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Evaluation of the Economic Impact and Public Value of the Superfast Broadband Programme

Final Report

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Glossary

Additionality	The extent to which the outcomes of public sector intervention would have not have occurred in its absence
APS	Annual Population Survey
Bandwidth	The amount of data that can be transferred in a fixed amount of time
BCR	Benefit to cost ratio – the value of the benefits of a policy relative to its costs
BDUK	Broadband Delivery UK
Benefit	Describes those impacts that can be understood as a social benefit under the guidelines of the Green Book
Black postcodes	Postcodes expected to receive superfast coverage from multiple commercial suppliers
Crowding-out	The extent to which public spending reduces levels of private investment
DCMS	Department for Digital, Culture, Media and Sport
Deadweight	Outcomes that would have been delivered in the absence of public intervention
Digital Divide	Difference in connectivity between areas, with some areas having access to much faster speeds than others
Displacement	Describes effects in product markets where the growth of one firm will results in the loss of market share for its competitors
DWP	Department for Work and Pensions
Fixed effects	Fixed effects refers to econometric models applied to compare outcomes over time that accommodate unobserved characteristics of areas or businesses that do not change over time
Gainshare	Gainshare refers to the contractual mechanism included in contracts that obliged suppliers to return a share of future revenues to the public sector if take-up was greater than expected
GVA	Gross Value Added – the value added in the production process, and measured as the sum of wages and profits
Grey postcodes	Postcodes expected to receive superfast coverage from a single commercial supplier
Home nations	England, Wales, Scotland and Northern Ireland
Hyperfast	Hyperfast loosely refers to download speeds in excess of 500Mbit/s
JSA	Job Seekers Allowance
Impact	Impacts are the effects on the outcome that are attributable to the Superfast Broadband programme over and above what would have occurred in the absence of the programme
Mbit/s	Megabits per second
NGA	Next generation access, describing technologies that can deliver superfast speeds including Fibre to the Cabinet (FTTC) or Fibre to the Premises (FTTP).

Outcome	Outcomes are social or economic measures that could be affected by the Superfast Broadband programme (e.g. jobs, turnover, life satisfaction)
OMR	Open Market Review – consultation process used by BDUK and local authorities to establish the superfast roll-out plans of suppliers
ONS	Office for National Statistics
PAYE	Pay As You Earn
Productivity	Productivity refers to the effectiveness of production as measured by the rate of GVA per unit of input.
SRS	Secure Research Service
Sorting Effects	Describes effects where firms or individuals change their location in response to public intervention
Spill over	Spill over build refers to the additional infrastructure brought forward that was not directly subsidised by the programme and that would not otherwise have taken place.
Superfast	Superfast speeds refer to download speeds of at least 24Mbit/s (as applied by BDUK) or 30Mbit/s (as applied by Ofcom)
Take-up	The share of premises receiving subsidised superfast coverage taking up superfast broadband services
Ultrafast	Ultrafast speeds refer to speeds in excess of 300Mbit/s
Underspend	Underspend occurs when the actual investment costs are lower than the budget defined in contracts
VAT	Value Added Tax
White postcodes	Postcodes not expected to receive superfast coverage under the commercial plans of suppliers

1. Executive Summary

Ipsos MORI (with Simetrica, George Barrett and Dr. Pantelis Koutroumpis) were commissioned by the Department for Digital, Culture, Media and Sport (DCMS) in May 2017 to undertake an evaluation of the economic and public value impacts of the Superfast Broadband programme. This report sets out the results of the evaluation.

Superfast Broadband programme

The Superfast Broadband programme was announced in 2010/11 in response to concerns that the commercial deployment of superfast¹ broadband would fail to reach many parts of the UK. On the expectation that extension of superfast broadband coverage to these areas would produce economic, social and environmental benefits, the Government established the programme to fund further deployment. The scheme was initially backed by £530m of public funding, with the aim of extending superfast coverage to 90 percent of UK premises by early 2016. The programme was expanded in 2015, with a further £250m made available to extend coverage to 95 percent of premises by the end of 2017. Broadband Delivery UK (BDUK), a directorate of DCMS, is the accountable body for the programme. An additional two percent of premises will receive superfast under existing BDUK contracts. The Future Telecoms Infrastructure Review² sets out options to cover the remaining three percent, including the Universal Service Obligation.

Evaluation aims and objectives

The aim of this evaluation was to address the following questions:

- What are the outcomes of the scheme?
- How has the behaviour of individuals and organisations changed?
- How effective and efficient has the delivery of the programme been?
- Was the investment cost effective?
- What can we learn to improve future policy designs and implementation?

The study does not seek to provide a complete answer to all these questions and forms a part of a wider DCMS programme of evaluation and research. This evaluation focuses on the impact of the programme between June 2012 and June 2016 owing to data availability at the time of writing. However, more up to date measures of some outcomes (such as take-up) are provided where available.

The quantitative results of the evaluation are based on comparisons between postcodes receiving subsidised coverage and a group of white postcodes sharing similar features. A variety of statistical techniques were applied to developing findings that are robust to unmeasured differences between these areas or external drivers of change that could distort

¹ Defined as download speeds of at least 24 megabits per second.

² <https://www.gov.uk/government/publications/future-telecoms-infrastructure-review>

findings. Measures of the economic impact of the programme have been developed that are net of possible offsetting effects arising from the relocation of firms to postcodes receiving subsidised coverage or through the loss of market share of competing firms.

Programme overview

- **Expected impacts:** A range of impacts were expected from the programme including accelerated roll-out of superfast broadband across the UK, increased productivity and employment growth amongst firms benefiting from enhanced access and improved quality of life for citizens.
- **Programme Delivery:** The programme had funded deployment of superfast broadband to 4.8m premises in the UK by December 2017. Most of these premises were residential in nature, and located in rural areas with low population densities.
- **Areas benefitting from investment:** Data held by BDUK suggests that the postcodes benefitting from subsidised coverage were associated with features thought to increase the costs of upgrading local broadband infrastructure and reduce potential revenues. This signals that the resource allocation process was effective in diverting resources to areas where infrastructure upgrades were less commercially viable.

What are the outcomes of the scheme?

The results of the evaluation indicate that the scheme had a significant net impact in extending superfast coverage to premises and postcodes that would not have received it under the commercial plans of suppliers³:

- **Superfast coverage:** It was estimated that 2.5m premises received access to superfast speeds that would not have done so without the programme by June 2016. Additionally, it is estimated that a further 1m premises received superfast coverage one to two years earlier than they would have done otherwise.
- **Take-up:** Take-up of superfast broadband services has grown over time and exceeded the expectations of suppliers. Management information held by BDUK show that average take-up rates reached 38 percent for premises upgraded under Phase One of the programme at the end of March 2017 and 20 percent for those upgraded under Phase Two.

³ Based on comparisons with 'white' postcodes that did not receive subsidised coverage.

These impacts on connectivity have fed through to a range of local and national economic impacts:

- **Impact on performance of local firms⁴:** The evidence indicated that making superfast broadband speeds available improved local economic performance. It is estimated that postcodes benefitting from subsidised coverage saw employment rise by 0.8 percent and turnover grow by 1.2 percent in response to improved infrastructure. Overall, it is estimated that subsidised superfast coverage led to the creation or retention of 49,000 additional jobs on those postcodes that received upgraded infrastructure. The total turnover of firms located on those postcodes also expanded by almost £9.0bn (per annum) in response to the upgraded infrastructure. The productivity of local economic activity, as approximated by turnover per worker⁵, also increased by 0.32 percent as a result of faster available download and upload speeds, accounting for £2.1bn of overall turnover growth. There was evidence, however, that over 80 percent of these impacts were driven by the relocation of firms to postcodes receiving subsidised coverage.
- **Effects of ultrafast and hyperfast broadband:** Exploratory research examining the effects of faster fixed broadband speeds delivered with and without public subsidy suggested that the economic impacts of broadband increase substantially with faster speeds.
- **Productivity gains:** Making superfast broadband speeds available also appeared to raise the productivity of firms that did not change location while the programme was delivered. It was estimated that subsidised coverage raised the turnover per worker of these firms by 0.38 percent, broadly consistent with other estimates of the impact of faster broadband in the UK, equivalent to £1,390 in GVA per firm per annum. This gives assurance that the economic impacts of the programme were not purely driven by the relocation of firms. Assuming the results reflect underlying efficiency improvements, it is estimated that the programme led to a net increase in national economic output (GVA) of £690m by June 2016⁶.
- **Unemployment:** Subsidised coverage also supported reductions in unemployment in the areas benefitting from the programme. It was estimated that subsidised coverage reduced the number of individuals claiming Jobseekers Allowance (JSA) by 8,800 by 2016, as well as reducing the number of long term claimants (those claiming JSA for 12 months or longer) by 2,500. These impacts are estimated to have increased national economic output by a further £38m by June 2016⁷.

⁴ These estimates are based on comparisons with postcodes that did not receive subsidised coverage but have not been adjusted for deadweight associated with investment in infrastructure, or for displacement of economic activity between areas of the UK.

⁵ The costs of purchasing goods and services ought to be relatively stable in the short term, and this proxy measure used is considered reasonable proxy for GVA per hour or per worker.

⁶ Net of displacement and crowding out, and allowing for deadweight associated with investments in infrastructure.

⁷ Again, net of displacement and crowding out, and allowing for deadweight associated with investments in infrastructure.

- **Out of work benefits:** There was no evidence that the programme reduced economic inactivity, at least amongst those claiming out of work benefits⁸.

In addition, there was also evidence that subsidised coverage raised the wellbeing of households benefitting from access to superfast broadband services:

- **Use of the internet:** Primary research (including both surveys and qualitative interviews of households in relevant areas) indicated that while use of the internet is similar across areas receiving subsidised coverage and those that did not, there was some evidence of greater reliance on the internet among those in upgraded areas. Households in areas receiving upgrades tended to use social networks more frequently, and considered the internet to have a more important role in connecting them to others in this way. Similarly, those in upgraded areas were more likely to consider the internet to be essential to accessing entertainment content. The role of the internet in accessing educational content also emerged as an area of growing importance.
- **Importance of speed and reliability:** Participants in the research found connection reliability to be more important than overall speed potentially because issues with reliability (such as dropped connections) were more noticeable for all except those with the slowest internet speeds. However, there may be some overlap between these two concepts in participants' minds too: a connection that is so slow that webpages do not load could be considered the result of a dropped or slow connection.
- **Impact on wellbeing:** Evidence from the survey did not show any significant differences in the subjective wellbeing of respondents in upgraded and non-upgraded areas. However, more rigorous econometric analysis using larger sample sizes suggested the programme had a positive effect on wellbeing, although there were variable effects across age groups. These benefits were valued at £222.25 per premises upgraded per annum. The total net value of the wellbeing impacts of subsidised coverage was estimated to be £932m by June 2016.
- **Future impacts:** The development and roll-out of transformative technologies relying on greater bandwidth were only at a nascent stage in 2016, and the quality of life benefits from the programme may largely arise in the future. Indeed, the programme may also contribute to accelerating their development and adoption through expanding the potential addressable market and increasing incentives to invest.

⁸ The main out of work benefits comprise Jobseeker's Allowance, Employment Support Allowance, Incapacity Benefits and Income Support.

How has the behaviour of individuals and organisations changed?

This section summarises evidence about the effect of the programme on the behaviour of individuals and businesses benefitting from subsidised coverage:

- **Business outcomes:** The evaluation indicated that superfast connectivity proved influential in firm relocation decisions, with a high share of the local economic impacts driven by firms moving to postcodes with subsidised coverage. There may have been offsetting impacts elsewhere as a result. As no qualitative research was completed with the businesses benefitting from enhanced access to superfast broadband as part of this study, it not possible to provide detailed insight into how the programme led to its apparent economic impacts. This could be explored in future research.
- **Labour market matching and teleworking:** The evidence suggested that upgrades to non-residential premises were the primary driver of reductions in unemployment. There was less evidence that subsidised coverage enabled workers to more effectively search for work or to take up teleworking roles and any impact of this nature was small relative to the impact of local job creation. This could be explained if the types of teleworking role expected have not emerged on the scale anticipated, or if lower income residents were either unable to pay the costs of superfast broadband or did not have the skills to access these opportunities. Further research with workers would be required to understand any constraints in more detail. It should also be noted that this evaluation did not explore the impact of the programme on individuals that were not claiming out of work benefits.
- **Household bandwidth needs:** While average maximum available download speeds rose from 20Mbit/s to 64Mbit/s on those postcodes receiving subsidised coverage, businesses appeared to derive more significant benefits from the technology than households. Qualitative research with 36 households on upgraded and non-upgraded postcodes provided some insight into the factors that may be driving this result. Internet use was similar across both groups of households interviewed, with few appearing to use the internet for purposes that required high bandwidths. Households in upgraded areas that had not opted to move to higher speeds tended to report that their current internet speeds were sufficient for their needs, while those that had upgraded were typically motivated by factors other than a direct need for faster download speeds, such as a feeling of wanting “the best”. Interviews with a small number of households with very low fixed broadband speeds suggested that they found alternatives, such as mobile broadband. It should be noted that high speed networks are expected to drive more significant social impacts by enabling remote service delivery, such as remote and real-time medical diagnostics. The development and roll-out of these technologies were only at a nascent stage in 2016, and the programme may have a larger impact on quality of life in the future. The programme may also contribute to accelerating the development and adoption of these applications by expanding the potential market and increasing incentives to invest.

How effective and efficient has the delivery⁹ of the programme been?

This section summarises evidence about on the efficiency and effectiveness of the programme in extending and accelerating superfast roll-out:

- **Short term additionality:** The evidence suggested that the programme created incentives for suppliers to extend coverage to premises that would not have otherwise received it. It was estimated that over 70 percent of premises upgraded with BDUK subsidies would not have received NGA coverage within two years of the upgrade. In this respect, the Open Market Review process was largely effective in encouraging suppliers to reveal their short term commercial plans.
- **Additionality in the medium term:** There was evidence that for a share of premises upgraded, the impact of the scheme was to accelerate access to superfast broadband in addition to bringing coverage to premises that would not have received it at all. This implies falling additionality as time passed following the installation. The estimated share of premises that would not have otherwise received superfast coverage is estimated to lie between 39 and 62 percent by June 2016¹⁰.
- **Changing commercial conditions:** The evidence indicated that commercial viability increased with time as take-up rates rose. This would explain declining rates of additionality, as suppliers may have otherwise been encouraged to expand their commercial roll-out plans at a later date by greater expected revenues. It is also possible that the programme led to a process of demand discovery that encouraged providers to expand their commercial roll-out programme. BDUK will continue to monitor additionality over time.
- **Contractual protections:** The underspend and take-up gainshare mechanisms had a significant role in protecting the value for money associated with the programme. These protections have reduced the expected net cost of the programme to the public sector from £1.6bn to £1.1bn, although this is dependent on anticipated future take-up. This implies that the public sector is not expected to incur costs on a share of premises that would have been upgraded by the market without the programme. This would raise the average rate of additionality by June 2016 from 60 to 84 percent, provided future take-up aligns with expectations. In the absence of these protections, the estimated unit cost per premises upgraded would have risen by 40 percent.

⁹ The evidence refers to the delivery of high speed connections, rather than the operational delivery of the programme. A process evaluation of the programme will be the subject of further research and evaluation, commissioned by DCMS.

¹⁰ A variety of different approaches were applied to explore the impact of the programme on superfast coverage. These approaches had varying levels of robustness and generalizability, resulting in a range of estimates for the impact of the programme.

Was the investment cost effective?

- **Overall value for money:** An indicative analysis of the costs and benefits of the scheme to date suggests that it delivered an acceptable payback by June 2016. The overall value of the additional economic and public value benefits brought about by the programme over this period were estimated at £1.7bn against the forecast net costs to the public sector of upgrades completed by June 2016 of £848m. This gives an estimated benefit to cost ratio of £1.96 per £1 of public sector spending to date¹¹, suggesting that the programme is close to meeting the rates of return typically required for the approval of public sector investment decisions. This is an early assessment of the net benefits of the programme (3-4 years) and does not factor in any future benefits associated with the infrastructure upgraded. These are likely to rise as take-up increases and as more bandwidth intensive applications are developed. At the same time, results also showed that additionality declines with time, so there may be a limit to the total net benefits that may eventually be realised.

What can we learn to improve future policy design and implementation?

This section summarises evidence about lessons learnt from the evaluation and how they might be applied in future policy design or delivery:

- **Resource allocation process:** The contracts developed to procure the programme have offered the public sector the opportunity to share the profits of higher than expected take-up. The gainshare mechanism is rarely employed in public sector programmes involving financial support to the private sector, and could have more widespread applicability. It is possible to speculate as to the underlying success factors. For example, it was possible to monitor take-up with accuracy over time, enabling enforceable conditions to be written into contracts, which may be less straightforward in other areas of Government policy. Further research into its potential transferability could be beneficial, particularly given that cross Government learning for large procurement programmes was a key benefit anticipated from the programme.
- **Role of broadband in economic development:** The findings corroborate other research that highlights the role of fixed broadband in raising economic performance by improving the efficiency of firms. The evaluation also suggested that broadband availability influences the spatial pattern of economic development outcomes, although there were signals that these impacts are mainly significant at local levels. This may be a function of the comparatively widespread availability of superfast broadband - ultrafast and hyperfast speeds could potentially have more significant impacts on the performance of local economies.

¹¹ Past research on the potential benefits of the programme explored effects over much longer time horizons (up to 2035).

- **Residential and non-residential deployment:** The evidence from the evaluation suggests that while firms have used faster speeds to improve efficiency, households appear to have less intensive bandwidth requirements and derive smaller benefits from consuming superfast services. The estimated benefit to cost ratio of residential and non-residential coverage was £1.18 and £12.28 respectively. This does not necessarily imply that BDUK could have attained greater value for money by delivering a smaller programme with a higher level of targeting of non-residential premises. The unit costs associated with a more targeted initiative would likely have been higher, and the practicalities of building networks in non-residential areas difficult to manage. Additionally, much of the quality of life improvements associated with the programme are expected to arise in the future, and it is too early to make a judgement as to the relative costs and benefits of residential and non-residential deployment.

2. Introduction

Ipsos MORI (with Simetrica, George Barrett and Dr. Pantelis Koutroumpis) were commissioned by the Department for Digital, Culture, Media and Sport (DCMS) in May 2017 to undertake an evaluation of the economic and public value impacts of the Superfast Broadband programme. This report sets out the results of the evaluation.

2.1. Superfast Broadband programme

The Superfast Broadband programme was announced in 2010/11 in response to concerns that the commercial deployment of superfast¹² broadband would fail to reach many parts of the UK. On the expectation that extension of superfast broadband coverage to these areas would produce economic, social and environmental benefits, the Government established the programme fund further deployment. The scheme was initially backed by £530m of public funding, with the aim of extending superfast coverage to 90 percent of UK premises by early 2016. The programme was expanded in 2015, with a further £250m made available to extend coverage to 95 percent of premises by the end of 2017. Broadband Delivery UK (BDUK), a directorate of DCMS, is the accountable body for the programme. An additional two percent of premises will receive superfast under existing BDUK contracts. The Future Telecoms Infrastructure Review¹³ sets out options to cover the remaining three percent, including the Universal Service Obligation.

2.2. Evaluation questions

2.2.1 Aims and objectives of the evaluation

The aim of this evaluation was to address the following questions:

- What are the outcomes of the scheme?
- What changed in individuals/organisations behaviour for these outcomes to come about?
- How effective and efficient has the delivery of the programme been?
- Was the investment cost effective?
- What can we learn to improve future policy designs and implementation?

The study does not seek to provide a complete answer to these questions and forms part of a wider DCMS programme of evaluation and research. The following subsections put the study into the context of this wider evaluation framework.

¹² Defined as download speeds of at least 24 megabits per second.

¹³ <https://www.gov.uk/government/publications/future-telecoms-infrastructure-review>

2.2.2. *Benefits Realisation Plan*

The anticipated benefits of the Superfast Broadband programme are defined in the Benefits Realisation Plan¹⁴ prepared by BDUK¹⁵. These encompass a broad range of social, economic and environmental outcomes and this study focuses exclusively on those aspects relating to reducing the digital divide, productivity growth, employment and aspects of public value. Qualitative research with suppliers and businesses benefitting from enhanced connectivity was deemed out of the scope of this study. As such, the study only seeks to provide partial coverage of the second evaluation question defined in the preceding subsection.

Table 2.1: BDUK Benefits Realisation Framework

Benefit Type	Measure	In Scope?
Productivity growth	• Increased business productivity	
	• New businesses established	
	• Increased ICT skills and wider education	
Employment	• Employment (safeguarded or new)	
Public sector efficiency	• More efficient delivery and increased access to public services	
	• Cross-Government learning for large procurement programmes	
Digital divide	• Reducing the digital divide	
Public value	• Improved quality of life and wellbeing	
	• Consumer savings	
Environment	• Reduced impact on the environment	
Stimulating the broadband market	• Innovation and knowledge of new technologies	
	• Stimulated private sector partnerships and investment	
	• Market failure addressed through appropriate intervention	
	• Increased competition in the market, including small suppliers	

Source: *Superfast Broadband programme Benefits Realisation Plan, BDUK*

¹⁴ Based on a range of sources including the UK Broadband Impact Study, <https://www.gov.uk/government/publications/uk-broadband-impact-study--2>.

¹⁵ Aligning with the key benefits management principles set out by the IPA: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/671452/Guide_for_Effective_Benefits_Management_in_Major_Projects.pdf.

2.2.3 State Aid Evaluation Plan

In addition, BDUK agreed a separate Evaluation Plan¹⁶ with the European Commission as part of the State Aid judgement. This defines seven questions of importance to the evaluation under the themes of reducing the digital divide and stimulating the broadband market. This evaluation explores how far aid produced increased access to NGA networks, take-up of services made available, and the strength of the incentive effect on aid beneficiaries. It does not seek to answer questions relating to effects on competition, which will be the focus of a separate programme of research and evaluation.

Table 2.2: State Aid Evaluation Plan Questions

Reducing the Digital Divide		Stimulating the Broadband Market	
	In scope?		In scope?
<ul style="list-style-type: none"> To what extent has the aid resulted in increased access to an NGA network in white NGA areas? 		<ul style="list-style-type: none"> Has the aid had a significant incentive effect on aid beneficiaries? 	
<ul style="list-style-type: none"> To what extent has the target of the intervention been used and what speeds are available? 		<ul style="list-style-type: none"> Has the aid had a material effect on the market position of the direct beneficiaries? 	
		<ul style="list-style-type: none"> Is there evidence of changes to parameters of competition arising from the aid? 	
		<ul style="list-style-type: none"> Is the gap funding model efficient compared to alternative schemes? 	
		<ul style="list-style-type: none"> Did the aid lead to commercially sustainable networks? 	

2.3. Methodology

Evidence to support the evaluation was collected using the following methods:

- Theory of change development:** The evaluation planning stage was used to agree a description of the process by which the Superfast Broadband programme was expected to lead to its intended impacts on connectivity, employment and productivity growth, and the quality of life of citizens. Further work was completed to refine the understanding of the potential quality of life impacts of the programme, including a rapid review of the available literature and an expert workshop that included participants from central Government departments and representatives of consumers.
- Analysis of management information:** BDUK supplied data on the areas eligible for funding through the programme, the premises receiving improved broadband infrastructure, take-up of the services enabled, and the costs involved in delivery. This

¹⁶ Available at http://ec.europa.eu/competition/state_aid/cases/263954/263954_1760328_135_4.pdf.

information was used to describe the delivery of the programme and fed into statistical analysis seeking to establish its impacts.

- **Econometric analysis:** A series of statistical analyses were completed to examine the impact of the programme on superfast availability, economic growth, and quality of life. These drew on postcode level data captured in Ofcom's Connected Nations report and a range of other datasets held within the ONS Secure Research Service (SRS), alongside the management information supplied by BDUK. Details of this research are provided in Annexes A, B and C. The findings fed into an indicative cost-benefit analysis summarised in Section 7 of this report, and reported in more detail in Annex E.
- **Qualitative research with households:** Research into the public value impacts of the Superfast Programme included a series of purposively sampled qualitative interviews with households benefiting from BDUK investment as well as a number within areas without superfast availability¹⁷. A total of 36 interviews were conducted, nine with households that did not receive subsidised coverage, 13 with households in an area benefitting from the programme but who opted to take a slower than superfast speed, and 14 with households in an area benefitting from BDUK investment and who adopted superfast. These interviews covered questions around the use and importance of broadband and superfast broadband in terms of communicating with friends and family, viewing entertainment and educational content, managing day-to-day life, and participating in, or keeping up, with the local community.
- **Postal survey of households:** The final stage of research involved a postal survey designed to explore quality of life outcomes in areas upgraded under the Superfast Broadband programme and in those without access to superfast speeds. The postal questionnaire covered similar areas to the qualitative research phase, with the survey being conducted between 19 March and 9 April 2018. A total of 1,314 responses were received – 600 from households in areas receiving subsidised coverage and 714 from households without superfast availability.

2.4. Structure of this report

The remainder of this report is structured as follows:

- **Section 3:** Provides an overview of the Superfast Broadband programme and its delivery between 2012 and 2016.
- **Section 4:** Explores the impact of the programme on superfast availability.
- **Section 5:** Summarises the findings in relation to the economic impacts of the programme, including its impacts on employment, productivity, output (GVA) and the labour market.

¹⁷ Areas in which the maximum download speed available in the postcode was less than 24 Mbit/s according to the 2017 Ofcom Connected Nations report.

- **Section 6:** Provides a summary of the evidence of the programme's impact on wellbeing and quality of life including findings from the econometric analysis, qualitative interviews and the postal survey. This section also includes a discussion of wider findings from the interviews and survey on the ways in which households use the internet and the importance of speed and reliability.
- **Section 7:** Outlines the findings from the cost-benefit analysis.
- **Section 8:** Concludes the report with an overview of the key findings from the evaluation, implications for public policy, and evidence gaps.

3. Programme Overview

Summary

- **Expected Impacts:** A range of impacts were expected from the programme including accelerated roll-out of superfast broadband across the UK, increased productivity and employment growth amongst firms benefiting from enhanced access and improved quality of life for citizens.
- **Programme Delivery:** The programme funded deployment of superfast broadband to 4.8m premises in the UK by December 2017. Most of these premises were residential in nature, and located in rural areas with low population densities.
- **Areas benefitting from investment:** Postcodes benefitting from subsidised coverage were associated with a range of features thought to increase the costs of upgrading local broadband infrastructure and reduce potential revenues. This signals that the resource allocation process was effective in diverting resources to areas where infrastructure upgrades were less commercially viable.
- **Availability of superfast:** Next Generation Access (NGA) coverage rose rapidly in areas covered by the scheme. The share of postcodes in the build plans of Phase One schemes with NGA coverage increased from less than 10 percent in 2012 to 87 percent in 2016 in postcodes. The share of postcodes in the build plans of Phase Two schemes with NGA coverage rose from 18 to 55 percent over the same period.
- **Take-up:** Take-up of the superfast broadband services enabled by the programme has grown over time and proved higher than expected by suppliers. Thirty eight percent of premises enabled under Phase One and around 20 percent of premises enabled under Phase Two took up the service by the end of 2016/17.
- **Efficiency:** Delivery of the programme comprised contractual mechanisms to return funds to the public sector if costs of delivery were lower than expected, or if take-up of the services enabled was higher than expected. These protections have reduced the overall expected cost of the programme from £1.6bn to £1.1bn over time, and reduced unit costs per premises upgraded by 40 percent.

This section provides an overview of the Superfast Broadband Programme, including its aims and objectives, expected impacts, and details of its delivery between 2012 and 2016. It also answers the State Aid Evaluation Question 'to what extent has the target of the intervention been used and what speeds are available?' This section draws primarily on a review of monitoring information supplied by BDUK to inform the evaluation.

3.1 Programme aims

The primary aim of the Superfast Broadband Programme was to increase the coverage of superfast broadband (defined as download speeds of 24Mbit/s) in the UK. The programme was delivered in phases with the following targets:

- **Phase One:** Extend superfast broadband coverage to 90 percent of UK premises by December 2016; and,
- **Phase Two:** Extend superfast broadband coverage to 95 percent of UK premises by December 2017.

A project called *Market Test Pilots* was announced in 2014 to test options for rolling out superfast broadband past 95% coverage. This project is outside the scope of this evaluation.

3.2 Rationale

The Superfast Broadband programme was introduced in 2010/11 in response to concerns that the commercial deployment of superfast broadband¹⁸ would fail to reach many part of the UK due to the cost of installing the technology relative to expected revenues. On the expectation that coverage of these areas would produce economic, social and environmental benefits that cannot be captured by suppliers, the Government established the programme with £530m of public resources to fund further deployment. This was extended in 2015, with a further £250m made available to extend coverage by the end of 2017.

BDOUK, a Directorate of DCMS, is the accountable body with responsibility for delivery. However, in acknowledgement that delivery would need to address locally specific issues that could not be adequately managed from central Government, the programme was delivered in partnership with local authorities and the devolved administrations (DAs). Local authorities and DAs were challenged to match central Government funds on a 1:1 basis, and were responsible for the procurement and management of contracts with suppliers.

3.3 Expected impacts

The Superfast Broadband Programme was expected to produce a wide range of impacts of which the following are within the scope of this evaluation:

- **Increased availability of superfast broadband:** Subsidies were expected to encourage providers to extend superfast availability to postcodes that would not have otherwise received it. Resources were allocated through a competitive procurement process which comprised measures to mitigate the risk that public money was used to fund infrastructure

¹⁸ Defined as a download speed of 24 Megabits per Second (Mbit/s or 1m bits of data per second). Superfast download speeds reduce the time associated with downloading a high definition movie from 1.5 hours to 30 minutes compared to a 10Mbit/s connection, and enable streaming of ultra high definition movies.

upgrades that would have been delivered under existing commercial plans. These included an initial Open Market Review (OMR) and Consultation process to establish providers' commercial roll-out plans and identify those postcodes that would not receive coverage (defined as 'white' postcodes by the European Commission). Subsidies were only made available to provide coverage in these areas. Contracts also included clauses to return funds to the public sector if costs were lower than anticipated, or if take-up was higher than anticipated.

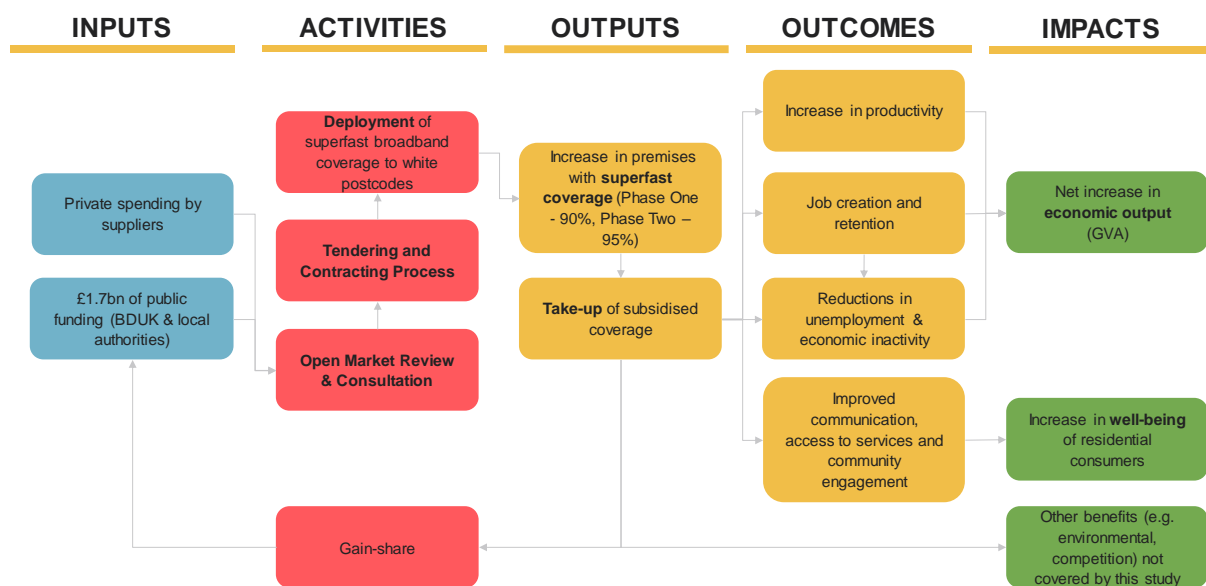
- **Productivity growth:** A variety of studies¹⁹ have shown that faster broadband stimulates productivity growth. Firms located on postcodes receiving enhanced access could see their efficiency improved, either by enabling faster processing or exchange of digital information, or indirectly by encouraging product and process innovation or increasing the productivity of teleworkers. These improvements may take time to arise and could require complementary investment, such as recruitment of appropriately skilled staff.
- **Firm expansion:** 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. These types of impact may be locally significant, but would be limited at the national level if firms take market share from domestic competitors or if their increased demand for labour and other inputs leads to higher prices.
- **Labour market outcomes:** Creation of jobs in the local economy could also lead to reductions in unemployment. These impacts could be significant if enhanced availability of superfast broadband services helps retain economic activity that would have otherwise been lost, reducing the risk that those workers less able to adapt lapse into long term unemployment. Superfast connectivity may also increase the supply of labour if it helps people who would otherwise be economically inactive obtain work as teleworkers.
- **Improved wellbeing and quality of life:** Social benefits may also arise from household consumption of the broadband services enabled. Superfast broadband may enable better access to online services, improved communications or increase quality of life by enabling households to obtain lower prices or greater choice. Quality of life could also rise through consumption of enhanced entertainment services, improved personal financial management or easier access to social networks. Better connectivity could also lead to increased civic participation by strengthening local communities. More generally, the

¹⁹ See for example "The Economic Impact of Broadband: Evidence from OECD countries, Pantelis Koutroumpis for Ofcom, April 2018". <https://www.ofcom.org.uk/research-and-data/telecoms-research/broadband-research/economic-impact-broadband>

internet enables superior access to information, potentially raising wellbeing by enabling households to make better or more informed decisions. There may, however, also be some dis-benefits insofar as there is the potential for some individuals to become isolated and/or addicted through mediums such as social media²⁰. However, the transformative potential of high speed networks speeds has been thought to be linked to scope to provide services remotely (e.g. telemedicine) and the development of these applications are currently at a nascent stage.

A simplified logic model is set out in the following figure. More detailed analysis of the programme and its anticipated effects is provided in Annex A, B and D.

Figure 3.1: Superfast Broadband programme – outline logic model



3.4 Costs

A total of £1.6bn of public funding was committed to local projects funded under Phase One and Phase Two of the Superfast Broadband programme²¹. These contracts involved £689m of BDUK funding and £903m of public subsidies contributed by local bodies, alongside a commitment of £615m in supplier spending. The cost of the programme varied compared with the expectations defined in these contracts for the following reasons:

- **Underspend:** The cost of installation proved lower than expected by providers and the overall level of underspend is estimated by BDUK to be £127m. A total of £66m of this was

²⁰ See Social Media Use and Children’s Wellbeing, McDool, Powell, Roberts and Taylor, Sheffield Economic Research Paper Series, December 2016. Available at https://www.sheffield.ac.uk/polopoly_fs/1.669622!/file/paper_2016011.pdf

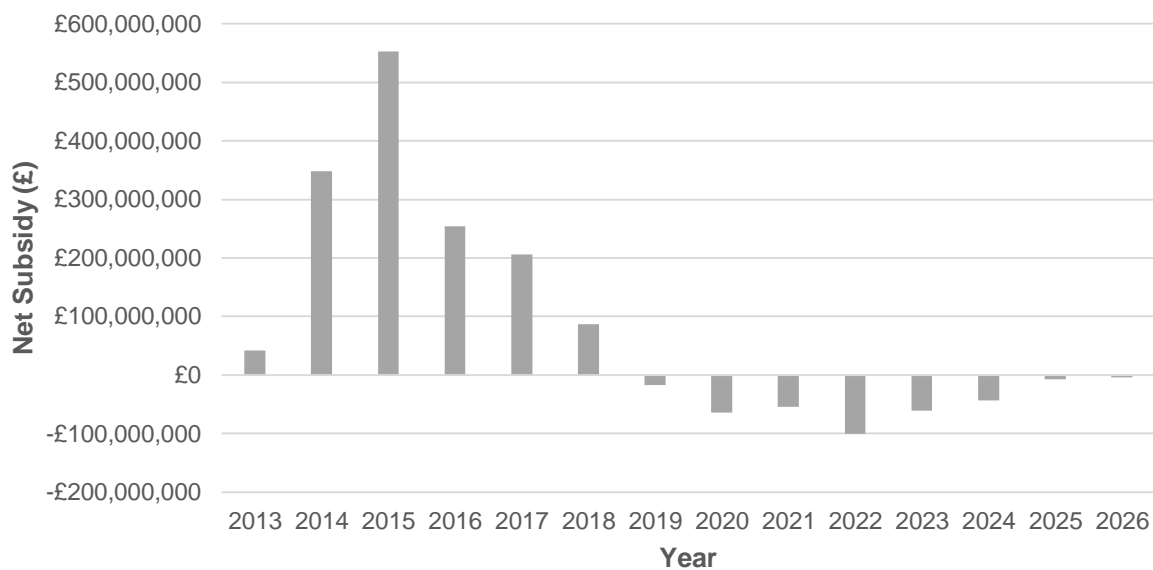
²¹ The total contracted number of premises to be upgraded was 5.3m, including upgrades resulting from reinvestment of underspend and gainshare.

reinvested in achieving higher coverage rates (by extending Phase One contracts, for example). The net reduction in the public contribution to investment costs was £60m.

- **Take-up gainshare:** Take up was higher than anticipated by providers and is expected to trigger payments to the public sector of £489m²². Again, a share of these resources (£84m) was reinvested in achieving higher coverage rates.

The total net cost of the programme following these adjustments is estimated at £1.1bn (in 2016/17 prices), as illustrated in the figure below.

Figure 3.1: Forecast delivery costs and income, 2013 to 2026 (2016/17 prices)



Source: BDUK monitoring information

3.5 Programme delivery

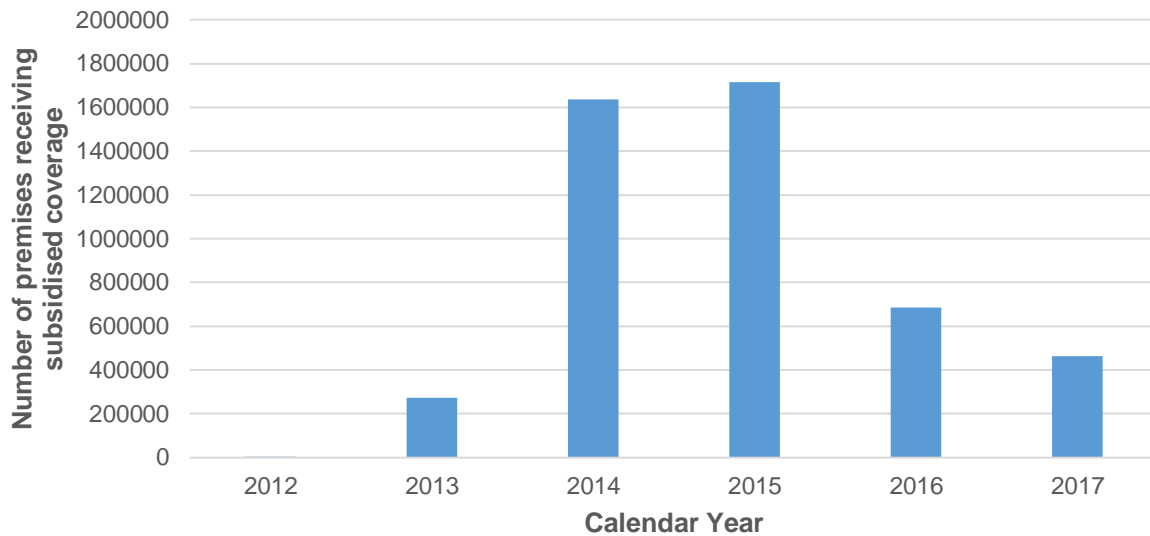
The programme funded deployment of superfast broadband to 4.8m premises in the UK by December 2017:

- **Time profile of delivery:** As illustrated in Figure 3.2 below, delivery of the programme began in 2013 and peaked in 2015 with 1.7m premises receiving subsidised superfast coverage. Volumes have receded as Phase One contracts came to an end and delivery of smaller Phase Two contracts started²³.

²² Based on projections provided by BDUK in November 2017

²³ Broadband Performance Indicator, December 2017. Available at <https://www.gov.uk/government/collections/broadband-performance-indicators> (accessed May 2018).

Figure 3.2: Number of premises receiving subsidised superfast (24Mbit/s) coverage



Source: *Broadband Performance Indicator, BDUK, December 2017*

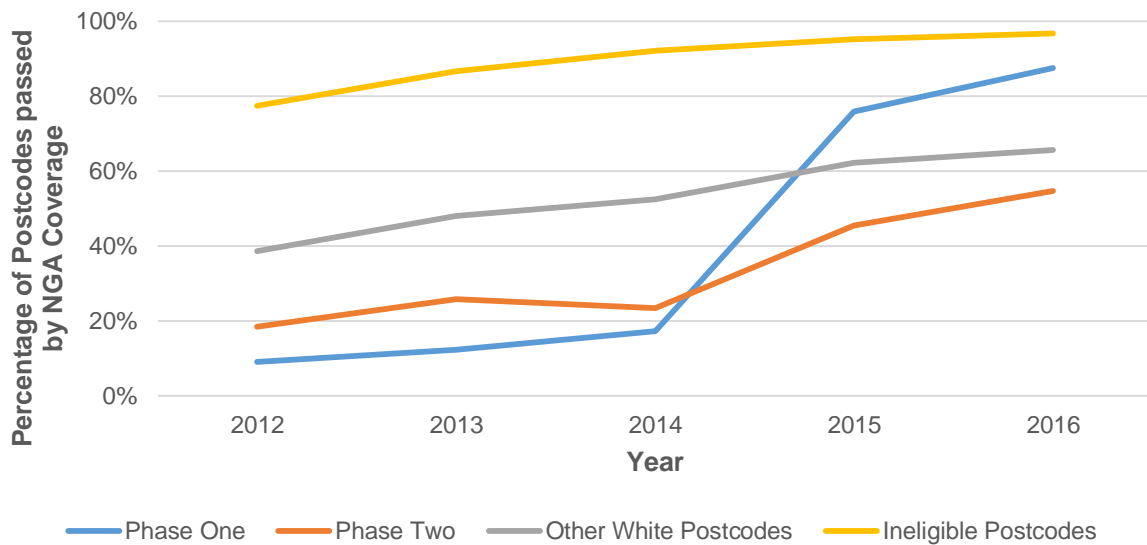
- Characteristics of postcodes receiving subsidised coverage:** Postcodes receiving subsidised superfast coverage were associated with features expected to reduce the commercial viability of upgrading local infrastructure. They were typically located further from the local exchange than ineligible postcodes, and a higher share had exchange only lines, increasing the cost of installation. Demand, and by extension, expected revenues, would also have been limited by low local population and premises densities. This indicates that the OMR process was effective in levering resources into the types of postcodes that were less likely to receive superfast coverage under commercial plans.
- Rural and urban:** Analysis based on a sample of postcodes included in the build plans of local schemes suggested that the programme was predominantly targeted at rural areas. Seventy-four percent of postcodes in the build plans of Phase One schemes were classified as rural²⁴ as were 67 percent of the postcodes in the build plans of Phase Two schemes.
- Residential and non-residential:** The programme was primarily focused on residential properties. An estimated 93 percent of premises receiving subsidised coverage were residential in nature.

²⁴ Postcodes were classified using the data in the August 2017 ONS Postcode Directory based on the 2011 Census the definition of urban and rural postcodes agreed with Defra in the Digital Taskforce Group. Postcodes in Northern Ireland were unclassified in this data, and were reclassified using the classifications based on the 2001 Census that are also available in the ONS Postcode Directory.

3.6 Changes in NGA availability

Changes in Next Generation Access²⁵ (NGA) availability on postcodes included within the scope of Phase One and Phase Two schemes are illustrated in Figure 3.3. The share of postcodes with NGA within the build plans of Phase One schemes rose rapidly between 2012 and 2016 (from less than ten percent to 87 percent). Postcodes included within the build plans of Phase Two schemes also saw NGA coverage increase, though at a slower rate (from 18 percent to 55 percent). White postcodes that were not included within the scope of Phase One or Two schemes also saw NGA coverage increase.

Figure 3.3: Changes in Next Generation Access coverage, 2012 to 2016



Source: Connected Nations, Ofcom, Ipsos MORI analysis

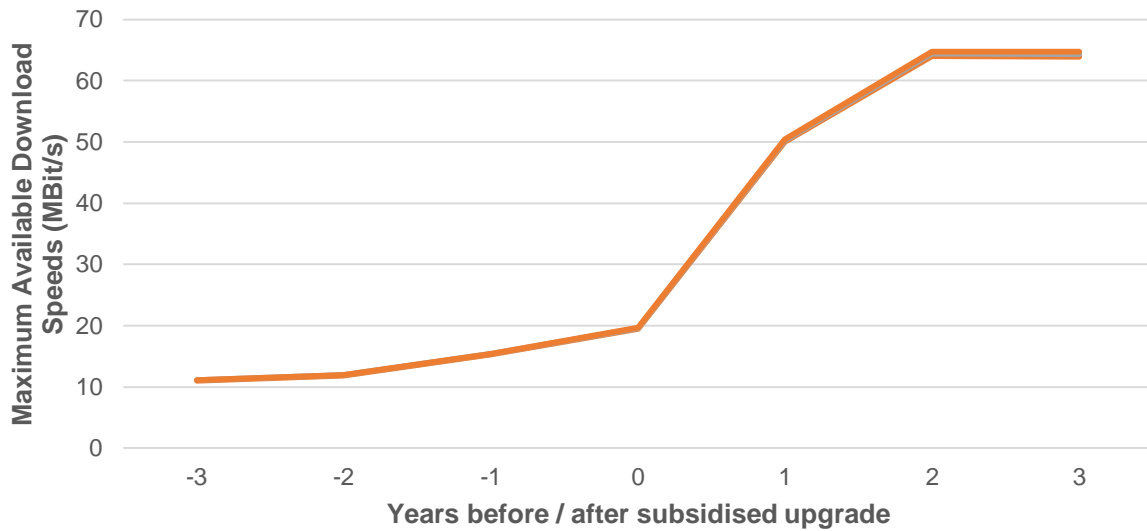
3.7 Changes in available download speeds

The figure below illustrates changes in available download speeds on postcodes receiving subsidised coverage. On average, maximum available download speeds increased from just under 20Mbit/s in the year prior to the installation of subsidised coverage to 64Mbit/s in the first two years following installation²⁶.

²⁵ Measures of superfast availability is not available for all years between 2012 and 2016 from the Connected Nations report, though NGA availability provides an approximation.

²⁶ To illustrate the gross effect of the programme on maximum available speeds, the analysis was restricted to those postcodes benefitting from the programme for which data on available speeds was available in each year between 2012 and 2016.

Figure 3.4: Average maximum available download speeds on postcodes receiving subsidised coverage before and after the upgrade (Mbit/s)

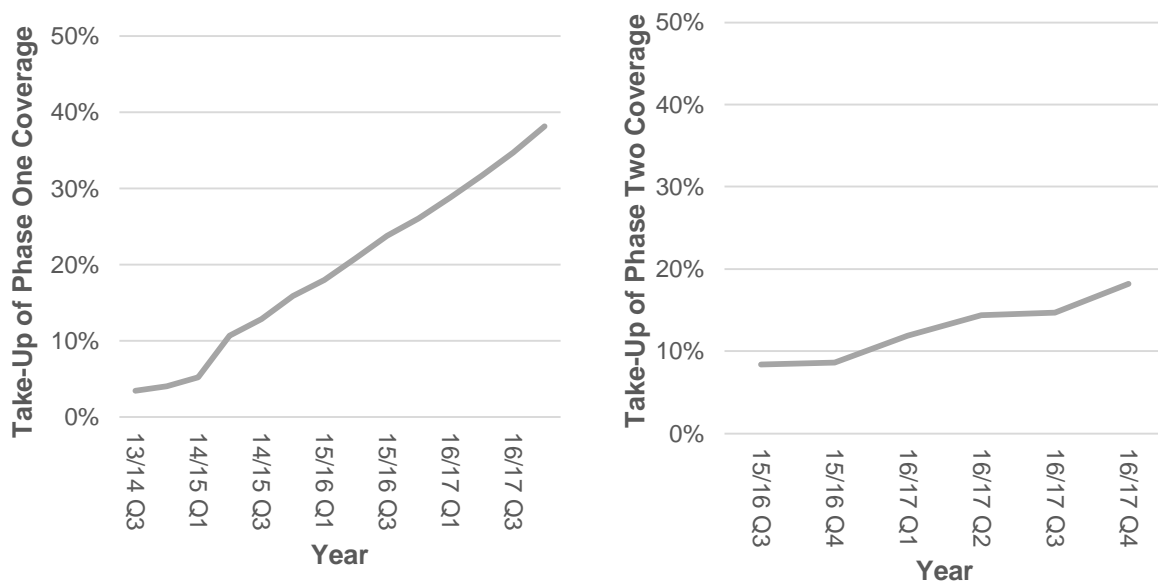


Source: Connected Nations and C3 Reports supplied by BDUK.

3.8 Take-up of subsidised coverage

Take-up of coverage funded under Phase One of the programme grew steadily to an average of 38 percent at the end of 2016/17. Take-up of superfast broadband services enabled through Phase Two of the programme reached around 20 percent, slightly higher than achieved under Phase One over a similar period, presumably reflecting growth in demand for digital services. There was a degree of variation in take-up rates by area, ranging from 29 percent to 54 percent under Phase One in 2016/17 and from five percent to 31 percent under Phase Two.

Figure 3.5: Take-up of subsidised coverage under Phase One and Phase Two



Source: BDUK Monitoring Information

3.9 Efficiency

As indicated, the underspend and gainshare mechanisms have meant that the programme delivered superfast coverage at a gross cost per premises upgraded below that originally anticipated:

- **Contracted unit costs:** The gross contracted cost to the public sector per premises upgraded (i.e. before gainshare is accounted for) was £297²⁷.
- **Forecast unit costs:** The forecast gainshare from higher take-up is expected to deliver a substantial improvement in the unit cost per premises upgraded with an ex-post unit cost per premise of £211. This implies a reduction in gross unit costs to the public sector of 40 percent.

This evidence also suggested that providers underestimated the demand for the technology at the point at which tenders were prepared and overestimated the cost of installation.

²⁷ The present value in 2013 at 2016/17 prices.

4. Impact on Superfast Roll-out

Summary

- **Impact:** The evaluation results indicate that the Superfast Broadband programme had a substantial effect in extending superfast broadband connectivity. It is estimated that by the end of 2017, around 2.5m premises received NGA coverage that would not have done so at all, and a further 1m received coverage up to two years earlier than they would otherwise have.
- **Incentive effect:** The evidence suggested that the programme created incentives for suppliers to extend coverage to premises that would not have otherwise received it. It was estimated that over 70 percent of premises upgraded with BDUK subsidies would not have received NGA coverage within two years of the upgrade. In this respect, the Open Market Review process was largely effective in encouraging suppliers to reveal their short term commercial plans.
- **Additionality over time:** There was evidence that a share of premises upgraded received access to superfast broadband more rapidly than they otherwise would have, implying falling additionality following the installation of upgrades. The estimated share of premises that would not have otherwise received superfast coverage by June 2016 is estimated to lie between 39 and 62 percent.
- **Changing commercial conditions:** The evidence indicated that commercial viability increased with time as take-up rates rose. This would explain declining rates of additionality, though it is also possible that the programme led to a process of demand discovery that encouraged providers to expand their commercial roll-out programme.
- **Diversion of investment from grey and black postcodes:** The evaluation indicated that the programme largely avoided the risk of diverting investment from areas that were ineligible for the programme. This may be a signal that the programme was well timed, taking place after the bulk of commercial roll-out was completed. However, there were also signs that a small share of premises on white postcodes received superfast coverage later than they would have without the programme. This could be explained by the time needed to complete the OMR, public consultation, and procurement processes.
- **Gainshare and policy learning:** The contracts developed to procure the programme have offered the public sector the opportunity share in the benefits of higher than expected take-up. These contractual mechanisms are expected to contain the net public cost per additional premises upgraded to £352. The unit cost would have risen to £494 without these protections, and can be interpreted as raising the rate of additionality to 84 percent.

This section provides estimates of the impact of the Superfast Broadband programme on the availability of superfast broadband services. This section seeks to answer the following evaluation questions from the State Aid Evaluation Plan:

- To what extent has the aid resulted in increased access to an NGA network in white NGA areas?
- Has the aid had a significant incentive effect on aid beneficiaries?

This section draws primarily on the statistical analysis described in detail in Annex A.

4.1 Overview of Approach

The Superfast Broadband programme provided subsidies to commercial providers to extend the roll-out of superfast coverage. However, there was a risk that providers sought subsidies to upgrade premises that would have received superfast coverage under existing commercial plans. The objective of the analysis summarised in this section is to determine how far the programme led to an increase in superfast coverage and download speeds over and above what may have happened in the absence of the programme (additionality).

To provide a credible answer to this question, it was necessary to identify a comparison group of postcodes that did not benefit from the programme but were otherwise equivalent to those that did. This involved some challenges, as commercial operators chose which postcodes to upgrade from the pool of white postcodes covered by existing commercial plans. As a result, postcodes receiving subsidised coverage can be assumed to differ in systematic ways to those that did not. These differences could distort comparisons. Grey or black postcodes had deemed commercially viable by at least one supplier, and it can be assumed that they would be more likely to receive superfast coverage than white postcodes without the programme. Basic comparisons between grey or black and white postcodes will therefore understate the impact of the programme. The reverse would be expected in comparisons between white postcodes that did and did not receive subsidised coverage.

A variety of approaches were adopted to address these difficulties (explained in more detail in Annex A). These are summarised below in order of robustness:

- **Comparisons with eligible postcodes that did not receive subsidised coverage:** Postcodes receiving subsidised coverage were compared to a sample of eligible postcodes that did not receive BDUK investment, but shared similar network and socio-economic characteristics. These results will only be robust to the degree that it is possible to measure all relevant characteristics of the postcodes.
- **Comparisons with postcodes in the build plan of declined tenders:** BDUK funding was allocated through a competitive procurement process and each tenderer was required to propose a set of white postcodes they would upgrade through the contract. BDUK provided the details of one tender that was declined through this process. The postcodes included in the build-plan of this tender were compared to similar postcodes that received subsidised coverage. These results should provide a better measure of what the market

would have delivered without subsidies, though the findings relate to a single area and cannot be generalised.

- **Comparisons over time:** A further set of analyses were completed that described the relationship between the volume of premises receiving subsidised coverage and the overall number of premises with NGA coverage over time. This approach is better able to deal with problems driven by differences between subsidised and unsubsidised postcodes that cannot be measured.
- **Comparison with areas just inside ineligible local authority boundaries:** To provide further confirmation of results, a final set of analyses compared postcodes just inside and just outside the boundary of the Greater London Authority (which was ineligible for subsidies through the programme). This offered the most robust findings but the results cannot be generalised beyond areas at the boundary of London.

These analyses drew on the Ofcom Connected Nations report which provided measures of broadband availability at the postcode level. Issues with data availability have required the use of NGA access as a proxy for superfast availability, leading to an understatement of the programme's effects. Additionally, it was not possible to include Wales, Gloucestershire and Herefordshire, or North Yorkshire in the analysis. Further details on these issues can be found in section 1.3.1 of Annex A.

4.2 Impact on NGA and superfast coverage by 2016

The programme has two potential effects on NGA and superfast coverage. Firstly, the programme may result in premises receiving access to superfast broadband services that would not have done without the programme. Secondly, the programme may enable households and businesses to receive superfast broadband services earlier than they would have otherwise. This section focuses on the first of these two effects, the impact of the programme on the share of premises with access to superfast broadband services in 2016.

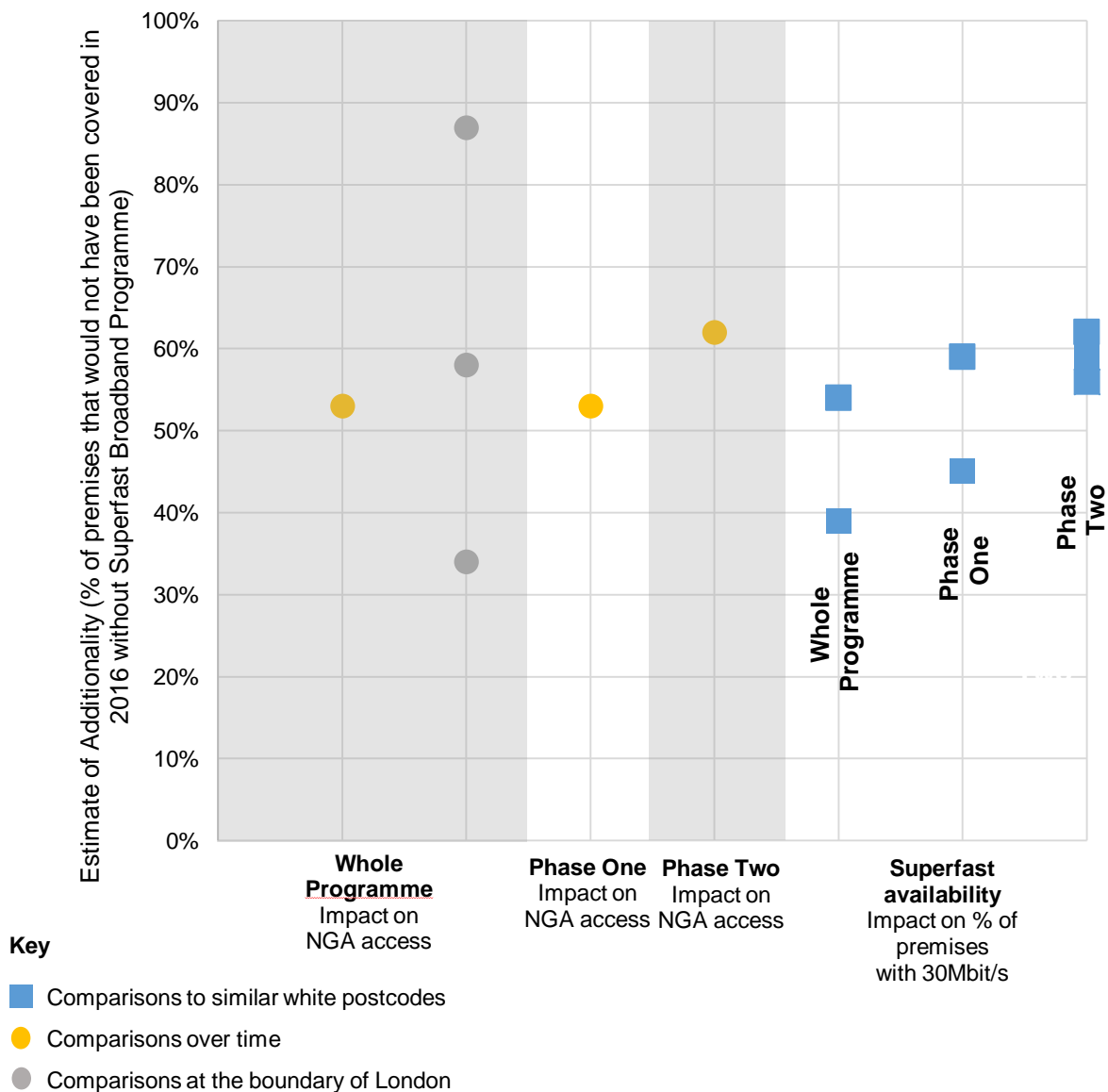
Figure 4.1 below summarises the findings of the various analyses in terms of the implied share of premises that would not have received superfast coverage in the absence of the programme by 2016:

- **Overall additionality:** The findings gave a range for the share of postcodes receiving subsidised coverage that would not have received superfast access in 2016 without the programme of between 39 to 62 percent. There was a reasonable degree of consistency across the results produced by the different analyses.
- **NGA vs superfast coverage:** The programme was estimated to have had a larger impact on the share of premises on relevant postcodes with superfast (30Mbit/s) access than NGA coverage. There appeared to be a group of postcodes receiving subsidised superfast coverage that would have otherwise received some form of infrastructure upgrade though not necessarily those required for superfast speeds. The findings also suggested that the

programme increased both maximum available download speeds and average download speeds on relevant postcodes by around 26 percent in 2016.

- Phase One vs Phase Two:** The estimated share of postcodes that would not have otherwise received superfast access in 2016 was higher for those postcodes receiving subsidised coverage in Phase Two than for Phase One. The analysis relates only to the first upgrades delivered under Phase Two and may not be representative of the roll-out as a whole.

Figure 4.1: Estimates of additionality of NGA and 30Mbit/s coverage in 2016



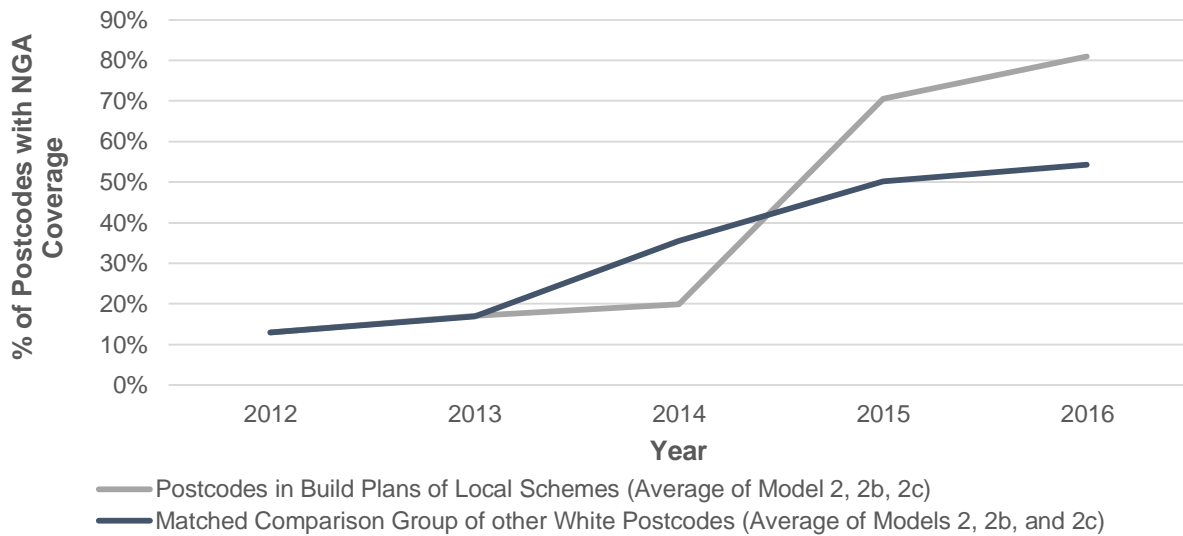
Source: Ipsos MORI analysis

4.3 Impact on NGA and superfast coverage over time

The findings set out above describe the impacts of the programme in 2016 and do not capture any effect of the programme in accelerating superfast availability. Figure 4.2 compares

changes in NGA coverage on postcodes included in the build plans of Phase One and Two schemes to a sample of other white postcodes with equivalent characteristics. This figure suggests that on postcodes benefitting from subsidised coverage, NGA coverage rose from 20 percent in 2014 to over 80 percent in 2016, while growing less rapidly on equivalent white postcodes that did not benefit from the programme. However, there were signs that the programme may have delayed the roll-out of superfast coverage in some postcodes benefitting from BDUK subsidies.

Figure 4.2: NGA coverage on postcodes receiving subsidised coverage and a matched group of white postcodes, 2012 to 2016



Source: Ipsos MORI analysis

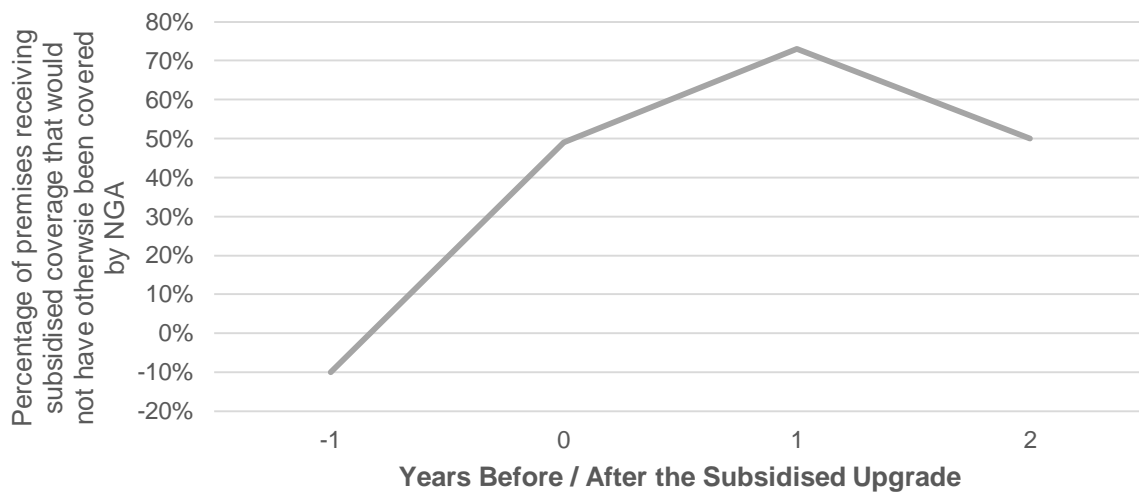
Figure 4.3 overleaf provides estimates of the how the share of premises that would not have been upgraded without the programme varies as time passes following the upgrade. This suggests that one year after the upgrade, 73 percent of premises upgraded would not have received NGA coverage in the absence of the programme. This falls to 53 percent two years following the upgrade, implying falling additionality with time.

This suggests that the Open Market Review process was effective in encouraging providers to reveal their immediate commercial plans. Declining additionality is interpreted as a signal that commercial plans evolved while the programme was being delivered. This is supported by the evidence reported in Section 2 that providers underestimated the demand for the technology, which increased with time. Costs have also been lower than expected. These changes in conditions may have altered the assessment of commercial viability of investing in white postcodes. With other things being equal, rising expected revenues and lower than expected costs will have resulted in some postcodes that were not deemed commercially viable in 2013 becoming so at a later stage. This would encourage providers to expand their commercial roll-out plans, which likely explains the apparent reduction in additionality from the second-year post-installation, implying that other areas have started to catch up. BDUK will continue to monitor additionality over time.

This also raises questions regarding the possible demonstration effects of the programme. It is possible that Phase One of the programme demonstrated the viability of locations previously thought to be unviable. If this led to further unsubsidised investment in superfast coverage, then the findings set out here will understate the level of additionality associated with the programme. However, it is not possible to assess the presence or magnitude of these types of effect given the data available.

Applying these results to the 4.8m premises receiving subsidised coverage by the end of December 2017, it was estimated that around 2.5m premises received NGA coverage that would not have done so at all, and a further 1m received coverage up to two years earlier than they would otherwise have. The findings also suggested that the programme may have had the cost of delaying the extension of coverage to a group of premises that would have otherwise received superfast connections approximately one year earlier, likely caused by the time absorbed by the Open Market Review, consultation, tendering and contracting processes.

Figure 4.3: Estimates of the additionality of subsidised coverage over time



Source: Ipsos MORI analysis

4.4 Diversion of investment from grey and black postcodes

Subsidising the roll-out of superfast coverage to white postcodes carried a risk that it led to the diversion of scarce resources, such as skilled labour or capital, away from areas where providers planned to install enhanced infrastructure without subsidy. A set of analyses were completed to determine the presence and size of these offsetting impacts, but found little evidence of a significant impact and any small effects were temporary in nature.

This may be attributable to the timing of the programme. Peak volumes of upgrades were delivered in 2014 and 2015, at the same time as levels of activity to upgrade broadband infrastructure in grey and black postcodes began to fall. It is likely that providers and their supply chains were carrying sufficient capacity to deliver the programme without putting pressure on parallel programmes of investment.

4.5 Effects by rural and urban areas

The table below provides estimates of the impact of the programme on NGA access, superfast coverage and maximum/average speeds on rural and urban postcodes included in the build plans of Phase One and Phase Two schemes. The estimated impact was larger in rural areas, and this reflects the focus of the programme on delivery in rural areas.

Table 4.1: Estimated impact of subsidised coverage on connectivity outcomes in 2016, rural and urban postcodes in the build plans of local schemes

Change in connectivity outcome attributable to the programme				
Type of Postcode	% of postcodes with NGA coverage	Max. Available Download Speeds (Mbit/s)	Superfast availability as % of premises	Average Download Speeds (Mbit/s)
Rural	31.4	11.0	37.2	4.4
Urban	15.6	5.8	18.9	0.8

Source: Ipsos MORI analysis

4.6 Value for Money

The results above can be used to assess the value for money delivery by the programme in terms of the net cost per additional premises upgraded:

- **Additional premises upgraded:** For the purposes of this analysis, an additionality rate of 60 percent was assumed based on the average additionality of NGA coverage post installation. Under this assumption, the programme is projected to result in 3.2m additional premises receiving access to superfast connectivity.
- **Net public subsidy per additional premises upgraded:** This gives an estimate of the net public subsidy per additional premises upgraded of £352. This is 16 percent higher than the unit cost contracted (£297).

Table 4.2: Estimated net cost per additional premises upgraded (present value in 2013 at 2016/17 prices)

	Gross public subsidy per gross premises upgraded	Net public subsidy per additional premises upgraded
Present value of public spending in 2017 (£m)	1,582	1,127
Contracted premises upgraded	5,333,681	3,200,209
Public spending per premises upgraded (£)	297	352

Source: Ipsos MORI analysis

The role of the underspend and take-up gainshare mechanisms in protecting the value for money associated with the programme are expected to be significant. Based on expectations in late 2017, the public sector will receive payments from suppliers for a share of those premises upgraded that would have received superfast access without the programme. This is expected to raise the rate of additionality from 60 to 84 percent. In the absence of these protections, the estimated unit cost would have risen by 40 percent to around £494 per net additional premises upgraded. Sixty-seven percent of this difference was driven by the take-up gainshare²⁸ mechanism. It is important to note that at the time of writing, this income is dependent on future take-up and subject to some uncertainty. Additionally, it is unclear how providers may have otherwise have behaved had the gain-share clauses not been present in the original contract.

The types of mechanisms referred to above are rarely employed in public sector programmes involving financial support to the private sector and could have more widespread applicability (one example of analogous mechanisms is the sales contingent loans offered to large aerospace producers through Repayable Launch Investment). It is possible to speculate as to the underlying success factors. For example, it was possible to monitor take-up with accuracy over time, enabling enforceable conditions to be written into contracts. This may not be feasible when subsidising early stage industrial R&D, for example, where it may be less straightforward to connect the intellectual property developed to any later resultant sales. However, further research into its potential transferability could be beneficial, particularly given that cross Government learning for large procurement programmes was a key benefit anticipated in the BDUK Benefits Realisation Framework. Other research²⁹ into the Superfast Broadband programme has suggested that further refinements to the gainshare mechanism could be made to incentivise more efficient delivery, and this may also be an avenue of potential further exploration.

²⁸ A contractual arrangement in which the supplier shares profits with the Government when they exceed a defined level agreed at the outset.

²⁹ The UK's National Broadband Scheme: An Independent Evaluation Report, BDUK, 2015

5. Economic Impact

Summary

- **Businesses benefitting from subsidised coverage:** Businesses located in postcodes receiving subsidised coverage tended to be smaller, less productive, and more concentrated in the manufacturing sector than those firms located on postcodes outside of the programme area. This is to be expected given the targeting of the scheme outside of more productive urban areas where commercial deployments were expected to be extensive.
- **Firm expansion outcomes:** The programme is estimated to have had positive economic impacts in those postcodes benefitting from subsidised coverage. It is estimated that faster available download speeds increased employment by 0.8 percent, turnover by 1.2 percent per annum, and turnover per worker by 0.3 percent per annum on postcodes benefitting from the programme. This equates to the creation over 49,000 jobs at the local level and an increase in turnover of £8.9bn.
- **Firm relocations:** A large share of the growth in firm level outcomes was driven by firm relocations.
- **Effects on incumbent firms:** However, improved connectivity is estimated to have raised the performance of businesses did not relocate to or from postcodes receiving subsidised coverage. As such, this provides some assurance that the local impacts of the programme were not driven wholly by displacement.
- **Open Market Review:** The findings reinforce the importance of the Open Market Review process in ensuring public investment reached lagging areas. Without encouraging firms to reveal their existing commercial plans, it is reasonable to expect that providers would have sought subsidies to deliver coverage in more dense and higher productivity areas where commercial returns were more assured.
- **Labour market effects:** It is estimated that the programme reduced the number of individuals claiming JSA by 8,800 and the number claiming JSA for more than 12 months by 2,500 by the end of 2016. However, there were no effects on the number of individuals claiming other types of out of work benefits.
- **Timeframes:** The timeframe for the analysis is relatively short (a period of 1 or 2 years following the installation of the new infrastructure) and it is too early to judge how far the apparent effects of the programme may prove persistent in the long term. The findings above also do not allow for the impact of any future premises receiving upgraded coverage through the programme.

This section explores the economic impacts of the Superfast Broadband programme between 2012 and 2016. It examines how far subsidised coverage raised the employment, turnover, and the productivity of firms located on relevant postcodes. It also explores how far those effects led to reductions in unemployment and number of claimants of out of work benefits. The findings below draw primarily on the results of the statistical analyses described in Annex B. It is important to note that this section examines the impact of improved connectivity but does not account for how far superfast coverage would have been brought forward in relevant postcodes in the absence of BDUK subsidies.

5.1 Overview of Approach

Information on the performance of firms over time was obtained from the Business Structure Database which provides annual records of employment and turnover for all companies registered for VAT or PAYE. Firms benefitting from subsidised coverage were identified by linking records of the postcodes of premises upgraded to this dataset. Information on unemployment and numbers of out of work benefit claimants at small area level was taken from the DWP Benefits Database.

This information was used to understand how firms and labour markets benefitting from access to faster broadband speeds have performed following the delivery of the upgrade. However, this does not provide a measure of the impact of improved infrastructure as a wide variety of factors will influence local economic performance. To understand the impact of subsidised coverage, it was necessary to compare firms and areas benefitting from subsidised coverage against a group of those that did not.

This was problematic as areas that receive investment in infrastructure tend to do so because they are expected to grow rapidly in the future. Comparisons between high and low connectivity areas would tend to yield misleading results because those areas benefitting from subsidised coverage would generally be expected to outperform areas that do not, regardless of the investment made.

To address this problem, an approach was developed that involved comparing those areas receiving investment first to those that received investment later. These areas can be assumed to share more similarities than areas that did not eventually receive investment, mitigating the underlying problems and offering a robust measure of the impacts involved provided there are no systematic differences between areas benefitting from subsidised coverage at different times. More detail on the approach is provided in Annex B.

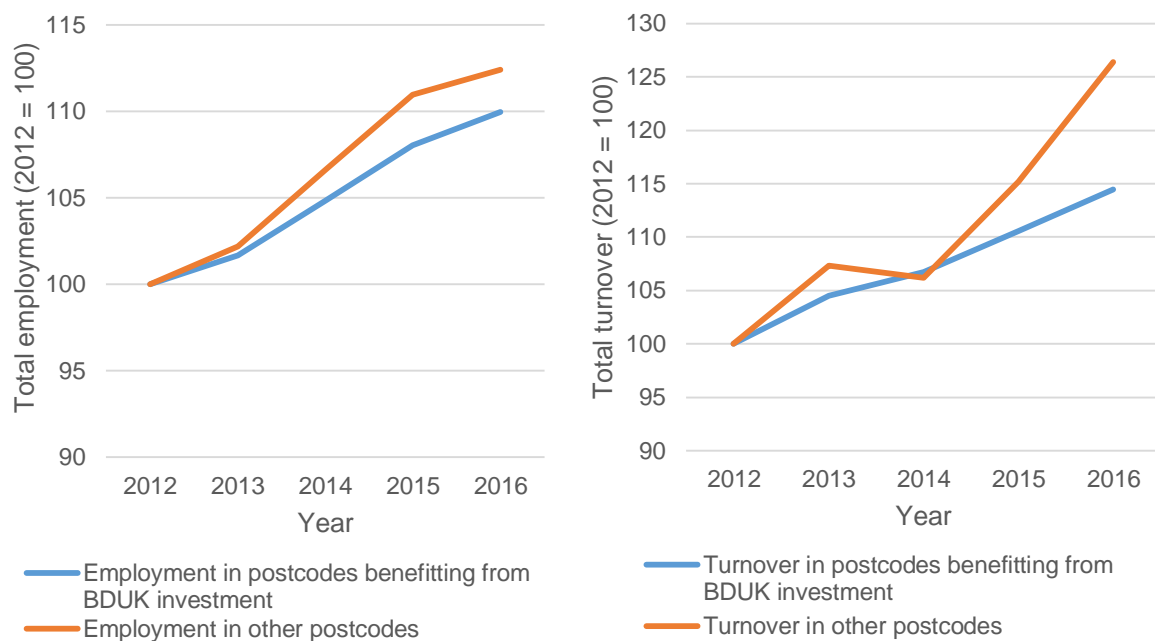
5.2 Socio-economic characteristics

Figure 5.1 shows growth in employment and turnover on postcodes receiving subsidised coverage and those that did not. Postcodes receiving subsidised coverage through the programme saw economic growth between 2012 and 2016 as the UK economy recovered from the 2008 financial crisis. Overall employment on these postcodes rose by 10 percent, though growth was less rapid than in other postcodes. In addition, the data suggested

businesses based on postcodes within the build plans of local schemes were associated with lower turnover per worker than the UK average between 2012 and 2016.

Over the same period, unemployment fell rapidly across the UK. The overall number of Jobseekers Allowance³⁰ (JSA) claimants fell from 1.3m in 2012 to 0.5m in 2016, and unemployment fell more rapidly in those areas that received subsidised coverage. The number of long term JSA claimants³¹ also fell from 344,000 to 129,000 over the same period. However, the number of individuals claiming out of work benefits³² fell less rapidly, declining by 25 percent from 4.1m to 3.1m over the period.

Figure 5.1: Employment and turnover of local units benefitting from subsidised coverage, 2012 to 2016



Source: Business Structure Database, Office for National Statistics

5.3 Local economic impacts

The statistical analyses suggested that the delivery of subsidised coverage had positive economic development impacts at the local level (summarised in table 5.1):

- **Employment:** The findings suggested that subsidised coverage led to an average increase in overall employment on relevant postcodes of 0.8 percent following the upgrade. Overall, it is estimated that subsidised coverage resulted in the creation of 49,400

³⁰ Benefit allowances for unemployed claimants looking for work.

³¹ Defined here as JSA claimants claiming for 12 months or more

³² The main out of work benefits consist of: Job Seekers Allowance, Employment and Support Allowance (ESA) and incapacity benefits, lone parents and other income related benefits.

jobs created on those postcodes. This amounted to around nine percent of the total number of jobs created on these postcodes over the period.

- **Turnover:** Additionally, the turnover of businesses located on postcodes receiving subsidised coverage increased by 1.2 percent as a result of the upgrade. Applying this to the average total turnover of businesses on relevant postcodes (£3.2m per annum), it is estimated that the total turnover of businesses located on these postcodes grew by just under £9.0bn due to the subsidised coverage. Again, this accounted for around nine percent of total turnover growth over the period.
- **Turnover per worker:** Additionally, subsidised coverage was found to increase turnover per worker on relevant postcodes by 0.3 percent, potentially indicating an increase in productivity. It is estimated that of the £9.0bn expansion in turnover, £2.1bn (23 percent) was driven by increases in turnover per worker.

Table 5.1: Overall economic impacts - postcodes receiving subsidised coverage

Effect	Estimated Effect (%)	Average per Postcode 2012-2016	Per Postcode Effect	No of Postcodes	Total Effect
Employment	0.81	26.19	0.21	232,069	49,361
Turnover	1.21	£3.2m	£38,600	232,069	£8,951m
Turnover per worker	0.32	£106,400	£9,000*	232,069	£2,089m

Source: Ipsos MORI analysis

5.4 Role of firm relocations

It is important to note that the findings above do not represent the net impact of the programme on the economy, and may be in part be driven by the relocation of firms:

- **Firm relocations:** The results of the evaluation also suggested that subsidised coverage led to an increase in the number of firms located on relevant postcodes (by around 0.3 percent). The availability of superfast broadband appeared to be attractive to firms, though this carries the implication that there may have been offsetting effects in the areas from which they relocated.
- **Firms that did not change location:** A supplementary set of analyses were completed to explore the effect of the programme on firms that did not change location. These suggested that incumbent firms also benefitted from subsidised coverage, and saw their employment increase by 0.2 percent, turnover grow by 0.6 percent per annum, and turnover per worker rise by 0.4 percent due to the upgrade. This suggests that local impact economic impacts have not solely been driven by the relocation of firms.

- **Share of local impacts driven by relocations:** Nevertheless, these analyses suggested that around 86 percent of the impact of jobs and 65 percent of the impact on turnover were driven by incoming or new firms. However, most (80 percent) of the apparent gain in efficiency - increases in turnover driven by turnover per worker rather than employment - was driven by firms that did not relocate.

5.5 Sector distribution of impacts

Analysis of the sector distribution of the impacts suggested:

- **Education and health and social work:** The chief beneficiaries of subsidised coverage were the education and health sectors³³. These sectors saw gains in turnover per worker of 4.7 and 3.7 percent respectively. The gains seen in these two sectors far exceeded those in others, suggesting that access to superfast connectivity removed a substantial constraint on the operation of those businesses. Further qualitative research into the factors driving these gains could be beneficial, though it might be possible to speculate that increasing digitalisation of the NHS may have been an important factor in the health sector.
- **Manufacturing:** The findings suggested that subsidised coverage raised turnover per worker in the manufacturing sector by around 0.8 percent. Manufacturers also appeared to be able to raise their turnover without expanding their employment. This could possibly be a signal that manufacturers were carrying spare capacity during the downturn precipitated by the financial crisis.
- **Professional services:** High value added professional services sectors saw growth in employment (0.7 percent), turnover (1.5 percent) and turnover per worker (0.7 percent) following the upgrade. This result is potentially unsurprising given the generally high consumption of information and communication technology in the sector over the past 30 years.
- **Construction and accommodation and food:** The construction and hospitality industries benefitted from greater turnover due to access to faster connectivity. However, these sectors also expanded their employment by a similar proportion in response to the subsidised upgrade and did not realise efficiency gains. This could be explained if enhanced connectivity enabled these industries to access wider markets, but did not help them deliver efficiency gains (e.g. construction activity is delivered off-site, so fixed broadband coverage may not enhance the efficiency of the production process, while the hospitality sector is highly labour intensive and difficult to digitise). It should be noted that there may be some doubt about the results relating to the construction industry, as figures on turnover are based on VAT returns and there may be some degree of under-recording.

³³ This will exclude public sector activity, but would include the activities of General Practitioners and Dentists that operate as private enterprises.

- **Financial intermediation and transport and storage:** Subsidised coverage appeared to have no effect on the performance of the finance and transport and storage sectors.

5.6 Unemployment and out of work benefits

Impacts on unemployment, long term unemployment and out of work benefit claimants were explored using data taken from the DWP Benefits Database. The findings indicated that:

- **Unemployment:** Subsidised coverage led to reductions in local unemployment. It is estimated that for every 10,000 premises upgraded through the programme, the number of JSA claimants fell by between 34 and 40 over a three-year period. The total reduction in claimant numbers attributable to subsidised coverage was estimated at 8,800 by 2016. This relates to an estimate of 49,000 jobs created on postcodes that benefitted from subsidised coverage, suggesting that many of those jobs were the product of firms relocating short distances or that vacancies were filled by commuters.
- **Long term unemployment:** Additionally, for every 10,000 premises upgraded through the programme, the number of long term JSA claimants (those claiming 6 months or more) fell by between 5 and 7. The overall estimated reduction in long term JSA claimants is estimated at 2,500 by 2016.
- **Out of work benefits:** The analyses provided mixed results regarding the effect of the programme in reducing the numbers of individuals claiming other out of work benefits. This suggests that faster download speeds were less effective in reducing economic inactivity rates amongst lower income groups. This could be explained either if anticipated job roles based primarily on teleworking did not emerge at the scale expected, if those on lower incomes were less able or willing to pay for the faster internet speeds required to access these opportunities, or if they did not have the skills needed. It has not been feasible to assess the effects of the programme on the labour market participation of those that do not claim benefits.

Effects on unemployment appeared to be driven by two separate processes. In the short term, upgrades to non-residential premises appeared to have much larger effects on JSA claimant numbers. These effects were realised relatively rapidly, and indicate that the effects of the programme in attracting or retaining economic activity and raising the performance of incumbent businesses are the more significant in reducing local unemployment. There was evidence that providing superfast coverage to residential premises had a small but growing effect on unemployment, which could suggest a role for the programme in widening search patterns or enabling teleworking. However, similar patterns could also arise if subsidised coverage attracted high skill residents, forcing lower skill residents to move elsewhere.

5.7 Impacts in rural and urban areas

Further analyses were completed to explore the impact of the programme in urban and rural areas³⁴.

- **Employment and turnover:** The estimated impact of subsidised coverage on employment and turnover were shown to be larger on urban postcodes in comparison to rural ones. Employment rose by 1.3 percent in response to subsidised coverage in urban areas, relative to 0.6 percent in rural areas. Additionally, the total turnover of businesses located on urban postcodes receiving subsidised coverage increased by 1.4 percent, relative to 1.2 percent in rural areas.
- **Turnover per worker:** However, there was no evidence that enhanced connectivity subsidised by the programme raised the efficiency of firms located in urban areas, while rural postcodes saw turnover per worker rise by 0.4 percent. The results also suggested that subsidised coverage had a larger impact in attracting firms than in rural areas, suggesting a higher share of the economic impacts were driven by firm relocations.

The analysis also showed that subsidised coverage had an impact on the numbers claiming JSA in rural areas but not in urban areas. This suggests that any economic impacts of the programme in urban areas were highly localised.

5.8 Effects by home nation

The analysis was also repeated to explore how the impact of the programme varied by home nation. The results suggested that subsidised coverage had a positive impact on turnover and turnover per worker, while positive impacts on employment were also found in England and Wales. These findings did not suggest the impact of subsidised coverage varied substantially by area. In addition, the results suggested that the impact of subsidised coverage had a larger effect in reducing unemployment in Scotland than in England (missing data prevented comparable analyses for Wales and Northern Ireland).

5.9 Effects of ultrafast and hyperfast broadband

This study also incorporated exploratory research examining the effects of faster fixed broadband speeds delivered with and without public subsidy (up to 1 Gigabit per second). These results were based on a similar methodology, and suggested that the economic impacts of broadband increase substantially with faster speeds. Hyperfast speeds were found to deliver increases in turnover per worker an order of magnitude larger than superfast speeds, as well as encouraging greater local economic dynamism. Additionally, the results suggested that there was substantial scope for variable effects across different types of local economy. The findings are reported in detail in Annex B.

³⁴ This analysis was completed using ONS urban and rural classification at an Output Area level - A zone for reporting small area statistics representing around 10 postcodes.

6. Public and Social Value

Summary

- **Use of the internet:** Comparisons between upgraded and non-upgraded areas suggest that the patterns of internet usage do not vary significantly across groups. Small differences are evident in the importance placed on the internet for the activities explored in the evaluation such as communicating with friends and family and accessing entertainment content for which respondents in upgraded areas considered internet access more important. Participants adopting superfast services stated more extensive usage of social networks with 45 percent of adopters using social networks several times or more a day compared to 36 percent of participants with slower speeds.
- **Importance of speed and reliability:** Connection reliability was seen to be more important than overall speed in both the quantitative survey and the qualitative interviews potentially because issues with reliability (such as dropped connections) were more noticeable for all except those with the slowest internet speeds. However, there may be some overlap between these two concepts in participants' minds too: a connection that is so slow that webpages do not load could be considered the result of a dropped or slow connection. The activities for which the internet was used typically reported by respondents to qualitative interviews did not typically require superfast speeds.
- **Impact on wellbeing:** Survey evidence did not show any significant differences in the subjective wellbeing of respondents in upgraded and non-upgraded areas. However, more rigorous econometric analysis using larger sample sizes suggested the programme had a positive effect on wellbeing, although there were variable effects across age groups. These benefits were valued at £222.25 per year per premises upgraded.
- **Future impacts:** The development and roll-out of transformative technologies relying on greater bandwidth were only at a nascent stage in 2016, and the quality of life benefits from the programme may largely arise in the future. Indeed, the programme may also contribute to accelerating their development and adoption through expanding the potential addressable market and increasing incentives to invest.

6.1 Overview of approach

The aim of this strand of the research was to investigate the potential impacts of the superfast broadband programme on wellbeing and quality of life (public and social value). As part of this the following activities were undertaken:

- **Evidence assessment:** The first stage of the research programme was a rapid literature review to identify and understand existing research into the public value and social impacts of superfast broadband and form hypotheses that could be tested through further research.
- **Logic model development:** The findings of the evidence assessment were used to generate a draft theory of change, which detailed the potential outcomes and impacts of the provision of superfast broadband identified in the literature. This model was then discussed and refined through an expert workshop, with some key outcomes prioritised for further research.
- **Qualitative interviews with members of the public:** A series of interviews with members of the public were carried out with those living in areas upgraded under the programme (“upgraded”), and those living in areas not covered by the programme who are unable to access superfast download speeds (“non-upgraded”). The discussion was structured around the four key areas of life identified through the theory of change as being potential outcome areas for superfast broadband, as well as overall subjective wellbeing.
- **Quantitative survey of households in upgraded and non-upgraded postcodes:** The final stage of research involved a postal survey designed to test for the existence of differences in social outcome measures between households in areas upgraded under the Superfast Broadband programme and households not in those areas. The postal questionnaire covered similar areas to the qualitative research phase, focussing on the four outcome areas and subjective wellbeing³⁵.
- **Assessment of the impact of superfast on wellbeing:** Finally, a series of econometric analyses were completed to ascertain the causal effect of the programme on wellbeing using data included in the Annual Population Survey (APS) and Understanding Society datasets, further details of which can be found in Annex C.

Annex D of this report contains a more detailed description of the research exploring the public value and social impacts of the programme.

³⁵ It should be noted that there was no information available on the demographic profile of bill payers so it is not possible to assess how far respondents were representative of the relevant populations.

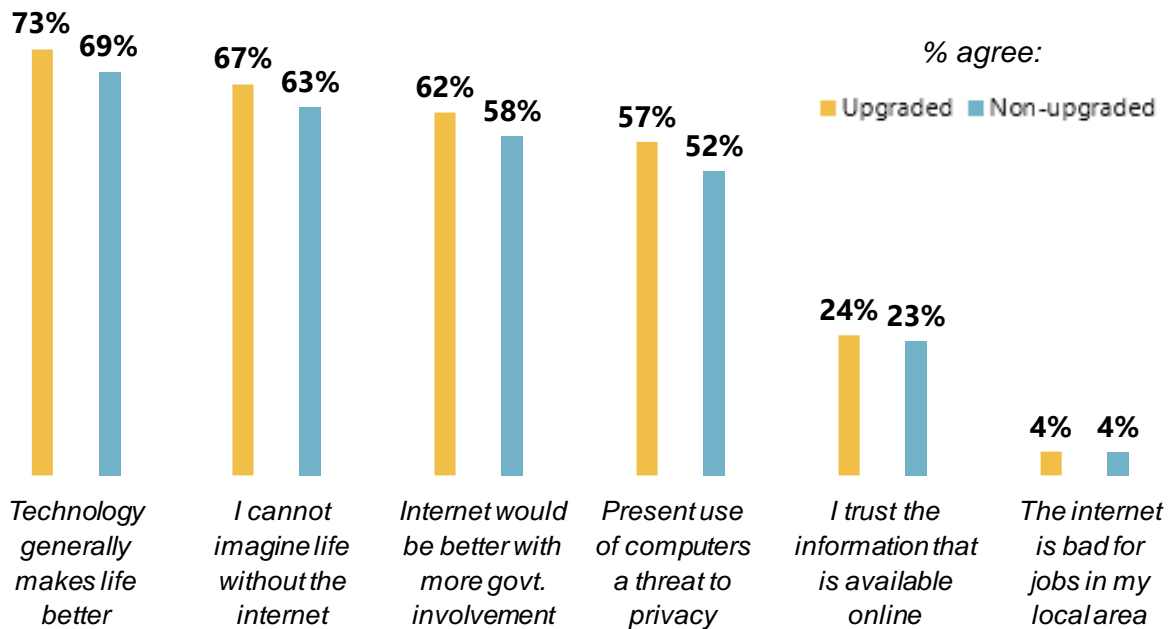
6.2 Attitudes and use of the internet

This section examines the relative attitudes of households in areas receiving subsidised superfast coverage and unable to access superfast speeds. It is important to note that differences between the two groups cannot be taken as an impact of the programme.

6.2.1 Attitudes towards the internet

Survey participants were asked about their attitudes towards the internet in broad terms to understand how these differ between households in postcodes upgraded with superfast coverage and non-upgraded households. Respondents in both groups held similar views with 9 in 10 people considering themselves confident in using the internet across both groups.

Figure 6.1: Views on the internet and technology – upgraded and non-upgraded



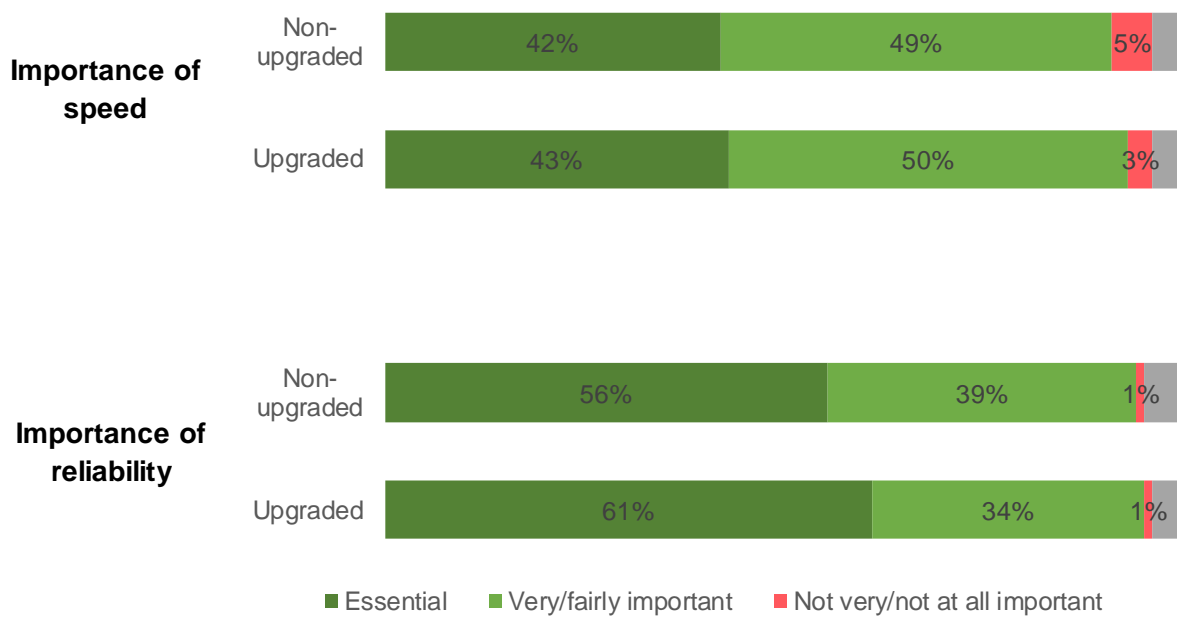
Source: Ipsos MORI survey of upgraded and non-upgraded areas

6.2.2 Importance of Speed and Reliability

Evidence on the importance of speed and reliability was also explored in the quantitative and qualitative research. Speed was not always seen as very important for the activities participants were using the internet for. Speed was identified as less of a concern than reliability through the language used in the qualitative research to describe participants' connections. Issues with reliability (such as dropped connections) were much easier to notice for all but those with the slowest internet speeds, and were therefore recalled by participants more readily. It is likely that there is overlap between these two issues in participants' minds too: a connection that is so slow that webpages do not load could equally be considered the result of a dropped or slow connection.

The survey results reinforce this. While both speed and reliability are considered very important, greater priority is given to reliability over speed. In both samples, just over four in ten considered the speed of their connection to be essential, compared with around six in ten who said the same about reliability. Those living in upgraded areas were significantly more likely than those in non-upgraded areas to consider reliability to be essential. The gap grows wider still among superfast adopters; 69 percent of those with superfast speeds considered reliability to be essential, compared with 60 percent of those with connections under 10Mbit/s.

Figure 6.2: Importance of speed and reliability of connection



Source: Ipsos MORI survey of upgraded and non-upgraded areas. Comparisons are made between a matched sample of respondents sharing similar characteristics.

6.3 Communication with friends and family

The use of video chat applications and internet calls to communicate with family and friends was covered in the most depth by existing academic research, and in the expert workshop it was commonly cited as a key frustration among those with slow connections.

Comparisons of the methods participants used to keep in touch with friends and family from the survey were not very different in areas that were upgraded to those non-upgraded. There was, however, a difference in the use of messaging platforms, with internet-based messaging services such as WhatsApp and Facebook Messenger significantly more used more widely by participants in upgraded areas. Participants in both samples were equally likely to have accounts on a wide range of social networks, however, upgraded participants were significantly more likely to say that they use social networks several times a day or more often than those located in non-upgraded areas (four in ten of the former and one third of the latter). Upgraded participants were also more likely to state that the internet is essential for keeping in touch.

Table 6.1: Frequency of use of social networks

	Non-upgraded / upgraded area		Superfast / slower	
	Non-upgraded	Upgraded	Slower internet	Superfast adopter
Use social networks “several times a day or more”	34%	40%	36%	45%

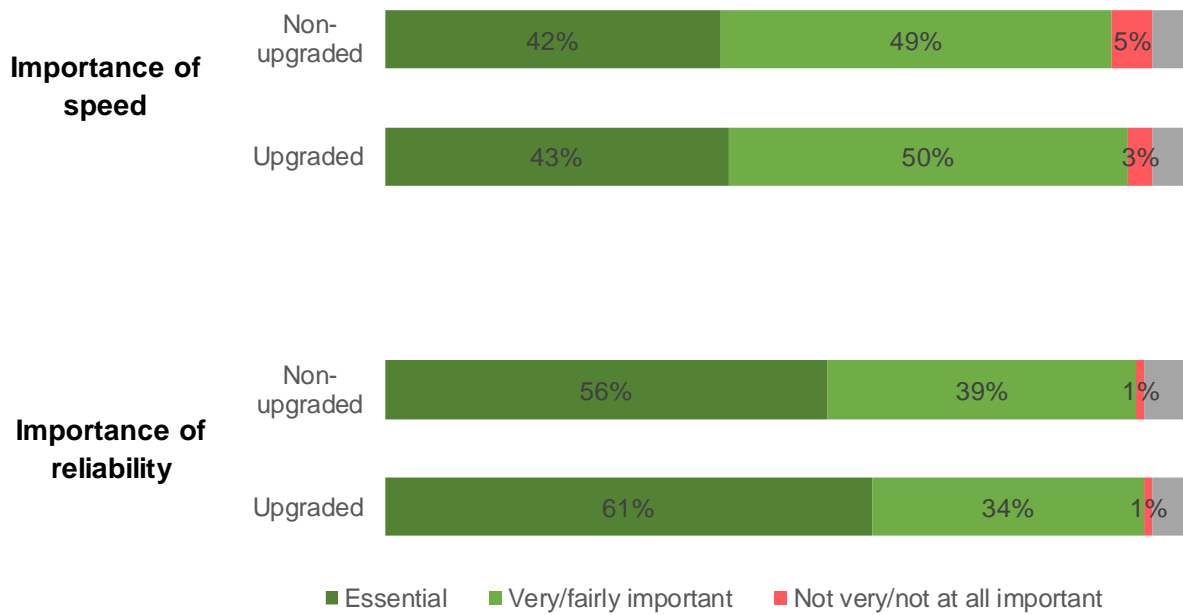
Source: Ipsos MORI survey of upgraded and non-upgraded areas. Comparisons are made between a matched sample of respondents sharing similar characteristics.

6.4 Accessing entertainment and educational content

Quantitative research among the public identifies streaming and downloading entertainment content as among the most frequent uses of the internet in Britain³⁶. Evidence from the survey suggested that internet usage for accessing entertainment content was also similar across upgraded and non-upgraded areas. This was supported in the qualitative work which highlighted the limited use of streaming in the sampled group with only one participant not able to download or stream the content they wanted due to a lack of speed. Differences again emerged between those in non-upgraded and upgraded areas on how essential the internet is for accessing entertainment content. Participants in upgraded areas were significantly more likely to consider the internet essential than those in non-upgraded areas (15% to 10%).

³⁶ More recent qualitative studies have also highlighted the growing importance of a good home internet connection for learning. See: Ashmore, F., J Farrington & S. Skerratt (2015): “Superfast Broadband and Rural Community Resilience: Examining the rural need for speed” in *Scottish Geographical Journal* (131: 3-4) pp265-278. This is an important topic, and was explored in the qualitative research. It was not possible to include questions on education in the quantitative research as they would have not been relevant to most people answering the survey.

Figure 6.2: Importance of the internet to accessing entertainment content



Source: Ipsos MORI survey of upgraded and non-upgraded areas. Comparisons are made between a matched sample of respondents sharing similar characteristics.

6.5 Managing everyday life

Being able to use the internet to run a household (for instance through online banking, online shopping and utility billing) was an important proposed outcome of upgrading to superfast as it frees up more time for leisure or other interests, which may help improve wellbeing.

The survey did not provide evidence of any differences in the use of broadband in terms of managing respondents’ day-to-day lives through tasks such as paying bills, banking, buying groceries and non-food items. These were, however cited frequently in qualitative interviews as an area where internet access has made a significant difference. Many described making use of online banking, online accounts for utilities, as well as online shopping. Participants that had adopted superfast services were also more likely to agree with the statement “I manage as much I can of my day-to-day life online”.

Table 6.2: Role of the internet in managing day to day life

	Non-upgraded / upgraded area		Superfast / slower	
	Non-upgraded	Upgraded	Slower internet	Superfast adopter
“I manage as much of I can of my day-to-day life online” % agree	24%	26%	21%	32%

Source: Ipsos MORI survey of upgraded and non-upgraded out areas. Comparisons are made between a matched sample of respondents sharing similar characteristics.

6.6 Strengthening local communities

More recent literature suggested that superfast could be positive for dispersed communities and older people by making it easier for them to communicate through Facebook, video messaging, and other online platforms. The concept of “community resilience”³⁷ covers the potential for superfast connectivity to generate positive outcomes for the cohesion and strength of local (especially rural) communities. This could be by making it easier for remote or disparate communities to communicate with each other, or allowing older people to participate more fully in their neighbourhoods online.

Both the qualitative and quantitative research suggests that the importance of the internet in this area is low, generally, and participants did not see a need for superfast connections in this area. In the qualitative research, while participants made frequent use of Facebook as a source of local information, they received more information from face-to-face discussions with friends and neighbours, local groups, or in local shops. While email was used by many local organisations (and some had websites), this again was seen as an addition to the core functions of these groups rather than a replacement. As discussed elsewhere, the bandwidth requirements of email and Facebook are low – and well within what many non-upgraded could manage - so participants were unsure why they would need a superfast connection.

6.7 Wellbeing outcomes

Survey participants were asked about their subjective wellbeing using the ONS-recommended measures of subjective wellbeing³⁸. Most notably, there were no statistically significant differences between those living in areas upgraded with superfast broadband and those who were unable to access superfast speeds. Comparing respondents based on the speed they received showed that those receiving a speed more than 24Mbit/s rated their lives as less

³⁷ Ashmore, F., J Farrington & S. Skerratt (2015): “Superfast Broadband and Rural Community Resilience: Examining the rural need for speed” in *Scottish Geographical Journal* (131: 3-4) pp265-278.

³⁸ The four measures ask participants to rate their well-being on a scale of 0-10 for four questions – see Annex D for more detail

worthwhile than those with connections under 10 Mbit/s – although there were no significant differences on any other ONS wellbeing measures.

Table 6.3: Wellbeing scores by speed available to participant

	Worthwhile life	Anxious yesterday	Happy yesterday	Life satisfaction
Faster connections (>24 Mbps)	<u>7.3</u>	3.2	7.2	7.4
Slower connections (<10 Mbps)	<u>7.8</u>	3.1	7.5	7.6

Source: Ipsos MORI survey of upgraded and non-upgraded areas. Comparisons are made between a matched sample of respondents sharing similar characteristics.

The reasons for this relationship likely lie outside the areas under investigation in this survey and have not been fully explored. For example, this pattern could arise if those with other characteristics associated with lower wellbeing (for instance, having children, or commuting for work) choose live in areas more likely to be upgraded under the programme, while those with higher scores (older and retired people) choose to live living in areas where superfast speeds are unavailable. These issues are addressed by the analysis set out in the following subsection.

6.8 Impact of Superfast Broadband Programme on Wellbeing

The econometric analysis of the wellbeing outcomes, detailed in Annex C, was undertaken to estimate of the impact of superfast availability data on subjective wellbeing captured in large social surveys. The effect was then monetised to give a monetary value of the wellbeing impacts over and above the economic impacts of the programme.

The results suggested that the provision of superfast broadband subsidised through the programme was associated with a wellbeing uplift equivalent to £222.25 per year for the average premise upgraded. This impact persisted for at least the first year following an upgrade in connectivity, though it was not possible to test how far beyond this the effect reaches given the recent nature of investment and limited sample sizes.

A significant degree of variation was found in the results when analysed by age, with subsidised coverage associated with a much larger uplift in wellbeing for people aged 16 to 35 (£1,389.07). Conversely a significant negative impact was identified for people aged between 36 and 64 (-£565.09), whilst no effect was found on individuals aged 65 or older. Estimates of the wellbeing values for these groups are shown below. It should be noted that there are some uncertainties regarding the nature and size of the wellbeing impacts of the programme, and some analyses did not find that the subsidised coverage led to an increase in wellbeing at the level of the population overall. As such, these estimates should be treated with a degree of caution.

The effect on wellbeing was found to be larger for frequent internet users suggesting that the wellbeing benefits of the programme may grow over time, if take-up and internet use increases. However, it should be noted that the transformative social impacts of high speed networks are expected to arise from enabling of remote service delivery (such as remote and real-time medical diagnostics). The development and roll-out of technologies relying on greater bandwidth were only at a nascent stage in 2016, and the quality of life benefits from programme may largely arise in the future. The programme may also contribute to accelerating their development and adoption through expanding the potential market and increasing incentives to invest.

Table 6.4: Summary of wellbeing impact findings by age

Scope	Wellbeing value
Per targeted person aged 16-35	£1,385.07*
Per targeted person aged 36-64	-£565.09*
Per targeted person aged 65+	£12.59
Per person residing in premises upgraded	£93.78 (£7.81 pcm)
Per premise upgraded	£222.25 (£18.52 pcm)

*Table note. All wellbeing values are annual unless indicated otherwise. An * indicates the statistical significance of the underlying coefficient in the age-interaction wellbeing regression at the 10% level.*

7. Cost-Benefit Analysis

Summary

- **Value for money by 2016:** Overall, it is estimated that the programme delivered a benefit to cost ratio of £1.96 per £1 of gross public sector spending. This will understate the net benefits of the programme as it does not include any value associated with the future use of the infrastructure.
- **Residential and non-residential:** The estimated BCRs associated with upgrades to residential and non-residential upgrades are estimated at £1.18 and £12.28 respectively.
- **Policy implications:** The evidence from the evaluation suggests that while firms can use faster speeds to improve efficiency, households to date have less intensive bandwidth requirements and derive smaller benefits from consuming superfast services. This does not necessarily imply that BDUK could have attained greater value for money by delivering a smaller programme with a higher level of targeting of non-residential premises, as the unit costs associated with a more targeted initiative would likely have been higher and the practicalities of building networks in non-residential areas difficult to manage. Additionally, much of the quality of life improvements associated with the programme are expected to arise in the future, and it is too early to make a judgement as to the relative costs and benefits of residential and non-residential deployment.

This section sets out the findings of an indicative cost-benefit analysis of the Superfast Broadband programme, providing an assessment of the value for money it has delivered to date. The cost-benefit analysis has been completed in line with the principles of the HM Treasury Green Book, and covers both the value of the economic impacts associated with the programme and wellbeing impacts described in the preceding chapter.

7.1 Overview of Approach

A cost benefit analysis requires an assessment of the costs of delivery against the economic and the value of the associated consumer welfare impacts. This involves several challenges, including:

- **Relocations, displacement, and crowding out:** While businesses located on postcodes receiving subsidised coverage expanded their sales and employment, this will have come at the expense of loss of market share for competing firms, leading to offsetting impacts in other locations. Even if firms expanded without negatively affecting their domestic competitors, increased demand for workers and other inputs would be expected to lead to higher prices, encouraging other firms to scale back their activities. Local economic impacts were shown to be partly driven by the relocation of higher productivity firms to

areas receiving subsidised coverage, and it is likely that much of the job creation impacts would have been realised in other locations. As such, only impacts in terms of raising productivity can be considered to qualify as an economic benefit at the national level.

- **Valuing improvements in wellbeing:** Life satisfaction is not traded in markets and does not have readily observable 'price.' The evaluation involved the application of methods to value the subjective wellbeing impacts of the programme, in a manner consistent with economic theory and the HM Treasury Green Book³⁹.
- **Double counting of benefits:** Productivity gains brought about by the programme may raise the wellbeing of residents if they benefit from higher wages. However, as the estimates of the wellbeing impact of the programme allows for household incomes, the risk of double counting is mitigated.
- **Future costs and benefits:** A relatively short amount of time has passed since the subsidised coverage was delivered, and it is unlikely that the benefits of the programme will have been fully realised by 2016. Forecasting the future benefits of the programme is outside the scope of this study, but the findings from this evaluation will be used to update and develop the BDUK Benefits Model⁴⁰.

7.2 Costs

The present value of the net cost to the public sector associated with the delivery of the Superfast Broadband programme – after allowing for underspend and take-up gainshare – is forecast to be £1.1bn (in 2016/17 prices). These costs are projected to fund the extension of superfast broadband coverage to 5.3m premises at a unit cost of £211 per premise upgraded.

However, there is no information available on how far the £1.1bn of funding was or will be invested in enabling residential or non-residential properties. Additionally, while detailed information is gathered on the premises that have benefitted from subsidised coverage, it does not describe whether they are residential or non-residential in character. As such, the costs that will be incurred by upgrading residential and non-residential need to be approximated using other sources of information:

- **Number of residential and non-residential delivery points:** Information was supplied by BDUK on the number of residential and non-residential delivery points at a postcode level. It has been assumed that where a postcode has benefitted from superfast availability subsidised by the programme, each delivery point has an equal probability of being upgraded. Applying this assumption gives an estimate that 93 percent of premises upgraded were residential, and 7 percent were non-residential. These shares were applied to the total number of premises upgraded by June 2016 (4.0m), giving an overall estimate

³⁹ See Annex C for more detail

⁴⁰ This model was originally developed in 2013 as part of the BDUK Broadband Impact Study, and is used by DCMS to make ex-ante assessments of the costs and benefits of potential investments.

of the number of residential and non-residential premises upgraded of 3.7m and 0.3m respectively.

- **Cost of residential and non-residential delivery:** To reach estimates of the present value of the costs incurred in upgrading residential and non-residential premises, it was further assumed that the unit cost (£211) was equivalent across both types of premises. This gave estimates of the total net cost to the public sector of premises upgraded by June 2016 of £848m. This breaks down as £789m to upgrade residential premises, and £59m to upgrade non-residential premises (in 2016/17 prices).

These estimates do not include the additional private sector investment that has been leveraged by the programme, the opportunity costs of which would normally be counted as a cost. However, on the basis that the programme was delivered with a gap funding model, it is assumed that the present value of the profits earned by providers due to making enhanced connectivity available will be at least equal to these investment costs (and can therefore be ignored for the purposes of this indicative cost benefit analysis).

Table 7.1: Estimated net cost to the public sector of premises upgraded by 2016

	Estimated share of premises upgraded %	Number of premises upgraded	Unit cost (£)	Total cost (£m)
Residential	0.93	3,738,048	211	789
Non-residential	0.07	282,999	211	59
Total	100	4,021,047	211	848

Source: Ipsos MORI analysis. 2016/17 prices

7.3 Economic benefits to 2016

7.3.1 Productivity gains

The results of the evaluation suggested that subsidised connectivity led to positive economic impacts at a local level, raising employment, turnover and turnover per worker. As indicated, it is likely that these impacts will be largely neutral at the national level, being driven by firms changing location or claiming the market share of their competitors. In line with the HM Treasury Green Book, only the effects of the programme in terms of raising productivity are considered to qualify as an economic benefit at the national level.

This issue is dealt with by restricting the focus to firms that did not change location between 2012 and 2016. This gives greater assurance that the effect was driven by improvements in productivity rather than the relocation of firms. Additionally, a conservative assumption is made in that the improvement in productivity is assumed to only apply only to those workers in place before the premises was upgraded. While these firms may also have expanded and taken on further workers, there is a risk this growth was achieved at the expense of their competitors (and may simply represent a displacement effect).

Estimates of the productivity gains associated with the programme were derived as follows (see Annex B for more detail):

- **Annual percentage effect on GVA per worker:** The results of the evaluation suggested that the programme led to an improvement in the turnover per worker of 0.38 percent per annum. It is assumed that this approximates the productivity effect of the programme (i.e. on GVA per worker⁴¹). While turnover per worker has been used in several studies as a proxy measure of productivity, it could overstate these effects if broadband has enabled greater outsourcing, or helped firms secure lower prices for their inputs.
- **Annual effect on GVA per worker:** Applying this to the average GVA per worker for firms benefitting from the programme (£38,120 in 2012⁴²) gave an estimated impact on GVA per worker of £145.
- **Annual effect on GVA per firm:** Applying this result to the average employment of firms that did not change location over the 2012 to 2016 period (9.6) gave an estimated increase in GVA per firm of £1,390.

The findings of the evaluation suggested 408,000 firms benefitted from subsidised coverage that did not change location between 2012 and 2016. Assuming these firms experience the productivity gain from the point of the upgrade, and this effect does not increase or decay, with time, it is estimated that the upgraded connections resulted in an increase in output of £1.3bn. Allowing for the estimated level of additionality implied by the findings in section 3⁴³, the present value of GVA impacts resulting from productivity gains are estimated at £690m.

7.3.2 Labour market impacts

The evaluation also suggested that for every 10,000 premises upgraded there was a reduction in long term unemployment of 6.2 claimants in the year of installation. Applying this to the number of premises upgraded, it was estimated that the programme resulted in 2,500 fewer long term JSA claimants (on a cumulative basis).

Assuming the impacts of the programme in reducing long term unemployed also represent an increase in the overall productive capacity of the economy, and valuing the output produced by those individuals at £14,458 per annum⁴⁴, it is estimated that subsidised coverage led to a further £70.5m in GVA by 2016. Again, allowing for the additionality of the subsidised

⁴¹ The costs of purchasing goods and services ought to be relatively stable in the short term, and this proxy measure used is considered reasonable proxy for GVA per hour or per worker.

⁴² In 2016/17 prices.

⁴³ And discounting in line with the HM Treasury Green Book recommendations.

⁴⁴ It is assumed that the productivity of the average worker avoiding long-term unemployment due to the programme is lower than the national average, and here we have assumed that workers would gross annual pay at the 25th percentile of all workers (based on the 2017 Annual Survey of Hours and Earnings).

infrastructure (60 percent), the present value of GVA attributable to the programme is estimated at £38m.

7.4 Wellbeing benefits to 2016

The results from the analysis of the effects of the programme on the subjective wellbeing of households suggested that the average improvement in wellbeing of £222 per annum, per premises upgraded⁴⁵. This measure includes both direct impacts from leisure use of the technology, indirect benefits and well as any accruing to self-employed workers which are not captured in measures of firm productivity above. This value is averaged across households that do and do not take up the technology, and represents the value over and above the cost of paying for superfast broadband services.

To reach an estimate of the total value of the wellbeing impacts of the programme to 2016:

- It is assumed that wellbeing increases in the year of installation and does not decay or grow with time. This could understate the value of these effects in later years (and overstate the value of effects in earlier years) to the extent that these benefits have been driven by increasing take-up of the technology.
- The average value of wellbeing gains per premises upgraded is applied to the cumulative number of premises receiving enhanced connectivity. This gives an estimate of the gross value of wellbeing benefits of £1.7bn by June 2016.
- Allowing for additionality and discounting in the manner above, gives an estimate of the present value of wellbeing gains attributable to the programme of £932m (by June 2016).

It should be noted that there are some uncertainties regarding the nature and size of the wellbeing impacts of the programme, and the analysis did not find the subsidised coverage led to an increase in wellbeing at the level of the population overall. As such, these estimates should be treated with a degree of caution.

7.5 Value for money to 2016

Combining the costs described in section 6.2 and the benefits estimated above gave the following estimates of the value for money:

- Overall, it is estimated that the programme has delivered a benefit to cost ratio of £1.96 per £1 of gross public sector spending by June 2016.
- These are early estimates of the impact of the programme, and will substantially understate the net benefits of the programmes as it does not include any value associated with the future use of the infrastructure. The benefits of the programme will likely grow with

⁴⁵ Regardless of whether the premises was residential or non-residential in nature.

time as take-up rises and firms and households have more time to absorb the technology and data intensive applications become more widespread.

- At the same time, there was also evidence that additionality of subsidised coverage declined with time, which may limit the total level of net benefits that may eventually be realised.
- The estimated BCRs associated with upgrades to residential and non-residential upgrades are estimated at £1.18 and £12.28 respectively. It should be noted that these results are highly sensitive to the assumed share of non-residential premises upgraded through the programme, which is unknown.
- The evidence from the evaluation suggests that while firms can use faster speeds to improve efficiency, households appear to date to have less intensive bandwidth requirements and derive smaller benefits from consuming superfast services. This does not necessarily imply that BDUK could have attained greater value for money by delivering a smaller programme with a higher level of targeting of non-residential premises, as the unit costs associated with a more targeted initiative would likely have been higher. Additionally, much of the quality of life improvements associated with the programme are expected to arise in the future, and it is too early to make a judgement as to the relative costs and benefits of residential and non-residential deployment.

Table 7.2: Estimated BCRs – residential and non-residential premises upgraded

Type of premises upgraded	Total cost (£m)	Total benefits (£m)	BCR (£)
Residential	789	932	1.18
Non-residential	59	729	12.28
Total	848	1,660	1.96

Source: Ipsos MORI analysis

8. Conclusions

This section sets out the main conclusions from the evaluation.

8.1 Key findings from the evaluation

- **Reducing the digital divide:** Results from the evaluation indicate that the scheme had a significant net impact in extending superfast coverage to premises and postcodes that would not have received it under the commercial plans of suppliers⁴⁶. It was estimated that 2.5m premises received access to superfast speeds that would not have done so without the programme by June 2016. Additionally, it is estimated that a further 1m premises received superfast coverage one to two years earlier than they would have done otherwise. The additionality of subsidised coverage was estimated at over 70 percent in the short term, though this fell with time as growing demand made postcodes previously thought to be commercially unviable more attractive over time.
- **Contractual protections:** The underspend and take-up gainshare mechanisms included in contracts had a significant role in protecting the value for money associated with the programme. These protections have reduced the expected net cost of the programme to the public sector from £1.6bn to £1.1bn, though this is dependent on anticipated future take-up. This implies that the public sector is not expected to incur costs on a share of premises that would have been upgraded by the market without the programme. This would raise the average rate of additionality by June 2016 from 60 to 84 percent, provided future take-up aligns with expectations. In the absence of these protections, the estimated unit cost per premises upgraded would have risen by 40 percent.
- **Economic impacts⁴⁷:** The evidence indicated that making superfast broadband speeds available improved local economic performance. Overall, it is estimated that subsidised superfast coverage led to the creation or retention of 49,000 additional jobs on those postcodes that received upgraded infrastructure, while the annual turnover of firms located on those postcodes also expanded by almost £9.0bn (though there would have been offsetting effects elsewhere). The programme is estimated to have led to net gains in productivity valued at £690m by June 2016. In addition, subsidised coverage was found to the number of individuals claiming JSA by 8,800 by 2016, as well as reducing the number of long term claimants (those claiming JSA for 12 months or longer) by 2,500. These impacts are estimated to have increased national economic output by a further £38m by June 2016⁴⁸.

⁴⁶ Based on comparisons with 'white' postcodes that did not receive subsidised coverage.

⁴⁷ These estimates are based on comparisons with postcodes that did not receive subsidised coverage but have not been adjusted for deadweight associated with investment in infrastructure, or for displacement of economic activity between areas of the UK.

⁴⁸ Again, net of displacement and crowding out, and allowing for deadweight associated with investments in infrastructure.

- **Impact on wellbeing:** Evidence from the survey did not show any significant differences in the subjective wellbeing of respondents in upgraded and non-upgraded areas overall. However, more rigorous econometric analysis using larger sample sizes suggested the programme had a positive effect on wellbeing, although there were variable effects across age groups. These benefits were valued at £222.25 per premises upgraded per annum. The total net value of the wellbeing impacts of subsidised coverage was estimated to be £932m by June 2016.
- **Overall value for money:** An indicative analysis of the costs and benefits of the scheme to date suggests that it delivered an acceptable payback by June 2016. The overall value of the additional economic and public value benefits brought about by the programme over this period were estimated at £1.7bn against the forecast net costs to the public sector of upgrades completed by June 2016 of £848m. This gives an estimated benefit to cost ratio of £1.96 per £1 of public sector spending to date⁴⁹, suggesting that the programme is close to meeting the rates of return typically required for the approval of public sector investment decisions. This is an early assessment of the net benefits of the programme and does not factor in any future benefits associated with the infrastructure upgraded. These are likely to rise as take-up increases and as more bandwidth intensive applications are developed. At the same time, results also showed that additionality declines with time, so there may be a limit to the total net benefits that may eventually be realised.

8.2 Learning for future policy design and implementation

- **Resource allocation process:** The contracts developed to procure the programme have offered the public sector the opportunity to share the profits of higher than expected take-up. The gainshare mechanism is rarely employed in public sector programmes involving financial support to the private sector, and could have more widespread applicability. It is possible to speculate as to the underlying success factors. For example, it was possible to monitor take-up with accuracy over time, enabling enforceable conditions to be written into contracts, which may be less straightforward in other areas of Government policy. Further research into its potential transferability could be beneficial, particularly given that cross Government learning for large procurement programmes was a key benefit anticipated from the programme.
- **Role of broadband in economic development:** The findings corroborate other research that highlights the role of fixed broadband in raising economic performance by improving the efficiency of firms. The evaluation also suggested that broadband availability influences the spatial pattern of economic development outcomes, although there were signals that these impacts are mainly significant at local levels. This may be a function of the comparatively widespread availability of superfast broadband - ultrafast and hyperfast

⁴⁹ Past research on the potential benefits of the programme explored effects over much longer time horizons (up to 2035).

speeds could potentially have more significant impacts on the performance of local economies.

- **Labour market matching and teleworking:** The evidence suggested that upgrades to non-residential premises were the primary driver of reductions in unemployment. There was less evidence that subsidised coverage enabled workers to more effectively search for work or to take up teleworking roles and any impact of this nature was small relative to the impact of local job creation. This could be explained if the types of teleworking role expected have not emerged on the scale anticipated, or if lower income residents were either unable to pay the costs of superfast broadband or did not have the skills to access these opportunities. Further research with workers would be required to understand any constraints in more detail. It should also be noted that this evaluation did not explore the impact of the programme on individuals that were not claiming out of work benefits.
- **Residential and non-residential deployment:** The evidence from the evaluation suggests that while firms have used faster speeds to improve efficiency, households appear to have less intensive bandwidth requirements and derive smaller benefits from consuming superfast services. The estimated benefit to cost ratio of residential and non-residential coverage was £1.18 and £12.28 respectively. This does not necessarily imply that BDUK could have attained greater value for money by delivering a smaller programme with a higher level of targeting of non-residential premises. The unit costs associated with a more targeted initiative would likely have been higher, and the practicalities of building networks in non-residential areas difficult to manage. Additionally, much of the quality of life improvements associated with the programme are expected to arise in the future, and it is too early to make a judgement as to the relative costs and benefits of residential and non-residential deployment.

8.3 Evidence gaps and suggestions for future research

- **Spill over build:** The Superfast Broadband programme largely involved the expansion of fibre networks to cabinets. This could potentially reduce future marginal cost of extending fibre to premises (FTTP), resulting in possible spill over effects as full fibre networks become more prevalent. Future evaluation studies could potentially consider the role of the programme in producing these types of spill overs.
- **Business impacts:** There may be merit in completing qualitative research with the businesses benefitting from enhanced access to superfast broadband to understand how access to superfast connectivity was used, how it raised efficiency, and any complementary investments that have been made.
- **Workers:** Further research with unemployed workers and the economically inactive could be useful in understanding the possible role of teleworking in enabling these individuals access employment opportunities on a remote basis. Additionally, there may be an opportunity to use longitudinal data on earnings held within the ONS Secure Research

Service to examine how far workers have benefitted from the apparent increase in firm productivity.

- **Process evaluation:** The Open Market Review and gainshare mechanisms used in contracts appeared to be effective in raising value for money associated with the programme. Future process evaluation could usefully examine the lessons learned in the implementation. Research into its potential transferability to other areas of Government policy could also be helpful.
- **Wider research into the impacts of superfast broadband:** The unique analytical feature of the survey completed as part of this study has been access to premise-level internet speed data from Sky. Other research exploring the social outcomes of standard and superfast internet access has not had this level of granularity of information on participants. Expanding a similar survey to a wider sample of the country could represent a significant contribution to literature in this area, though findings may be similar.
- **Research into drivers and barriers of superfast adoption:** Another potential area for further research would be understanding the factors that either inhibit or promote upgrading to faster broadband speeds among the public, given that this is a necessary precursor to experiencing potential positive and negative social outcomes and impacts.



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