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Digital, Culture,
Media & Sport

Evaluation of the SuperConnected Cities Programme: Final Synthesis Report

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For:

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Contents

1. Executive summary	4
Evaluation aims and objectives	4
2. Introduction	10
2.1. Evaluation aims and objectives	10
2.1.1. Evaluation modules	12
2.2. Methodology	13
2.3. Structure of this report	13
2. SuperConnected Cities Programme	15
2.1. Programme overview	15
2.2. Project summaries	16
2.2.1. Capital projects	16
2.2.2. Connection voucher scheme	17
2.3. Intervention logic model	18
2.3.1. Inputs	18
2.3.2. Outputs	18
2.3.3. Connectivity outcomes	18
2.3.4. Economic impacts	19
2.3.5. Intervention logic model	19
2.1. Lessons from past research	21
3. Context	23
3.1. State aid challenges	23
3.2. Overview of digital infrastructure landscape	23
3.3. Overview of digital policy landscape	23
4. Programme delivery	25
4.1. Summary of programme delivery	25
4.1. Key themes and issues	28
4.1.1. Project planning and market testing	28
4.1.2. Role of the public sector	28
4.1.3. Aggregation points and carrier neutrality	29
4.1.4. New build developments	29
4.1.5. Re-use of existing assets	30
4.1.6. Ongoing maintenance of contracts and infrastructure	30

4.1.7.	Supplier capacity	31
4.1.8.	Market engagement activities	31
4.1.9.	Administration of voucher schemes	32
4.2.	Learning and recommendations for LFFN	33
5.	Impact on connectivity outcomes	34
5.1.	Direct connectivity outcomes	34
5.1.1.	Supply side effects on superfast, ultrafast and full fibre availability	34
5.1.2.	Take-up	35
5.2.	Spill-over build	38
5.2.1.	Supply side effects on superfast, ultrafast and full fibre availability	38
5.2.2.	Demand side effects on take-up of superfast, ultrafast and full fibre services	41
5.3.	Learning and recommendations for LFFN	42
6.	Economic impacts	44
6.1.	Business performance impacts	44
6.1.	Wider economic impacts	48
6.2.	Learning and recommendations for LFFN	49
7.	Conclusions and recommendations	50
7.1.	Conclusions	50
7.2.	Recommendations for LFFN	50
7.3.	Recommendations for future monitoring and evaluation activity	51

1. Executive summary

Ipsos MORI, in association with Simetrica and George Barrett, was commissioned to undertake an evaluation of the SuperConnected Cities Programme (SCCP) in April 2018. This report brings together the findings of the evaluation in a final synthesis report to complement the individual case studies presented as annexes to this report.

SuperConnected Cities Programme

The SuperConnected Cities Programme was established in 2012 with £150m of public funding with the aim of supporting the Government's economic growth policy by delivering faster and better broadband to businesses and residents in major cities. The programme involved a range of interventions, including several capital projects delivered through a challenge fund, a broadband voucher scheme and public sector wireless upgrades and concessions. The programme was developed to align with the spatial development priorities of the Coalition Government, particularly the City Deal Programme, that emerged from the 2011 "Unlocking Growth in Cities"¹ policy paper. The programme initially began with 22 SuperConnected Cities before expanding to 50 cities in the national rollout of the connection voucher scheme.

Evaluation aims and objectives

The overarching objectives of the evaluation were to:

- Establish the impacts and benefits of the several projects of SCCP.
- Enable learning from the several SCCP projects to be used for Local Full-Fibre Network programme (LFFN) development.

The evaluation took a modular approach and focused on a selection of capital projects and the connection voucher scheme. The study advances the BDUK benefits realisation evidence base by measuring the impacts of the selected capital projects and voucher scheme on connectivity and businesses performance.

Programme overview

The interventions in scope of the evaluation covered five of the twelve capital projects funded through the programme and the voucher scheme:

- **Brighton Digital Exchange (BDX):** BDUK funded the capital outlays necessary to install a fibre optic network in a local authority owned commercial building to access ultrafast broadband speeds in addition to the installation of both an uncontested link to the London Internet Exchange and a data centre.

¹ HM Government. (2011). Unlocking growth in cities. Available at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/7523/CO_Unlocking_20GrowthCities_acc.pdf [Accessed: 11/03/2019]

- **Cardiff Internet Exchange (CIX):** The programme provided grant funding to SME Internet Service Providers (ISPs) and other qualifying SMEs/organisations to connect to the then newly complete Cardiff Internet Exchange.
- **Bristol ducting projects:** Comprised of several aspects, the Bristol projects involved BDUK funding to repair and extend an existing ducting network in the area under a concession model, fund a further extension of the ducting network into a strategically important area and put in place the fibre infrastructure required to set up an R&D Testbed.
- **Baildon ducting project:** Public funding was used to cover the cost of the installation of general purpose ducting within the Baildon business park that was at the time under development.
- **Connection voucher scheme (CVS):** BDUK funding was made available to SMEs in the form of vouchers entitling them to up to £3,000 towards the costs of upgrading to a superfast or ultrafast connection.

A range of impacts were expected from the programme overall including accelerated roll-out of superfast broadband across the UK and increased productivity and employment growth amongst firms benefiting from enhanced access.

Outcome and impacts of the programme

The findings of the evaluation show that the projects led a gross increase in the availability of superfast connectivity though there was variation in these outcomes across the projects examined:

- **Availability of superfast, ultrafast and FTTP:** The BDX, Baildon ducting project and CVS (to a lesser extent) all resulted in increased superfast² availability between 2013 and 2016 with the connection voucher scheme leading to just over 42,000 superfast connections. The scheme also led to increased ultrafast³ and FTTP⁴ availability with 2,400 FTTP connections installed. In Brighton, superfast and ultrafast speeds were made available to all units in New England House through FTTP connectivity. In Bristol, while initial progress was reportedly made in the rollout of fibre connections, the concession has since ceased with uncertainty as to the extent of any enhanced connectivity delivered.
- There was evidence that CVS resulted in net increases in the availability of superfast connectivity, both directly and by inducing spill-over build in postcodes close to voucher applicants. It was estimated that each voucher led to an additional 1.4 superfast enabled premises on the postcode but a small decrease within postcodes 200m away, possibly representing a displacement effect⁵. FTTP connections were estimated to have the most significant impacts of superfast availability at the local level, with each relevant voucher

² Refers to download speeds equal to, or in excess of, 24Mbps unless otherwise specified. Note that the Ofcom definition of superfast is a download speed over 30Mbps or higher

³ Refers to download speeds equal to, or in excess of, 300Mbps

⁴ Fibre to the premise, refers to the use of fibre optic cabling all the way to the premise as opposed to the cabinet as per FTTC.

⁵ Describes effects in product markets where the growth of one firm will result in the loss of market share for its competitors" – from the published Superfast report. The magnitude wasn't quantified in the evaluation

claimed leading to an additional 2.7 superfast enabled premises on the postcode of the voucher applicant and 0.8 further premises enabled on other postcodes within 200m.

- **Take-up:** Take-up of superfast services was evident in both Brighton and the Baildon business park, however in each case, evidence from the evaluation consultations suggested that it was likely that such services would have been taken up in the absence of the projects.

Evidence on wider, indirect take-up outcomes comes primarily from the case study of the connection voucher scheme with vouchers linked to indirect increases in take-up both on the postcode and postcodes within 200m. Each voucher was estimated to have led to an additional 4 superfast connections in the postcode of the voucher applicant and a further 0.4 in each postcode within 200m.

The impacts on connectivity were expected to have lead on to a range of local and national economic impacts. The evaluation findings suggest that, in practice, these were only significant in the case of the CVS:

- **Business performance impacts:** The vouchers issued through the connection voucher scheme were estimated to have increased the employment and turnover of recipient firms by 2.4 and 2.6 percent respectively. Both fixed wireless and leased line connections were found to have larger impacts on employment at 3.4 and 4.3 percent respectively. Only uncontested lines were found to increase turnover per worker (a proxy measure for productivity) and evidence from the qualitative research suggested that productivity gains had been realised but were small in general and linked to the speeds taken.

In the case of the capital projects, a lack of wider indirect connectivity outcomes being realised limited the extent of any business expansion and productivity effects. The termination of the Bristol concession stalled progress in achieving the economic outcomes for businesses potentially standing to benefit from the re-use of B-Net ducts. Limited progress in the regeneration of Brighton's New England Quarter limited the ability of co-operative members to provide services to businesses in the wider area which therefore were unable to benefit to any great extent.

Issues hindering the progress of the capital projects varied but included a lack of a significant push behind the project (Cardiff), a lack of fibre deployment (Baildon), issues installing equipment or permission to expand (Brighton) and the termination of the concession (Bristol). The degree of local buy-in and the certainty of wider plans were therefore key barriers to achieving some of the intended outcomes

- **Effects on rents:** The findings also indicated that the CVS had an impact on commercial rents (another proxy measure for productivity). Each voucher was associated with a 0.6 to 0.9 percent increase in the rateable value per m² of commercial and industrial premises on postcodes where voucher applicants were located, and a further 0.3 and 0.4 percent for other premises located within 200m

Recommendations for the Local Full Fibre Networks (LFFN) Programme

The evaluation highlights several factors for consideration for the LFFN Programme:

- **Use of public funding:** The role of the public sector should be carefully considered in LFFN applications involving digital exchanges or internet exchanges. In such cases alternatives to fund the capital and equipment costs should be reviewed with the likely role of the public body being to co-ordinate partners.
- **Ongoing management of infrastructure:** LFFN contracts should ensure that measures are in place to manage the ongoing use and maintenance of any infrastructure (such as ducting) put in place using BDUK funding, with roles and responsibilities made sufficiently clear to all parties involved.
- **Concession model:** There are likely to be several key learning points that can be taken away from the concession model utilised in the Bristol ducting project that should be considered when appraising applications that propose the use of a similar model.
- **Carrier neutrality:** There is a need to maintain carrier neutrality, as well as a perception of carrier neutrality, in projects similar to the IX and BDX capital projects (as participation of users may be constrained otherwise).
- **LFFN strategic case:** The findings provide evidence that supports the strategic case for investment in LFFN and the GVS. The LFFN programme is anticipated to result in the expansion of full fibre networks from the infrastructure brought about to serve public buildings and the evidence here suggests that fibre is likely to provide the greatest degree of spill-over build.
- **Demand for full fibre:** The voucher scheme findings also indicated a lack of demand for full fibre at present as expressed by SMEs in consultations. Many businesses appear satisfied with the connections delivered through the voucher scheme, most of which were below 100Mbps. Many SMEs use of fixed line connectivity was not great enough to necessitate full fibre for capacity reasons and the improvements it would bring over ultrafast were not understood by firms. Consultations with businesses indicated price as the key barrier for SMEs to make the jump to full fibre..
- **Assurance and challenge of wider plans and contingent developments:** The LFFN due diligence process should incorporate an element of check and challenge to local bodies on the wider developments of relevance to the project at the application stage. This should incorporate an understanding of exactly which elements of wider plans are necessary for the application to lead to its desired outcomes and assurances that a roadmap is in place to deliver these if not funded through BDUK..
- **Commercial sustainability:** The co-operative model does not appear to exhibit any strong weaknesses that may lead to it being unsustainable. In addition, the need for public funding may not initially be around any capital equipment associated with such projects but instead required to coordinate delivery partners and members. However, the

evaluation does suggest that the sustainability of the model is intrinsically linked to its members whom, in part, are dependent on the wider context. Brighton highlights these links most clearly illustrating the need for wider development to come forward.

- **Potential for firm expansion and productivity effects:** The evidence indicates significant potential for a voucher scheme, such as the GVS, to lead to firm expansion and profitability effects. The speeds involved in that scheme could also indicate effects of magnitudes larger. This is evidenced to some extent in the previous evaluation of the Superfast Broadband Programme⁶.
- **Raising awareness of the benefits of full fibre:** There is a potential case for complementary activities to be undertaken by the public sector in raising awareness amongst SMEs of the benefits full fibre could bring them. Through supporting businesses to generate a justification for such connectivity, public intervention could begin to make some headway in raising the demand for full fibre networks that appears to be relatively weak at present (described in section 5).

⁶ Evaluation of the Economic Impact and Public Value of the Superfast Broadband Programme. (2018). DCMS. Available at: <https://www.gov.uk/government/publications/evaluation-of-the-economic-impact-and-public-value-of-the-superfast-broadband-programme>

Glossary

BDUK	Building Digital UK, the broadband delivery body of the Department for Digital, Culture, Media and Sport
BDX	Brighton Digital Exchange, the data exchange and co-operative set up as part of the Brighton SuperConnected Cities Programme
BIO	Bristol is Open, is a joint venture between the University of Bristol and Bristol City Council and was involved in the R&D Testbed aspect of the Bristol SuperConnected Cities Programme
B-NET	Bristol Network, refers to the ducting and fibre communications network owned by Bristol City Council and the subject of a concession as part of the Bristol SuperConnected Cities Programme
CIX	Cardiff Internet Exchange, the internet exchange set up as part of the Cardiff SuperConnected Cities Programme owned and run by LINX
CVS	Connection Voucher Scheme, the national voucher scheme element of the SuperConnected Cities Programme
DCMS	Department for Digital, Culture, Media and Sport
FTTC	Fibre to the cabinet, refers to the use of fibre optic cabling from the exchange to the cabinet and then traditional copper wires on to the premise
FTTP/Full Fibre	Fibre to the premise, refers to the use of fibre optic cabling all the way to the premise as opposed to the cabinet as per FTTC.
GPST	General purpose service trench, refers to the trench intended for use by telecoms and other utilities and forming part of the Bristol SuperConnected Cities Programme
GVS	Gigabit Broadband Voucher Scheme
ISP	Internet service provider
IX	Internet Exchange,
LFFN	Local Full Fibre Networks Programme
LINX	London Internet Exchange, a not-for-profit organisation managing the Cardiff IX
LTE	Refers to the 4G mobile communications standard
NEH	New England House, refers to the building housing the Brighton Digital Exchange
PRP	Pre-registered package, refers to the second stage of the Connection Voucher Scheme in which bundles of voucher were pre-approved with suppliers
SCCP	SuperConnected Cities Programme
SME	Small to medium sized enterprise, also includes micro businesses
Superfast	Refers to download speeds equal to, or in excess of, 24Mbps unless otherwise specified. Note that the Ofcom definition of superfast is a download speed over 30Mbps or higher
TDIC	The Tameside Digital Infrastructure Cooperative, refers to the co-operative set up in Tameside as part of the Wave 1 Local Full Fibre Networks Programme
Ultrafast	Refers to download speeds equal to, or in excess of, 300Mbps
VOA	Valuation Office Agency, executive agency sponsored by HM Revenue and Customs providing advice and valuations to the government in support of taxation and benefits

2. Introduction

Ipsos MORI, in association with Simetrica and George Barrett, was commissioned to undertake an evaluation of the SuperConnected Cities Programme (SCCP) in April 2018. This final synthesis report presents the combined learning from the evaluation and is intended to be read alongside the case studies presented in the Annexes.

2.1. Evaluation aims and objectives

As set out in the tender documents, the objectives of the evaluation were:

- To establish the impacts and benefits of the several projects of SCCP.
- To enable learning from the several SCCP projects to be used for LFFN development.

The evaluation was commissioned as part of the BDUK Benefits Realisation Plan, and advances its evidence base by measuring the impacts of capital projects and voucher schemes on connectivity and businesses. The evidence will also be used to inform development of LFFN given the similarities between the schemes. Evidence may also be relevant more widely in the department through the 5G programme and the Digital Inclusion work currently being undertaken at DCMS.

Specifically, the evaluation sought to explore benefits around productivity growth and public-sector efficiency from the benefits matrix below.

Table 1.1: BDUK Benefits Realisation Plan

Benefit Type	Outcome/Impact
Productivity Growth	Increased Business Productivity
Productivity Growth	New Businesses Established
Productivity Growth	Increased ICT Skills and Wider Educational Attainment
Employment	Employment (safeguarded or new)
Public Sector Efficiency	More Efficient Delivery and Increased Access to Public Services
Public Sector Efficiency	Cross-Government Learning for Large Procurement Programmes
Digital Divide	Reduced Digital Divide
Public Value	Improved Quality of Life and Wellbeing
Public Value	Consumer Savings
Stimulating the Broadband Market	Stimulated Private Sector Partnerships and Investment
Stimulating the Broadband Market	Market Failure Addressed Through Appropriate Intervention
Stimulating the Broadband Market	Increased Competition in the Market, Including Small Suppliers
Stimulating the Broadband Market	Innovation and Knowledge of New Technologies
Stimulating the Broadband Market	Increased Community Capacity in Procuring Infrastructure
Reducing Impact on the Environment	Reduced Impact on the Environment

2.1.1. Evaluation modules

The evaluation was divided into six modules covering five capital projects and the Connection Voucher Scheme (CVS). The table below outlines the modules, scheme(s) it relates to and the key evaluation aims or questions set out in the research specification.

Table 1.2: Module evaluation research questions

Evaluation Module	Evaluation aims/questions
<p>Module A - Brighton Digital Exchange (BDX)</p>	<ul style="list-style-type: none"> ● What, if any, are the economic benefits of the Brighton Digital Exchange? ● For whom, how and in what circumstances, have these come about? ● To what extent was the public subsidy necessary to achieve these outcomes? ● What has helped or hinder these outcomes to come about? ● Does public investment represent value for money? ● What can be learnt to support future Digital Exchange projects?
<p>Module B - Cardiff Internet Exchange (CIX)</p>	<ul style="list-style-type: none"> ● What are the commercial and economic outcomes of the Cardiff Internet Exchange? ● Was the public subsidy received a necessity to achieve these outcomes? ● Does the public investment represent value for money? ● For whom, how and in what circumstances have these benefits come about? ● What has helped or hindered these outcomes to materialise? ● What can be learnt to support future internet exchange projects?
<p>Module C – Baildon ducting project & Bristol ducting projects</p>	<ul style="list-style-type: none"> ● Has the ducting been used by other providers/companies? ● What is the expected future use of the ducting? ● What outcomes have come about? ● What has helped or hindered these outcomes to come about? ● Does the public investment represent value for money? ● What can be learnt to improve future ducting projects?
<p>Modules D, E & F – Connection Voucher Scheme</p>	<ul style="list-style-type: none"> ● To establish the extent of any spill-over infrastructure build in areas in receipt of vouchers ● What helped or hindered the market to aggregate demand? ● What impact did the Connection Voucher Scheme have on the current pricing of similar products? ● To establish the benefits to businesses of gigabit connectivity

2.2. Methodology

The evaluation involved a theory based evaluation of each of the schemes triangulating monitoring information, evidence from secondary sources, qualitative evidence from stakeholder interviews, and (in the case of the voucher scheme) primary survey research. The approach to each evaluation is described more fully in the Annexes, though the general approach remained broadly similar across each:

- **Analysis of management information:** Documentation and records kept by BDUK and the partners involved in delivery of projects were examined to identify progress made in delivery, resultant outcomes, and challenges encountered. A number of gaps were identified in the available documentation however, with further information sought through stakeholder consultations to fill these where possible but gaps remain (these are detailed in the annexes).
- **Analysis of secondary data sources:** Secondary data sources were analysed to explore connectivity outcomes and economic impacts. The sources reviewed varied by project but included Ofcom Connected Nations data, Thinkbroadband, company accounts data from Companies House and Valuation Office Agency (VOA) valuations of commercial property.
- **Stakeholder consultations:** Consultations completed with relevant stakeholders for each project to explore the expectations of the project, their delivery and the extent to which outcomes have been achieved. Once again, the stakeholders differed across case studies but typically included representatives for each strand from within BDUK, a relevant member of the local body, any delivery partners involved and some of the businesses ultimately affected. There was a need for BDUK to secure consent before contact and there was also a significant degree of churn in local bodies hindering the contact of some key individuals.

The evaluation of CVS also included a survey of voucher applicants in which 616 interviews (539 with voucher recipients and 77 with non-recipients) were achieved using a BDUK provided sample⁷, in-depth interviews with 15 applicants, further stakeholder consultations with 10 of local bodies and voucher suppliers, an econometric assessment of spill-over infrastructure build (using Ofcom Connected Nations data) and a data-linking exercise to match voucher applicants to Business Structure Database (BSD) data on firm performance

2.3. Structure of this report

The remainder of this report is structured as follows:

- **Section 2 - SuperConnected Cities Programme:** Provides an overview of SCCP including an overall intervention logic model for the programme;

⁷Note that there is the potential for non-response bias to be present given the relative lack of non-recipient firms responding. See the Connection Voucher Scheme Case Study for more information.

- **Section 3** – Context: Provides a brief background and context to this research;
- **Section 4** - Programme delivery: Summarises the outputs of the projects evaluated and draws out the Key themes and issues involved in delivery;
- **Section 5** – Connectivity outcomes: Details the key themes influencing the achievement of the expected connectivity outcomes targeted by the projects;
- **Section 6** – Economic Outcomes: Covers the themes, issues and factors influencing the extent to which the projects were able to achieve the economic impacts expected; and
- **Section 7** – Conclusions and recommendations: The final section summarises the main conclusions across the projects evaluated and the key recommendations of relevance both for LFFN and future evaluations of similar interventions.

2. SuperConnected Cities Programme

This section of the report outlines the SuperConnected Cities Programme, the rationale for its introduction and the intervention logic model describing the causal mechanism through which the intervention was expected to lead to the connectivity outcomes and economic impacts targeted.

2.1. Programme overview

Established in 2012 with up to £150m of funding, the SCCP aimed to support the Government's economic growth policy by delivering faster and better broadband to businesses and residents in major cities. There were four objectives underpinning the primary aim of the programme:

- To provide a significant and sustainable upgrade in capability of business connections in participating cities
- To increase the coverage of wireless connectivity in city centres
- Provide a national network of Wi-Fi hotspots in public buildings
- To deliver select cutting edge connectivity projects that will increase broadband capability in participating cities and support a more robust, resilient and sustainable broadband infrastructure

The programme was developed to align with the key spatial development priorities of the Coalition Government, particularly the City Deal Programme that emerged from the 2011 "Unlocking Growth in Cities"⁸ policy paper. The general strategic case for investment centred on research showing that broadband connectivity is a proven driver of growth with the potential for it to increase productivity of firms and the overall output of cities. Market failures in the form of information/co-ordination effects (e.g. a lack of awareness of the benefits amongst business) and positive externalities/network effects were cited in the economic case as factors leading to a sub-optimal level of connectivity provision amongst businesses.

The scheme involved a variety of interventions including several capital projects delivered through a challenge fund, a broadband voucher scheme and public sector wireless upgrades and concessions. Each of these had a specific focus on SMEs. There were 22 SuperConnected Cities in total but 50 cities implemented the voucher scheme aspect of the programme.

⁸https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/7523/CO_Unlocking_20GrowthCities_acc.pdf

2.2. Project summaries

2.2.1. Capital projects

A total of 12 capital projects were funded as part of the programme, five of which were in scope of this evaluation:

Brighton Digital Exchange

Forming a part of the wider refurbishment of New England House, a local authority owned commercial building with around 100 small and medium sized units, this project involved capital outlays to install a fibre optic network to enable occupants of New England House to access ultrafast broadband speeds. In addition, the project involved the installation of an uncontested link to the London Internet Exchange and investment in a data centre on the site. The data centre consisted of racks, digital equipment and a separate server for use by cooperative members. The establishment of this co-operative formed the final aspect of the project. The cooperative model allowed for a carrier neutral aggregation point and was hoped would enable local telecoms suppliers to offer high speed broadband and data services to businesses in Brighton. The main aim of the project was to promote the growth of the creative and digital sector in the city with a total investment of £600,000.

Cardiff Internet Exchange

The Cardiff Internet Exchange (CIX) project formed part of a series of interventions in Cardiff and BDUK funding was originally sought to design, build and deliver an Internet Exchange. An Internet Exchange provides a mechanism through which 'peering organisations' can exchange large volumes of data directly without the need for the transfer to be routed through external networks. This provides potential advantages in terms of reduced costs and latency as well as increased reliability.

A market test day and follow on consultations established that the Exchange could be developed without the need for public sector funding, with London Internet Exchange (LINX) going on to develop the facility. The role of SCCP support was recast to one of providing grant aid for a Connectivity Grant Scheme (CGS) to facilitate SME ISPs and other qualifying SMEs/organisations – in particular data centres, digital intensive businesses and media content providers – to secure connections to CIX. Grants covering up to 100 percent of connection costs were made available to cover the costs of the capital expenditure involved, primarily the purchase and set up of the routers and equipment required to join the facility. In total, BDUK funding for this amounted to just under £660,000 and the CIX is hosted within BT Stadium House within the City Centre Enterprise Zone. It was opened in 2014 and became fully operational in 2015.

Bristol Ducting Projects

The General-Purpose Service Trench (GPST) and B-NET Duct Concession projects were part of a wider SuperConnected Cities Programme in Bristol, 'GigaBit Bristol', to enhance digital connectivity in Bristol. The ducting projects included the following three elements in scope of this evaluation:

- **General purpose service trench (GPST) - also known as the Bristol Temple Quarter Enterprise Zone (BTQ EZ) Duct:** £1.56m of BDUK funding was provided to construct a duct in the BTQ EZ (which aims at supporting the creative industry), to be operated as a concession⁹.
- **B-NET Concession:** £5.3m¹⁰ of BDUK funding was used to repair and extend a duct network owned by Bristol City Council, and to deploy dark fibre, to create the B-NET fibre network. This 76km, 10Gbit/s fibre network can provide high-speed connectivity to nearby premises, including to Bristol University and Broadband Media Exchange (BMEX). Duct access was originally opened through a B-NET concession to the telecommunications market, and now is open on a non-exclusive basis and managed by Bristol City Council.
- **Bristol is Open (BiO) R&D Testbed:** Bristol is Open (BiO) is a Joint Venture between Bristol City Council and the University of Bristol which was formed in May 2015. It is an R&D Testbed based on a fibre network laid in some of the B-NET ducts, and using SCCP funding to purchase additional assets. BiO's purpose is to provide an R&D Testbed facility which researchers and commercial partners (including corporations and SMEs) can use for experimentation and pilot projects, such as testing and developing new hardware and software; it is open to potential users through a proposal process and subject to access charges. The network is secure and private and it was Europe's first Smart City R&D programme¹¹.

Baildon Ducting Project

The Baildon ducting project formed part of the development of the Baildon Business Park and enabled the installation of just under 1km of general purpose ducting beneath the publicly owned road through the centre of the 16-acre park. BDUK contributed £250,000 towards the ducting on the business park with the aim of future proofing the infrastructure on the park and supporting the development of major employment sites as part of the Airedale Masterplan. The site was constructed over three phases with all units in Phases 1 and 2 occupied, and Phase 3 sites either occupied or in final sale with a total of 14 businesses registered onsite. The business park is now known as the Sapper Jordan Rossi Business Park.

2.2.2. Connection voucher scheme

The Connection Voucher Scheme (CVS) enabled SMEs to apply for a voucher entitling them to up to £3,000 towards the costs of upgrading to a superfast or ultrafast connection. Initially offered in the 22 SuperConnected Cities, the scheme was expanded to 50 cities in 2015 and over 54,000 vouchers were issued by March 2016. The scheme was initially administered by local authorities (referred to as the CVS mechanism) with BDUK providing a supporting role in an audit and assurance capacity. However, BDUK took a more central role part way through the programme with the introduction of pre-registered packages (PRP mechanism) to offer

⁹ SCCP Evaluation report – other capital projects summary

¹⁰ Formative interview

¹¹ Final SCCP Lessons Learnt Report

vouchers. The aim of the scheme was to improve connectivity to SMEs, providing an uplift in the speeds they receive and, in doing so, support the Government's economic growth policy allowing the UK's cities to develop the digital infrastructure capability they need to remain internationally competitive and attractive places to invest. However, local bodies were required to outline their own ambitions in their bids for programme funding (such as aims to support sustainable growth and local investment, and developing an enterprise culture).

2.3. Intervention logic model

Whilst each case study is unique, there are some similarities in terms of the inputs, outcomes and casual linkages across both the capital projects and the voucher scheme:

2.3.1. Inputs

The capital projects involved the pooling of resources from both central and local government alongside funding from other delivery partners in some cases. The amount of public funding varied substantially across projects as does the proportion funded through BDUK, local bodies and delivery partners. The simplest case, Baildon, involved only public-sector costs incurred by BDUK covering the construction of the ducting and local body resource costs expended in administration of the project. Costs for the other main delivery partner, the site developer, were covered by the BDUK subsidy.

In the case of the voucher scheme, BDUK funding covered the cost of the voucher (up to £3,000) whilst the SME would be required to cover the remainder of the cost of connection if this amounted to more. BDUK and local bodies also both incurred costs in the administration of the scheme but local body resource costs appeared greater before the switch to the PRP mechanism and several local bodies describe costs incurred in market engagement (although these were not seen to be as significant as those incurred in validation and assurance activity). Finally, some suppliers incurred costs in terms of marketing related to the scheme but these appeared to vary with some suppliers incorporating the scheme in existing marketing.

2.3.2. Outputs

The outputs achieved by the projects vary substantially across projects. These are covered in the case study annexes in more detail and a summary of these are included in section 4 of this report.

2.3.3. Connectivity outcomes

The connectivity outcomes expected from the capital projects and the voucher scheme fall broadly into three categories:

- **Direct connectivity outcomes:** Each project was expected to result in a direct increase in the availability and quality of broadband services through the installation of superfast, ultrafast or gigabit capable technology, and an increase in the take-up of such services amongst businesses (including by allowing businesses to share connection costs through group schemes funded through the voucher programme).

- **Indirect connectivity outcomes:** Although not a direct objective of the programme, the direct effects on connectivity have the potential to lead on to indirect effects on the availability and quality of connectivity such as superfast and ultrafast. Any expansions of supplier's networks brought about by delivering direct connections could lead to reductions in the marginal costs to suppliers to extend their networks further as the cost from going from one premise to another falls the closer the network gets. In turn, this may lead to suppliers extending their networks as more areas may become commercially viable.
- **Wider connectivity outcomes:** This final group of connectivity outcomes includes competition effects and subsequent impacts on price. In the case of the voucher scheme, there was an expectation of increased competition arising as a result of the demand stimulated through the scheme. Suppliers, it was expected, would compete with each other more to capture the new business e.g. through more active marketing or by lowering prices. For the capital projects, the Baildon ducting project, the reduction in costs for suppliers (wholesale costs) to provide fibre connectivity to the site was expected to make the site more viable for more suppliers than otherwise would have been the case. This was also seen to have the potential to reduce prices for businesses locating to the site.

Variations of these outcomes are expected across the case studies with several of these present in some logic models but not others. In addition, other outcomes not mentioned here are applicable to one or more projects.

2.3.4. Economic impacts

The expected economic impacts of the projects fell broadly into two categories:

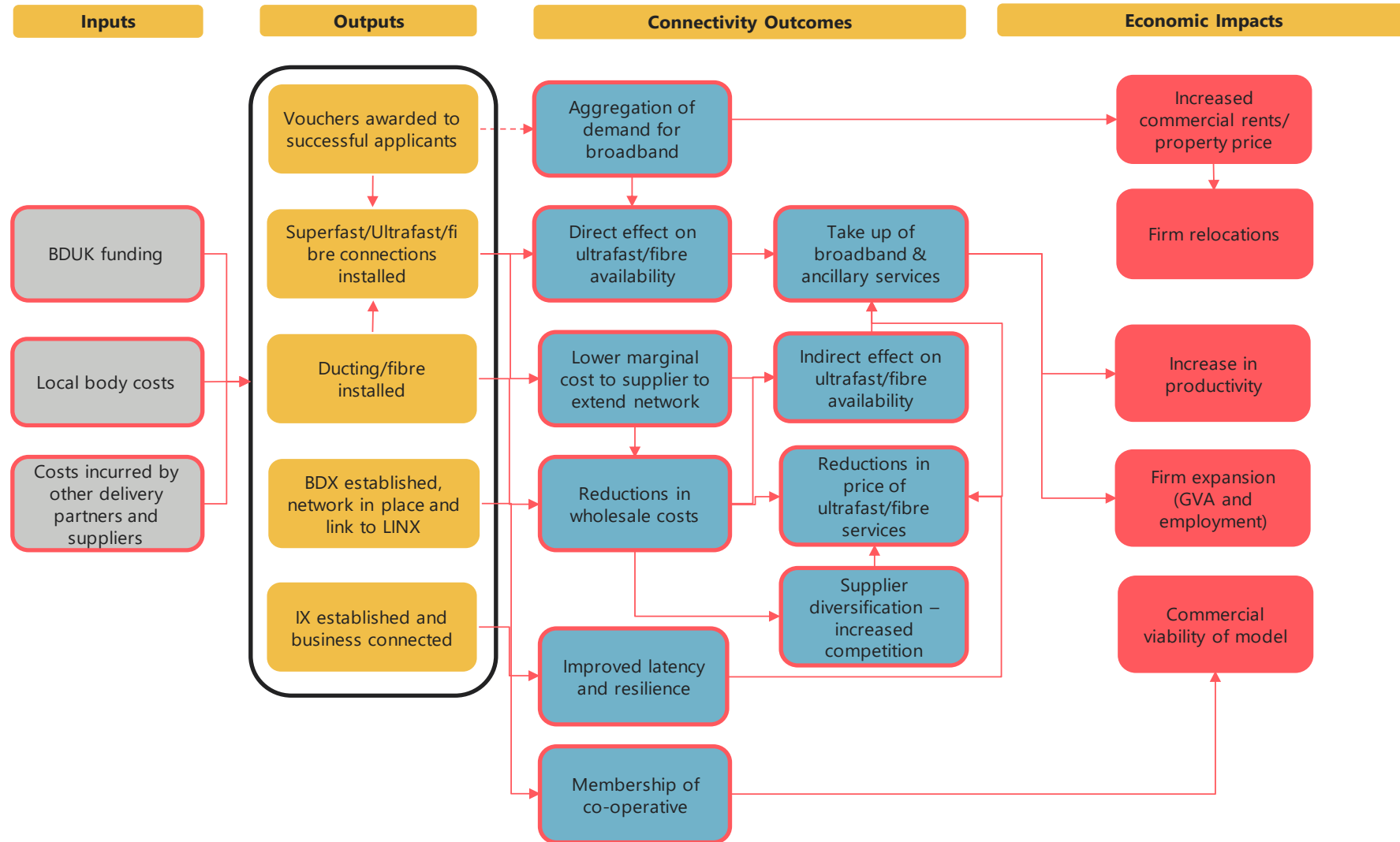
- **Firm expansion and productivity effects:** Take-up of better connections by SMEs is expected to raise productivity as these businesses make use of the improved connectivity to carry out tasks more quickly or to expand their market. An increased market to target may also result in expansions in the size of the firm in order to service the larger market.
- **Wider economic impacts:** The availability of superfast, ultrafast or faster connectivity is expected to result in property market effects, increasing the price of property in the areas affected. A number of projects also include wider economic impacts in terms of the viability of delivery models (such as the co-operative) or wider regional impacts in terms of bringing development forward (e.g. Baildon).

In addition to these, elements of the Bristol project included several social impacts which was not possible to explore in detail as part of this evaluation.

2.3.5. Intervention logic model

The figure below provides a much simplified and condensed logic model for the interventions evaluated. The case studies each present tailored, project specific logic models.

Figure 2.1: Combined intervention logic model



2.1. Lessons from past research

Past research has identified a crucial role of broadband as an enabling technology at the core of the diffusion of the information society and the development of ICTs which are key potential drivers of productivity and growth with the capacity to promote the delivery of new services and the improved delivery of those which already exist¹². It also highlights potential complex effects on local employment with potential positive effects from the acceleration of innovation and the attraction of employment from other regions as well effects on productivity¹³. The evaluation of the Superfast Broadband programme also found a range of positive economic impacts, including increases in employment, turnover and productivity on the postcodes benefitting from superfast availability¹⁴.

Research from as early as 2004 also highlighted that broadband adoption was more ‘demand constrained’, in that it was restricted more by a lack of demand at the time, than ‘supply constrained’ i.e. restricted by the availability of the infrastructure, although policies to deliver access of high speed broadband to end consumers (households and SMEs) have often largely focused upon infrastructure development¹⁵. Previous research from BDUK supports the ‘demand constrained’ view with a BDUK survey indicating a lack of awareness of the benefits of improved broadband¹⁶. This could suggest that a demand side approach focussed, in part on educating SMEs on the benefits, such as a voucher scheme, could alleviate barriers to the take-up of connectivity.

Local evaluations were also carried out by the cities involved in the programme, with the depth and detail of these varying. Many briefly outlined the potential benefits of the capital projects and the voucher scheme, but limited evaluation activity was undertaken to robustly quantify the magnitude of these. In addition, the evaluations reviewed as part of this study did not cover the process employed. Summaries of the outcomes identified in the evaluations for the capital projects as part of this research include:

- **Baildon:** In Baildon, the site was still under development at the time of the evaluation and therefore only the intended outputs were outlined.
- **Bristol:** Similarly, in Bristol the GPST aspect was not due to be completed until after this evaluation took place, so the outcomes were not evidenced. The B-NET concession was

¹² For example: Kongaut, C. & Bohlin, E. (2014). “Impact of broadband speed on economic outputs: An empirical study of OECD countries Paper to the 25th European Conference of the International Telecommunications Society. Brussels

¹³ Katz R and Suter S (2009) “Estimating the Economic Impact of The Broadband Stimulus Plan”, Columbia Business School

¹⁴ Evaluation of the Economic Impact and Public Value of the Superfast Broadband Programme. (2018). DCMS. Available at: <https://www.gov.uk/government/publications/evaluation-of-the-economic-impact-and-public-value-of-the-superfast-broadband-programme>

¹⁵ Stanton L (2004) “Factors Influencing the Adoption of Residential Broadband Connections to the Internet, Proceedings of the 37th International Conference on System Sciences

¹⁶ A BDUK survey was referenced in the business case for the SCCP programme, however, as it was very small scale, it is not publicly available.

in a similar position with the contract still to be awarded at the time. With regard to the BiO R&D Testbed however, the evaluation highlights a total of £1.8m of investment drawn to the testbed and more than 50 SMEs expressing an interest in using it.

- **Cardiff:** The Cardiff City Evaluation outlines a total of 29 grants awarded to connect to the IX which was fully operational from October 2014. Organisations reported an expectation of employment effects in the 3 years following connection. In total, this amounted to a total of 140 forecasted jobs.

No local evaluation was available for Brighton.

Previous work has also been undertaken on the impacts of the voucher scheme¹⁷. This found that the scheme had led to a total of 42,000 firms able to improve their connection to services 18 times faster on average. In addition, a small survey also found an additional increase in employment of 0.27 employees per SME.. However, the sample size was small and the survey did not include a counterfactual with which to compare outcomes against.

¹⁷ DCMS (2017). Broadband Connection Voucher Scheme Impact and Benefits Study. Available at: <https://www.gov.uk/government/publications/broadband-connection-voucher-scheme-impact-and-benefits-study>

3. Context

This section provides a brief overview of the digital infrastructure and policy landscape at the time of the introduction of the SuperConnected Cities Programme. It begins with a short description of the state aid challenges encountered during development:

3.1. State aid challenges

Consultations with BDUK officials illuminated some of the issues faced in the design of the programme and identified state aid requirements and challenges as a key factor motivating a shift in focus and the resulting spread of interventions. Initially, the SuperConnected Cities Programme was to deliver subsidised connections akin to the rural focussed Superfast Broadband Programme (see below), however suppliers expressed state aid concerns about such an approach. Subsidised connections in urban areas could undercut existing leased line connections provided by suppliers resulting in a loss of market share. The need to disburse funds sooner rather than later led to BDUK taking the decision to drop the approach and instead adopt a demand side voucher scheme approach as the bulk of the SCCP intervention.

3.2. Overview of digital infrastructure landscape

In the years prior to 2012, the major suppliers (Openreach, Virgin Media, WightFibre and KCom) had increased the rollout of FTTC significantly, as detailed in the 2012 Infrastructure Report¹⁸. Superfast coverage was estimated to be at 65 percent of UK premises at this point in time, however, there had been limited FTTP roll out to date with data not available. A significant disparity was also evident in the availability of superfast broadband services between rural and urban areas. Whereas 84 percent of urban premises had access to superfast broadband, only 65 percent did in semi urban areas and just 19 percent of premises had access in rural areas.

This disparity provides support for the basis of the Superfast Broadband Programme (outlined below) but could weaken the argument for the focus on cities in the SuperConnected Cities Programme. However, the SuperConnected Cities programme did not directly subsidise connections, as was the case in the former, and instead it encompassed the innovative capital projects, expansion of wireless networks in the public sector and a demand side scheme to encourage take-up.

3.3. Overview of digital policy landscape

The development of the SuperConnected Cities Programme overlapped with the Superfast Broadband Programme which was announced in 2010/11 in response to concerns that the commercial deployment of superfast broadband would fail to reach many parts of the UK. The Superfast Broadband programme was based upon similar expectations as to the SCCP, that the extension of superfast coverage would produce economic, social and environmental benefits. The scheme was initially backed by £530m of public funding, with the aim of

¹⁸ Infrastructure Report (2012). Ofcom. Available at:

https://www.ofcom.org.uk/_data/assets/pdf_file/0027/78237/Infrastructure-report2012.pdf

extending superfast coverage to 90 percent of UK premises by early 2016. The programme was expanded in 2015, with a further £250m made available to extend coverage to 95 percent of premises by the end of 2017¹⁹. Building Digital UK (BDUK) were also the accountable body for the programme.

Delivery of the Superfast Broadband Programme began with the first premises receiving superfast availability in 2013 with the number gaining superfast availability peaking in 2015 at 1.7m. The majority of the contracts for this programme were awarded to Openreach who also played a part in the SCCP through the provision of BT voucher connections through the voucher scheme. The delivery of connections in both programmes would have required the same set of skills and there may have been the potential for a skills shortage, although this was not born out in the evaluation.

¹⁹ A Universal Service Commitment (USC) - that virtually all homes should be able to receive at least 2Mbit/s – was also introduced prior to 2012

4. Programme delivery

This section of the synthesis report covers the delivery of the capital projects and voucher scheme, beginning with a summary of the outputs delivered by each project and the extent to which these outputs were in line with targets. The main focus of this chapter is then on the key themes and issues relating to project delivery that arose throughout the case studies.

4.1. Summary of programme delivery

Each of the individual case studies presented as annexes to this report covers the outputs of each project in detail, however it is clear that on the whole the majority of outputs intended to be delivered were to some extent delivered, albeit with a number of issues arising in several cases. These included:

- **Co-ordination issues:** In the case of the BDX, initial issues were reported in getting companies to collaborate with one another at the outset, and agree on a cohesive and fair governance structure that worked in terms of day-to-day running of the cooperative.
- **Concession model:** The concession model implemented in Bristol as part of the Bristol ducting project, although was said to be initially successful in rolling out fibre through the ducting, ultimately broke down. The reasons for this were however unclear.
- **Supplier capacity:** The case study of the connection voucher scheme highlighted some instances in which suppliers overcommitted to deliver connections. These instances were restricted to certain suppliers but these ultimately resulted in connections not being delivered to SMEs seeking one.

Table 4.1 sets out the key findings in relation to project delivery.

Table 4.1: Summary of project delivery

BDX	Cardiff IX	Bristol	Baildon	CVS
Delivered on time and to budget: This covers the extent to which the project/schemes were delivered on time and within budget, highlighting any issues encountered therein				
Yes	Yes	Partially	Yes	Yes
Delivered on time and to budget, although public subsidy not needed to cover some capital equipment	Delivered on time and to budget, 29 vouchers awarded - although public subsidy not needed to establish the IX	Only the BiO R&D Testbed was delivered	Delivered on time and to budget	No defined timetable to deliver over with scheme ending upon set budget being committed. However, a small number of vouchers were not delivered by suppliers as a result of some over-committing.
Civil and technical outputs delivered: Summarises the extent to which the technical and infrastructure outputs of the projects were delivered e.g. ducting built, connections installed. The first row provides a broad indication as to the achievement of these outputs with the key issues summarised in the row below, where relevant				
Yes	Yes	Partially	Yes	Yes
Data centre, fibre network and link to LINX in place and to specification. Potential to build a higher spec data centre was present but remedial work was required to remove asbestos. However, the link to France was not established	Total of 29 firms connected to the IX	Initial progress made on rollout of fibre as part of the B-NET concession, BiO R&D Testbed complete and ducting in place for GPST	Yes, just over 1km of general purpose ducting in place. However, ducting collapsed not long after completion	See above
Established commercial vehicle: This summarises the whether or not the commercial model of relevance to the project was established and any issues in bringing these about e.g. concession model in Bristol, co-operative in Brighton				
Yes	Yes	Unclear	N/A	N/A
The co-operative was successfully established with an initial seven	IX membership model. Firms connected became members,	Concession model in place and awarded but there remained an	-	No commercial vehicle established as in the other projects, however

Department for Digital, Culture, Media and Sport
Evaluation of the SuperConnected Cities Programme: Final Synthesis Report

members (now six). However, evidence of some initial issues getting the structures in place to manage the co-operative fairly - centred on establishing the day to day management responsibilities	however some have since dropped out	ongoing dispute and the operational status of the concessionaire was unclear		there was a change from the CVS approach to the PRP approach (described in section 2)
Total BDUK cost: Outlines the extent of public funding disbursed by BDUK				
£700,000 (as per delivery plan)	£570,000	£368,000 (B-NET) & £1.56m (GPST) ²⁰	£250,000	£81m (in grants awarded)
Direct connections provided: Summarises the number of direct connections coming about as a result of the delivery of the projects. Note that for both the ducting projects this was not a direct output (which was to have ducting/fibre in place)				
100+	29	Unclear	0 (14)	43,000
Direct connections available for all of the occupiers of NEH	Links to the IX established for the 29 members	Concession and GPST aspects not meant to provide direct connections as an output but these were expected to arise as an outcome. Unclear how many were brought about in initial stages but none at present for the concession	The project was not expected to provide direct connectivity as an output but to install ducting. However, potential generated for suppliers to connect 14 units.	Vouchers issued resulting in a proliferation of technologies but all connections at least superfast capable
Indicative cost per connection: Provides a very rough indication of the average cost per direct connection. The variation in the projects should be kept in mind here with the Cardiff connections different to those in Brighton				
£7,000	£20,000	-	(£18,000)	£1,900

²⁰ A further £3.91m was made available for the BiO R&D Testbed

4.1. Key themes and issues

The summary above provides a high-level overview of the outputs delivered by each project separately, however the case studies highlight a number of common themes with wider relevance to policy and programme delivery in this space in addition to a number of key issues for consideration:

4.1.1. Project planning and market testing

The Cardiff project illustrated the importance of getting large players onboard and ensuring commitments are met. BT reportedly committed to peer with the first 20 organisations which joined the IX and to become a member itself. However, neither took place and the extent to which the first was achievable is debated. This contributed to the heightened expectations of the benefits of the project for members who expected to be able to peer with BT. In addition, the BDX project relied, to an extent, on the redevelopment of the New England Quarter and the plans to place a mast on the roof of New England House which also did not materialise.

This suggests there may be benefit in the public sector testing the certainty of claims made in funding applications to a degree. Such dependencies on wider regeneration, developments and commitments could form a part of the project appraisal process with the ability for BDUK to check and challenge the assumptions and plans put forward in project/funding applications.

4.1.2. Role of the public sector

One factor preventing the emergence of aggregation points, such as the Cardiff IX and the BDX, is a co-ordination problem. Digital and Internet Exchanges reduce the costs of exchanging information between networks, by allowing this exchange to take place locally rather than incurring wholesale charges to use the backbone network. These benefits increase with the number of firms using the Exchange, and at critical point, the benefits of the exchange will exceed its costs. However, before this point, investment in a local aggregation point will potentially be loss making. This creates a co-ordination problem, in that no single firm has an incentive to make the initial investments required. Other market failures that might lead to failure of firms to co-ordinate on such a project include the threat of free-riding, potential unevenness of returns across partners, and the risk that one partner may acquire information about their competitors' operations, that they can exploit to their advantage.

Evidence from both the Brighton Digital Exchange and the Cardiff Internet Exchange projects highlights the most important role of the public sector as that of a co-ordinating body, bringing together and matching local partners and deciding on a location for the aggregation point, as opposed to necessarily providing the capital funding required for construction of facilities and the installation of equipment. The change in scope of the Cardiff project and the evidence from the consultations in Brighton that public subsidy was not considered necessary to cover the capital costs of the BDX are both relevant here. In the case of the BDX, public intervention was seen as key to co-ordinating potential members and defining the location of the data exchange in particular whilst in Cardiff the public-sector role was more around engaging and co-ordinating potential IX members. On the whole, it appears to have been the local bodies

undertaking this role with support from central government in the form of funding, advice and assurance.

Taken together, this suggests that the role of the public sector and the relative roles of central and local government should be carefully considered for digital and internet exchange projects such as these. On the whole, stakeholders in Brighton were of the view that the project would not have gone ahead there had the public sector not played the co-ordinating role. The public sector appears to be most effective at supporting the coordination of potential partners, and the provision of guidance relating to the establishment and running of a co-operative, if relevant, was also considered an important part of the role. In the case of Cardiff, the findings highlight a role for the public sector in engaging potential partners and members through the use of education to develop understanding of the facility and its benefits, subsequently bringing potential members on board.

It is important to recognise the relatively healthy digital and creative economy in Brighton which may have gone some way to easing the requirement for public funding of capital equipment in that case. However, the relatively weaker local digital economy in Cardiff also supports the case for public sector intervention in a co-ordinating role which would suggest that this finding is generalisable to wider digital and internet exchange projects.

4.1.3. Aggregation points and carrier neutrality

The value of aggregation points is connected to the number of users connected and whilst the scale of networks involved is a key factor driving momentum in a project, the involvement of a dominant supplier can produce uneven returns with suboptimal outcomes arising from users not engaging. The BDX involved the creation of a carrier-neutral local aggregation point in which the local network providers connected to a backbone network (Openreach). Similarly, the Cardiff IX was to be carrier neutral with the facility based in a carrier neutral data centre with the location settled on inside BT Stadium House in Cardiff. This latter choice to locate in BT Stadium House created a perception issue in that the exchange was not seen by all organisations involved as entirely carrier neutral having been placed in a major competitor's premise. Whereas the location of the Brighton DX (inside a council owned building) did not present any such perception issues, the choice of location in Cardiff was significant to the extent that members were concerned about leaving their equipment on site, potentially contributing to the relatively few members. In addition, issues were reported in securing day to day access to the building for maintenance and other purposes.

4.1.4. New build developments

The public intervention in the Baildon project was considered necessary by some stakeholders to ensure the business park was futureproofed in terms of its connectivity needs and to ensure the ducting was installed at the most efficient time under a 'dig once' approach. It was suggested that funding constraints faced by the developer would preclude them being able to install the ducting without public subsidy, however it is not clear as to the extent to which funding was constrained in development in this case. The phased nature of the development was seen, however, to leave some uncertainties as to how much ducting would be required, as demand for unit space would drive later phases and, if this was not forthcoming, the ducting

could have been left unused. The uncertain economic climate in the years just prior to the development also added to the uncertainties around demand for plots.

In addition, the case study of the Baildon ducting project would suggest that businesses expect full fibre capability to be present at new developments. Together, these suggest a potential case for a regulatory requirement for full fibre capability to be present on all new commercial developments similar to the proposal for full fibre availability for new homes announced in the Future Telecoms Infrastructure Review²¹. However, consideration of where the burden of cost falls and the potential costs this may place upon developers would need to be balanced against the expectations of businesses, especially where developments take place a long way from existing full fibre infrastructure as may be the case with some business/science parks.

4.1.5. Re-use of existing assets

Initial progress in Bristol would support the principles behind asset re-use, such as in the LFFN delivery model. Public sector intervention is clearly necessary in terms of extending access to the asset to suppliers for connections to be provided and stakeholders valued the opportunity to access and use the asset with initial services provided at a lower cost to businesses. Anecdotally, this was said to have led to an initial increase in full fibre availability (although not evident in the data) in the early stages of the project.

However, the breakdown of the concession model suggests there is a role for the public sector here in terms of identifying the most appropriate model through which access to existing assets is granted. The concession approach utilised in Bristol does not appear to have led to the impacts anticipated (see section 3 and 4 on the connectivity and economic outcomes), beyond those described anecdotally in the initial stages, and the current operational status of the concessionaire is unclear with dormant accounts filed since 2017.

4.1.6. Ongoing maintenance of contracts and infrastructure

The two ducting projects potentially highlight lessons that could be learnt in terms of ongoing contract management and post project completion governance arrangements. In particular, the Baildon project indicates a need for the roles and responsibilities for the maintenance of infrastructure to be clearly defined before construction begins with all parties aware of what they are and are not responsible for. This was made evident when a part of the ducting collapsed, preventing Openreach from providing services through it and there was a significant back and forth between the supplier, business on the site and the site developer to establish who was responsible for repair. Uncertainty over who exactly was responsible for maintaining the ducting led to delays in getting businesses on the park connected and therefore delays in achieving the outcomes. Similarly, there may be lessons from the B-NET concession that are relevant here, however exact details were unclear as was the operational status of the concession model.

²¹ Future Telecoms Infrastructure Review. (2018). DCMS. Available at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/732496/Future_Telecoms_Infrastructure_Review.pdf

4.1.7. Supplier capacity

The evaluation of the voucher scheme highlighted the importance of small suppliers in the expansion of FTTP networks. These suppliers accounted for a large proportion of the FTTP connections delivered, and consultations with a small number of them found that some of these had expanded their 'nascent' networks on from these direct connections. However, the case study of the connection voucher scheme also illustrated a potential for some smaller suppliers to overcommit in some instances. A number of vouchers were issued but for which connections were not delivered for this reason. Similarly, the breakdown of the Bristol concession was reportedly related to this issue with them reportedly taking on a number of similar projects.

It was not possible to fully explore the reasons for which suppliers may have over extended themselves, however it does raise the point that an assessment of the commitments of suppliers would be beneficial at an early stage, and while it is not possible to completely remove these risks, it does highlight the need for robust due diligence, whether that be conducted by central or local government. Central government may be able to fulfil this to a greater extent than local government as they will likely possess greater information regarding the wider national picture and exposure of the supplier. This was the approach taken in the CVS but there may be potential scope to bolster the due diligence activity for the Gigabit Voucher Scheme based upon weaknesses identified with some suppliers in the CVS and any evidence arising from the B-NET concession.

A degree of flexibility could also be provided by the voucher scheme to avoid similar occurrences as in the CVS where SMEs were tied to vouchers already approved but for which the connection would not be delivered. Time limits could be applied to vouchers with the SME free to seek a subsidised connection from a competitor if a supplier cannot deliver the connection in the agreed time. The introduction of such an option may introduce its own set of risks which would need to be carefully considered.

4.1.8. Market engagement activities

Consultation evidence from the case study of the connection voucher scheme provides examples of market engagement which could be done in the context of such a voucher scheme but with the potential for transferable learning:

- **Local body and digital delivery organisation involvement:** The majority of industry engagement activities undertaken throughout the voucher scheme were led by the local bodies and a significant number of digital delivery bodies within these local bodies. Activities undertaken comprised a range of instruments including seminars and presentations designed to educate businesses on the benefits that a better connection could give them as well as email campaigns to raise awareness in the scheme. The local knowledge of these organisations was seen to be an important factor in targeting engagement activities:
 - **Sector/cluster targeting:** Several local bodies took a sectoral approach to their market engagement. Engagement with sector bodies was perceived to be

particularly successful where clusters of businesses in that sector were located in the local area. This approach was typically taken where direct targeting of businesses was not possible.

- **Direct targeting of businesses:** This approach, although not directly evidenced in consultations with a local body taking it, was suggested to have been used by some local bodies where the local knowledge was available to this degree of detail. Where local bodies possessed lists of firms that had enquired about connectivity, or had engaged with the local body via other means but were considered likely to be interested in a voucher scheme, direct communication could be used to improve awareness and was perceived to be better at resulting in a positive outcome (take-up of a voucher).
- **Supplier led engagement:** The findings suggest that supplier led engagement differed across the type of supplier involved with larger suppliers perceived to be more likely to target existing customers, offering a better connection at the same or lower cost, typically through the PRP mechanism. Some smaller suppliers consulted emphasised wider engagements with potential customers, typically through leaflet or telephone marketing, in order to support network development. This point has less relevance to cases similar to Cardiff however, given the different type of project.

4.1.9. Administration of voucher schemes

In many respects, the PRP mechanism already put into practice remedies for some of the issues identified with the prior CVS mechanism. The latter placed the emphasis on the SME to apply for the voucher by obtaining a quote from a supplier before applying to the local body for the voucher. The local body would then assess the voucher application against the eligibility criteria and would be responsible for the issuance of the voucher (the cost of which was recovered from BDUK) and assurance of the final connection being installed. The PRP mechanism sought to smooth out this process by packaging vouchers which were made available to approved suppliers. Suppliers were then able to offer vouchers to SMEs along as the firm and connection met the eligibility criteria that remain unchanged. SMEs were still free to approach suppliers in order to upgrade their connection with a website providing a list of eligible suppliers offering vouchers and active in their area. The Local body still remained responsible for validating the connection usually through a site visit and/or telephone conversation with the SME. The PRP approach offered a number of benefits as evidenced through the evaluation:

- **Reduced burden on Local Authority:** The PRP centralised the approval process for vouchers resulting in local body resource only being heavily involved in validation and assurance activities instead. Local bodies engaging with the CVS described a larger amount of resource being necessary in the administration of the scheme alongside promotion with some of the resource able to be diverted in to further scheme promotion following the change to the PRP.

- **Encouraging supplier marketing:** The PRP mechanism also led to a perceived increase in the degree of marketing activity undertaken by suppliers. Supplier engagement under the CVS was reportedly muted but the introduction of the PRP shifted the focus of promotion partly on to suppliers who could then attach the vouchers to their marketing offer.

In both cases (PRP and CVS), timeliness of approvals was considered a potential area for improvement, particularly where large group schemes required BDUK approval. There may, therefore, be potential to streamline the approval process for large schemes. Similarly, data quality represented an issue for several local bodies where low-quality data meant that they were required to expend further resource assuring the data before they could begin validating connections. Assurance that supplier provided data and processes for providing such data are accurate should be sought wherever possible and the data validated.

4.2. Learning and recommendations for LFFN

The bullet points below summarise the key learning most relevant to the LFFN programme:

- **Use of public funding:** The role of the public sector should be carefully considered in LFFN applications involving digital exchanges or internet exchanges. In such cases alternatives to fund the capital and equipment costs should be reviewed with the likely role of the public body being to co-ordinate partners.
- **Ongoing management of infrastructure:** LFFN contracts should ensure that measures are in place to manage the ongoing use and maintenance of any infrastructure (such as ducting) put in place using BDUK funding, with roles and responsibilities made sufficiently clear to all parties involved.
- **Concession model:** There are likely to be a number of key learning points that can be taken away from the B-NET Concession that should be considered when evaluating applications that propose the use of a similar model.
- **Mitigating supplier risk:** There may be scope to strengthen the due diligence process for the GVS based upon learning from the CVS and the suppliers overcommitting or ceasing to trade.
- **Carrier neutrality:** There is a clear need to maintain carrier neutrality, as well as a perception of carrier neutrality, in projects similar to the IX and BDX capital projects. The lack of which is shown to reduce the participation of partners and hinder the achievement of the indirect connectivity outcomes. The principle does form a basis of the co-operative model being rolled out in Tameside through the TDIC and LFFN.

5. Impact on connectivity outcomes

This section of the synthesis report relates to the connectivity outcomes expected to be realised by the projects explored in the evaluation. As described briefly in section 2, the projects were expected to result in a wide range of direct, indirect and wider connectivity outcomes with each project expected to realise variations of these to lesser and greater extents.

The remainder of this section is split into four sub-sections. The first sub-section explores the direct connectivity outcomes realised by the projects and the key issues and themes arising from the research relating to these, whilst the second and third sub-sections take the indirect and wider connectivity outcomes in turn. The final sub-section outlines the key learning relevant for LFFN projects.

5.1. Direct connectivity outcomes

The direct connectivity outcomes can be split across the direct supply side outcomes and the direct demand side outcomes:

5.1.1. Supply side effects on superfast, ultrafast and full fibre availability

Table 5.1: Summary of supply side direct outcomes

BDX	Cardiff IX	Bristol	Baildon	CVS
Availability of superfast: Did the project lead to increases in the availability of superfast in the areas/for the businesses involved?				
Yes	N/A	Unclear	Yes	Yes
Available throughout NEH (100 percent in 2018)	Increased availability of superfast was not expected as a direct outcome	Consultations suggested initial progress was made in delivering fibre (and therefore superfast) availability, however it was not possible to evidence further and it appeared superfast was no longer available from the concession	Superfast available throughout the site (100 percent in 2018)	Connections installed were to a minimum of superfast speeds
Availability of ultrafast: Did the project lead to increases in the availability of ultrafast in the areas/for the businesses involved?				
Yes	N/A	Unclear	No	Yes
Available throughout NEH (100 percent in 2018)	Increased availability of ultrafast was not expected as a direct outcome	As above	No ultrafast availability on site as of 2018	Resulted in more than 900 ultrafast or faster connections

Availability of FTTP: Did the project lead to increases in the availability of FTTP in the areas/for the businesses involved?				
Yes	N/A	Unclear	No	Yes
FTTP connections available in NEH (not from suppliers in Connected Nations data)	Increased availability of ultrafast was not expected as a direct outcome	As above	No FTTP available on site as of 2018	Resulted in around 2,400 FTTP connections ²²

In terms of the key themes and issues arising from the case studies relating to the direct supply side effects, there were few significant barriers evident across the majority of projects, aside from in Bristol where initial progress appeared to have been made but issues with the supplier and the concession have since undone some of this progress (these issues are explored in a bit more detail in section 4).

However, the extent to which the availability of superfast and ultrafast was additional in each case was also explored:

Additionality of connections brought about

There is a degree of uncertainty around the likelihood that some of these connections would have been brought about in the absence of the projects. In the case of the voucher scheme, the survey suggested that around 60 percent of SMEs that applied for but did not receive a voucher went on to upgrade through other means, however these connections were less likely to be leased line connections and it was not clear whether or not superfast was already available in the area or not.

In the case of Baildon, only superfast availability has been extended to the park to date and it is likely that this would have been the case in the absence of the project. However, in Brighton, the availability of full fibre has not spread much further than small pockets of new developments, e.g. the marina, which may be indicative of the connections available at NEH being additional.

5.1.2. Take-up

Looking across the projects evaluated in this research, the demand side intervention, connection voucher scheme, is shown to be the most successful in terms of bringing about the take-up of superfast and faster connections. The supply side interventions exhibit more mixed results:

²² Note that this is according to the data supplied by suppliers and some uncertainty remained as to the validity of some FTTP claims

Table 5.2: Summary of take-up outcomes

BDX	Cardiff IX	Bristol	Baildon	CVS
Take-up of superfast: Did the project lead to increases in the take-up of superfast in the areas/for the businesses involved?				
Yes	N/A	Unclear	Yes	Yes
18 of 33 connections with superfast in 2018	N/A	N/A	3 of 8 connections of superfast speeds taken up as of 2018 in Connected Nations	Connections installed were to a minimum of superfast speeds – 43,000 connections taken up in total
Take-up of ultrafast: Did the project lead to increases in the take-up of ultrafast in the areas/for the businesses involved?				
Unclear	N/A	Unclear	No	Yes
Whilst ultrafast and full fibre are available throughout NEH there is no evidence in Connected Nations	N/A	N/A	No ultrafast availability on site as of 2018	Resulted in more than 900 ultrafast or faster connections taken up
Take-up of FTTP: Did the project lead to increases in the take-up of FTTP in the areas/for the businesses involved?				
Unclear	N/A	Unclear	No	Yes
As above	N/A	N/A	No FTTP available on site as of 2018	Resulted in around 2,400 FTTP connections taken up ²³

Key themes and issues

Density of local digital economy and lack of large scale users

Both the Cardiff and Brighton case studies highlighted the role of the local digital economy and need for large, marque users when it comes to take-up. The Brighton digital economy was seen as a relatively healthy one whilst this was not so much the case in Cardiff with the local digital infrastructure seen here to be reasonable but somewhat patchy. Whereas, the firms involved in the digital economy in Brighton were comparatively close together spatially, many of the organisations getting involved with the CIX were very much spaced apart and there was the potential that the lack of momentum in Cardiff for the IX before the development of the ‘Action Plan’ may have been partly linked to this.

In both cases there was a distinct lack of large, or marque, members. In Cardiff this has reduced the incentive for smaller firms to join as members as a key driver of their participation is the opportunity to share/peer with larger organisations that account for a large proportion of their data use. The incentive for a large organisation is not so clear however, as they share

²³ Note that this is according to the data supplied by suppliers and some uncertainty remained as to the validity of some FTTP claims

far less with such firms and may not get involved at all. Where they do get involved, large firms could be a 'pull' for other small organisations to join in addition to large firms.

Understanding and marketing of full fibre

There appeared to be a lack of understanding and potentially some confusion amongst businesses consulted across the research in relation to FTTP or full fibre. Consequently, there could be a case for public support to educate SMEs on the technology and how it differs from FTTC or other technologies used to deliver superfast and above connections. In particular, businesses sometimes reported having a fibre connection already when in fact it was an FTTC connection. This appeared to be linked in part to supplier marketing activity and the marketing of 'fibre' connections often referring to FTTC and not FTTP/full fibre. Clarity in supplier marketing would potentially mitigate some of the misconceptions observed.

Demand for connectivity and types of businesses

The businesses located on the business park in Baildon were varied and there did not appear to be a need or desire amongst those interviewed for full fibre services. Those consulted in the research were satisfied with speeds around 80Mbps and were not actively seeking anything faster. Similarly, in Brighton the businesses located in NEH largely fall into the category of either creative or digital industry²⁴ but many appear to be small and/or studios that are unlikely to require ultrafast or full fibre services. Depth research for the voucher scheme highlighted costs as a key constraint for SME to pursue ultrafast and faster connectivity.

The relatively low rents offered in NEH were cited as a key motivator for firm relocations to the building and this is likely considered a more important factor for businesses in the area than the connectivity on offer. Similarly, in Baildon, convenience of the location was a more critical factor for businesses. In addition to this, businesses indicated that high-speed connectivity is something they "expect" from any building, particularly a new development or refurbishment, echoing the points made in Baildon and described in section 4 on the role of the public sector.

Demand aggregation

The group application process was viewed positively by stakeholders. However, a small number of cases were highlighted in which groups 'fell apart' due to firms dropping out as a result of moving and the requirement that the process began anew leading to a duplication of effort.

Demand aggregation was reportedly most beneficial and practical where relatively recent developments were concerned and where clusters of similar firms (not necessarily creative and digital) were based. Local bodies were much more easily able to market to these firms and the proximity of many such businesses meant a group scheme would be more beneficial than a standard application. This would suggest that a viable approach for the promotion of the GVS would be to target such areas. The role of landlords was also seen as largely supporting and in most cases their involvement helped to encourage aggregation. Similarly, engagement with landlords may prove beneficial for the GVS in terms of stimulating group applications. Exceptions to this were noted where landlords were very large, managing a multitude of sites with multiple occupants and in different locations. For such companies, there

²⁴ Except Space Makers Agency Ltd which are property agents and Real Patisserie Ltd which is a baked goods producer

was a perception that the considerable amount of effort required to co-ordinate facilities across their portfolio would discourage them from participating.

Sustainability of co-operative/IX model

With regards to the sustainability of the co-operative model, the BDX was operating at a surplus as of 2018. However, the surplus did not cover the costs of depreciation and the value of the overall assets has been declining steadily over recent years (see section 4). Therefore, whilst the public funding was not considered vital for the capital equipment aspects of the project, public subsidy may be necessary in the future to ensure the sustained operation of the co-operative. The wider plans discussed above are seen as the driver of this with the sustainability of the BDX likely dependent on how far and how quickly wider development comes forward.

Questions also remain over the sustainability of the IX in Cardiff. Given the drop-in membership and the very low level of traffic experienced to date it is not clear how long the model can be sustained. However, the development of the 'Action Plan' (as detailed in the case study of the Cardiff Internet Exchange project) is seen by stakeholders to go some way to addressing concerns over sustainability. It's focus on engaging public-sector organisations into the membership could be a learning point for any other potential IX projects in the future.

5.2. Spill-over build

As described in section 5, there was potential for the projects to lead on to indirect spill-over build but this was not an aim of the projects:

5.2.1. Supply side effects on superfast, ultrafast and full fibre availability

Indirect supply side connectivity effects were evident most notably in the case study of the connection voucher scheme with spill-over build evidenced both on the postcodes containing firms receiving a voucher and also within 200m. For the capital projects however, limited spill-over build had occurred with external factors and delivery constraints a key factor for the BDX.

For both Brighton and Cardiff, significant activities appeared to be underway to revitalise these projects. Stakeholders in Brighton remained optimistic that developments would come forward though and plans to link the project to elements of the LFFN programme were being discussed. Similarly, in Cardiff the development of the 'Action Plan' aims to bring about some momentum behind the project. Therefore, the findings outlined here may change in the future should sufficient progress be made.

Table 5.3: Summary of spill-over build

BDX	Cardiff IX	Bristol	Baildon	CVS
Spill-over build: Did the project lead to any spill-over build occurring?				
No	No	No	No	Yes
Wider development failed to come forward and hindered supplier's ability to expand from the building	No evidence of indirect spill-over build occurring in Cardiff	Issues in the cessation of the concession and lack of fibre deployment in the GPST have led to no progress on spill-overs	The geography of the site prevents spill-over build. The ducting extends from a road on one side with the river Aire on the other.	The voucher scheme was estimated to have led to spill-over build at both the postcode level and within 200m as described below.

Connection voucher scheme

A more detailed econometric analysis of the extent of spill-over build was possible in the case study of the connection voucher scheme owing to the large number of postcodes involved. The analysis was carried out using a 'pipeline' approach in which the postcodes that contained firms receiving vouchers in earlier years were compared to those postcodes with firms receiving vouchers later, on the basis that these firms should be similar in terms of their characteristics motivating application to the scheme.

The findings of the case study of the connection voucher scheme highlight the very localised nature of indirect effects from connections on the availability of superfast:

- **Effect on the postcode:** Each connection voucher was associated with around 1.4 additional premises with superfast availability, suggesting significant spill-overs at the very local level whilst FTTP connections were associated with 2.7 additional premises with superfast availability. These findings would imply that the scheme was successful at raising the supply of superfast connectivity at the postcode level over and above the initial connection installed through the voucher.
- **Effects within 200m:** Each connection was also estimated to lead to 0.06 fewer superfast enabled premises within 200m. This could be indicative of a small degree of displacement if suppliers have diverted attention to these postcodes away from other local postcodes. However, FTTP connections were associated with a further 0.8 superfast enabled premises per postcode within 200m implying a degree of spill-over for such connections.

Table 5.4: Estimated additional number of premises superfast enabled per voucher

	All vouchers	FTTP vouchers
Effect on the postcode	1.4***	2.7***
Effects within 200m	-0.06*	0.8***

Source: Simetrica analysis of Connected Nations data (2018); * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Interviews with voucher suppliers lent some support to the findings with smaller suppliers providing some evidence of full fibre network expansion as a result of connections installed through the voucher scheme. The extent of spill-overs was reported to depend upon the characteristics of the local area with more dense areas most likely to see more spill-over build with business parks cited as an example.

Key themes and issues

The key points arising from the research on these outcomes are described below:

Importance of wider context and contingent delivery

The first key issue of relevance is the importance of wider plans for the local areas involved in projects such as the capital projects explored in the evaluation, in particular where the achievement of outputs and outcomes depends upon the realisation of wider plans. Most evident in the case of the Brighton Digital Exchange, the lack of progress made in the local area in terms of both the redevelopment of the New England Quarter and the plans to place a mast on the roof of New England House has had a significant impact on the extent to which the network outputs and outcomes have been realised. To date, the project has not resulted in a significant degree of spill-over build as was intended (see section 3 for more detail) and the reliance of the project on the wider regeneration appears key to this.

Whilst it is recognised that there is always a risk associated with local development projects to the extent that complementary investments are not forthcoming as a result of planning or funding constraints, there is a need to mitigate this risk to some extent. The bullet points below identify two potential ways to address this point:

- **Assurance of local plans:** Any dependencies on wider regeneration and developments could form a part of the project appraisal process with the ability for BDUK to check and challenge the assumptions and plans put forward in project/funding applications. This should go some way to addressing such issues arising in future projects, however changing circumstances at the local level may still lead to a number of developments not coming forward.
- **Funding of key elements:** Another option could be for BDUK to consider funding some of the aspects of wider development necessary specifically for the achievement of the project outcomes. This would again require scrutiny of the project application and an analysis of exactly which elements are necessary to achieve the desired outcomes but

could potentially reduce the risk that outcomes fail to materialise due to changes in the local context.

Case for a focus on full fibre to expand networks

The case study of the connection voucher scheme presents the findings of the econometric analysis with respect to the technology type of the connections installed. This finds that FTTP were the most effective at generating spill-over build with an additional 2.7 premises on the postcode becoming superfast enabled from each voucher claimed and a further 0.8 premises per postcode within 200m. The findings presented in the case study of the connection voucher scheme are therefore supportive of the strategic case for full fibre connections with the largest impacts on superfast availability present from such connections. Suppliers emphasised the fact that the voucher scheme has helped them to expand very nascent fibre networks outward to an increasing number of customers. Such expansion was not possible with other connections.

5.2.2. Demand side effects on take-up of superfast, ultrafast and full fibre services

Evidence from the voucher scheme shows that the scheme was successful in encouraging the take-up of superfast connections within the areas receiving vouchers but the findings from the capital projects highlights the importance of the indirect supply side connectivity outcomes being realised. For each of the capital projects, limited evidence of wider take-up was found with the aforementioned wider development context in Brighton, the geography of the site in Baildon and the uncertainty around the status of the concession in Bristol all limiting progress.

Table 5.5: Summary of indirect take-up outcomes

BDX	Cardiff IX	Bristol	Baildon	CVS
Spill-over build: Did the project lead to further take up occurring beyond the direct connections?				
No	No	No	No	Yes
Wider development failed to come forward and hindered supplier's ability to expand from the building	No evidence of indirect spill-over build occurring in Cardiff	Issues in the cessation of the concession and lack of fibre deployment in the GPST have led to no progress on spill-overs	The geography of the site prevents spill-over build. The ducting extends from a road on one side with the river Aire on the other.	The voucher scheme was estimated to have led to further take-up at both the postcode level and within 200m as described below.

Connection voucher scheme

As mentioned above, more detailed econometric analysis was possible in the case study of the connection voucher scheme utilising a 'pipeline' approach but focusing on the number of superfast connections taken up instead of the availability of superfast.

The findings of the case study of the connection voucher scheme with respect to the take-up and hence demand side connectivity outcomes highlighted positive findings on the take-up of superfast:

- **Effect on the postcode:** Each connection voucher was associated with around 4 more connections on the postcode of above 30Mbps with FTTP connections slightly higher at 4.1 connections. This would imply that the scheme was successful at also raising the demand of superfast connectivity at the postcode level over and above the initial connection installed through the voucher.
- **Effects within 200m:** Each connection was estimated to lead to a potential 0.4 further 30Mbps or greater connections per postcode within 200m. This suggests that the demand side spill-over outcomes extend wider than the supply side outcomes. However, each FTTP connection was associated with 3 fewer such connections within 200m. An additional set of analyses was also undertaken to explore this anomaly, the results of which were inconclusive. It may be possible that FTTP connections resulted in very localised sorting effects amongst firms, whereby firms seeking FTTP connectivity move very small distances to access it, but this could not be proven.

Table 5.6: Estimated additional number of 30Mbps+ connections per voucher

	All vouchers	FTTP vouchers
Effect on the postcode	4***	4.1*
Effects within 200m	0.4**	-3*

Source: Simetrica analysis of Connected Nations data (2018); * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Key themes and issues

The following theme arose through the research:

Limited evidence of immediate demand for full fibre

Whilst the evidence supports the case for full fibre as a means to expand networks as is the case with the GVS, both suppliers and businesses do not evidence an abundance of demand for such high-speed connections. Voucher analysis by technology type showed that each voucher was associated with 4.1 more 30Mbps or faster connections on a postcode but each voucher is also associated with 3 fewer such connections within 200m. Many businesses reported satisfaction with their superfast speeds and suppliers reported little demand for their more expensive fibre packages compared to other options. This suggests that an approach such as that in the Gigabit Voucher Scheme mandating high speed capable connections would be more effective in future proofing the network and increased reliability.

5.3. Learning and recommendations for LFFN

The bullet points below summarise the key learning around the realisation of the expected connectivity outcomes most relevant to the LFFN programme:

- **LFFN strategic case:** The findings around the extent to which FTTP connections led to extension in the wider network and the availability of superfast and above speeds in the local areas receiving vouchers provide evidence in support of the strategic case for LFFN

and the GVS. The LFFN programme is anticipated to result in the expansion of full fibre networks from the infrastructure brought about to serve public buildings and the evidence here suggests that fibre is likely to provide the greatest degree of spill-over. In addition, this supports the focus of the GVS on gigabit capable technologies.

- **Demand for full fibre:** The voucher scheme findings also indicated a lack of demand for full fibre at present. Many businesses appear satisfied with the connections delivered through the voucher scheme, most of which were below 100Mbps. Many SMEs use of fixed line connectivity was not great enough to necessitate full fibre for capacity reasons and the improvements it would bring over ultrafast were not understood by firms. Consultations indicated price as the key barrier for SMEs to make the jump to full fibre.
- **Assurance and challenge of wider plans and contingent developments:** The LFFN due diligence process should incorporate an element of check and challenge to local bodies on the wider developments of relevance to the project at the application stage. This should incorporate an understanding of exactly which elements of wider plans are necessary for the application to lead to its desired outcomes and assurances that a roadmap is in place to deliver these if not funded through BDUK.
- **Commercial sustainability:** The co-operative model does not appear to exhibit any strong weaknesses that may lead to it being unsustainable and the need for public funding may not initially be around any capital equipment associated with such projects but instead required to coordinate delivery partners and members. However, the evaluation does suggest that the sustainability of the model is intrinsically linked to its members whom, in part, are dependent on the wider context. Brighton highlights these links most clearly illustrating the need for wider development to come forward.

6. Economic impacts

This section of the report covers the economic impacts of the 5 projects/schemes evaluated as part of the evaluation. As described in the overall and individual theory of change diagrams for the schemes, the SCCP programme was expected to result in a range of economic impacts for the areas and businesses benefitting from changes brought about in connectivity e.g. local businesses, peering organisations, co-operative members or voucher recipients²⁵. The individual project level case studies cover the details of which outcomes were expected in each case and a statement of the evidence collected against each in order to arrive at a conclusion, however this report collates the evidence on the economic impacts across all cases to identify common themes as well as areas in which projects deviate in terms of achievement of economic outcomes.

The remainder of this section is split into three with the first section exploring the economic impacts realised by businesses whether they be voucher recipients (CVS), local businesses (Bristol), building/business park tenants (Baildon and Brighton), peering organisations (Cardiff) or co-operative members (Brighton). The second section explores the wider economic impacts that were expected to arise from these projects and the associated combined learning from the case studies. The final section presents the key learning and set of recommendations.

6.1. Business performance impacts

Productivity and expansion effects are common threads across all of the schemes explored in the evaluation with these outcomes expected to arise in each case as a result of the take-up of superfast connections or through any clustering effects brought about the scheme (should like-minded typically digital intensive firms locate to the areas affected).

²⁵ Please refer to the individual case studies for more detail

Table 6.1: Summary of business expansion, profitability and productivity outcomes

BDX	Cardiff IX	Bristol	Baildon	CVS
Business performance: Did the project lead to any business expansion, profitability or productivity effects?				
No	No	No	Some	Yes
Wider development failed to come forward and hindered expansion from the building. Effects for firms on site appear limited	A lack of traffic suggests little use of the IX to date and therefore few productivity or expansion benefits	Issues in the cessation of the concession and lack of fibre deployment in the GPST have led to a lack of connections available for businesses to use	Some small productivity gains discussed by firms but previous connections described as adequate so gains likely minimal	The voucher scheme was estimated to have led to increases in productivity. These gains varied from the faster completion of day to day tasks to larger shifts to cloud computing solutions. Expansion effects were also visible on employment and turnover of firms receiving vouchers

Overall, evidence on the achievement of business performance impacts was mixed across the case studies. Where the capital projects were concerned, the findings were less clear and in several cases external factors have prevented the connectivity outcomes from translating into economic benefits. The termination of the Bristol concession stalled progress in achieving the economic outcomes for businesses in the area of the ducting. Similarly, limited progress in the regeneration of Brighton's New England Quarter limited the ability of co-operative members to provide services to businesses in the wider area which therefore were unable to benefit to any great extent.

Econometric analysis carried out as part of the connection voucher scheme research however, did highlight some Gross Value Added (GVA)²⁶ benefits having been realised through this mechanism in the form of increased employment and turnover. The analysis linked records of voucher applicants to ONS held data on business performance and found:

- **Overall business expansion effects:** Increases of 2.4 and 2.6 percent in employment and turnover respectively were identified following a voucher claim.
- **Technology type:** Breaking down the findings by technology type, both fixed wireless and leased line connections were found to have larger impacts on employment at 3.4 and 4.3 percent respectively. Leased line connections were also associated with positive effects on turnover in the region of 5 percent.
- **Contented vs uncontended lines:** In addition, effects for uncontended lines were found to be larger than for contended connections. Such connections were associated with a 3.8

²⁶ Gross value added is the value generated by any unit engaged in the production of goods and services. It is therefore a measure of output.

percent increase in employment, 4.6 percent increase in turnover and a 0.8 percent increase in turnover per worker.

Table 6.2: Estimated impact of vouchers on business performance

	All vouchers	Leased line connections	Fixed wireless connections	Uncontended lines
Employment	2.4%***	4.3%**	3.4%**	3.8%**
Turnover	2.6%**	5%*	-	4.6%*
Turnover per worker	-	-	-	0.8%*

Source: Simetrica analysis of ONS Business Structure Database (2018) ; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Businesses consulted in the depth interviews also reported productivity gains as having been realised, however most of these were relatively small gains in terms of the speed at which day-to-day task could be completed. However, more significant changes, evidenced in the business survey, were in the use of cloud computing where connections were to ultrafast speeds.

Key themes and issues

Dependency on take up

Firm expansion and productivity effects are reliant on the take-up of superfast or faster connections with take-up a necessary factor in generating economic impacts for businesses. However, across the capital projects explored in the evaluation wider take-up has been limited. The connectivity outcomes section above outlines the key findings with respect to take-up and the issues evident in both their measurement and the extent to which these outcomes have been realised across the projects looked at.

Limited degree of clustering

Local clustering of digital intensive and creative businesses was envisaged as another way for the Cardiff IX, Baildon ducting project and Brighton Digital Exchange to lead to the aforementioned firm expansion and/or productivity effects (these effects could also arise as a result of the Bristol ducting project and the CVS however clustering was not specifically targeted in these cases). Network effects were expected to result in further improvements in the performance of business connecting to the IX, locating to the business park or moving into the building.

However, the extent to which clustering has occurred in each locale has been lower than initially expected. In both, Brighton and Baildon firms moving into the building and business park respectively were not noticeably reliant on high quality, above superfast speeds on the whole. In NEH, the 21 businesses moving in were largely creative studio type firms and very

small in size whilst the tenants of Sapper Jordan Rossi Business Park constitute a mix of sectors with a minority of firms dependent on high quality internet connectivity.

Factors such as the artificially frozen rents in NEH have likely had an impact on the extent to which clustering has occurred there, with the increased connectivity capability of business space not reflected in the prices offered to tenants and therefore there has been no rationing of the connectivity through the usual price mechanism. The evidence from Baildon also suggests that other factors are considered to be more important to businesses when it comes to relocating. Relatively small scale regional developments, such as the Sapper Jordan Rossi Business Park, would appear to be attractive to many local SMEs primarily because of the location and the convenience such sites offer to management and employees who often live locally. In addition, the size of the plots on the development were of a size attractive to many local firms looking to expand to some extent regardless of the connectivity needs of the business. Taken together, this would suggest that the businesses moving to such sites are willing to pay for the connectivity anyway, on the assumption that the cost of acquiring or renting a plot/unit would be higher than it otherwise would have been had the ducting not been present.

Realisation of productivity benefits and firm profitability/expansion

The case study of the connection voucher scheme identified some productivity benefits arising from the voucher scheme. There was evidence that firms have been making use of their upgraded connections and they envisage some productivity gains to be realised. However, these were predominantly small gains in terms of the speed at which relatively simple day-to-day tasks could be completed. A small number of firms report more substantial benefits in terms of productivity with one example where a firm gained the ability to more quickly transfer and share large files with clients with ease, something not possible before. It was also clear that the extent of any productivity benefits accruing to SMEs through the voucher scheme depended in part on the base level of connectivity prior to upgrade. Where speeds were very slow or connections fairly unreliable beforehand, the benefits were perceived to be larger.

Overall, the above provides support for the GVS and suggests that firm expansion and profitability effects could be realised through that scheme.

Limited awareness of the benefits of full fibre connectivity amongst SMEs

Findings from the depth interviews with businesses highlight a limited degree of awareness in relation to the benefits that full fibre connectivity could bring. There was a clear perception that full fibre meant simply faster speeds to most SMEs, a need for which did not exist at present given satisfaction with current speeds. However, a small number of firms did note the resilience of full fibre networks and recognised the role such technology could play in future proofing the network. Cost remained a key factor for SMEs, however, with many unable to justify the current rate for full fibre connectivity.

There could then be a case for public intervention in the form of raising awareness of these benefits in the delivery of the GVS as was incorporated into the CVS around superfast speeds. This could educate SMEs on how to use the technology and the potential for future benefits, helping to build a business case to justify the costs involved.

6.1. Wider economic impacts

The wider economic impacts cover impacts on property markets, firm relocations and the viability/sustainability of particular delivery models (e.g. co-operative model or IX):

- **BDX:** A limited number of relocations to NEH were evidenced in the evaluation with connectivity not considered key in the SMEs considerations. Property market effects were not evident in this case either using VOA data. This is likely a consequence of the data collection taking place before project completion and the artificially low rents in the building. Finally, findings on the commercial sustainability of the co-operative model were inconclusive. Whilst the co-operative has produced a surplus in recent years, the value of assets has depreciated at a rate exceeding this and the reserves held.
- **Baldon business park:** Wider economic impacts in Baldon include the acceleration of site development. It was thought that the plots would have taken slightly longer to sell/lease in the absence of the ducting and access to fast and reliable connections was considered a requirement for most firms and in particular on new developments. Relocations to the site, however, were largely local in nature with convenience and access to a larger space the key drivers of these. Finally, the general-purpose ducting was expected to lead to reduced costs of other non-connectivity related utilities such as gas and electricity. Whilst these outputs were delivered, no evidence was provided on any cost savings these may have led to and the expectation is that these would be minimal.
- **Cardiff IX:** A range of economic development impacts were highlighted in relation to the Cardiff IX but the extent to which these had been realised to date is unclear. Stakeholders remained optimistic, however, that the IX would be able to deliver some of these including the expected 140 jobs and potentially an expansion in the local digital ecosystem.
- **CVS:** Evidence of effects on rents was found in the case study of the connection voucher scheme with estimates from econometric analysis suggesting that each voucher was associated with between a 0.6 to 0.9 percent increase in the rateable value per m² (a proxy for rental value of non-domestic property) on the postcodes that contained an SME receiving a voucher. In addition, spill-over impacts were indicated within 200m with an increase of between 0.3 and 0.4 percent. This could be understood as a measure of productivity gain as the uplift in value should be equal to the expected gain in productivity. The estimates here are consistent with the estimated productivity gain from uncontested line connections of 0.8 percent within the postcode, described in the section above, giving confidence that this is a true productivity effect.

When broken down by technology type, FTTP connections were associated with larger than average effects on postcodes within 200m at between a 0.7 to 0.8 percent increase in rateable value but not on the postcode itself, whilst cable and ethernet first mile connections were similarly effective at increasing rateable value on postcodes within 200m but not on the postcode itself.

The picture in Bristol remained unclear given the activities the evaluation team were able to undertake, but the extent to which any wider economic impacts are likely to have arisen is probably limited. This conclusion is based upon the lack of realisation of many connectivity outcomes and apparent breakdown of the concession model.

Key issues and themes

Increased rents

The potential impact on rental values evidenced through the connection case study of the connection voucher scheme could present two competing effects. A rise in the value a landlord can charge would be a benefit to them allowing for an increase in revenue but this creates a corresponding negative effect on the tenant. This could have the effect of forcing out tenants that are unable and/or unwilling to pay this increased cost. However, the land value uplift brought about should reflect the productivity gain to incoming firms paying the new rate. This means it is possible to generate a BCR based upon the increase in rental values evidenced through the case study of the connection voucher scheme. This is included in Annex A.

6.2. Learning and recommendations for LFFN

The lack of evidence pertaining to the economic impacts achieved to date through the capital projects explored can be traced back to the limited extent to which the connectivity outcomes were achieved. Issues in delivery and external factors limiting progress have hindered the achievement of these economic impacts. In spite of this, the bullet points below summarise the key learning around the realisation of the impacts most relevant to the LFFN programme (predominantly from the voucher scheme):

- **Potential for firm expansion and productivity effects:** The evidence indicates significant potential for a voucher scheme, such as the GVS, to lead to firm expansion and profitability effects. The speeds involved in that scheme could also indicate effects of magnitudes larger. This is evidenced to some extent in the previous evaluation of the Superfast Broadband Programme²⁷.
- **Raising awareness of the benefits of full fibre:** There is a potential case for complementary activities to be undertaken by the public sector in raising awareness amongst SMEs of the benefits full fibre could bring them. Through supporting businesses to generate a justification for such connectivity, public intervention could begin to make some headway in raising the demand for full fibre networks that appears to be relatively weak at present (described in section 5).

²⁷ Evaluation of the Economic Impact and Public Value of the Superfast Broadband Programme. (2018). DCMS. Available at: <https://www.gov.uk/government/publications/evaluation-of-the-economic-impact-and-public-value-of-the-superfast-broadband-programme>

7. Conclusions and recommendations

The final section of the report provides a broad overview of the realisation of outcomes from each section above and presents the key recommendations for LFFN alongside recommendations for future evaluation activity of similar programmes.

7.1. Conclusions

In general, across the projects evaluated in this study, there has been substantive progress in terms of the realisation of direct connectivity outcomes across all aspects. However, the realisation of indirect and wider connectivity benefits appears less evident for the capital projects. Programme delivery issues were seen to be largely responsible for this, as described in sections 5 and 6). The voucher scheme however, illustrates a range of indirect effects which help support the foundation of the GVS and the LFFN Programme.

Evidence of the economic impacts is also less evident in many cases for the capital projects, hindered by the lack of the connectivity outcomes coming about. Once again, the voucher scheme provides the strongest findings suggestive of significant impacts on SMEs.

7.2. Recommendations for LFFN

The sections of the report above highlight the relevant learning for LFFN. These have been combined into a set of recommendations below:

- **Raising awareness of the benefits of full fibre:** There is a potential case for complementary activities to be undertaken by the public sector to raise awareness amongst SMEs of the benefits full fibre could bring them. Through supporting businesses to generate a justification for such connectivity, public intervention could begin to make some headway in raising the demand for full fibre networks that appears to be relatively weak at present (described in section 5).
- **Use of public funding:** The role of the public sector should be carefully considered in LFFN applications involving Digital Exchanges or Internet Exchanges. In such cases alternatives to fund the capital and equipment costs should be reviewed with the likely role of the public body being to co-ordinate partners.
- **Ongoing management of infrastructure:** LFFN contracts should ensure that measures are in place to manage the ongoing use and maintenance of any infrastructure (such as ducting) put in place using BDUK funding, with roles and responsibilities made sufficiently clear to all parties involved.
- **Concession model:** There are likely to be a number of key learning points that can be taken away from the B-NET Concession that should be considered when evaluating applications that propose the use of a similar model. The evaluation has been unable to delve into these issues in any detail but BDUK may be better placed to explore them.

- **Mitigating supplier risk:** Finally, there may be scope to strengthen the due diligence process for the GVS based upon learning from the CVS and the suppliers overcommitting or ceasing to trade.

7.3. Recommendations for future monitoring and evaluation activity

The SuperConnected Cities Programme was the first large scale public intervention in the digital infrastructure space administered by BDUK and throughout the delivery of this evaluation, a number of lessons for future monitoring and evaluation activity came to light. However, it should be noted that BDUK has since invested in its evaluation activities with evaluation now considered earlier in programme design:

- **Building evaluation into the design of programmes:** The relative lack of monitoring information collected throughout for the capital projects included in the SCCP Programme highlights the importance of considering evaluation when designing programmes. In particular, the collection of monitoring information is a key factor enabling robust evaluation and should be mandated for all projects. Such information should include the collection of data on the outcomes before, during and after project completion where possible and not just the outputs delivered. This is something for which steps have been taken in the design of the LFFN programme and other BDUK programmes alongside BDUK investment in a data strategy to make use of existing Management Information (MI) to support evaluation activity.
- **Timing of research:** Evaluative research should ideally take place throughout delivery and after where possible. Formative evaluation during delivery can then provide feedback necessary to adjust the programme in order for it to better meet its stated aims. Summative evaluation can then be carried out post completion to assess the extent to which those aims were met. Between delivery of the projects evaluated and the point at which this evaluation was conducted, a significant period of time had elapsed. Institutional and individual memory was consequently eroded with churn in local bodies and the dissolution of many local connectivity programme delivery bodies contributing to the problem. However, the approach to evaluation of the LFFN programme seeks to mitigate these problems with external evaluation activity conducted in parallel for Wave 1 projects and evaluation is considered much earlier in the project lifecycle across the BDUK portfolio.
- **Provision to process data:** Given the introduction of General Data Protection Regulation (GDPR) in May 2018, there is a need to identify the legal basis upon which personal data is processed. Where this evaluation was contracted just prior to this, the legal basis had not been established leading to a delay in delivery. Specifically, this led to a requirement to pursue an additional opt-in exercise for the voucher scheme survey which impacted response rates. New programmes will now need to consider the legal basis for the processing of personal data and the implications of the chosen legal basis on evaluation activity should be carefully considered. Linked to this, contracts and grant agreements should include provisions for data processing alongside mandated data collections in relation to the outcomes (as described above). Where legacy projects such as SCCP are

concerned, it would be necessary to review any contracts or agreements for restrictions on data processing and transfer.



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