred since there is already plenty of regarding costs structures from previous studies, as outlined in previous paragraphs. As a result no strong assumptions were made regarding the distribution of costs across time (front/even/back loaded). Regardless, a front-loaded cost parameter was used to align our projections more with established industry practice (as outlined previously, broadband investment tends to be front loaded), but only marginally interfered in producing the cost function, as can be seen in Figure B below.

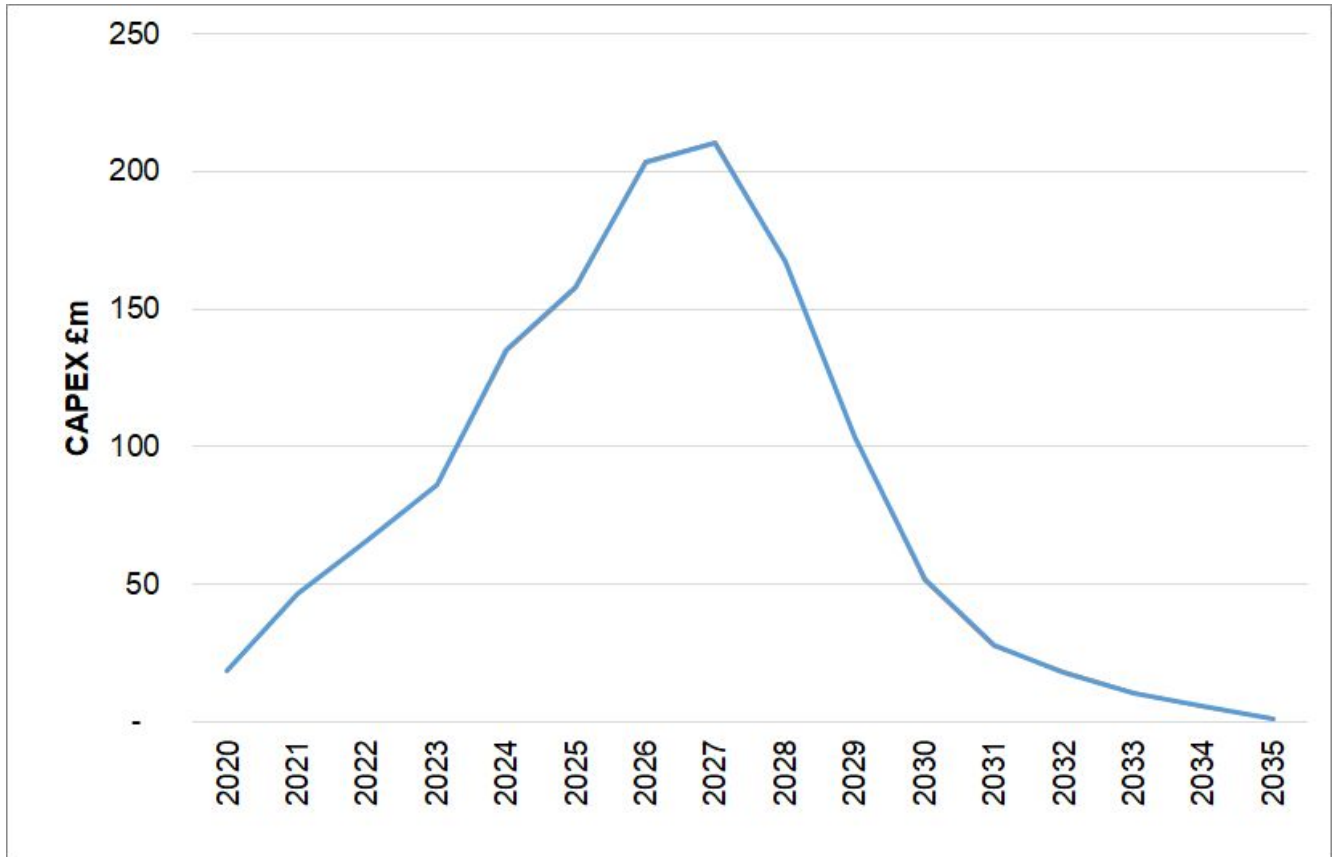
132. Sensitivity analysis was conducted regarding the effects on the cost-benefit analysis of changing the front-loaded cost parameters, but with negligible effects being identified. A maximum of 10% was used in the parameter analysis, as using any value higher than that

¹¹² DCMS (2018), ‘Future Telecoms Infrastructure Review’. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/727889/Future_Telecoms_Infrastructure_Review.pdf

¹¹³ DCMS (2018), “New Build Developments: Delivering gigabit-capable connections”. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/752146/New_Building_Developments_Impact_Assessment_FINAL.pdf

resulted in negative CAPEX in the period 2034-2035. A parameter value of 0.02% was used eventually to retain the effects of the bottom approach to the fullest extent.

Figure C: Different Capex profiles based on front-loaded parameters for best estimate scenario, option 2



Source: DCMS own analysis

Optimism Bias

133. The optimism bias used in the main analysis is 34.85%, relatively close to the 44% upper bound, which is based on non-standard civil engineering projects within the HM Treasury Green Book. However, the costs involved in this policy are relatively known and while we test the upper bound optimism bias as part of our sensitivity analysis, ultimately we believe that 34.85% appears to be more accurate. For example, the process for installing full fibre connections is proven and in use today. Similarly, the input costs to this model are based on BDUK approximations of the cost of delivery by different suppliers in different areas. Given this, the optimism bias could reasonably be lower than the one used.

134. Table F shows the impact on the cost benefit analysis for different optimism biases ranging from 3% (lower bound) to 44% (upper bound, HMT's Green Book). The analysis suggests that an optimism bias of up to around 38% would generally produce a positive net present value even when discounting welfare benefits, while when including them even the 44% upper limit returns highly positive results.

Table F: Sensitivity analysis of different optimism bias (all benefits of best estimate scenario relative to do nothing), constant 2018 prices, £m

Optimism Bias	Option 2		Option 3	
	Without Welfare benefits	With welfare benefits	Without Welfare benefits	With welfare benefits
Social net present value, £ millions				
3%	901.3	5,597.8	1,020.5	5,986.3
10%	626.2	4,706.6	714.6	5,028.8
20%	316.6	3,641.4	368.6	3,883.9
35%	4.5	2,593.5	17.7	2,755.1
44%	-116.3	1,823.1	-120.7	1,929.9

Source: DCMS own analysis based on SQW model

Rollout scenarios

135. In the main analysis, it was assumed that the entirety of the hold-up areas will not be covered even in the best case scenario. This was applied to derive a more pessimistic benefits profile, rendering the upper bound of coverage of hold-up areas to 65% (option 3), based on the optimism bias parameter. Sensitivity analysis was conducted by benchmarking the optimism bias and the results can be found above. Shifting the optimism bias changed not only the costs upwards, but also the extent of the rollouts downwards with the least optimistic scenario predicting a 56% network coverage (i.e. 100% - 44% optimism bias), with the net present value of the legislation remaining positive in all scenarios.

Risks and mitigating factors

Policy Risks

Full fibre investment incentives do not materialise

136. Per the General Objectives set out in **Article 3**, the EECC is designed to promote the deployment of VHCN, which includes full fibre and 5G in addition to upgrades to legacy infrastructure that use older technologies. This technology-flexible¹¹⁴ approach will allow for flexibility as new innovations around quality and speed emerge – though may not protect against prolonging costly reliance on legacy networks. This is mitigated by:

The pro-investment focus of the EECC overall, as providers choosing to deploy their own networks rather than rely on access to legacy infrastructure are likely to choose a future-proof technology for deployment; and

Ofcom's continued focus on promoting the deployment of full fibre.

¹¹⁴ Whilst a number of technologies could comprise VHCN, the inclusion of fibre elements in the definition implies a shift away from pure technological neutrality.

Uncertain consumer outcomes

137. In its EECC impact assessment, the EC acknowledges that a shift away from ex ante regulation, and towards longer market review cycles, would result in a more hands-off approach to shaping consumer outcomes. It found that this would be set off against the benefits of a competitive market on consumer outcomes. FTIR analysis found that competitive investment is key to improving consumer outcomes, in terms of choice, service quality, innovation and price over the longer-term.

Strategic play entrenching market power

138. A reduction in SMP obligations including a shift towards an alternative approach, and additional symmetrical mechanisms such as transparency, can encourage investment for SMP providers and their competitors. Implementation and regulatory decisions could affect the balance of these advantages with regards to the geographic survey and forecasts under Article 22, and forbearance under certain SMP co-investment scenarios under Article 76.

139. The granularity of geographic survey and forecast information made directly accessible under Article 22 will have implications for opportunities for strategic play. It is unlikely that information that providers consider to be commercially sensitive will be shared publicly. It is also unlikely that Ofcom will publish information that could result in a breach of competition law, or fail to act where there is evidence of a breach.

140. Sharing information on specific areas' coverage prospects once the designation process has kicked in will be restricted to about 10% of the country, a decade from now. We anticipate that it will create competitive incentives to seek first-mover advantage – including through earlier network extension, to support the business case for new network deployment in adjacent areas. It is reasonable to assume that all mechanisms within the EECC will be compliant with EU competition law.

141. With regards to Article 76, advance knowledge of the co-investment conditions that would mandate forbearance on SMP obligations has the potential to create opportunities for SMP providers to circumvent necessary SMP obligations. This will depend on the type of advance guidance Ofcom provides on criteria to qualify for co-investment.

Competition does not develop

142. In addition to the risk of entrenched market power at national level, certain transparency measures may give operators enough information to plan deployment in a way that may lead to the formation of regional monopolies. Here, again, it is unlikely that Ofcom will publish information that could result in a breach of competition law, or fail to act on breaches of competition law should they arise. We also anticipate that providers will continue to deploy in areas where the profit is commensurate with the level of risk assumed – including in areas where they would have to share the market.

Modelling Risks

143. There are risks to the proposed policy, both on the upside and downside. This includes:

Potential cost efficiencies. The model does not account for any cost efficiencies with delivering connectivity. It could be the case that factors such as 'dig once' where infrastructure can be delivered at the same time can reduce installation costs. Similarly, the underlying cost inputs to the model are based on 'upgrade' costs only, so there could be some further cost efficiencies as it would be 'first fit'. We will use the consultation to gauge the prospect of these cost efficiencies and introduce them as part of sensitivity to the economic appraisal.

Potential overestimation of coverage targets. It is likely that actual additional coverage unlocked by the proposed legislation is overestimated even when using the maximum optimism bias (44%). While several shareholders, especially competitors of the incumbent, have already indicated the value of the legislation in boosting competition and expected rollouts, it remains an uncertain scenario that requires to be modeled and therefore conservative estimates were preferred. The public consultation will be used to update these estimates according to telecom operators' own estimates.

Monitoring and evaluation

144. As part of this policy, a Post Implementation Review (PIR) will be conducted five years after implementation. Some of the research questions that we propose in order to assess impact include:

- Has the policy been successful in deploying fibre in hold-up areas? If so how actual coverage matches the forecast scenarios?
- Is the rationale for intervention still valid? For instance, whether the information failures that existed between telecoms operators and the regulator still persist.
- Business impacts - what were the overall impacts on business?
- Direct and indirect impacts - did the assumed impacts occur and were there others that were not identified both direct and indirect?
- Cost assessment - did any efficiencies materialise and potentially decrease total costs?
- Assessment of compliance and enforcement - Did stakeholders comply, if not, how did Government respond to ensure adherence to the policy?
- Market structure impacts - was there any impact on the market structures of network providers?

Annex: Glossary of terms

Term	Definition
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5G	The term used to describe the next generation of wireless networks beyond 4G LTE mobile networks. 5G is expected to deliver faster data rates and better user experience. Technical standards are still under development and are likely to include both an evolution of existing and new radio technologies. Generations of technology are often defined as 2G (the introduction of rudimentary data and SMS services), 3G (upgraded online data services and connectivity quality), 4G (introduction of high-speed data services).
5G Testbeds and Trials programme	A programme that coordinates the development of 5G services and applications through a series of trials, which contribute to the development of the 5G ecosystem across the UK.
Access	The making available of facilities and/or services to another undertaking, under defined conditions, on either an exclusive or non-exclusive basis, for the purpose of providing electronic communications services, including when they are used for the delivery of information society services or broadcast content services.
Bandwidth	The measure of the maximum capacity of a data link in the network.
Body of European Regulators for Electronic Communications (BEREC)	The Body of European Regulators for Electronic Communications (BEREC) was created in 2009 to improve consistency of the EU telecoms rules and to contribute to the development of the Single Market. The mission of BEREC is to assist the Commission and the national regulatory authorities (NRAs) in the implementation of the EU telecoms rules, to give advice on request and on its own initiative to the European institutions and to complement at European level the regulatory tasks performed at national level by the regulatory authorities.
Broadband	A service or connection generally defined as being 'always on' and providing a bandwidth greater than narrowband. Broadband has been the norm for Internet connectivity (non-mobile) since the mid-2000s, with ADSL being the first mainstream technology standard adopted.
Bundled offers, services, or 'bundles'	A contract that includes more than one service, such as a landline, broadband, pay TV and/or mobile service. The majority of Internet broadband services in the UK come bundled with a telephone line, and increasingly so with a pay-TV offer.

Competent Authority	A person or organisation that has the capacity and legally delegated authority to perform the functions assigned to it. In many places, for example spectrum management, the EECC updates the current framework to give Member States the flexibility of assigning certain functions to a competent authority other than the National Regulatory Authority.
Devolved Administrations	The governments of the devolved nations of the UK. These are the Scottish Government, the Welsh Government and the Northern Ireland Executive.
European Commission	The European Commission is the EU institution that has the monopoly on legislative initiative and important executive powers in policies such as competition and external trade. It is the principal executive body of the European Union and it is formed by a College of members composed of one Commissioner per Member State.
European Electronic Communications Code (EECC)	The EECC is a European directive setting out current rules for telecoms. The EECC will replace the following four existing telecoms directives: Framework, Access, Authorisation and Universal Service.
EU institutions	There are a number of EU bodies which are defined under the Treaties as EU institutions including the European Parliament, the European Council, the Council of the European Union and the European Commission.
Electronic Communications Network	Transmission systems, whether or not based on a permanent infrastructure or centralised administration capacity, and, where applicable, switching or routing equipment and other resources, including network elements which are not active, which permit the conveyance of signals by wire, radio, optical or other electromagnetic means, including satellite networks, fixed (circuit- and packet-switched, including internet) and mobile networks, electricity cable systems, to the extent that they are used for the purpose of transmitting signals, networks used for radio and television broadcasting, and cable television networks, irrespective of the type of information conveyed.
Fibre to the Premises (FTTP), or Full Fibre	An access network using optical fibre to provide the connection between the local exchange and the end users' houses or business premises. The optical fibre may be point-to-point – a dedicated fibre connection for each home – or may use a shared infrastructure such

	as GPON (Gigabit passive optical network). This type of connectivity is considered in general more reliable and being capable of providing higher throughput and speeds than legacy copper-based networks (i.e. DSL services provided over telephone lines).
Future Telecoms Infrastructure Review (FTIR)	The FTIR, published in July 2018, set out a national, long-term strategy for digital infrastructure in the UK, with the aim of securing world-class connectivity that is gigabit-capable, reliable, secure and widely available.
General Conditions of Entitlement, or ‘General Conditions’	Regulatory conditions that all providers of electronic communications networks and services must comply with in order to provide services in the UK.
GHz	Gigahertz – a unit of frequency of 1 billion cycles per second.
Gigabit-capable networks	A network connection that is capable of achieving 1,000 Megabits per second (Mbps), i.e. 1 Gigabits per second (Gbps), download speeds.
Interconnection	The physical and logical linking of public communications networks used by the same or a different undertaking in order to allow the users of one undertaking to communicate with users of the same or another undertaking, or to access services provided by another undertaking. Services may be provided by the parties involved or other parties who have access to the network. Interconnection is a specific type of access implemented between public network operators.
Latency	The amount of time a message takes to travel across a system.
National Regulatory Authority (NRA)	The body or bodies charged by a Member State with any of the regulatory tasks assigned in the EECC. Ofcom is the UK’s National Regulatory Authority and is responsible for regulating the telecoms, broadcasting, and postal sectors.
Number-independent interpersonal communication service (NIICS)	An interpersonal communications service which does not connect through the use of publicly assigned numbering resources, namely, a number or numbers in national or international numbering plans, or which does not enable communication through a number or numbers in national or international numbering plans. This includes several over-the-top (OTT) communication apps that allow users to communicate using Internet Protocol (IP) communications. Some OTT communication apps enable voice-over-ip (VoIP) using assigned

	numbered resources while being enabled by the Internet.
Ofcom	Ofcom is the regulator and competition authority for the UK communications industries. It regulates the TV and radio sectors, fixed line telecoms, mobiles, postal services, plus the airwaves over which wireless devices operate.
Ofgem (Office of Gas and Electricity Markets)	Ofgem is the independent regulator for the electricity and gas industries. It is a non-ministerial government department and an independent National Regulatory Authority, recognised by EU Directives. Its principal objective when carrying out its functions is to protect the interests of existing and future electricity and gas consumers.
'Outside-in' approach	The Government's approach to ensure connectivity across all areas of the UK is achieved at the same time, and no areas are systematically left behind.
Over the top (OTT) services	An Over-The-Top (OTT) application is any digital product that disrupts or provides an alternative to the traditional billing models of telcos or cable/satellite companies.
Spectrum	The descriptor of the range of electromagnetic frequencies which can be modulated to carry information. Spectrum is a finite resource and a critical national asset that the Government wants to ensure is maximised for its economic and social value.
Significant market power (SMP)	A communications provider is deemed to have significant market power if, either individually or jointly with others, it enjoys a position in the market equivalent to dominance, that is to say a position of economic strength affording it the power to behave to an appreciable extent independently of competitors, customers and ultimately consumers.
Statement of Strategic Priorities (SSP) for Ofcom	As described in Clause 98 of the Digital Economy Act 2017, the SSP will set out the Government's strategic priorities for Ofcom in telecommunications, the management of radio spectrum, and postal services. Under the legislation Ofcom must have regard to the Statement when carrying out its regulatory functions.
Universal service obligation (USO)	A legal right established by the UK Government for everyone to access high speed fixed broadband (10 Mbps download, 1 Mbps upload) if they do not have it, subject to a cost threshold.

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