

Annex E: Cost Benefit Analysis

This Annex sets out estimates of the costs and benefits of the Superfast Broadband programme to 2016. This includes a breakdown of the costs and benefits of residential and non-residential coverage.

1.1 Costs of Residential and Non-Residential Coverage

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. 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 (in 2016 prices).

However, there is no information available on how far the £1.1bn of funding will be invested in enabling residential or non-residential properties with superfast broadband availability. While detailed information is gathered on the premises that have benefitted from enhanced connectivity subsidised through the programme, 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.

Information was supplied by BDUK on the estimated number of residential and non-residential delivery points at a postcode level (as modelled by BDUK). 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 seeing their connectivity 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 (4.0), giving an overall estimate of the number of residential and non-residential premises upgraded of 3.7m and 0.3m respectively.

To reach estimates of the total 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.

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 on these investments will be at least equal to these investment costs (and can be ignored for the purposes of this indicative cost benefit analysis).

Table 1.1: 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 | 93 | 3,739,574 | 211 | 789 |
| Non-Residential | 7 | 281,473 | 211 | 59 |
| Total | 100 | 4,021,047 | 211 | 848 |

1.2 Firm Productivity

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. However, at the national level, it is likely that the local economic impact of the programme will be largely neutral. While businesses located on postcodes receiving subsidised coverage have expanded their sales, this will have come at the expense of loss of market share for competing firms (who could be located locally, elsewhere in the UK or overseas). The findings also suggested that relocation of economic activity was an important driver of the effects observed – and it is likely that much of the job creation impacts described above would have been realised in other locations in the UK. Even if firms expanded without displacing the activities of domestic based competitors, increased demand for factor inputs can be expected to have placed additional pressure on prices, resulting in reductions in output and employment elsewhere.

As such, only the effects of the programme in terms of raising productivity are considered to qualify as economic benefits at the national level (with improvements in turnover per worker taken as a proxy measure for productivity). However, while the results suggested that around 23 percent of the overall growth effect was driven by improvements in turnover per worker, this was partly a function of more productive firms relocating to postcodes receiving subsidised coverage (a displacement effect).

This issue is dealt with by restricting the focus to firms that did not change location between 2012 and 2016 (i.e. spatially stable firms), giving greater assurance that the effect was driven by improvements in efficiency rather than displacement or crowding out effects. Secondly, the efficiency gain is assumed to only apply only to workers in place before the premises was upgraded – with any further output facilitated by the recruitment of additional workers assumed to be represent a displacement effect. This gives the following results:

- **Efficiency effects on spatially stable firms:**
 - The results of the evaluation suggested that the programme led to an improvement in the turnover per worker of local units that did not change location between 2012 and 2016 of 0.38 percent.
 - It is assumed that this offers a reasonable approximation of the productivity effects of the programme. Average GVA per worker for firms benefitting from the programme was £38,120 in 2012¹, giving an estimated impact on GVA per worker of £145 (i.e. $0.0038 * £38,120$).
 - Average employment for this group of firms was 9.6 between 2012 and 2016, giving an estimate of the overall uplift in GVA per annum per firm of £1,391 due to improvements in efficiency resulting from the subsidised coverage (i.e. $9.6 * £145$).
- **Gross GVA impact:** A total of 408,000 local units that did not move location are thought to have benefitted from superfast coverage subsidised through the programme, with the time distribution set out in the table below. It is assumed that the productivity effect estimated above apply from the point installation and does not increase or decay with time. Based on these assumptions, it is estimated that the upgraded premises led to an overall increase in national output of £1.3bn between 2012 and 2016.

¹ This taken from the sample of firms benefitting from enhanced superfast availability that appeared in the ABS and was not wholly representative of the population of firms based on relevant postcodes.

- **Additionality:** The evaluation results suggested that over a three-year period, 60 percent of the premises upgraded would not have received enhanced connectivity without the programme. It is assumed that this result applies equally to residential and non-residential premises, and that 40 percent of the increase in national economic output would have been realised without the programme. This gives an estimate of the increase in GVA attributable to the programme of £772m.
- **Discounting:** The value of GVA resulting from productivity gains has been discounted at 3.5 percent per annum from 2012 onwards in line with the recommendations of the HM Treasury Green Book. This gives an estimate of the present value of GVA impacts resulting from productivity gains of £692m.

It is important to highlight that this is a conservative approach – and will not include any productivity effects driven by the displacement of output from lower to higher productivity producers. Additionally, the results assume that turnover per worker is a reasonable measure of the efficiency gains associated with the programme – this measure accounts for workers employed in the production process but not other factor inputs (such as capital or raw materials). This will overstate the productivity gains associated with the programme if firms have increased their outsourcing in response to an increase in demand (or understate productivity gains if they used the technology to secure lower input prices). There may also have been productivity gains that were captured by providers of superfast broadband services (e.g. stemming from local monopoly power for example), which would not be visible in measures of GVA.

Table 1.2: Estimated GVA Impact Driven by Productivity Gains (2016/17 prices)

| Local units benefitting from subsidised coverage in ... ² | 2012 | 2013 | 2014 | 2015 | 2016 | Total |
|---|------------|--------------|---------------|---------------|---------------|---------------|
| 2013 | 0 | 22748 | 22748 | 22748 | 22748 | |
| 2014 | 0 | 0 | 138148 | 138148 | 138148 | |
| 2015 | 0 | 0 | 0 | 173468 | 173468 | |
| 2016 | 0 | 0 | 0 | 0 | 73348 | |
| Number of Local Units Receiving Access to Enhanced Connectivity | 0 | 22748 | 160896 | 334364 | 407712 | |
| Effect on national GVA, per firm (£) | £1,391 | £1,391 | £1,391 | £1,391 | £1,391 | |
| Gross GVA impact (additional, £m) | 0.0 | 31.6 | 223.7 | 465.0 | 567.0 | 1287.3 |
| Additionality (% of firms that would not have received enhanced access without the programme) | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | |
| GVA impact attributable to programme (£m) | 0.0 | 19.0 | 134.2 | 279.0 | 340.2 | 772.4 |
| Discount factor | 1.00 | 0.97 | 0.93 | 0.90 | 0.87 | |
| Present value of GVA attributable to the programme (£m) | 0.0 | 18.3 | 125.3 | 251.6 | 296.5 | 691.7 |

² Note the estimates of benefits here assume that businesses (and consumers) benefit from enhanced connectivity from the start of the year. This is not the case in practice though this is unlikely to affect the results (if postcodes have an equal chance of being upgraded on each day of the year, then this approach effectively moves the observation window forward by 6 months).

1.3 Reductions in Long-term Unemployment

The results of the evaluation suggested that for every 10,000 premises upgraded there was a corresponding reduction in long term unemployment of 6.2 claimants in the year of installation. The results suggested that these effects were persistent rather than temporary (i.e. there was no evidence that these individuals returned to long-term unemployment after a certain period, though the findings are clearly short term in nature). Applying these results to the number of premises upgraded gives an estimate of the reduction in long-term unemployment attributable to the programme of 4,400 claimants as illustrated in the table below.

Assuming the effects on long-term unemployed represent the effect of the programme on the overall productive capacity of the economy, and valuing the output produced by those individuals at £14,458 per annum³, it is estimated that these effects could have led to a further £70.5m in national economic output (GVA) by 2016. Additionality assumptions and discounting have been applied in line with the approach set out for firm productivity gains, with the present value of the net GVA impact estimated at £37.7m.

Table 1.3: Estimated GVA Impact Driven by Reductions in Long Term Unemployment (2016/17 prices)

| Local units receiving subsidised coverage in ... | 2012 | 2013 | 2014 | 2015 | 2016 | Total |
|---|------------|------------|------------|-------------|-------------|-------------|
| Number of Premises Receiving Enhanced Connectivity | 0 | 38343 | 849770 | 2017651 | 1115283 | 4021047 |
| Reduction in Long Term JSA Claimants Resulting From Premises Upgraded in the Current Year | 0 | 24 | 528 | 1254 | 693 | |
| Cumulative Reduction in Long Term JSA Claimants | 0 | 24 | 552 | 1805 | 2498 | |
| Average Gross Annual Wages of 25th Percentile Worker (£) | 14,458 | 14458 | 14458 | 14458 | 14458 | |
| Increase in GVA associated with reductions in Long Term JSA Claimants (£m) | 0.0 | 0.3 | 8.0 | 26.1 | 36.1 | 70.5 |
| Additionality | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | |
| Net Increase in GVA associated with reductions in Long Term JSA Claimants (£m) | 0.0 | 0.2 | 4.8 | 15.7 | 21.7 | 42.3 |
| Discount Factor | 1.00 | 0.97 | 0.93 | 0.90 | 0.87 | |
| Present Value of Net GVA (£m) | 0.0 | 0.2 | 4.5 | 14.1 | 18.9 | 37.7 |

1.4 Consumer Welfare

The results from the analysis of the effects of the programme on subjective well-being of households suggested that the average improvement in consumer welfare of £222 per annum, per premises upgraded. This measure will include both direct consumer benefits from leisure uses of the technology, indirect benefits (such as increases in house prices for home owners that do not take up the technology) as well as any accruing to self-employed workers which are not captured in measures of firm productivity above. This value is averaged over both residential and non-residential premises upgraded

³ 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).

(and across households that do and do not take up the technology), and represents the value over and above the cost of taking superfast broadband services (i.e. the consumer surplus).

To reach an estimate of the total increase in consumer welfare resulting from the programme:

- It is assumed that these benefits are realised in the year of installation and do 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 are mediated by take-up of the technology.
- The average value of consumer welfare gains per premises upgraded is applied to the cumulative number of premises receiving enhanced connectivity (i.e. residential and non-residential). This gives an estimate of the gross value of consumer welfare gains of £1.7bn by June 2016.
- Additionality and discounting is applied in the same way as for the preceding analyses, giving an estimate of the present value of consumer welfare gains attributable to the programme of £932m (by June 2016).

Table 1.4: Estimated Value of Consumer Welfare Gains (2016/17 prices)

| Local units receiving subsidised coverage in ... | 2012 | 2013 | 2014 | 2015 | 2016 | Total |
|--|------------|--------------|---------------|----------------|----------------|---------------|
| Number of Premises Receiving Enhanced Connectivity | 0 | 38343 | 849770 | 2017651 | 1115283 | |
| Cumulative Number of Premises Receiving Enhanced Connectivity | 0 | 38343 | 888113 | 2905764 | 4021047 | |
| Annual Value of Consumer Welfare Gains per Premises Upgraded | 222.25 | 222.25 | 222.25 | 222.25 | 222.25 | |
| Gross Value of Consumer Welfare Gains | 0.0 | 8.5 | 197.4 | 645.8 | 893.7 | 1745.4 |
| Additionality | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | |
| Net Value of Consumer Welfare Gains | 0.0 | 5.1 | 118.4 | 387.5 | 536.2 | 1047.2 |
| Discount Factor | 1.00 | 0.97 | 0.93 | 0.90 | 0.87 | |
| Present Value of Consumer Welfare Gains | 0.0 | 4.9 | 110.6 | 349.5 | 467.3 | 932.3 |

1.5 VFM

Estimates of the value for money associated with the programme based on the results above are set out in the table below. 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 programmes as it does not include any value of the technology derived in the future, though there was also evidence that additionality of the technology declined with time as commercial viability improved.

The estimated BCRs associated with upgrades to residential and non-residential are estimated at £1.18 and £12.28 respectively. It should be noted that these results are sensitive to the assumed share of non-residential premises upgraded through the programme, which is unknown.

Table 1.5: Estimated BCRs – Residential and Non-Residential Premises Upgraded (2016/17 prices)

| Type of Premises Upgraded | Total Cost (£m) | Total Benefits (£m) | BCR (£) |
|---------------------------|-----------------|---------------------|-------------|
| Residential | 789 | 932.3 | 1.18 |
| Non-Residential | 59 | 729.4 | 12.28 |
| Total | 848 | 1,661.7 | 1.96 |