Report for the States of Guernsey

Guernsey Connectivity Review

25 April 2016

Ref: 2004591-402

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1 Executive summary

A core part of the States of Guernsey's ten-year *Public Service Reform Framework* is the delivery of its *SMART Guernsey* programme, aimed at progressing government's digital growth strategy. *SMART Guernsey* is about using modern technology to empower service users and the whole community, and supporting a competitive business environment. One of the commitments of the programme is that the government will define the future connectivity requirements of the island, and it is in this context that the States of Guernsey has commissioned Analysys Mason to conduct a connectivity review.

It is anticipated the results of this review will enable the States of Guernsey to develop a more detailed telecoms strategy to fulfil the Bailiwick's longer-term ambitions, and help create the right set of conditions that will enable further industry growth, sustained development of the digital sector, the future delivery of new digital government services, and a digitally enabled society with the right choice of products and services. Below we provide a summary of the main points of each of the section of the report.

In Section 3 we consider the characteristics of Guernsey's telecoms market, looking at both on- and off-island connectivity

By many international standards, Guernsey is well connected, with a range of products and services broadly comparable to other markets. There are multiple service providers and several infrastructure operators, including three separate mobile network operators, and a number of owners of off-island subsea fibre cables.

With high levels of security, resilience, capacity and a good choice of data centres and hosting providers, the island is also well positioned to provide data storage and hosting solutions.

The broadband market continues to show steady growth, and in 2013, the broadband penetration was measured at 86% of households. Most fixed broadband services in Guernsey are delivered using legacy copper-based products, and take-up of next-generation access technologies stands at less than 10%. However, where Next Generation Access (NGA) services are used, download speeds compare very favourably to global benchmarks.

All three of the mobile network operators provide 4G (LTE)[1] coverage, and availability is generally widespread.

[1] 4G: a fourth-generation mobile technology, capable of delivering high-speed broadband. LTE: Long Term Evolution, the most common 4G technology.

In Section 4 we consider the future digital environment and connectivity requirements for government, businesses and citizens

For Guernsey to continue to develop its existing business sectors, and attract the scale of inward investment it needs to deliver its economic development ambitions, an advanced telecoms environment is essential.

For large enterprises, access to high-speed connectivity is vitally important, and continuing to meet the needs of these larger businesses will ensure they play a key and growing role in Guernsey's economic success.

SMEs' connectivity requirements are increasing rapidly, and research in the UK suggests there is some evidence of a 'product gap' between consumer-type broadband services, which for many SMEs do not offer sufficient levels of performance to run business-critical applications, and dedicated connections (leased lines) which are unaffordable for many small businesses.

Government and public-sector institutions are expanding their use of online services and advanced digital technologies, and their demand for secure, reliable connectivity will continue to rise.

For consumers, the primary growth driver for fixed broadband usage appears to be rich media content, i.e. video-dominated services such as YouTube, catch-up TV services like iPlayer, and other video applications. Our forecasts of consumers' bandwidth requirements suggest that in the foreseeable future the use of VDSL[2] by operators is likely to be sufficient to meet most household's needs.

In Section 5 we consider the required infrastructure and products needed to deliver Guernsey's future connectivity requirements

Our engagement with stakeholders shows that in general the demand for on-island leased-line products is being satisfied and that sufficient capacity is available. However, the price of leased lines is viewed by many as uncompetitive and high when compared to other jurisdictions.

We welcome the related market reviews conducted by CICRA and support its conclusions on market dominance and the differential pricing of leased lines. Nevertheless, data confirms users' perception that the price of on-island leased lines is high when compared to other markets such as the UK (even though the price of on-island 10Mbit/s and 100Mbit/s Ethernet circuits in Guernsey is broadly comparable to similar products in Jersey.)

If the higher pricing of leased lines in Guernsey compared to other jurisdictions persists, then further analysis may be required to understand the extent to which this is potentially detrimental to the local economy.

[2] VDSL: Very-high-bit-rate Digital Subscriber Line. (VDSL) is a technology using existing copper telephone lines for the final drop to the user premises, combined with fibre to the cabinet (FTTC) infrastructure which provides fibre connections from the street cabinet onward to the core network. The second-generation of VDSL (ITU-T specification G.993.2) is referred to as VDSL2.

ADSL[3] and VDSL are used to provide most fixed broadband services on the island, but these technologies have the limitation that the length of the copper cables to users' premises increases, the delivered bandwidth decreases. This drawback is not so serious in Guernsey, however, as the distribution of line lengths on the island is such that ADSL and VDSL performance is relatively high for the majority of those using broadband provided over Sure's copper access network.

Less than 10% of customers are connected to a VDSL service, so further demand stimulation is required in order to increase VDSL take-up.

We estimate that the overall cost of a VDSL solution to connect every domestic property on Guernsey would be in the region of GBP11 million.

There is a variety of 'DSL acceleration'[4] technologies which can improve the bandwidth–distance performance of copper connections and hence increase download speeds. Sure has indicated that these technologies are included in its roadmap for improvement of its network.

The justification for investment in FTTH[5] needs to be strong, since the deployment costs are significant: we estimate the overall cost of an FTTH solution to connect every domestic property in Guernsey could be in the region of GBP60 million. However, it is important to note that the costs of FTTH deployment depend on a wide range of factors, and any estimate of costs needs to be taken with these variations in mind.

Like the price of on-island leased lines, the price of off-island connectivity is viewed by many stakeholders as uncompetitive and high when compared with other markets. We welcome the related review conducted by CICRA, and the conclusions reached can be broadly supported. The underlying issue, at least in part, appears to be the low traffic volumes on off-island links. The high transit costs to IXPs[6], such as those in London and Paris, could also be a contributory factor. Nevertheless, if the high pricing of off-island connectivity persists, then further analysis may be required to understand whether this is detrimental to Guernsey's economy.

In terms of capacity, the capacity of the existing subsea links appears to be sufficient to deal with traffic demand in the near-to-medium term.

3 ADSL: Asymmetric Digital Subscriber Line. ADSL is an access technology which uses legacy copper lines between the customer's premises and the local exchange, with no optical fibre components in the access network.

4 'DSL acceleration' has emerged as an umbrella terms to describe a variety of technical innovations that can increase the speed and/or the reach of Digital Subscriber Line (DSL) broadband services.

5 FTTH: Fibre to the home; sometimes referred to as fibre to the premise (FTTP). FTTH is a network architecture where fibre replaces the legacy copper access network completely and connects the exchange directly to the end-user premises.

6 Internet Exchange Point (IXPs) are technical facilities used for the interconnection and exchange of Internet traffic.

All of the mobile operators in Guernsey are migrating to 4G, but further investments in 4G network quality and coverage will be required to ensure the networks can deliver the mobile broadband speeds possible in future variants of the LTE standard.

For small island economies such as Guernsey, with characteristics that make providing some infrastructure services costly, effective regulation is critical to keep prices no higher than they need to be. It can also ensure that service providers are able to recover fair and reasonable costs – and in doing so lead them to seek innovative service delivery solutions better suited for small islands.

In Section 6 we provide insight to inform some of the wider decisions facing the government

Given the market's size, it could be more effective to concentrate on retail competition rather than network competition. The States of Guernsey and industry could therefore collaboratively develop and implement goals in terms of developing the island's infrastructure.

A number of options might be considered to make better use of existing infrastructure, including sharing of network infrastructure, improved access to State assets, and the use of a network co-investment (NetCo) model.

With close to 60% of customers able to connect to an NGA service, the States of Guernsey might consider action to help achieve ubiquitous access to high speed broadband services. Key to this would be consideration of:

- How to encourage and accelerate further investment in the commercial rollout of high-speed services.
- Extending availability of high-speed broadband through potential intervention for segments of the population where commercial investment is unlikely to occur without action from government.

The government's role in supporting the commercial roll-out of high-speed broadband services is to remove barriers to investment, cut red tape that increases the cost of roll-out, and ensure the continuance of a well-designed regulatory framework that makes Guernsey an attractive place to invest.

To the extent that such actions lower the marginal costs of the provision of high-speed broadband they could increase the availability of commercially driven high-speed broadband services, and reduce the need for any intervention. However, where commercial investment is unlikely to occur without action or support from government, some form of public intervention may be warranted.

Based on the bandwidth requirements forecasts set out in the report, the financial arguments for using lower-cost solutions such VDSL and G.fast[7] to deliver more than the median demand become more compelling than a wide-scale FTTH/P roll-out at this point in time.

Notwithstanding this financial argument, the gigabit speeds delivered by FTTH undoubtedly have promotional benefits, both for the service providers that offer such speeds, and also to the municipalities where they are available. It can also be argued that FTTH is 'future proof' – whilst the immediate benefits may be limited, FTTH offers ample capacity for substantial future requirements, even if today we cannot identify what might drive those requirements.

The intensity of aid for broadband projects can vary considerably, depending on the scale of private-sector investment. This in turn is determined by a number of factors, including the overall expenditure required, the uncertainties around the level and rate of take-up, the risk related to market demand, and the strategic value associated with winning such a contract.

The government WAN[8] contract with JT has shown that moving to a more integrated and shared infrastructure model can deliver efficiencies across the public service. However, aggregation of public-sector demand in this way can also have a significant effect on the market in Guernsey, since such demand represents a sizeable share of the overall market.

Data connectivity pricing, both on-and off-island, is viewed by the local digital industry as uncompetitive and high, and could be potentially damaging to existing firms and a deterrent to potential new businesses.

In Section 7 we summarise our conclusions and recommendations

In relation to recent market developments, we propose that the States of Guernsey should continue to consult with CICRA and adopt a pragmatic view, recognising that the proposed merger of JT and Airtel-Vodafone should be judged on an individual basis.

Consideration should be given to how infrastructure sharing might be promoted in Guernsey. However, infrastructure-sharing deals can require extensive engagement with government and regulatory authorities, and a collaborative approach with CICRA and industry would therefore help serve to overcome any issues or concerns.

7 At a basic level, G.fast works by expanding the frequency range used by broadband signals. VDSL2 technology uses 17MHz and 30MHz, while G.fast widens this to 106MHz and to 212MHz.

8 A wide area network (WAN) is a telecommunications network or computer network that extends over larger geographical distances.

The establishment of a 'one-stop shop' should be considered that would allow operators who wish to use State assets such as fibre or ducts deal with one entity rather than multiple Departments.

Ensuring that easily accessible ducting is installed at the construction stage of new major public construction projects, as well as in new-build private developments, could encourage the roll-out of fibre across Guernsey.

Guernsey might also contemplate innovative regulatory approaches and models in order to promote future investment in telecoms infrastructure, and in particular consider whether there is an economic case for a network co-investment model (NetCo) – and if so, how the model could be implemented so that it delivers benefits to all stakeholders.

We note that a number of EU Member States have embarked on a range of projects designed to meet high-speed broadband targets. These, together with numerous projects elsewhere, provide a sense of the scale of investment that governments worldwide are committing to improve broadband networks.

The potential scale of public subsidy required to provide high-speed broadband to all properties in Guernsey would depend on the download speed target determined by policy makers, and would also depend on the investment appetite shown by the private sector.

Not rolling out FTTH would avoid substantial cost, and leaves open the option of delivering increased broadband speeds through relatively less expensive technologies. However, it clearly carries the risk that over time Guernsey's digital infrastructure becomes outdated in its capabilities.

The long term economic benefits of any significant public sector intervention are normally demonstrated through a detailed cost – benefit analysis, including the consideration of a 'do nothing approach'. Policy makers should consider undertaking such analysis to ensure the States of Guernsey and the public receive value for money from any public subsidy provided.

The right balance needs to be struck between the costs and benefits associated with the government WAN contract, and the potential negative effects on the market. We suggest careful analysis is necessary to identify the most effective procurement strategy for any future contract renewal, and the form and scope of aggregation to be pursued. Any contract renewal should also be cognisant of the recommendations made in the Analysys Mason WAN/telephony project report from 2012.

If the high price of on – and off – island connectivity persists, then further analysis may be required to understand the extent to which this may be inhibiting business growth and development and potentially damaging the economy.

Government, CICRA, telecoms operators and knowledge institutions could work collaboratively to bring tests of international stature to Guernsey. Such initiatives could provide companies from around the world the opportunity to test, research, develop and launch products and services in an actual real-life market environment.

To improve access for telecoms services, the States of Guernsey could consider issuing technical guidance as part of, or as an accompaniment to existing buildings regulations, to increase awareness of data infrastructure issues and promote good practice.

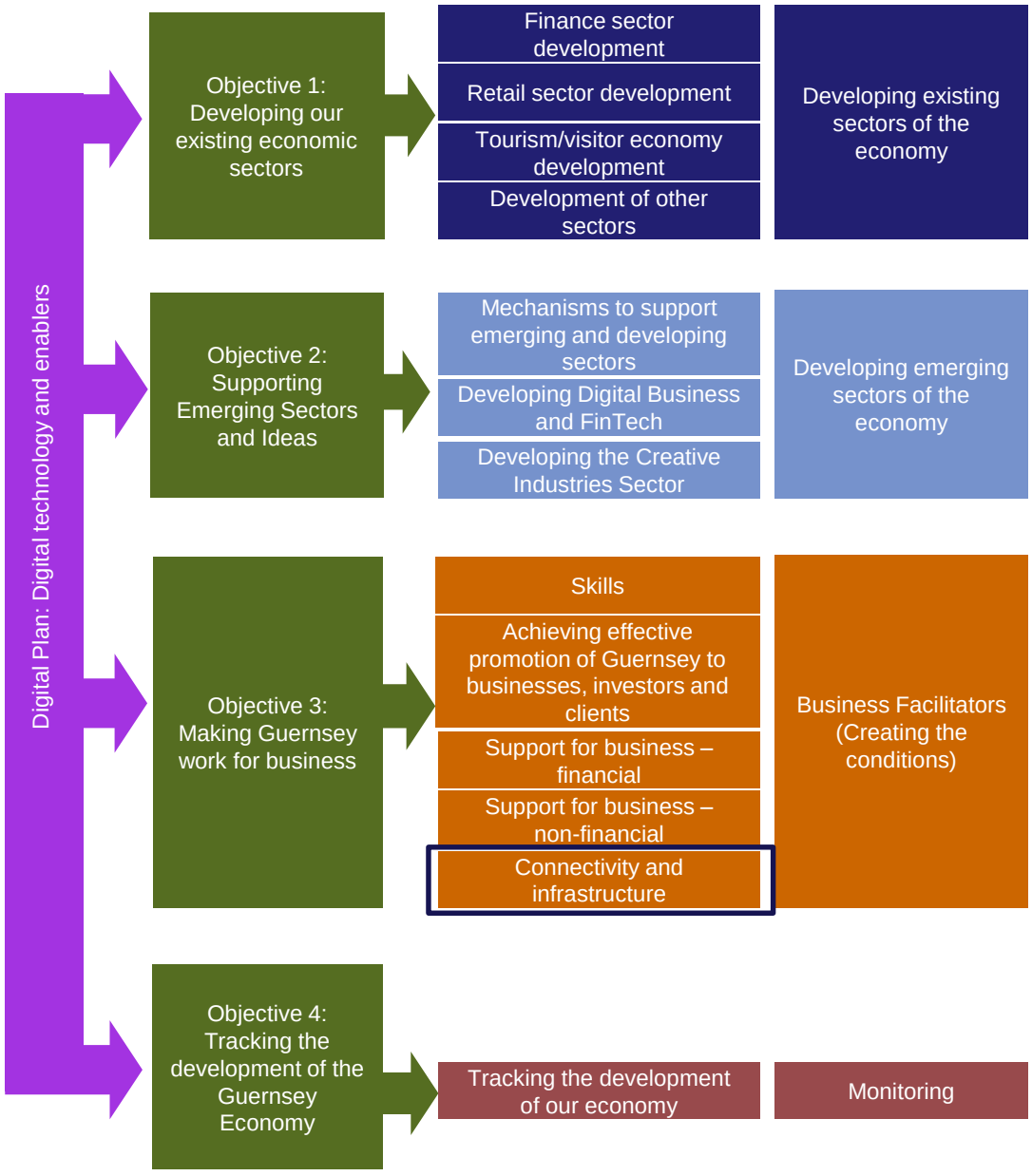
The States of Guernsey could consider a similar initiative to the UK's connection voucher scheme. However, further analysis would also be needed to confirm the extent to which such a demand-led scheme would be likely to improve the overall availability of broadband infrastructure.

2 Introduction

Background

In February 2014, the Commerce and Employment Department of Guernsey, in conjunction with the Policy Council, published the *Strategic Framework for Economic Development* which sets out four key objectives to develop and diversify Guernsey's economy; these are summarised in Figure 2.1. The Framework set in train key pieces of foundational work and research, many of which were focused on ways of making Guernsey a more attractive and easier place in which to do business.

Figure 2.1: Key objectives and digital and technology enablers set out in the Strategic Framework for Economic Development [Source: States of Guernsey, 2015]



As part of the foundational work and research, the States of Guernsey identified a need to undertake a connectivity review within Guernsey, Alderney and Sark in order to define the future requirements for citizens, businesses and government. It is anticipated the results of this review will enable the States of Guernsey to develop a more detailed telecoms strategy to fulfil the Bailiwick's longer-term ambitions, and help create the right set of conditions for further industry growth, sustained development of the digital sector and delivery of new digital government services, and to further promote a digitally enabled society with the right choice of products and services.

Objectives

The objectives of this study, as defined by the States of Guernsey, were to:

- Define the future digital environment for government, businesses and citizens supporting: (a) the delivery of the SMART Guernsey and eGov agendas; (b) existing digital industries; and (c) the development of new and emerging digital industries, and new consumer products.
- Define future connectivity requirements for government, businesses and citizens.
- Investigate and analyse the mix of infrastructure, products and services needed to deliver the connectivity requirements of government, businesses and citizens, and consider and recommend options for the delivery of such infrastructure, products and services.

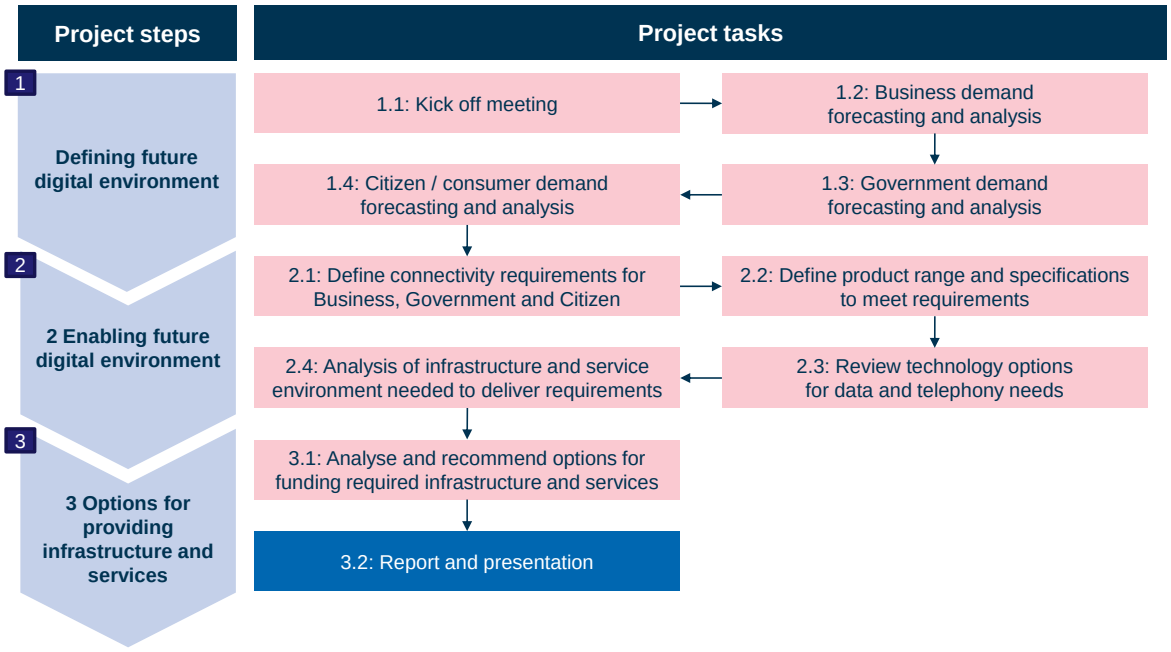
Scope

The scope of this study included both on-island and off-island connectivity. The full scope is set out in Analysys Mason's proposal to the Commerce and Employment Department of the States of Guernsey government.

Approach to the study

Our overall approach to the study is summarised in Figure 2.2.

Figure 2.2: Approach to review of connectivity [Source: Analysys Mason, 2015]



As part of the study, we met with a variety of relevant stakeholders. In a first phase of stakeholder engagement, we met with various government and business stakeholders. During a second phase, we met with representatives from telecoms service providers and the industry regulator, CICRA. All these stakeholders are listed in Annex E.

Structure of the report

The remainder of this report is laid out as follows:

- Section 3 describes the current supply of digital connectivity in Guernsey, provides a brief summary of the Bailiwick's telecoms market, and examines the performance of fixed and mobile broadband compared to international benchmarks.
- Section 4 considers the future digital environment and connectivity requirements for government, business and citizens.
- Section 5 considers the required mix of infrastructure, products and services needed to deliver the Bailiwick's future connectivity requirements.
- Section 6 sets out potential options for the delivery of such infrastructure, products and services.
- Section 7 provides our conclusions and recommendations.

The report also includes a number of annexes containing supplementary material:

- Annex A contains a glossary of abbreviations and terms used.
- Annex B provides benchmarks comparing the cost of fixed broadband services to consumers in Guernsey with the cost in other European countries.
- Annex C provides additional information in relation to broadband connections in Guernsey.
- Annex D contains international benchmarks of broadband performance.
- Annex E lists the set of stakeholders consulted as part of this study.

3 Supply: The telecoms market in Guernsey

In Guernsey the main operators offering telecoms services are Sure (the incumbent, offering a full range of fixed, mobile and broadband services), JT (offering mobile and broadband services) and Airtel-Vodafone (offering predominantly mobile services).

By international standards, Guernsey is well connected, with a range of products and services broadly comparable to other markets. Whilst Sure is the leading service provider and owns the majority of on-island infrastructure, it should be recognised that there are multiple service providers and multiple infrastructure operators, including three separate mobile network operators, as well as multiple separate owners of off-island subsea fibre cables.

In this section, we briefly review the current provision of telecoms infrastructure in Guernsey, provide a summary of the telecoms market, and examine the performance of fixed and mobile broadband compared to international benchmarks.

3.1 Infrastructure

3.1.1 Sure

In April 2013, Sure was acquired by the Batelco Group, a major communications company centred in Bahrain with direct and indirect investments across 16 geographies, including Guernsey, Jersey, and the Isle of Man. In July 2014, Sure (Jersey) Limited announced the acquisition of Foreshore, which means that Sure now has a data centre in Jersey to complement its data centre in Guernsey.

Sure's infrastructure comprises diverse subsea fibre-optic cable systems, a national fixed network based on copper and fibre technology, data centre facilities, and a mobile network which is being upgraded to 4G (LTE).

3.1.2 JT

Jersey Telecom is the former monopoly operator in Jersey. In 2010, it completed its acquisition of Newtel Guernsey and also announced the acquisition of eKit.com. In 2011, Jersey Telecom rebranded to JT.

JT provides Guernsey with a range of fixed and mobile telephony services as well as broadband. The operator is rolling out its *Gigabit Isles* fibre-to-the-home (FTTH) project across Jersey and Guernsey, which will see a number of broadband lines for consumers and businesses in Guernsey gain access to fibre-optic broadband. The JT mobile network in Guernsey is also being upgraded to 4G (LTE).

3.1.3 Airtel-Vodafone

Airtel-Vodafone, a partnership between mobile network operators Bharti Airtel and Vodafone, launched a network in Jersey in June 2007, and followed this in Guernsey in March 2008. Airtel-Vodafone is also rolling out 4G (LTE) services across its network in Guernsey.

3.1.4 Off-island connectivity

In terms of off-island connectivity, Guernsey is well connected, having six subsea cables connecting the island to the UK and France as illustrated in Figure 3.1. Further details of these cables are provided in Figure 3.2 below.

Figure 3.1: Submarine cables connecting with Guernsey [Source: Telegeography, Analysys Mason, 2015]

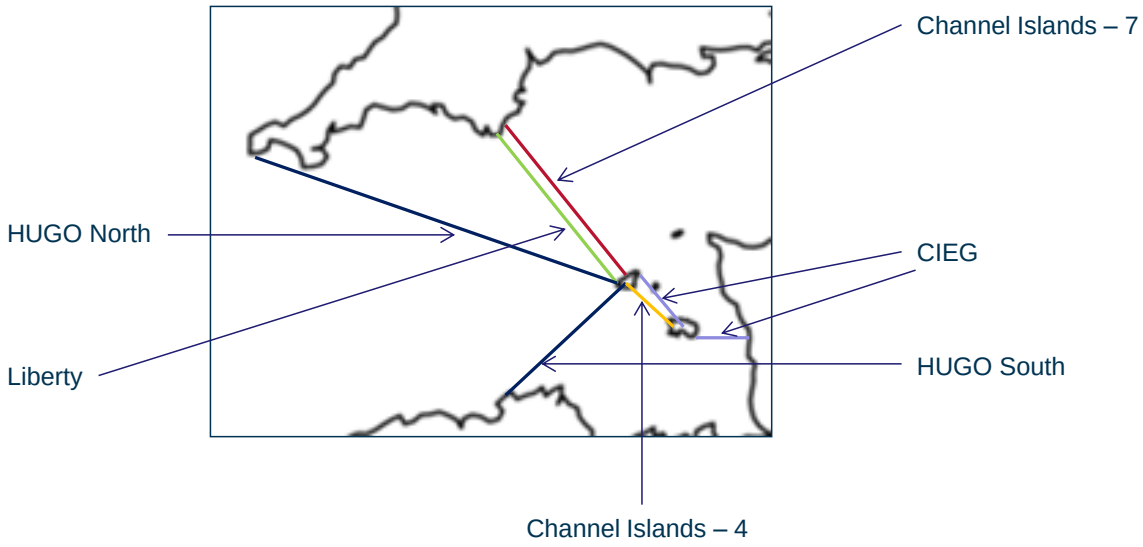


Figure 3.2: Details of submarine cables connecting with Guernsey [Source: Telegeography, Digital Jersey, Analysys Mason, 2015]

Submarine cable	Owner	RFS	End of service (estd.)	Cost (estd.)	Capacity	Comments
CI-4	BT/Sure/JT	1994	2019*	Not available	6 fibre pairs	Also known as Guernsey-Jersey-4
CI-7	BT/Sure/JT	1994	2019*	Not available	6 fibre pairs	–
HUGO**	Sure/Vodafone	2006	2031[9]	USD11.96m[1]	2 fibre pairs	Cable is a recovered section of the GEMINI South cable laid in 1997
Liberty	JT	2008	2033*	GBP8.0m[10]	4 fibre pairs	Also referred to as CI-9
CIEG***	JEC/Sure	Installed 2000	2025*	Not available	24 fibre pairs	Telecom cable integrated in power cable. Cable sometimes referred to as INGRID

* Assumes 25-year design life. Note however, that innovations in network architecture together with technological enhancements and appropriate route selection are all factors which can contribute to a potential extension of the lifetime of submarine cables beyond the initially anticipated 25-year lifespan.

** HUGO: High-capacity Undersea Guernsey Optical-fibre.

*** CIEG: Channel Islands Electricity Grid. This is a 50/50 joint venture between Jersey Electricity (JEC) and Guernsey Electricity (GEL).

HUGO

The HUGO subsea cable system connecting Porthcurno (UK), Guernsey and Lannion (France) is partly owned jointly by Sure and Vodafone. It was a redeployment of parts of the decommissioned GEMINI system, and has recently been upgraded through the insertion of repeaters (optical amplifiers).[11] This upgrade extends the lifetime and increases the capacity of the cable. HUGO in its original form did not use repeaters, and its capacity had become limited by the relatively high loss across the length of the cable. The addition of repeaters removes these limitations and creates the potential for being a much higher capacity system.

9 Submarine Cable Almanac, Submarine Telecoms Forum, Issue 10, May 2014

10 http://www.jtglobal.com/Guernsey/super-footer/Latest-News/2012/Guernsey---Why-Guernsey-Has-The-Competitive-Edge-/

11 http://www.xtera.com/news/xtera-upgrades-the-hugo-subsea-cable-system-with-its-next-generation-repeater/

CIEG

The Channel Islands Electricity Grid (CIEG) is continuing to develop its subsea cable network, and a new project, *Normandie 3*, will see the installation of a further cable between Jersey and France; additional connections between the islands and France are currently being devised.

In the CIEG subsea system, telecoms cable is integrated with the CIEG power cable, with the cable sometimes referred to as INGRID.

Terrestrial links in the UK and France

Off-island connectivity is also reliant upon terrestrial connections between the respective cable landing stations in the UK and France to the city centres of London and Paris, as well as onward connections to other major European metropolitan areas.

Compared to large service providers, smaller operators typically face higher transit costs to connect with Internet Exchange Points (IXPs) such as those in London and Paris. International and regional transit capacity unit costs are generally higher for smaller providers because of their lower capacity requirements, and hence their reduced buying power, making it more difficult for them to negotiate favourable terms with larger carriers. In Guernsey, this contributes to the higher pricing of off-island connectivity, which is a concern expressed by many local stakeholders (see Section 5.3).

Connectivity to Alderney and Sark

Alderney and Sark have benefited from the development of telecoms infrastructure and data-centre facilities provided by the main operators providing services in Guernsey, although it is worth noting that both islands are heavily reliant on microwave radio links for on- and off-island connectivity.

3.1.5 Data centres

Guernsey is well positioned to provide data storage and hosting solutions, having high levels of security, resilience and capacity, and a good choice of data centres and hosting providers. There are a number of data centres located in Guernsey:

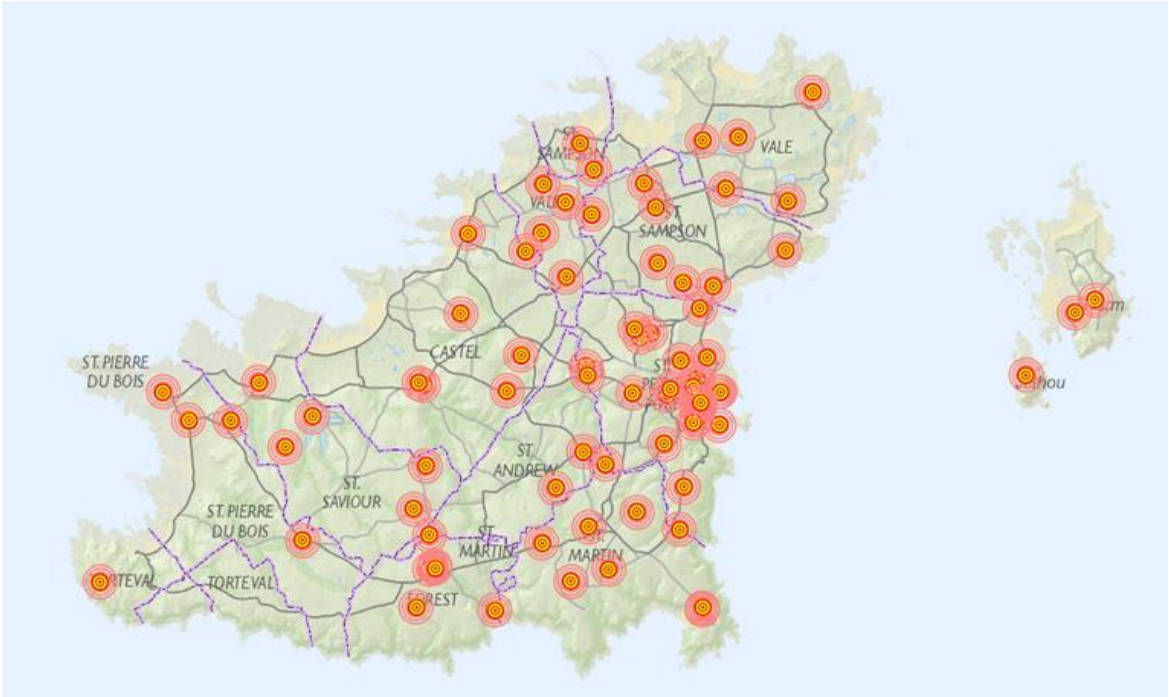
- Sure operates a single data centre, at Centenary House in St Peter Port
- JT Guernsey operates two data centres, at First Tower Lane and St Georges Hall
- C5 Alliance also operates two data centres, at Gibauderie and Braye Road
- Fusion Systems operates a data centre in St Peter Port.

In addition to these facilities, the Long Port Group, a privately owned property development, regeneration and investment company based in Guernsey has announced that is developing the Guernsey Data Park (GDP), a major data centre and business continuity scheme.

3.1.6 Mobile network coverage

The extent of mobile network coverage across Guernsey can be illustrated using the audit information provided by CICRA,[12] as shown in Figure 3.3. All three mobile network operators now provide 4G (LTE) coverage, and availability in Guernsey is widespread.

Figure 3.3: Locations of telecoms masts in Guernsey [Source: CICRA audit, July 2010]



3.2 Telecoms market

3.2.1 Overview

According to CICRA's *Telecommunications Statistics Market Report 2013*,[13] in 2013 the total turnover of the telecoms industry in the Channel Islands, including fixed, mobile, Internet, the sale of handsets and the provision of data hosting services, was GBP210 million (3.6% of the total GDP of the Channel Islands).[14] This represents a 12.5% increase over the 2012 figure of GBP186.6 million (3.3% of Channel Island GDP). A breakdown of the 2013 turnover is provided in Figure 3.4 below

12 See http://masts.digimap.gg/

13 *CICRA: Telecommunications Statistics Market Report, 2013* (Document No: CICRA 15/39), September 2015.

14 Guernsey's GDP in 2013 was £2.186 billion (Source – GDP 2013 First Release Aug 2014 - The States of Guernsey Policy Council Policy and Research Unit). Jersey's GDP was £3.703 billion (Source - Measuring Jersey's Economy GVA and GDP – 2013 - Statistics Unit: www.gov.je/statistics).

Figure 3.4: Turnover of the telecoms industry in Guernsey and Jersey in 2013 [Source: CICRA Industry Questionnaire, October 2014]

	Fixed (GBP)	Mobile (GBP)	Other (GBP)	Total (GBP)
Guernsey	**34 140 351**	**22 390 867**	**13 114 658**	**69 645 876**
Jersey	36 772 500	38 264 990	65 280 568	140 318 058
Total	70 912 851	60 655 857	78 395 226	209 963 934

Note: Fixed turnover includes Internet business services, wholesale revenue and corporate data services revenues. Mobile turnover includes retail, business and inbound-roaming service revenues. Other turnover includes all non-mobile and non-fixed and is believed to include data hosting revenues

The same report indicates that during 2013 the operators invested GBP10.7 million in Guernsey, with the majority of capital investment being concentrated on expanding and enhancing the fixed and mobile access network infrastructure, and improving IT systems (see Figure 3.5).

Figure 3.5: Capital investment by the telecoms industry in Guernsey and Jersey in 2013 [CICRA Industry Questionnaire, October 2014]

	Fixed access (GBP)	Fixed backhaul (GBP)	Mobile access (GBP)	Mobile backhaul (GBP)	IT systems (GBP)	Other (GBP)	Total (GBP)
Guernsey	**2 678 968**	**1 581 767**	**2 030 188**	**475 297**	**2 181 443**	**1 777 937**	**10 725 600**
Jersey	14 078 989	960 084	1 289 043	1 071 898	7 058 030	297 988	24 756 032
Total	16 757 957	2 541 851	3 319 231	1 547 195	9 239 473	2 075 925	35 481 632

Note: Fixed access capital investment in Jersey was predominantly related to JT's FTTH roll-out, the *Gigabit Jersey* initiative.

In 2013, consumers in Guernsey spent on average GBP74.31 per month per household on telecoms services (9.8% more than the GBP67.66 in 2012). 37% of this was spent on fixed voice and broadband products, with the actual spend increasing marginally from GBP27.20 in 2012 to GBP27.66 in 2013.

3.2.2 Business market

Leased lines

At the end of 2013, there were 585 retail leased lines installed in Guernsey (a fall from the 707 in 2012) and 922 in Jersey (a fall from 1013 in 2012).[15] On-island leased lines are defined as lines that originate and terminate on the same island; on both Guernsey and Jersey, on-island leased lines accounted for about 79% of total leased lines (compared to 80% in 2012).

15 There were also 491 wholesale leased lines in Guernsey (compared to 435 in 2012) and 349 wholesale leased lines in Jersey (compared to 334 in 2012); wholesale lines are supplied by an infrastructure owner, usually the incumbent, to other telecoms operators; these, in turn, provide retail lines to end users.

	Retail	Wholesale	Total
Guernsey	**585**	**491**	**1076**
Jersey	922	349	1271
Total	1507	840	2347

Figure 3.6: Demand for retail and wholesale leased lines in Guernsey and Jersey in 2013 [Source: CICRA Industry Questionnaire, October 2014]

Figure 3.7 shows that the profile of demand for leased-line products was different in Guernsey and Jersey. In Guernsey, 48% (51% in 2012) of leased lines purchased offered capacity between 10Mbit/s and 100Mbit/s, whereas the demand for such products was lower in Jersey at 40% (35% in 2012). In Jersey the greatest demand was for sub-1Mbit/s products, amounting to 605 lines (48% of total leased lines), compared to 502 (47%) in Guernsey. The demand in Jersey for >100Mbit/s leased lines was significantly higher than in Guernsey, at 153 connections or 12% (162 or 12% in 2012), compared to Guernsey's 54 or 5% (50 or 4% in 2012).

	<10 Mbit/s	10–100 Mbit/s	>100 Mbit/s	Total
Guernsey	**502**	**520**	**54**	**1076**
Jersey	605	513	153	1271
Total	1107	1033	207	2347

Figure 3.7: Profile of leased line demand in Guernsey and Jersey in 2013 [Source: CICRA Industry Questionnaire, October 2014]

Off-island and inter-island connectivity

Off-island leased lines connect the Channel Islands with the UK or France; in 2013, these amounted to 14% of total leased lines (compared to 16% in 2012). Inter-island leased lines accounted for close to 7% of total leased lines (compared to 5% in 2012). Inter-island lines are attributed to the island from which they originate; more inter-island lines originate in Guernsey (96) than in Jersey (76).

Direct Internet Access

Direct Internet Access (DIA) is a dedicated connection to the Internet provided directly from a customer's site over a permanent link. This type of product can sometimes be referred to as Managed Internet Access or Internet IP Feed.

It is our understanding that CICRA do not presently monitor the demand for DIA connections.

3.2.3 Government services

Government wide-area network (WAN)

In 2012, the States of Guernsey entered into a contract with JT for the provision of a corporate WAN over a five-year term. The JT-designed network comprises a Multi-Protocol Label Switching (MPLS) network consisting of a number of points of presence throughout Guernsey.

TETRA

In 2011, Motorola Solutions provided interoperable TETRA[16] digital radio systems for police and emergency services in Jersey and Guernsey. The systems allow the two islands to collaborate in public safety provision and emergency services, and can be joined together whenever needed. By uniting the two TETRA systems, network coverage has also been expanded to include areas of the English Channel around Jersey and Guernsey not previously reached.

3.2.4 Residential market

Fixed market

There is no significant competition in the landline market in Guernsey, as Sure continues to be the only operator offering the full range of fixed services. According to CICRA data,[17] in 2013 there was a 1% drop in fixed subscriber numbers, although the average revenue per fixed voice or broadband subscription increased slightly from GBP27.20 in 2012 to GBP27.65.

Internet and broadband market

CICRA's figures show that the broadband market continues to show steady growth. In 2013, broadband penetration per household was 86% (up from 84% in 2012). This compares favourably with the 72% seen in the UK.[18] Broadband subscribers are served by either Sure or JT. At the end of December 2013, Sure's market share of broadband subscribers was 81% (18 477 subscribers), whilst JT's was 19% (4280 subscribers). Broadband services to JT's subscribers are supplied on a wholesale basis via the Sure network.

Most broadband services in both Guernsey and Jersey are delivered using copper-based ADSL technology. As shown in Figure 3.8 below, ADSL accounted for 94% (97% in 2012) of broadband service delivery in Guernsey, and 94% (99% in 2012) of broadband service delivery in Jersey.

Looking at higher-performance fixed broadband technologies, in Guernsey, Sure used VDSL technology on 1373 (664 in 2012) lines. VDSL still uses copper wires in the final drop to customers' premises, though the connection from the local exchange to the street cabinet uses fibre-optic cable. In contrast, in Jersey, JT has progressed with its roll-out of a fibre access network that runs all the way to the home (fibre to the home, or FTTH) or to the business premises (fibre to the premises, or FTTP). By 2013, JT had delivered 754 (144 in 2012) fibre-based broadband services to consumers.

16 TETRA: Terrestrial Trunked Radio, a digital radio standard for professional mobile radio. TETRA systems are used by the emergency services, and by other companies to communicate with their work forces.

17 *CICRA: Telecommunications Statistics Market Report 2013*

18 *Ofcom: Communications Market Report, 2015*, Figure 5.55

Finally, fixed wireless (WiMAX[19]) technology is used by Newtel in Jersey to provide broadband services to 1319 end users (266 in 2012); there is no WiMAX network in Guernsey.

Figure 3.8: Breakdown of technologies used to deliver broadband services in Guernsey and Jersey in 2013 (numbers of lines provided) [Source: CICRA Industry Questionnaire, October 2014]

	ADSL	VDSL	FTTP/H	WiMAX	Total
Guernsey	**21 384**	**1373**	**0**	**0**	**22 757**
Jersey	32 931	0	754	1319	35 004
Total	54 315	1373	754	1319	57 761

As part of this study, Sure provided more recent data for Guernsey, as shown below.

Figure 3.9: Actual and potential broadband subscribers in Guernsey [Source: Sure, February 2016]

	Total (%)
Total broadband subscribers	24 010 (90% penetration)
ADSL subscribers	21 612
VDSL subscribers	2 398 (15% take-up)
Potential VDSL subscribers (i.e. VDSL coverage)	15 807 (59% coverage)

Note: The figures for broadband penetration and VDSL coverage are calculated based on a total of 26 692 domestic premises in Guernsey (source: Policy Council Research Team, 2015)

JT also provided more recent data in relation to their FTTH coverage in Jersey. According to JT, there are now 17, 576 FTTH connections and fibre for the remaining connections is on average within 100 metres of each remaining home.

Annex B provides international benchmarks comparing the cost of fixed broadband services to consumers in Guernsey with costs in other European countries.

Mobile market

In 2013, there were 103 mobile subscriptions per 100 inhabitants in Guernsey (the same as in 2012). This is considerably less than the figure for the UK, namely 130 subscriptions per 100 inhabitants.[20] Figure 3.10 below shows the number of mobile subscribers per operator in Guernsey and Jersey. In Guernsey, the total number of mobile subscriber reduced marginally by 0.4% in 2013 compared to 2012. Average revenue per user also reduced slightly for pre-paid subscribers, falling to GBP9.41 from GBP9.91 in 2012, although it increased for post-paid subscribers, rising to GBP33.38 compared with GBP30.55 in 2012.[21] In Guernsey, in 2013, the proportion of pre-paid

19 WiMAX (Worldwide Interoperability for Microwave Access) refers to interoperable implementations of the IEEE 802.16 family of wireless-networks standards ratified by the WiMAX Forum.

20 *Ofcom: Communications Market Report, 2015*, Figure 5.44: the total number of mobile subscriptions in the UK in 2013 was 83.1 million, whereas the population (according to the World Bank) was 64.1 million.

21 *CICRA: Telecommunications Statistics Market Report 2013*

subscribers was 42% (46% in 2012), compared to 45% (50% in 2012) in Jersey. In the UK, the proportion of pre-paid subscribers was 43%.[22]

	Airtel-Vodafone	JT	Sure	Total
Guernsey	**9258 (14%)**	**12 614 (19%)**	**43 042 (66%)**	**64 914**
Jersey	19 585 (17%)	67 310 (60%)	25 569 (23%)	112 464
Total	28 843 (16%)	79 924 (45%)	68 611 (39%)	177 378

Figure 3.10: Mobile subscribers per operator in Guernsey and Jersey in 2013 [Source: CICRA Industry Questionnaire, October 2014]

3.3 Broadband performance in Guernsey compared with Europe

3.3.1 Fixed broadband performance in Guernsey

One of the key performance indicators of fixed broadband is the *average sync speed*, also referred to as the download speed, sync rate, downstream rate or DSL connection rate. In effect this is the speed of the broadband connection between the local exchange and the end user's router, or in the case of FTTC connections, the speed from the local MSAN[23] or DSLAM.[24] As part of our engagement with industry stakeholders, Sure provided information about the performance of its ADSL and VDSL connections in Guernsey; this is summarised in Figure 3.11.

Figure 3.11: Performance indicators for Sure's ADSL and VDSL networks in Guernsey [Source: Sure, 2015]

Fixed broadband performance indicator	ADSL	VDSL
Average sync speed	15.70Mbit/s	36.08Mbit/s
Average line length	1059m	729m

For ADSL and VDSL the average sync speed is largely determined by the characteristics of the copper line connecting the end user. In other words, it is the length and quality of the copper connection which strongly influences the broadband speed obtained. Annex C presents data on the line length distribution of Sure's ADSL and VDSL connections in Guernsey, provided by Sure as part of this review. Broadband technology and performance is considered further in Section 5.2.

Results of CICRA's customer survey of broadband services

In addition to regular customer satisfaction surveys of mobile services (discussed in Section 3.3.2), CICRA also conducts regular surveys of customer satisfaction with broadband services in Guernsey. One of the questions in a recent survey was "How likely are you to change your broadband provider in the future? If you have answered 'very likely' or 'likely' what are your main reasons for possibly changing provider?" The results are shown in Figure 3.12. It can be seen

22 *Ofcom: Communications Market Report, 2014,* Figure 5.45.

23 MSAN: Multi-Service Access Node, a device typically installed in the local exchange, though sometimes in a street cabinet, which connects customers' DSL lines to the core network via optical fibre.

24 DSLAM: Digital Subscriber Line Access Multiplexer, a device generally installed in the local exchange which connects customers' DSL lines to the core network via optical fibre.

that the most often cited reasons for wanting to change service provider were broadband speed and reliability. (These were also the reasons most often cited by respondents in Jersey.)

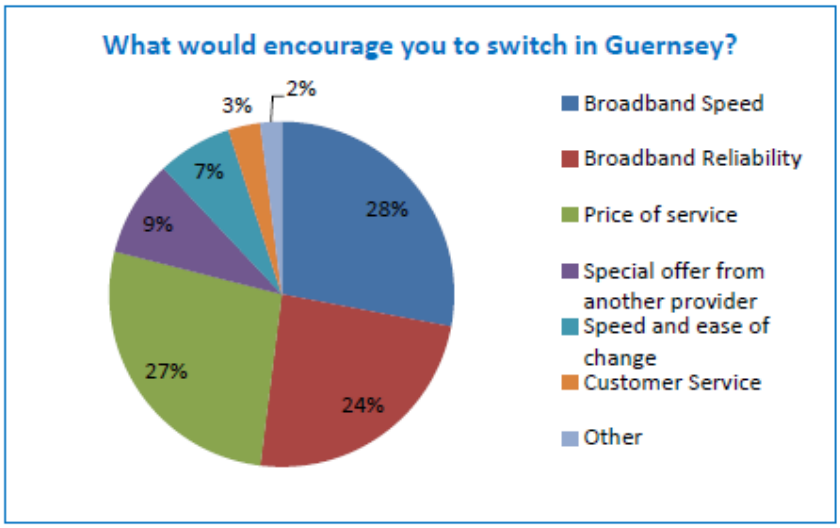


Figure 3.12: Factors influencing fixed broadband users in Guernsey to switch to another provider [Source: CICRA broadband customer satisfaction survey, 2015]

3.3.2 Mobile broadband performance in Guernsey

In Guernsey, as in other mature markets characterised by high levels of penetration, all of the mobile networks are migrating to 4G. Research by many organisations, including Ofcom,[25] has shown that 4G significantly outperforms 3G.

Results of CICRA's customer survey of mobile services

CICRA conducts a regular survey to track changes in customer satisfaction with mobile services over time, and to see how responsive the mobile service providers are to customer feedback. In May 2015, CICRA commissioned its third survey of 500 customers. Although none of the questions specifically addressed mobile *broadband* services, one of the questions asked was "Over the last 6–12 months, have you changed your mobile service provider? If yes, what were your main reasons for switching mobile provider?" The survey results are shown in Figure 3.13 below. The results indicate that network quality is the second most important factor after price, and this was cited by 21% of respondents, indicating that customers at least perceive that the quality of network service could be improved. However, network *coverage* was not a dominant factor: just 11% of those surveyed stated that this factor influenced their switch to another provider.

25 http://stakeholders.ofcom.org.uk/market-data-research/other/telecoms-research/broadband-speeds/mobile-bb-april-15/

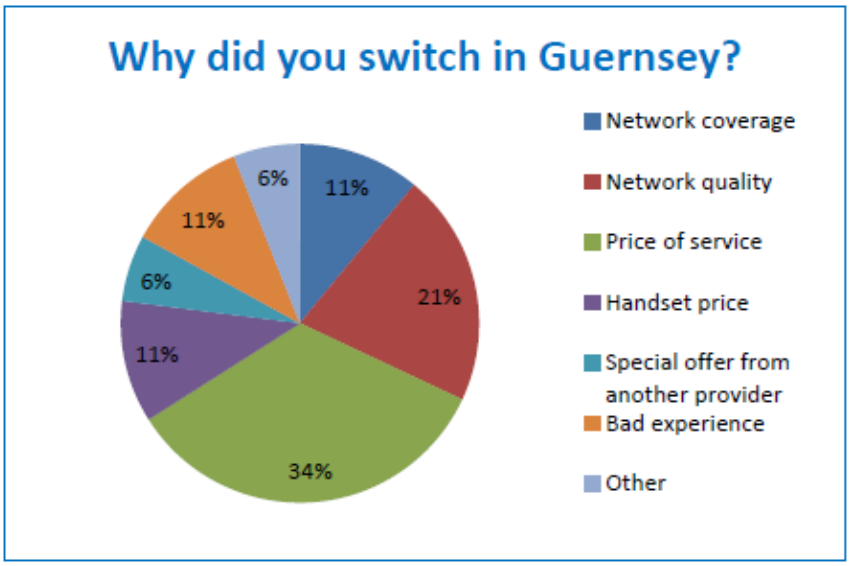


Figure 3.13: Factors influencing mobile users in Guernsey to switch to another provider [Source: CICRA mobile customer satisfaction survey, 2015]

3.3.3 International benchmarks

It is useful to compare the performance of Guernsey's existing broadband connectivity with that in other countries and regions. We have analysed benchmarks from three sources:

- the *Cisco Cloud Readiness Tool*, which has data on download and upload speeds for fixed and mobile networks in a number of Western European countries
- Akamai's *State of the Internet* report, which provides data on the average connection speed of fixed networks in major countries worldwide
- the European Commission's *Digital Agenda Scoreboard*, which provides data on a number of key indicators including broadband speeds and coverage across Member States.

In this subsection we present the data from these sources, and in the following subsection we consider how Guernsey's broadband compares to the benchmarks.

Cisco Cloud Readiness Tool

Figure 3.14 below sets out the Cisco data on the average download speed, upload speed, and latency[26] of both fixed and mobile networks in a number of Western Europe countries.[27] It is important to note the data provided by Cisco is not aligned to any particular technology, and is divided only according to fixed and mobile networks.

26 Latency refers to the amount of time it takes for data to be transmitted from source to destination across a telecoms network, and is measured in milliseconds.

27 http://www.cisco.com/c/en/us/solutions/service-provider/cloud-readiness-tool/index.html

Figure 3.14: Speeds and latency of fixed and mobile networks in selected countries in Western Europe in 2015 [Source: Cisco, 2015]

	Fixed networks			Mobile networks		
	Average download speed (Mbit/s)	Average upload speed (Mbit/s)	Latency (ms)	Average download speed (Mbit/s)	Average upload speed (Mbit/s)	Latency (ms)
Austria	21.7	5.5	31	13.3	5.0	63
Belgium	27.0	4.5	34	19.1	4.8	46
Cyprus	6.5	1.5	65	5.9	1.8	92
Denmark	34.4	24.4	22	19.6	12.8	40
Finland	32.0	13.3	29	18.4	7.8	52
France	20.2	7.5	45	13.3	5.0	77
Germany	27.0	5.1	41	14.8	4.0	62
Greece	8.4	1.0	46	8.8	1.6	66
Guernsey	**15.7 / 36.1**	-	-	-	-	-
Iceland	34.5	30.8	23	20.7	20.1	38
Ireland	24.4	8.9	43	13.1	6.1	73
Isle of Man	18.0	4.8	52	n/a	n/a	n/a
Italy	6.8	1.2	70	6.7	1.8	101
Luxembourg	66.6	57.9	34	18.0	10.8	41
Malta	23.5	1.9	31	n/a	n/a	n/a
Netherlands	38.7	16.1	27	23.4	11.1	33
Norway	26.4	18.0	32	17.9	5.2	55
Portugal	23.9	5.8	37	12.6	4.5	62
Spain	21.2	5.1	55	12.5	4.1	79
Sweden	42.9	24.5	36	19.6	12.1	50
Switzerland	35.0	9.5	32	19.7	6.6	45
United Kingdom	24.7	6.8	40	16.6	5.4	60
Western Europe	22.8	7.4	44	13.7	4.8	70

Note: Guernsey average download speed listed is average sync speed for ADSL / VDSL provided by Sure (see Figure 3.11)

Akamai's State of the Internet report

Figure 3.15 below provides data from Akamai's *State of the Internet* report for Q2 2015[28], detailing the average connection speed in the countries with top ten highest scores. Countries are ranked according to average speed (the rankings of a larger selection of EMEA countries are provided in Annex D).

To calculate average connection speeds, an average is taken by Akamai of all of the connection speeds from unique IP addresses determined to be in a specific country. It is important to note the

[28] https://www.akamai.com/us/en/multimedia/documents/content/akamai-state-of-the-internet-report-q2-2015.pdf

calculation therefore includes *all* types of access technology, some of which may only be capable of providing comparatively low connection speeds.

		Average connection speed (Mbit/s)	Year-on-year change
1	South Korea	23.1	-11%
2	Hong Kong	17.0	1.3%
3	Japan	16.4	7.4%
4	Sweden	16.1	18%
5	Switzerland	15.6	6.4%
6	Netherlands	15.2	11%
7	Norway	14.3	38%
8	Latvia	14.2	4.5%
9	Finland	14.0	27%
10	Czech Republic	13.9	13%
Global average:		5.1	17%

Figure 3.15: Average connection speed by country/region [Source: Akamai,Q2 2015]

Figure 3.16 provides data, also from the Akamai's *State of the Internet* report for Q2 2015, relating to the average *peak* connection speed with countries ranked accordingly (the rankings of a larger selection of EMEA countries are provided in Annex D). To calculate average *peak* connection speeds, an average is taken by Akamai of *only the highest connection speed* calculated from each unique IP address determined to be in a specific country. It is therefore important to note the calculation is largely driven by those access technologies capable of delivering much higher broadband speeds such as FTTP and DOCSIS 3.0. [29]

		Average connection speed (Mbit/s)	Year-on-year change
1	Singapore	108.3	60%
2	Hong Kong	94.8	22%
3	South Korea	83.3	12%
4	Japan	75.1	19%
5	Taiwan	74.5	32%
6	Romania	72.1	17%
7	Qatar	71.7	71%
8	Israel	71.4	-14%
9	Sweden	62.8	24%
10	Macao	62.6	36%
Global average:		32.5	26%

*Figure 3.16: Average **peak** connection speed by country/region [Source: Akamai, Q2 2015]*

[29] DOCIS: Data Over Cable Service Interface Specification, an international standard that permits the addition of high-bandwidth data transfer to an existing cable TV system.

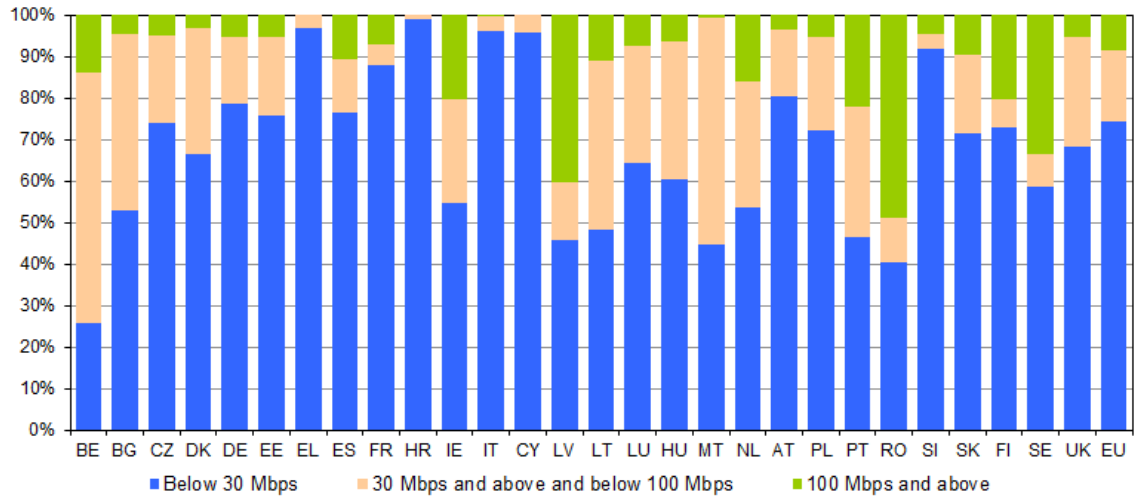
Digital Agenda for Europe – Scoreboard

The European Commission's *Digital Agenda for Europe* (DAE) is one of seven flagship initiatives within the *Europe 2020* strategy for smart, sustainable and socially inclusive growth. One of the aims of the DAE is to enable Europe's citizens and businesses to get the most out of digital technologies. To support this aim it identifies 13 goals, three of which are particularly relevant to this study:

- the entire EU to be covered by broadband by 2013
- the entire EU to be covered by broadband above 30Mbit/s by 2020
- 50% of EU citizens to subscribe to broadband above 100Mbit/s by 2020.

The *Digital Agenda Scoreboard*[30] measures progress of the European digital economy, and provides a number of key indicators which illustrate some key dimensions of the European information society. Indicators within the Connectivity report include broadband speeds and coverage in all Member States in 2015; a selection of the data is shown below in Figure 3.17 to Figure 3.19.

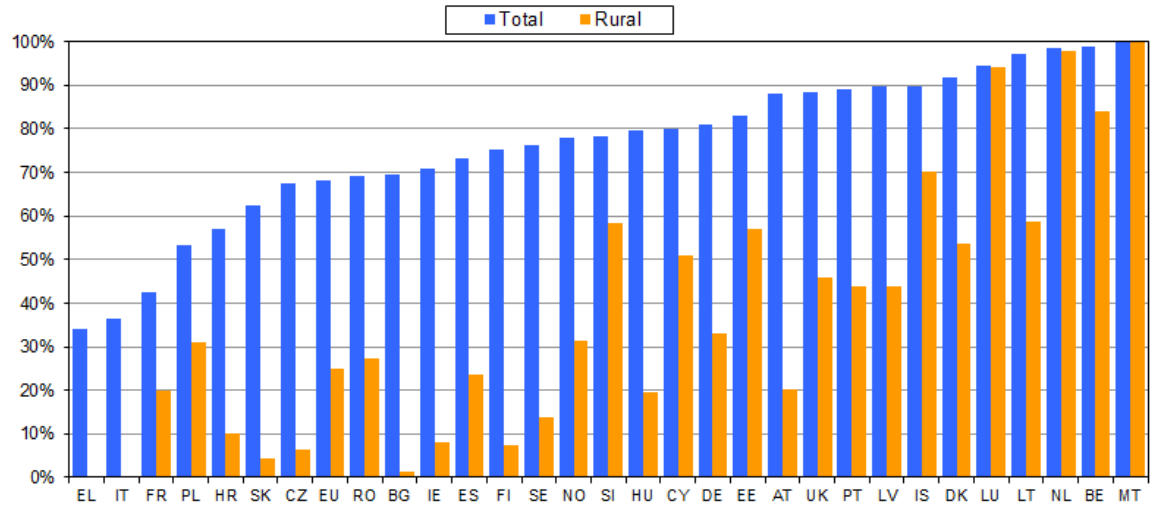
Figure 3.17: Fixed broadband subscriptions in EU countries, January 2015, broken down by speed [Source: European Commission, 2015]



96% of European homes have access to at least 2Mbit/s broadband, and 64% of homes to 30Mbit/s.

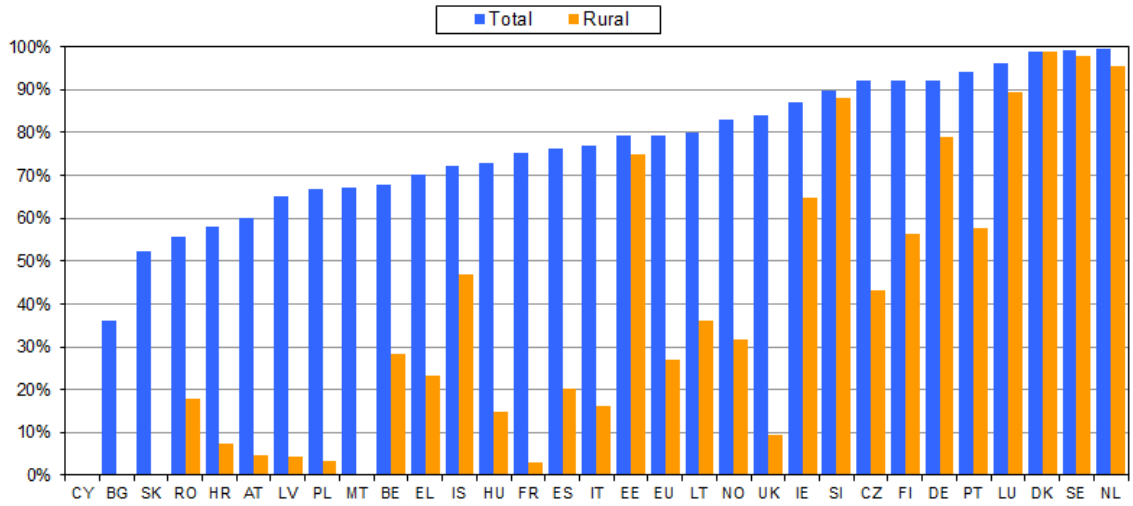
30 http://ec.europa.eu/digital-agenda/en/download-scoreboard-reports

Figure 3.18: Coverage of NGA networks in EU countries, end 2014 – overall and in rural areas [Source: European Commission, 2015]



Next-generation access (NGA) networks deliver high-speed broadband services using various technologies, including VDSL, FTTH/FTTP and DOCSIS 3.0. NGA networks are still very much limited to urban areas: across Europe only 25% of rural homes are covered, mainly using VDSL.

Figure 3.19: LTE coverage in EU countries, end 2014 – overall and in rural areas [Source: European Commission, 2015]



The population coverage of 4G (LTE) mobile broadband in Europe reached 79% by the end of 2014, up from 27% just two years previously. LTE has been commercially launched in all but one Member State (Cyprus), though so far deployments have focused on urban areas, and only 27% of rural homes are covered. However, in ten Member States, LTE is now available in the majority of rural homes, with particularly high availability being achieved in Denmark, Sweden and the Netherlands.

3.3.4 Conclusions from international benchmarks

Before drawing conclusions about Guernsey's broadband performance based on the benchmark data summarised above, we should note that obtaining consistent data on downstream bandwidths is problematic. The EC at times provides slightly inconsistent information, and companies offering information such as Cisco and Akamai do so using different methodologies, and their data is subject to issues such as sampling bias. The figures available therefore vary widely and need to be treated with some caution. However, despite the differences in the figures produced by these sources, the relative *rankings* of the countries are broadly consistent.

We can therefore draw some conclusions about the level of fixed broadband connectivity available in Guernsey:

- Average **ADSL** download speeds in Guernsey are comparable to the *average connection speeds* in those countries ranked favourably in the Q2 2015 Akamai *State of the Internet* report, but lag behind many of the speeds in countries included in the Cisco study and, in some cases, lag considerably behind.

- Average **VDSL** download speeds in Guernsey compare very favourably to the *average connection speeds* in those countries ranked highly in the Akamai report, and in many cases are comparable, if not better, than the speeds in countries included in the Cisco study. However, VDSL *take-up* in Guernsey is low at less than 10%, with only a limited number of customers connected to exchange or on-street MSANs. According to data provided by Sure, VDSL *coverage* in Guernsey is presently around 59%.[31]

- The general absence of **FTTH/P** in Guernsey is visible; FTTP coverage at EU level was 19% at the end of 2014, up from 14% at the end of 2013.[32]

In terms of mobile broadband coverage, all three of Guernsey's mobile network operators now provide 4G (LTE) coverage, and availability is generally widespread. 4G (LTE) coverage in Guernsey therefore ranks favourably in comparison to the majority of EU Member States.

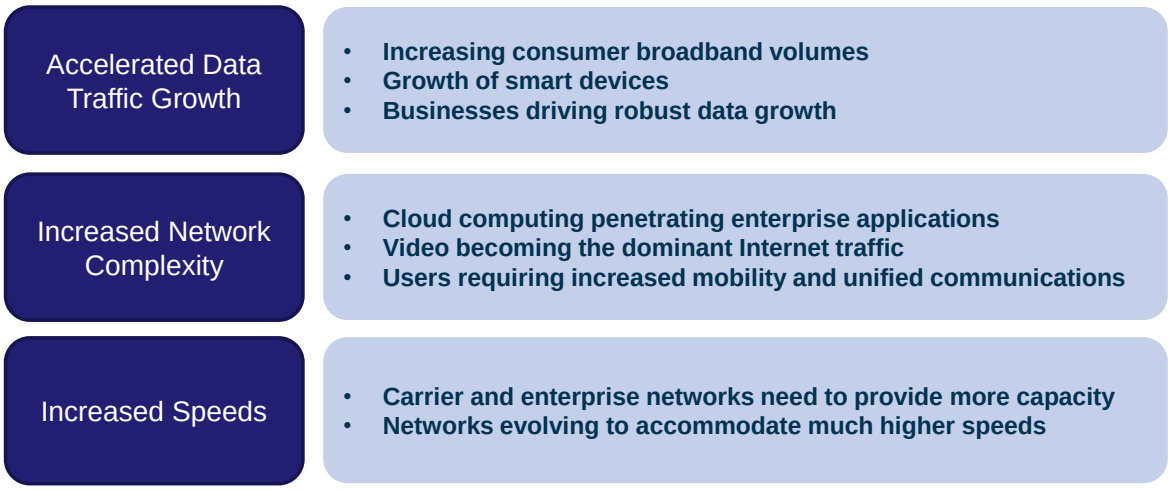
31 Based on potential coverage of 15 807 premises out of a total of 26 692 domestic property units (see Figure 5.5).

32 *Connectivity: Broadband market developments in the EU*, Digital Agenda Scoreboard, European Commission, 2015.

4 Demand: Defining Guernsey's future digital environment

Over the coming years, the proliferation of Internet-ready platforms and advanced mobile devices will generate an increased demand for online video, cloud-based applications and more. As devices and applications grow in sophistication, so will the demand pressures for bandwidth and content delivery (see Figure 4.1). This section considers the demand drivers which will shape Guernsey's future digital environment.

Figure 4.1: Main trends driving bandwidth and connectivity requirements [Source: Analysys Mason, 2015]



4.1 Business demand

The availability of ICT infrastructure is an important consideration for businesses and their decisions on where to locate. Therefore, when companies look to locate to Guernsey, or build on their existing presence on the island, they need to be confident that the required technologies are available and that service providers have the capacity to deliver. The diverse range of companies operating on a global scale from Guernsey is an indication of the availability and capacity of ICT available. However, the dimensions of ICT requirements are nuanced – the needs of businesses can be highly varied depending on their business type, size and scope of operations. For Guernsey to continue to develop its existing business sectors, and attract the scale of inward investment it needs to deliver its economic development ambitions, an advanced telecoms environment is essential.

4.1.1 Demand from key sectors

Guernsey's economy is underpinned by a culture of innovation, and there are a number of innovative sectors already established, and some developing, that offer new and exciting opportunities for the island. Key sectors include financial services, FinTech (the integration of finance and technology), eGaming and creative industries, and we discuss their connectivity requirements below.

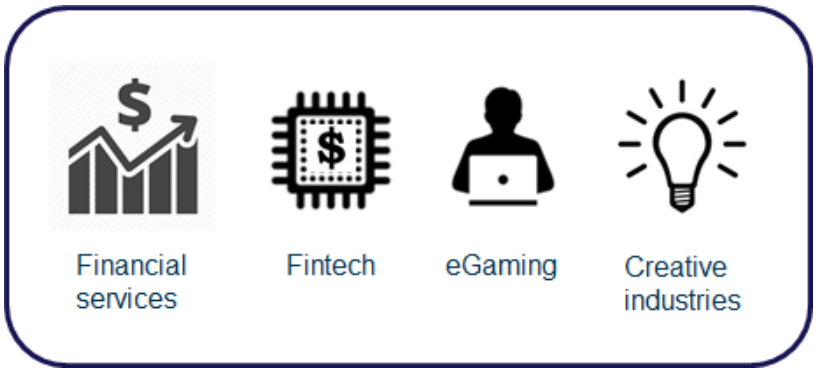


Figure 4.2: Key sectors in Guernsey [Source: Analysys Mason, 2015]

Financial services

Guernsey has many financial services companies, which are part of a much larger finance sector. As an international finance centre, the island provides services in numerous fields such as banking, fund management and administration, private wealth and insurance.

Financial services companies need to offer innovative options and sophisticated online transaction capabilities in order to differentiate themselves and enable their customers to access account information and transact business. This leads to an ever-increasing demand for secure, reliable, robust, high-bandwidth connectivity. Guernsey therefore needs to maintain a telecoms environment that offers scalable, reliable, secure and cost-effective solutions to meet the connectivity demands of the evolving financial services sector.

FinTech

The FinTech sector seeks to evolve financial models using the latest technology to transform established models and ways of working. It represents an exciting opportunity for Guernsey to combine its mature and internationally renowned finance sector with opportunities for innovation, and potentially establish itself as a leader in the rapidly growing field of FinTech, including services such as peer-to-peer lending, crowd funding, virtual currencies, online payments and digital banking. Maintaining the connectivity and resilience that the island's banks and eGaming companies rely upon will be essential to the future of FinTech in Guernsey.

eGaming

eGaming has been a major success story for Guernsey in recent years, with companies attracted by the world-leading regulatory regime of the Alderney Gambling Control Commission (AGCC), high-quality telecoms infrastructure, and Guernsey's long-standing fair and competitive tax regime which meets or exceeds all OECD, EU and UK standards of transparency and information exchange.

Low-latency Internet connectivity is a crucial deciding factor for eGaming companies looking for a base of operations: in the gaming world, even the slightest glitch in connectivity could represent

a large compromise to perceived credibility. eGaming organisations also require a secure hosting environment and reliable IT services.

Creative industries

Creative industries are a successful and growing sector in Guernsey, and include companies specialising in design, advertising, film and video, architecture and web and software development. [33] More than 1000 people work in the creative industries, which are making an increasing contribution to the island's economy.

For this sector to thrive, infrastructure should be just as focused on moving digital content as physical goods and people. Well-connected consumers are of course vital, but the ability to put content online easily is just as, if not more, important for creative digital businesses. There is huge demand on creative businesses to upload increasingly large files, and this means that they require high *upload* speeds as well as download speeds, which leads to a preference for broadband technologies like FTTP or VDSL rather than ADSL (which can only offer relatively slow upload speeds).

4.1.2 Demand from large enterprises

Large enterprises require continuous high-speed data connections in order to function effectively in today's fast-paced environment. The performance they require from their network infrastructure is also changing: increasingly data-rich services and the movement of applications to the cloud mean that network connectivity now has to be more robust and scalable than ever before. The need for high-capacity communication will continue to grow for a number of reasons, including:

- While most businesses have networks at each of their locations, there is also a clear need for enterprise-wide networks that offer high-bandwidth connections to their facilities in other cities and regions. High-speed data connectivity allows all facilities, regardless of physical location, to share information more effectively across increasingly global WANs.

- Internet traffic has increased exponentially. Enterprise users now routinely use web browsers and web-based communication, creating considerable traffic.

- Businesses and organisations in almost every sector and industry are increasingly embracing the cloud and remote services. They want the agility, security and performance that cloud technology delivers.

Access to high-speed connectivity is therefore vitally important for large enterprise, and continuing to service the needs of the larger businesses located on the island will ensure they play a key and growing role in Guernsey's economic success.

[33] http://www.locateguernsey.com/creativeindustries

4.1.3 Demand from SMEs

Small and medium-sized enterprises comprise a wide range of different types of business, in terms of both size and function, and their communications needs are therefore highly varied. Many SMEs use communications products aimed predominantly at residential customers, whilst others use products aimed more at larger organisations, but in important respects their broadband needs often differ from both consumers and enterprises:

- As many SMEs rely on broadband for business-critical services, they often have a lower tolerance of outages than residential consumers. SMEs are also more likely than consumers to use services dependent on a high-quality *uplink* such as cloud-based applications: a recent study by the UK's Broadband Stakeholder Group[34] found that even small businesses require substantial upload bandwidth: more than 50% of small business premises exceeded the 1Mbit/s upload limit of 'standard broadband'.

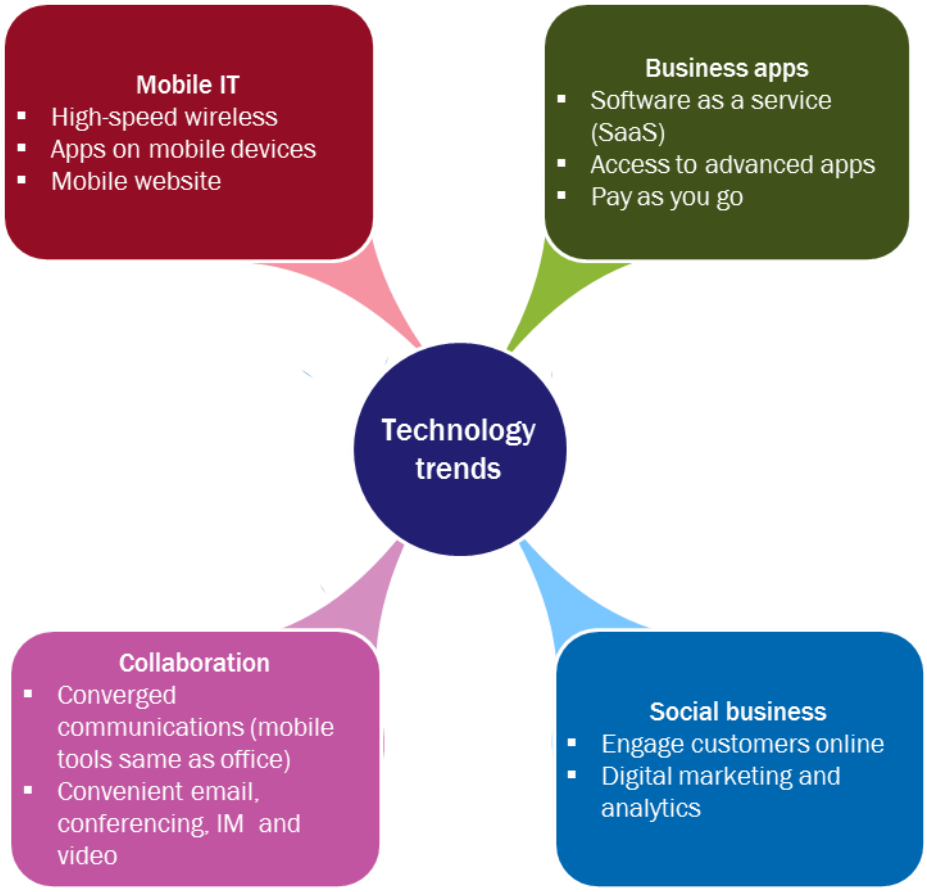
- On the other hand, compared to larger enterprises SMEs are more likely to depend on mass-market broadband products as they have less need for the dedicated, uncontended[35] connectivity provided by leased lines, and are less able to afford the high costs of these products.

SMEs generally regard technology as an important enabler for their business. For example, technology improves their ability to respond to customers, and enables their staff to be reached outside the office, or to work on the go. SMEs also increasingly compete against big businesses for mobile and online customers. Figure 4.3 highlights some of the technology trends that are driving SMEs towards digital solutions.

34 *BSG: The broadband requirements of small businesses in the UK*, August 2015.

35 Most telecoms access networks have a tree structure which means that multiple users have to share (or 'contend') capacity higher up in the network. If many users are connected at the same time, the amount of bandwidth available to each of them is reduced. In contrast, a leased line is a point-to-point connection which is 'dedicated' to a single customer.

Figure 4.3: Technology trends that are driving SMEs towards digital solutions [Source: Analysys Mason, 2015]



Analysys Mason research commissioned by Ofcom[36] on SMEs' current and future communications needs found that the use of more sophisticated communications services, including IP and cloud-based services, are increasing the need for higher-specification connectivity services. Key findings from our research include the following:

- Copper-based broadband services (i.e. ADSL) do not meet the bandwidth needs of many SMEs. And although fibre-based offerings (i.e. VDSL or FTTP) typically meet the needs of smaller SMEs, in some cases even these services cannot meet some SMEs' needs for uplink bandwidth. While dedicated leased lines would meet these requirements, some SMEs consider them unaffordable.

- SMEs typically place great value on *resilient* connectivity, and for some of them this is as important a factor as the availability of adequate bandwidth.

- SMEs have high expectations regarding technical support for their connectivity services, and these expectations are not always being met by their service providers.

Clearly the connectivity demands being made by SMEs are accelerating rapidly, and our research for Ofcom suggests that there is some evidence of a 'product gap' between the more common

36 Analysys Mason: Understanding the demand for communications services by SMEs, April 2015

broadband services, which do not offer sufficient levels of performance to run business-critical applications, and leased lines, which are unaffordable for many SMEs.

4.2 Public-sector and government demand

4.2.1 Demand from the public sector

Guernsey's Corporate and Service Departments are rapidly adopting new ways of working to enhance productivity and reduce IT costs. All of these activities are increasing demand on the network connectivity between public-sector sites. In response to this increasing demand, the States entered into a contract with JT for the provision of a corporate WAN to connect 42 States of Guernsey buildings to its new fibre network, and 120 sites to an MPLS WAN. This robust, high-speed broadband network will provide a foundation for future connectivity, delivering a secure, dedicated connection across which to share services and information.

4.2.2 Demand from e-Government

With the desire to improve delivery of e-Government services, the States of Guernsey, through the *SMART Guernsey* initiative, is promoting the use of smart technology to empower citizens, and is working closely with the business sector to further enable the delivery of government services.

The *SMART Guernsey* initiative, which forms part of the States' wider *Framework for Public Service Reform*,[37] is about using modern technology to empower service users and the whole community. It aims to support a competitive business environment and use smart technology to build a secure and trusted digital environment, leading to the adoption of a 'digital by default' approach to customer engagement.

e-Government services are vital to the growth of the public sector, providing services ranging from tax payments to data collection and understanding citizens' needs. The continued success and expansion of e-Government services depends on the performance of the underlying network services. As government and other public-sector institutions expand their use of online services and advanced digital technologies, the demand for secure, reliable, connectivity continues to rise.

4.3 Consumer demand

A key component of the debate around consumer broadband has been about the demand for higher speeds, and to what extent this applies to different types of users. However, while considerable private and public sector investment and consideration is being directed to improving broadband, there is limited forecast data on the expected demand for bandwidth. There are certainly *traffic* forecasts: Cisco's *Visual Networking Index*[38] forecasts are widely cited, for instance. However, while valuable, these tell us little about the need for *bandwidth*, particularly the demand from consumers.

37 A copy of the framework can be accessed at http://change.gov.gg/

38 http://www.cisco.com/c/en/us/solutions/service-provider/visual-networking-index-vni/index.html

Figure 4.4: Factors impacting on the future digital environment for consumers [Source: Analysys Mason, 2015]

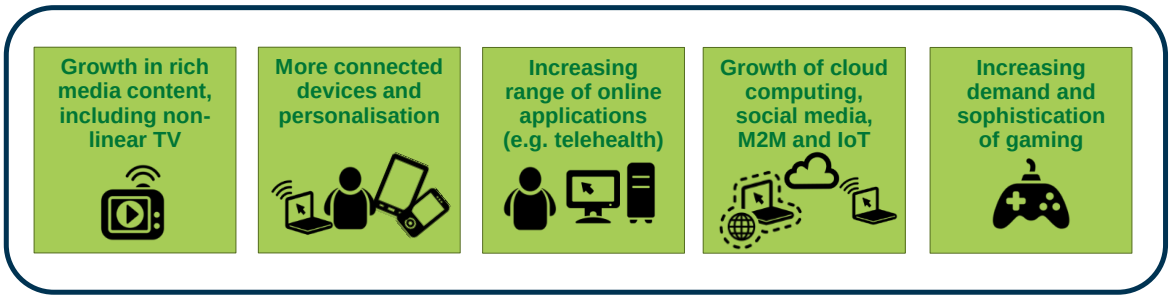


Figure 4.4 highlights the main factors driving the need for increasing bandwidth. The primary growth driver for fixed broadband usage amongst consumers appears to be *rich media content*, i.e. media services such as YouTube, catch-up TV services like the BBC's iPlayer, and other video-content dominated applications, which could potentially include unicast or multicast TV services. While some applications can run in the background, the dominant bandwidth-intensive applications, whether video or interactive gaming, are associated with screens, and these cannot be used for more than one application simultaneously. Hence, the maximum plausible number of screens operating at their full potential in terms of formats, and the number of people per household, should set the upper limits on demand.

Analysys Mason has forecast the bandwidth demand generated by a household which is among the top 1% of households in terms of usage, and broken this demand down by application. Figure 4.5 shows our estimate of what a top-1% family might need in bursts during the peak hour by 2020. However, this probably bears no relation to the bandwidths that *average* households will actually buy.

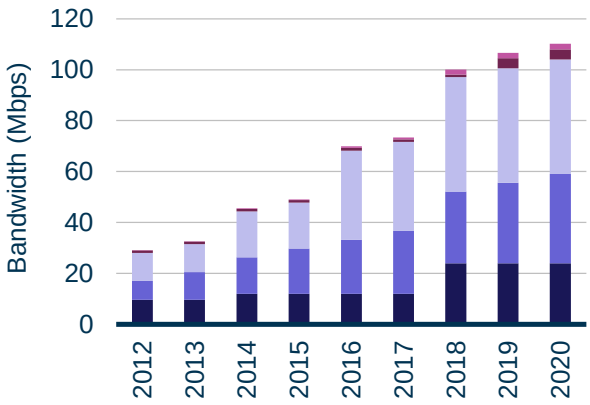


Figure 4.5: Forecast for peak bandwidth demand by a top-1% household, broken down by application, 2012–2020 [Source: Analysys Mason, 2015]

In order to gain a better picture of typical broadband usage over the next 3–5 years, we have carried out the following analysis. First, we consider the number of media streams generated per household (i.e. the number of concurrent users); this varies depending on the type of household. We assume the number of streams ranges from 1.0 for single-person households, up to 3.5 for households containing several families. The average bandwidth per stream is assumed to be 10Mbit/s, which broadly corresponds to a high-definition (1080p resolution) video stream. Clearly,

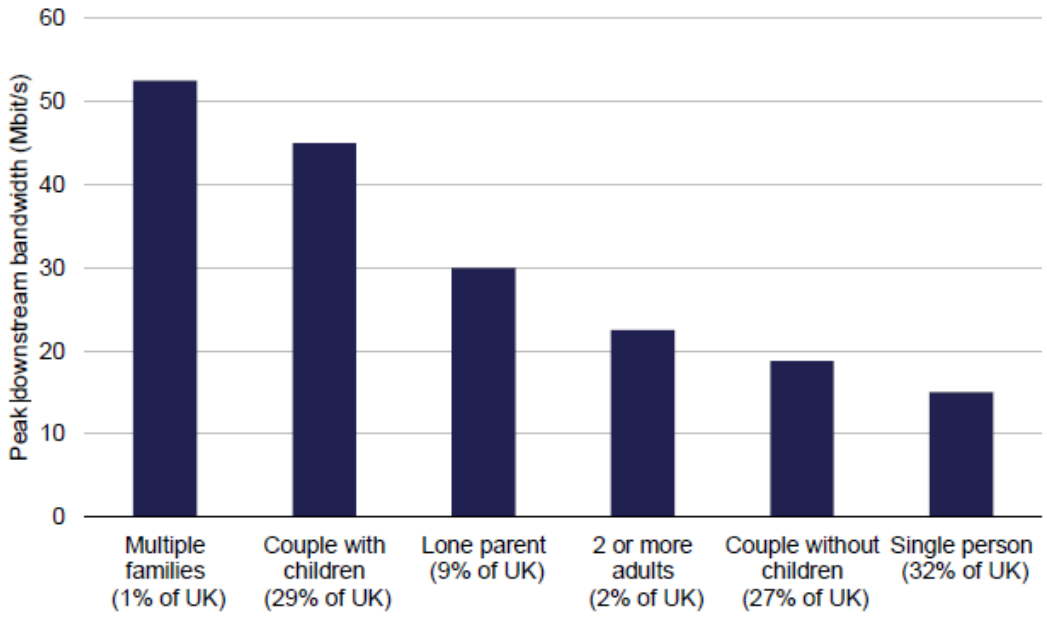
higher-resolution streams such as 4K[39] or 8K would increase the bandwidth used, although future compression technologies would mitigate this. Also, greater use of local storage (e.g. time-shifting using a PVR[40]) could reduce the number of streams per household.

In addition, we provide an allocation of bandwidth for non-media-related applications, assumed to be 50% of the total bandwidth required for the media streams. In the case of the multiple-family households this additional bandwidth amounts to a significant 17.5Mbit/s, whereas in single-person households only 5Mbit/s is required.

Our analysis forecasts that the peak bandwidth requirements of UK households over the next 3–5 years will range from 15Mbit/s to 52.5Mbit/s per household. A report from the Broadband Stakeholders Group published in 2013[41] arrives at a similar conclusion, forecasting that in 2023 the median household's bandwidth demand will be 19Mbit/s.

These analyses suggest that, in the foreseeable future at least, the current use of VDSL by many incumbent operators (including Sure in Guernsey) is likely to be sufficient to meet most consumers' needs. However, as noted in Section 3.2.4, VDSL coverage in Guernsey is currently relatively low, standing at around 60%.

Figure 4.6: Peak downstream bandwidth requirements by different types of UK households over the next 3–5 years; figures in brackets are household type as a percentage of all UK households [Source: Analysys Mason, 2015]



39 4K ultra high definition (UHD) is a resolution of 3840 pixels × 2160 lines and is one of the two resolutions of UHD television targeted towards consumer television, the other being 8K UHD which is 7680 pixels × 4320 lines.

40 PVR: Personal video recorder.

41 *Broadband Stakeholders Group: Domestic demand for bandwidth*, November 2013. More details, including links to the report and the underlying model, can be found at http://www.broadbanduk.org/2013/11/05/bsg-publishes-new-model-for-analysing-domestic-demand-for-bandwidth/

5 Gap: Supporting Guernsey's future digital environment

Guernsey's *Strategic Framework for Economic Development*[42] explicitly identifies telecoms connectivity and infrastructure as a key theme of the third of its four objectives, namely "making Guernsey work for business". But more generally, the need for a strong, sustainable digital environment, supportive of existing and emerging sectors, permeates the entire Framework. On- and off-island connectivity therefore needs to support Guernsey's digital initiatives and economic ambitions, and enable the current and future requirements of citizens, businesses and government.

This section considers Guernsey's future digital environment in terms of the product and service requirements of key stakeholders. In particular, we consider requirements in four areas: connectivity for large enterprises; fixed broadband; off-island connectivity; and mobile broadband.

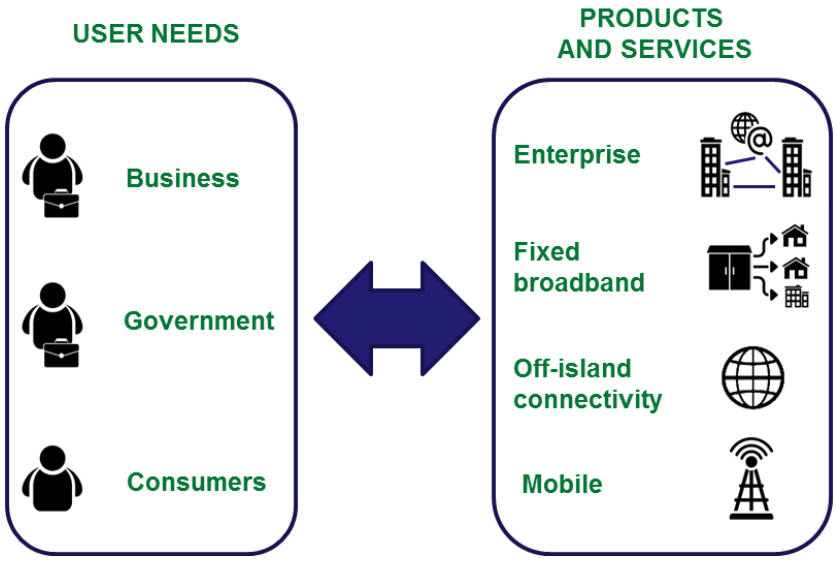


Figure 5.1: Matching user needs to products and services [Source: Analysys Mason, 2015]

5.1 Enterprise connectivity

As discussed in Section 4, larger enterprises are demanding increasingly large amounts of bandwidth and an extremely reliable set of services from their service providers so that they can deliver a rich suite of voice, video and business-critical data applications with the desired level of performance and quality of service. In preparing this report, we interviewed a number of business representatives in Guernsey in order to assess whether their requirements are being met now, and are likely to remain so in the future. In the following, we focus on enterprises' requirements for three products: leased lines, Direct Internet Access and SIP trunking.

42 See http://www.gov.gg/EconomicFramework

5.1.1 Leased lines

During our stakeholder engagement, the general view of end users was that demand for leased-line products is being satisfied and that sufficient capacity is available. However, leased-line pricing is viewed by many stakeholders as uncompetitive and high when compared to other jurisdictions. A particular concern was the disparity between the prices of in-exchange and out-of-exchange leased lines.[43]

Figure 5.2 compares the price of leased lines (also called private circuits) in Guernsey, Jersey and the UK. Prices are broadly comparable in Guernsey and Jersey for 10Mbit/s and 100Mbit/s Ethernet[44] connections, but the price of a 1Gbit/s line in Guernsey is significantly higher than in Jersey. In the UK, Openreach's price for 100Mbit/s and 1Gbit/s connections is significantly lower than that of Sure and JT – though it should be noted that the Openreach pricing is for *wholesale* products, which are not sold directly to end users.

Figure 5.2: Comparison of prices of leased lines in Guernsey, Jersey and the UK in 2015 [Sources: Sure,[45] JT,[46] Openreach[47]]

Service provider	Product Name	Capacity	Connection charge (GBP)	Annual rental (GBP)
Guernsey				
Sure	LANlink10 (Ethernet)	10Mbit/s	Not specified	2592 (same exchange) 4666 (different exchange)
Sure	LANlink100 (Ethernet)	100Mbit/s	Not specified	9860 (same exchange) 18 320 (different exchange)
Sure	LANlink1000 (Ethernet)	1Gbit/s	Not specified	28 800 (same exchange) 51 840 (different exchange)
Jersey				
JT	Fibre Link 10/16 (>300m)	10Mbit/s	2500	5280
JT	Fibre Link 100 (>300m)	100Mbit/s	2500	11 980.80
JT	Fibre Link 1000 (>300m)	1Gbit/s	3000	16 588.80

43 In Guernsey, Sure's pricing of leased lines differs depending on whether or not the circuit from the customer's premises terminates within the same exchange area as where it originates, or in a different exchange area.

44 Ethernet is a transmission technology that is used in high-capacity data networks.

45 https://international.sure.com/assets/Uploads/PL-ETHERNET3.pdf

46 http://www.jtglobal.com/Jersey/Business/Internet--Data/Hosted-Solutions/Private-Circuit-Tariffs/

47 https://www.openreach.co.uk/orpg/home/products/pricing/loadProductPriceDetails.do?data=5uW5cDedIGJkun%2FLo2I67PEgpNm%2BtShF6YESRcCqrDFZ6rNZujnCs99NbIKJZPD9hXYmiijxH6wrCQm97GZMyQ%3D%3D

Service provider	Product Name	Capacity	Connection charge (GBP)	Annual rental (GBP)
UK				
Openreach	EAD 10 (Wholesale)	10Mbit/s	GBP 2108	2550
Openreach	EAD 100 (Wholesale)	100Mbit/s	GBP1950	2400
Openreach	EAD 1000 (Wholesale)	1Gbit/s	GBP2100	4200

It is useful to put this issue into further context. In the *Business connectivity market review: Guernsey*[48] published by CICRA in October 2014, the Guernsey Competition and Regulatory Authority (GCRA) concluded that in the *wholesale* market for on-island leased lines, Sure has significant market power (SMP). In the *retail* market for on-island leased lines, the GCRA concluded that no operator should be designated as having SMP. The GCRA cited two main reasons for this latter decision: (a) the substantial changes in market share that have occurred in the recent past between Sure and JT, with the latter now holding the largest market share;[49] and (b) likely competitive developments in this market over the medium term.

In the subsequent *Review of the price control for wholesale on-island leased lines: Guernsey*,[50] Sure argued that differential pricing of leased lines was justified in Guernsey because the same exchange/different exchange difference recognised additional equipment and longer line lengths. The GCRA reiterated its view that, as under the existing price control, Sure is free to eliminate differential pricing of leased lines should it wish to do so. In light of this, and given that the GCRA believes technology developments are likely to lead to the elimination of differential pricing over the medium term, the regulator maintains its position that the issue is one for the operators themselves to address. The GCRA expects the operators to respond to the demands of their customers, and would expect any differentiated pricing to fairly reflect differences in the cost of providing the service. The GCRA therefore concluded that the issue of differential pricing of leased lines by Sure would not be addressed as part of the price control review.

The reviews conducted by CICRA are welcomed, and its conclusions on SMP and differential pricing can be broadly supported. Nevertheless, the data presented in Figure 5.2 above confirms users' perception that the price of on-island leased lines is high when compared to other markets such as the UK. However, Sure's pricing for on-island 10Mbit/s and 100Mbit/s Ethernet circuits in Guernsey is broadly comparable to JT's pricing of similar products in Jersey – though Sure's price for a 1Gbit/s leased line is significantly higher than JT's.

48 *Final Decision* (Document No: CICRA 14/49), October 2014.

49 This market share development appears to have been primarily been driven by JT winning the tender to supply the government with a managed data service comprising a WAN and IP connectivity. Previously the Guernsey government had bought leased lines directly, and managed its own network. The new contract is a shift to the government contracting for a managed network, in which leased lines are an input. This single contract makes up a significant proportion of the retail leased-line market on the island, to the extent that it is possible that whoever holds the contract is likely to be the major supplier of retail leased lines in Guernsey.

50 *Final Decision and Response to Consultation and Draft Decision* (Document No: CICRA 15/16), May 2015

If the higher pricing of leased lines in Guernsey compared to other jurisdictions persists, then further analysis may be required to understand the extent to which this may be detrimental to the local economy. Additionally, CICRA might need to consider undertaking a further review, which could include the application of cost-orientation principles.

5.1.2 Direct Internet Access

Direct Internet Access (DIA) is a dedicated (uncontended) leased line connecting a customer's premises directly to a global Internet node. A number of stakeholders identified the pricing of DIA in Guernsey as a concern. The high price of this product on the island may, at least in part, be driven by (a) the need for end users to also require a leased line at their premises (see Section 5.1.1); and (b) the high price of off-island connectivity that is needed to connect Guernsey to a global Internet Exchange Point – this has also been highlighted as a concern and is discussed separately in Section 5.3.

It is not certain, however, that the pricing of DIA is primarily related to the price of these cost inputs, and it may be prudent for CICRA to undertake further analysis to understand further the reasons for the higher pricing and also its potential impact on the users most affected.

5.1.3 SIP trunking

SIP[51] trunking services allow a business to replace its existing telephony service, particularly ISDN[52] lines, with a voice-over-Internet-protocol (VoIP) solution which connects its private branch exchange (PBX) to a service provider using an Ethernet leased line. Many companies already use VoIP within their PBX on their local area network to connect to IP phones. SIP trunking also uses VoIP to take advantage of shared lines, such as a company's Internet connection, to allow more flexibility in communications. Traditional legacy systems which are not VoIP-capable can be connected using common VoIP gateways to take advantage of SIP trunking.

Some stakeholders identified the unavailability of SIP trunking on the island as an inhibitor to the development of their business. We raised this issue with Sure in our discussions, and understand that a SIP product could be made available in its portfolio of enterprise products during the course of 2016.

It is perhaps also interesting to note that in Jersey, JT is withdrawing all copper-provided products as part of its NGA fibre roll-out, and in the future will be unable to provide ISDN services on its fibre network. We understand that JT is in the process of scoping the work required to develop a SIP-based alternative to ISDN2 and ISDN30 which will replace the current services.

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51 SIP: Session Initiation Protocol, the standard communications protocol for voice and video in a Unified Communications (UC) solution implemented on a data network.

52 ISDN: Integrated Services Digital Network, a communications standard for sending voice, data and video over telephone lines. ISDN only supports data transfer rates of 64kbit/s.

5.2 Fixed broadband

5.2.1 Technology and performance

In Section 3.3 we discussed the performance of the ADSL and VDSL connections in Guernsey, and compared their performance to other countries. In the following, we consider how the performance of ADSL and VDSL infrastructure compares to FTTP/FTTH networks, where optical fibre extends from the network provider's switching equipment all the way to a home or business premises, thereby completely replacing the existing copper infrastructure.

5.2.2 FTTx technologies

ADSL using the existing copper access network can provide up to 24Mbit/s immediately adjacent to the local exchange, but this performance depends on the length of the copper connection, and the condition of the copper wires themselves. Increasingly, ADSL does not meet the growing market demand for bandwidth, and telecoms operators are therefore looking to increase the bandwidths they offer in a cost-effective and timely fashion. There is an increasing array of fibre technologies (jointly referred to as FTTx) that operators can use to help them achieve these goals; these broadly fall into two main categories:

- **Fibre to the cabinet (FTTC)**, where new fibre cables connect the exchange to street cabinets which contain DSLAMs or MSANs. This equipment then uses VDSL2 technology to transmit the signals over legacy copper wires to end-user premises. However, the actual rate delivered varies widely depending on the distance between the premises and the cabinet: it can reach a maximum of around 80Mbit/s on very short copper lengths, but over a typical distance of 600m a downstream rate of only 50Mbit/s can be delivered.

- **Fibre to the premises (FTTP) or home (FTTH)**, where fibre replaces the legacy copper access network completely and connects the exchange directly to the end-user premises. Depending on network design, a downstream rate of 40Mbit/s all the way up to 100Gbit/s or more can be delivered to each end user. Furthermore, for a given network design, the same bandwidth can be delivered to every end user.

These two types of fibre networks are compared with ADSL networks in Figure 5.3 below.

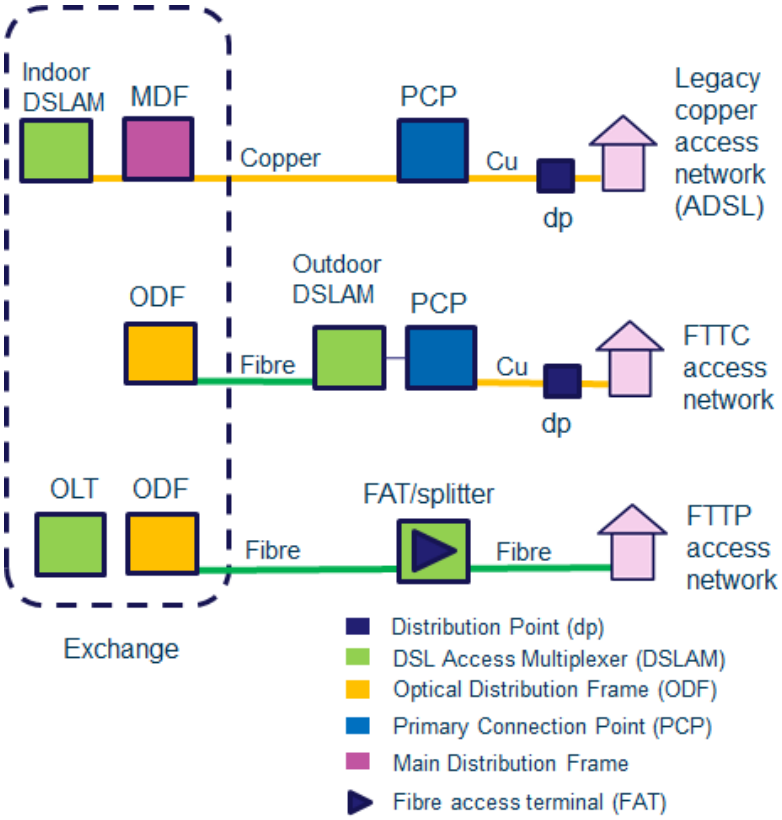


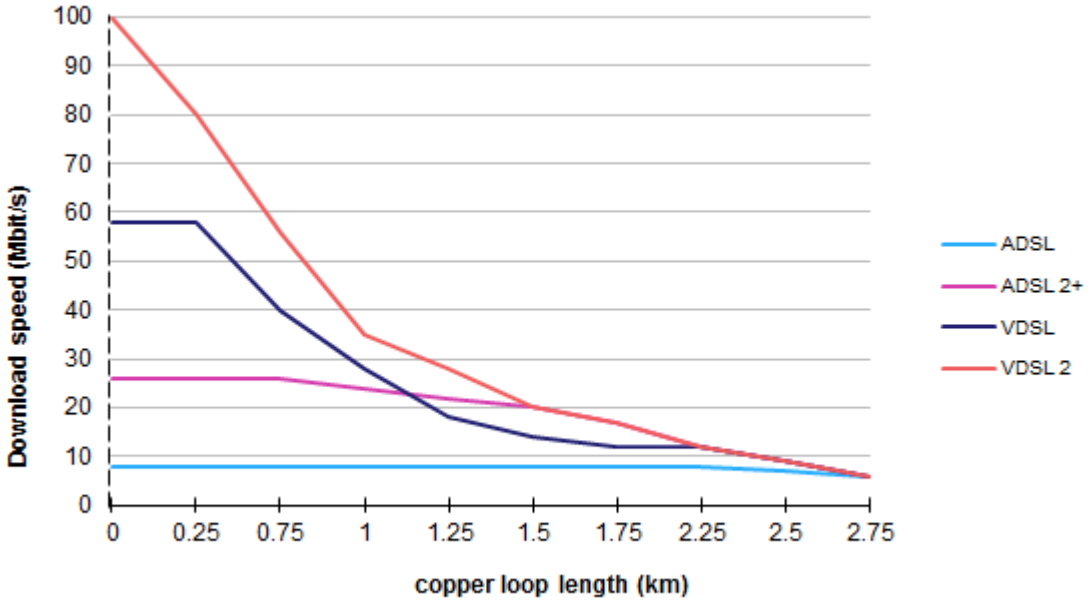
Figure 5.3: Comparison of ADSL and FTTx network architectures [Source: Analysys Mason, 2015]

In addition to ADSL and VDSL, there are a number of technologies in the DSL family, including ADSL2+[53] and VDSL2[54]. With all these technologies, the delivered bandwidth decreases as the length of the copper cables increases, mainly due to signal attenuation; this is illustrated in Figure 5.4. The bandwidth for VDSL (FTTC) is much higher than for ADSL2+ at shorter distances, but the performance benefit is lost at greater distances. Therefore, for long copper connections between the cabinet and end user premises, VDSL2 performance will not be better than that of ADSL2+ systems.

53 ADSL2+ is the more modern version of ADSL.

54 VDSL2 is deployed by Sure.

Figure 5.4: Performance of ADSL, ADSL2+, VDSL and VDSL2 systems as the length of the copper connection increases [Source: Analysys Mason, 2015]



FTTx performance in Guernsey

As described in Section 3.3.1, Sure has provided us with data relating to the line length distribution of its ADSL and VDSL connections in Guernsey (see Annex C).[55] A number of observations can be made in relation to this information:

- The majority of the ADSL connections are less than 1.5km in length and are therefore capable of supporting relatively high speeds: Figure 5.4 suggests that the performance of ADSL2+ only begins to deteriorate significantly at distances greater than 1.5km.
- Nearly 75% of VDSL connections are less than 1km in length and are therefore in many instances capable of supporting download speeds of above 30Mbit/s.

Both of these observations align with the ADSL and VDSL performance statistics provided by Sure, which indicate an average sync speed of 15.7Mbit/s for ADSL connections and 36Mbit/s for VDSL connections (see Figure 3.11 on page 21).

Despite these favourable performance statistics, however, the fact remains that less than 10% of customers are currently connected to a VDSL service, whether via an exchange or an on-street cabinet.

55 Sure confirmed the line length distribution information provided is representative of all copper lines in Guernsey.

5.2.3 DSL acceleration technologies

Whilst the average copper line length in Guernsey is capable of supporting adequate download speeds for many users, there are options to improve performance for more demanding customers. There are a number of 'DSL acceleration' technologies – notably including vectoring[56] and bonding[57] – which can improve the bandwidth–distance performance of copper connections and hence increase download speeds.

The length of copper wire that the signal must traverse can also be reduced further (compared to VDSL systems) by rolling out fibre beyond the cabinet to distribution points nearer the customer's premises. This solution is referred to as fibre to the distribution point (FTTdp). In combination with a technology called G.fast, tailored especially to this type of architecture, FTTdp can enable FTTH-like speeds to be delivered. Described by some as a stepping stone to FTTP, G.fast is attractive to incumbent service providers because it allows them to continue to use their copper lines, and delays the need for a wide-scale investment in FTTP.

We understand through our discussions with Sure, that a number of improvements to its existing copper access network are planned, including (a) expansion plans to install additional MSAN cabinets around the island, with the aim of making VDSL accessible to all properties; and (b) the introduction of vectoring, FTTdp and G.fast in 2017. We also understand the company intends to increase FTTH penetration in Guernsey in the period 2018–2020.

5.2.4 Growing importance of upload capacity

Consumer broadband traffic has changed greatly since broadband services first emerged. It started as highly asymmetrical traffic with downstream volume many times greater than upstream. However, now the importance of upload speeds is becoming more emphasised by increases in user-generated content, interactivity, social media, and video conferencing and, to some extent, the Internet of things (IoT).

Fortunately, today's technology can accommodate increased upstream speeds, through deployment of optical networks or through upgrades to legacy copper and cable networks. Whilst many of these technologies were intentionally designed to be asymmetrical so they could carry the heavier volumes of downstream traffic, *upstream* capacity is also starting to increase. Despite some new services demanding increased upstream bandwidth, however, the most popular and bandwidth-intensive services remain highly asymmetrical: as highlighted earlier in this report, the largest bandwidth demand comes from downstream IPTV video and Internet video. Nonetheless, upload capacity is becoming more important for some types of user – upload speeds are typically much more important for business users than for residential users.

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56 Vectoring is a transmission method that employs the coordination of line signals to reduce the level of interference (crosstalk) between adjacent copper cables, thereby improving performance.

57 Bonding combines the capacity of two discrete copper pairs, and can be used to increase the range of an xDSL system for a given bandwidth. However, spare copper pairs must be available.

5.2.5 Increasing FTTC/FTTP coverage

In studies for the Broadband Stakeholder Group (BSG),[58] Analysys Mason has modelled the cost of deploying various next generation broadband technologies, including FTTC and FTTP, in a number of different scenarios. We found that the cost per premise connected for FTTC and FTTP deployments is dependent on a number of factors including premise density per km^2, exchange size and the distance from the exchange to the premises connected. Selected results from these studies, modified for the purposes of this report, have been used to calculate the estimated cost of deploying FTTC and FTTP across Guernsey.

According to the latest *Guernsey Facts and Figures Booklet* published by the Policy Council,[59] the total number of domestic property units is as shown in Figure 5.5.

Location	No. of units	No. units per km^2
Rural area	15,539	279
Urban area	11,153	1,403
Total	26,692	420

Figure 5.5: Domestic property units – December 2014 [Source: Policy Council Research Team, 2015]

The cost of FTTC in Guernsey

Using the no. units per km^2 (premise density per km^2) as the *only* selection criteria for choosing the closest corresponding geotype in our report for the BSG, Figure 5.6 indicates the deployment cost for FTTC *per premises connected* for rural and urban areas. Assuming these costs are representative of the costs in Guernsey, the overall cost of a FTTC solution to connect every domestic property unit would be in the region of **GBP10.8 million**.

Location	Deployment cost per premise connected (GBP)
Rural area	407
Urban area	401

Figure 5.6: Deployment costs per premise connected using FTTC [Source: Analysys Mason, 2015]

The cost of FTTH in Guernsey

As discussed in Section 6.3.2, the justification for investment in FTTH needs to be strong, since the deployment costs are significant. In the following we discuss two possible FTTH architectures, GPON[60] and PtP[61], which differ in their costs and relative merits.

58 http://www.broadbanduk.org/2008/09/05/bsg-publishes-costs-of-deploying-fibre-based-superfast-broadband/

59 See http://www.gov.gg/ff

► *FTTH/GPON*

As with the FTTC calculation, the number of units per km^2 (premise density per km^2) is used as the selection criteria for choosing the closest corresponding geotype in our report for the BSG. Figure 5.7 indicates the deployment cost for FTTC/GPON per premises connected for rural and urban areas. Assuming these costs are representative of the costs associated with a FTTH/GPON deployment in Guernsey, the overall cost of a FTTH/GPON solution to connect every domestic property would be in the region of **GBP53.4 million**. However, we note from our stakeholder engagement that dig costs, which comprise a significant part of the overall deployment costs, are higher in Guernsey than in the UK – this would therefore suggest GBP53.4m is a conservative estimate and in reality the deployment costs could be considerably higher.

Location	Deployment cost per premise connected (GBP)
Rural area	2216
Urban area	1700

Figure 5.7: Deployment costs per premise connected (FTTH/GPON) [Source: Analysys Mason, 2015]

► *FTTH/PtP*

Figure 5.8 indicates the deployment costs for an FTTH/PtP solution. Applying these costs to Guernsey, we estimate that the overall cost of a FTTH/PtP solution to connect every domestic property on the island would be approximately **GBP59.7 million**. Again this is a conservative estimate given the higher dig costs reported in Guernsey.

Location	Deployment cost per premise connected (GBP)
Rural area	2371
Urban area	2047

Figure 5.8: Deployment costs per premise connected (FTTH/PtP) [Source: Analysys Mason, 2015]

At this point it is interesting to note the JT's *Gigabit Jersey* project aims to roll out FTTH/PtP to around 42 000 premises in Jersey at a reported cost of c. GBP50 million.

60 GPON: Gigabit Passive Optical Network, an FTTH architecture and technology that implements a point-to-multipoint architecture, in which unpowered (passive) fibre optic splitters are used to enable a single optical fibre to serve multiple end-points (customers), without having to provision individual fibres between the hub and customer.

61 PtP: Point-to-Point, an FTTH architecture and technology which involves one strand of fibre being connected directly into the customer premises all the way from the main hub or exchange. Point-to-point networks use active switches instead of passive optical splitters. PTP FTTH is considered a more future-proof and agnostic architecture than GPON (see below) because the operator can scale on an individual basis.

Variation in FTTP deployment costs

The costs highlighted above are estimates, and it is important to note that the costs of FTTP deployment depend on a wide range of factors, and that these variations should be kept in mind:

- **Labour costs:** the greatest cost component of FTTP deployment is 'civils' (installing fibre in the ground and into individual premises), which can represent up to 80% of the total.
- **Population density:** areas with higher population density are cheaper to serve, since civil costs per household are lower (because fibre lengths are shorter).
- **Existing assets:** the availability of capacity in existing ducts, and the nature of the existing network topology, can reduce deployment costs.
- **Nature of connections:** wayleaves and other permissions can be challenging. Older or historic buildings can also be problematic, as new in-premise wiring may be required.
- **New developments vs. existing buildings:** for new developments, the cost of FTTP is generally similar to copper installations, since new ducts and cables must be deployed in either case. It is generally much more expensive for existing properties (where copper is already deployed, but new fibre must be laid).

5.3 Off-island connectivity

In relation to off-island connectivity, the general opinion expressed by end users suggested that demand for leased line products was being met and that sufficient capacity is available. From our engagement with stakeholders and service providers, we understand that barely a tenth of the island's international fibre capacity is being utilised. However, a similar view to that expressed in relation to leased line pricing is clear – pricing of off-island connectivity is viewed by many local stakeholders as uncompetitive and high when compared to other jurisdictions.

The prices of off-island connectivity in Guernsey and Jersey are presented in Figure 5.9 below. The comparison shows broadly comparable pricing for 10Mbit/s connections, but customers in Guernsey face higher prices for a 100Mbit/s connection.

Figure 5.9: Prices of off-island leased lines in Guernsey and Jersey in 2015 [Source: Sure[62], JT[63]]

Service provider	Product Name	Capacity	Connection charge	Annual rental (GBP)
Sure (Guernsey)	Guernsey – Central London Ethernet (Half Circuit[1])	10Mbit/s	Not specified	10 720
Sure (Guernsey)	Guernsey – Central London Ethernet (Half Circuit[1])	100Mbit/s	Not specified	62 814
JT (Jersey)	Digital Private Circuit – Jersey to UK (Half Circuit[1])	10Mbit/s	1,250	13 288
JT (Jersey)	Digital Private Circuit – Jersey to UK (Half Circuit[1])	100Mbit/s	1,250	50 505

Note 1: Circuits to the UK are provided on a half circuit basis. The UK half of the circuit can be purchased through Sure or JT respectively, but will be provided by other licensed telecoms operators in the UK. The price of the 'far end' connection is dependent on customer requirements

It is useful to put this issue into further context. In the *Business connectivity market review: Guernsey*[16] published by CICRA, the GCRA concluded that although Sure continues to hold the largest market share within the *wholesale* market for off-island leased lines, due to the existence of multiple competing providers and the amount of capacity available, no operator is dominant in this market and therefore no operator should be designated with SMP in the market for wholesale off-island leased lines

The GCRA also concluded that its proposals for the regulation of the on-island market can most effectively address the need for access to cost-effective and high-quality off-island connectivity. The GCRA indicated it will keep this issue under active review, in particular to ensure that there are no artificial barriers at the on-island level to access off-island services, and vice versa.

In the *retail* market for off-island leased lines, the GCRA concluded that no operator should be designated with SMP. According to the GCRA, JT has supplanted Sure as the leader in terms of market share held in the provision of retail off-island circuits. Combined with the other factors that need to be taken into account when assessing the level of competition, the GCRA concludes that dominance is not a factor within this market

As in the case of the analyses of on-island leased lines, the review conducted by CICRA is welcomed, and the conclusion reached in relation to no market dominance can be broadly supported.

62 https://international.sure.com/assets/Uploads/PL-ETHERNET3.pdf

63 http://www.jtglobal.com/Jersey/Business/Internet--Data/Hosted-Solutions/Private-Circuit-Tariffs/

In relation to the pricing of off-island connectivity, the underlying issue, at least in part, appears to be the low traffic volumes on the off-island links: put simply, if there was more traffic the unit costs would be lower. However, if prices are not falling as fast as traffic is rising then there might be a problem requiring further investigation. Similarly, as highlighted in Section 3.1.4, smaller service providers typically face higher transit costs to IXPs such as those in London and Paris than larger providers. This can also contribute to higher pricing of off-island connectivity.

However, if the higher pricing of off-island connectivity persists then further analysis may be required to understand the extent to which this is potentially detrimental to Guernsey's economy and whether further regulatory investigation is merited.

In terms of capacity, with the recent insertion of a repeater which will extend the lifetime and capacity of the HUGO cable,[64] there would appear to be no immediate concern in relation to the existing subsea links being able to deal with traffic demand in the near-to-medium term.

5.4 Mobile broadband

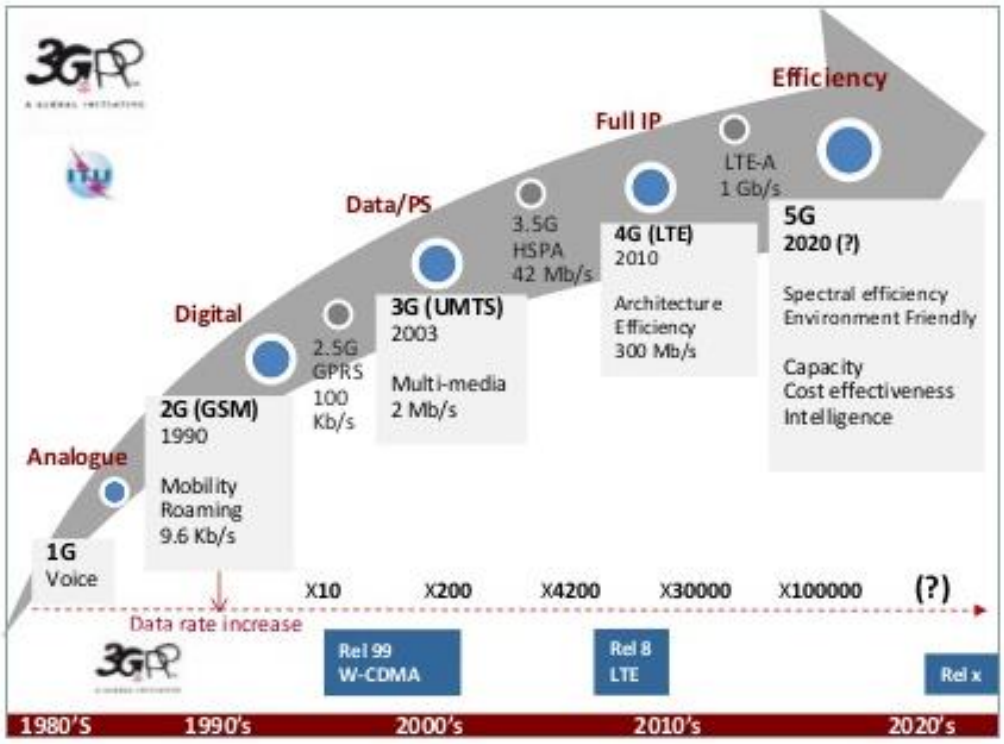
5.4.1 LTE: technology and performance

LTE is a more spectrally efficient technology than earlier 3GPP[65] specifications (see evolution illustrated in Figure 5.10), which means higher download speeds can be achieved with LTE using the same amount of spectrum. There are different variants of LTE; the first, the so-called Release 8, was standardised by 3GPP in 2008 and launched commercially in 2009.

64 This project represents the first deployment of Xtera's repeater in a commercial system, as well as the industry's first deployment of a Raman-based submarine repeater.

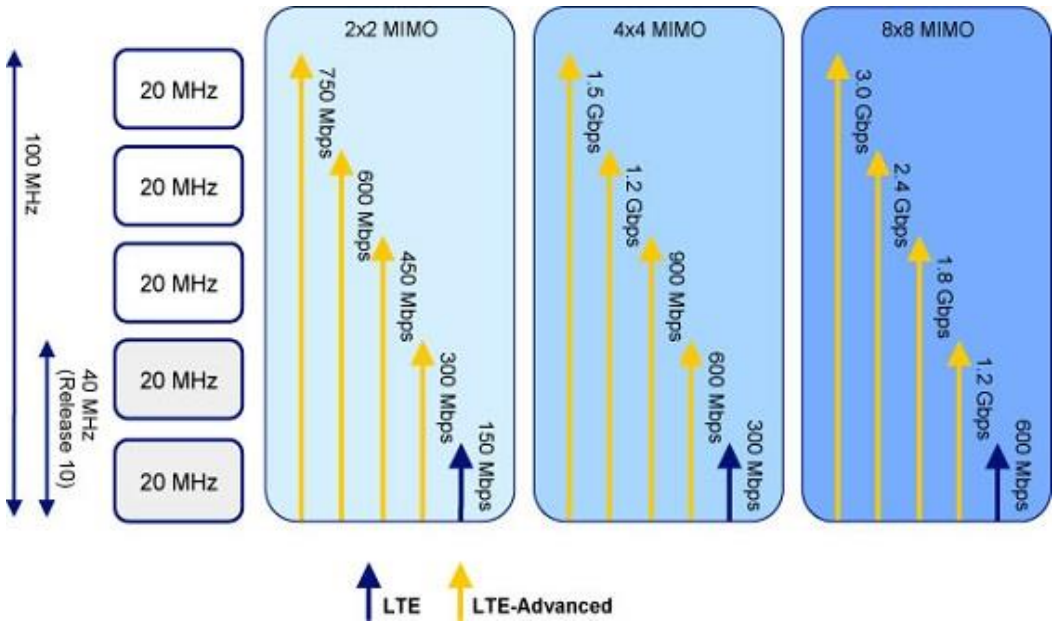
65 Third Generation Partnership Project; a collaboration between groups of telecoms associations. The initial scope of 3GPP was to make a globally applicable third-generation (3G) mobile phone system specification based on evolved GSM specifications. The scope was later enlarged to include the development and maintenance of: GSM and related "2G" and "2.5G" standards (including GPRS and EDGE), UMTS and related "3G" standards (including HSPA), LTE and related "4G" standards.

Figure 5.10: Evolution of mobile telecoms technologies [Source: 3GPP, 2013]



As an evolution of an existing, widely-deployed technology, LTE is perfectly placed to deliver against the future expectations of users, driving new consumer and business applications. In LTE and LTE-Advanced (LTE-A), peak download speeds increase with channel size – the maximum size of carrier is 20MHz, although carrier aggregation is now possible in LTE-A. Figure 5.11 highlights the peak download speeds possible after the introduction of LTE Release 10.

Figure 5.11: LTE peak download speeds (from Release10) [Source: Analysys Mason, 2015]



5.4.2 Future of mobile services in Guernsey

All of the mobile network operators in Guernsey, like those in other mature markets characterised by high subscriber penetration levels, are migrating to 4G. The migration is being driven by expanding 4G coverage and rising smartphone adoption. The improved coverage, a greater number of available devices at a broader range of price points, and increasing use of music and video streaming services are some of the factors driving increased adoption of 4G devices. All three mobile operators in Guernsey have invested significant amounts in 4G upgrades:

- The Sure network upgrade is understood to represent a GBP10 million investment.[66]
- JT has invested over GBP12 million in its LTE-A network across Guernsey and Jersey.[67]
- Airtel-Vodafone is said to be making a 'multimillion pound investment' in upgrading the services it offers.[68]

However, further investments in network quality and coverage will be required to ensure the 4G infrastructure in Guernsey can deliver the mobile broadband speeds possible in future variants of the LTE standard.

There is still uncertainty about 5G as it is largely still a concept at this point, and industry has yet to settle on any standards. However, there is general consensus that certain key goals will be achieved with 5G:

- *Significantly faster data speeds***:** Users can expect to access 5G networks at 10 times greater data rates than 4G networks.
- *Ultra-low latency*: particularly important for some industrial applications and driverless cars.
- *A more "connected world"*: The Internet of Things (wearable devices, smart home appliances, connected cars) is expected to grow exponentially over the next 10 years, and it will need a network that can accommodate billions of connected devices. Part of the goal behind 5G is to provide that capacity, and also to be able to assign bandwidth depending on the needs of the application and user.

Although the timeline for 5G deployments is still uncertain, most experts are predicting that we will see the first commercial 5G network in around 2020, with many observers expecting the first commercial deployments of 5G in the run-up to the Tokyo Olympics in 2020.

66 https://www.telegeography.com/products/commsupdate/articles/2015/04/02/sure-guernsey-becomes-first-on-island-to-obtain-4g-concession-first-sites-already-activated/

67 http://www.bailiwickexpress.com/jsy/connect/guernsey-media-releases/jts-4g-network-complete/#.VsHbzHkrGM8

68 https://www.telegeography.com/products/commsupdate/articles/2014/11/05/airtel-vodafone-selects-nokia-networks-as-sole-supplier-for-4g-network/

5.5 Regulatory environment

5.5.1 Effective regulation promoting long-term stability and investment

For small island economies such as Guernsey, with characteristics that make providing some infrastructure services costly, effective regulation is critical to keep prices no higher than they need to be. It can also ensure that service providers are able to recover fair and reasonable costs – and in doing so, lead them to seek innovative service delivery solutions better suited for small islands. If Guernsey wishes to attract businesses that will contribute to its long-term economic potential then it must have a system of regulation that promotes long-term stability and investment. Long-term visibility will provide confidence to service providers seeking to invest, and allow a greater stakeholder contribution on the direction Guernsey should take.

5.5.2 Promoting competition

Competition in retail services is vital to providing end users with a wide range of innovative and competitively priced products and services. In particular, wholesale access to the Sure fixed network is key to the further development of fixed-line competition in Guernsey. Competitive access to this network will stimulate greater retail competition in fixed-line services, provide consumers with greater choice and better pricing, and help drive innovation in the services provided to end users.

The recent introduction of wholesale line rental (WLR) is welcomed, providing the opportunity for new entrants to establish direct billing services to customers and to offer bundled services. In terms of implementation, we acknowledge that WLR is the least complex wholesale access product to introduce. However, we also encourage CICRA to undertake a cost-benefit analysis of introducing the naked DSL bitstream product.

It should be said that the investment by other licensed operators to roll out products based on local loop unbundling, compared to the returns they are like to get from the Guernsey market, may limit actual interest. However, if one or more ISPs express an interest, we would encourage CICRA to consider its introduction.

6 Considerations for government

For Guernsey's industries and economy to thrive, a vision is needed for where Guernsey's connectivity should be in 5–10 years' time – a vision shared by industry, government, businesses and consumers.

Guernsey's telecoms sector remains vital to the island's efforts to further grow and diversify the economy. However, in the context of a global drive towards further development of communications networks, it is clear that for Guernsey's infrastructure to remain leading edge in sectors such as FinTech and eGaming, and to develop new wealth-creating industries, clear and informed telecoms policy is crucial to encourage continued investment.

This section looks at some of the near-term issues and challenges confronting the States of Guernsey, and provides insight to inform some of the wider decisions facing government arising from the analysis presented in earlier sections of the report.

6.1 Market developments

Airtel and JT have confirmed they have been in talks to possibly merge their operations across the Bailiwicks of Guernsey and Jersey. The size of the Channel Islands economy may ultimately affect the economic realities surrounding any merger and, in turn, the final outcome.

We propose that the States of Guernsey continue to consult with CICRA and adopt a pragmatic view, recognising that the potential merger, like any other, should be judged on a case-by-case basis.

6.2 Making better use of existing infrastructure

Given the market's size, it could be more effective to concentrate on retail competition rather than network competition. The States of Guernsey and industry could therefore collaboratively develop and implement goals in terms of developing the island's infrastructure. The level of investment that might bring the maximum economic benefit for Guernsey may be a level that is higher than industry would choose to invest in independently. Therefore, there should be wide input, from stakeholders across the island, on the additional investment that industry could undertake and options for collaboration and public/private partnerships also explored.

The Commerce and Employment Department should work with colleagues in government and consult with key stakeholders to ascertain the investment priorities of the islands, and then engage in discussions with industry to establish the formal investment goals.

Government should also consider the following questions:

- What policy changes are required to enhance the attractiveness of the sector and increase investment?

- How can best-in-class infrastructure for telecoms-dependent economic sectors be promoted?
- How could the telecom sector's contribution (direct or indirect) to government revenues be optimised while addressing government needs and ensuring sector development?

By encouraging investment, Guernsey could advance more widespread coverage of faster fixed and mobile broadband technology.

A number of options might be considered to make better use of existing infrastructure, including:

- network infrastructure sharing
- improved access to State assets
- examining a network co-investment (NetCo) model.

6.2.1 Sharing of network infrastructure

Infrastructure sharing started with mobile network operators allowing each other to situate antennas on their mast sites. However, service providers can share infrastructure in many ways, depending on the regulatory environment and other legislation.

Network infrastructure sharing is primarily driven by potential reductions in operating expenditure (opex) and capital expenditure (capex):

- Opex reduction: sharing costs of shared infrastructure between multiple operators can significantly reduce opex. This is a driver in more penetrated and mature markets where price competition and margin pressure are big features of the market.
- Capex reduction for network roll-outs: this is a particular driver for new entrants, and for roll-out in more rural areas, and where a new technology (e.g. 4G) requires a more extensive number of sites.

Regulators are generally supportive of network infrastructure sharing, and strong arguments can be made that commercial and public policy interests are aligned in this area. In particular, sharing can alleviate pressure of network roll-out and cost management on operators, allowing them to focus on customer service in a competitive and increasingly customer-centric industry.

Consideration should be given to how infrastructure sharing might be promoted in Guernsey. Infrastructure-sharing deals can be complex, requiring extensive information gathering and negotiation on commercial issues. They may also require extensive engagement with government and regulatory authorities. A collaborative approach with CICRA and industry would therefore help to overcome any issues or concerns. For example, pilots for infrastructure sharing could be encouraged, helping to identify and address associated technical, commercial and legal issues in a collective manner.

6.2.2 Access to State assets

Similarly, access to State assets such as ducts, trenches and other infrastructure that could be used for fibre roll-out would be valuable for operators, particularly those with no or limited network footprint, by reducing the costs associated with the civil engineering aspects of infrastructure build.

The establishment of a "one-stop shop" that would allow operators who wish to use State assets such as fibre and/or ducts to deal with one entity rather than multiple Departments could be especially useful. Nonetheless it is important to recognise the practical implications involved in the co-ordination of multiple administrative organisations, infrastructure types and owners. There are also ongoing practical issues of security and access to ducts that will need to be considered in the context of operator duct sharing. While such issues can be overcome, they can be significant in terms of complexity.

Ensuring that easily accessible ducting is installed at the construction stage of new major public construction projects as well as new-build private developments could also be a very useful method of perpetuating the roll-out of fibre across Guernsey.

6.2.3 Network co-investment (NetCo)

Guernsey might go a step further and contemplate innovative regulatory approaches and models in order to promote future investment in telecoms infrastructure and consider whether there is an economic case for a network co-investment model (NetCo) in infrastructure. If an economic case exists, Guernsey may also consider how the model could be implemented so that it delivers benefits to all stakeholders, including the incumbent, other operators, new entrants and consumers.

One approach could involve the co-investment vehicle being a structurally separate commercial entity mainly supplying 'passive' access and primarily owned by its participant-operators (service providers and, potentially, the States of Guernsey and/or financial investors). Third-party entrants could purchase 'active' wholesale services from the participant-operators. Participant-operators would commit to funding the network during construction, and would receive a share of revenues. NetCo would control the passive network elements but would leave the investment in active equipment, as well as innovation in content and the applications layer, to the service providers. In other words, NetCo would principally own and control only the most non-replicable passive parts of the network.

Critical to the success of such a co-investment model would be its implementation-which would need to achieve legitimacy, and balance the potentially conflicting interests of stakeholders, including the incumbent, other operators, and CICRA.

If appropriately implemented, a NetCo model could provide a basis for more private investment. Central to this conclusion is the identification and analysis of the correct counterfactual of there being no NetCo in Guernsey. We also recognise that a co-investment model, even if implemented only for a narrow set of assets, would represent a significant change in Guernsey. However, it

could provide a basis for more investment and make for a more competitive market in the retail layers of the value chain.

6.3 Guernsey's broadband strategy

There is widespread recognition of the increasing importance of ubiquitous and effective high-speed broadband for economic growth, delivery of key services and participation in society.

The States of Guernsey might consider action to help achieve ubiquitous access to high-speed broadband services across the islands. Key to this would be consideration of:

- how to encourage and accelerate further investment in the commercial roll-out of high-speed services
- extending availability of high-speed broadband through potential intervention for the segments of the population where commercial investment is unlikely to occur without action from government.

6.3.1 Encouraging commercial roll-out

The benefits that broadband can bring to consumers, businesses, the island economy and society as a whole are clear and Guernsey should be committed to ensuring that the regulatory landscape is such that next-generation fixed and mobile broadband roll-out is both facilitated and encouraged.

A healthy, competitive market will encourage further investment, and ensure that consumer demands are satisfied. Consumer demand will define the infrastructure investment and the services that are ultimately provided.

Government's role in supporting the commercial roll-out of high-speed broadband services is to remove barriers to investment, to cut any red tape that increases the cost of roll-out, and to ensure the continuance of a considered regulatory framework that makes Guernsey an attractive place to invest.

To further encourage commercial roll-out a number of actions could be considered:

- Establish a regular forum between government and industry to facilitate the identification and resolution of any barriers to investment or infrastructure-related issues potentially prohibiting roll-out at an early stage.
- Examine how making better use of existing infrastructure in a way that does not infringe competition law is likely to lower costs for providers – this is considered further in Section 6.2.
- Work with industry to develop strategies for stimulating broadband demand, helping to address any obstacles for adoption on the demand side.

To the extent that such actions lower the marginal costs of the provision of high-speed broadband, they could, other things being equal, increase the penetration of commercially driven high-speed

broadband services and reduce the need for any intervention. However, where commercial investment is unlikely to occur without action or support from government, some form of public intervention may be warranted.

6.3.2 Extending the availability of high-speed broadband

Before considering the case for intervention, and the potential ownership and investment models, it is useful to consider other government investments in a European and wider international context.

National broadband projects – European context

As set out in Section 3.3.3, the European Commission has targeted download rates of 30Mbit/s for all of its citizens and at least 50% of European households subscribing to Internet connections above 100Mbit/s by 2020.

A number of European Union Member States have embarked on a range of projects designed to meet these objectives. We are aware of such schemes being implemented in a number of Member States, including France, Spain, Italy and Portugal:

- **France**: the "Programme Très Haut Débit" has a budget of EUR750 million[69] to target investment in a FTTH solution or, where suitable, and after careful consideration, a FTTC solution using VDSL2 technology.

- **Spain**: the extension of high-speed broadband (PEBA-NGA) specifies very high-speed NGA with "a download speed higher than 100Mbit/s" and a high-speed service of greater than 30Mbit/s. The programme is technology neutral and requires multi-fibre ducts where State aid is provided. The budget for PEBA-NGA amounts to EUR360 million over a three-year period.[70]

- **Italy**: Digital Strategy Italy is following the DAE targets and is technology neutral. It specifies that 50% of the population must be able to access greater than 100Mbit/s broadband services over FTTH architectures. The Italian authorities estimate that the total investment required to deliver the DAE objectives in Italy will be in excess of EUR9 billion, which is expected to be delivered with a mix of private and public funding. The Italian authorities envisage public aid of EUR2.5 billion. The budget for the first projects, in southern regions, is EUR500 million, mostly coming from European structural funds.[71]

[69] C(2011)7285 final: State aid SA.31316 (N330/2010) – France – Programme national "Très Haut Débit" – Volet B

[70] C(2013)4353 final: State aid SA.35834 (2012/N) – Spain Extension of high speed broadband in Spain (PEBA-NGA)

[71] C(2012)9833 final: SA.34199 (2012/N) – Italy, Digital Plan – Super-high speed broadband

- **Portugal**: High-speed broadband in Portugal – specifies a minimum speed of 40Mbit/s and is technology neutral. The total investment in the 20 years of the project is expected to reach EUR182.6 million.[72]

In June 2015, Germany received the go-ahead from the EC for EUR3 billion of aid to roll out superfast broadband throughout the country. By comparison, the UK government committed GBP530 million to superfast broadband roll-outs back in 2010, and by March 2015 Broadband Delivery UK (BDUK) had spent over GBP300 million to cover over 2.4 million premises (excluding investment from local authorities).

National broadband projects – other international examples

In addition to these European examples, a number of other high-profile, international projects provide a sense of the scale of investment that governments worldwide are committing to improved broadband networks:

- **Australia**: the projected cost of the National Broadband Network (NBN) is AUD41.5 billion (GBP24 billion), of which government funding is capped at around AUD29.5 billion (GBP17 billion). The change of government in September 2013 led to a change in the direction of superfast broadband deployment: instead of the predominantly FTTP approach proposed originally, the strategic review of December 2013 opted for an approach including five different access technologies, namely FTTP, FTTN/B[73], HFC[74], fixed wireless and satellite, and is intended to minimise peak funding levels and maximise long-term gains.

- **New Zealand**: the government is providing NZD1.35 billion (GBP700 million) of funding for the Ultra-Fast Broadband (UFB) programme. The network will connect up to 75% of premises (around 1.5 million premises) by 2020. The total cost has been estimated at NZD3 billion (GBP1.56 billion).

- **Singapore**: the government is providing grants of up to SGD750 million (GBP375 million) to the OpenNet consortium (led by the incumbent Singtel) to build the Next Generation National Broadband Network (NGNBN). It is providing a further SGD250 million (GBP125 million) to the operating company Nucleus Connect (led by the cable operator StarHub). The private sector is expected to invest SGD200–300 million (GBP100–150 million).

72 C(2011)312 final: State aid SA.30317 – Portugal, High-speed broadband in Portugal

73 FTTN: Fibre to the node (or sometimes neighbourhood), an architecture similar to VDSL where fibre is terminated in a street cabinet, with the final connection being copper. FTTN is often an interim deployment step toward full FTTH. FTTB: Fibre to the building, an architecture where fibre reaches the boundary of a building, such as the basement or ground floor in a multi-dwelling unit, with the final connection to the individual living space being made via alternative means

74 HFC: Hybrid fibre coaxial, a technology predominantly used by the cable TV industry in which optical fibre cable and coaxial cable are used in different portions of the network to carry broadband content.

- **Japan** and **South Korea:** these countries have a long history of providing tax incentives and subsidised loans to stimulate fibre deployment. However, no reliable data is available to allow direct comparison with the above projects.

UK Broadband Universal Service Obligation (USO)

In November 2015, the UK government announced that Internet access is to be considered an essential utility, with all UK homes and businesses given the right to a 10Mbit/s connection.

The Prime Minister said that giving Internet access an equal footing with other basic services, like water and electricity, will cement Britain's position as the most digitised major economy in Europe.

A broadband Universal Service Obligation (USO) is currently being drafted which will give everyone the legal right to request a connection to broadband with speeds of 10Mbit/s, no matter where they live in the UK. Data from Ofcom shows that 10Mbit/s is the minimum speed needed to meet the demands of typical families and business in the UK[75].

A USO is designed to ensure that all households and businesses can access the broadband speeds needed to do business online, use key services or stream live TV.

The obligation may also be upgraded over time as technology and demand evolve, which the government said it will consult on in early 2016.

The case for intervention

► *Cost–benefit analysis*

In order to justify a significant public intervention, it will be necessary to demonstrate that the long-term benefits of any proposed initiative outweigh its costs. This approach would serve to ensure that the States of Guernsey and the public receive value for money from any public subsidy provided.

The costs considered in such an analysis would include:

- costs to the States of Guernsey of providing the subsidy
- costs incurred by private operator(s) in the deployment and operation of the network.

The cost–benefit analysis would be expected to quantify benefits in a number of categories, including:

- benefits to residential households including from access to better services and time savings from teleworking
- productivity improvements for business and industry
- reductions in the costs of public service provision, such as healthcare provision from use of e-health services.

75 *Ofcom Infrastructure Report 2014*, Ofcom, December 2014

In addition, there are likely to be additional benefits that arise such as:

- improved education outcomes resulting from increased use of e-education services
- increased employment in construction and engineering sectors during infrastructure deployment
- boosts in output or productivity in other sectors of the economy.

► *The investment decision-FTTC or FTTH*

The bandwidth requirements forecasts set out in Section 4 suggest that, in the foreseeable future at least, the use of FTTC is likely to be sufficient to meet most consumers' needs. Equally, in Section 5 we discuss the improvements in copper technology performance, in part through ever more sophisticated transmission equipment, and partially by moving fibre closer to the building.

As copper speeds increase, this reduces the probability that there are material numbers of households needing FTTH, or put another way, pushes out the date when such need will manifest. This reduces the incremental benefits of FTTH over FTTC, though of course upgrading to new generations of copper technology does carry its own cost.

However, in light of the ambition of the national broadband projects outlined in Section 6.3.2, it could be reasonably argued that the States of Guernsey should intervene to encourage FTTP across the island. One challenge in making this case is that, to date, there is limited evidence of the benefits of FTTH over, for example, FTTC, which might justify market intervention. This may be because it is too early for such benefits to have materialised. The result is that the case for public investment in FTTP has to be on more speculative grounds, or on non-economic grounds.

This is particularly the case since forecasts of bandwidth discussed earlier in this report suggest that FTTC could provide sufficient bandwidth for some years to come. Some forecasts anticipate demand for higher speeds, but still within the capability of technologies such as G.fast – suggesting that FTTH is not essential even to meet these forecasts.

If the demand statistics in Section 4.1 are true, the financial arguments for using lower cost deployments such as VDSL2 and G.fast to deliver more than the median demand become more compelling than a wide scale FTTP roll-out at this point in time.

Notwithstanding, the gigabit speeds delivered by FTTH undoubtedly have promotional benefits. This applies both to the service providers that offer the speeds, but also to the municipalities that can point to very high speed broadband availability.

There are also merits in the 'future proof' argument for FTTH – acknowledging that while immediate benefits may be limited, FTTH will have ample capacity for substantial future requirements, even if today we cannot identify what might drive those requirements.

Investment and ownership models

There are a range of options for combining public and private investment, and these are presented in Figure 6.1. Each model is applicable in different circumstances, depending on the scope of the required infrastructure, the specific aims of government, and the investment/risk appetite of potential private sector partners.

Figure 6.1: Summary of investment and ownership models [Source: KPMG/Analysys Mason, 2015]

Investment model	Description
A. Private sector build, finance, own and operate (Gap funding)	Government pays a capital grant to a private sector operator for developing, owning and operating the network. The capital grant is set or capped through a competitive tender process and is the minimum necessary for the private sector operator to deliver the project on a normal, commercially viable basis. The private sector operator bears the downside risks associated with network deployment and operation and the public sector shares in upside benefits through "clawback" mechanisms. Grant payments are calculated on the capital funding requirement and spread across the contract term and are normally subject to deductions in the event of sub-standard performance against KPIs
B. Private sector finance, build and operate with asset reversion (Full concession)	Government contracts with a private sector operator to design, build, finance and operate the network. The operator derives economic benefit from the network for the duration of the contract at which point ownership reverts to the State. The private sector partner also receives a performance-related unitary payment from government (set through the procurement process) which allows for a reasonable commercial return. The private sector partner assumes all of the risk and rewards of ownership before this reverts to government at the end of the contract
C. Joint venture model	The government and a private sector partner form a joint venture (JV) which will design, build and operate the network. Both parties own equity in the entity and split the risk and rewards of ownership. Equity is invested by the State and the private sector over the deployment period in proportion to their shareholdings. The government may also pay a social policy objective grant to the JV during the contract term. The grant is calculated to address the commercial viability gap associated with the investment with grant payments being subject to the JV-meeting-specified service levels and contractual obligations
D. Public sector finance and own with private sector design, build and operate (Operating concession)	Government funds and owns the network and contracts with a private sector partner for the network's design, build and operation. The partner derives the economic benefit from the network and bears the commercial risk of operations until the contract ends. At the end of the operating concession government can decide to re-tender the operating contract, operate the network itself, or sell the network. The State bears the majority of risks associated with network ownership and reinvestment

Investment model	Description
E. Public sector build, finance, own and operate	Government designs, builds, operates and owns the network, most likely through the establishment of a new semi-State entity. It will derive all benefits associated with development and operation of the network and assume all risk. There is no private sector involvement in the project beyond any traditional contracting of network design and build

Options – gap funding model

This section of the report provides an analysis of the potential funding requirements on the basis that the preferred ownership option is gap funding (Option A in Figure 6.1).

The potential funding requirements under a gap funding model is dependent on which of the following options is chosen:

- capital subsidy only
- capital-related subsidy during operations only
- capital subsidy upfront and during operations.

Each of the three options is illustrated below.

Figure 6.2: Gap funding – capital subsidy only [Source: KPMG/Analysys Mason, 2015]

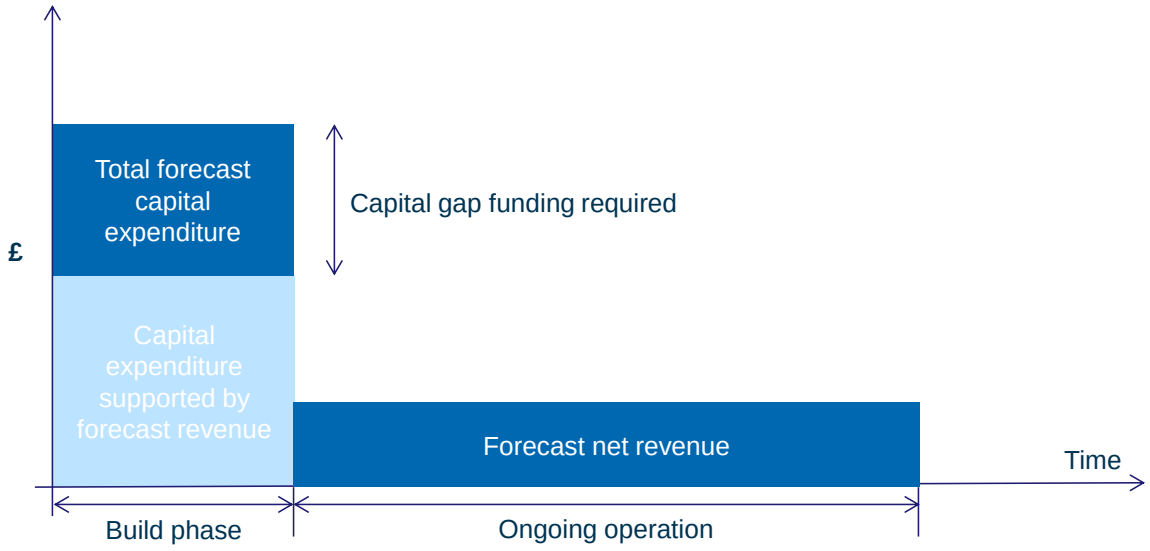


Figure 6.3: Gap funding – capital-related subsidy during operations only [Source: KPMG/Analysys Mason, 2015]

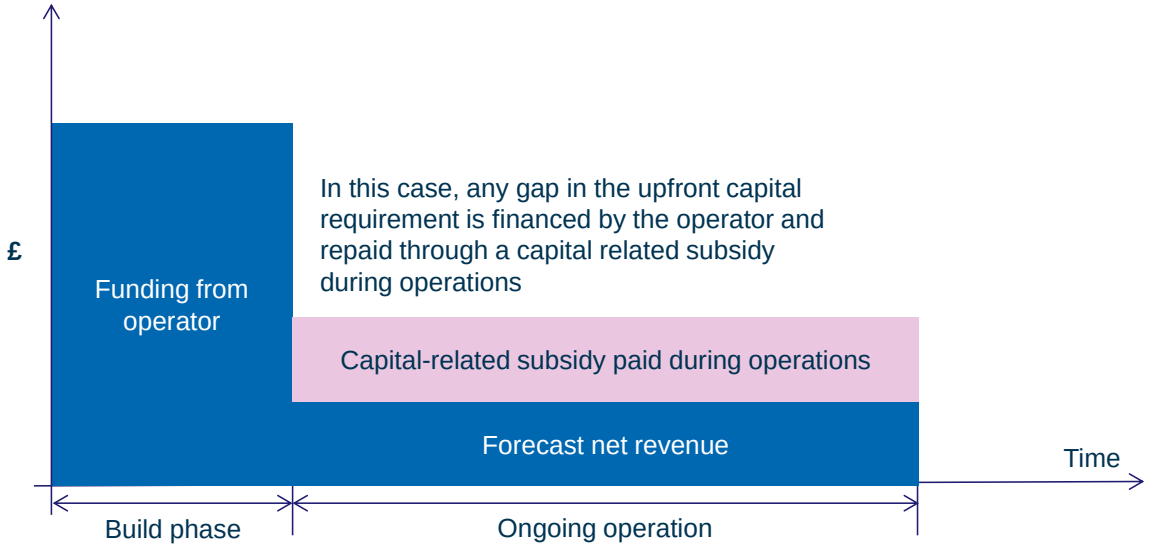
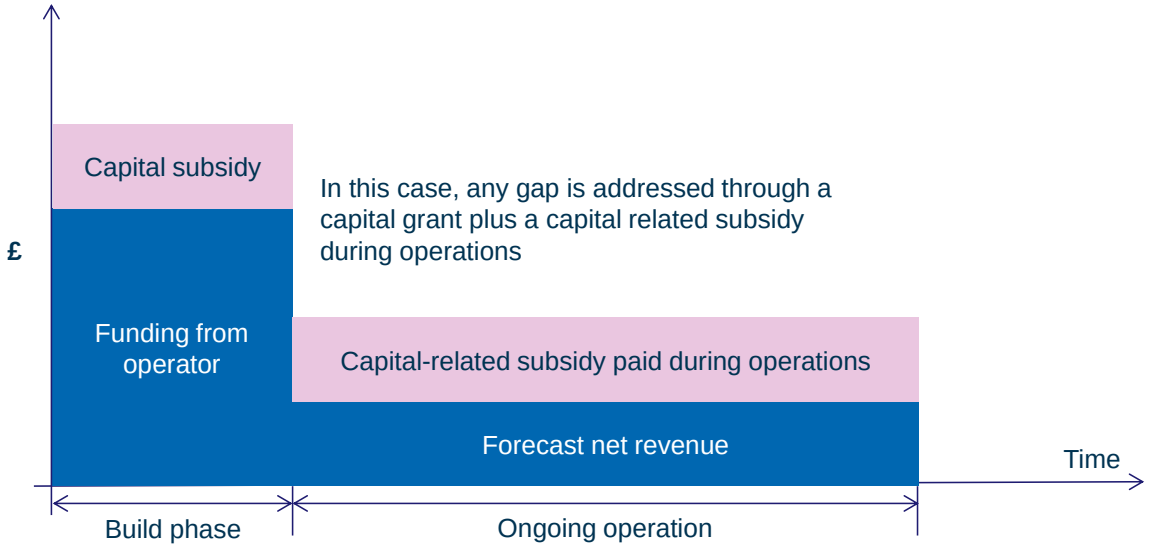


Figure 6.4: Gap funding – capital subsidy upfront and during operations [Source: KPMG/Analysys Mason, 2015]



The least expensive funding option to government on a net present value (NPV) basis is the capital subsidy upfront-only option. Over the build phase, however, the capital subsidy upfront-only option is more expensive than the other options in nominal cash terms (i.e. least affordable at this time).

The capital-related subsidy during operations model, which is the most expensive option in NPV terms, is the least expensive option over the build phase, in nominal cash terms.

The capital subsidy upfront and during operations option provides a balance between the two options, with a lower NPV cost than the capital-related subsidy during operations model, and a lower nominal cash cost in the build phase versus the capital subsidy upfront only option. In addition, this option allows for public subsidy to both match key roll-out period milestones and it facilitates the linking of ongoing payments to key performance indicators (KPIs) and provision of appropriate service level agreements (SLAs) during operations.

Funding requirement or aid intensity

The level of public funding required to support an intervention, or the aid intensity, is generally expressed as a percentage of the total costs eligible for support, as illustrated in Figure 6.5.

Funding	Total
Overall funding requirement	GBP total (GBP public + GBP private sector funding)
Public funding	GBP public funding
Aid intensity	**GBP public funding/GBP total×100%**
Total private sector funding	GBP private sector funding

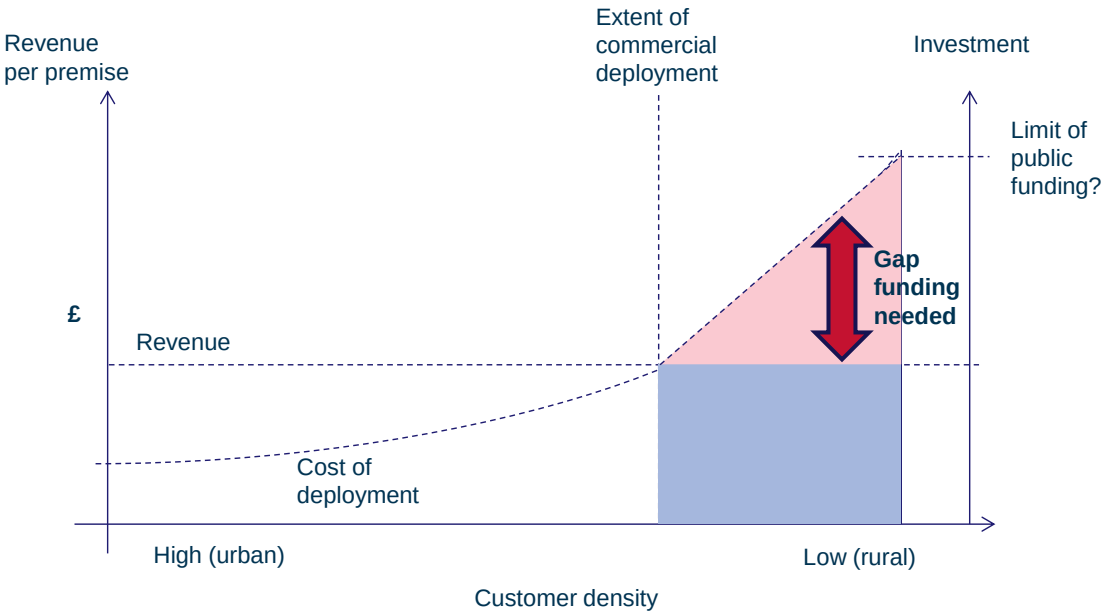
Figure 6.5: Calculation of aid intensity [Source: Analysys Mason, 2015]

Aid intensity can vary considerably for broadband projects, with the level of private sector funding determined by a number of factors, including:

- the overall quantum of the expenditure required, the complexity of the capital expenditure roll-out and the timeframe over which this is likely to occur
- the uncertainties around the level and rate of take-up of services (both by wholesale purchasers of the services and retail consumers)
- uncertainties around revenue and pricing models
- level of market demand risk (volume, price and take-up) associated with the project
- general technology risk associated with the project, including obsolescence risk
- the recognition of a strategic value associated with winning such a contract, based on the private sector partner's ability to develop the project and its capabilities.

However, in general terms, the scale of gap funding and the level of aid intensity usually increase as the rurality of the coverage requirement increases, as illustrated in Figure 6.6.

Figure 6.6: Commercial principles of gap funding [Source: Analysys Mason, 2015]



To further illustrate the variability of private sector funding, and therefore the aid intensity required, a number of examples are set out in Figure 6.7.

Project	Private sector funding	Public sector funding	Total funding (aid intensity)
Next Generation Broadband Project (NI)	GBP30 million	GBP18 million	GBP48 million (38%)
Superfast Cornwall	GBP78.5 million	GBP54.5 million	GBP133 million (41%)
BDUK rural programme	BDUK estimated that aid intensities for local broadband projects could vary from 53% to 89%, with an average of 71% across the UK[1]		

Note 1: See para (25) of State aid SA.33671 (2012/N)

Figure 6.7: Broadband projects – variability of private sector funding/aid intensity [Source: Analysys Mason, 2015]

6.4 Further considerations

There are a number of other considerations for government, including:

- the renewal of the current government WAN contract
- the pricing of data connectivity, both on- and off-island
- the possibility of choosing to promote Guernsey as a centre for testing and trials.

6.4.1 Renewal of government WAN contract

All public bodies, while having widely diverse responsibilities, employ similar technologies and systems for delivery of day-to-day activities. These include networks, telephony, email, servers and storage. All of these can be seen as infrastructure that is generally similar across public bodies. Often this infrastructure is largely delivered on a standalone basis with each department developing and managing its own infrastructure from separate locations.

The government WAN contract has shown that moving to a more integrated and shared infrastructure model can deliver efficiencies across the public service. However, aggregation of public sector demand in this way can also have a significant effect on the market. This is because public sector demand represents a sizeable share of the overall market in Guernsey.

The government WAN contract makes up a significant proportion of the retail leased line market on the island, to the extent that it is possible that whoever holds the contract is likely to be the major supplier of retail leased lines in Guernsey.

There is also the possible creation of incumbency advantage. Such incumbency advantages may be due to JT developing a better understanding of the public sector's requirements, or having made investments that give it a cost advantage over other tenderers. If the incumbent is in such a privileged position when it comes to the re-tendering, this may discourage participation of other service providers and may weaken competition overall.

The right trade-off balance between the costs and benefits associated with the government WAN contract and the potential effects on the market needs to be struck. With this in mind we suggest careful analysis is necessary to identify the most effective procurement strategy for any future contract renewal, and the form and scope of aggregation to be pursued.

Any contract renewal should also be cognisant of the recommendations made in the Analysys Mason WAN/telephony project report from 2012. We were commissioned by the States of Guernsey to conduct a technical due diligence of the WAN solution designed by the service provider, and to check the proposed network's adherence to government information security guidelines. We concluded that the proposed design was generally robust, allowing the States of Guernsey to get maximum value from their existing telephony assets, while also introducing IP handsets for half of its estate.

6.4.2 Pricing of data connectivity

Data connectivity pricing, on- and off-island, is viewed by the local digital industry as uncompetitive, high when compared to other jurisdictions, and as being potentially damaging to existing digital businesses, and a deterrent to potential new businesses. This is particularly the case for those requiring on-island high-bandwidth leased lines, or off-island high-bandwidth leased lines and associated IP feeds.

If the higher pricing for on- and off-island connectivity persists, then further analysis may be required to understand the extent to which this may be inhibiting business growth and development and potentially be damaging to the island economy with remedial action being taken where appropriate.

6.4.3 Promoting Guernsey as a centre for testing and trials

With worldwide demand for broadband devices continuing to grow and data consumption of networks ever increasing, testing and trialling in a real-life environment is becoming more important than ever before.

With this in mind, government, CICRA, existing telecoms operators and knowledge institutions could work collaboratively to bring tests of international stature to Guernsey. Such initiatives could provide companies from around the world with the opportunity to test, research, develop and launch products and services in an actual real-life market environment. Similarly, plans to promote Guernsey in this way could help publicise the island in a wider context.

However, careful consideration would be required as a number of other locations are already marketing this type of idea. For example, the JT Lab[76] in Jersey, where JT is offering access to its networks and customer base for innovative companies to test and trial their products, has already attracted a number of leading companies such as the RAD Group, Comverse and UTStarcom.

Another example of a similar initiative is Test & Trial Ireland, offered by the Irish telecoms regulator (ComReg) which supports wireless research and development. Ireland has a relatively high availability of clean radio spectrum and has a low use of spectrum by State services. International radio frequency co-ordination is eased by the fact that Ireland has only one land border, as it co-ordinates spectrum use with the UK only. The resulting advantage means that it is often possible to test in Ireland on clean radio frequencies as well as in almost any frequency band, even ones that may have existing users.

Another approach could be to consider developing Guernsey as a Smart City[77], putting to use digital and telecoms technologies to enhance quality and performance of public services, to reduce costs and resource consumption, and allow the States to engage more effectively and actively with its citizens.

6.5 Additional actions

The States of Guernsey might also consider the issuing of technical guidance to increase awareness of data infrastructure issues and to promote good practice. The introduction of a connection voucher scheme, similar to that introduced in the UK, might also be considered.

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76 http://www.jt-lab.com/

77 In a ‘smart city’ traditional services are made more efficient with the use of digital and telecoms technologies, for the benefit of those living and working in the city.

6.5.1 Building regulations – technical guidance

The increased use of electronic communications services in buildings has resulted in the supply of those services being routed in a number of different ways. The unavailability of ready access to facilitate the routing of cables for electronic communications services in new and existing buildings can cause inconvenience to the owners and occupiers of buildings and subsequent disruption to the building fabric and surrounding ground.

It may therefore be prudent for the States of Guernsey to consider the issuing of technical guidance, as part of or an accompaniment to existing buildings regulations, to increase awareness of data infrastructure issues and promote good practice. Such guidance could describe the different ways in which data infrastructures can be configured – both outside and inside buildings, and highlight at least some of the options available in terms of layout, ducts, and chambers and trenching on site, and possible ways of delivering ducting in single and multi-occupied buildings. It could also list the most common standards applying.

6.5.2 Voucher scheme for SMEs

Launched in December 2013, the UK government's *Connection Voucher* scheme was targeted at SMEs, charities and social enterprises. These organisations could apply for a voucher worth up to GBP3000 towards the cost of getting their business connected to superfast broadband (30Mbit/s+).[78] In September 2015, it was revealed that 40 941 businesses in the UK had benefited from the vouchers.

Given its apparent success, the States of Guernsey could consider a similar initiative. However, careful consideration should be given to whether money could be better spent on bringing faster connectivity to more rural parts of the islands. Further analysis would also be needed to confirm the extent to which such a demand-led scheme would be likely to improve the overall availability of broadband infrastructure.

[78] The minimum value of the grant was GBP100 and the maximum value of the grant was GBP3000 per SME. The grant did not cover VAT or revenue charges (ongoing rental). The grant was intended to cover genuinely incurred eligible costs.

7 Conclusions and recommendations

The telecoms sector has been fundamental in developing the competitive edge enjoyed by Guernsey over recent years, and remains vital to the island's continuing focus on further growing and diversifying its economy. We conclude our report by setting out our view of the existing connectivity and infrastructure, and by highlighting a number of recommendations for Guernsey to consider as part of achieving their strategic aims.

7.1 Conclusions

By many international standards, Guernsey is well connected, with a range of products and services broadly comparable to other markets. Whilst Sure is the leading service provider and owns the majority of on-island infrastructure, it should be recognised that there are multiple service providers and several infrastructure operators, including three separate mobile network operators, as well as several owners of off-island subsea fibre cables.

The general view put forward by end users indicates that the demand for on- and off-island connectivity for enterprises is being satisfied and that sufficient capacity is available. However, the pricing of enterprise connectivity remains a concern, with many stakeholders viewing prices as uncompetitive and high when compared to other markets.

With high levels of security, resilience, capacity and a good choice of data centres and hosting providers, the island is well positioned to provide data storage and hosting solutions.

Most fixed broadband services are delivered using legacy copper-based ADSL products, and take-up of next-generation VDSL technology currently stands at less than 10%. However, VDSL is available to approx. 60% of premises, and in those areas where these services are being used, download speeds compare very favourably to global benchmarks.

All three of the mobile network operators now provide 4G (LTE) coverage, and availability is generally widespread.

Figure 7.1 summarises our view of Guernsey's existing connectivity and infrastructure.

Figure 7.1: Connectivity and infrastructure – conclusions [Source: Analysys Mason, 2015]

Infrastructure	Conclusions
Enterprise connectivity (on- island)	• The general view of end users is that demand for on-island leased line products is being satisfied and that sufficient capacity is available. • Leased line pricing is viewed by many local stakeholders as uncompetitive and high when compared to other jurisdictions. • Data confirms that the price of on-island leased lines is high when compared to other markets such as the UK.
Enterprise connectivity (off-island)	• Guernsey is well connected, with six subsea cables connecting it to the UK and France. From our engagement with stakeholders and service providers, we understand that barely a tenth of the international fibre capacity is being utilised – the general view is that sufficient capacity is available. • The pricing of off-island connectivity is viewed by many stakeholders as uncompetitive and high when compared to other jurisdictions. • The underlying issue, at least in part, appears to be the low traffic volumes on the off-island links. However, if prices are not falling as fast as traffic is rising then there might be a problem requiring further investigation. The high transit costs to IXPs, such as those in London and Paris, incurred by the island's service providers could also be a contributory factor.
Data centres	• With high levels of security, resilience, capacity and a good choice of data centres and hosting providers, the island is well positioned to provide data storage and hosting solutions. • There are a number of data centres located in Guernsey, with providers including Sure, JT Guernsey, and C5 Alliance. The Long Port Group, a privately owned property development, has also announced that is developing the Guernsey Data Park, a major data centre and business continuity scheme.
Fixed broadband	• Most fixed broadband services are delivered using legacy copper-based ADSL products, and take-up of next generation VDSL technology currently stands at less than 10%. • With ADSL and VDSL, as the length of the copper cables increases, the delivered bandwidth decreases. However, the line-length distribution on Guernsey is such that ADSL and VDSL performance is relatively high for the majority of those using broadband provided over Sure's copper network. • VDSL is available to approx. 60% of premises in Guernsey. In areas where these services are being used, download speeds compare very favourably to global benchmarks.
Mobile	• All three mobile network operators provide 4G (LTE) coverage, and availability is generally widespread. • Interoperable TETRA digital radio systems for police and emergency services operate across Guernsey and Jersey. The systems allow the Channel Islands to collaborate in public safety provision and emergency situations, and can be joined whenever needed.

7.2 Recommendations

We conclude our report by setting out a number of recommendations for the States to consider as part of achieving their strategic aims.

7.2.1 Market developments

JT and Airtel-Vodafone have confirmed they have been in talks to possibly merge their operations across Guernsey and Jersey. The size of the Channel Islands economy may ultimately affect the economic realities surrounding any merger and, in turn, the final outcome.

At this point in time, we propose the States of Guernsey continue to consult with CICRA and adopt a pragmatic view, recognising that the possible merger, like any other, should be judged on an individual basis.

7.2.2 Developing the island's infrastructure

Given the market's size, it could be more effective to concentrate on retail competition rather than network competition. The States of Guernsey and industry could therefore collaboratively develop and implement goals in terms of developing the island's infrastructure.

A number of options might also be considered to make better use of existing infrastructure, including:

- sharing of network infrastructure
- improved access to State assets
- examining a network co-investment (NetCo) model.

Infrastructure sharing

Sharing of network infrastructure can alleviate the financial pressure of network roll-out and ease cost management for operators, allowing them to focus on customer service in a competitive and increasingly customer-centric industry.

Consideration should be given to how infrastructure sharing might be promoted in Guernsey. It should be noted that such deals may require extensive engagement with government and regulatory authorities, so a collaborative approach with CICRA and industry would therefore help to overcome any issues or concerns.

Improved access to State assets

Access to State assets such as ducts, trenches and other infrastructure that could be used for fibre roll-out would be valuable for operators, particularly those with no or limited network, by reducing the costs associated with the civil engineering aspects of infrastructure build.

The government should consider establishing a "one-stop shop", that would allow operators who wish to use State assets such as fibre or ducts to deal with a single entity rather than multiple Departments.

Ensuring that easily accessible ducting is installed at the construction stage of new major public construction projects, as well as in new-build private developments, could also be a useful method of encouraging the roll-out of fibre across Guernsey

Examining a network co-investment (NetCo) model

Guernsey might go a step further and contemplate innovative regulatory approaches and models in order to promote future investment in telecoms infrastructure, in particular considering whether there is an economic case for a network co-investment model (NetCo) in infrastructure, and, if so, how the model could be implemented so that it delivers maximum benefits to all stakeholders.

If appropriately implemented, a NetCo model could provide a basis for more private investment. Central to this objective is the identification and analysis of the correct counterfactual of there being no NetCo, and we also recognise that a co-investment model, even if implemented only for a narrow set of assets, would represent a significant change in Guernsey. However, it could provide a basis for more investment and make for a more competitive retail market.

7.2.3 Determining Guernsey's broadband strategy

The case for intervention

There is widespread recognition of the increasing importance of ubiquitous and effective high-speed broadband for economic growth, delivery of key services and participation in society. The States of Guernsey might therefore consider action to help achieve ubiquitous access to high-speed broadband services. Key to this would be consideration of:

- How to encourage and accelerate further investment in the commercial roll-out of high-speed services.
- Extending availability of high-speed broadband through potential intervention for the segments of the population where commercial investment is unlikely to occur without action from the government.

To the extent that government actions (some of which are considered in Section 6.3.1) lower the costs of the provision of high-speed broadband, they could – other things being equal – increase the penetration of commercially-driven high-speed broadband services and reduce the need for any intervention. However, where commercial investment is unlikely to occur without action or support from government, some form of public intervention may be warranted.

A number of EU Member States have embarked on a range of projects designed to meet the broadband targets of the Digital Agenda for Europe. In addition, several other high-profile international projects provide a sense of the scale of investment that governments worldwide are committing to improved broadband networks. Furthermore, in November 2015, the UK government announced that Internet access is to be considered an essential utility, with all UK homes and businesses given the right to a 10Mbit/s connection.

The long term economic benefits of any significant public sector intervention are normally demonstrated through a detailed cost – benefit analysis, including the consideration of a 'do nothing approach'. Policy makers should consider undertaking such analysis to ensure the States of Guernsey and the public receive value for money from any public subsidy provided.

Guiding principles

A guiding principle in the EU is that any State intervention should limit as much as possible the risk of crowding out or replacing private investments, of altering commercial investment incentives and ultimately of distorting competition. Applying the principle to the deployment of broadband infrastructure in Guernsey, it needs to be ensured that public funds are used carefully, and that any subsidy or aid is complementary and does not substitute or distort investments of market players. Public funding for high-speed broadband should, therefore, not be used in areas where market operators plan to invest, or have already invested.

Notwithstanding the overall principle of not substituting or distorting competition, there is also the question of selecting a suitable technology that fits with the State's targets, and the choice of investment and ownership model. In order to comply with EU State aid principles, any intervention should be technology-neutral and focussed on performance targets. A range of options for combining public and private investment is set out in Section 6.3.2; each model is applicable in different circumstances, depending on the scope of the required infrastructure, the specific aims of government, and the investment/risk appetite of potential private sector partners.

Potential cost impact

Figure 7.2 below provides a high-level summary of the potential funding requirements for different *universal coverage* performance targets:

- **10Mbit/s download target**, akin to the recently announced UK Broadband Universal Service Obligation (USO)
- **30Mbit/s download target**, corresponding to the Digital Agenda for Europe (DAE) goal of the entire EU being covered by broadband above 30Mbit/s by 2020
- **100Mbit/s download target**, which would provide for the higher broadband connection speeds available in countries/regions such as Singapore, Hong Kong and South Korea

The analysis is provided on the basis that the preferred ownership option is gap funding, and the technology requirement is limited to a choice of either FTTC/VDSL or FTTP.

However, it should be noted that wireless technologies could, in some instances, meet the performance targets specified and a composite approach involving the use of fixed and wireless network technologies, such as 4G and 5G, may be appropriate. That said, the deployment costs of a wireless network dimensioned to ensure the higher-speed targets on a wide scale could become prohibitive. Furthermore, the performance of wireless networks is dependent on the availability of sufficient and suitable spectrum. Wireless networks can also be more expensive to operate in the longer term than their fixed counterparts.

It is important to note that the States should also examine the 'do nothing' approach – a prerequisite for any apposite cost-benefit analysis – to understand the outcomes of a reference scenario where no subsidy or aid is applied in addition to normal market investment. Whilst it is difficult to predict the point at which the extent of commercial deployment might end, it is not unreasonable to believe that Sure will continue to invest in its VDSL roll-out, reaching a coverage level broadly equivalent to its existing ADSL footprint and, in the longer term, also increasing FTTH coverage. In this context, a policy of State intervention could aim to principally accelerate end user connections to a network capable of supporting desired performance targets, and to address the most remote areas of the Bailiwick where commercial investment is unlikely to occur.

Figure 7.2: Potential funding requirements for different broadband performance targets, based on the deployment of FTTC/VDSL and FTTP technologies [Source: Analysys Mason, 2015]

Universal download target	Technology requirement	Comments
10Mbit/s	Potentially achievable through the extension of existing FTTC/VDSL coverage. In some areas DSL acceleration' technologies may be required to improve the bandwidth–distance performance of copper connections. The solution may also require some re-engineering of the copper network in some instances to address longer line lengths. Whilst such a solution should be capable of providing a minimum universal 10Mbit/s download performance, many premises would benefit from significantly higher download speeds.	Assumes existing VDSL coverage is c.59% and does not increase through further commercial deployment. The additional investment requirement is estimated to be upwards of GBP5 million, allowing for the limited deployment of acceleration technologies and some re-engineering of the copper network. Aid intensity would be subject to the investment appetite of the private-sector partner – public subsidy would vary, potentially between GBP2 million and GBP4.5 million. Deployment timescales would be dependent on the local environment and resource availability, but such a solution could be deployed within 2–3 years.
30Mbit/s	Potentially achievable through the extension and improvement of existing FTTC/VDSL coverage (via the use of DSL acceleration technologies and copper network re-engineering), in conjunction with the deployment of FTTH in some areas. Whilst a combined VDSL and FTTH deployment should be capable of providing a minimum universal 30Mbit/s download performance, many premises would benefit from significantly higher download speeds.	Assumes 50% of premises in Guernsey could be served by FTTC/VDSL, with the other 50% being served by FTTH/GPON, this would suggest an overall capital investment requirement of c.GBP30 million. Public subsidy requirement potentially GBP12–27 million Deployment timescales would be dependent on the local environment and resource availability, but the deployment of the FTTH component of this solution could take up to 3 years.
100Mbit/s	Almost entirely dependent on a universal FTTH deployment, with only a limited number of premises (having shorter copper line lengths) being satisfied with FTTC/VDSL technology. Whilst such a solution should be capable of providing a minimum universal 100Mbit/s download performance, many premises would benefit from significantly higher download speeds. FTTH has ample capacity to meet substantial future requirements	Assumes 90% FTTH/GPON deployment, and 10% FTTC/VDSL, suggesting an overall capital requirement of at least c.GBP55 million. Public subsidy requirement potentially GBP22–50 million. The deployment timescale of a solution of this nature is dependent on local conditions and resource availability, but could take 3–5 years to deliver.

Note: Public subsidy estimates are based on an aid intensity of 40%–90%.

Factors influencing deployment decisions

If the demand statistics shown earlier in this report are true, the financial arguments for using lower-cost deployments such as VDSL2 and G.fast to deliver more than the median demand become more compelling than a wide scale FTTP roll-out at this point in time.

Not rolling out FTTP avoids substantial cost, and leaves open the option of delivering increased broadband speeds through relatively less expensive technologies. However, this strategy clearly carries the risk that over time Guernsey's digital infrastructure becomes outdated in terms of its capabilities.

Notwithstanding the financial arguments, the gigabit speeds delivered by FTTH undoubtedly have promotional benefits, both to the service providers that offer these speeds, and also to the municipalities that can point to the availability of very high-speed broadband in their areas.

There is also merit in the argument that FTTH is 'future proof' – acknowledging that whilst the immediate benefits may be limited, FTTH has ample capacity to meet substantial future requirements, even if today we cannot identify what might drive those requirements.

The long term economic benefits of any significant public sector intervention are normally demonstrated through a detailed cost – benefit analysis, including the consideration of a 'do nothing approach'. Policy makers should consider undertaking such analysis to ensure the States of Guernsey and the public receive value for money from any public subsidy provided.

7.2.4 Renewal of government WAN contract

The government WAN contract has shown that moving to a more integrated and shared infrastructure model can deliver efficiencies across the public services. However, aggregation of public-sector demand in this way can also have a significant effect on the market since it represents a sizeable share of the overall market in Guernsey.

The right trade-off balance between the costs and benefits associated with the government WAN contract and the potential effects on the market needs to be struck. With this in mind we suggest careful analysis is necessary to identify the most effective procurement strategy for any future contract renewal, and the form and scope of aggregation that is to be pursued. Any contract renewal should also be cognisant of the recommendations made in the Analysys Mason WAN/telephony project report from 2012.

7.2.5 Pricing of data connectivity

Data connectivity pricing, on – and off – island, is viewed by the local digital industry as uncompetitive, high when compared to other jurisdictions, potentially damaging to existing digital businesses, and a deterrent to potential new businesses.

If the high price of on – and off – island leased line connectivity persists then further analysis may be required to understand the extent to which this may be inhibiting business growth and potentially damaging the island's economy, and whether further regulatory investigation is merited.

Government might also work with CICRA to understand the extent to which local businesses do, or might want to, use 'self-supply' solutions using point-to-point microwave, providing the availability of suitable spectrum.

7.2.6 Promoting Guernsey as a centre for testing and trials

With worldwide demand for broadband devices continuing to grow and data consumption ever increasing, testing and trialling in a real-life environment is becoming more important than ever before.

The government, CICRA, telecoms operators and knowledge institutions could work collaboratively to bring tests of international stature to Guernsey. Such initiatives could provide companies from around the world with the opportunity to test, research, develop and launch products and services in an actual real-life market environment.

7.2.7 Additional actions

The States of Guernsey might also consider the issuing of technical guidance to increase awareness of data infrastructure issues and to promote good practice. The introduction of a connection voucher scheme, similar to that introduced in the UK, might also be considered.

Building regulations – technical guidance

The unavailability of ready access to facilitate the routing of cables for electronic communications services in new and existing buildings can cause inconvenience to the owners and occupiers of buildings, and subsequent disruption to the building fabric and surrounding ground.

To improve access for telecoms services, the States of Guernsey could consider issuing technical guidance as part of or as an accompaniment to existing buildings regulations, to increase awareness of data infrastructure issues and promote good practice.

Voucher scheme for SMEs

Launched in December 2013, the UK government's Connection Voucher scheme was targeted at SMEs, charities and social enterprises, allowing such organisations to apply for a voucher towards the cost of getting their business connected to superfast broadband.

The States of Guernsey could consider a similar initiative to the UK's connection voucher scheme for SMEs. However, further analysis would also be needed to confirm the extent to which such a demand-led scheme would be likely to improve the overall availability of broadband infrastructure.

Annex A Glossary of abbreviations used

Technical terms are explained in footnotes at their first occurrence within the report.

Abbreviation	Full term
3GPP	3rd Generation Partnership Project
ADSL	Asymmetric digital subscriber line
DAE	Digital Agenda for Europe
DOCSIS	Data over cable service interface specification
DSLAM	Digital subscriber line access multiplexer
FTTB	Fibre to the building
FTTdp	Fibre to the distribution point
FTTH	Fibre to the home
FTTN	Fibre to the node
FTTP	Fibre to the premises
GPON	Gigabit Passive Optical Networks
HFC	Hybrid fibre coaxial
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet protocol
ISDN	Integrated services digital network
ITU	International Telecommunication Union
IXP	Internet exchange point
LTE	Long term evolution
MPLS	Multi-protocol label switching
MSAN	Multi-service access node
NGA	Next generation access
PBX	Private Branch Exchange
PtP	Point-to-point
PVR	Personal video recorder
SME	Small or medium-sized enterprise
SMP	Significant market power
TETRA	Terrestrial Trunked Radio
VDSL	Very-high-bit-rate digital subscriber line
VoIP	Voice-over-Internet-protocol
WAN	Wide-area network
WiMAX	Worldwide Interoperability for Microwave Access
WLR	Wholesale line rental

Annex B Cost of fixed broadband services in Guernsey

B.1 Introduction

In this Annex, we provide an analysis of the cost of fixed broadband services in Guernsey compared to other European countries.

B.2 Methodology

Publicly available price data for home broadband packages available in Guernsey was gathered from JT and Sure websites.

For the benchmark data set, we considered broadband package prices for operators in a number of Western European countries:

- Belgium
- Denmark
- France
- Germany
- Italy
- Netherlands
- Sweden
- UK

A publicly available dataset: *Global Broadband Pricing Study: Updated Dataset*[79] was used to determine the pricing of broadband products in these countries.

The price data collected for the operators in both Guernsey and the benchmark countries is exclusively for the monthly cost to a subscriber. Any costs related to equipment or connections have been ignored.

B.3 Results

We have analysed the results of this benchmarking exercise within two categories related to the downlink speed of the service:

- 0 – 30 Mbit/s
- > 30 Mbit/s

[79] http://policybythenumbers.blogspot.ie/2015/02/global-broadband-pricing-study-updated.html

B.3.1 0 – 30 Mbit/s broadband comparison

As shown in Figure B.1, all of the 0 – 30Mbit/s prices fall above the trend line for benchmark prices.

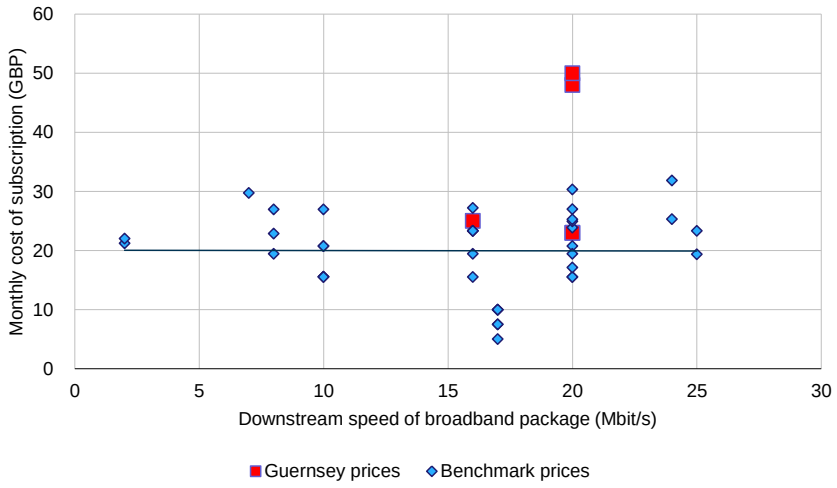


Figure B.1: Comparison of 0 – 30Mbit/s broadband pricing for operators in Guernsey and in benchmark countries [Source: operator websites, Google international broadband pricing study, 2015]

B.3.2 > 30 Mbit/s broadband comparison

As can be seen in Figure B.2, all > 30Mbit/s packages are priced above the level of the corresponding packages in benchmark countries. In some cases, the price differential is quite significant.

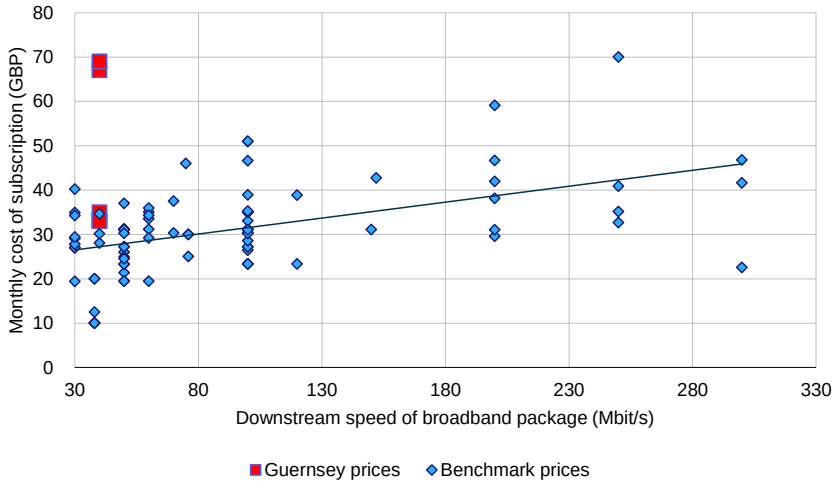


Figure B.2: Comparison of > 30Mbit/s broadband pricing for operators in Guernsey and in benchmark countries [Source: operator websites, Google international broadband pricing study, 2015]

Annex C Sure – ADSL and VDSL statistics

C.1 Sure statistics on ADSL line length

Figure C.1: ADSL Consumer Service Line Lengths [Source: Sure, October 2015]

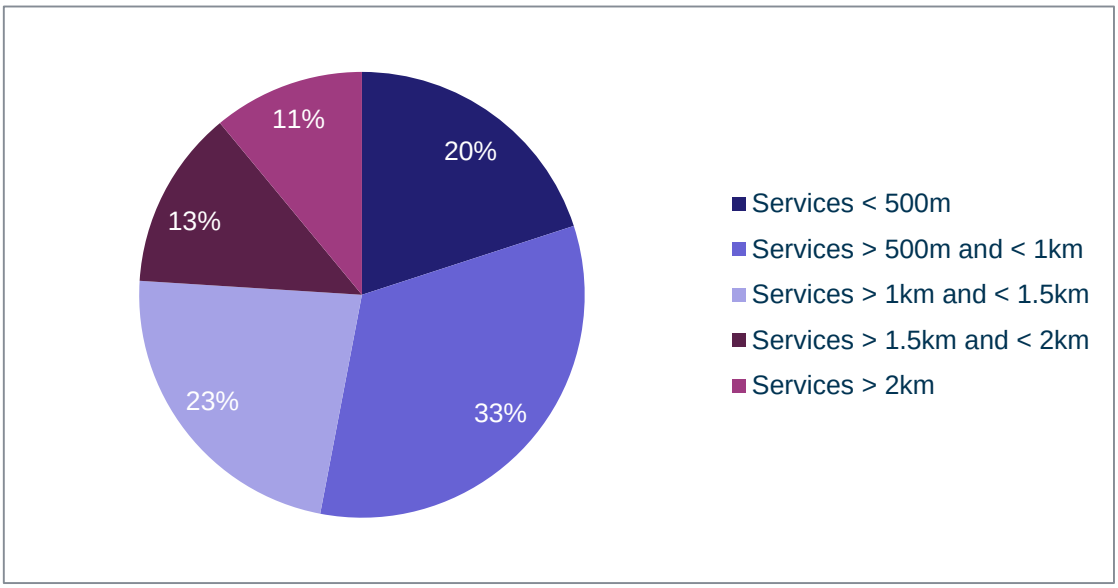
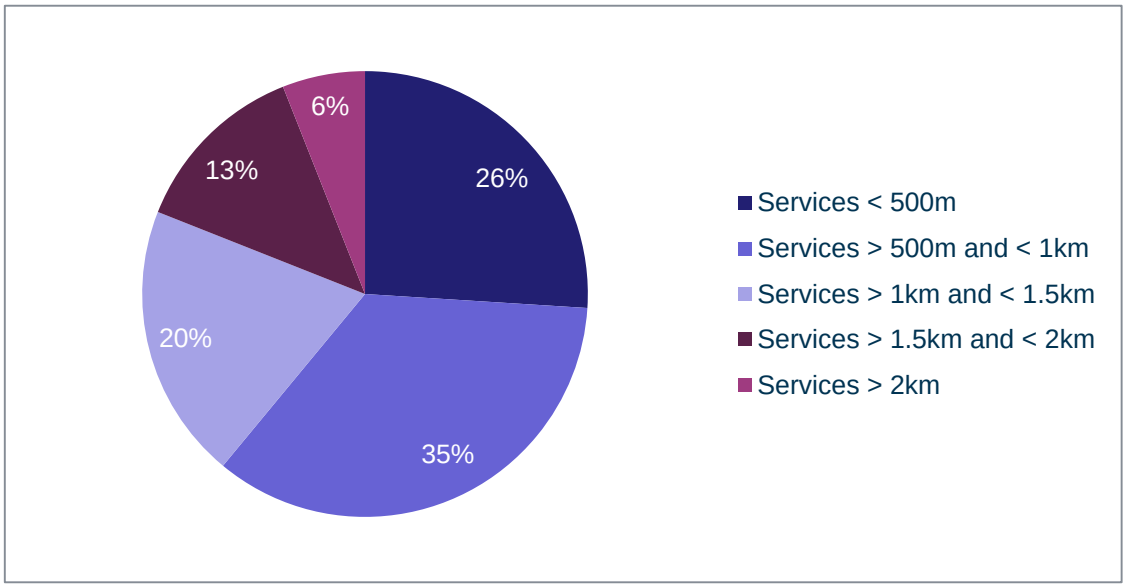


Figure C.2: ADSL Pro Service Line Lengths [Source: Sure, October 2015]



In the figures above, the 'Pro Service' statistics refer to those Sure products specifically designed for small businesses or home users who frequently using the Internet for gaming or streaming HD content.

C.2 Sure statistics on VDSL line lengths

Figure C.3: VDSL Consumer Service Line Lengths [Source: Sure, October 2015]

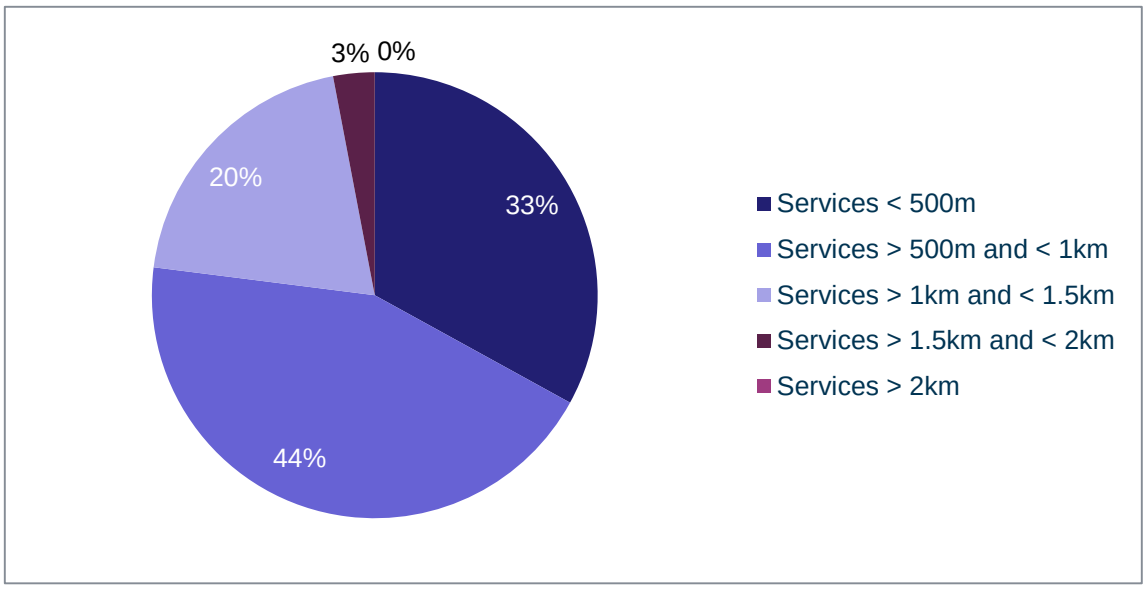
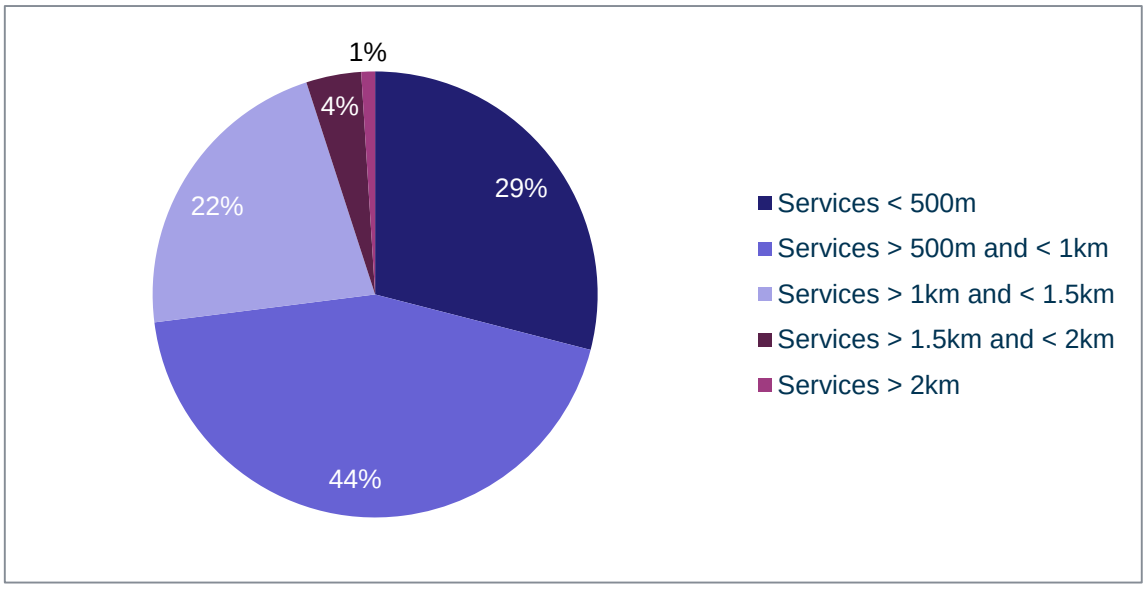


Figure C.4: VDSL Pro Service Line Lengths [Source: Sure, October 2015]



In the figures above, the 'Pro Service' statistics refer to those Sure products specifically designed for small businesses or home users who frequently using the Internet for gaming or streaming HD content.

Annex D Broadband performance benchmarks

D.1 Akamai State of the Internet – average connection speed by EMEA country

Global rank	Country/region	Q2 2015 Average (Mbit/s)	YoY change
4	Sweden	16.1	18%
5	Switzerland	15.6	6.4%
6	Netherlands	15.2	11%
7	Norway	14.3	38%
9	Finland	14.0	27%
10	Czech Republic	13.9	13%
12	Denmark	12.9	14%
13	Romania	12.8	9.6%
17	Belgium	12.4	11%
18	Israel	12.1	4.0%
19	United Kingdom	11.8	7.6%
22	Ireland	11.0	10%
23	Austria	10.9	6.4%
24	Germany	10.7	21%
27	Portugal	10.4	31%
28	Slovakia	10.3	34%
31	Hungary	10.0	14%
32	Poland	10.0	25%
34	Spain	9.7	22%
36	Russia	9.6	5.0%
45	France	7.9	12%
48	United Arab Emirates	7.0	47%
54	Italy	6.4	12%
56	Turkey	6.3	20%
94	South Africa	3.3	7.7%

Figure D.1: Average connection speed by EMEA country (fixed networks) [Source: Akamai, Q2 2015]

D.2 Akamai State of the Internet – average peak connection speed by EMEA country

Global rank	Country/region	Q2 2015 Peak (Mbit/s)	YoY change
6	Romania	72.1	17%
8	Israel	71.4	-14%
9	Sweden	62.8	24%
12	Netherlands	60.9	16%
14	Switzerland	59.4	11%
15	Belgium	57.3	10%
17	Russia	54.2	19%
18	Finland	53.2	31%
19	Hungary	51.7	17%
23	United Kingdom	50.9	8.5%
25	Norway	50.0	34%
27	Czech Republic	48.7	11%
29	Portugal	48.2	9.1%
31	Denmark	48.1	20%
32	United Arab Emirates	47.7	35%
34	Spain	47.4	27%
36	Germany	46.8	12%
37	Ireland	46.4	9.5%
40	Slovakia	44.0	22%
41	Poland	43.5	22%
42	Austria	43.5	4.1%
52	Turkey	37.5	21%
53	France	37.2	24%
69	Italy	30.2	12%
123	South Africa	16.8	26%

*Figure D.2: Average **peak** connection speed by EMEA country (fixed networks) [Source: Akamai, Q2 2015]*

Annex E Stakeholder consultations

During this engagement we consulted extensively with stakeholders in government, public services, and industry. We would like to thank everyone who took time to contribute their knowledge and opinions.

Contributor	Organisation
Jay Almer	The Potting Shed (Chairman of Chamber Creative and Digital Subgroup)
Chris Arnold	Guernsey Airport
Patrick Banfield	Social Security Department, States of Guernsey
Chris Beeching	States of Alderney (Head of Operations)
Justin Bellinger	Sure
Dan Boylet	Generali
Michael Byrne	CICRA
Ian Campbell	Airtel – Vodafone
Mike Culverwell	Commerce and Employment Dept., States of Guernsey (Digital Greenhouse)
Iain Davidson	Generali
Pat Devine	CICRA
Steve Dorrity	Home Department, States of Guernsey (Police)
Alex Duncan	Health and Social Services, States of Guernsey
Gareth Fooks	Sure
Mark Holt	Cambridge Park Capital
Ian Hunter	Home Department, Guernsey Police
Cyrille Joffre	Sure
Gareth Jones	Commerce and Employment Dept., States of Guernsey (Digital Greenhouse)
Wayne Kelly	Treasury and Resources Department, States of Guernsey
Marc Lainé	C5 Alliance Group
Glen Le Cheminant	Home Department, States of Guernsey
David Le Ray	Royal Court, States of Guernsey
Paul Le Sauvage	Environment Department, States of Guernsey
John Lowe	PwC
Paul Lower	Healthspan
Martin Lucas	Home Department, Guernsey Fire
Neil Martin	Treasury and Resources Department, States of Guernsey
Daragh McDermott	JT
Graeme Millar	JT
Ashley Nicholas	Guernsey Airport
Mark Ogier	Longport Group
Tom Ozanne	Public Services Department, States of Guernsey (Guernsey Water)
Mark Robinson	Education Department, States of Guernsey
Alan Rowe	Fusion Systems (Confederation of Guernsey Industry)

Contributor	Organisation
Eddie Saints	Sure
Ruskin Snow	Specsavers
Paul Taylor	JT
Jonathan Tooley	CICRA
Julian Turner	Guernsey Electricity
Nick Vermuelen	PwC
Steve Vowles	Fultura Limited
Scott Walter	Guernsey Electricity
Emma Walton	Guernsey Registry, States of Guernsey
Ellie Whittles	Commerce and Employment, States of Guernsey (Digital Greenhouse)
Doug Wright	Longport Group