State aid evaluation of the UK National Broadband Scheme

Technical Appendix 2 – Modelling of Internal Rates of Return

Ipsos MORI



Contents

onten	<u>its</u>	.2
ey Te	<u>rms</u>	. 5
imma	ary	. 6
Key o	evaluation questions	6
Back	g <mark>round</mark>	6
Key f	findings	6
Intro	duction	.9
<u>1.1</u>	Key evaluation questions	9
<u>1.2</u>	Approach	9
<u>1.3</u>	Contract design	10
<u>1.4</u>	Methodology	12
<u>1.5</u>	Limitations	16
<u>Anal</u>	ysis of Phase 1 and 2 contracts	18
<u>2.1</u>	Internal rates of return at the tendering stage (IRR1 and IRR2)	18
<u>2.2</u>	Expected and actual build costs	19
<u>2.3</u>	Take-up, revenues and operational costs	20
<u>2.4</u>	Internal rates of return before clawback (IRR3 and IRR4)	22
<u>2.5</u>	Clawback	23
<u>2.6</u>	Internal Rates of Return after clawback (IRR5)	24
<u>Phas</u>	se 3 analysis	25
<u>3.1</u>	Methodological issues	25
<u>3.2</u>	Internal rates of return at the tendering stage (IRR1 and IRR 2)	25
<u>3.3</u>	Expected and actual build costs	26
<u>3.4</u>	Take-up, revenues and operational costs	27
<u>3.5</u>	Internal rates of return before clawback (IRR3 and IRR4)	28
<u>3.6</u>	Clawback	29
<u>3.7</u>	Internal rates of return after clawback (IRR5)	29
open	dix - Methodology	30
<u>3.8</u>	Internal Rate of Return (IRR)	30
<u>3.9</u>	Take-up	30
<u>3.10</u>	Revenue	31
<u>3.11</u>	Premises passed	32
<u>3.12</u>	Opex	33
<u>3.13</u>	Capex	35
<u>3.14</u>	Capital clawback	37
<u>3.15</u>	Take-up clawback	37
<u>3.16</u>	Cash flow	39
<u>3.17</u>	Assumptions	41
	Interpretended W Te W Te Imma Key (III) Back Key (III) 1.1 1.2 1.3 1.4 1.5 Anal 2.1 2.3 2.4 2.5 2.6 Phase 3.1 3.2 3.4 3.5 3.6 3.7 Dpend 3.8 3.9 3.10 3.11 3.12 3.13 3.14 3.15	Internals immary Rev evaluation questions Background Key findings Introduction 1.1 Key evaluation questions 1.2 Approach 1.3 Contract design 1.4 Methodology 1.5 Limitations Analysis of Phase 1 and 2 contracts 2.1 Internal rates of return at the tendering stage (IRR1 and IRR2) 2.2 Expected and actual build costs 2.3 Take-up, revenues and operational costs 2.4 Internal rates of return after clawback (IRR3 and IRR4) 2.5 Clawback 2.6 Internal rates of return after clawback (IRR5) Phase 3 analysis 31 3.1 Methodological issues 3.2 Internal rates of return at the tendering stage (IRR1 and IRR 2) 3.3 Expected and actual build costs 3.4 Take-up, revenues and operational costs 3.5 Internal rates of return after clawback (IRR3 and IRR4) 3.6 Clawback 3.7 Internal rates of return after clawback (IRR5) prendix - Methodology 38

Ipsos MORI | Internal Rates of Return Analysis Evaluation of the Superfast Broadband Programme

Key Terms

Term / acronym	Meaning
FTTP / FTTH	Fibre to the Premises / Fibre to the Home – This refers to an access network structure in which the optical fibre runs from the local exchange to the end user's living or office space.
FTTC	Fibre to the Cabinet - An access network structure in which the optical fibre extends from the exchange to the cabinet. The street cabinet is usually located only a few hundred metres from the subscriber's premises. The remaining part of the access network from the cabinet to the customer is usually copper wire but could use another technology, such as wireless.
Implementation clawback	Subsidies returned to the public sector in the event that build costs are lower than originally contracted.
IRR	Internal rate of return – the discount rate that sets the present value of a cash flow to zero of the lifetime of a project
Network provider	Telecommunications providers which own infrastructure which is used to deliver internet services
PMO costs	Project management office costs
PFM	Project Financial Model – a model of the investment projects costs and revenues used to determine the level of subsidy to be offered
Take-up clawback	Subsidies returned to the public sector in the event that take-up exceeds original expectations.
WACC	Weighted Average Cost of Capital – a measure of the cost of capital faced by network providers.

Summary

This methodological appendix provides modelling of the expected future profitability of contracts awarded to network providers under the 2016 to 2020 UK National Broadband Scheme (known as Phase 3 of the Superfast Broadband programme). As these contracts were at an early stage of delivery at the time of writing, this analysis was informed by comparable analysis of contracts awarded under the 2012 to 2016 UK National Broadband Scheme (known as Phase 1 and 2). Comparisons between Phases have been used to draw inferences in relation to trends in the expected profitability as the programme has evolved.

Key evaluation questions

This analysis addresses the following evaluation questions set out in the State aid evaluation plan:

- Has the aid had a significant incentive effect on the aid beneficiaries?
- Was the subsidy required to deliver commercially sustainable networks?

Background

The motivation for this analysis stems from the results of classical economic theory that suggest the private sector will maximise profits by implementing all projects that generate a rate of return that at least equal their cost of capital. The rationale for the programme is underpinned by an assumption that there are some areas of the UK where investments in superfast broadband infrastructure will not generate a rate of return that exceeds the cost of capital. These investments would not be commercial viable. The programme seeks to provide the minimum subsidy that would be required to make these investments commercially viable (i.e. the subsidy that would equalise the expected returns associated with the investment and the cost of capital faced by the network provider).

However, the public sector cannot perfectly observe the expected costs and revenues associated with potential investments in superfast coverage and network providers have incentives to seek subsidies for investments that would have been commercially viable without public support. These risks are addressed by an Open Market Review process designed to encourage network providers to reveal their investment plans and ensure subsidies are directed towards premises that would not be covered by commercial deployments. Contracts are also designed to protect the public sector from the risk that the subsidy exceeds the minimum needed for the project to go forward (for example, if costs prove less significant than originally expected or if revenues exceed original expectations).

Key findings

- **Commercial viability without subsidy:** Based on projections provided by network providers at the tendering stage, the proposed network build was expected either to generate losses or to deliver positive rates of return that were substantially lower than the cost of capital faced by the network provider. Updating this evidence based on observed costs and take-up suggests that:
 - Phase 1: Phase 1 contracts are expected to be substantially more profitable than anticipated at the tendering stage as build costs were systematically overstated and take-up was systematically understated. On average, the portfolio of Phase 1 contracts are projected to deliver an IRR of [redacted], relative to the network providers Weighted Average Cost of Capital of [redacted]. Eight of the 28 contracts were expected to deliver a rate of return that exceed the network provider's WACC. This calls into question the strength of the incentive

effect in these cases – i.e. the network provider would arguably have had an incentive to proceed with these projects without subsidy.

- Phase 2: Phase 2 contracts were expected to be loss making without subsidy on average (an IRR of [redacted] on average). However, 3 of the 31 contracts were expected to deliver rates of return that exceeded the network provider's WACC.
- Phase 3: The expected IRRs associated with Phase 3 projects without subsidy are not significantly higher than those expected at the tendering stage (moving from [redacted] per annum loss to positive annual rate of return of [redacted]). In all cases, the IRRs associated with the projects were expected to be substantially lower than the WACC of the network provider ([redacted]). Arguably, a subsidy would have been needed in all cases to create a sufficient economic incentive to deliver these contracts.
- Effectiveness of contractual mechanisms: The protections put in place by BDUK to protect the public sector from the risk that it provided more the minimum subsidy needed have proven effective. The contracts have been designed such that network providers are required to return resources to the public sector if build costs are understated or if take-up proves higher than expected (leading to higher levels of profitability):
 - IRRs: After the clawback of subsidy, the average IRRs associated with Phase 1, 2 and 3 contracts are expected to fall to [redacted], [redacted] and [redacted] on average. Few contracts awarded under Phase 2 or 3 are expected to deliver a rate of return that exceeds the network providers' WACC.
 - Net public spend: Many contracts awarded under Phase 1 were expected to deliver IRRs that exceeded the network provider's WACC after the application of implementation and takeup clawback. These schemes were largely commercially viable without a subsidy and the clawback mechanisms are expected to return almost all subsidy to the public sector.
- OMR process: The OMR process identifies postcodes that where there are no plans to deploy superfast on a commercial basis in the next three years. However, this analysis suggests that the absence of commercial deployment plans does not necessarily imply delivery of infrastructure is not economically viable commercial deployments may also be constrained by other market failures or the capacity of network providers. As suggested in Technical Appendix 1, the provision of subsidies may also be effective in encouraging network providers to bring forward commercially viable schemes more rapidly than they would have otherwise. The contracting mechanisms have enabled this to take place often at no net cost to the public sector (ignoring the administrative costs associated with the programme).
- Understatement of take-up: Network providers have consistently underestimated the level of take-up in their ex-ante projections submitted as part of the tendering process. It is not possible to determine how far network providers took an overly conservative approach during Phase 1 (as no information is available on wider take-up of commercial deployments). Take-up projections in Phases 2 and 3 do appear understated given network providers would have had information on take-up from prior contracts. The understatement of take-up will have fed through to understated revenue projections and rates of return, increasing the level of gap funding required from the public notionally required to make the project economically viable. While the contractual mechanisms have helped contain the risk that network providers earn excess

returns, they still have benefitted from a reduction in the risk they faced in making the investment (as while higher than expected take-up clawback reduced the net revenues earned, the higher levels of subsidy awarded provided protection in the event the project was a commercial failure).

- Opportunity costs: While the contracts have proven largely effective in containing subsidies to the minimum needed for the project to go forward, the public sector has incurred opportunity costs by tying resources up in the programme. BDUK may wish to consider whether seeking to contain these opportunity costs in future procurements could be justified. The evidence in this analysis indicates that higher levels of competition limit the extent to which network providers can transfer risk to the public sector (as doing so results in less competitive tenders). However, other options could include using the information on the tail end of the distribution of observed take-up rates across Phase 1, 2 and 3 contracts to set a maximum level of subsidy to be offered as part of a given procurement. This may still allow network providers to understate profitability by adjusting revenues via price schedules (though if BDUK are able to monitor revenues earned on connections as well as volumes of customers, this may limit scope to do so).
- Future competition: The results of these analysis also do not factor the possibility that the
 network providers' market share and any excess profits are eroded by the entry of competitors
 via the open access arrangements required by the programme. This could only be realistically
 assessed if BDUK were able to monitor revenues earned by network providers alongside
 customer volumes (as this would help explore issues in relation to both market share and prices).
- **Future analysis:** It should be noted that the analysis of Phase 3 contracts is based on limited evidence on actual build costs and take-up (and assumptions were largely developed based on experiences across Phase 1 and 2 of the programme). This analysis will need to be revisited as part of any future evaluation.

1 Introduction

This methodological appendix provides modelling of the expected future profitability of contracts awarded to network providers under the 2016 to 2020 UK National Broadband Scheme (known as Phase 3 of the Superfast Broadband programme). As these contracts were at an early stage of delivery at the time of writing, this analysis was informed by comparable analysis of contracts awarded under the 2012 to 2016 UK National Broadband Scheme (known as Phase 1 and 2). Comparisons between Phases have been used to draw inferences in relation to trends in the expected profitability as the programme has evolved.

1.1 Key evaluation questions

This analysis addresses the following evaluation questions set out in the State aid evaluation plan:

- Has the aid had a significant incentive effect on the aid beneficiaries?
- Was the subsidy required to deliver commercially sustainable networks?

1.2 Approach

The aim of the analysis is to explore whether public subsidies were needed to provide an incentive to network providers to extend superfast networks to the areas targeted by the programme. The approach adopted in this appendix is informed by the methodology agreed in the State aid evaluation plan agreed between Building Digital UK (BDUK) and the European Commission. This involves comparing the expected rates of return on the investments made to the cost of capital faced by the network provider.

The motivation for this analysis stems from the results of classical economic theory that suggests - in a competitive market with no transaction costs - the private sector will maximise profits by implementing all projects that generate a rate of return that at least equal their cost of capital. The rationale for the programme is underpinned by an assumption that there are some areas of the UK where investments in superfast broadband infrastructure will not generate a rate of return that exceeds the cost of capital. These investments would not be commercial viable, leaving some areas at risk of being excluded from superfast broadband coverage (producing a 'digital divide'). The programme seeks to provide the minimum subsidy that would be required to make these investments commercially viable (i.e. the subsidy that would equalise the expected returns associated with the investment and the cost of capital faced by the network provider).

However, it is not feasible for the public sector to perfectly observe the expected costs and revenues associated with potential investments in superfast coverage before it awards subsidies. Network providers also have an incentive to seek subsidies for investments that would have been commercially viable in the absence of public support to maximise profitability and minimise risk exposure. The design of the programme anticipates this risk through the implementation of an Open Market Review process designed to encourage network providers to reveal their investment plans and to ensure that subsidies are directed towards premises that would not be covered by commercial deployments. The contracts are also designed to protect the public sector from the risk that the subsidy exceeds the minimum needed for the project to go forward (for example, if costs prove less significant than originally expected or if revenues exceed original expectations).

This section examines the effectiveness of these arrangements by comparing the expected rate of return on the contracts awarded (the Internal Rate of Return¹ or IRR) to the network providers Weighted Average Cost of Capital (WACC)². As highlighted in the State aid evaluation plan, if the actual IRR earned on the investments made exceeds the WACC before the subsidy was awarded, then this would call into question the strength of the incentive effect provided by the subsidies. It should be noted that this may not hold true where there are market failures (e.g. a dominant supplier with market power may not be incentivised to implement an investment project if it earns a marginal rate of return).

1.3 Contract design

1.3.1 Determination of the subsidy provided

Contracts are awarded through the programme by local bodies. BDUK is not party to the contract but enters a Grant Agreement (or Budget Transfer Agreement) with the local bodies when allocating public funds³. Under the model, the winning network provider finances, designs, builds, owns, and operates the network and earns profits on the revenues generated by take-up of superfast coverage. This feature of the model aims to allow private providers to leverage existing infrastructure whilst encouraging continuous investment in the network⁴.

As highlighted above, the funding is provided through a gap funding model, which seeks to prevent the network operator from bidding for more than the minimum subsidy needed to deliver the project to deliver an IRR that broadly equals the providers cost of capital⁵. The minimum subsidy is determined by the network provider's Project Financial Model (PFM) which is submitted as part of the tendering process. This provides expectations of the:

- Number of premises to receive subsidised coverage under the proposed network build (by type of technology)
- Capital and operational costs associated with the proposed network build
- Share of premises that will take up a superfast connection over time (including churn in customers)
- Average prices to be charged to customers taking up different packages and/or technologies
- Revenues earned from customers taking up superfast services
- Operational and capital costs associated with connecting new customers to the network and providing superfast broadband services on an on-going basis
- · Weighted Average Cost of Capital of the network provider

These expectations determine the expected rate of return (the IRR) that would be earned on the proposed network build. The difference between the IRR and the network provider would determine the maximum level of subsidy the network provider could bid for. Subsidies were provided to the winning network provider in instalments following the completion of contractual milestones and for qualifying costs only. Qualifying costs refer to capitalisable expenditure directly attributable to

¹ The discount rate that sets the present value of an income stream to zero.

² For the purposes of this analysis, an average comparison between IRR and the network provider WACC has been made. A comparison to the marginal cost of capital would be preferable approach and may therefore produce different results from average rates.

³ BDUK (2020). Contracts: Superfast. An Overview of the Contract for the Superfast Programme.

⁴ BDUK (2016). Funding options for BDUK funded broadband infrastructure. Accessed at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/548348/2016_NBS_-

<u>State_Aid_Guidance - Delivery_and_Funding_Options.pdf</u> on 7 April 2020.

⁵ BDUK (2016). Funding options for BDUK funded broadband infrastructure. Accessed at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/548348/2016_NBS_-

<u>State Aid Guidance - Delivery and Funding Options.pdf</u> on 7 April 2020.

^{18-101398-01 |} Final Version | This work was carried out in accordance with the requirements of the international quality standard for Market Research, ISO 20252, and with the Ipsos MORI Terms and Conditions which can be found at http://www.ipsos-mori.com/terms. © DCMS 2020

delivering the deployed services and incremental to current business⁶. There were some changes in both the items included in the PFM and the qualifying costs over the three phases as set out in Table 1.1.

	Costs described in the Project Financial Model		Qualifying costs		sts	
	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
Build capex ⁷	Y	Y	Y	Y	Y	Y
Build opex (or deployment opex) ⁸	N	Y	Y	N	Y	Y
Connection capex ⁹	Y	Y	Y	Y	Y	N
Connection opex	Y	Y	Y	N	N	N
Maintenance/incremental opex	Y	Y	Y	N	N	N
PMO costs	Y	Y	Y	Y	Y	Y
Ongoing contractual reporting	Incurre	d by through	out although it provider's o	t does not for contribution.	n part of the i	network

Table 1.1: Allowable costs by phase

Source: BDUK

1.3.2 Clawback mechanisms

The design of the tendering process described above will set the IRR equal to the network providers cost of capital if the network provider provides accurate assessment of the expected costs and revenues associated with the network build. The actual IRR earned by the network provider could vary from these expectations if:

- Actual build or operational costs vary against original expectations
- Take up of subsidised coverage is (or the prices charged are) higher or lower expectations producing differences in the revenues earned

Such differences could arise if network providers made systematic errors in their projections (for example, if demand for superfast coverage expanded more rapidly than the market expected). Network providers could also behave strategically by overstating the anticipated build cost or understating expected future revenues. This would increase the apparent level of public subsidy required for the project to go forward. This would allow the network provider to earn excess returns on the investment (though as this strategy would reduce the competitiveness of the proposed network build, scope to adopt this approach will be limited by the strength of the competition for the contracts). To minimise the risk that public subsidy exceeded the minimum required for the project to go forward, the contracts incorporated two clawback mechanisms:

• Implementation clawback: Contracts with network providers incorporate an 'implementation clawback' mechanism. If a PFM contains overly pessimistic build cost assumptions, or if

⁶ BDUK (2020). Value for Money: Superfast. An Overview of Value for Money Analysis on the Superfast Programme.

⁷ Costs incurred to dig up roads, manage projects, install infrastructure

⁸ Operating costs incurred during the build phase

⁹ Costs related to connecting individual premises to the network, e.g. providing routers, or sending an engineer to the premises⁹

unexpected cost savings are made during the deployment phase, the overall network provider's investment remains unaltered, whilst public funding is reduced accordingly¹⁰.

Take-up clawback: To further reduce the risk of overcompensating providers, contracts include a take-up clawback mechanism to recuperate funding in instances where actual revenues and profits have exceeded network operator expectations set out in the bid. If take-up is higher than expected for any type of technology deployed, some of the extra profit made by the network provider is shared with the Local Body up to seven years after the contract closure date. As such, the contracts have been designed to limit excess profits earned in scenarios where take-up exceeds expectations. The enforcement of this contractual mechanism is enabled by ongoing monitoring of take-up of superfast connections.

The contracting model, however, does not imply that all the commercial risk is transferred to the network provider. Mechanisms are in place in the contract to allow for errors or incorrect assumptions, which can be amended before specific milestones are achieved¹¹. The contracting model also allows providers to transfer risk to the public sector in some scenarios. If providers provide low take-up assumptions, this will increase the assumed level of subsidy required for the project to be commercially viable. This strategy will require the provider to return a higher level of funding to the public sector if the project is a commercial success. However, the network provider will benefit from greater protection from the risk that the project does not lead to the anticipated revenues.

1.4 Methodology

1.4.1 Approach to estimating the expected IRR

The aim of the analysis is to compare the IRRs earned in practice by network providers against their cost of capital. However, this involves several challenges:

- Data availability: Network providers have a contractual obligation to provide BDUK with information on the actual costs of the network build and the share of premises upgraded that have been connected. However, network providers are not required to provide information on on-going operational costs or revenues earned (partly due to challenges in attributing operational costs to the infrastructure). As such, it is not possible to observe the profitability of the contracts awarded directly.
- Time horizons: The IRR associated with the network build is determined over long time horizons (i.e. fifteen to twenty years depending on the Phase). Due to the early stage of implementation for a large proportion of Phase 3 contracts, information on final build costs are not yet available and there are few quarters of reported information on take-up to provide meaningful comparisons against expectations.

The following general methodology was adopted in light of these constraints:

Phase 1 and 2: A modelling exercise was completed to project the costs, revenues and IRR associated with Phase 1 and 2 contracts. The build costs – and any implementation clawback - associated with these contracts were either known (where the contract was complete) or revised expectations were available from BDUK where the project was at advanced stages of

¹⁰ The maximum amount of implementation clawback is equal to the total amount of public funding originally agreed with the network provider. For further information: BDUK (2020). *Value for Money: Superfast. An Overview of Value for Money Analysis on the Superfast Programme.*

¹¹ BDUK (2020). Contracts: Superfast. An Overview of the Contract for the Superfast Programme.

completion. Observations of take-up were available for an extensive period, though not for the fifteen-year period over which the IRR was originally calculated. A projection of future take-up was developed by projecting past trends forwards. Estimates of revenues, operational costs and take-up clawback were derived by applying assumptions provided by the network provider in their original PFM relation to the average revenue and operational costs per user to this revised take-up projection. These revised estimates of expected costs and revenues were used to provide an update to the expected IRR on the project.

Phase 3: There was limited data available on the costs and take-up of most Phase 3 contracts owing to their comparatively early stage of implementation. Projections of the build costs associated with these contracts were developed by scaling initial expectations in light of any changes in the number of premises to be upgraded. Information on actual take-up was generally insufficient to develop a projection by extrapolating past trends into the future, so an assumption was adopted that take-up would broadly follow patterns observed and projected for Phases 1 and 2.

A comprehensive overview of the methodology is included in the appendix of this report. The following sections provide key details of the measures that have been developed and the information sources used.

1.4.2 Calculating the IRR

The IRR for each project represents the discount rate that makes the net present value (NPV) of a project zero - it is the value of r in the following (where c is a stream of net cash flows over t time periods):

$$NPV = \sum_{t=1}^{T} \frac{C_t}{(1+r)^t} = 0$$

The net cash flow in each period from the point of view of the network provider is equal to:

$$C_t = (S_t - CB_t) + R_t - (BC_t + O_t)$$

Here, $(S_t - CB_t)$ represents the net subsidy received in period t (i.e. the subsidy less clawback returned to the public sector). R_t is the revenue earned in period t. $(BC_t + O_t)$ represents the costs incurred by the network provider in terms of build costs (BC_t) and operational costs (O_t) . The IRR is sensitive to the overall time frame of the investment and the timing of expenses and revenues. It cannot be derived analytically and is typically estimated using iterative methods (in BDUKs PFM it is implemented using the IRR function in Excel). Five types of IRR were considered for each contract (in line with the State aid evaluation plan), defined in the following table.

Table 1.2: Estimated IRRs

IRR number	Description	Overview	Data sources used
IRR 1	The original IRR before state aid (baseline).	Estimated by the network provider at the time of bid based on expected build costs, operational costs and revenues. This provides the network providers estimated return on the investment, without subsidy, at the tendering stage.	Expected cash flows are provided in the PFM developed by the network provider (from which the IRR was derived by Ipsos MORI).
IRR 2	The original IRR after state aid (estimated by the network provider at the time of bid).	Estimated by the network provider at the time of bid based on expected build costs, operational costs, revenues and the proposed subsidy. This provides the network providers estimated return on the investment, with subsidy, at the tendering stage. The IRR2 would be expected to align approximately with the network provider's WACC.	Expected cash flows with subsidy payments are provided in the PFM and calculated by the network operator and presented in the PFM.
IRR 3	The updated estimate of IRR before state aid (modelling exercise based on latest available data and/or evidence- based assumptions).	The estimated rate of return on the project based on actual (or forecast) build costs, and modelled revenues and operational costs (based on actual and projected take-up). Net subsidy payments are set to zero. This gives an estimate of the actual rate of return on the investment, had the project been implemented without a subsidy. contract.	Information on actual build costs are provided in Finance Tracker and/or Investment Reports provided to BDUK by network providers. Forecast build costs are provided by BDUK or estimated based on any variance between the originally contracted and current expected number of premises to be upgraded. Information on actual take-up is taken from C3 reports provided by BDUK. Take-up is projected based on observed trends to provide a future projection for the remainder of the time. Estimates of revenues and operational costs are derived by applying assumptions set out in the PFM with respect to average revenues and operational costs per user/customer.
IRR 4	The updated estimate of IRR after state-aid and before clawback (modelling exercise based on latest available data and/or evidence-based assumptions).	This provides the estimated return on investment based on actual build costs, revenues, and operational costs (as above), and after subsidy payments paid by BDUK but before clawback is returned to the public sector.	As for IRR3, including information on actual subsidy payments derived from the Finance Tracker reports provided to BDUK by network providers. Forecast subsidy payments are
IRR 5	The updated estimate of IRR after state-aid and after clawback (modelling exercise based on latest available data and/or evidence-based assumptions).	This provides the estimated return on investment based on actual build costs, revenues, and operational costs (as above), and after subsidy payments paid by BDUK and after clawback is returned to the public sector.	As for IRR4, including information on forecast implementation and take-up clawback. Where contracts are complete, these have been derived from Investment Reports provided by BDUK and updated where there are differences in expectations regarding clawback.

1.4.3 Sources of information

The following sources of information have been used to develop the analysis:

7

18-101398-01 | Final Version | This work was carried out in accordance with the requirements of the international quality standard for Market Research, ISO 20252, and with the Ipsos MORI Terms and Conditions which can be found at http://www.ipsos-mori.com/terms. © DCMS 2020

- Project Financial Models (PFMs): In all three phases, providers are required to submit a PFM with their bid for contracts. As highlighted above, PFMs provides the network provider's expectations at the point of tendering in relation to:
 - how many premises will be upgraded and when under the proposed scheme
 - the costs associated with delivery broken down by type
 - the level of expected take-up for different types of technologies
 - the revenues assumed to be generated, and
 - on-going operational costs.

In addition, the network provider is required to provide expectations around cost and price inflation over the timeline, and the level of funding required at each milestone from the Local Body. Providers are asked to provide their discount rate for the project and justify this in relation to their Weighted Average Cost of Capital (WACC)¹². The network provider uses this information to project cashflows over the project timeline. The period over which cashflows (and the associated IRRs) are considered varies across Phases (20 years for Phase 3 and 15 years for Phases 1 and 2). There are also minor differences in the treatment of subsidy payments (from Phase 2, public subsidies are recognised in the cash flow in the quarter following the claim rather than in the same quarter).

- Finance Tracker: Details on the actual costs incurred in the network build are provided by network providers, submitted to local bodies and shared with BDUK, which include quarterly information about milestones achieved, as well as public sector funding and network provider's own investment.
- **Premises passed and connections data**¹³: The actual cumulative number of connected premises per quarter is reported in the WSS section of the C3 report provided by the network provider and the total number of premises to be upgraded¹⁴.
- Monitoring Log: BDUK's Cora management information database holds records of the delivery
 of contracts (whether they are closed or still ongoing) as well as the final public subsidy provided
 to the providers. As most Phase 2 and all Phase 3 contracts are still open the database only
 contained final public funding figures for (completed) Phase 1 contracts.
- Investment Fund Reports: Network providers are required to provide a summary of the investment made, the funding claimed, clawback, and interest payments, which are compiled after contract closure. This marks the end of the contractual payments from the Local Body to the network provider. The reports are only provided for completed contracts.

1.4.4 Scope of analysis

The modelling was completed for those contracts for which the required information was available. The focus varied depending on the Phase of the contract:

• **Phase 1:** The focus of the analysis of Phase 1 was on developing an approach that could be applied to Phase 3 contracts. The modelling was applied to completed projects where there was

¹² UKRN (2018). *Cost of Capital – Annual Update Report. Information Paper*. Accessed at: <u>https://www.ukrn.org.uk/wp-content/uploads/2018/11/2018-UKRN-Annual-WACC-Summary-Update-v2.pdf</u> on 7 April 2020.

¹³ Premises passed, and connections data is reported in the C3 report WSS extract sourced from the OpenReach report ¹⁴ Whilst there are generally low levels of FTTP in Phase 1, Phase 3 has considerably more FTTP technology than FTTC

full information on the actual build costs and implementation clawback. At the time of the analysis, 28 of the 45 contracts awarded under Phase 1 were complete.

- Phase 2 and 3: As few Phase 2 and 3 contracts had closed at the time of the analysis, the modelling of Phase 2 and 3 contracts was extended to incomplete projects. As highlighted above, information on project delivery (including costs incurred and premises upgraded) is collected through the BDUK Finance Tracker. However, not all network providers were providing these to BDUK at the time of the analysis and information on actual delivery was unavailable for 17 Phase 2 contracts and 16 Phase 3 contracts. As such, the ex-ante projections provided in the PFM could not be updated for these contracts.
- Recent Phase 3 contracts: The population of contracts for the analysis was based on those signed by July 2019. A further 15 contracts were agreed between August 2019 and October 2020. These were not included in the analysis as insufficient information was available on the delivery of these project.

Table 1.3 below summarises the number of contracts covered by this analysis across all three phases, (out of 135 contracts).

	Phase 1	Phase 2	Phase 3
Total number of contracts45		48	51
Number of contracts in scope	28	31	20
Network providers	 BT/Openreach 	 Airband BT/Openreach CallFlow Gigaclear UKB 	AirbandGigaclearOpenreach

Table 1.3: Contracts in scope for analysis

1.5 Limitations

There are several general limitations associated with the analysis which should be borne in mind when reviewing IRR3 through to IRR5:

- Take-up: Estimates of revenues, operational costs and take-up clawback are driven by a projection of future take-up. This projection is based on an extrapolation of past trends and actual take-up may be higher or lower than projected in practice. Deviations from these projections will have complex effects on the IRRs presented in the following sections. For example, while higher take-up than projected would imply higher revenues and higher IRRs, the network provider may need to return a higher share of the subsidy received to the public sector via the take-up clawback mechanism than expected.
- Modelling of revenues: The modelling of future revenues is based on the price schedules put forward by the network provider in its PFM submitted as part of the tendering process. The analysis assumes that these prices are both accurate and are constant over the duration of the period. Additionally, the average revenue per user is based on the share of customers taking up FTTC and FTTP technologies assumed by the network provider in its PFM. In practice, prices

may vary over time. For example, increased competition may place downward pressure on prices (resulting in lower revenues and lower IRRs than estimated in the following analyses). If demand for more expensive packages is higher than expected, this will result in higher revenues and higher IRRs than estimated. This cannot realistically be addressed in any future iterations of the evaluation unless BDUK were to begin monitoring the revenues earned by network providers on connections made to subsidised infrastructure.

- Operational costs: The modelling of operational costs are based on the forecast of operational costs provided by the network provider in its PFM, divided by the forecast number of customers, to provide an estimate of the operational cost per user. If actual operating costs per connection differ from these assumptions for example, due to technological change then the IRRs will be higher or lower than presented below.
- Customer upgrades: The PFM (and by extension, the updates to these models in light of observed costs and take-up) do not account for any revenues foregone by network providers as a result of any customers upgrading from existing packages. As such, the IRRs presented below will be systematically overstated (and the significance of this issue is unknown).
- Internal focus: The IRRs focus on the revenues earned and costs incurred by the network provider with the primary objective of establishing whether the network provider had an economic incentive to deliver the network build without a subsidy. However, it should be noted that there will likely be displacement of customers, revenues and profits from other network providers. While this issue does not affect the IRRs, the rates of return presented will not mirror the social rate of return.
- Comparability: The IRRs for Phase 1 and 2 are not strictly comparable to those for Phase 3 as the Project Financial Model developed by the BDUK considers costs and revenues over different time horizons (and the IRRs for Phase 3 will be systematically higher than those presented for Phase 1 and 2). The degree to which these differences are significant will be dependent on how significant the residual value of Phase 1 and 2 schemes will be at the end of 15 years.

2 Analysis of Phase 1 and 2 contracts

This section sets out the modelling of the rates of return earned contracts awarded under the 2012 to 2016 UK National Broadband Scheme (Phase 1 and 2). The scope of this analysis applies to the 28 closed contracts in Phase 1, two closed Phase 2 contracts, and 29 open Phase 2 contracts, **[redacted]**. **[Redacted]**.

For the purposes of the following analysis, it is important to note that most Phase 1 contracts were awarded through a framework agreement with two network providers, under which BT/Openreach were the sole bidder. Phase 2 saw the more widespread use of OJEU processes and contracts were awarded to a more diverse mix of network providers including Airband, CallFlow, Gigaclear, and UKB. As such, comparisons between the IRRs earned on Phase 1 and 2 contracts can also reveal some insights into the behaviour of tenderers under different competitive conditions.

2.1 Internal rates of return at the tendering stage (IRR1 and IRR2)

The expected internal rates of return at the tendering stage are based on the projected cash-flows provided by the network provider in its PFM for each contract. These provide the estimated IRR of the proposed network build without and with the subsidy provided by BDUK. If the gap funding model is effective, subsidies should be allocated to projects that deliver an IRR that is lower than the cost of capital faced by network provider. The subsidy provided should bring the IRR associated with the project in line with its cost of capital.

Table 2.1 summarises the IRRs associated with Phase 1 and 2 contracts pre- and post-subsidy:

- Commercial viability without subsidy: On average, the projected IRR associated with the network build was substantially lower than the network provider's WACC ([redacted]) for both Phase 1 and 2 contracts. In both cases, the proposed network build was expected to be loss making ([redacted] and [redacted] per annum for Phase 1 and 2 respectively). This also suggests that Phase 2 schemes were expected to be less profitable than Phase 1 schemes. This is to be expected as Phase 2 schemes were intended to target 'harder to reach' areas than Phase 1. However, this also masks differences in the underlying bidding strategy Phase 2 contracts were prepared the basis of more optimistic higher take-up assumptions than Phase 1 (and had assumptions been rolled over from Phase 1, Phase 2 contracts would have been expected to be less profitable than implied below).
- Commercial viability with subsidy: The average IRR 2 (after public funding) across Phase 1 and 2 was estimated at [redacted] and [redacted] respectively. This is [redacted] to [redacted] percentage points lower than the cost of capital faced by the network provider ([redacted]) and would on the surface suggest that these projects would be unviable even with the public subsidy. This could be explained if the network provider considered future profitability beyond the clawback period (from which all profits made would be retainable) in its calculations, which would have raised long-term returns.

Table 2.1: Internal rates of return for Phases 1 and 2 contracts in scope at tender stage [Redacted]

2.2 Expected and actual build costs

The qualifying build costs associated with the proposed network build eligible for public funding support were estimated by the network provider to be approximately £341.8m across the Phase 1 portfolio for 28 contracts. The total qualifying build costs associated with the 31 Phase 2 contracts was £358.0m. Information on actual build costs are taken from BDUK's Finance Tracker¹⁵. Beyond this point, it has been assumed that:

- **Phase 1:** No further build cost will be incurred for Phase 1 contracts, as the networks have been built and the contracts have since closed.
- **Phase 2:** For Phase 2 contracts that are still open, future build costs have been estimated based on reported spend to date and expected future premises to be passed.

Table 2.2 compares actual build costs compared to those expected at the tendering stage:

- **Phase 1:** The build costs associated with Phase 1 contracts were systematically understated (though it should be noted that network providers did have the option of submitting a change request to rescope the project, and this may be partly reflected in the figures below). On average, build costs were **[redacted]**. Other things being equal, this will raise the expected IRR on the investment, though this effect will be offset by the implementation clawback mechanism.
- **Phase 2:** The reverse pattern was observed in Phase 2. Build costs were systematically understated, and on average build costs were expected to be **[redacted]**.

The differences between the two Phases might be explained by differences in their scale and geographical coverage. Phase 1 contracts were larger and it may have been more straightforward to generate scale economies. They were also targeted at areas that were more straightforward to upgrade. However, this may also reflect the effect of competition. While the public sector is insulated from the risk of underspend via the implementation clawback mechanism, if network providers overstate the anticipated build cost they are protected from unforeseen costs (transferring risk to the public sector). This bidding strategy is relatively more feasible where competitive conditions are weak (as such an approach would reduce the competitiveness of the original bid).

 $^{^{\}rm 15}$ Up to Q1 FY13/14 for Phase 1 and Q4 FY16/17 for Phase 2

^{18-101398-01 |} Final Version | This work was carried out in accordance with the requirements of the international quality standard for Market Research, ISO 20252, and with the Ipsos MORI Terms and Conditions which can be found at http://www.ipsos-mori.com/terms. © DCMS 2020

Table 2.2: Expected and actual build costs, Phase 1 and 2 contracts in scope[Redacted]

2.3 Take-up, revenues and operational costs

2.3.1 Take-up

The take-up level represents the number of premises connected (i.e. households taking up the superfast services enabled). It is a significant component of the analysis as it influences both the level of revenues earned by providers, operational costs, as well as subsidies to be returned to the public sector via the take-up clawback mechanism.

Figure 2.1 below shows the profile of expected take-up (as a percentage of premises passed) for Phase 1 and 2 contracts, as sourced from each respective PFM. This is compared to actual take-up as monitored by BDUK. The figure illustrates that actual take-up has substantially exceeded expected take-up in both Phases 1 and 2 of the programme:

- **Phase 1:** In the long-run, take-up was predicted to peak at **[redacted]** of the premises passed. In practice, actual take-up exceeded this level in the third year of the contract and continued to increase to almost **[redacted]** by 2019/20.
- **Phase 2**: Expected take-up was predicted by network providers to peak at **[redacted]** for Phase 2 contracts. Given the network providers had learned from Phase 1, some questions could be raised about the credibility of these expectations (i.e. observed take-up on Phase 1 contracts had already broadly reached this level at the time Phase 2 contracts were awarded). In practice, actual take-up of Phase 2 rose more quickly than for Phase 1 contracts and had reached **[redacted]** by 2019/20.

Based on this information, a generalised logistic function has been used to forecast take-up beyond the point of latest available data in both phases, capped at a maximum value of 85%. This is in line with the assumption that the maximum take-up level is around 85% across the UK¹⁶. The forecast suggests that take-up could reach a peak of **[redacted]** across the Phase 1 portfolio (28 contracts) by the end of the project lifetime (Q4 FY27/28) **[redacted]** by the end of Phase 2 (31 contracts). Overall, the figures indicate that network providers understated future take-up in both Phases and this implies that the IRRs presented in the previous subsection will also be understated (though clearly this will also be influenced by the cost overruns expected for Phase 2).

Figure 2.1: Take-up levels for Phase 1 and 2 contracts (in scope)

[Redacted]

2.3.2 Modelled revenues

Revenues are not reported by the network operator. As such revenues are modelled on two values: reported or modelled take-up (as described above) and the average revenue per user as reported by the network provider in its PFM¹⁷. On average across the portfolios, the ARPU for FTTC is £22.50 and £23.38 in Phase 1 and 2 respectively. The difference in ARPU for FTTP is much larger, at £50.62 in

¹⁶ Ofcom (2018). *Connected Nations 2018*. Accessed at: <u>https://www.ofcom.org.uk/__data/assets/pdf_file/0020/130736/Connected-Nations-2018-main-report.pdf on 7 April 2020</u>. Page 18.

¹⁷ ARPUs for Phase 1 are calculated based information sourced from Phase 1 PFMs, notably steady-state revenue FTTC rental and steady-state FTTC connected premises.

Phase 1 and £34.50 in Phase 2 (suggesting that price premium associated with FTTP services has come down over the period). The assumed ARPU by contract is illustrated in Table 2.3.

Table 2.3: Calculated ARPUs (£s)

[Redacted]

These figures were combined with the take-up projections described above to provide an estimate of the revenues earned by network providers under initial assumptions put forward in the PFM, and how these may differ in light of observed levels of take-up:

- Phase 1: Up until quarter 3 2019/20, network provider take-up predictions underestimated takeup by a factor of [redacted] on average across the portfolio in Phase 1. Using these average revenue per user assumptions, network providers would be expected to have earned [redacted] in revenues ([redacted] more than the [redacted] expected under the original take-up projection). Over the 15 years covered by PFM, revenues across the Phase 1 contracts in scope are estimated at [redacted] ([redacted] expected under the original take-up projection).
- **Phase 2:** For Phase 2, network providers underestimated take-up levels by a factor of **[redacted]**. The total modelled revenue for Phase 2 contracts is forecast at **[redacted]** over the 15-year assessment period, approximately **[redacted]** than predicted at the baseline.

The higher than expected revenues earned on Phase 1 and 2 contracts will place upward pressure on the IRRs earned by network providers. However, it should be noted that much of these revenues are recognised many years after the initial investment cost and their present value will be substantially lower than the nominal values presented below.

Table 2.4: Expected and forecast revenues, Phase 1 and 2 contracts [Redacted]

2.3.3 Operational costs

Operating costs (i.e. costs associated with providing broadband services) are not reported by the network provider. The only source of information on operating costs is the operating expenditure projections provided by the network provider in the PFMs. These projections were combined with the projections of take-up provided in the PFM, to provide an estimate of the operational cost per connection. This result was then applied to the updated projection of take-up described above to estimate the additional operational costs that would be incurred under higher levels of demand. It should be noted that this imposes an assumption of constant returns to scale (i.e. there are no scale economies associated with a larger number of customers). It also assumes that these costs are both accurate and do not change with time.

The original projections of operating costs are compared to revised estimates based on the updated take-up projection in the table below. As take-up was higher than anticipated, operating costs are also expected to exceed original expectations (with offsetting effects on the IRRs earned).

Table 2.5: Expected and forecast operating costs, Phase 1 and 2 contracts[Redacted]

2.4 Internal rates of return before clawback (IRR3 and IRR4)

The above estimates of the actual and forecast costs and revenues were used to estimate the expected IRR for each contract in light of the observed evidence. The estimates are set out in the table below. The figures show:

- Viability of projects without subsidy (IRR3): The data indicates that on average, Phase 1 and 2 contracts would not have delivered a rate of return that exceeded the network provider's WACC ([redacted]). As such, in general terms, network providers would not have had an incentive to make these investments without public support. However, projects were more profitable than expected at the tendering stage, delivering substantially higher rates of return than the expectations set out in the PFM (IRR1 in Table 2.1):
 - This was particularly the case for Phase 1, where the IRRs were driven up both by higher than expected take-up and lower than expected build costs. The overall portfolio was expected to deliver an IRR of [redacted] (approaching the IRR with subsidy expected of [redacted] expected at the tendering stage), and 8 of the 28 contracts were expected to deliver a rate of return that exceed the network provider's WACC. This calls into question the strength of the incentive effect in these cases i.e. the network provider would arguably have had an incentive to proceed with these projects without subsidy.
 - Phase 2 contracts were expected to be loss making without subsidy on average (an IRR of [redacted] on average). However, 3 of the 31 contracts were expected to deliver rates of return that exceeded the network provider's WACC.
- IRR with subsidies (IRR4): Once the subsidies provided by the public sector are factored in, network providers could be expected to earn internal rates of return that substantially exceed their WACC in many cases. The average IRR with subsidy payments (but before clawback) based on actual and/or expected costs and take-up rose to [redacted] for Phase 1 and [redacted] for Phase 2. These excess returns are driven largely by the conservative projections of take-up put forward by network providers (and in Phase 1, lower than anticipated build costs).

Table 2.6: Internal rates of return for Phases 1 and 2 contracts based on actual and forecastcosts and take-up, before clawback

[Redacted]

2.5 Clawback

As highlighted in Section 1, to reduce risk that suppliers earn excess returns, two types of clawback mechanisms are used ex-post to retrieve excess public funding:

- **Implementation clawback:** if suppliers underestimate build cost assumptions, or if unexpected cost savings are made during the deployment phase, the overall supplier's investment remains unaltered, whilst public funding is reduced accordingly. As such all underspend is recouped.
- **Take-up clawback:** Where final take-up is higher than expected for any type of technology deployed, a portion of the extra profit made by the supplier is shared with the local body up to seven years after the contract closure date.

There is an additional capping mechanism in place for network provider protection, whereby take-up clawback is capped to the level of the Local Body's net fund (where the net investment fund is defined as total public funding net of capital underspend). Estimates of underspend and take-up clawback are based on a combination of BDUK projections prepared on the closure of the contract (as set out in the Investment Report). For incomplete contracts, clawback modelling is based on expected take-up, the Project Unit Margin (PUM) and Project Investment Ratio (PIR) as determined by the network provider in the PFM, and the Gainshare Investment Ratio (GIR) set at 85% as determined by discussions with BDUK (see appendix for more detail on these terms).

The results indicate that the clawback mechanisms are expected to return substantial levels of funding to the public sector. For example, while £280m of public funding was awarded to the Phase 1 contracts in the scope of this analysis, the net cost is expected to fall to £38m (primarily due to take-up clawback). 10 of the 28 contracts were delivered at close to no net subsidy. For Phase 2, the £331m public funding awarded to these contracts is expected to fall to £186m once clawback is received.

Table 2.7: Underspend and take-up clawback across subset of Phase 1 portfolio (28 contracts)[Redacted]

2.6 Internal Rates of Return after clawback (IRR5)

The following table provides the estimated IRR once clawback has been accounted for (and compares this to IRR4):

- Phase 1: The expected IRR associated with Phase 1 schemes after clawback is estimated at [redacted] on average. This exceeds the WACC of the network provider ([redacted]) and reflects the likelihood that a share of the investments would have been commercially viable in the absence of a subsidy. It should be noted that the clawback mechanisms, in many cases, are expected to recover almost all the subsidy awarded to the network provider. The evidence from the Technical Appendix 1 (Reducing the Digital Divide) also suggests that the subsidies encouraged network providers to bring forward coverage more rapidly. As such, Phase 1 may have helped accelerate superfast availability in many areas with limited public expenditure (beyond the opportunity cost of tying resources up in the programme).
- Phase 2: On average, the clawback mechanisms reduced the expected IRR of Phase 2 contracts from [redacted] to [redacted]. Most schemes funded under Phase 2 were not expected to be commercially viable without a subsidy. Assuming these projects will have a residual value at the end of the timescale for this analysis, it indicates that the clawback mechanisms are effective in containing the level of subsidies at the minimum level needed to create an economic incentive for network provider to proceed with the project.

Table 2.8: Internal rates of return for Phases 1 and 2 contracts based on actual and forecast costs and take-up, before clawback

[Redacted]

3 Phase 3 analysis

This section sets out the results of applying the modelling approaches described in the preceding section to Phase 3 contracts awarded under the 2016 to 2020 UK National Broadband Scheme. This analysis covers 20 of the 51 contracts that had been awarded at the time of writing. The 31 contracts not covered by this analysis were excluded either because information on actual delivery costs had not been supplied to BDUK by the network provider at the time of the analysis, or because the contracts were awarded after September 2019 (and little progress had been made with delivery). These issues are described in more depth in Section 1.

3.1 Methodological issues

Phase 3 contracts were at a relatively early stage of delivery. By September 2019, around 17 percent of the contracted premises to be upgraded had been delivered. This creates some additional challenges and uncertainties in relation to developing a projection of the likely profitability of the contracts subject to the analysis:

- Delivery costs: Many contracts had not completed a meaningful share of their delivery and updated forecasts of final delivery costs were not available although the number of premises upgraded and costs incurred to date were known. An assumption was adopted that the network provider would deliver the remaining premises to be upgraded at the unit cost per premises graded estimated in the PFM at the tendering stage. This was applied to current forecasts of the number of the premises to be upgraded (capturing any changes made to the scale of the contracts that had been agreed with the Local Body). However, this assumes that delivery costs will align with original expectations. It also assumes that the delivery costs are uniform over the delivery of the contract and to the degree that suppliers prioritised areas that were easier to upgrade, this could lead to an understatement of the costs associated with these contracts (an overstatement of the associated IRRs).
- Take-up: There was insufficient information to extrapolate future take-up based on past trends (most contracts had one or two quarters of reported take-up). An assumption was adopted that growth in take-up would mirror patterns observed in Phases 1 and 2. If take-up proves higher (or lower) than observed on past contrasts, this will lead to an understatement (overstatement) of the associated IRRs.
- **Time horizon:** It should be noted that the PFMs for Phase 3 contracts considered the costs and revenues over 20 years (rather than 15 years in Phase 1 and 2). As such, the IRRs estimated in the following section are not directly comparable with those set out in the preceding section.

In light of the above, the estimates of the IRRs associated with Phase 3 contracts should be treated as indicative. Greater certainty can be provided in any future evaluation, as there will be more information available on actual delivery costs and take-up.

3.2 Internal rates of return at the tendering stage (IRR1 and IRR 2)

The following table provides the IRRs for Phase 3 contracts at the tendering stage, with and without public subsidies. The table also includes the IRRs associated with 13 contracts that were out of scope because the network provider did not provide Finance Tracker information (but a PFM was available). The table shows:

- Commercial viability without subsidy: On average, Phase 3 contracts were expected to be loss making without a subsidy (delivering a IRR of [redacted]). There was substantial variation at the individual contract level, although no project was expected to deliver an IRR that exceeded the network provider's WACC. The expected profitability of investments proposed by network providers facing a higher cost of capital were broadly in line with those put forward by the dominant supplier which faced a lower cost of capital (a weighted average of [redacted] and [redacted] respectively). It should be noted that the dominant supplier will have a competitive advantage in bidding for contracts awarded under a gap funding model, as the level of subsidy required to make the project economically viable will be lower.
- Commercial viability with subsidy: The expected IRR associated with the contracts with subsidies averaged [redacted] per annum. This was lower than the average network providers WACC ([redacted] on average). [Redacted] expected an average IRR of [redacted] annum ([redacted] below its WACC). The IRRs associated with contracts awarded to [redacted] were slightly higher (at [redacted]) but some [redacted] below their average WACC ([redacted]). As highlighted in the preceding section, it is possible that the network providers saw residual value in the network build at the end of project lifetime. However, this also suggests that the greater competition for Phase 3 contracts have led some network providers to commit to potentially loss making investments (from an economic point of view), and greater risk transfer from the public to the private sector.
- Comparison with Phase 1 and 2: The expected profitability of Phase 3 contracts without subsidy was expected to be higher than those associated with Phase 1 and 2 contracts, meaning that they would require a lower level of public support to make them economically viable. This appears counter-intuitive as Phase 3 contracts were targeted at harder to reach areas. As illustrated below, this was driven primarily by the more optimistic take-up assumptions adopted by network providers in tenders. This could also be driven by the higher levels of competition involved, which may have limited scope for network providers to use less optimistic take-up assumptions to transfer risk to the public sector.

Table 3.1: Internal rates of return expected at the tendering stage¹⁸ [Redacted]

3.3 Expected and actual build costs

At the tendering stage, the expected costs associated with the network build (for the contracts in the scope of this analysis) were estimated by network providers to be approximately £169m. Based on information on actual costs to date:

- **Costs to date:** Network providers had incurred costs of £101m in delivering the network build based on information available at the time of writing.
- Forecast future costs: Across the portfolio, the future costs associated with the network build were expected to be £66m.
- **Expected versus forecast:** At the portfolio level, the forecast costs are broadly in line with expected costs and as such have little effect on the IRRs presented below. While there is variation at the contract level, this variance is primarily driven by differences in the contracted

¹⁸ Possibility for all contracts to be placed into an annex if preferred.

^{18-101398-01 |} Final Version | This work was carried out in accordance with the requirements of the international quality standard for Market Research, ISO 20252, and with the Ipsos MORI Terms and Conditions which can be found at http://www.ipsos-mori.com/terms. © DCMS 2020

number of premises to be upgraded and any changes that have subsequently been agreed with the local body. The results do not factor in any possible differences in the expected and actual efficiency of the network build, and to the degree that these are significant, the estimated IRRs presented below will be overstated or understated. As such, this will need to be revisited in any future evaluation.

Table 3.2: Expected build costs, actual build costs and forecast build costs

[Redacted]

3.4 Take-up, revenues and operational costs

3.4.1 Take-up

Figure 3.1 below shows the profile of average take-up (as a percentage of premises passed) for Phase 3 contracts:

- **Expected take-up:** On average, network providers expected take-up to reach just over **[redacted]** in the long-term. As highlighted above, this is higher than assumed for Phase 1 and 2 contracts, and has increased the expected IRRs on Phase 3 contracts. However, there are questions around the plausibility of these assumptions given that take-up on Phase 1 and 2 contracts had already exceeded this value at the time many of these contracts were awarded.
- Actual take-up: There was limited data available on actual take-up (shown in a solid orange line in the following figure). Take-up did lag expectations, but this is primarily driven by delays in delivery of the scheme rather than lower than expected demand for superfast services. However, as the associated revenues will be realised at later stages than originally expected, these delays will have the effect of reducing the IRR associated with the investments.
- **Projected take-up:** As highlighted above, owing to the limited data available on the take-up, it has been assumed that future take-up patterns will mirror the growth in demand observed for Phase 1 and 2 contracts (the dashed curve is based on the average of Phase 1 and 2). This is a source of additional uncertainty (particularly as most delivery is FTTP rather than FTTC) and will require revisiting in any future evaluation.

Figure 3.1: Expected and modelled take-up levels for Phase 3 contracts in scope [Redacted]

The average take-up curve for Phase 1 and 2 suggests that overall take-up for FTTC/P technologies across Phase 3 contracts have predicted higher rates of take-up than observed on Phase 1 and 2 contracts. The forecast suggests that take-up could reach a peak of **[redacted]** premises connected across the Phase 3 portfolio by the end of the project lifetime (20 year period).

3.4.2 Modelled revenues

Revenues were modelled in the same way as for Phase 1 and Phase 2. The table below gives the average revenue per user for Phase 3 contracts by FTTC and FTTP technologies. Average revenues per user for FTTC broadly align with those assumed for Phase 1 and 2 contracts. However, average revenues per user for FTTP (at £43.20) lay somewhere between average prices for Phase 1 (£50.62) and Phase 2 (£34.50). It is unclear what is driving these differences, although it should be noted that the PFMs for Phase 3 allowed for revenues driven by FTTP enabled Fibre Voice Access products which were not explicitly accounted for in Phase 1 and 2.

Table 3.3: Phase 3 ARPUs (average revenue per quarter) [Redacted]

As with Phase 1 and 2, these estimates of the average revenue per user were applied to the projection of take-up to provide an updated projection of future revenues. Figure 3.2 below presents the modelled revenue against the network provider prediction at the baseline. Total revenue across the Phase 3 portfolio is estimated to be in the region of **[redacted]** at the end of 20 years, around **[redacted]** higher than expected in the PFM (**[redacted]**). The figure also highlights the effect of delays in the early years of the contract. While revenues are expected to exceed expectations, this is not expected to occur until the seventh year following the commencement of the contract (with cumulative revenues exceeding expectations in the eleventh year).

Figure 3.2: Baseline revenue projections against modelled revenue for Phase 3 contracts (in scope)

[Redacted]

3.4.3 Operating costs

Similarly, Figure 3.3 below presents the modelled operating costs. Modelled operating costs in Phase 3 include network and wholesale connection opex, deployment closure costs, ongoing contractual reporting, wholesale cessation costs and wholesale migration costs. The analysis suggests that the level of operating costs is forecast to exceed predictions by **[redacted]**, in line with higher than predicted take-up.

Figure 3.3: Baseline operating cost projections against modelled revenue for Phase 3 contracts (in scope)

[Redacted]

3.5 Internal rates of return before clawback (IRR3 and IRR4)

The following table summarises the IRRs for Phase 3 contracts with and without subsidy, based on the updated revenue and cost projections set out in the preceding sections:

- Commercial viability without subsidy: Although projected take-up is higher than assumed by network providers at the tendering stage, the IRR associated with the projects without subsidy are not significantly higher (moving from [redacted] per annum loss to positive annual rate of return of [redacted]). This can be explained by the delays early in the contract, resulting in revenues being recognised later than originally expected. In all cases, the IRRs associated with the projects were expected to be substantially lower than WACC of the network provider ([redacted]). Arguably, a subsidy would have been needed in all cases to create a sufficient economic incentive to deliver the scheme.
- Commercial viability with subsidy: The provision of subsidies increases the average IRR associated with the contracts to [redacted]. This exceeds the network providers WACC and as with the other Phases, in 12 of the 20 cases the network provider would be expected to earn excess returns without the application of implementation and take-up clawback. However, it should be noted that the size of these excess returns is substantially smaller (on average) than those associated with Phase 1 and 2 contracts. Again, this provides a signal that the more competitive environment for Phase 3 contracts may have limited scope for network providers to transfer risk to the public sector.

Table 3.4: Internal rates of return based on forecast build costs, revenues and operational costs, before clawback¹⁹

[Redacted]

3.6 Clawback

Estimates of clawback have been developed on the basis of predicted underspend associated with the network build and predicted take-up levels, and are substantially more uncertain than for Phase 1 and 2 contracts. However, the modelling shows that the Phase 3 contracts could be expected to generate **[redacted]** of implementation clawback. Additionally, fewer contracts are expected to trigger take-up clawback (with **[redacted]** of take-up clawback expected across the portfolio). This is again explained by the delays associated with the delivery of Phase 3 contracts – while take-up is projected to exceed original expectations, this is not expected to occur until relatively late on in the lifetime of the project (often beyond the final review point that takes place seven years into the contract).

Table 3.5: Modelled implementation and take-up clawback

[Redacted]

3.7 Internal rates of return after clawback (IRR5)

The following table shows the expected IRRs after the application of clawback. Overall, the analysis suggests that the clawback mechanism may prove effective in limiting any excess returns that might be earned by network providers. Across the portfolio, the clawback mechanisms are expected to reduce the IRR associated with the contracts (on average) to **[redacted]** – broadly in line with ex-ante expectations (IRR2, **[redacted]**). Additionally, at the individual contract level, only one is expected to deliver a rate of return that exceeds the WACC of the network provider.

Table 3.6: Internal rates of return for Phase 3 based on forecast costs and take-up, after clawback

[Redacted]

⁷

¹⁹ Possibility for all contracts to be placed into an annex if preferred.

^{18-101398-01 |} Final Version | This work was carried out in accordance with the requirements of the international quality standard for Market Research, ISO 20252, and with the Ipsos MORI Terms and Conditions which can be found at http://www.ipsos-mori.com/terms. © DCMS 2020

Appendix - Methodology

3.8 Internal Rate of Return (IRR)

The internal rate of return (IRR) is the rate of return that brings the net present value of all inflows and outflows to zero (i.e. the rate of return on the project). If the IRR of the project exceeds the cost of capital (i.e. the cost to the company of obtaining money in order to undertake that project) then the project will increase the wealth of the shareholders and, in broad terms, should be undertaken.

The internal rate of return is calculated using Excel's IRR formula, to mirror the calculations of network operators within the PFM. The IRR function syntax has a *value* argument which is required. This is an array or reference to cells that contain the values for which to calculate the IRR i.e. annual cashflows. The IRR uses the order of values to interpret the order of cash flows.

3.9 Take-up

Take-up (i.e. number of premises connected) is derived from a combination of actual and predicted information and is analysed separately for FTTC and FTTP.

3.9.1 Phase 1 approach

Actual data on take-up is available up to and including Q3 FY19/20 from C3 reports²⁰. From Q4 FY19/20 and to the end of the 15-year contract period forecast take-up figures have been used.

The following generalised logistic function has been used to forecast take-up:

$$y(t) = A + \frac{K - A}{(1 + Q \cdot e^{-g \cdot t})^{\frac{1}{v}}}$$

The function is thus bounded between a lower asymptote (A) and an upper asymptote (K), whilst g is the growth rate, t the inflection point, and v is positive and influences the inflection point and the shape of the curve. In the model, the function takes the following specification:

$$take - up = \frac{0.85}{(1 + 1.4 \cdot e^{-g \cdot t})^{\frac{1}{v}}}$$

The function is thus only positive (A = 0) as take-up cannot be negative, and takes a maximum value of 85% take-up as its upper bound (K = 0.85). This, in line with the assumption that average take-up level is around 85% across the UK²¹, ensures that combined take-up of FTTC and FTTP does not exceed 85% of all passed premises. In order to match the data as closely as possible, the parameters of the function g and v (with $v \neq 0$), as well as Q, were adjusted iteratively to ensure that the function matched the actual take-up trend in the final few quarters of observed data.

The generalised logistic function is applied to FTTC and total FTTC and FTTP take-up. Given the small number of premises taking-up FTTP broadband, the function does not appear suitable to

²⁰ C3 reports are standard schedules that include information on take-up quarterly from the first M2 milestone.

²¹ Ofcom (2018). *Connected Nations 2018*. Accessed at: <u>https://www.ofcom.org.uk/___data/assets/pdf_file/0020/130736/Connected-Nations-2018-main-report.pdf on 7 April 2020</u>. Page 18.

^{18-101398-01 |} Final Version | This work was carried out in accordance with the requirements of the international quality standard for Market Research, ISO 20252, and with the Ipsos MORI Terms and Conditions which can be found at http://www.ipsos-mori.com/terms. © DCMS 2020

estimate future take-up levels for FTTP²². For FTTP take-up, a logarithmic regression in the following form is used to determine the parameters for predicted take-up by quarter (t):

$$y(t) = \alpha \cdot \ln(t) + \beta$$

In one case, for instance, the logistic function led to an overestimation of take-up in the early quarters and an underestimation in slightly later periods before the actual and the forecast trends converge in the last quarters for which take-up is observed.

3.9.2 Phase 2 approach

Actual data on take-up for Phase 2 is available up to and including Q1 FY20/21 from C3 reports. Takeup after Q4 FY19/20 and to the end of the 15-year timeline was forecasted using the same logistic function approach in Phase 1.

For contracts in Phase 2, the take-up forecast is based on the latest **[redacted]** (ORMP) figure from C3 reports (Q1 20/21).

3.9.3 Phase 3 approach

Data on actual connections for Phase 3 contracts is limited due to the relatively recent start of the contracts (in general roll-out began after FY17/18).

The treatment of take-up in Phase 3 is therefore based on actual take-up data from C3 reports until Q1 FY20/21 (on average four quarters of information across the contracts) and subsequently follows the average take-up from Phase 1 and 2. In this case, the percentage take-up is applied to the ORMP figure derived from the contracts' Speed & Coverage Template (SCT).

The timeline considered in Phase 3 is 20 years as per the contracting mechanism, note that this is a longer assessment period than contracts in Phases 1 and 2 (each 15 years).

3.10 Revenue

Revenue figures are not provided by network operators. The calculation of revenue is informed by actual and predicted levels of take-up (premises connected). Revenue is split into recurring and non-recurring revenue as per the PFM and is calculated separately both for FTTC and FTTP.

3.10.1 Phase 1 approach

Recurring revenue

Recurring revenue (wholesale revenue²³) is calculated for FTTC and FTTP as follows:

Recurring revenue = Take-up * ARPU * revenue inflation (deflation) assumption

Two methodologies have been applied to determine ARPUs for FTTC and FTTP:

²³ Wholesale prices are defined as the prices that the network operator can charge other communications providers to gain access to telecoms services (i.e. the technology rolled out). The provision of wholesale access is required by contract in compliance with State Aid rules. For further information: Ofcom (2020): *Next Generation Access Glossary*. Accessed at: https://www.ofcom.org.uk/ data/assets/pdf file/0013/63220/nga glossary.pdf on 3 August 2020.

18-101398-01 | Final Version | This work was carried out in accordance with the requirements of the international quality standard for Market Research, ISO 20252, and with the Ipsos MORI Terms and Conditions which can be found at http://www.ipsos-mori.com/terms. © DCMS 2020

²² On average, the function led to an overestimation of 860,322 premises connected in each quarter of Phase 1 and 295,380 premises connected in each quarter of Phase 2.

- Phase 1 ARPUs: As ARPUs are not indicated in the Phase 1 PFMs, these have been calculated using the steady-state rental revenue divided by the number of connected premises at steadystate, from which a price per connected unit at steady-state is derived;
- Phase 3 ARPUs: Where contracts for the same local body were awarded to [redacted] also in Phase 3, ARPUs from Phase 3 PFMs were applied to connections. If a Phase 3 contract for a local body had not been awarded to [redacted], a similar [redacted] Phase 3 contract was used to derive ARPUs²⁴.

The revenue inflation (deflation) assumption is assumed by the network operator as constant throughout the period and equal to 1.

Non-recurring revenue

The following types of non-recurring revenue have been considered both for FTTC and FTTP churned volumes:

• **Installation:** the installation price included in PFMs and customer growth net of churn based on actual figures until Q3 FY19/20 and predicted take-up afterwards:

Installation revenue = (connections + net customer growth) * installation price * revenue inflation (deflation) assumption

• Cease: relating to the predicted termination of contracts:

```
Cessation revenue = cease volumes * service cessation cost * revenue inflation (deflation)
assumption
```

- **CP:CP:** migration costs
- Migration revenue = CP:CP volumes * service migration cost * revenue inflation (deflation) assumption

All cost figures for installation, cessation, and migration have been derived from Phase 3 PFMs or a comparator where an equivalent contract in Phase 3 was not available.

3.10.2 Phase 2 approach

Similar to Phase 1, revenue in Phase 2 is split into recurring revenue and non-recurring revenue. Calculations follow the same methodology applied to Phase 1 contracts.

3.10.3 Phase 3 approach

Phase 3 revenue calculations, both for recurring and non-recurring revenues, are entirely based on Phase 3 PFM assumptions, but follow the same methodology applied in the case of Phase 1 and Phase 2.

3.11 Premises passed

Premises passed values are used in the analysis to determine take-up and future build capex where contracts remain open.

²⁴ Geography and ORMPs were generally considered to find a Phase 3 equivalent of a Phase 1 contract.

3.11.1 Phase 1 approach

All Phase 1 contracts in scope of the analysis are closed contracts. It was therefore not a requirement to estimate premises passed.

3.11.2 Phase 2 approach

The majority of Phase 2 contracts (29 out of 31) were open at the time of this analysis²⁵. The forecast premises passed figure in this case has been sourced from the latest C3 report (Q1 FY19/20).

3.11.3 Phase 3 approach

All 20 Phase 3 contracts covered by the analysis were open at the time of this analysis. The forecast premises passed figure in this case has been derived from the contracts' SCT build plans.

3.12 Opex

Opex (i.e. the operating expenditure connected to the roll-out and functioning of the service) is not provided by network operators. It has been calculated based on data from the PFMs and the actual and forecast take-up data.

3.12.1 Phase 1 approach

In Phase 1, opex was calculated for **connection opex** and **maintenance opex**.

The unit opex cost was calculated based on PFM data for FTTC and FTTP as follows:

Which was applied to the number of connections to determine connection opex:

connection opex = number of connections * average opex unit cost * opex inflation (deflation) assumption

Maintenance opex is based on a BDUK assumption of a maintenance opex cost of £18.60 (network operator phase 3 assumption) a year for both FTTC and FTTP.

maintenance unit opex cost = number of connections * quarterly maintenance opex cost (£4.65) * opex inflation (deflation) assumption

Inflation is assumed to be constant and equal to 1 throughout the period²⁶.

3.12.2 Phase 2 approach

There are three components to opex in Phase 2: **connection opex**, **deployment opex**, and **incremental opex**, applied to both FTTC and FTTP connections.

The unit cost for opex is determined using the same approach as Phase 1 per quarter for both FTTC/P:

Unit opex cost =total opex (from start of take-up) / number of connections

²⁵ The only two closed contracts in the sample were CORN201 and SGLO201.

²⁶ This assumption is included in Phase 3 PFMs.

Connection opex

The approach to calculating connection opex follows the same methodology as in Phase 1. An addition to the contracting mechanism in Phase 2 is the inclusion of deployment opex.

Deployment opex

Compared to Phase 1, in Phase 2 deployment opex is a qualifying cost as it is directly attributable to build activities, although it is not capitalisable. It includes elements such as ineffective engineers' time and costs related to a service centre, but overall it makes up a small proportion of the build cost²⁷.

Thus, deployment opex was updated by firstly calculating average deployment opex. From the PFM, the measure of average deployment opex across the period was used alongside the expected number of premises passed to find the average opex deployment cost for each contract as follows:

average deployment opex unit cost = deployment opex / total number of premises passed

The actual and predicted number of premises passed by quarter, introduced in Section 3.11, was then used to obtain a measure of deployment opex throughout the project timeline as follows:

deployment opex = actual and predicted premises passed * average deployment unit cost

Inflation is assumed to be constant and equal to 1 throughout the period²⁸.

3.12.3 Phase 3 approach

Opex is presented differently in Phase 3 contracts, structuring it into "build vs in-life costs" as opposed to operating and capital expenditure. The modelling replicates the network operators' calculations in the PFM, updated for revised connections.

Component	Туре	Calculation
Network opex	FTTC & FTTP	(FTTC + FTTP premises connected) * unit opex cost per connection * opex inflation (deflation) assumption
GEA connection	FTTC & FTTP	Churned volumes + net customer growth (net of churn) * opex unit cost * opex inflation (deflation) assumption

²⁷ BDUK information.

²⁸ This assumption is included in Phase 3 PFMs.

^{18-101398-01 |} Final Version | This work was carried out in accordance with the requirements of the international quality standard for Market Research, ISO 20252, and with the Ipsos MORI Terms and Conditions which can be found at http://www.ipsos-mori.com/terms. © DCMS 2020

GEA cease	FTTC & FTTP	(FTTC + FTTP chumed volume cessation) * opex unit cost per ceased FTTC/FTTP connection * opex inflation (deflation) assumption
CP:CP	FTTC & FTTP	(CP:CP FTTC + FTTP churned volumes) * opex unit cost per CP:CP transfer FTTC/FTTP connection * opex inflation (deflation) assumption

Two additional costs set out in the PFM, deployment closure costs and ongoing contractual reporting, could not be updated due to the lack of actual information on network volumes; thus, data from the PFM (i.e. the network operators' forecast) has been used for the modelling.

3.13 Capex

Capex is analysed as **build capex** (relative to the premises that have been passed) and **connection capex** (for premises that have been connected to broadband). Actual capex information is provided in the Finance Trackers by network operators to BDUK.

3.13.1 Phase 1 approach

Build capex

The total cost of passing premises is based on the number of premises passed by quarter divided by the build capex for both FTTC and FTTP.

The average build capex is obtained by dividing the total cost of passing premises over the 15-year contract period by the number of premises passed at steady-state, both for FTTC and FTTP. Build capex becomes zero after the end of the deployment period.

As all Phase 1 contracts are closed, updated cashflow calculations utilise actual build capex as reported in the Finance Tracker.

Connection capex

Similarly, the total cost of connecting premises with FTTC or FTTP is given by the total connection cost divided by the number of premises connected at steady-state.

For FTTC and FTTP, connection capex is estimated as:

```
connection capex = net customer growth * average connection capex * capex inflation (deflation)
assumption
```

Net customer growth is calculated as in the case of non-recurring revenue and is net of churn.

3.13.2 Phase 2 approach

Build capex

As the majority of Phase 2 contracts have not completed deployment, there is a requirement to model future build capex associated with future premises passed. A unit cost of build capex using baseline network operator predictions and total predicted build capex was calculated (in the same way as Phase 1) to support the estimate of future build expenditure.

The components to produce this estimate are set out below:

Value	Source	
Total predicted premises	PFM	network operator prediction
Total predicted cost	PFM	network operator prediction
Build capex unit cost	Calculation	Predicted premises / Predicted cost
Total spend to date	Finance tracker	Reported data
Assumed premises passed to date	BDUK modelling	
Revised build capex unit cost	Calculation	Spend to date / assumed premises passed to date
Remaining expected premises passed	Calculation based on BDUK modelling	Total assumed premises passed – assumed premises passed to date
Assumed remaining spend	Calculation	Revised build capex unit cost * remaining expected premises passed

Connection capex

For Phase 2 contracts connection capex is an allowable cost and is therefore reported in the Finance Tracker by network operators. Beyond the latest available quarter, it has been estimated for future periods for both FTTC/P:

```
connection capex = net customer growth * average connection capex * capex inflation (deflation)
assumption
```

Net customer growth is calculated as in the case of non-recurring revenue and is net of churn.

3.13.3 Phase 3 approach

As Phase 3 contracts have not completed deployment, there is a requirement to model future build capex associated with future premises passed. A unit cost of build capex using baseline network operator predictions and total predicted build capex was calculated (in the same way as Phase 1) to support the estimate of future build expenditure.

The components to produce this estimate are set out below:

Value	Source	
Total predicted premises	PFM	network operator prediction
Total predicted cost	PFM	network operator prediction

Build capex unit cost	Calculation	Using above
Total spend to date	Finance tracker	Reported data
Total predicted premises	SCT	
Revised assumed total spend	Calculation	Total predicted premises * build capex unit cost
Assumed remaining spend	Calculation	Revised assumed total spend - total spend to date

Another element of build capex included in the Phase 3 calculations is non-PMO build capex, replicating this from the PFMs.

Connection capex

The approach to calculating connection capex follows the same methodology as applied in Phase 2.

3.14 Capital clawback

Capital clawback is triggered where the network operators' prediction of build capex exceeds actual expenditure.

3.14.1 Phase 1 approach

Capital clawback for Phase 1 contracts was sourced from the contract summary in the IFGR files provided by BDUK. As closed contracts, values for capital clawback did not require forecasting.

3.14.2 Phases 2 and 3 approach

For Phases 2 and 3, capital clawback has been estimated as follows:

Component	Source
Build capex to date	Finance Tracker
Future build capex	Calculation as per 1.5.1 above
Total revised estimate of build capex	Calculation – sum of lines above
Baseline build estimate	PFM
Overspend or underspend prediction	Comparing revised estimate and baseline estimate, where underspend triggers clawback

3.15 Take-up clawback

3.15.1 Phase 1 approach

In Phase 1, IFGR files were used as a source of information for take-up clawback. The IFGR forms include information on the following to calculate take-up clawback:

- **Project Unit Margin (PUM):** The Project Unit Margin (PUM) is the modelled average profit per customer over the term of the contract.
- Project Investment Ratio (PIR): The Project Investment Ratio is the proportion of OIR.
- Outturn Investment Ratio (OIR): cost invested by the supplier at the end of the build.
- Gainshare Investment Ratio (GIR). The maximum of the PIR and OIR.

The maximum of the PIR and OIR is used to determine the GIR. The triggers of clawback (i.e. the exposure to clawback) is determined by review points set by BDUK and is calculated as:

take-up clawback = net additional take-up²⁹ * PUM * (1 - GIR)

The take-up reinvestment amount is calculated as:

take-up reinvestment amount = exposure to claw-back – any take-up clawback amounts already paid back to the LB

3.15.2 Phase 2 and 3 approach

Clawback calculations for the two Phase 2 closed contracts (CORN201 and SGLO201) follow the same methodology applied to Phase 1 contracts (above).

Clawback for open Phase 2 and 3 contracts is forecast based on data included in the PFM and additional management information shared by BDUK.

The components required, and respective sources, are set out below:

Component	Source
Actual and forecast connections	C3 report and modelling forecast
Variance in connections	Difference between C3 report/modelling forecast and PFM information
PUM	PFM
PIR	PFM
OIR	[BDUK modelling for Phase 2] Not included for Phase 3
GIR	Maximum of PIR and OIR (always OIR)
Interim review proportion	85% for all contracts with a few minor exceptions where it's 50%
Take-up review points	Phase 2 review points sourced from BDUK. Phase 3 review points are annually from contract start date as per BDUK guidance.

²⁹ Net additional take-up represents the difference between actual take-up and PFM take-up. For further information, please refer to *Schedule 5.1 Milestone Payments and Claims Procedure* of any Phase 1 contracts.

3.16 Cash flow

The previously determined revenue, opex, and capex have been used to calculate cashflow throughout the project timeline. The structure of the cashflow is consistent across all three phases.

Cashflow item	Description		
Revenue	Calculations based on calculated ARPUs or Phase ARPUs		
Opex	Calculation		
EBITDA	Revenue – Opex		
Build Capex	Actual figures from the Finance Tracker have been used up to and including (Phase 1 Q4 FY16/17; Phase 2 up to Q3 FY19/20; Phase 3 up to Q4 FY19/20), which is the point of steady-state for passed premises. After this, it is modelled for open contracts or assumed that no further build costs are incurred for completed contracts.		
Connection capex	Calculation		
Total capex	Sum of build and connection capex		
Cashflow pre funding	EBITDA - Capex		
Public funding	Actual figures from Finance Trackers up to and including (Phase 1 Q4 FY16/17; Phase 2 up to Q3 FY19/20; Phase 3 up to Q4 FY19/20). If differences exist between BDUK records of paid public funding, the difference is added in the last quarter recorded in the Finance Tracker.		
Adjusted cashflow post funding	Cashflow pre funding + public funding		
Capital Clawback	Sourced from IFGR files for closed contracts, modelled for open contracts.		
Take-up Clawback	Sourced from IFGR files for closed contracts, modelled for open contracts.		
Interest on capital	Sourced from IFGR files for closed contracts, not modelled for open contracts.		
Interest on clawback (gainshare)	Sourced from IFGR files for closed contracts, not modelled for open contracts.		
Clawback capping	Where take-up clawback is above net funding (Total public funding – capital clawback – interest on capital), it triggers a capping of the clawback.		
Total clawback	Sum of capital clawback, take-up clawback, interest and capping		

Adjusted cashflow post clawback	Cashflow post funding – clawback		
Baseline IRR pre-funding	Baseline IRR before state aid - estimated by the network operator at the time of bid		
Baseline IRR post-funding	Baseline IRR post state aid – estimated by the network operator at the time of bid		
Updated IRR (pre-funding pre-clawback)	Modelled IRR before state aid and clawback		
Updated IRR (pre-clawback)	Modelled IRR post state aid but before clawback		
Updated IRR (post-clawback)	Modelled IRR post state aid post clawback		

3.17 Assumptions

The results of the financial analysis are largely dependent on a number of assumptions. Table 3.7 below sets out a RAG rating for all assumptions applied in the analysis and the respective assumed degree of sensitivity for the IRR results. The level of assumed take-up and the capping of 85% in particular are significantly influential on the IRR results. This capping was deemed appropriate through discussions with BDUK and with reference to Ofcom's Connected Nations 2018 report indicating average take-up of 85% across the UK. No time factor has been applied to decrease the assumed 15% of premises which do not take-up superfast broadband over time. Scenario analysis could be undertaken to understand the degree to which the IRRs are underestimated as a result of this capping. Other external factors, such as the COVID-19 pandemic, have not been taken into account quantitatively but it can be assumed that the delivery and take-up profile have been disrupted as a result, which may have a suppressing effect on the IRRs.

Table 3.7: RAG rate assumptions

Component	Phase	Required for	Source	Quality of assumption RAG rating	Influence on analysis
Steady-state FTTC connected premises	1,2,3	Revenue calculation	PFM		High
Steady-state FTTP connected premises	1,2,3	Revenue calculation	PFM		High
Steady-state revenue FTTP rental	1,2,3	Revenue calculation	PFM		High
FTTC ARPU (£)	1 and 2	Revenue calculation	Calculation (Steady-state revenue FTTC rental/Steady-state FTTC connected premises, source: PFM)		High
FTTP ARPU (£)	1 and 2	Revenue calculation	Calculation (Steady-state revenue FTTP rental/Steady-state FTTP connected premises, source: PFM)		High
FTTC ARPU (£) Phase 3	3	Revenue calculation	Phase 3 PFM		High
FTTP ARPU (£) Phase 3	3	Revenue calculation	Phase 3 PFM	_	High
FTTC Installation price	1,2,3	Revenue calculation	Phase 3 PFM		Medium
FTTP Installation price	1,2,3	Revenue calculation	Phase 3 PFM		Medium
CP-CP GEA Migration same product/premise	1,2,3	Revenue calculation	Phase 3 PFM		Medium
Service cessation (any product variant)	1,2,3	Revenue calculation	Phase 3 PFM		Medium
Quarterly maintenance cost	1 and 2	Operating expenditure	BDUK provided assumption (£18.60 per customer per annum Phase 3 network operator prediction)		Medium
FTTC opex average unit cost	1 and 2	Operating expenditure	Calculation (FTTC opex cost/FTTC solutions volumes, source: PFM)		High

FTTP opex average unit cost	1 and 2	Operating expenditure	Calculation (FTTP opex cost/FTTP solutions volumes, source: PFM)	High
Deployment opex	2	Operating expenditure	Calculation (Deployment opex cost/premises passed within deployment phase, source: PFM)	Low
Deployment closure cost	3	Operating expenditure	Phase 3 PFM (directly sourced; not updated)	Low
Contractual reporting	3	Operating expenditure	Phase 3 PFM (directly sourced; not updated)	Low
Network operating cost	3	Operating expenditure	Calculation (total FTTP and FTTC connections*unit operating cost source: PFM)	High
FTTC connection (wholesale)	3	Operating expenditure	Calculation (FTTC churned volumes + FTTC net customer growth) * wholesale opex cost per quarter per connection source: in life cost book PFM)	High
FTTP connection (wholesale)	3	Operating expenditure	Calculation (FTTP churned volumes + FTTP net customer growth) * wholesale opex cost per quarter per connection source: in life cost book PFM)	High
FTTC & FTTP CP: CP migration	3	Operating expenditure	Calculation (FTTC and FTTP migration churned volumes * wholesale migration cost per quarter per connection source: in life cost book PFM)	Medium
GEA (FTTC) Cease	3	Operating expenditure	Calculation (FTTC cease churned volumes*wholesale cessation cost per quarter per connection source: in life cost book PFM)	Medium
GEA (FTTP) Cease	3	Operating expenditure	Calculation (FTTP cease churned volumes*wholesale cessation cost per quarter per connection source: in life cost book PFM)	Medium
FTTC build unit cost	1,2,3	Capital expenditure, implementation clawback	Calculation (FTTC total cost/max FTTC premises passed, source: PFM)	High
FTTC connection unit cost	1,2	Capital expenditure	Calculation (FTTC connection capex/max FTTC premises connected, source: PFM)	Medium
FTTC connection unit cost	3	Capital expenditure	In life cost book PFM (unit capex cost FTTC)	Medium
FTTP build unit cost	1,2,3	Capital expenditure, implementation clawback	Calculation (FTTP total cost/max FTTP premises passed, source: PFM)	High
FTTP connection unit cost	1,2,3	Capital expenditure	Calculation (FTTP connection capex/max FTTP premises connected, source: PFM)	Medium
FTTP connection unit cost	3	Capital expenditure	In life cost book PFM (unit capex cost FTTP)	Medium
Premises passed profile	2,3	Capital expenditure, implementation clawback	BDUK modelled forecasts	High
Total predicted premises passed per contract	3	Capital expenditure, implementation clawback	Speed and coverage templates	High

Total predicted premises passed per contract	2	Capital expenditure, implementation clawback	BDUK modelled forecasts	High
Take-up	1,2	Take-up, revenue, operating costs, implementation clawback, take-up clawback	Logistic function using subset of reported take-up capped at 85%	High
Take-up	3	Take-up, revenue, operating costs, implementation clawback, take-up clawback	Average take-up curve for Phase 1 and 2 (FTTC and FTTP combined) capped at 85%	High

For more information

3 Thomas More Square London E1W 1YW

t: +44 (0)20 3059 5000

www.ipsos-mori.com http://twitter.com/lpsosMORI

About Ipsos MORI Public Affairs

Ipsos MORI Public Affairs works closely with national governments, local public services and the not-for-profit sector. Its c.200 research staff focus on public service and policy issues. Each has expertise in a particular part of the public sector, ensuring we have a detailed understanding of specific sectors and policy challenges. Combined with our methods and communications expertise, this helps ensure that our research makes a difference for decision makers and communities.



