NBP Cost Benefit Analysis Report

April 2019

pwc

Contents

Glossary of Terms (1/2)

Table 1: Glossary of Terms

Term	Acronym	Description
Baseline Benefit	-	The benefit which is realised from a move from entry-level basic broadband (i.e. <5Mbps maximum download speed) to NGA broadband (i.e. reliably available 30 Mbps download speed).
Cost Benefit Analysis	CBA	An analysis of the costs and benefits which attach to a proposed investment.
Department of Communications, Climate Action and Energy	DCCAE	DCCAE was formerly known as the Department for Communications, Energy, and Natural Resources (DCCAE).
Digital Subscriber Line	DSL	Digital subscriber line technology which enables much faster transmission than was traditionally the case with digital subscriber loop.
Discount Rate	-	An expression of the time value of money. By extension, the discount rate defines the minimum internal rate of return which the project should deliver.
Fibre-to-the-Premises	FTTP	Fibre to the premises is a form of fibre-optic communication delivery, in which an optical fibre is run in an optical distribution network from the central office all the way to the premises occupied by the subscriber.
Fixed Wireless Access	FWA	A type of internet access which uses radio signals instead of cable for service provider connection.
Full-Time-Equivalent	FTE	A full-time job for a full year.
Fourth / Fifth Generation	4G / 5G	Fourth and fifth generation of mobile telecoms technology.
Gross Value Added	GVA	A productivity metric that measures the difference between the value of goods and services produced and the costs of production inputs.

Glossary of Terms (2/2)

Table 1 (cont'd): Glossary of Terms

Term	Acronym	Description
Internal Rate of Return	IRR	Internal rate of return (IRR) is the interest rate at which the net present value of all the cash flows (both positive and negative) from a project or investment equal zero.
Intervention Area	IA	Those areas of the country which are being considered for investment under the NBP, as commercial provision of NGA services is not probable in the medium-term.
Megabits per Second	Mbps	A measure of the speed at which data is transferred online.
Multinational Corporation	MNC	Corporate organisations that own or control production of goods or services in 2 or more countries other than their home countries.
National Broadband Plan	NBP	Plan to deliver NGA broadband services to all parts of Ireland, regardless of location.
Next Generation Access	NGA	NGA describes a significant upgrade to the Broadband available by making a step change in speed and quality of the service.
Real Internal Rate of Return	Real IRR	The rate of return (or compounded interest rate) which is realised on an investment, the costs and benefits of which are expressed in today's prices.
Real Net Present Value	NPV	The value of incoming and outgoing cash flows over time (expressed in today's prices), which has regard to the time value of money.
Shadow Price of Public Funds	-	The opportunity cost of public funds, which reflects the negative productivity implications of raising taxes to fund public expenditures.
Small-to-Medium Enterprise	SME	For the purposes of this study, the SME sector in the intervention area relates to home-based and micro-enterprises with average employment estimated to be at less than 3 FTE per enterprise.

Executive Summary

Executive Summary

This report was commissioned to PwC by the Department of Communications, Climate Action and Energy (DCCAE) in May 2018 as part of a contract extension from January 2015. It presents the updated findings of a cost benefit analysis (CBA) of the National Broadband Plan (NBP).

This plan, the need for which was referenced in the Programme for a Partnership Government (May 2016) and remains a priority objective of Government, aims to provide Next Generation Access (NGA) broadband services to Irish households and businesses, located in areas which will not have access to commercial NGA services in the medium-term. These areas, referred to collectively as the NBP Intervention Area (IA), account for almost 23% (1.1m people) of our population. Additionally, the NBP IA is home to 55,804 farms and 44,185 non-farm businesses.

The objective of this CBA is to assess the extent to which a State intervention to support the attainment of the primary NBP objective of universal NGA access will yield a positive return to Irish society.

This CBA was prepared as part of a wider-NBP assignment, which included:

- an overarching NBP strategy work-stream completed in 2015 (PwC-led);
- a financial appraisal work-stream (KPMG-led); and
- a technical, design and planning work-stream. (Analysys Mason-led).

The CBA was prepared for one technical option for modelling purposes (100% Fibre-to-the-Premises or FTTP) only, and therefore this technical option is the basis of the CBA assessment. This technical option was advised to the PwC CBA team by the technical project advisors, Analysys Mason, who concluded that this technology was capable of delivering the NBP objective of universal NGA in the IA. To further support the technical advisors finding, the Bidder has also assumed FTTp as the most cost effective technology to achieve the objective of the NBP Intervention over the 25 year contract period. The FTTP technical option yields a positive real NPV of €858m over a 25 year period, with a Benefit : Cost ratio of 1.30.

A scenario analysis was run to determine the range of potential outcomes and it was found that the CBA result was positive for all scenarios, as shown below in Table 2.

Under the central / base case scenario, total project costs are €2.9bn (real NPV). All cost estimates were sourced from the financial appraisal work-stream which was undertaken by KPMG in collaboration with technical advisors, Analysys Mason.

Enterprise benefits including farm enterprises, non-farm IA enterprises, non-IA enterprises, and increased employment result in over €1.5bn in benefits. The general public who live within the IA also significantly benefit from the plan with a total of approx. €2.2bn benefits (real NPV) realised by households.

Table 2: CBA Costs and Benefits, €m

€m	Pessimistic Scenario (Central Benefits, Pessimistic Costs)	Central Scenario	Optimistic Scenario
Total Project Costs	(3,256)	**(2,896)**	(2,721)
Residential Benefits	2,243	**2,243**	3,568
Enterprise Benefits	1,511	**1,511**	2,251
NPV Result	497	**858**	3,097
Benefit : Cost ratio	1.15	**1.30**	2.14

Source: PwC Derived

Executive Summary – Residential

Residential households within the IA can significantly benefit from access to NGA broadband, particularly the ability for adults in the IA to work remotely. On average, adults comprise 0f 73% of households within the IA and the average time spent online by an adult is increasing annually resulting in greater potential benefits arising to residential households, and adults in particular, from access to NGA broadband services.

Residential benefits within this CBA analysis include:

i. Bundled communications: realised savings available by purchasing communication 'bundles'
ii. Service waiting: reduced time required for value-adding online activity to be completed
iii. Remote working: time and cost savings for white collar workers being able to work remotely
iv. Transaction savings: time and cost savings from online shopping

The key underlying factors driving the overall increase in residential benefits in the current CBA relate to:

1. an increase in the number of adults living in the IA (805,312), and
2. Irish adults spending an increased number of hours (8.7 hours) on the internet each week

Residential benefits will reach approx. €2.2bn in present value terms over the twenty five years to 2043, with the key component driven by reduced service waiting time benefits of €1.58bn. It is forecast that households will gradually be connected to NGA broadband services and will cap at circa 80% by the end of the contract period, recognising that there will be premises that may never connect or use alternative sources.

After this point, additional connections will most likely be for new households built in the IA with the remaining 25% never availing of the broadband services available to them from NBP roll-out.

An overview of the estimated annual average baseline benefit realised by IA households with NBP NGA broadband is shown in Table 3.

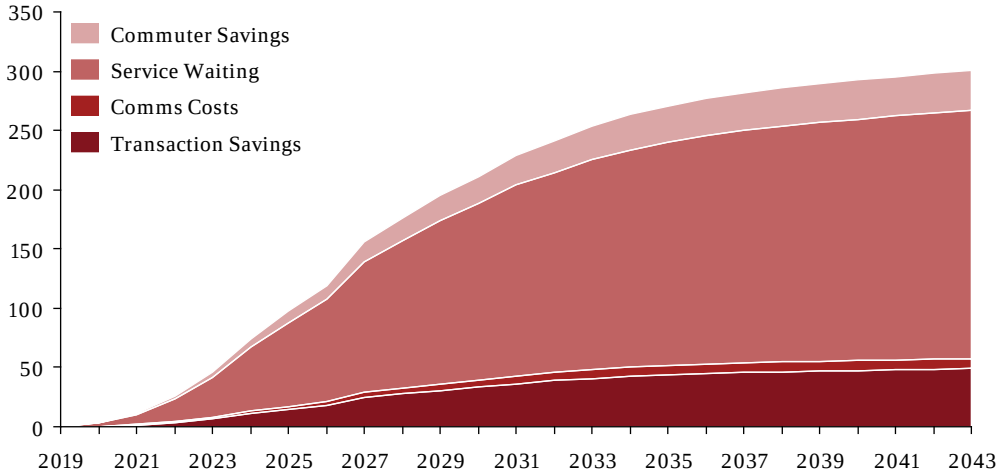
Table 3: Residential benefit categories – benefit per household / adult

Residential Benefit Categories	Average Household[1]	Average Adult Resident[1]	Total NPV Benefit
Bundled Communications	€31	€15	€65m
Reduced Service Waiting	€511	€245	€1,576m
Remote Working	€81	€39	€246m
Transaction Savings	€117	€56	€356m
Total Benefit	**€740**	**€355**	**€2.24bn***

Source: PwC Derived

[1]Non-Discounted benefits
*May not sum exactly due to rounding

Figure 1: Assumed evolution of annual residential benefits, €m[1]



Executive Summary - Enterprise

The CBA analysis identifies benefits totalling €1.5bn to farm and non-farm enterprises in the IA, non-IA enterprises, and from additional job creation (employment benefits) for enterprises within the IA.

Within the enterprise category, the most significant beneficiaries are **enterprises located outside of the NBP IA** whose employees live and commute from the IA (€1.4bn real NPV). The CBA estimates that there is a high incidence of white collar commuting from the IA to urban areas, i.e. 80% of the total of circa 146,000 white collar workers in the IA.

The productivity of these employees will be significantly enhanced as a result of the "always on" capability in their homes as well as from the productivity gains associated with teleworking. This ability to telework is becoming an increasing requirement of MNCs and domestic corporates, whose global footprints often require employees to work irregular hours, including home-based teleconferencing.

Farm benefits are estimated at €186m in real NPV terms, with these stemming in large part from the assumed adoption of precision or "smart" farming methods by a small share of progressive farmers as well as the remote monitoring of livestock. The IA accounts for 68% of farms in Ireland and precision farming, which will become much more pervasive with time and be a fundamental determinant of our international competiveness longer-term, requires NGA broadband access.

The estimated benefits to **IA-based non-farm SMEs** are €332m in real NPV terms. The micro nature of a large share of these enterprises led to PwC adopting relatively conservative assumptions on the impact of NGA services on the GVA of these businesses.

The number of white collar workers who live in the IA has increased since the 2011 Census (146,739 vs. 115,515) and therefore impact positively on enterprise benefits. The percentage of these workers who travel outside of the IA for work purposes has increased to 80% so **non-IA enterprises** can benefit from their employees ability to work remotely. This benefit amounts to €930m in real terms over the lifetime of the NBP.

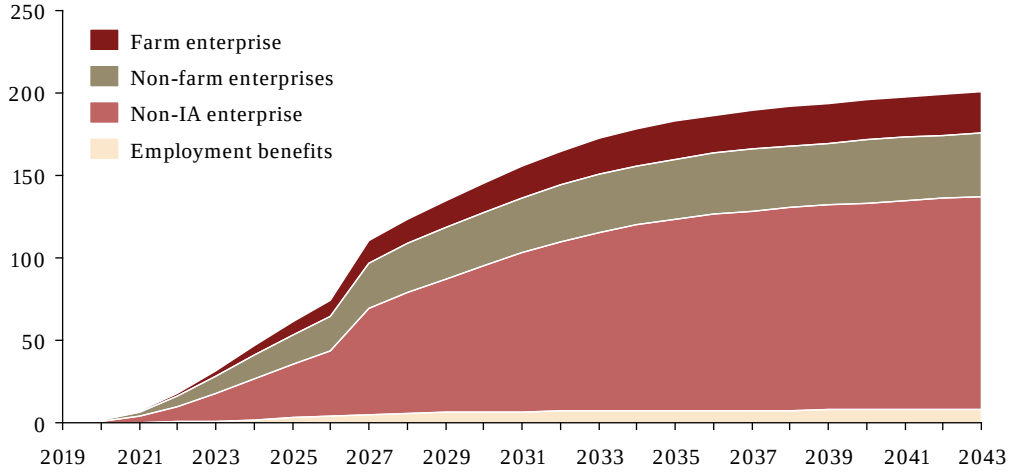
New **employment benefits** have been identified based on new job creation within existing or established businesses that will gain access to NGA broadband services. This will enable businesses to expand service offerings, enhance existing market presence and share and develop new markets access. The total NPV benefit associated with this uplift is estimated to be €63m over the 25 years.

Table 4: Estimated annual average baseline benefit to IA households

Enterprise Benefit Categories	Average GVA Improvement per enterprise[1]	% of GVA	Total NPV Benefit
Farm Enterprise	€492	1.73%	€186m
Non-farm SME	€1,170	0.88%	€332m
Non-IA White Collar Worker	€1,063[2]	0.97%	€930m
Employment Benefits	€212	-	€63m
Total			**€1.5bn***

Source: PwC Derived
[1]Non-Discounted benefits, [2]GVA improvement per worker
*May not sum accurately due to rounding

Figure 2: Assumed evolution of annual enterprise benefits, €m



Executive Summary – Qualitative Benefits

In including and profiling benefits, PwC adopted a deliberately conservative approach to ensure benefits were not overstated. As a result, there are important categories of NBP benefits which are not quantified in the CBA analysis. Table 5 provides a high level overview of these benefits and examples of how IA households and enterprises may benefit from these following the roll-out of NGA broadband services.

Table 5: Qualitative benefits sample

Qualitative Benefits	Example
Education	• Improved effectiveness of instruction and enhanced learning outcomes through engaging interactive activities • Promotion of innovation by how education is delivered • Broadens access to resources
Environment	• Mitigation of emissions via ICT use from the ability to work from home • Dematerialisation – facilitating shift towards circular economy • Contribution to Government policy agenda (e.g. National Mitigation Plan, EU 2030 & 2050, Sustainable Development Goals)
Social Inclusion & Rural Development	• Promotion of digital inclusion to enhance digital literacy and the ability to 'stay in touch'
Tourism	• Access to a wider customer base • Improved customer service with the provision of accessible WiFi
Transportation	• Enhanced transport efficiency which can reduce 'wasted' time that could otherwise be used for leisure • Increased efficiency in traffic management
Health	• eHealth enables both healthcare professionals and patients to gain access to the most appropriate care • Enables more informed decision making and enhanced quality of care • Facilitation of earlier and more accurate diagnoses
Entertainment	• Enhanced entertainment offering improves overall wellbeing and increases access to online subscription services

Executive Summary – CBA Results

In the longer-term, the NBP will be an important contributor to the overall competitiveness of Ireland as it supports improved educational outcomes, a more tech-savvy workforce, and security for the elderly.

The NBP will generate direct employment over the period of its construction and thereafter. The scale of this employment will be significant to support the five year programme of construction/service roll-out and for on-going operation. The NBP also supports a broad range of other policy priorities of the Irish Government.

As highlighted, total residential and enterprise benefits contribute to approximately €3.75bn of the total NBP benefits.

Costs to deliver FTTP to the intervention area will involve costs to the state and the operator. Costs to the operator have increased to reflect final bidder costs submitted to DCCAE. Costs to the state have also increased as the subsidy is now more front loaded and the contingency has also been updated. This results in total costs of €2.9bn.

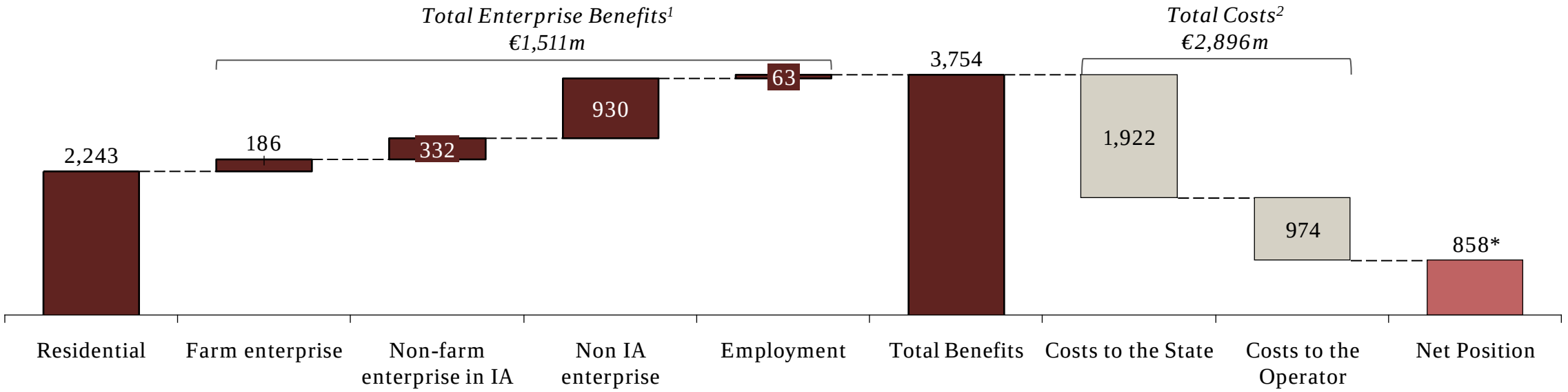
The CBA is based on 100% FTTP, as a wireless model is not possible for discrete high cost FTTP at this stage absent detailed network design at geo type level.

However the Department have advised us that they reserve the option to change the technical solution on a case by case basis during deployment where it makes technical and commercial sense to do so during the build period.

Figure 3 below outlines the total benefits and total costs, resulting in a net position of approximately €858m (NPV) in the central scenario.

In summary, the conclusion of the PwC CBA analysis is that the NBP will deliver a positive societal return, which extends significantly beyond those benefits which are capable of a credible quantification.

Figure 3: Overview of benefits and costs, 25 years (€m)



1. PwC Derived
2. Project costs provided by KPMG

Introduction

Terms of Reference

PwC was commissioned by the Department of Communications, Climate Action and Energy (formerly DCCAE) in January 2015 to prepare a cost benefit analysis (CBA) of the National Broadband Plan (NBP). We were further requested to update the CBA in May 2018.

Specifically, the PwC terms of reference required the following, among others:

- identify and quantify the benefits associated with the NBP;
- incorporate the full project costs associated with the NBP, provided by KPMG, in the updated CBA; and
- Evaluate the technical option, having regard to the scale of the associated benefit and risk.

A full copy of the PwC CBA Terms of Reference is attached as Appendix 1.

The CBA was commissioned in tandem with a number of other NBP work-streams, which provided important contextual information and inputs to the CBA. The most significant of these are as follows:

- an overarching NBP strategy work-stream (PwC-led) completed in 2015, which provided relevant context information such as the targeted NGA service levels;
- a detailed demographic and socio-economic profiling workstream (FTI-led), which provided CBA inputs from the 2016 Census mapped against IA small area codes;
- a financial appraisal work-stream (KPMG-led), which provided CBA inputs on assumed residential and enterprise take-up of NBP Next Generation Access (NGA) broadband services and the full project costs over the 25 year period;
- a technical, design and planning work-stream (Analysys Mason-led), which advised the financial appraisal and (by extension) the CBA work-stream on the technical options to be evaluated.

This CBA output is a single element of a wider business case which addresses the related issues of: i) sustainability of the private operator business model; ii) the proportionality and cost-effectiveness of the proposed technical options; and iii) the societal return from the proposed intervention.

The evaluation of societal return is the primary objective of the CBA and the focus hereafter.

National Broadband Plan Objectives

Outlined in the Government's National Broadband Plan (NBP) which was published in August 2012 and further updated in December 2015, was the aim of attaining "a minimum of 30Mbps for every remaining home and business in the country – no matter how rural or remote". This note outlines the objectives underpinning this aim.

1. Fulfilment of economic and social objectives

1.1 Economic benefits

Widespread affordable and reliable high-speed broadband coverage is expected to have a positive impact on competitiveness and to reduce industry costs across the intervention area. In so doing it will support job retention/creation, micro-enterprises, SMEs, Foreign Direct Investment in addition to the farming and tourism industries. Similarly, it will enable e-farming, e-health, trading online, e-education, tourism, savings for consumers, etc.

Significant benefits to residential households are also expected to accrue in the form of access to better services and time savings from teleworking and reduction in time needed to complete online activities.

1.2. Assist in closing the Digital Divide

Another goal of providing ubiquitous high-speed broadband is that it will assist in closing the digital divide that exists between urban and rural dwellers. The provision of high speed broadband to rural areas where connectivity is poor is needed so that segments of the population will not become marginalised and unable to participate fully in a society that is increasingly relying on digital and online services. Closing the divide will also help provide important support for rurally-based industries including micro-businesses, SMEs, farming and tourism.

2. Assist in the fulfilment of objectives of other government policies

2.1 From successive memoranda for government, Departments were afforded the opportunity to examine the proposed NBP. From this process it has been recognised that the NBP has significant potential to support a broad range of other policy priorities in areas including education, environment, social inclusion, tourism, balanced regional development, and public sector reform. In particular delivery of service in critical areas such as education and healthcare are expected to rely increasingly on digital platforms and that will demand high speed connectivity.

2.2 Furthermore the NBP is envisaged to support fulfilment of the current eGovernment and eHealth Strategy, which focuses on increasing the online delivery of public services. It also complementary to the objectives of the National Digital Strategy which are to encourage digital adoption amongst citizens, enterprises and in education practices.

3. Fulfil objective of common European interest

3.1 As a member state of the European Union, Ireland is participating in realising the ambitions of the Digital Agenda for Europe (DAE). Launched in May 2010, the DAE aims at boosting Europe's economy by delivering sustainable economic and social benefits from a digital single market. The DAE contains 13 specific goals, several of which relate to broadband speeds and coverage such as that the "entire EU to be covered by broadband over 30 Mbps by 2020" and that "50 % of the EU to subscribe to broadband above 100 Mbps by 2020". The social and economic benefits linked to these goals are described in a study commissioned by DG Connect entitled "Study on the socio-economic impact of bandwidth (SMART 2010/0033)".

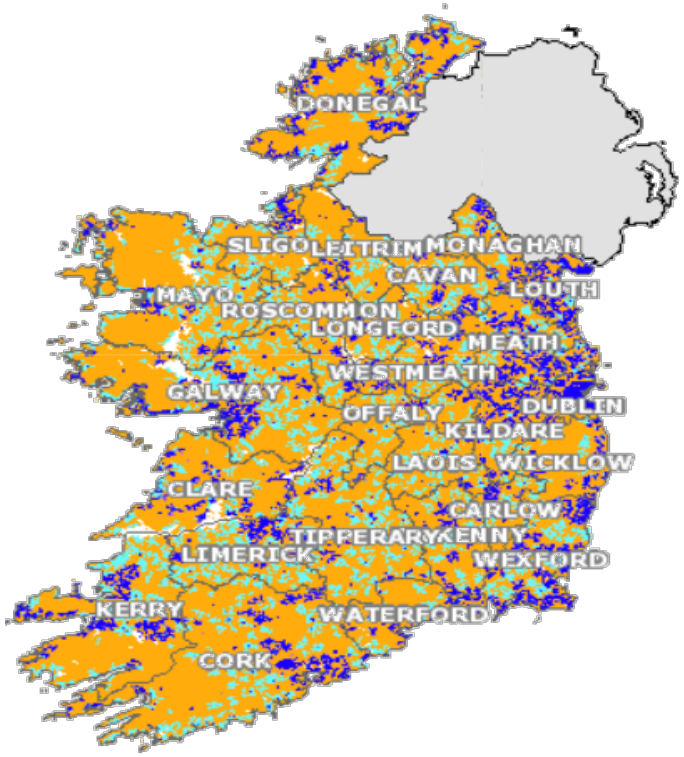
More detail on the observations from Departments is available if required.

National Broadband Plan

The NBP was published in August 2012, and provided a commitment to the provision of NGA broadband services to all Irish citizens and businesses, regardless of location. The plan was built on a commitment contained in the current programme for Government and its importance has been re-affirmed in the Statement of the Government Priorities 2014 to 2016. Irish policy objectives in this regard are reflected at European level, with the European Commission's Digital Agenda for Europe having an objective of all EU locations having minimum download speeds of at least 30 Mbps and at least 50% subscribing to services > 100 Mbps by 2020.

The share of the Irish population with access to NGA broadband has evolved since the publication of the NBP in 2012, with the commercial sector expected to provide services to 77% of Irish premises.

Figure 4: NBP Intervention Area (Amber), 2018



The estimates are based on consultations with commercial providers of Next Generation Access (NGA) broadband services undertaken by DCCAE (formerly DCCAE) over the last four years (2013 – 2017), as well as a broader public consultation on the resultant assessment of areas of the country likely to require State intervention if NGA broadband services are to be available. These areas, hereafter referred to collectively as the "intervention area" (IA), are the primary focus of the report which follows. They are shown in Figure 4. The map is updated each quarter to reflect the agreement with Eir, to deliver high speed broadband to 300,000 premises in rural Ireland.

FTI analysis researched the approximate number of persons per household to determine the population per small area code. The number of persons per household is determined to be ~2.9 resulting in a total population in the IA of just over 1.1m, which represents 23% of the Irish population.

Key points of note are the following:

- the share of the national land mass accounted for by the IA, is disproportionately large relative to its share of the national population (23%);
- the very rural nature of many households across this intervention area, with only 17% of premises located within 1 kilometre of a village centre.

This is the intervention area as defined for the purposes of the analysis which follows.

Source: DCCAE

PwC Research Approach

The PwC approach to the preparation of the CBA built sequentially on:

- assumptions on the timing of availability and extent of residential and enterprise take-up of NBP NGA broadband, taken from the financial appraisal work-stream;
- related assumptions on the annual capital and operational cost of the NBP split across the Exchequer and the wholesale operator of the NBP infrastructure as provided by KPMG;
- a detailed demographic and socio-economic profiling of the NBP intervention area, relying on FTI analysis;
- a detailed review of relevant national and international literature, focusing primarily on research which quantified the residential and enterprise benefits of NGA broadband;
- a series of consultations with relevant experts, including policymakers, enterprise development agencies, private enterprise and their representative bodies, and private individuals.

In broad terms, and largely reflecting a degree of uncertainty on the likely pace and direction of our rapidly evolving "connected" society, PwC adopted a conservative approach to the inclusion as well as to the quantification of benefits. This is reflected in the non-quantification of a series of benefits which are widely attributed to NGA broadband services and/or are included in comparator CBAs. These qualitative benefits are outlined in further detail in a separate benefits report.

In quantifying benefits, for the computation of "baseline" estimates of benefits, PwC assumed a movement from an entry-level quality of broadband provision (e.g. < 5 Mbps download speed) to NGA services. A deflator was applied for the share of the population in the intervention area with basic broadband service exceeding the defined minimum standard required for benefit attainment by year.

No upward adjustment on the baseline benefit was made for download speeds greater than 30 Mbps.

Also conservatively, no accommodation is made in the model for the fact that NGA broadband services enable multiple individuals in a residential household or enterprise to access online services simultaneously. This is an important restriction of all basic broadband services in the NBP IA at present.

Finally, economic benefits which derive from the construction and operation of the NBP NGA wholesale infrastructure are not included in the CBA analysis. This reflects a belief that a high share of this spend would also be incurred under the counterfactual scenario (i.e. low additionality), as it is funded through the Exchequer and consumer charges. This is a considered a conservative, if prudent, approach vis-à-vis other CBAs reviewed.

Additional detail is contained in the supplementary Excel-based CBA model.

CBA Model Parameters

Table 6: CBA Model Parameters

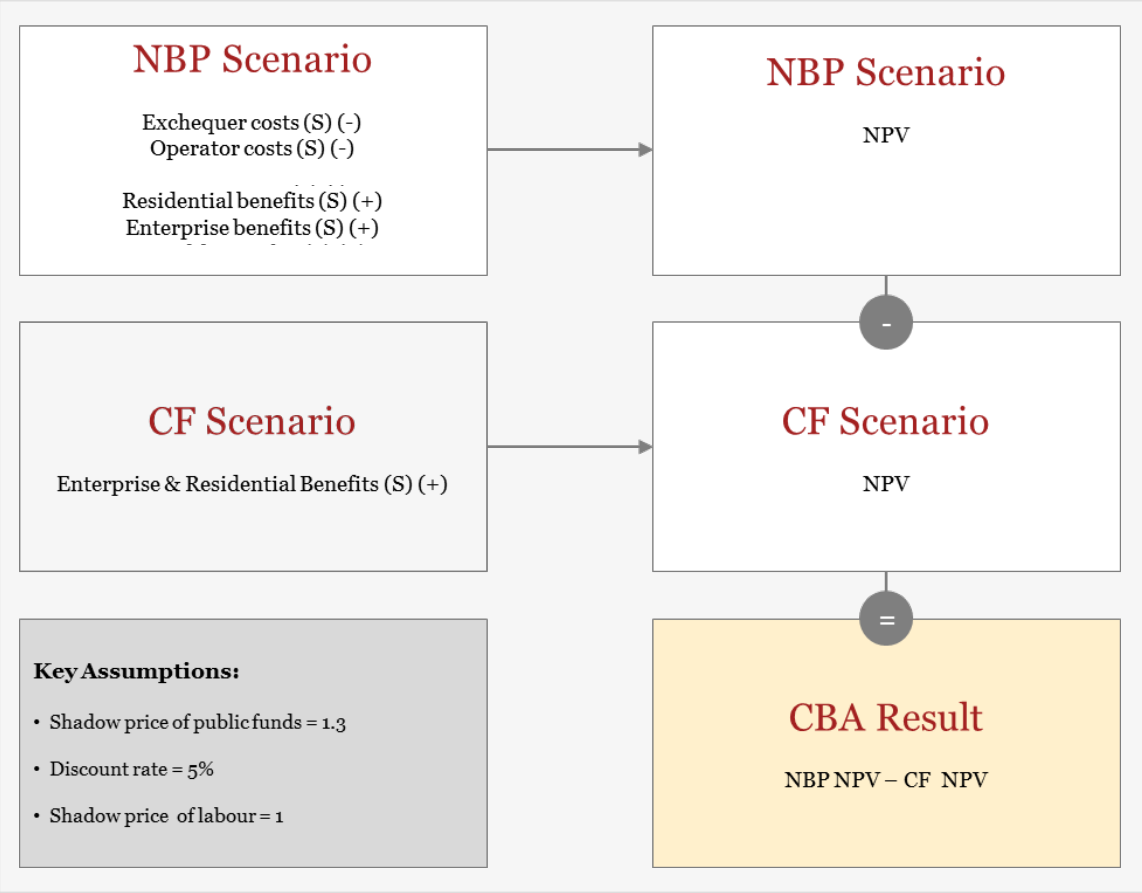
Parameter	Treatment
Calendar Periods Used	Annual
Start Date	2019
Model Duration (Years)	25
Model End	2043
Discount Rate	5%
Baseline Year for Discounting	2019
Shadow Price of Public Funds	1.3
Shadow Price of Labour	1.0
Inflation	2%
Stakeholder Treatment	Non-Distributional
Benefits	NGA Incremental Only
Costs	Wholesale costs
Counterfactual	Depression of NGA Benefits

- Baseline benefits are computed on the basis of an assumed uplift in service speed from 5 Mbps to 30 Mbps. A deflation factor is applied to all benefits for all basic broadband speeds above the level deemed sufficient to realise the benefit. No inflation factor is applied for speeds > 30 Mbps.
- The counterfactual scenario comprises of a single variable only, i.e. the extent to which affordable NGA services would have been available in the absence of the NBP. This reflects a position that the NBP will not drive demand for "any broadband" service to levels above those that would have otherwise pertained, i.e. there is no category of user moving from a "no broadband" to "high-speed broadband" fully as a result of the NBP.
- Related to the foregoing, retail costs are not considered in this model. Rather, the focus is on the capital and operations expenditures required to deliver the wholesale infrastructures needed to enable the retail provision of NGA services. This is considered appropriate as retail costs (e.g. marketing and administration) are also incurred for the basic broadband service and are not NGA incremental. Only the incremental benefits associated with NGA are considered.
- No regard is had in the model to the opportunity costs associated with redundant counterfactual infrastructures for the delivery of basic broadband services, reflecting the fact that licensed FWA operators have renewed licences. DSL operators use existing telecoms infrastructures for the provision of fixed broadband services.
- Finally, no regard is had to producer surpluses in the model, reflecting: i) the use of the gross wholesaler operator cost in the model, i.e. before any regard is had to revenues; ii) the distributed only nature of payments between service users and the wholesale operator, and iii) the assumption that there are no prematurely obsolete producer infrastructures as a result of the NBP.
- A discount rate of 5% has been applied for the CBA analysis to be compliant with appraisal parameters. DPER have indicated that the discount rate will likely be reduced to 4%[1] once signed off which would have a positive impact of approx. €350m on the net present value of the NBP CBA.

1. Central Technical Appraisal Parameters, Staff Paper 2018

CBA Model Structure

Figure 5: Map of CBA Model Structure



- A KPMG-led team provided CBA inputs on assumed residential and enterprise take-up of Next Generation Access (NGA) broadband services of the National Broadband Plan (NBP).
- Total project costs (Costs to the state and costs to the operator) were also provided by KPMG as inputs to the CBA model
- FTI provided a detailed demographic and socio-economic profiling of the NBP intervention area which provided CBA inputs from the 2016 Census mapped against IA small area codes.
- The benefits were derived by a PwC-led team and comprise of residential and enterprise benefits. These benefits used data provided by FTI, CSO and various derivations in order to calculate benefits per household, uplift in GVA per enterprise and increase in new employment.
- The counterfactual (CF) scenarios provide inputs to the CBA to support the calculation of enterprise and residential benefits. The counterfactual scenarios have been updated in early 2018 to reflect changing technological trends since the initial CBA analysis carried out in 2015.
- Key assumptions in the calculation of all benefits and costs are the shadow price of public funds (1.3), the discount rate (5%) and shadow price of labour (1).
- The CBA was calculated to represent a period of 25 years starting from 2019 and ending in 2043.

CBA Model Scenario Analysis

Table 7: Scenario analysis, %

Scenarios	Take Up	Unit Benefits	CF NGA
Pessimistic Scenario (Central Benefits, Pessimistic Costs)	100%	100%	12%
Central Scenario	100%	100%	12%
Optimistic Scenario	110%	120%	0%

The range of potential outcomes was modelled by running sensitivities on those factors which are least certain and/or most determinant of CBA result. These are service take-up, the size of baseline benefits and the extent to which there would have been an affordable commercial provision of NGA services in the absence of the NBP. Details of the sensitivities applied are shown above.

Three metrics are applied to report the CBA result as follows:

- Real NPV result, i.e. the quantum of discounted benefits minus costs over the model duration;
- Benefit cost ratio, i.e. the ratio of benefits to costs, expressed in real NPV terms;
- Real IRR, i.e. the compound interest rate realised on the investment, expressed in 2018 prices.

Other specific scenario analyses are estimated further in the report.

Counterfactual Approach

The CBA methodology used recognises that there are benefits that would arise in the IA even if the NBP was not rolled out (i.e. broadband from other technologies). These benefits (counterfactual) have been quantified and subtracted from the total benefits arising from the full roll-out of the National Broadband Plan within the Intervention Area.

1 Establish baseline (coverage and speed in 2015) for each technology

Approach

- Leverage available information to construct current availability of broadband coverage and broadband speeds in IA (per technology)

Result

- Per technology: Overview of the existing speeds and coverage in 2018
- Technologies are:
  - DSL/Fibre
  - FWA
  - Mobile
- Speed categories are:
  - Entry (<5 Mbps)
  - Low (<10 Mbps)
  - Medium (<20 Mbps)
  - High (<30 Mbps)
  - NGA (>30 Mbps)

2 Formulate three scenarios for each technology

Approach

- Construct 3 scenarios for each technology
- All 3 scenarios based on assumptions on 5 factors: willingness to pay, technology driven efficiency, innovation, spectrum availability and regulation

Result

- Description of how the 5 factors evolve in the three scenarios:
  - **Conservative**: defined by low impact to the market, as-is situation
  - **Central**: defined by medium impact to the market and foreseeable gradual improvements
  - **Progressive**: defined by high impact, significant changes and new developments taking place

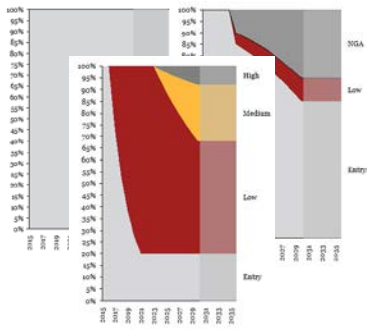
3 Assess how coverage and speed evolve in each scenario for each technology

Approach

- Assess how coverage and speeds of technologies evolve in the three scenarios by identifying impact of key drivers
- Qualitative description with quantification where possible

Result

- Per technology: speed and coverage evolution over time under three scenarios



Assessment per technology

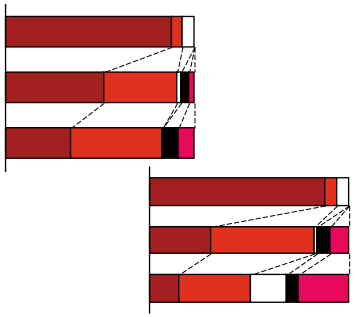
4 Establish availability per speed for all technologies together

Approach

- Assess to what extent the coverage of different technologies overlaps and to what extent technologies compete
- Formulate an aggregate evolution of availability in the IA by speed category

Result

- Distribution of premises by a maximum available speed available to them



Assessment at market level

Benefits

CBA Model Benefits

The original NBP CBA (May 2015) identified both residential and enterprise benefits arising from the roll-out of NGA broadband services in the Intervention Area. These benefit categories reflect updated demographic, macro and technological changes experienced in Ireland in recent years. An additional benefit category has also been identified in relation to job creation for small and micro enterprises in the IA arising from access to broadband services for people living and working in the IA.

Table 8: Overview of benefit categories and key drivers for CBA model

Residential Benefits	Enterprise Benefits
Remote Working	**Non-IA enterprises**
Service Waiting	**Non-farm Enterprises in the IA**
Bundled Communications	**Farm Enterprises in the IA**
Transaction Savings	**Employment in the IA**
Key Drivers	*Key Drivers*
This section presents an overview of the benefits which will accrue to private residential households as a result of the NBP. This is determined in most part by the quality of basic broadband services available in the IA, the assumed take-up of NBP NGA services among residential households and the nature of their engagement with online services.	*This section describes the benefits which will accrue to enterprises as a direct result of the NBP NGA. The focus is on accrued benefits to enterprises situated outside of the IA, non-farm enterprises within the IA and farm enterprises within the IA measured by the increased productivity due to NBP NGA. An additional benefit has been identified based on job creation for existing small and micro businesses in the IA.*

Residential Benefits Profile

In spite of the rural nature of the intervention area, the socio-economic profile is broadly in line with that for the rest of the country. The population is marginally older with a lower incidence of white collar workers in the working population. Average household size is larger in the IA, likely reflecting a higher incidence of single occupant households in the larger urban centres. Average weekly household spend is similar in the intervention area to urban areas and has seen a year on year increase over the last number of years which is reflective of the improving national economic conditions.

Total population in the IA is just over 1.1m reflecting 2.9 persons per household in the intervention area and a total number of residential households of 387,033. Detailed analysis, carried out by FTI, of the number of households per small area code enabled a more up to date estimate of the total population in the IA.

Table 9: Profile of IA Population

Feature	Intervention Area	Rest of Country	National
No. of Households	387,033	1,315,256	1,702,289
Residential Population	1,108,897	3,652,968	4,761,865
Average Household Size	2.9	2.7	2.8
No. of Adults	805,312	2,766,051	3,571,363
% Population >70 years	10.4%	8.5%	9%
% Population at Work	41%	42%	42%
% Working Population in White Collar Jobs	32%	38%	36%
Average Weekly Household Spend (rural v. non-rural)	€847	-	€845

Source: Census 2016, FTI, CSO

Residential Benefit Categories

This section presents an overview of the benefits which will accrue to private residential households as a result of successful delivery of the NBP. These benefits are determined in most part by the quality of basic broadband services available in the IA, the assumed take-up of NBP NGA services among residential households and the nature of their engagement with online services.

Residential benefits have been quantified across four categories: remote working, service waiting, bundle communications savings, and transaction savings. See high level detail below of these categories as well as the key drivers of the quantifiable benefits.

Table 10: Overview of residential benefit categories and key drivers for CBA model

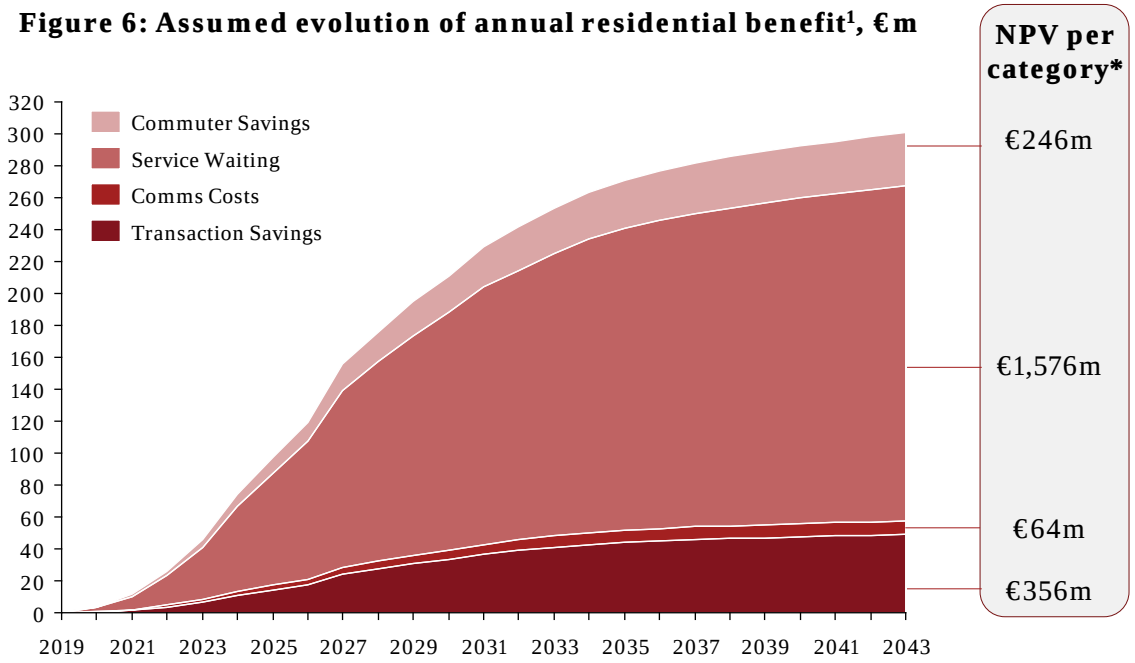
Remote Working	Service Waiting	Bundled Communications	Transaction Savings
This benefit represents the time and cost savings associated with white collar workers living in the intervention area being able to work remotely to a greater extent than heretofore.	This benefit measures the time savings associated with a reduction in the average time required for productive or value-adding (e.g. motor tax payment) online activity to be completed.	This benefit measures ability of IA households to realise the significant savings now available to households with access to fibre networks by purchasing communication "bundles", specifically fixed landline, television, mobile phone and broadband services.	This benefit represents the time and cost savings which derive from online shopping, specifically higher-involvement goods and services which require faster download speeds for a quality experience.
Key Drivers	*Key Drivers*	*Key Drivers*	*Key Drivers*
The number of white collar workers in the IA, the average fuel cost and the average value of hours saved (assumed to be leisure time) are the main drivers of this benefit and result in the average annual value to an IA household with NBP NGA.	*The key driver of this benefit is the average adult time on the internet per week which has been increasing year-on-year, coupled with the increased number of adults residing in the intervention area.*	*The key driver behind this benefit is the gap between a TV/internet bundle in Dublin compared to outside of Dublin which equates to the consumer value of a bundle.*	*Average weekly household spend in both urban and rural areas are key drivers of this benefit.*

Residential Benefits Summary

Figure 6 outlines the evolution of annual residential benefits from having access to NBP NGA over a 25 year period. The benefit relating to service waiting has the greatest impact on average household benefits. This can be largely attributed to increased average time spent online by adults in the intervention area, as well as the increase in number of adults living in the intervention area.

The CBA forecasts will cap at circa 80% by the end of the contract period. This will result in a gradual ramp up in benefits realised over the first 10 years followed by a minor increase per annum to account for new household builds in the IA. The total NPV of residential benefits amounts to over €2.24bn over the twenty five year timeframe of the NBP.

Figure 6: Assumed evolution of annual residential benefit[1], €m



Source: PwC derived
1. Non-discounted annual benefits
*May not sum exactly due to rounding

For counterfactual modelling purposes, analysis has factored in the share of IA households which would still have had NGA services in the absence of the NBP roll-out. The assumption is that there are likely to be 10% of IA premises (close to urban areas) that would be able to avail of NGA services in the absence of NBP.

Table 11 below outlines the average benefit per household based on having access to NBP NGA with reduced service waiting time being the main benefit for residential households having access to NGA services. Supplementary detail on benefit computation is provided in Benefit Annex 3.

Table 11: Average benefit per household

Residential Benefit Categories	Average Household
Bundled Communications	€31
Reduced Service Waiting	€511
Remote Working	€81
Transaction Savings	€117
Total benefit per household	**€740**

Source: PwC derived

Enterprise Benefits Profile

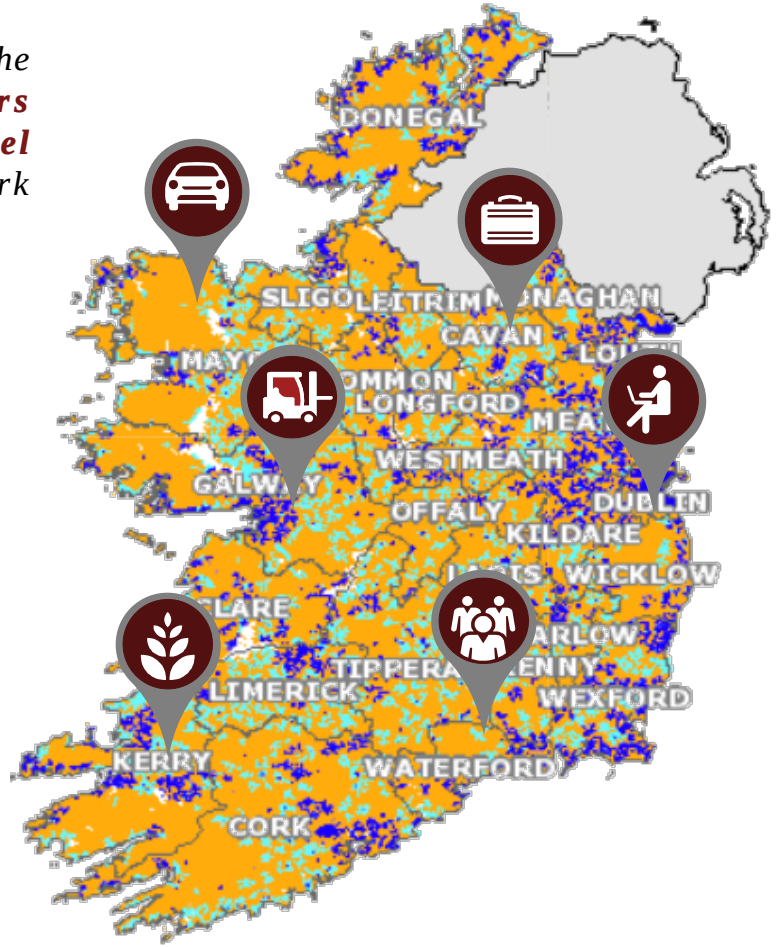
The focus of this section is on enterprise benefits arising from (i) farm enterprises, (ii) SME enterprises within the IA, (iii) white collar workers commuting to employment outside of the IA and (iv) job creation for existing enterprises in the IA.
Large to medium-sized companies in the IA are excluded on the basis that they are relatively few in number and it was not possible to determine the extent to which they have existing arrangements in place for the supply of NGA broadband, e.g. leased lines. In this event, their benefits would be limited to lower costs for broadband supply than is presently the case.
The SME sector in the IA is dominated by home-based and micro-enterprises and average employment is estimated to be at less than 3 FTE per enterprise.

Figure 7: Intervention Area Map

The majority (80%) of the ***white collar workers*** *who live in the IA* ***travel outside of the IA*** *to work*

More than half of all enterprises are accounted for by ***farms (56,000)***

68% of farms *are situated in the Intervention Area*



Non-farm enterprises are dominated by ***SMEs***

There are nearly ***100,000 businesses*** *in the Intervention Area*

White collar worker *prevalence is only marginally below the national average*

Map source: DCCAE

Enterprise Benefits Profile

The table below shows the breakdown of population and enterprises in the Intervention Area following detailed analysis by FTI Consulting

Table 12: Profile of IA Population

Feature	Intervention Area	National	% of National
Total Population	1,108,897	4,761,865	23%
No. of Adults	805,312	3,571,363	23%
Population at Work	458,054	2,006,641	23%
Population at Work (Agricultural sector)	56,065	89,116	63%
Population at Work (White Collar Workers)	146,739	716,316	20%
% of Working Population in White Collar Jobs	32%	38%	-
Number of Non-Farm enterprises (including 'own-account workers')	44,185	[data not available]	-
Number of Farm Enterprises	55,804	82,508	68%

Source: Census 2016, FTI, PwC Derived

Enterprise Benefit Categories

Table 13: Overview of enterprise benefit categories and key drivers for CBA model

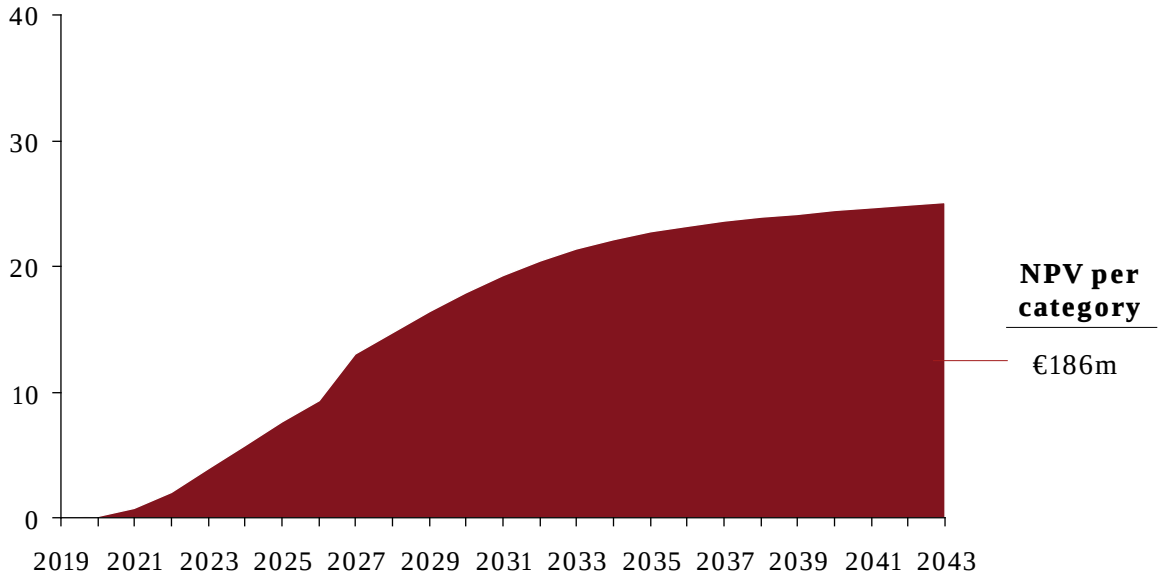
Farm enterprise in the IA	Non-farm enterprise in the IA	Non-IA enterprise	Employment in IA
This benefit measures the productivity gains of the IA farming sector, deriving in greatest part from yield improvements realised as a result of precision or "smart" farming and remote livestock monitoring.	This benefit measures the productivity gains of the SME sector, largely as a result of the NGA access of white collar business owners in their homes, an improved process efficiency in the case of stand-alone businesses and a first time engagement with digital strategy for home-based businesses.	This benefit measures the productivity gains that accrue to enterprises outside of the IA as a result of the NGA broadband access of their white collar employees living in the IA.	Employment benefit emerges from the economic benefit (i.e. GVA uplift) associated with the new jobs created within existing/established businesses as a result of the NBP. Broadband connection enables businesses to expand their workload and service offering, enhance existing market presence (and market share), and develop new markets access. Such enhanced business activity creates a demand for new employees.
Key Drivers	*Key Drivers*	*Key Drivers*	*Key Drivers*
Overall GVA for farms is a key driver of this benefit however, the measure of productivity improvement (uplift in GVA) for the value of farm output driven by NGA in the IA has marginally decreased by less than one percentage point.	*The increase in GVA for business owners has been the key driver of the increased benefits for non-farm enterprises in the intervention area, as well as the increase in own-account workers who live in the IA.*	*The increases in both the number of white collar workers and uplift in white collar GVA account for the majority (c. 85%) of the increased non-IA enterprise benefits. Additionally, the percentage of "white collar workers" who live in the IA but work outside of the IA has increased. These workers could significantly benefit from remote working.*	*A key driver of this benefit is the number of SME businesses (excluding own-account workers) within the intervention area.*

Farm Enterprise Benefits

The roll-out of NGA services in the IA is estimated to deliver farm enterprise benefits of €186m (real NPV) over a 25 year period. The main driver of this benefit is the impact of productivity through the adoption of SMART / Precision farming techniques by a small number of more progressive farmers. Given this farming technique is relatively transformative in nature, the CBA assumes that none of the small share of farmers who adopt this farming method will realise the full value of the benefits until five years after first-time availability of NGA services.

The number of farms in the intervention area is 55,804 which accounts for 68% of farms nationally. Accessibility of farms to basic broadband services is assumed to be as per the residential population in aggregate, although this may be challenging in the case of some very remote farms.

Figure 8: Assumed evolution of annual Farm benefits[1] over time, €m



Source: PwC derived
1. Non-discounted annual benefits

Table 14 below outlines the impact on average GVA per farm based on a number of factors in relation to precision farming techniques. The table outlines the fact that a large share of the estimated return is the assumption that only a small number of farmers will make use of the techniques involved in SMART or Precision farming. Other factors that drive the benefit include time savings due to remote monitoring and self-service administrative savings from Single Farm Applications (SFPs), which as of 2018, can no longer be filled out via hard copy, and instead must be submitted online.

The total NBP impact per farm is estimated to be €492 which is reflective of minor updates in the various factors such as productivity gains and time savings driving the precision farming benefits.

The benefits result in a NBP impact as a % of average GVA of 1.73% per farm enterprise.

Table 14: Assumptions on average baseline Farm benefits

Farm Enterprise	Key Assumptions
Productivity gain from SMART/Precision farming	€482
Reduced Animal Mortality	30%
Time Savings	€50
Investment in Sensor Technology	(€143)
Total NBP Impact per Farm	€492
Displacement factor	16.3%
NBP Impact as a % of Average GVA	1.73%

Source: PwC derived

Non-Farm Enterprise Benefits

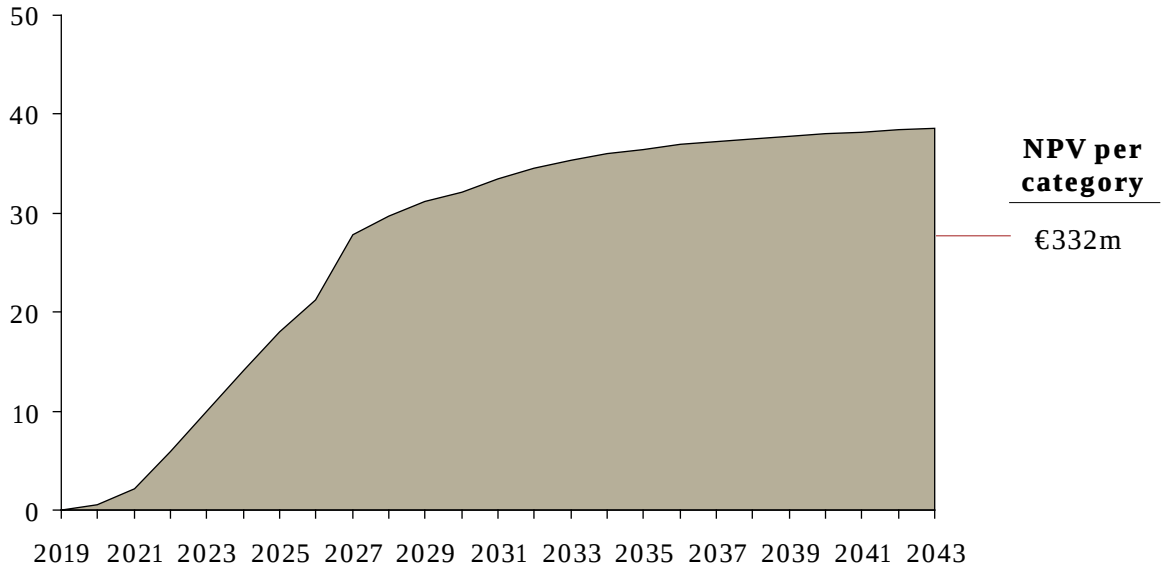
Non-farm enterprise benefits cumulate to a total of €332m (real NPV) over a 25 year period. This benefit focuses on a mix between micro and SMEs rather than medium- to large-sized enterprises given that the vast number of non-farm enterprises in the intervention area are SMEs (~98%). Micro businesses generally comprise of “own account workers” or sole trader-type businesses.

SMEs comprising of under 50 employees can benefit from managers who have the ability to work remotely. Adjustments are made in the CBA model to this baseline benefit to reflect the share of the IA population with basic broadband levels sufficiently high to enable remote working, as well as an assumed growth in the incidence of remote working over time.

Table 15 below outlines the impact on average GVA per non-farm enterprise based on a number of factors which show the impact on productivity at enterprise level. If an enterprise in the intervention area has access to NBP NGA, the business processes can be improved and thus represent a cost saving. In addition to this, professional managers would have the flexibility of "always being connected" and thus experience productivity gains, while own account workers can realise the benefit of digital enablement to help to grow revenue via new channels.

GVA per business owner and white collar workers has increased significantly due to the uplift in the Irish economy over the last five years. The overall NBP impact as a % of average GVA is 0.88% for non-farm enterprises in the IA.

Figure 9: Annual Non-farm Benefits[1] over time, €m



Source: PwC derived
1. Non-discounted annual benefits

Table 15: Assumptions on average baseline Non-farm Enterprise benefits

Non-Farm Enterprise (SME)	Key Assumptions
Improved Business Productivity (Stand-alone Business)	€524
Improved Business Process Efficiency (Stand-alone Business)	€618
First-time Engagement with Digital (Home-based Business)	€258
Total NBP Impact per Non-Farm Enterprise	€1,401
Displacement factor	16.3%
NBP Impact as a % of Average GVA	0.88%

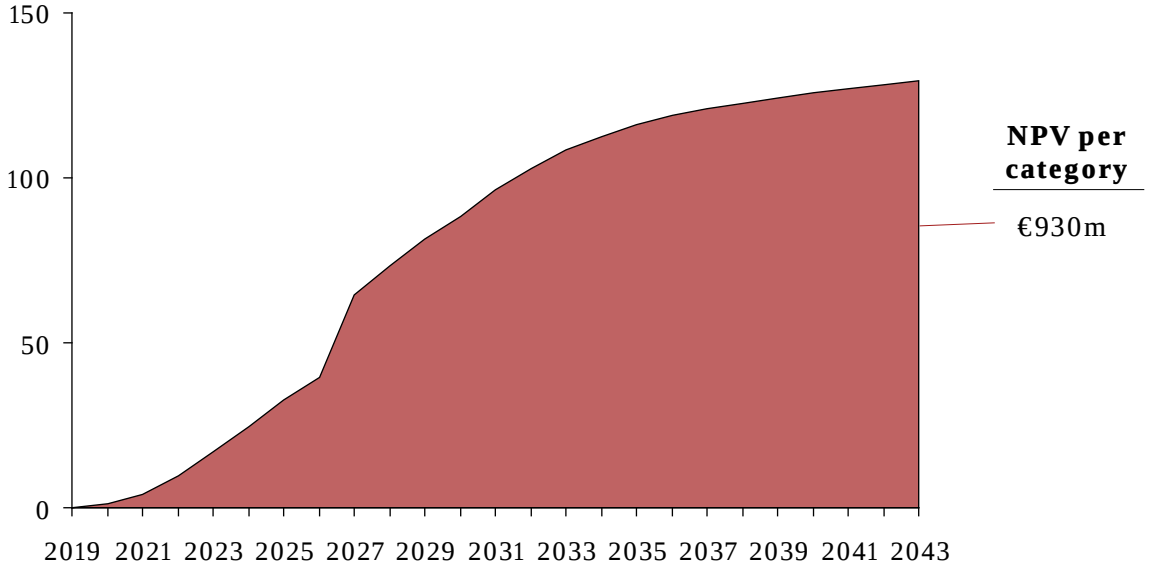
Source: PwC derived

Non-IA Enterprise Benefits

Non-IA enterprises benefit the most from access to NBP NGA broadband with a total of €930m (real NPV) benefits over a 25 year period. This benefit derives from the fact that the productivity of employees living within the intervention areas but working outside the IA is estimated to grow as a result of their having access to high-speed broadband services in their homes.

Given that 80% of white collar workers commute from the IA to areas outside of the IA, productivity improvements can be enhanced by a number of capabilities such as the ability to work remotely and the 'always-on' capability for those who work in the evening. Adjustments are made in the main CBA model to this baseline benefit to reflect the share of the IA population with basic broadband levels sufficiently high to enable remote working, as well as an assumed growth in the incidence of remote working over time.

Figure 10: Assumed evolution of annual non-IA Enterprise Benefits[1] over time, €m



Source: PwC derived
1. Non-discounted annual benefits

Table 16 below outlines the impact on average GVA per non-IA enterprise given the ability of white collar workers who live in IA to work remotely.

Enhanced productivity based on the ability to work remotely has the largest share of impact on average GVA. The flexibility provided by the option of working remotely also helps to reduce the instance of absenteeism, which can be enhanced by the 'always-on' capability provided by NGA broadband. The GVA per white collar work has increased significantly to nearly €110,000, which is reflective of the upturn in the Irish economy over the last five years. This, coupled with the increase in the number of white collar workers living in the IA, has resulted in non-IA enterprise benefits totalling €930m.

Table 16: Assumptions on average baseline Non-IA Enterprise benefits

Non-IA White Collar Worker	Key Assumptions
Enhanced Productivity (tele- and out-of-hours working)	€921
Reduced Absenteeism	€143
Total NBP Impact per White Collar Worker	€1,063
Average GVA per White Collar Worker	€109,624
NBP Impact as a % of Average GVA	0.97%

Source: PwC derived

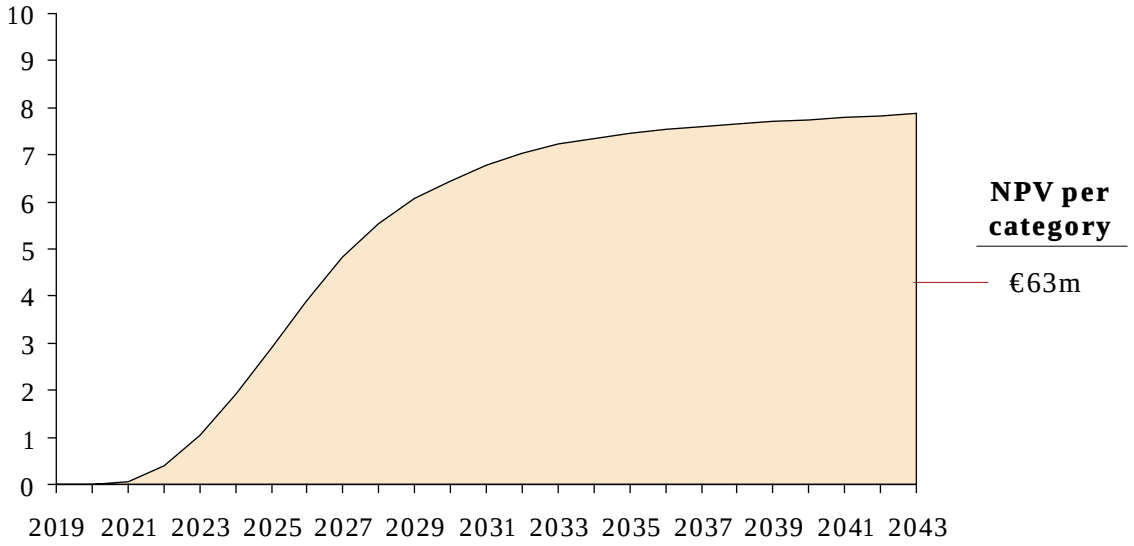
Employment Benefits

It has been noted that the provision of NGA broadband services in the IA is likely to lead to additional job creation for existing rural enterprises. Broadband connection enables businesses to expand their service offering, enhance existing market presence, and create access to new markets.

More recently, a small sample of international comparisons (Northern Ireland and Cornwall in the UK) have quantified benefits regarding additional job creation arising from rural enterprises having access to NGA broadband services. The methodology has been reviewed and considered suitable to quantify and include in this CBA analysis.

The benefits from additional job creation would result in total benefits of €63m (real NPV) over the 25 year period.

Figure 11: Annual Employment Benefits[1] over time, €m



Source: PwC derived
1. Non-discounted annual benefits

There are more than 44,000 small and micro enterprises in the IA, however, more than half (~23,250) are 'own-account worker' employees who do not employ staff and so they have been not been considered as likely contributors to additional job creation. Medium and large enterprises have also been removed as it is assumed they already have some method of accessing broadband services. The remaining 21,000 small and micro businesses are considered likely to benefit from access to NGA broadband services resulting in the need to hire additional staff.

The GVA uplift takes into consideration likely counterfactual job creation as well as employment displacement in non-IA areas due to people taking up roles in the IA rather than commuting outside of the IA. It is assumed that job creation will be realised no sooner than two years after enterprises gain access to NGA broadband services. Access to these services is estimated to result in a GVA uplift per small and micro enterprise of €212 per annum.

Table 17: Assumptions on average baseline employment benefits

Potential Employment	Key Assumptions
No. of small & micro businesses in the IA	43,458
No. of small & micro businesses in the IA excl. 'own workers'	~21,000
Attributable FTE jobs created per business	0.18
GVA per employee of micro businesses	€23,606
Counterfactual job creation	0.464
Displaced employment	80%
GVA uplift per small & micro enterprise	€212

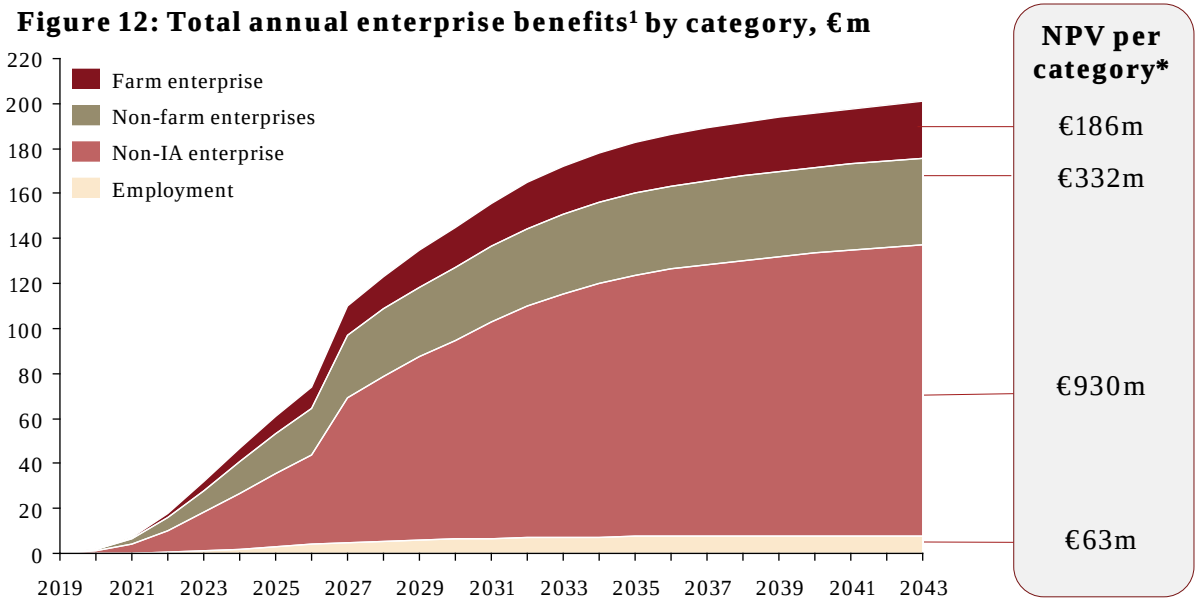
Source: PwC derived

Overall Enterprise Benefits

Figure 12 outlines the evolution of annual enterprise benefits from enterprises or their employees having access to NBP NGA. The greatest benefit is to non-IA enterprises, whose workers live within the intervention area. This benefit relates to the productivity that accrues as a result of the ability for employees who live in the IA to work remotely and is predominantly driven by increased GVA and by the increase in the number of white collar workers who live in the intervention area.

The NBP will deliver €1.5bn (real NPV) in gross benefit to enterprise over a 25 year period. The largest, most significant category of enterprise beneficiary are enterprises located outside of the intervention area with white collar employees commuting from the intervention area (€930m real NPV). The significance of this benefit corresponds with the view of enterprise policymakers (e.g. DJEI) who hold the view that the ability of MNC employees to work remotely, including teleconferencing "out-of-hours", is an increasingly important constituent of Ireland FDI competitiveness.

Figure 12: Total annual enterprise benefits[1] by category, €m



Source: PwC derived

1. Non-discounted annual benefits

Farm benefits are estimated at circa €186m (real NPV), with benefits heavily influenced by an assumption that only a small share of farmers will engage comprehensively with SMART or precision farming methods and that the transformation will require at least five years to materialise.

Non-farm enterprise benefits over the lifetime of the NBP amount to €332m driven by productivity gains for micro and SME enterprises in the IA.

Benefits arising from additional job creation for established small and micro enterprises in the IA is a new benefit category included within the enterprise benefits. It is estimated that this will give rise to €63m in benefits.

In total, the roll-out of NGA broadband services is estimated to deliver €1.5bn in enterprise benefits (real NPV).

Table 18: Estimated average baseline GVA benefit by category

Enterprise Benefit Categories	Average GVA Improvement	% of GVA
Farm Enterprise	€492	1.73%
Non-farm SME	€1,401	0.88%
Non-IA White Collar Worker	€1,063	0.97%
Employment Benefits (Annual Net)	€212	0.90%

Source: PwC derived

Costs

CBA Costs

Nominal costs of the NBP roll out have been updated for the current iteration following final bidder submission. The total real (present value) costs of the plan amount to €2.9bn over the 25 year timeframe.

Table 19: Overview of CBA costs

Central Scenario, (€m)	Mar 2019 25 Years
Nominal Cost	
Costs to the State	(€2,143)
Costs to the Operator	(€2,451)
Total	**(€4,595)**
Real/Discounted Cost	
Costs to the State	(€1,922)
Costs to the Operator	(€974)
Total	**(€2,896)**

The NBP costs are based on 100% Fibre-to-the-Premises (FTTP) roll-out for modelling purposes. While this is the most expensive broadband delivery option, it is considered to deliver the highest quality NGA broadband services. It is the Government's intention to seek alternative to FTTP, if appropriate, in the very remote or difficult to reach parts of the IA.

Under the Public Spending Code, nominal costs to the state are adjusted upwards by a factor of 1.3 to reflect the opportunity cost of public funds before the discount rate of 5% is applied. This results in the real costs to the state being higher than the costs to the operator despite nominal costs being less to the state than to the operator.

Key points to note in terms of treatment of costs:

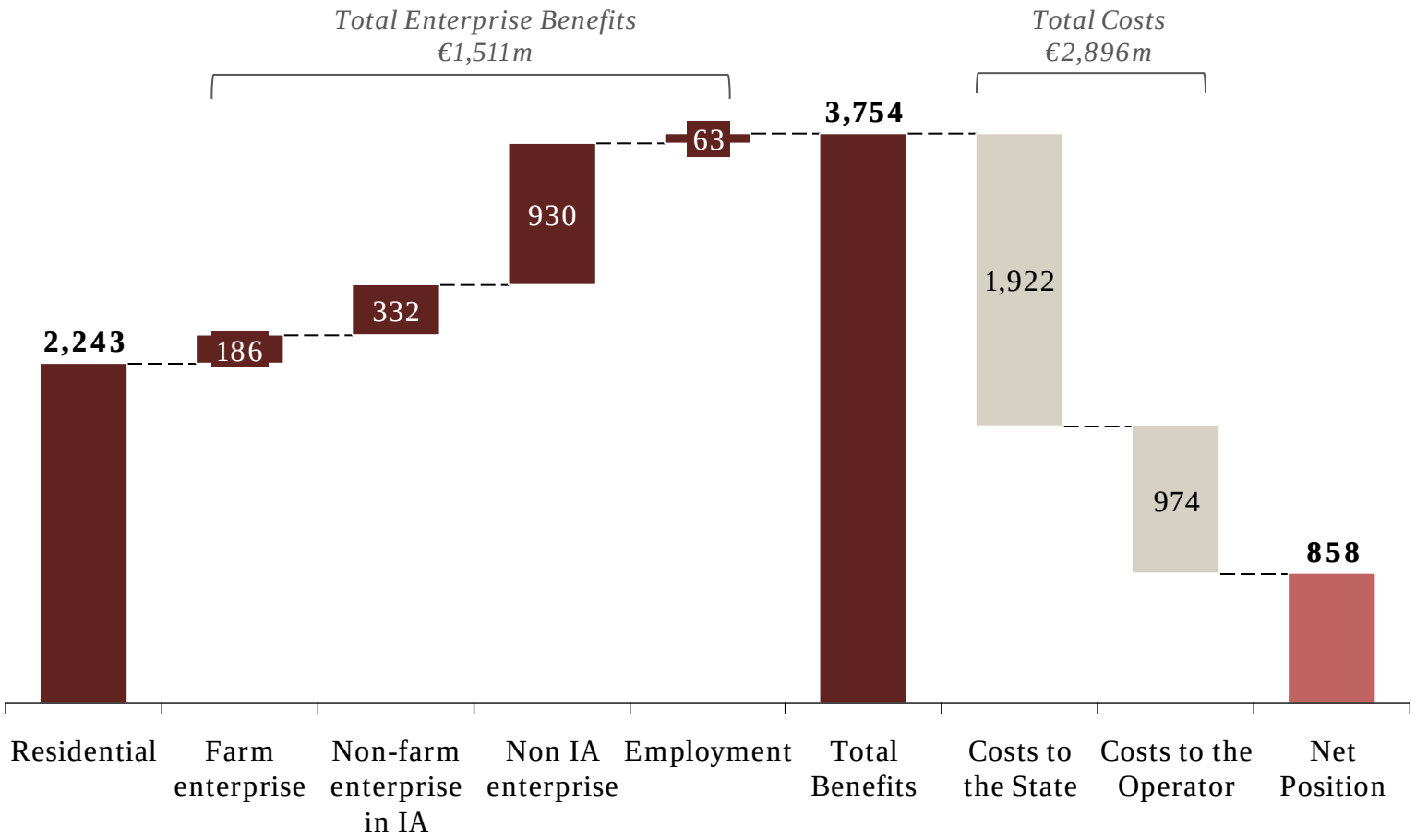
- *Data source: cost sourced from the financial appraisal work-stream undertaken by KPMG in collaboration with technical advisors, Analysys Mason*
- *Costs to the state: adjusted upwards by a factor of 1.3 to reflect the opportunity cost of public funds*
- *Opportunity cost of labour: no adjustment is made to the market costs of labour*
- *Baseline discount year: updated to 2019 from 2017 to reflect updated start period for roll-out of NBP*

CBA Results & Sensitivity Analysis

CBA Result Overview

Total NBP (real) benefits amount to c. €3.8bn while costs total €2.9bn resulting in a net benefit in real terms of just over €858m over the 25 year timeframe.

Figure 13: Overview of benefits and costs (central scenario), 25 years (€m)



*Figures may not sum exactly due to rounding

The central case of the CBA delivers an NPV of approximately €858m over a 25 year timeframe.

The increase in benefits is driven by an increase in existing residential and enterprise benefits as well as the inclusion of new employment benefits of €63m within the enterprise benefits.

Some of the key drivers of the increase in overall benefits include:

- updated estimate of the IA population, in particular, the number of adults and number of white collar workers in the IA;
- GVA uplift due to the improving Irish economy;
- an increase in the average amount of time spent by adults on the internet.

Total costs amount to €2.9bn in real terms incorporating the sole bidder's final costs.

The NPV of just over €858bn in the central scenario results in a Benefit Cost Ratio of 1.30.

CBA Result – Sensitivity Analysis of Key CBA Inputs

The CBA result is sensitive to a number of key inputs across the benefit categories such as GVA per worker, number of white collar workers in the IA, average number of hours spent online by adults in Ireland, and productivity improvements.

Figure 14: Sensitivity Analysis of key inputs

Key Input	Base Case	Total Net Benefit Range
1 **Average weekly time spent online by adults**	8.7 hours	5 hrs / 8.7 hrs / 10 hrs €0.2bn / €0.9bn / €1.1bn
2 **# White Collar workers living in IA**	146,739	115,515 / 146,739 / 200,000 €0.7bn / €0.9bn / €1.2bn
3 **Avg. GVA per White Collar worker outside IA**	€109,624	€80,000 / €109,624 / €160,000 €0.6bn / €0.9bn / €1.3bn
4 **Reduced time needed for productivity usage**	20%	10% / 20% / 30% €0.1bn / €0.9bn / €1.7bn
5 **% increase in productivity from teleworking and 'always on' capability**	35%	10% / 35% / 50% €0.3bn / €0.9bn / €1.2bn

The benefit inputs and assumptions of the CBA have been updated where possible to reflect updated demographic (e.g. white collar workers in IA), macro-economic (GVA per worker) and technological (hours spent on internet) trends in Ireland.

There are a number of key inputs that have a significant impact on the residential and enterprise benefits and as a result, updated figures have resulted in significant changes in the overall NPV of the CBA (see comparison slide for further detail).

There are other assumptions, in particular regarding productivity improvements, which have remained constant but are material to the overall benefits. In these cases, conservative estimates have been taken in the CBA.

€858m = Central scenario NPV

Source: PwC derived

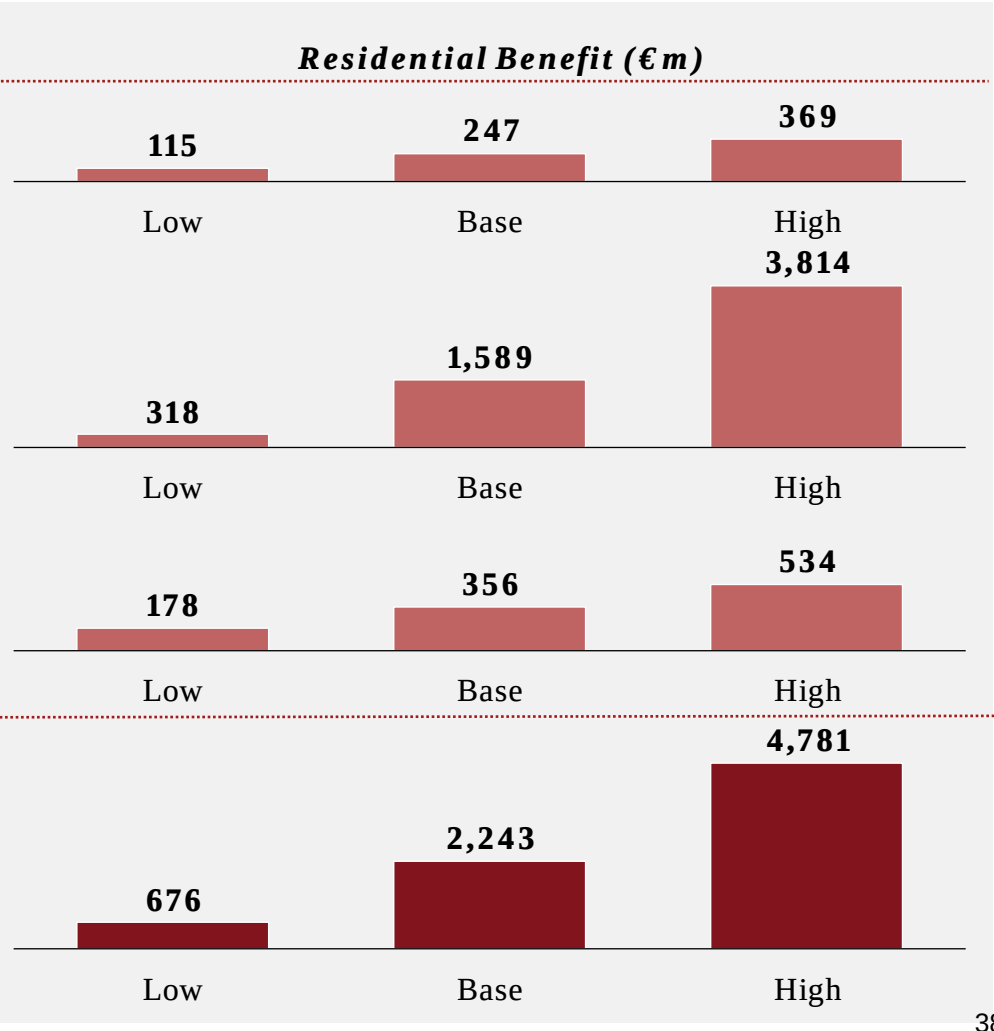
*Figures may not sum exactly due to rounding

CBA Result – Sensitivity Analysis – Residential Benefits

The Residential Benefit categories have been analysed to determine their sensitivity to a number of the key general assumptions used to quantify the benefit associated with the category.

Figure 15: Sensitivity Analysis on Residential Benefit Categories

Benefit Categories	Key Inputs	Low	Base Case	High
1 Remote Working / Commuter Savings	a Incidence of remote working	2%	4%	6%
	b Value of hour saved	€9.55	€10.89	€10.89
2 Faster Online Response Times	a Share of online time that is productive	10%	25%	40%
	b Reduced time needed for productivity usage	10%	20%	30%
3 Online Shopping Benefits	a Incidence of basic broadband online shopping v. high speed	90%	80%	70%



Total Residential Benefits*

*each scenario includes Communications costs savings of €65m

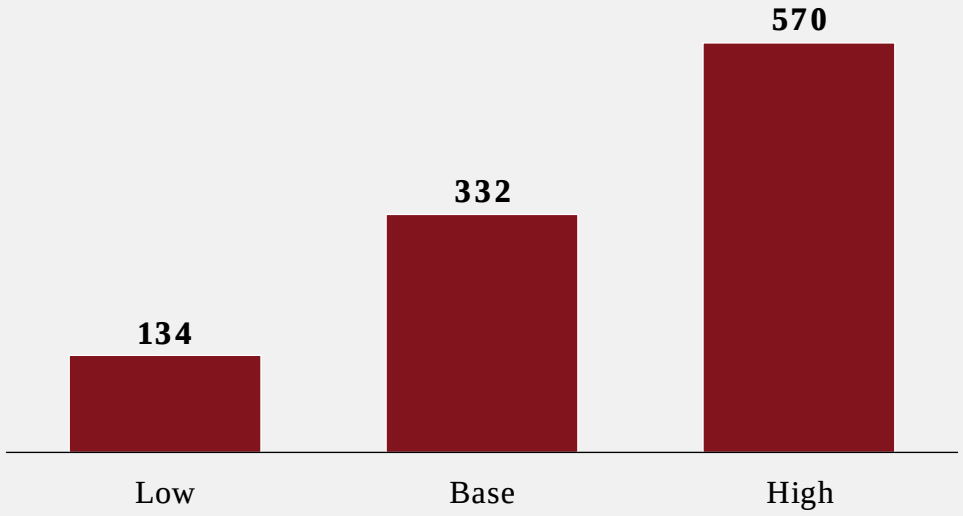
Source: PwC derived
Figures may not sum exactly due to rounding

CBA Result – Sensitivity Analysis – Enterprise Benefits

The Non-farm Enterprise Benefit category has been analysed to determine their sensitivity to a number of the key general assumptions used to quantify the benefit associated with the category.

Figure 16: Sensitivity Analysis on IA non-farm SME Benefit Categories

Benefit Categories	Key Inputs	Worst	Base Case	Best
1 Productivity of non-farm SMES	a % reduction in business costs	0%	1%	2%
	b Incidence of "own account workers" adopting digital technology	2%	6%	10%
	c % increase in productivity for "own account" workers	5%	10%	15%



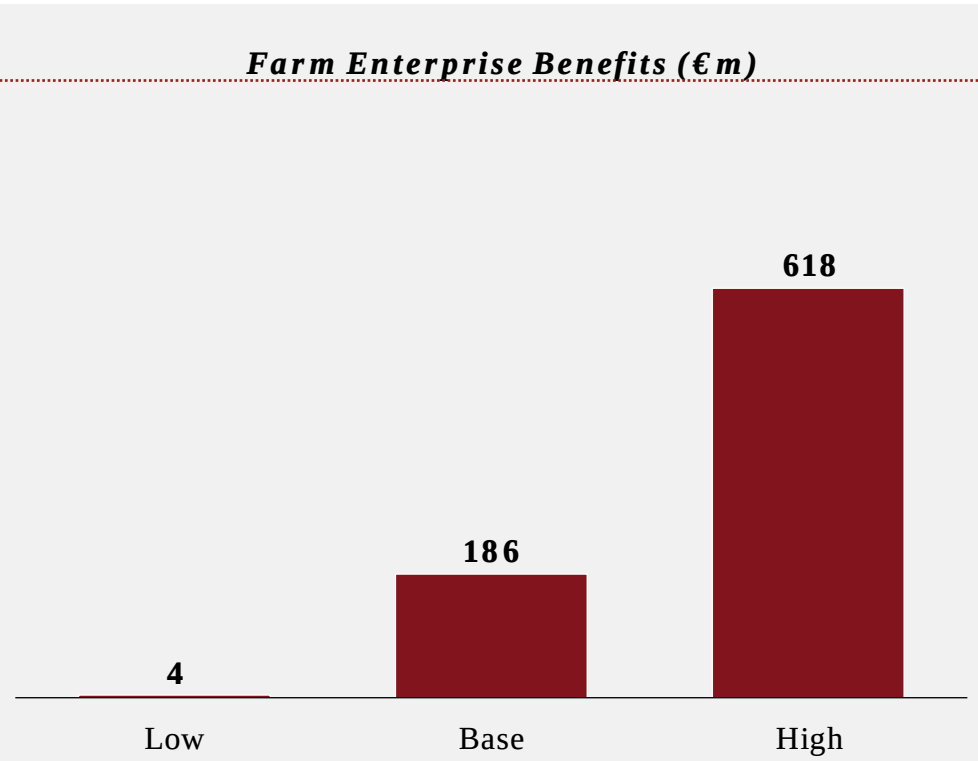
Source: PwC derived
Figures may not sum exactly due to rounding

CBA Result – Sensitivity Analysis – Enterprise Benefits

The Farm Enterprise Benefit category has been analysed to determine their sensitivity to a number of the key general assumptions used to quantify the benefit associated with the category.

Figure 17: Sensitivity Analysis on IA Farm Enterprise Benefit Categories

Benefit Categories	Key Inputs	Worst	Base Case	Best
1 Productivity of IA farm enterprises	a % of farms that self-serve with higher speed broadband	10%	30%	50%
	b Productivity gain on a "smart / precision" farm	10%	20%	30%
	c % of farms that absorb the benefit of "Smart Monitoring"	5%	10%	20%
	d Improvement in calf mortality	5%	20%	30%
	e % of calves born on "smart" farms	25%	50%	60%
	f Labour time per cow during calving (hours)	1	3.2	5
	g Reduction in labour time due to better use of "remote monitoring"	15%	30%	40%
	h Proportion of farms to adapt the monitoring technology	10%	20%	30%



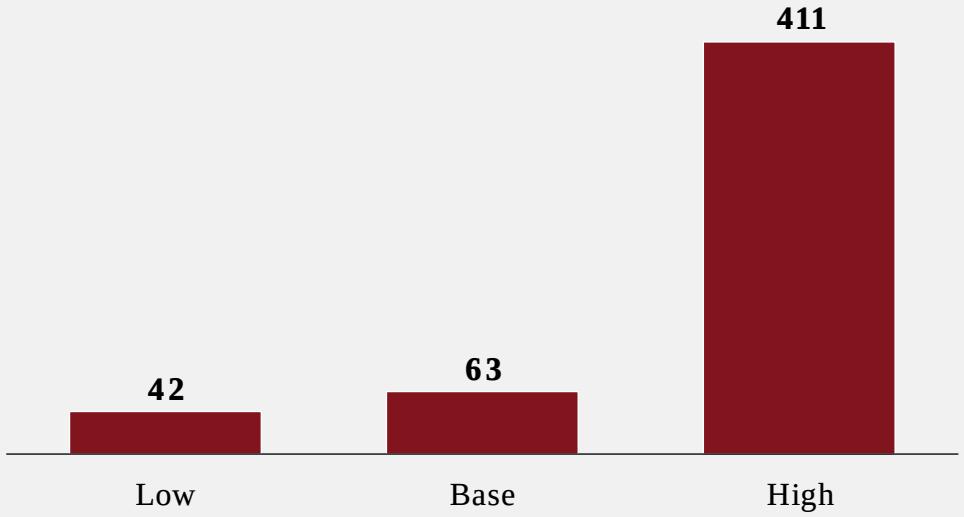
Source: PwC derived
Figures may not sum exactly due to rounding

CBA Result – Sensitivity Analysis – Enterprise Benefits

The Employment (job creation) Enterprise Benefit category has been analysed to determine their sensitivity to a number of the key general assumptions used to quantify the benefit associated with the category.

Figure 18: Sensitivity Analysis on Employment (Job Creation) Enterprise Benefit Categories

Benefit Categories	Key Inputs	Worst	Base Case	Best
1 Job Creation levels on GVA	a Attributable FTE jobs created per business/enterprise	5%	18%	30%
	b Counterfactual Job Creation GVA	60%	46.4%	30%
	c Displaced Employment	95%	80%	50%
	d Economic Multiplier	1	1	1.2



CBA Result – Scenario Analysis

The central CBA scenario returns a Benefit: Cost ratio of 1.30 while the Optimistic scenario has a BC ratio of 2.14. The pessimistic scenario returns a ratio of 1.15 as a result of an overall NPV of €497m.

Table 20: Scenario CBA Comparisons

25 Years, PV, €m	Pessimistic	Central	Optimistic
Total Project Costs	(€3,256)	(€2,896)	(€2,721)
Residential Benefits	€2,243	€2,243	€3,568
Enterprise Benefits	€1,511	€1,511	€2,251
Net Position	€497	€858	€3,097
Benefit: Cost Ratio	1.15	1.30	2.14

Benefit categories assume:

- 20% uplift on benefit under optimistic
- 10% uplift on take-up under optimistic
- The Counterfactual assumes 12% under central and pessimistic scenarios and 0% under optimistic scenario

While the CBA results are based on a central / base case scenario, additional scenarios have been run to consider both optimistic and pessimistic outcomes in relation to both project costs and benefit categories.

In the case of the project costs, the range of results is within a range of approx. €535m between the pessimistic and optimistic scenarios.

There are greater ranges within the benefit categories between the central and optimistic scenarios as the uplift / reduction is applied to both benefit and take-up of broadband services. The two key benefits impacted are residential and Non-IA enterprise benefits within overall enterprise benefits.

Benefits are also impacted by counterfactual benefits and these have been removed entirely in the optimistic scenario.

In the event of all the pessimistic cost scenario assumptions occurring, the impact is a net result of €497m while the central would result in a positive net result of €858m and in the optimistic scenario of €3.1bn.

Source: PwC derived

*Figures may not sum exactly due to rounding

Risks

NBP CBA – Challenges / Risks

A summary overview of the main challenges faced in the preparation of this updated CBA report and their treatment is presented in the below table.

Table 21: CBA Challenges / Risks & Treatment

Challenge / Risk	Description	Mitigating Action
Basic broadband services	Less than perfect information is available on the quality of basic broadband services available in the IA	The CBA still assumes that the quality of basic broadband service available in the IA is no better in aggregate than Digital Subscriber Line (DSL) maximum feasible speeds
Impact of 4G & 5G on basic broadband services	4G has been rolled out by all three mobile operators in Ireland with discussions now taking place about the possible rollout of 5G from 2019. 4G services are considered to provide more than adequate speeds for both residential and commercial purposes, however, it is not yet proven if broadband services in the IA can reach these service levels	Benefits have been identified based on the assumption that residents and enterprises will have access to 4G broadband services, with some 5G service to be deployed. These are now considered widely available from all three mobile operators and therefore the IA will also be able to access broadband services to these speeds once the infrastructure is rolled out
Reliably available versus maximum feasible	The IA covers over 90% of the national land mass of Ireland and the NBP has provided a commitment to the provision of NGA broadband services to all Irish citizens and businesses, regardless of location. There is likely to be highly remote areas within the IA that will not be feasible to connect to these broadband services	The CBA analysis assumes that residential connections to NGA broadband services will cap at circa 80% by the end of the contract period, recognising that there will be premises that may never connect or use alternative sources
Profile of NBP IA enterprise sector	The CBA analysis did not determine the level of broadband services currently available to enterprises within the IA which could under or overestimate the benefits arising from NGA broadband rollout	Enterprise benefits excluded medium and large enterprises as it is assumed that given their size, alternative steps have been taken to gain access to sufficient broadband services. It has been assumed that micro and small businesses in the IA will be the beneficiaries of NGA broadband services
Scale of multiple user constraint	Multiple users of a single broadband access at the same time can impact the speed and reliability of the broadband services	The average household size in the IA is approx. 2.9 persons. While there will be households with more than the average, it is not assumed that they will not be able to avail of the benefits identified from access to NGA broadband services

NBP CBA – Challenges / Risks

A summary overview of the main challenges faced in the preparation of this updated CBA report and their treatment is presented in the below table.

Table 21 (cont'd): CBA Challenges / Risks & Treatment

Challenge / Risk	Description	Mitigating Action
Rapidly changing digital society	Digital interactions are becoming more and more integrated in everyday society and is likely to continue to increase, however, it is unclear what level of integration will be experienced in areas that are yet to have access to reliable and fast broadband services. This could lead to the NBP benefits being under or over-estimated over time	A conservative assumption has been taken in relation to the average number of hours spent online per adult per week. This is a key driver of residential benefits in the CBA and may increase over time as digital interactions become more integrated in society
Counterfactual service availability & cost	If there were a step change in the counterfactual availability of basic broadband services, then the benefits of the NBP could be overstated. A material consideration is that within 10 years of roll out, it is assumed that NGA service will be required for the realisation of all benefits considered in this report. Reflecting this, a step change in basic services (if they were to occur) would only impact benefits in the short-term	Since the initial research was conducted in 2014 on basic broadband services (e.g. FWA, DSL), developments show that these are outmoded technologies and not likely to be the focus of significant investment in the medium to long-term. However some operators have recently signalled investments in wireless high speed broadband services, but this potential impact is a consideration in the counterfactual and also a consideration in demand assumptions/benefit realisation in early years.
Broadband quality for benefit realisation	Broadband quality is a key assumption in the realisation of both residential and enterprise benefits. If the quality assumed (>30 Mbps) was not achieved, there could be a negative impact on the realisation of quantified benefits	In non-IA, all three providers are offering up to 100 Mbps with Virgin now providing up to 240Mbps. These are considerably higher service levels than those assumed in the CBA analysis and so it is felt that the levels (> 30Mbps) required are conservative in the medium to long-term

Conclusions

Conclusions

CBA Objective & Updates	• The objective of this CBA is to assess the extent to which a State intervention to support the attainment of the primary NBP objective of universal NGA access will yield a positive return to Irish society. • The CBA for the National Broadband Plan (NBP) has been updated to account for a changing demographic landscape, significantly improved macro-economic climate from when original CBA was carried out, and the changes in technological trends that we are witnessing for both residential households and enterprises.
Benefits	• **Residential:** household benefits have increased significantly and are largely composed of (i) the time saving value due to faster response time of a 'next generation access' (NGA) service, (ii) by travel time and cost saving relating to the ability to work remotely, and (iii) by the full realisation of the benefits of better purchase value and time savings while online shopping. They deliver an NPV benefit of approx. €2.24bn over the timeframe of the NBP roll out. • **Enterprise:** benefits comprise of productivity gains for farm and non-farm enterprises in the IA as well as non-IA enterprises with workers living in the IA. These benefits have increased due to improved GVA per worker as well as a greater number of white collar workers living in the IA. New benefits in relation to increased employment in the IA have also been identified. The combined enterprise and employment benefits deliver an NPV of just over €1.5bn.
Costs	• The NBP costs are based on 100% Fibre-to-the-Premises (FTTP) roll-out for modelling purposes and these estimates are sourced from the financial appraisal work-stream undertaken by KPMG in collaboration with technical advisors, Analysys Mason. However the Department have advised us that they reserve the option to change the technical solution on a case by case basis during deployment where it makes technical and commercial sense to do so during the build period. • Nominal costs in relation to costs to the state and operator costs have been updated for the current CBA iteration. This brings the total nominal costs to €4.6bn over the 25 year period. • Real (present value) costs result in a total cost of approx. €2.9bn for the full delivery of the NBP roll-out across the IA.
CBA Result	• The central case CBA delivers a net present value of approx. €858m resulting in a Benefit: Cost ratio of 1.30. • A number of inputs to the benefit categories such as number of white collar workers living in the IA, GVA per person, average number of hours spent online, and productivity savings are key drivers of the overall benefits. Changes to these in future could result in significant impacts to the overall CBA result. • Additional scenarios have been run to consider both optimistic and pessimistic outcomes. Realisation of the pessimistic outcome would result in a net benefit of €497m while the optimistic scenario would deliver a net benefit of nearly €3.1bn.

Appendix

Appendix 1: Terms of Reference (1/5)

Cost Benefit Analysis workstream – Key Deliverables

The successful Tenderer will have sole responsibility for the delivery of the outputs required under the CBA workstream.

The allocation of scarce economic resource to competing policy objective is a challenge inherent to public sector investment. Any allocative decision will necessarily involve making choices between alternative approaches to the achievement of a specific policy objective and the ranking of priorities. CBA is an economic appraisal tool for the comparison of costs and benefits associated with alternative approaches. CBA provides a useful basis for decision - making and assists in the systematic appraisal and management of capital and current programmes.

A CBA is the mandatory appraisal technique for programmes costing more than €2.0m and therefore the successful Tenderer ·will be required to carry out a CBA which shall encompass a report to the Minister on the socio-economic benefits and likely costs to the State that will arise from implementing the State-led intervention under the NBP (the "CBA Report").

The CBA Report must clearly set out the steps required to allow options to be evaluated and a preferred option to be selected and must clearly demonstrated what the differentiators between the various options in terms of costs and benefits are. The CBA Report will need to be updated from time to time to allow for stakeholders views to be taken into account as they are received during Phases 1. 2 and 3 of the Programme.

The Government has published its Public Spending Code and Tenderers are referred specifically to the 'Guide to Economic Appraisal: Carrying out a CBA'. The CBA Report shall be undertaken in compliance with the Public Spending Code.

The CBA Report will take into account the outputs from other Programme Workstreams in. particular the intervention strategy and the network cost modelling workstreams. As part of the CBA Report, the successful Tenderer shall identify the socio-economic case related to the State-led intervention under the NBP, particularly in the context of wider Government policy.

The socio-economic analysis should assess the likely benefit and costs to the State of ubiquitous broadband for all citizens under the following suggested areas (at a minimum):

- overall national economic prosperity;
- education, improving skills e.tc;
- changing employment patterns;
- equity and social justice; and
- urban migration.

Appendix 1: Terms of Reference (2/5)

Scope of CBA Report

It is envisaged that the CBA Report will consider and report on whether:

significant benefit will accrue to the State as a whole as a result of the proposed State-led intervention :

the overall benefits, quantitative and qualitative accruing to Ireland will outweigh the costs of this investment in the long term;

citizen's lives and businesses will be enhanced through the State-led intervention;

the State-led intervention will assist with safeguarding population centres in the areas where the State-led intervention will take place and mitigate the migration away from rural areas: and

the manner by which the proposed State-led intervention under the NBP will have a knock on benefit for all consumers of broadband in the ta e (both business and residential) regardless of location and not just those in "White" areas.

Tenderers are requested to please note that the above list is non-exhaustive and that the CBA Report will be required to provide a comprehensive assessment of the advantages, disadvantages, risks and potential benefits of the intervention strategy proposed.

The CBA Repo1t should consider the impact of the proposed State-led intervention over a timeframe of 20 to 30 years. This timeframe is based on the current proposal from Government that the intervention will be a long term, sustainable and future proofed.

Identification & quantification of benefits

The CBA Report will be required to identify the socio-economic benefits of the State-led intervention. The assessment should consider the following potential socio-economic benefits:

Society and Government

- The overall benefits that would accrue to society, in general, and to Government through the successful implementation of the State-led intervention under the NBP.
- Benefits of ubiquitous broadband for online businesses and the services they provide.
- Benefits to Local Authority services.
- Benefits to e-Government services.

Enterprise

- The requirements of small and medium enterprises ("SMEs") in the areas requiring the State-led intervention under the NBP and how these SMEs might benefit.
- The positive -impact high speed broadband can have on the ability to work from home and the direct and indirect effects of this.
- The possible implication for foreign direct investment and how this might impact upon the competitiveness of the State.

Appendix 1: Terms of Reference (3/5)

Identification and quantification of benefits (continued)

Tourism and Sport

- The possible benefits for accommodation providers in the tourism sector (hotels, bed and breakfasts, hostels).
- The development of high speed Wi-Fi regardless of location.
- The development of local initiatives to promote tourism.
- The raising of awareness of the State as a tourism attraction to overseas and domestic visitors.
- The benefits for sports clubs and competitions in those areas in which the State-led intervention under the NBP takes place.

Health

- The possible benefits for healthcare professionals in those areas in which the State-led intervention under the NBP takes place (including doctors. dentists. pharmacists, opticians, veterinary surgeons etc.
- The impact on hospitals and health centres in those rural areas in which the State-led intervention the NBP takes place.
- The positive impact for patients.

Education

- The positive impact of bringing high speed broadband to schools and colleges.
- The impact on students and families in those rural areas which the State-led intervention under the NBP takes place.

Social Protection

How the State led intervention might aid social inclusion with a particular focus on:

- the elderly;
- the unemployed;
- disadvantaged citizens general; and
- those socially marginalized due to geographic location.

Agriculture and fisheries

- The further development of agri-businesses.
- The further development of the sea food industry.
- Employment
- Retention and creation of jobs in rural areas.

Environment

The CBA Report shall include a high level environmental impact analysis of the roll out of a high speed broadband network and consider the positive impact the provision of a high speed network could have over the corning decades on the environment.

Other benefits

The above list is not exhaustive and the CBA Report should identify additional benefits and related advantages disadvantages, risks and rewards where relevant.

The successful Tenderer will also be required to quantify the socio-economic benefits identified. The valuation of benefits should be carried in line with the guidance set in the Public Spending Code.

Appendix 1: Terms of Reference (4/5)

Identification & quantification of costs

The successful Tenderer shall also undertake a comprehensive cost analysis as part of the CBA. This assessment shall not be confined to an assessment of monetary costs but shall identify, categorise and quantify all relevant monetary and non-monetary costs. Please note that non-monetary costs must be quantified and set out in monetary terms. The identification and valuation of costs should be in line with the Public Spending Code.

A financial model ('Financial Appraisal Model') will be developed under the financial appraisal workstream by the financial and procurement External Advisors. The Financial Appraisal model will operate all of the relevant financial costs and revenue associated with the proposed intervention and will provide the necessary financial models) (including calculation of net present ·value and internal rate of return) and the production of financial statement (including cash flow statements). TI1e Financial Appraisal Model will be shared with the successful Tenderer. The successful Tenderer may further develop the Financial Appraisal Model to fulfil the requirements of this workstream. The successful Tenderer will be required to work with the financial and procurement External Advisors to ensure clarity around the specification of the Financial Appraisal Model and to ensure duplication of effort is avoided. The Financial Appraisal Model may be amended from time to time to ensure alignment with the intervention strategy proposed.

All necessary outputs and deliverables should be agreed at the Inaugural Workshop.

Case Studies

The successful Tenderer will also be required to carry out case studies/market research which may support consumer demand theory in the areas identified as requiring State-led intervention under the NBP. The case studies must address, at a minimum, the following samples from the proposed areas identified for intervention:

- a very rural geographic area. for example a small village;
- a sample of small local businesses;
- a sample of family homes in a rural area· and
- teleworking examples.

The samples must be selected based on the outputs of the intervention locations workstream and in consultation with the Minister.

Analysis of Options and Risks

The successful Tenderer will be required to develop a number of preferred op io1h ideally no more than three - one of these could be the option of doing nothing, which should be the subject of detailed analysis under the CBA Report.

As well as qualitative and quantitative analysis of costs and benefits of each option, the CBA Report should include value for money indicators such as benefit-cost ratio, net present value and internal rate of return. As costs and benefits are likely to occur at different points in the life of the State-led intervention, the valuation of costs and benefits must take into account the time at which they occur and also the discount factors set out in the Public Spending Code.

The robustness of indicators developed should be assessed with reference to the main risks associated with the proposed intervention strategy. Sensitivity analysis against these risks shall also be undertaken.

Appendix 1: Terms of Reference (5/5)

Recommendation on preferred option

The CBA Report shall conclude with the successful Tenderer's recommendation on the preferred option for Government, supported by key indicators such as benefit-cost ratio, net present value and internal rate of return.

Economic Model & Specification Document

The successful Tenderer shall develop a detailed economic modelling tool to support the CBA report. Any such model should be accompanied by a model specification document explaining material inputs, sources of data used and key assumptions made within the model. This model specification document shall be in Microsoft Excel format or other equivalent that can be read immediately.

The specification document must contain among other things:

- overview of the model structure;

- description on how to use the model; and

- list of key assumptions made and the reasons for inclusion of such assumptions.

Comparison with other Member States

The CBA Report shall also provide commentary on how other comparable Member States and countries are implementing or proposing to implement similar national broadband interventions and, at a high level, the socio-economic benefits that have accrued or that they expect to accrue from such interventions. This is to ensure that the State-led intervention is in line with best practice and keeping pace with European and international developments. The CBA Report should also include an assessment of the cost of not keeping pace with other countries.

Engagement with State Bodies and External Advisor

The successful Tenderer shall be required to engage with other External Advisors and relevant State bodies as appropriate in particular the Department of Finance and the Department of Public Expenditure and Reform) in producing the CBA. In particular, Tenderer should be aware of the Report of the Commission for the Economic Development of Rural Areas entitled 'Energising Ireland's Rural Economy' which makes a number of recommendations in relation to broadband in rural areas. Responsibility for implementation of the Report rests with the Department of Agriculture, Food and the Marine. All such engagement should take place well in advance of any submission to Government in June 2015 to ensure any issues raised are fully addressed prior to any such submission seeking Government approval to proceed with Phase 3 of the Programme (Procurement).

Appendix 2: CBA Cost Overview (1/5)

This note is to support the updated PwC CBA ('CBA') analysis and is intended to illustrate and explain the costs and demand assumptions used in the updated iteration of the CBA, and provide an overview of the scenarios set out in the updated CBA. All figures in have been provided by KPMG and are ex-VAT figures.

1. CBA Input Costs and Demand

There are three scenarios in the CBA, Optimistic, Central and Pessimistic. The central scenario is based on most likely outcome and is based on the Bidders final bid. The Pessimistic scenario represents the capped additional conditional and contingent subsidy that may be required per defined contract assumptions and encroachment criteria in the contract. The optimistic scenario represents a scenario where there is lower capex and opex and greater take-up/commercial revenues.

The below table provides an overview of the cost and demand in the CBA based on input tables provided by KPMG. A more detailed breakdown of costs and demand profiles is set out in Appendix 1.

Table 1 – Overview/source of cost/demand

	Optimistic	Central	Pessimistic
A. Total Project Costs (nominal)	€4,841m	€4,594m	€4,974m
B. Cost to the State (or Subsidy requirements) (nominal)	€1,660m	€2,143m	€2,623m
C. Cost to operator (nominal) i.e. Total Project cost less Cost to the State A - B	€3,180m	€2,451m	€2,351m
D. Take-up/Demand Profile	• August 2018 budget model	• Bidders final Model	• Bidders final Model
Source of Costs/Take-up	• August 2018 budget model • Ref: 190307 NBP - Optimistic Scenario - Output for CBA (revised format) (2).xlsx • Shared 7th March	• Bidders final Model – September 2018 • Ref: Copy of CBA Cost Inputs update 19Feb2019 v1.xlsx • Shared 19th February	• Bidders final Model - September 2018 • Ref: Copy of CBA Cost Inputs update 19Feb2019 v1.xlsx • Shared 19th February

Source: KPMG

Appendix 2: CBA Cost Overview (2/5)

This note is to support the updated PwC CBA ('CBA') analysis and is intended to illustrate and explain the costs and demand assumptions used in the updated iteration of the CBA, and provide an overview of the scenarios set out in the updated CBA. All figures in have been provided by KPMG and are ex-VAT figures.

2. Overview of CBA scenarios

Overviews of the scenarios identified in CBA are set out below:

a. Central Scenario: The central scenario represents a subsidy ask from the Bidder of €2,143m in nominal terms ex VAT

b. Pessimistic scenario: The pessimistic scenario represents another layer of contingency in addition to that included in the central scenario above and as provided for in the final tender received. In the pessimistic scenario there is a provision for a further conditional subsidy and contingent subsidy of €480m (in nominal ex VAT terms) to allow for potential future unforeseen and unavoidable construction costs, or encroachment by commercial operators that might arise over the 25 year period. Given the variable nature of future activities, it was not possible for the Bidder or the Department to say with any certainty whether certain costs in the future might arise, however it was considered important to factor in the risk that certain additional costs could arise and this should be made transparent prior to contract award to avoid any future surprises)

c. Optimistic Scenario: There contract allows the State to benefit through claw-back where there are cost saving / improved financial performance (greater take-up, etc.) relative to Bidder final bid forecasts. Therefore the Cost to the State could be much lower than the central case; however there is no contractual floor on the minimum subsidy that may be required by NBPco. In this Optimistic Scenario the estimated subsidy (or cost to the state) is €1,660m (ex-VAT).

Source: KPMG

Appendix 2: CBA Cost Overview (3/5)

This note is to support the updated PwC CBA ('CBA') analysis and is intended to illustrate and explain the costs and demand assumptions used in the updated iteration of the CBA, and provide an overview of the scenarios set out in the updated CBA. All figures in have been provided by KPMG and are ex-VAT figures.

3. Costs incorporated into CBA[1]

The (nominal) costs discussed above are inputs into the CBA. In line with public spending code the costs are adjusted (as identified in table 2 below) and the final cost is represented in NPV terms.

Table 2 – Cost inputs to CBA and adjustments.

	Optimistic	Central	Pessimistic
Cost to state (nominal)	€1,660m	€2,143m	€2,623m
Adjustment to (nominal) Cost to State: • **Inflated by shadow costs of public funds (+30%)** • **Deflated to remove inflationary assumptions (annual inflation of 2%)** • **Discounted to calculate costs in Real value (annual discount factor of 5%)**			
Cost to State (NPV)	€1,486m	€1,922m	€2,321m
Cost to operator (nominal)	€3,180m	€2,451m	€2,351m
Adjustment to (nominal) Cost to Operator: • **Deflated to remove inflationary assumptions (annual inflation of 2%)** • **Discounted to determine costs in Real value (annual discount factor of 5%)**			
Cost to Operator (NPV)	€1,236m	€974m	€935m

Source: 1. KPMG

Appendix 2: CBA Cost Overview (4/5)

This note is to support the updated PwC CBA ('CBA') analysis and is intended to illustrate and explain the costs and demand assumptions used in the updated iteration of the CBA, and provide an overview of the scenarios set out in the updated CBA. All figures in have been provided by KPMG and are ex-VAT figures.

Source of Funds and Use of Funds[1]

The source of funds and use of funds is set out below. The Total use of funds represents the total project costs. The total Project costs (per use of funds table) is made up of:

- Capital Costs
- Infrastructure rental costs
- Operating costs
- Private finance costs (equity in form of interest on shareholder loans and dividends)
- Other Costs – working capital, tax, etc.

Table 3 – Summary of Project Costs (Use of Funds) and Source of Funds

	Optimistic	Central	Pessemistic
	Budget model - August 2018 Years 1-25 € million	Bidder Final tender Years 1-25 € million	Bidder Final tender Years 1-25 € million
Total Sources of Funds			
Subsidy Payments	1,660	2,143	2,143
Commercial revenue			
Equit/ Shareholder loan			
Ordinary share capital			
Comercial debt			
Conditional Subsidy payments			
Contingent Subsidy			
Total sources of funds (nominal)	**4,841**	**4,594**	**4,974**
Total use of funds			
Capex to pass			
Capex to connect			
Infrastructure Rental			
Op-ex*			
Dividends & Shareholder loan interest**			
Share capital & Shareholder loan repayment			
Commercial debt interest			
Commercial debt principle repayment			
Tax			
Working capital/VAT/cash Balances/Adjustments			
Conditional costs			
Total Uses of funds (nominal)	**-4,841**	**-4,594**	**-4,974**

Source: 1. KPMG

Appendix 2: CBA Cost Overview (5/5)

This note is to support the updated PwC CBA ('CBA') analysis and is intended to illustrate and explain the costs and demand assumptions used in the updated iteration of the CBA, and provide an overview of the scenarios set out in the updated CBA. All figures in have been provided by KPMG and are ex-VAT figures.

Description of costs and demand included in each scenario

The Bidders final tender was based on a 1 Jan 2019 start date and that is what has been used for the CBA. The likely start date is likely later in 2019 and any revised start date will be reflected in vote funding requirement analysis, but no adjustments are made for the purposes of the CBA analysis.

Central Scenario

Reflects Bidder final bid - September 2018

- The central scenario represents the actual capital expenditure, operating costs, and private finance costs included in Bidder final Bid.
- The commercial revenues assumptions reflect the actual take-up and wholesale pricing assumptions in Bidder final Bid.
- The subsidy requirement reflects the Bidder subsidy ask (over 25 years) in the Bidders final bid.

Pessimistic Scenario

Reflects Bidder final bid - September 2018

- Reflect the Central scenario above, plus inclusion of conditional and contingent subsidy of €480m

Optimistic Scenario

Based on Department's updated internal model - August 2018

- This represents a proxy for optimistic scenario for the State where capex and opex is lower and there are better take-up/commercial revenues.

Source: KPMG