A telecoms strategy for Jersey

Prepared for
Government of Jersey

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Contents

Glossary

ARPU	Average revenue per user. Usually stated on a per-month basis
CICRA	The Channel Islands Competition and Regulatory Authorities regulates the telecoms sector in Jersey
Contention	The degree to which bandwidth is shared between different end-users at the same network node. High contention (during periods of high use) leads to lower speeds between the service provider's access network and the end-user
eMBB	Enhanced mobile broadband
FRAND	Fair, reasonable and non-discriminatory
FTTP	Fibre to the premises
Gigabit	Refers to speeds of at least 1,000 Mbit/s
Gigabit network	Gigabit-enabled FTTP network
Gigabyte	Refers to a quantity of data. One Gigabyte (1GB) equals 100 Megabytes
IRU	Indefeasible right of use
ISP	Internet service provider
KPI	Key performance indicator
LTE	Long-term evolution is the name given to 4G technology, and is often taken to be synonymous with '4G'
MNO	Mobile network operators
MST	Margin squeeze test
NSA	Network sharing agreement—usually between MNOs
PPP	Purchasing power parity
Prime Talk	Prime Talk is a subsidised fixed telephony tariff offered by Jersey Telecom to citizens aged 65+
RAN	Radio access networks
RPI	The Retail Price Index is a measure of inflation in the UK
SMP	An operator has significant market power (SMP) if its market position (economic strength) means that it can behave to an appreciable extent independently of its competitors, customers and ultimately consumers
Spectrum	Radio spectrum, also known as radio waves, is used to carry traffic in mobile networks
TETRA	Terrestrial trunked radio is the European standard for two-way communications with 'push to talk' functionality, and is used by the emergency services in Europe (and in Jersey)
USO	Universal service obligation. Often defined by regulators to require telecoms operators to offer certain services to all consumers

Executive summary

Introduction

A forward-looking telecoms strategy that provides for the appropriate telecoms infrastructure underpinning the delivery of digital services is essential for Jersey. It is important not just for the telecoms sector but also for Jersey's economy as a whole, including the financial services sector. It is a *necessary* (but not sufficient) condition for the delivery of many, if not all, the economic developments that are at the heart of the Government's Strategic Plan.

A 2015 review of Jersey's competition and regulatory framework identified a lack of a clear strategy for the telecoms sector, within which the regulatory authority could help achieve the policy objectives for the sector.[1]

The objective of this Oxera study is to set out recommendations for such a future-proof telecoms strategy for Jersey that supports the development of an advanced digital infrastructure. Sectors with high growth potential, such as digital services and related industries (e.g. fintech, digital health and the Internet of things), depend on advanced digital infrastructure and are areas of potential economic growth for Jersey.

The telecoms sector is also a significant part of the Jersey economy in terms of employees and revenues. In 2016 the sector had 620 (full-time equivalent, FTE) employees (up from 433 in 2015), and its turnover (excluding Jersey Telecom's (JT) off-island activities) accounted for 2.4% of Jersey's GDP.[2] The total tax contribution of the sector in Jersey was £12.6m in 2016. The presence of a thriving telecoms sector in Jersey also means that human capital and knowledge related to the sector and associated industries are retained in Jersey.

The current state and recent history of the Jersey telecoms markets are crucial considerations when devising the telecoms strategy. Jersey already has a strong telecoms infrastructure and over the years has made significant levels of investment in infrastructure, including the Gigabit fibre to the premises (FTTP) network. These infrastructure developments, once completed and combined with the rollout of next generation mobile technologies, should meet the future connectivity requirements of Jersey residents and businesses. Jersey is ahead of many jurisdictions such as the UK and the European Union, which also have similar ambitions of rolling out next generation networks.

The Jersey Government has also put in place a legal framework based on international standards that has supported/enabled the development of the sector and is expected to do so going forward.

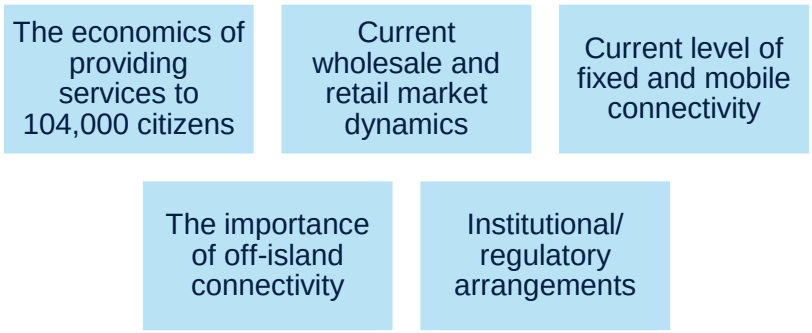
The development of the telecoms strategy requires consideration of which priorities contradict or reinforce each other and the avoidance of prioritising potentially contradictory objectives. The methodology followed by Oxera ensures that our recommendations:

- are in line with Government policy and the Strategic Plan for Jersey;
- take account of key stakeholder priorities and ambitions; and

[1] Oxera (2015), 'A review of the Jersey regulatory and competition framework', prepared for the Government of Jersey, 16 November.
[2] CICRA (2017), 'Telecommunications Statistics and Market Report 2016', Information Note, 17/21, 15 June.

- are feasible and proportionate for the telecoms sector in Jersey and the wider Jersey context as illustrated below.

The Jersey context



Source: Oxera.

These factors are relevant when considering the implications of possible objectives for the Jersey telecoms strategy. Where appropriate, we use international comparisons to compare and contrast with the telecoms sector in Jersey and draw out suitable recommendations.

Five policy principles and Oxera policy recommendations

Oxera's policy recommendations are presented below. These are organised under five policy principles.

Policy principle 1
Promote the path to next generation connectivity building on the current advanced digital infrastructure already in place (section 4.1)

1. Be a fast adopter of next generation technologies by:

    a. adopting, as a general principle, proactive policies to encourage investment in next generation technologies that have been tested elsewhere. This should include adopting technology neutrality, where different technology options are available. We provide below specific policy recommendations in the context of leveraging the JT Gigabit network and encouraging the rollout of mobile next generation technologies such as 5G;

    b. minimising regulatory and legal barriers for private enterprises to use Jersey as a test bed—for example, by providing required government authorisations quickly and flexibly.

2. Maximise the advantage of the Gigabit rollout by ensuring that:

    a. all new builds are connected to the Gigabit network—this will require builders and developers to install suitable in-building wiring and coordinate with the operators to connect the new builds to the Gigabit network;

    b. there is universal access to symmetric 1Gbps speeds on JT's Gigabit network in line with the Digital Policy Framework.

3. Adopt policies to incentivise mobile network sharing and rollout of mobile next generation technologies such as 5G across relevant Government departments and CICRA. The Government (and CICRA where appropriate) should use the following levers:

a. ensure, through regulation, efficient and effective access to spectrum, and high-capacity Gigabit fibre backhaul;

b. reduce any barriers from planning rules/legislation that prevent building new mobile sites (taking account of relevant health and environmental considerations), and ensure that any necessary planning process is efficient, timely and reflects Jersey's interests;

c. release the required spectrum in a timely manner, and make available spectrum innovation licences in Jersey for experimentation. (This would need to be done in conjunction with Ofcom);

d. encourage (or at least place no administrative obstacles in the way of) network sharing through spectrum award rules, planning rules and/or modernising telecoms licences;

e. ensure that the costs of accessing buildings, infrastructure, and land for telecoms network deployment is not a barrier to deploying new sites.

4. Continue spectrum management via Ofcom, with CICRA ensuring better coordination and communication with Ofcom on the specialised spectrum requirements for Jersey.

5. Coordinate with the UK, Guernsey and other European jurisdictions on using new technologies to deliver specialised services (e.g. TETRA).[3]

Policy principle 2
Promote retail competition (not network competition) as the most effective way of delivering the benefits of next generation connectivity to consumers and businesses (section 4.2)

6. CICRA should ensure that JT supplies other operators with wholesale access to the Gigabit network on a fair, reasonable and non-discriminatory (FRAND) basis, and that wholesale access seekers get access to wholesale products, which allow access seekers to compete based on differentiated retail services.

    a. This FRAND access should include fibre backhaul for mobile services.

7. CICRA should use this regulatory focus on the Gigabit network to review and publish its prioritisation principles and outline additional resources required, if any, to conduct its duties, including implementing the telecoms strategy. CICRA should ensure that it uses these principles to determine which cases to pursue and to clearly explain its decisions.

Policy principle 3
Set out clearly any universal service obligations and deliver social policies from the telecoms sector only when it is efficient to do so and the costs/funding are transparent (section 4.3)

8. Set out whether there are sector-related social policy objectives that the Government wants to pursue.

9. The existing social telecoms service delivered by JT (Prime Talk) is not fit for purpose as it is not well targeted and distorts retail competition. If a sector-related social policy is deemed to be required then it should be targeted, competitively neutral and with transparent funding. The social policy need

[3] TETRA (terrestrial trunked radio) is the European standard for two-way communications with 'push to talk' functionality. TETRA uses low-frequency spectrum and is therefore limited by low data-transfer rates.

not be delivered from within the telecoms sector. The Government should be well placed to deliver the policy by directly targeting the relevant group.

10. Ensure that all Jersey citizens and residents benefit from improved connectivity (for example, they are all able to access services such as e-Gov and e-Health).

11. Agree on a delivery mechanism (a suitable control centre to receive and direct calls) for the 999 call fielding service with JT.

12. Modernise licence obligations to reflect changing user needs (e.g. revisit the requirement to provide phone boxes given the availability of mobile phones) and to support the goals of the telecoms strategy.

Policy principle 4
Ensure resilience of off-island connectivity (section 4.4)

13. Adopt a formal mechanism to be used in the event of a connectivity failure.

14. Adopt an explicit 'resilience policy' to maintain the resilience of off-island links. This will require the following to be monitored:

    a. current usage of off-island links; and

    b. route diversity (for example, ensuring that, where feasible, not all off-island cables connecting Jersey to the UK are in close proximity to each other and vulnerable to the same catastrophic event).

We note that the Government will require ongoing access to telecoms expertise to implement the telecoms strategy—i.e. to coordinate/consult with industry, CICRA, and various Government departments in order to plan next steps and ensure that these are implemented in accordance with the telecoms strategy.

Policy principle 5
Measure outcomes using appropriate key performance indicators (KPIs) developed in consultation with the industry (section 4.5)

A number of KPIs should be developed and regularly reported to measure progress towards various strategic objectives of the telecoms policy. The publishing of these KPIs should aim to encourage transparency and investment in Jersey, as well as further facilitate consumer choice. The KPIs should cover mobile network(s); fixed wholesale access provided by JT; the retail market; digital industry development; and off-island connectivity.

These KPIs should be developed with industry consultation to ensure that they do not lead to overly burdensome reporting requirements for operators and that they reflect the interests of different stakeholders.

The importance of coordination with Guernsey

Coordination with Guernsey is important for many of these telecoms sector policies. For example, the delivery of the Channel Islands' emergency services (TETRA) and off-island connectivity should be coordinated, as this would result in greater resilience for both Jersey and Guernsey. Regarding mobile spectrum, the current arrangement between CICRA and Ofcom means that spectrum management policies are consistent across the Channel Islands (for example, spectrum is awarded on a pan-Channel Islands basis). This should continue.

Coordination with Guernsey on regulation of the telecoms sector would also help to ensure that JT, Sure, Airtel and other operators get similar wholesale access to networks in Jersey and Guernsey.

Oxera policy recommendations and consumers

Consumer welfare is at the heart of Oxera's policy recommendations. Promoting the path to next generation connectivity should result in Jersey consumers and residents gaining timely access to these services, while increasing retail competition should help promote the provision of higher-quality services at lower prices.

The smaller scale of telecoms networks and services means that achieving network competition may be challenging in Jersey, and the duplication of networks operating at output levels at which scale economies are not fully exploited means that network competition may lead to higher retail prices. Ensuring FRAND access to JT's Gigabit fibre network is a proportionate measure that should help promote retail competition, maximise the utilisation of the network, and exploit scale economies to the fullest extent possible. However, the smaller scale of telecoms networks and services in Jersey will always be a limiting factor in ensuring lower prices compared to other larger jurisdictions such as the UK.

Best-practice regulatory principles indicate that more intrusive forms of regulation, such as structural separation, should be considered as instruments of 'last resort', to be used only when other (less heavy-handed) forms of regulation have not been effective in addressing market failures. Indeed, structural separation is an extreme solution as it involves a costly and risky transition that requires the creation of a wholly new company. It also results in the weakest incentives to invest and innovate for the network division (which, in turn, may require further regulatory intervention). Crucially, once implemented, the structural separation can be very expensive to undo. In the specific case of Jersey, the conditions for adopting any 'heavy handed' form of intervention do not appear to be present at this time.

Publishing appropriate KPIs, especially retail market KPIs, may help increase transparency over the quality of service that operators offer, and should better inform consumers. This in turn should help to spur further competition between operators to offer better services at affordable prices.

Greater clarity over social policies and the universal service obligation will benefit those consumers in the most disadvantaged parts of society.

Oxera's policy recommendations build on the successes of the telecoms sector in Jersey and should establish the groundwork for greater consumer benefits as the sector continues to evolve, innovate and grow.

Oxera policy recommendations and JT

The valuation of JT is out of scope of Oxera's terms of reference for this project and is not covered by this report. Nevertheless, where possible, the report considers in qualitative terms the potential effects of different policy recommendations on the Government's shareholder value in JT.

It is not a priori the case that the Government's shareholder value in JT will decrease if the proposed strategic objectives are adopted—such as encouraging retail competition and ensuring FRAND access for other operators to JT's Gigabit fibre network. While some of JT's revenue streams may be reduced if

these objectives are adopted, other revenue streams may not be affected or might increase.

Fixed retail revenues may decrease as regulated wholesale access to the Gigabit network levels the playing field and allows JT's competitors to gain some retail market share. However, this should be offset, at least partially, by the fixed wholesale revenues that JT will receive from wholesale access seekers, and a reduction in costs incurred by JT as it no longer provides retailing services to customers who have switched away.

The effect on JT's mobile revenues is harder to predict as this will depend on the type of the network sharing agreement (NSA) between JT, Sure, and Airtel; how this affects the relative competitiveness of the different operators; and the investments made by the different network operators in the NSA. However, any NSA should lead to some network cost savings, especially in rolling out new services and in operating expenditure going forward. These cost savings should flow through to Jersey customers (in aggregate).

Adoption of the proposed strategic objectives could also have a positive impact on JT's revenues. For example, the adoption of retail competition (and not network competition) as a key objective, and higher economic growth in Jersey (than would otherwise be the case) could result in a better investment climate and greater potential demand for JT's services. This could result in higher revenues, especially in the context of generally increasing demand for connectivity—e.g. growing mobile data usage per person in Jersey.

1 Introduction

1.1 Motivation for a telecoms strategy and Oxera's terms of reference

At the heart of the Government's Strategic Plan for Jersey are the objectives of an increased focus on new sectors with high growth potential, and productivity-led growth.

Sectors with high potential growth, such as digital services and related industries (e.g. fintech, digital health and the Internet of things) are potential areas of economic growth for Jersey and also an enabler of productivity-led growth. A key enabler of such developments is a high-quality telecoms infrastructure (for example, in terms of resilience and capacity). The appropriate telecoms infrastructure is a *necessary* (but not sufficient) condition for the delivery of many, if not all, of the economic developments that are at the heart of the Government's Strategic Plan.

Jersey already has a strong telecoms infrastructure and over the years has made significant levels of investment in infrastructure, such as the Gigabit fibre to the premises (FTTP) network. This is a robust forward-looking policy, which, once completed and combined with the rollout of next generation mobile technologies, should meet the future connectivity requirements of Jersey residents.

A forward-looking telecoms strategy that helps maximise the advantage of the current advanced digital infrastructure in Jersey and the delivery of digital services is therefore essential. Such a strategy will be useful for the telecoms sector (which is a significant part of the Jersey economy in terms of employees and revenues)[4] and for Jersey's economy as a whole.

A 2015 review of Jersey's competition and regulatory framework identified a lack of a clear strategy for the telecoms sector, within which the regulatory authority could help achieve the policy objectives for the sector.[5] The objective of this Oxera study is to set out recommendations for such a future-proof telecoms strategy for Jersey.

The following are out of scope and not covered by this report:

- the valuation of Jersey Telecom (JT), although, where possible, the report does consider in qualitative terms the potential effects of different policy recommendations on the Government's shareholder value in JT;
- cybersecurity and data protection: these topics are covered by the Jersey Government as part of its Cyber Security Strategy and forthcoming revised Data Protection Law.

[4] The telecoms sector is also a significant part of the Jersey economy in terms of employees and revenues. In 2016 the sector had 620 (full-time equivalent, FTE) employees (up from 433 in 2015), and its turnover (excluding Jersey Telecom's off-island activities) accounted for 2.4% of Jersey's GDP. The total tax contribution of the sector in Jersey was £12.6m in 2016. The presence of a thriving telecoms sector in Jersey also means that human capital and knowledge related to the sector and associated industries are retained in Jersey. See CICRA (2017), 'Telecommunications Statistics and Market Report 2016', Information Note, 17/21, 15 June.

[5] Oxera (2015), 'A review of the Jersey regulatory and competition framework', prepared for the Government of Jersey, 16 November.

1.2 Approach to the study

In formulating recommendations for the telecoms strategy, we have taken into account the Government's Strategic Plan 2015–18, which establishes the priorities for Jersey; the Digital Policy Framework, which sets out the principles and objectives of the sector consistent with the Strategic Plan; and key stakeholder interviews, as shown in Figure 1.1.

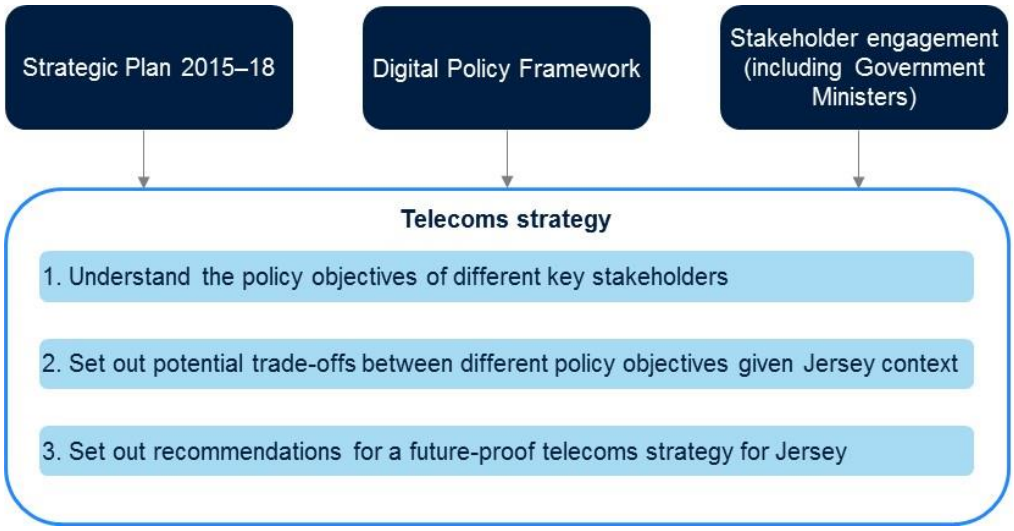
Also shown in Figure 1.1 are the steps in designing the recommendations. First, understanding the objectives of key stakeholders via a consultation process with a range of stakeholders. We conducted interviews with over 20 stakeholders. Oxera is grateful to all stakeholders who took part for their cooperation and openness during the interviews, and their anonymised feedback is referred to throughout this report as appropriate.

Second, clearly setting out the trade-offs between the objectives in the Jersey context; some objectives would come at the cost of other objectives, and it is important to understand the implications of pursuing any particular objective.

Third, making recommendations for the telecoms strategy based on an analysis of which priorities contradict or reinforce each other to avoid prioritising potentially contradictory objectives and discussions with Government Ministers.

This methodology ensures that our recommendations are in line with Government policy; are feasible and proportionate for the telecoms sector in Jersey; and take account of key stakeholder concerns and ambitions.

Figure 1.1 Framework for the design of the telecoms strategy



Source: Oxera.

1.3 Structure of the report

- Section 2 presents an analysis of the telecoms sector in Jersey, compares Jersey to similar jurisdictions, and, based on this, draws out implications for the telecoms strategy.
- Section 3 considers the key trade-offs between policy options and concludes on how best to deliver a future-proof telecoms strategy.
- Section 4 sets out Oxera's policy recommendations.

Appendices 1 and 2 list the references used in the report, and two Oxera reports: ‘A review of the Jersey regulatory and competition framework’ and ‘Business connectivity: Jersey to the UK’. These reports are referred to throughout this report, as appropriate.

2 Analysis of the telecoms sector and implications for the telecoms strategy

The key considerations in developing the telecoms strategy are that it should be consistent with the Digital Policy Framework, contribute to the Strategic Plan for Jersey, and provide the underpinnings for a thriving digital infrastructure for Jersey. In particular, the telecoms strategy should support the development of advanced digital infrastructure—that is, it should:

- bolster businesses in all sectors that increasingly rely on connectivity, and enable productivity-led growth across all Jersey's economic sectors, including its export sectors;
- deliver consumer benefits from connectivity and meet consumer demand for more data—for example, delivering citizen benefits through e-Gov and E-health;
- encourage affordable services, with appropriate choice for homes and businesses. Encouraging a range of service levels would allow consumers to have access to the level of service that is affordable to them;
- promote innovation in, and remove any necessary barriers to, the delivery of next generation networks and services;
- maintain a level of resilience and capacity in Jersey's digital infrastructure so that the needs of Jersey as a whole are met.

Advanced digital infrastructure and connectivity form the foundation of the digital economy and the Digital Policy Framework objectives. It is important to understand the components of the telecoms infrastructure that provide or will provide the foundation for this advanced digital infrastructure, and the following sections do this. Section 2.1 reviews the current state of fixed on-island connectivity, section 2.2 off-island connectivity, and section 2.3 mobile connectivity.

For each of these components, we review current infrastructure and connectivity, competition and pricing, and usage, to identify shortcomings if any that would need to be addressed by the telecoms strategy. Based on this analysis, section 2.4 sets out the implications for the telecoms strategy. International comparisons are used where appropriate.

2.1 On-island fixed network connectivity

2.1.1 Infrastructure and connectivity

There are currently three fixed-line service operators in Jersey: JT, Sure, and Newtel.

- **JT** operates the only Jersey-wide fixed network, over which it offers fixed voice and broadband services to residential customers as well as dedicated connectivity services to businesses.
- **Sure** operates a limited fixed network in Jersey (fibre-based, centred around St Helier). The fixed voice and broadband services offered by Sure in the rest of Jersey are based on wholesale access to JT's copper and fibre

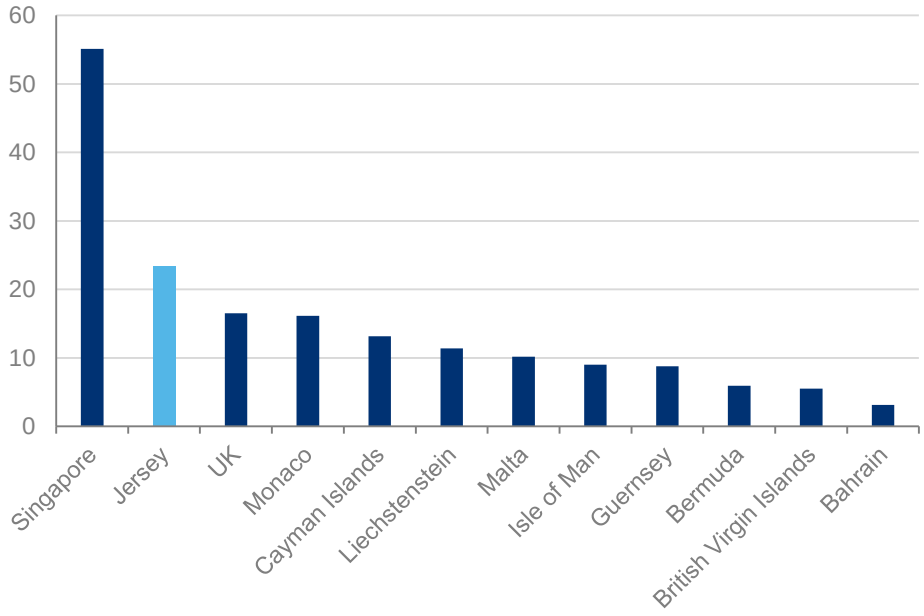
network. Sure also operates a data centre in Jersey,[6] and owns some of the off-island connectivity. (Sure is the incumbent fixed operator in Guernsey.)

- **Newtel** is focused on providing solutions to business customers. It also offers residential broadband services (using retail brands Homenet and Ytel)[7] through three networks: using its cable TV network which has limited coverage; wholesale access to JT's copper and fibre network; and Newtel's (wireless) WiMax network.[8]

Hence, there is limited competition in the provision of on-island fixed network infrastructure, with only one Jersey-wide fixed network. This is likely to reflect the economic characteristics of providing services in Jersey, which mean that it may be commercially challenging for more than one operator to invest in fixed networks in Jersey.[9]

However, we note that the existing JT network (and the rollout of the Gigabit network) provides Jersey residents with access to high speeds, especially when compared with other smaller jurisdictions and the UK, as shown in Figure 2.1.

Figure 2.1 Average fixed broadband (download) speed, August 2017



Note: The data is based on the results of speed tests conducted by consumers in each jurisdiction. There may be a downward bias in the results (if, among those with slower speeds, more feel the need to test their broadband connection). However, there is no reason to suspect that this bias affects Jersey more than other jurisdictions—the speeds of Jersey relative to the other jurisdictions should not be affected by this. The average (mean) broadband speed for Jersey comes from a sample of 3,500 speed tests by 1,500 distinct IP addresses. We note that the speed test provider, Ookla (http://www.speedtest.net/awards/je/2016), reports higher broadband speeds for operators in Jersey but covers fewer jurisdictions and uses a smaller sample size. Using the Ookla data would not change the conclusions or the policy recommendations made in this report.

Source: cable.co.uk worldwide database, accessed 31 August 2017.

[6] Sure (2014), 'Sure to acquire Jersey Data Centre and Cloud Services provider Foreshore', news release, 12 May, https://web.sure.com/jersey/about-us/news/sure-to-acquire-jersey-data-centre-and-cloud-services-provider-foreshore-.
[7] http://www.homenet.je/.
[8] According to CICRA, Newtel had 1,348 WiMax customers in 2016. See CICRA (2017), 'Telecommunications Statistics and Market Report 2016', Information Note, 17/21, 15 June. See also Newtel website for details. http://www.homenet.je/broadband-options/.
[9] The provision of the fixed network physical infrastructure exhibits economies of both scale and density.

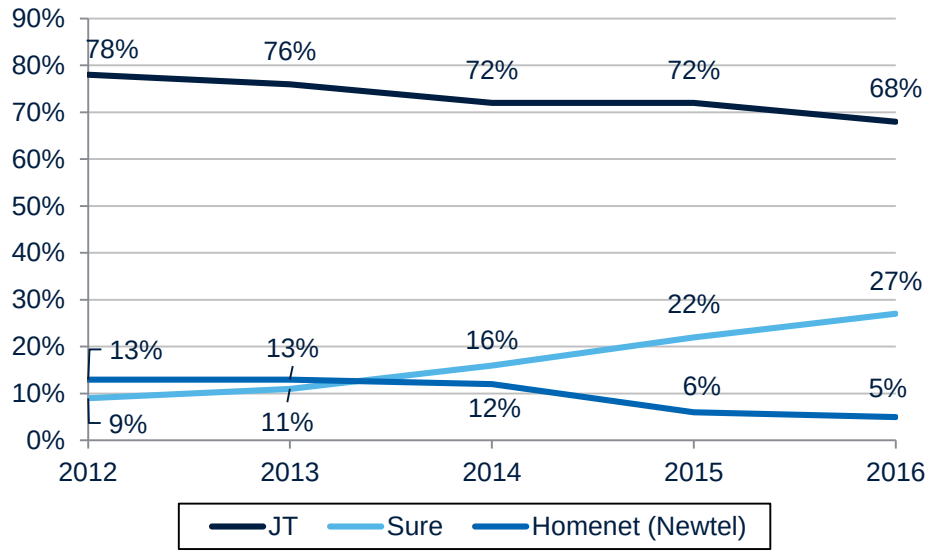
The average broadband speed available to Jersey residents should further increase once the Gigabit rollout is complete and all broadband subscribers are migrated to the Gigabit network. We understand that JT currently provides a minimum speed of 100Mbps on the Gigabit network, and JT may further increase this minimum speed in the future.

JT's Gigabit rollout, initiated in December 2011 (with the first homes connected in February 2012),[10] was completed in 2017. Further costs may be incurred in connecting households to the network (i.e. installing the final drop). This FTTP network currently offers speeds of up to 1Gbps download and 100Mbps upload. This compares well to a maximum of 20Mbps download and 736Kbps upload over the legacy copper network, which we understand is decommissioned as fibre is installed.

2.1.2 Retail competition and pricing

The fixed broadband retail market shares for these three operators are shown in Figure 2.2, and in Figure 2.3 below for the fixed voice market (by usage, minutes). JT's retail market share has been decreasing although it is still the largest operator in the broadband retail market, with 68% of the market share in 2016, and in the fixed voice market, with 82% of the fixed voice minutes share in 2016.

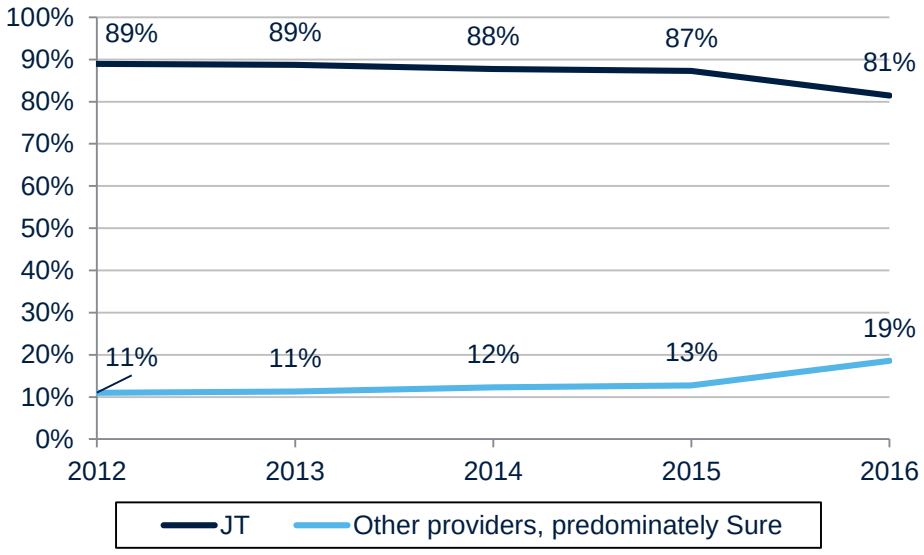
Figure 2.2 Fixed broadband market shares



Source: CICRA (2015), 'Telecommunications Statistics and Market Report 2014'; CICRA (2016), 'Telecommunications Statistics and Market Report 2015'; CICRA (2017), 'Telecommunications Statistics and Market Report 2016'.

[10] Treasurer of the States (2011), 'Infrastructure Investment in Jersey Telecom Group Limited and Reduction in Dividends: Gigabit Jersey (PtP)', Decision Reference MD-TR-2011-0139, 9 December.

Figure 2.3 Fixed telephony market shares (voice minutes)

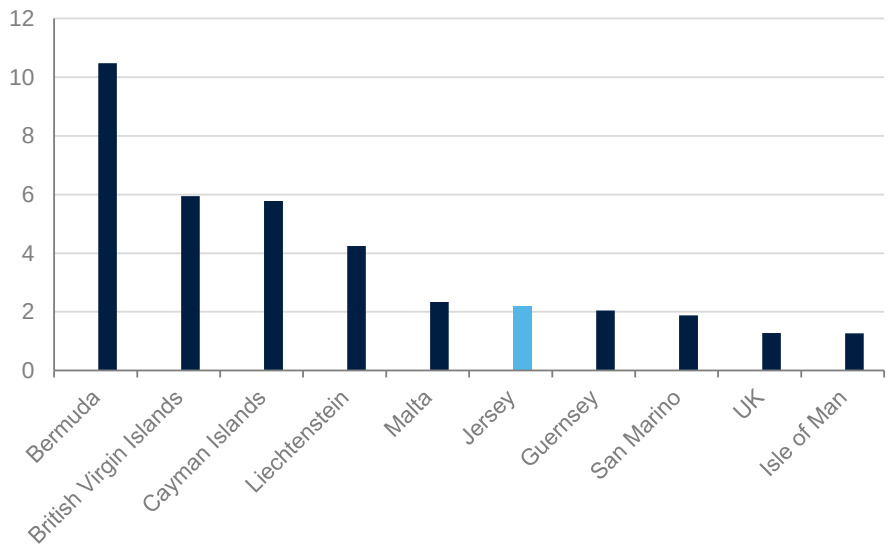


Source: CICRA (2015), 'Telecommunications Statistics and Market Report 2014'; CICRA (2016), 'Telecommunications Statistics and Market Report 2015'; CICRA (2017), 'Telecommunications Statistics and Market Report 2016'.

Comparing prices with other jurisdictions with similar scale economies, Jersey consumers face lower prices per Mbps, as shown in Figure 2.4 below for copper broadband products, and for fibre-based residential broadband products as shown in Figure 2.5. Survey results also suggest that satisfaction levels with residential landline and broadband services increased from 2014 to 2017, although there appears to be room for improvement.[11]

[11] CICRA (2017), 'Telecoms Customer Satisfaction Survey Results from May 2016 Survey', http://www.cicra.gg/media/3937/t1243gj-report-telecoms-customer-satisfaction-survey-results-may-2016.pdf and CICRA (2017), 'T1275GJ - Report - Jersey Infographic - Telecoms Customer Satisfaction Results 2017', 12 September, https://www.cicra.gg/cases/2017/t1275gj-telecoms-customer-satisfaction-2017/t1275gj-report-jersey-infographic-telecoms-customer-satisfaction-results-2017/ .

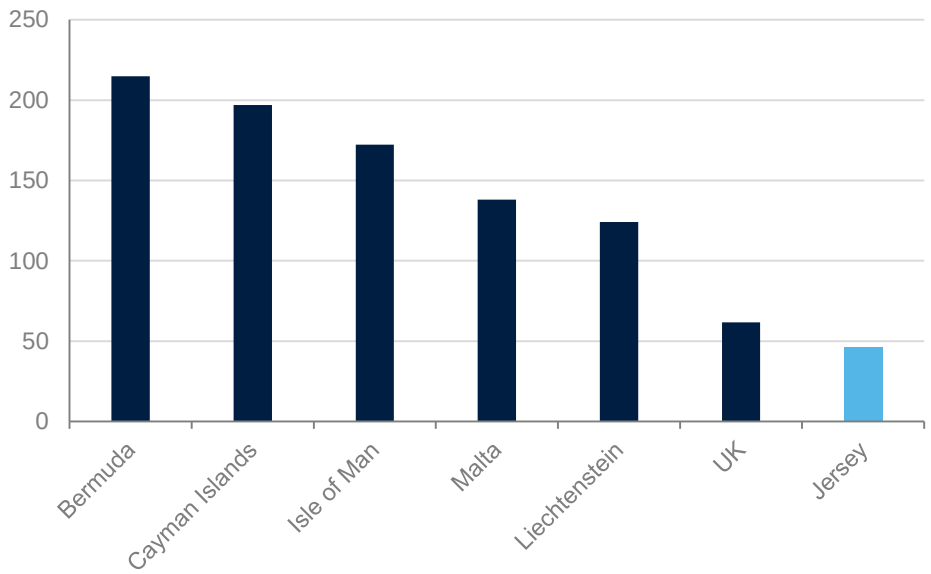
Figure 2.4 Average price per Mbps across copper fixed broadband tariffs of 10–30Mbps (PPP-adjusted USD, August 2017)



Note: PPP, purchasing power parity.

Source: Internet service provider (ISP) websites. UK data from four largest ISPs: BT, Sky, TalkTalk and Virgin Media. Home broadband (provided over the 4G network) from Airtel-Vodafone is included for Jersey, assuming 11Mbps download speeds, as tested according to Ookla.

Figure 2.5 Average monthly price for fibre based fixed broadband tariffs of 100–300Mbps (PPP-adjusted USD, August 2017)



Source: ISP websites. UK data from four largest ISPs: BT, Sky, TalkTalk and Virgin Media, although only Virgin Media offers products with speeds in the 100–300Mbps range.

However, there is a limitation to these comparisons. JT imposes data caps on all four of its broadband packages (other operators in Jersey generally do not impose data caps—see Table 2.1). Of the comparator jurisdictions, operators in Malta and the UK impose data caps. In the UK, data caps are present on low-speed broadband services only; for higher-speed services, data allowances are often unlimited subject to a fair use policy. This means that broadband services

in Jersey could be more expensive than first appears in Figure 2.4 and Figure 2.5 if customers exceed inclusive data caps.

Table 2.1 Data caps imposed by various operators

Operator	Details of broadband package	Data cap
JT	20Mbps, copper	100GB
	100Mbps, fibre	150GB
	1Gbps, fibre	300GB
Sure	20Mbps, copper	-
	100Mbps, fibre	-
	1Gbps, fibre	-
Homenet	20Mbps, copper	-
	100Mbps, fibre	-
	1Gbps, fibre	-
Airtel	4G	100GB

Note: Airtel speeds not advertised on the website, but according to CICRA Airtel's average 4G speed is 18Mbps.
Source: JT, Sure, Homenet and Airtel websites, accessed 6 October 2017.

The JT 1Gbps product is not included in the comparison as there are no products with comparable speeds in other comparable jurisdictions.

We note that prices are lower (for copper-based broadband connections) in the UK (which may be due to larger scale economies). This may explain the perception among some stakeholders that prices are higher in Jersey. Prices for speeds of 100–300Mbps are lower in Jersey.

2.1.3 Usage

Fixed broadband has seen growing demand over the last few years. The penetration of high-speed fixed broadband has remained at about the same level, with an increase in the average amount of data consumed (see Table 2.2). This led to the average revenue per user (ARPU) increasing by 31% during 2014–16.

Table 2.2 Fixed broadband market: key indicators

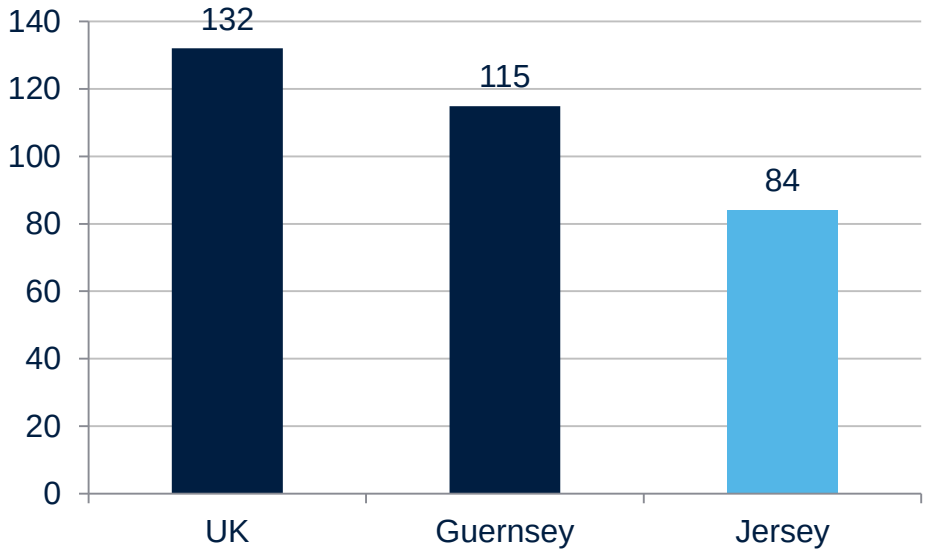
	2014	2015	2016
Fixed broadband subscriptions per 100 inhabitants	36.1	35.2	34.3
GB usage per connection(per month)	*	66.9	84.1
% subscribers consuming (advertised) speeds of at least 20Mbps	*	31.2%	65%
Fixed broadband ARPU, excluding line rental (per month)	£21.71	Between £27.11 and £28.41	£28.41

Note: * Data not reported.

Source: CICRA (2015), 'Telecommunications Statistics and Market Report 2014'; CICRA (2016), 'Telecommunications Statistics and Market Report 2015'; CICRA (2017), 'Telecommunications Statistics and Market Report 2016'.

The growth in fixed data consumption is in line with the trend in the UK,[12] although we note that the average data usage per connection in Jersey is lower than in Guernsey and the UK, as shown in Figure 2.6.

Figure 2.6 Average fixed data usage per connection (GB per month)



Source: CICRA data provided for Q3 2017, and Ofcom (2017), 'Communications Market Report 2017'.

Increasingly, both consumers and businesses require high-speed upload (in addition to download) speeds as well. This trend is likely to continue. For example, consumer usage of social media and online gaming both involve uploading data, and both are important in Jersey—in 2016, Jersey citizens spent 303 hours on average on Facebook, and JT offers an eGaming platform.[13]

Remote working is also increasingly popular (stakeholders emphasised the importance of being able to work from home) and involves the use of tools that require high upload speeds, such as videoconferences and cloud computing (e.g. remote access to data and real-time collaboration). Cloud computing is growing rapidly worldwide,[14] and this is likely to be reflected in Jersey (e.g. JT launched new cloud-based services in 2016).[15]

In retail fixed telephony in Jersey, the volume of fixed call minutes and ARPU is falling, with fixed line penetration remaining constant at around 60% of citizens.[16]

2.2 Off-island connectivity: undersea cables

2.2.1 Infrastructure and connectivity

The current number and owners of the main off-island undersea cables providing off-island connectivity are shown in Table 2.3 below. Two undersea cables

[12] The amount of fixed data per user went up from 58 GB in 2015 to 82 GB in 2016. See Ofcom (2016), 'Communications Markets Report 2016', 4 August, https://www.ofcom.org.uk/__data/assets/pdf_file/0024/26826/cmr_uk_2016.pdf.
[13] JT (2017), 'JT's Annual Review 2016/17'.
[14] Forbes (2017), 'Roundup of Cloud Computing Forecasts, 2017', 29 April https://www.forbes.com/sites/louiscolumbus/2017/04/29/roundup-of-cloud-computing-forecasts-2017/#344062331e87.
[15] JT (2017), 'JT's Annual Review 2016/17'.
[16] CICRA (2015), 'Telecommunications Statistics and Market Report 2014'; CICRA (2016), 'Telecommunications Statistics and Market Report 2015'; CICRA (2017), 'Telecommunications Statistics and Market Report 2016'. Population data from Jersey Statistics Unit.

connect Jersey to Guernsey, which in turn is connected to the UK via two cables and to France via another cable. Jersey is also connected directly to the UK and France by two independent cables. These multiple cables provide resilience in off-island connectivity. We note that the undersea cable links between Guernsey and Jersey are important in providing resilience to both islands.

Table 2.3 Ownership of main undersea cables

Cable	Route	Capacity	Ownership (%)			
			JT	BT	Sure	Vodafone
4	Jersey–Guernsey	✂	✂	✂	✂	✂
7	Guernsey–UK	✂	✂	✂	✂	✂
8	Jersey–UK	✂	✂	✂	✂	✂
9 (Liberty)	Guernsey–UK	✂	✂	✂	✂	✂
CIEG-Gu	Jersey–Guernsey	✂	✂	✂	✂	✂
CIEG-Fr	Jersey–France	✂	✂	✂	✂	✂
HUGO South	Guernsey–France	✂	✂	✂	✂	
HUGO North	Guernsey–UK	✂	✂	✂	✂	

Source: JT, Sure and Analysys Mason (2016), 'Guernsey Connectivity review', 25 April.

There is also potential to increase the number of undersea cables connecting. Jersey to France via CIEG cables. The CIEG link (Jersey–France) is provided using one power cable (Normandie 2). We understand that there is scope to activate (or light) the dark fibre on two further Jersey–France power cables (Normandie 1 and Normandie 3).[17]

2.2.2 Competition and pricing

During the stakeholder engagement, some stakeholders were of the view that the prices of international connectivity (i.e. private circuits) are high. The Jersey Government asked Oxera to consider whether there is indeed a possibility that prices are too high.[18]

We note that the price of international private circuits is determined to a significant extent by the costs of the international parts of the circuits (and not the parts physically located in Jersey). Considering connectivity to the UK mainland, Oxera's analysis, using a highly simplified methodology,[19] demonstrated that the revenues derived from international private circuits to the UK are approximately £2.8m and the costs of providing these circuits are approximately £2.7m–£2.9m. The aim of this exercise was not to show that the prices are precisely correct (which would require a much more in-depth analysis), but that the prices (and hence revenues) are not significantly out of line with the costs of providing these services.

Given this analysis, the higher price of international private circuits between Jersey and the UK is likely to arise from the relatively low total demand between the two jurisdictions, and the cost of the cables used. For the telecoms service suppliers to be able to recover their costs, average prices for connectivity will have to be higher than those that would apply where the infrastructure was shared among a greater demand.

[17] See https://www.jec.co.uk/about-us/latest-news/normandie-1-successfully-lands-in-st-catherine/ and https://www.jec.co.uk/about-us/about-us/our-projects/normandie-3/project-latest/.
[18] Oxera (2017), 'Business connectivity: Jersey to the UK', February.
[19] Ibid.

Market analysis undertaken by CICRA in 2014 also concluded that, although there might be issues with the market for private circuits in Jersey itself, in relation to the international connectivity part of the network, none of the three suppliers was dominant. As a result, no regulatory action was proposed for this market.[20]

2.2.3 Usage

Off-island connectivity, in the form of undersea cables to the UK, France, and Guernsey, is crucial for connecting Jersey to the rest of the world, including to the World Wide Web.

This resilience is of particular importance in attracting high-growth sectors (such as the digital industry) to Jersey. For example, many financial services firms require 24/7 connectivity in order to operate, and the loss of connectivity can be costly—the absolute certainty of connectivity is required for Jersey to continue to attract businesses to the island.

The 2016 submarine cable incident, where the anchor of a ship in the English Channel accidentally cut three submarine cables, highlights the importance of investing in resilience (with a number of different links to the UK and France), to ensure that services provided to existing (and potential) businesses located in Jersey are not materially affected when such rare events occur.

2.3 Mobile network connectivity

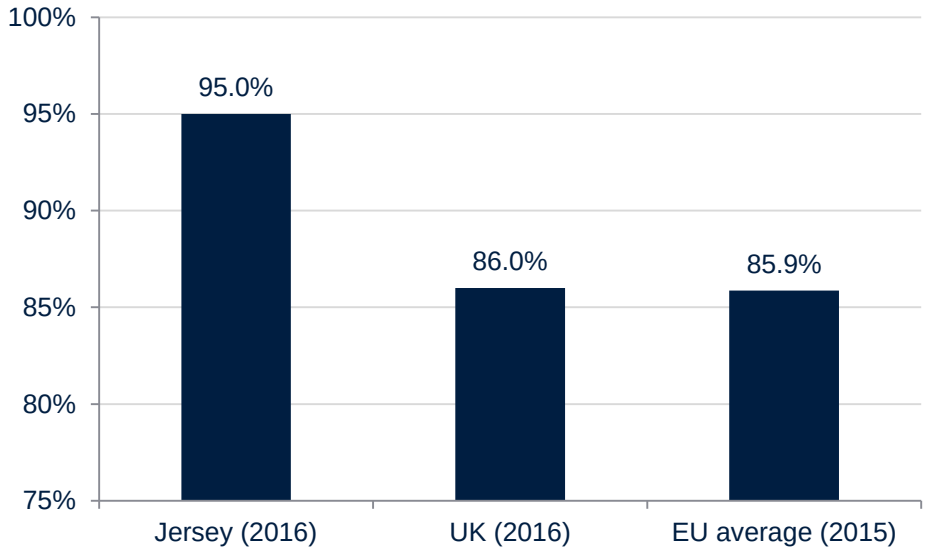
2.3.1 Infrastructure and connectivity

All three mobile network operators (MNOs) in Jersey (JT, Sure, and Airtel) have rolled out 4G networks and there is widespread 4G coverage in Jersey. As part of their 4G licence conditions, the three operators are obliged to provide 2 Mbps download speed to 95% of the Jersey population (90% of the time). According to a recent survey commissioned by CICRA, all operators have met these targets fully. The survey by Regulaid BV found that all three Jersey operators provide over 95% indoor and outdoor population coverage.

This level of coverage is higher than the UK and the average of the European Union, as shown in Figure 2.7 below. Indeed, the level of 4G coverage in the UK was 86% households in 2016, and across the whole EU 86% of households in 2015.[21] This difference is likely to be partly driven by the higher average population density of Jersey of 819 people per square km.[22] In comparison, the UK has an average population density of 267 people per square km, and the European average is 117 people per square km.[23] High population density means that the unit cost of covering population is likely to be lower.

[20] CICRA (2014), 'Business connectivity market review: Jersey', 5 August.
[21] Ofcom (2016), 'Connection Nations 2016', https://www.ofcom.org.uk/__data/assets/pdf_file/0035/95876/CN-Report-2016.pdf.
[22] Statistics Unit (2011), '2011 census results'.
[23] Eurostat (2017), 'Population density'.

Figure 2.7 4G coverage (premises covered, outdoors)



Source: Ofcom (2016), 'Connected Nations 2016'; European Commission (2017), 'Digital Agenda Scorecard key indicators'.

Mobile broadband speeds in Jersey are broadly similar to those in the UK, as shown in Figure 2.8. The range in the figure reflects the speed provided by different operators.

Figure 2.8 Average mobile download data speeds, 2016 (Mbps)

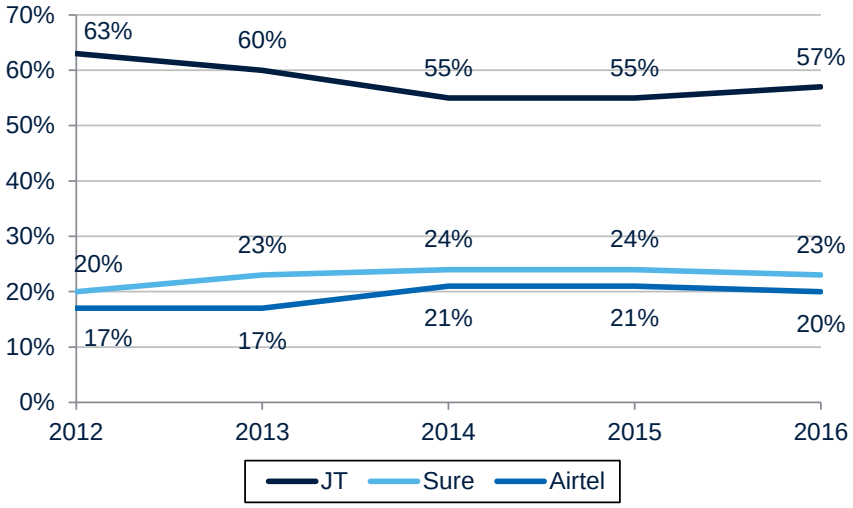
Note: UK average download speeds measured by Ofcom across 7 major cities in Q3 2016.

Source: CICRA data provided Q3 2017, Ofcom (2016), 'Connected Nations 2016'.

2.3.2 Competition and pricing

The market shares of the three Jersey MNOs have been broadly stable over the past five years, although JT's market share decreased from 63% in 2012 to 57% in 2016 (see Figure 2.9 below).

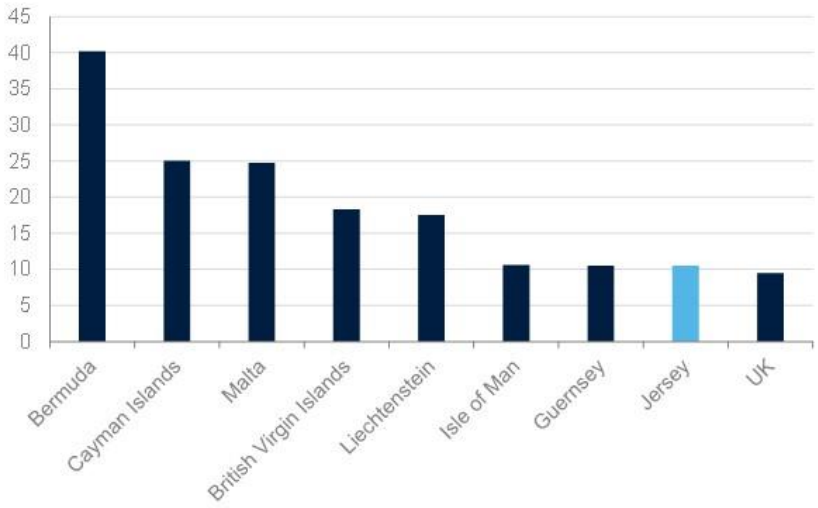
Figure 2.9 Mobile market shares



Source: CICRA (2015), 'Telecommunications Statistics and Market Report 2014'; CICRA (2016), 'Telecommunications Statistics and Market Report 2015'; CICRA (2017), 'Telecommunications Statistics and Market Report 2016'.

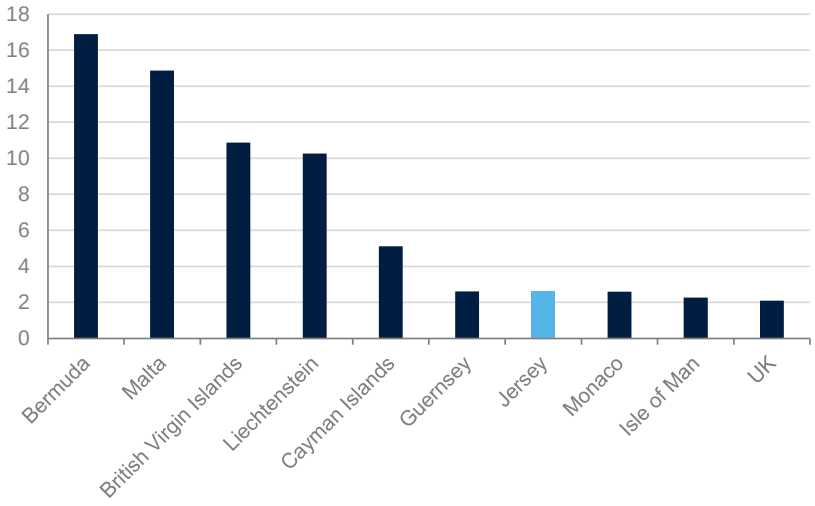
Competition among the MNOs may partly explain why consumers in Jersey face relatively low price per GB of data allowance than in other jurisdictions with similar scale economies. We note that prices are slightly lower in jurisdictions such as the UK (which may be due to larger scale economies), and this may explain the perception among some stakeholders that prices are higher in Jersey. This data is presented in Figure 2.10, which shows that only the UK has a lower implied cost per GB when considering products with 1–10 GB of data. For products with 10–30 GB of data, Jersey has somewhat higher prices, although it still compares favourably with other similar-sized jurisdictions (see Figure 2.11 below).

Figure 2.10 Average monthly price per GB of data allowance across tariffs with 1–10 GB of inclusive data allowance (PPP-adjusted USD, August 2017)



Source: ISP/MNO websites. UK data from four MNOs: EE, Vodafone, O2 and Three.

Figure 2.11 Average monthly price per GB of data allowance, across tariffs with 10–30 GB of inclusive data allowance (PPP-adjusted USD, August 2017)



Source: ISP/MNO websites. UK data from four MNOs: EE, Vodafone, O2 and Three.

2.3.3 Usage

With the deployment of 4G in 2015–16, mobile subscribers in Jersey are consuming greater amounts of mobile data. Mobile GB usage per subscriber per year rose by nearly three times from 2015 to 2016, from 16.1 GB to 44.8 GB per year (see Table 2.4 below). This growth is likely to be due to greater coverage of 4G (which continued to be rolled out throughout 2016) and could also be driven by the launch of Airtel's mobile home broadband product offering.[24] Both Sure and JT currently offer mobile packages with 100 GB of data per month, reflecting this growing demand for mobile data.[25]

An average of 44.8 GB per user per year (2016) is high relative to the UK average of 15 GB per active mobile connection per year (22 GB per active post-paid connection).[26,27] The Western Europe average is 14.4 GB per smartphone user.[28] However, Jersey's average is in line with certain segments of the UK market: in 2017, Three (an MNO which targets the market segment with greater data usage) reported that its customers use on average 72 GB per year.[29] Also relevant to the high data demand in Jersey is the relatively high income of its citizens.[30] London (a relatively high-income part of the UK) accounts for 23.5%

[24] https://airtel-vodafone.com/homebroadband.
[25] https://web.sure.com/jersey/mobile/price-plans. http://www.jtglobal.com/Jersey/Personal/Mobile/Handsets-and-tariffs/Pay-monthly/JT-SIM-only/.
[26] The number of active post-paid subscriptions was estimated by multiplying the proportion of post-paid subscriptions in the market (68%) by the number of active subscriptions. See Ofcom (2017), 'Communications Market Report 2017', 3 August.
[27] Ofcom (2016), 'Connected Nations 2016', 16 December; Ofcom (2017), 'Communications Market Report 2017', 3 August.
[28] https://www.ericsson.com/en/mobility-report/latest-mobile-statistics.
[29] http://www.threemediacentre.co.uk/facts-and-figures.aspx.
[30] Jersey's median average weekly earnings for FTEs are £570 compared with £539 for the whole of the UK. Jersey Government, 'Earnings and income statistics', https://www.gov.je/Government/JerseyInFigures/EmploymentEarnings/Pages/EarningsIncomeStatistics.aspx ; and Office of National Statistics (2016), 'Annual Survey of Hours and Earnings: 2016 provisional results', section 3, 'Average Earnings', 26 October, https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/bulletins/annualsurveyofhoursandearnings/2016provisionalresults#average-earnings.

of the UK's mobile data,[31] and only 13% of the UK's population, implying much greater mobile usage per person than in the rest of the UK.[32]

These mobile data usage patterns in Jersey suggest that the demand for mobile data is relatively high and is likely to rise as smartphone adoption grows and subscribers increase their use of data-intensive services such as video calling and streaming video on mobile phones.

The volume of SMS messages has been falling, in line with the greater availability of over-the-top messaging applications, while the volume of mobile voice minutes has been rising (potentially indicating some level of fixed–mobile substitution). ARPU appears to have been broadly stable.

Table 2.4 Mobile market: key indicators

	2014	2015	2016
Mobile subscriptions per 100 inhabitants	118	119	121
SMS messages per person (post-paid, annual)	1,195	1,167	1,024
Voice minutes per person (post-paid, annual)	919	1,325	1,777
GB per person (post- and pre-paid, annual)	*	16.1	44.8
Porting time (days)	1.8	1.8	*
ARPU (pre-paid) per month	£7.83	£11.59	£6.28
ARPU (post-paid) per month	£27.33	£31.17	£27.11
MNO out-roaming revenues	£10.5m	£10.5m	£10.1m

Note: * Data not reported.

Source: CICRA (2015), 'Telecommunications Statistics and Market Report 2014'; CICRA (2016), 'Telecommunications Statistics and Market Report 2015'; CICRA (2017), 'Telecommunications Statistics and Market Report 2016'.

Off-island mobile connectivity: roaming

Two types of roaming generate revenues for Jersey MNOs: 'out-roaming', where Jersey consumers travel abroad and pay their home MNO for the services they use while abroad (the Jersey MNO compensates the MNO providing the mobile services abroad); and 'in-roaming', where visitors to Jersey roam onto Jersey MNO networks.

All three MNOs offer roaming services to their domestic customers when they roam abroad. The number of voice minutes and SMS messages sent while abroad declined from 2015 to 2016, while the amount of data used while roaming increased significantly (see Table 2.5 below).

Table 2.5 Amount of out-roaming

	2015	2016
Minutes (million)	7.9	7.4
SMS messages (million)	6.0	5.2
Data (GB)	2,751	3,917

Source: CICRA (2016), 'Telecommunications Statistics and Market Report 2015'; CICRA (2017), 'Telecommunications Statistics and Market Report 2016'.

[31] Ofcom (2016), 'Connected Nations 2016', 16 December, https://www.ofcom.org.uk/__data/assets/pdf_file/0035/95876/CN-Report-2016.pdf.
[32] Office for National Statistics, 'Population Estimates for UK, England and Wales, Scotland and Northern Ireland', https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland.

In 2017, JT, Airtel[33] and Sure[34] announced lower out-roaming prices for their customers following the abolition of roaming charges in the EU and customer complaints about high roaming charges. JT, for example, has seen a 100% increase in customers' data usage while abroad since reducing roaming rates by 95% at the start of the summer.[35]

This suggests that the competition in the market (from operators based both in Jersey and outside it) is working to discipline roaming charges.

Spectrum policy

Radio spectrum is an essential input for mobile services, and is awarded on a pan-Channel Islands basis. Other uses of this radio spectrum include: TETRA to deliver emergency services,[36] and the Ports of Jersey, which uses radio spectrum to operate Jersey Airport's air traffic control (ATC) systems and air traffic navigation services to aircraft flying through Jersey controlled airspace.

For Jersey, it is currently managed by Ofcom, which has a duty 'to secure the optimal use of spectrum' that 'delivers the greatest value' to citizens and consumers, which it will achieve through market mechanisms where possible.[37]

After conducting a consultation that is typically initiated by an operator requesting spectrum,[38] or by CICRA assessing whether there is demand for unassigned spectrum, [39] CICRA makes a recommendation to Ofcom. Ofcom then awards the spectrum to the mobile operators (a process that could in theory be done through a competitive process).

We understand that, until 2025, emergency services in Jersey will continue to be delivered using the TETRA radio system provided by Motorola. After 2025 these services may be delivered over commercial mobile networks once appropriate systems and capacity are in place. This follows the UK, where TETRA network for the emergency services (Airwave) is being replaced by the use of the EE long-term evolution (LTE) network by 2020.[40] Therefore, the emergency services will not have a separate network for connectivity in the UK and will be able to make use of LTE services. However, the technology is still under development and the UK is at the forefront of moving away from TETRA networks.

2.4 Implications for the telecoms strategy

Based on the above analysis of current fixed, off-island and mobile telecoms connectivity and the requirements for an advanced digital infrastructure (as

[33] https://airtel-vodafone.com/discover/our-network/roaming

[34] Sure (2017), 'New Sure Roaming Booster Reduces Data Roaming Rates to 10p/MB', 2 August, https://web.sure.com/jersey/about-us/news/new-sure-roaming-booster-reduces-data-roaming-rates-to-10pmb.

[35] JT (2017), '"Roaming" doubles this summer following cost reductions', press release, 2 August, http://www.jtglobal.com/Jersey/super-footer/Latest-News/2017/Roaming-doubles-this-summer-following-cost-reductions/.

[36] TETRA (terrestrial trunked radio) is the European standard for two-way communications with 'push to talk' functionality. TETRA uses low-frequency spectrum and is therefore limited by low data-transfer rates.

[37] *Jersey Evening Post* (2015), 'JT defends pensioner tariff plan', 24 July, http://jerseyeveningpost.com/news/2015/07/24/jt-defends-pensioner-tariff-plan/.

[38] For example, the March 2017 2.1GHz consultation. CICRA (2017), 'Pan-Channel Islands Consultation on Spectrum Awards in the 2.1GHz Band', Consultation Document CICRA 17/03, 2 March, https://www.cicra.gg/media/597570/t1276gj-consultation-spectrum-awards-in-the-2.1ghz-band.pdf.

[39] For example, the July 2017 2.6GHz consultation. CICRA (2017), 'Pan-Channel Islands Consultation on Spectrum Awards in the 2.1GHz Band', Consultation Document CICRA 17/16, 5 July,

[40] UK Home Office (2015), 'Final contracts for new emergency services network are signed', 9 December, news release, https://www.gov.uk/government/news/final-contracts-for-new-emergency-services-network-are-signed.

defined in the Digital Policy Framework), this section sets out the potential implications for the forward-looking telecoms strategy for Jersey.

2.4.1 Implications for the telecoms strategy: fixed networks

There is only one Jersey-wide network, run by JT, but there is retail competition (based on wholesale access to JT's network), which appears to have delivered positive outcomes for consumers in terms of pricing (with low price per Mbps relative to other similar-scale jurisdictions).

The main usage trends are growing demand for high-speed broadband, and falling demand for fixed-line telephony services. Going forward, these trends suggest a growing need for high-speed broadband connectivity (including higher upload speeds).

The replacement of JT's copper network with the Gigabit network is a good forward-looking policy which should meet growing data requirements of customers. This also means that wholesale access to the Gigabit network is likely to be essential for other operators to compete in the retail market in the future.

We note that CICRA has considered the regulation of fibre services as part of broadband services in general. For example:

- in 2014 CICRA issued a consultation on the appropriate price of wholesale residential broadband prices for fibre products, with various proposed RPI-X remedies;[41]
- in October 2016 CICRA stated that it would be consulting on introducing wholesale bitstream access (BSA) products that may be provided over fibre or copper.[42] (Currently, Sure and Newtel re-sell 'white-label' fibre products.[43])

Any relevant regulations need to be implemented effectively and updated as appropriate to focus on ensuring that other operators get access to JT's Gigabit fibre network on fair, reasonable and non-discriminatory (FRAND) terms, and that wholesale access seekers get access to wholesale products that allow access seekers to compete on differentiated retail services.

2.4.2 Implications for the telecoms strategy—off-island connectivity

There are currently multiple undersea cables connecting Jersey to the UK, France, and Guernsey. These cables provide good resilience and spare capacity to deal with major incidents, as demonstrated during the November 2016 incident when the anchor of a ship in the English Channel accidentally cut three cables without affecting the provision of services to Jersey.

It is important that the resilience of this essential infrastructure be maintained by ensuring that there is sufficient capacity to meet Jersey's connectivity

[41] CICRA (2014), 'Wholesale Broadband Prices-JT (Jersey) Limited', April, https://www.cicra.gg/media/4060/t878j-consultation-cicra-considers-wholesale-broadband-charges-in-jersey.pdf. CICRA (2016), 'Telecoms Wholesale Access Services', February, https://www.cicra.gg/media/2154/t1189j-consultation-telecoms-wholesale-access-services.pdf.
[42] CICRA (2016), letter to wholesale operators, 4 October, https://www.cicra.gg/media/2202/t1189j-letter-to-operators-wholesale-access-consultation.pdf.
[43] Sure (2016), 'Sure's non-confidential response to CICRA's consultation on wholesale access services', 31 March, https://www.cicra.gg/media/3201/t1189j-telecoms-wholesale-access-services-consultation-response-sure.pdf.

requirements and there is an incident response mechanism in place. We discuss this issue further in section 3.7.

2.4.3 Implications for the telecoms strategy—mobile networks

There is mobile network competition among the three operators in Jersey on current technologies, which has resulted in positive market outcomes (greater coverage, deployment of 4G, and lower prices).

However, this network competition with three independent networks (without any network sharing) may not be sustainable in rolling out technological upgrades, including iterations of 4G and next generation mobile technologies such as 5G.

Indeed, some operators mentioned that they are not able to cope with the demand for 4G services and have to reduce speeds and/or data allowances at times in order to accommodate growth in the user base. We understand that one reason for this is that Sure and Airtel currently tend to use lower-capacity microwave for backhaul (instead of fibre backhaul). This would suggest that the Gigabit network could be leveraged to provide more fibre backhaul.

Finally, spectrum is an essential input for providing mobile services and should be managed efficiently such that it is used optimally to continue to provide the greatest benefits to Jersey residents and citizens.

Next, in section 3, we discuss the key trade-offs between policy options to deliver a forward-looking telecoms strategy, and set out our policy recommendations in section 4.

3 Options to deliver a forward-looking telecoms strategy

We first set out the components that any forward-looking telecoms strategy for Jersey would need to consider based on the objectives of the Strategic Plan and the Digital Policy Framework (as discussed in section 3.1). We then report (in section 3.2) on the feedback from stakeholders interviewed by Oxera and the Jersey Government as they relate to delivering a forward-looking telecoms strategy.

A brief reminder of the Jersey context is given in section 3.2 before a discussion of the trade-offs involved in prioritising possible key objectives (in sections 3.4 to 3.7).

Section 3.8 concludes and considers, in qualitative terms, how the proposed strategic objectives might affect the Government's shareholder value in JT.

3.1 A forward-looking telecoms strategy that contributes to Jersey's economy

Based on the requirements for an advanced digital infrastructure defined in the Digital Policy Framework, the telecoms sector must achieve the following objectives.

1. Ubiquitous and high-speed connectivity using both fixed and mobile networks (necessary for advanced digital infrastructure).
2. Encouraging affordable services that consumers value (which will encourage a thriving digital sector).
3. Maintaining a resilient infrastructure to ensure seamless off-island connectivity (necessary for advanced digital infrastructure).
4. A spectrum policy that supports the development of innovation in next generation mobile and specialised services (necessary for advanced digital infrastructure). There are few if any trade-offs in adopting a spectrum policy that ensures that spectrum is managed in a way that promotes efficient use of spectrum, and generates benefits for citizens and residents of Jersey. Our recommendations on the appropriate spectrum policy for Jersey are provided in section 4.1.4.

Below, we discuss the options and trade-offs inherent in delivering these objectives.

Ubiquitous and high-speed connectivity using both fixed and mobile networks

The telecoms strategy should consider the connectivity requirements for homes and businesses in Jersey and the mechanisms through which these requirements can be met by supporting the development and deployment of both fixed and mobile telecoms infrastructure.[44]

The delivery of next generation networks and services should ensure that the telecoms infrastructure continues to meet the changing connectivity

[44] It is essential to consider both fixed and mobile networks in any telecoms strategy because residents and businesses require fast and reliable connectivity at both fixed and mobile locations—i.e. when users are not in their usual place of residence or business. In addition, the optimal technology for meeting consumer demand is likely to involve a mix of fixed and mobile networks.

requirements of businesses and residents. We discuss (in section 3.5) whether Jersey should be a pioneer in the adoption of new technologies, or a fast adopter.

Encouraging affordable services that consumers value and are universally accessible

This will ensure that consumers enjoy the benefits of next generation connectivity. Tools to promote this objective (as discussed in the sections below) include competition (section 3.4) and social policy (section 3.6). Affordable services will help to achieve a thriving digital sector.

The sector should maintain a resilient infrastructure to ensure seamless off-island connectivity

Resilient off-island connectivity will help to maintain the resilience and capacity of Jersey's advanced digital infrastructure to ensure ubiquitous and high-quality connectivity for both businesses and consumers. This is crucial in order to continue to attract high-growth economic sectors. We consider the potential trade-offs in ensuring resilience in off-island connectivity (see section 3.7).

Next we report on the feedback from various stakeholders in Jersey on the current state of the telecoms market in Jersey. This feedback and the Jersey context are important to consider when looking at the trade-offs between options and deciding on a telecoms strategy. We discuss the Jersey context in section 3.3.

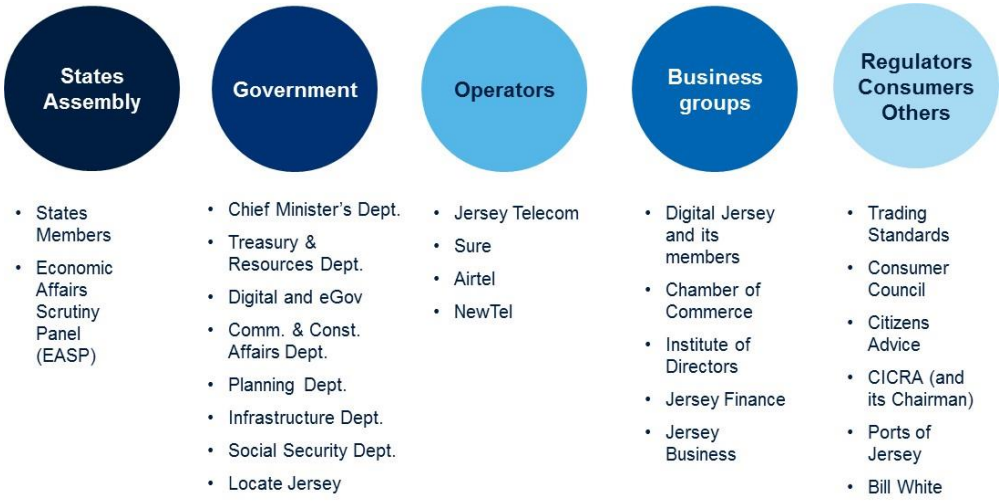
3.2 Stakeholder engagement

As part of this project Oxera met with a wide range of stakeholders (as listed in Figure 3.1). The aim was to understand the issues relating to the telecoms sector that matter to different stakeholders, and whether the sector is meeting their needs. This was helpful in identifying trade-offs between potentially conflicting objectives.

Oxera conducted these interviews in person, in Jersey and London. In some cases we met with stakeholders on more than one occasion. As in previous reviews, and in order to encourage open discussion, we conducted the interviews under the 'Chatham House Rule'. As such, comments are not individually attributed in this report.

Oxera is grateful to all stakeholders who took part for their cooperation and openness during the interviews. Their feedback is referred to throughout this report as appropriate.

Figure 3.1 Stakeholders interviewed



Source: Oxera.

Below we present the main points from the stakeholder feedback on fixed infrastructure and off-island connectivity, mobile networks, regulation of the telecoms sector; and the Government's role and social policy (sections 3.2.1–5 respectively). Section 3.2.6 concludes and discusses the feedback in relation to the telecoms strategy.

3.2.1 Feedback on fixed infrastructure and off-island connectivity

What works?

Most stakeholders view the Gigabit rollout as a significant success, with the widespread availability of high-speed broadband a key achievement and a potential factor increasing the attraction of businesses and entrepreneurs locating in Jersey. They noted the need to prioritise the effective use of the successful Gigabit rollout (e.g. using it for fibre mobile backhaul and wider offering of symmetric upload and download speeds).

Existing resilient off-island connectivity is also viewed as a success by stakeholders, with many pointing to connectivity surviving unforeseen incidents, and highlighting the importance of the ongoing need to ensure resilience of off-island connectivity.

Issues identified by stakeholders

Some stakeholders stated that the telecoms markets lack a level playing field between competing operators.

Many stakeholders stated that it is not always commercially viable to duplicate infrastructure in Jersey given its small size. Infrastructure competition was seen as unlikely to increase, and several stakeholders noted that further infrastructure competition would not be feasible given the limitation to exploit scale economies.

A few stakeholders find off-island connectivity expensive (e.g. the cost of cloud technology data/centres is high) compared with other jurisdictions such as the UK.

Some stakeholders stated that there needed to be a variety of broadband services available and that not everyone should be forced onto higher-speed services.

3.2.2 Feedback on mobile connectivity

What works?

Stakeholders were positive about the level of 4G coverage in Jersey of all three operators. Building on the success of 4G rollout, many stakeholders noted the need for Jersey to embrace 5G technology (although there were differing views on when).

Issues identified by stakeholders

The issue of the level playing field was relevant for mobile as well as fixed telephony, with some stakeholders stating that the cost of leasing fibre backhaul products is too high. This meant that some operators are not able to cope with the demand for 4G services and have to reduce speeds and/or data allowances at times in order to accommodate growth in the user base. Several stakeholders were unhappy with the way that speeds appear to reduce at peak times.

Many stakeholders stated that it is not efficient or sustainable to have three separate mobile networks in Jersey, especially looking forward to 5G. Concerns were raised over barriers to network sharing (difficulties in planning permission for lattice masts, etc.).

There were also concerns over the cost of roaming abroad and a lack of clarity on deals available for roaming.

3.2.3 Feedback on sector regulation

Issues identified by stakeholders

A number of stakeholders suggested that CICRA is ineffective and lacks sufficient specialised resources (e.g. telecoms expertise).

Some stakeholders also expressed their view that CICRA is not focusing on the right priorities for the sector. For example, more focus on ensuring good wholesale access to broadband services over the Gigabit network and less focus on mobile termination rates (not seen to be a critical issue) would be useful.

Some stakeholders felt that CICRA lacks a clear remit and is too process-bound because of the risk of litigation.

3.2.4 Feedback on the Government's role

What works?

Several stakeholders were generally positive about the impact that Government ownership of JT has had in enabling investment in the Gigabit network.

Issues identified by stakeholders

The stakeholders noted that the overlapping role of different parts that the Government may play in the sector is problematic, and the Government objective behind JT ownership is not clear. They therefore felt there needed to be greater clarity and transparency over the Government's objectives for both JT and CICRA—in particular, clearer guidance from the Government to CICRA and clarity over the Government's expectations of JT and its role in the sector.

Some stakeholders felt that privatisation of JT would lead to greater transparency, competition and innovation.

3.2.5 Feedback on social policy

What works?

Several stakeholders were generally positive about the impact of Government ownership of JT in helping deliver the Gigabit network.

Issues identified by stakeholders

Many stakeholders said that there is a lack of clarity regarding social policy obligations (e.g. it is not clear whether and/or how the Government mandates Prime Talk). Prime Talk was also singled out for criticism in that it undermines the level playing field between operators, among other reasons.

3.2.6 Summary and conclusion

There is positive feedback on a number of aspects of the development to date of the industry and its current state, the potential benefits of the Gigabit rollout, and the level of mobile coverage. Some stakeholders commented that these positive developments should be communicated more widely—both to Jersey residents and outside Jersey.

Stakeholders also raised issues, such as the lack of a sufficient level playing field among operators.

Importantly, all stakeholders recognise that there are the trade-offs in developing a telecoms strategy for a small-scale jurisdiction such as Jersey, and are looking to the Government for guidance.

3.3 The Jersey context

The 'Jersey context' is at the heart of the proposed telecoms strategy, and takes into account:

- the current state and recent history of the Jersey telecoms markets, including current wholesale and retail dynamics (discussed in section 2);
- the economics of providing telecoms services in an island with a population of around 104,000 people, and the consequent implications for retail versus wholesale competition (discussed in section 3.4);
- the economic and social benefits that the telecoms strategy can deliver to Jersey, including via the adoption of new technologies (section 3.5) and via social policy objectives (section 3.6);
- the importance of off-island connectivity (section 3.7);
- the institutional and regulatory arrangement and the Government's role in the telecoms sector (discussed below);
- the resources that can reasonably be made available to implement a telecoms strategy in Jersey (also discussed below).

3.3.1 Institutional and regulatory arrangements

The Jersey Competition Regulatory Authority (JCRA) is the sector regulator of telecoms in Jersey and since 2010 has been one-half of the umbrella body, CICRA. (CICRA is also responsible for Guernsey.) The JCRA reports to the Government of Jersey.

The Jersey Government owns JT, and the shareholder function rests with the Treasury and Resources Minister, supported by the States' Treasurer and the Treasury and Resources Department. The Government's relationship with JT is set out in a Memorandum of Understanding, which lays out objectives for JT. These include efficiency and profitability, delivery of returns to shareholders, and being responsive to the wider interests of the Jersey community.[45]

As noted earlier, the overlapping Government interactions with JT and CICRA are seen as problematic by many stakeholders, and the 2015 Oxera report 'A review of the Jersey regulatory and competition framework' also found that there was a lack of distinction between the duties of Ministers and the JCRA, and that this was problematic.

The Oxera report recommended that the Government (in conjunction with the JCRA) provide a clear description of these roles. The Government is currently drafting a Memorandum of Understanding between the Government and CICRA, which would clearly set out the respective roles of the JCRA and Ministers.[46]

3.3.2 CICRA resources

CICRA's wide remit includes responsibility for the administration and enforcement of competition law across the Channel Islands, together with the economic regulation of the telecoms, port and postal services sectors in Jersey.

CICRA's current strategic aim for telecoms is:[47]

> ensuring telecoms markets work in the best interests of consumers, through effective competition where appropriate; and regulation where competition is not sufficient to adequately protect consumer interests

We note that, compared with its wide remit, CICRA has a small number of staff. As at end of 2016, the CICRA Board comprised a Chairman, two non-executive directors, and two executive directors with seven staff.[48] To make best use of these limited resources, a clear prioritisation of the issues that CICRA should address in the telecoms sector would be useful. The proposed Memorandum of Understanding between the Government and CICRA should be useful in this respect, and we make some further policy recommendations (in section 4 below) based on the analysis of the trade-offs between policy options.

Next we discuss the trade-offs inherent in the strategic objectives of competition, being a pioneer in next generation network technologies, the delivery of social services, and building off-island resilience.

3.4 Competition: retail or network competition?

In general, effective competition on services, prices and quality can be expected to deliver good outcomes for consumers in meeting the current and evolving requirements of different consumer segments at competitive prices. This competition among operators can be at the network infrastructure level (each service provider has its own network) and/or at the retail level, although retail competition does not require network competition (each retail service provider may not own or run its own physical network).

[45] See Oxera (2015), 'A review of the Jersey regulatory and competition framework', 16 November.
[46] States of Jersey (2017), 'Regulatory and Competition Framework Review Action Plan', updated 9 June 2017, https://www.gov.je/SiteCollectionDocuments/Government%20and%20administration/P%20Competition%20Framework%20Action%20Plan%20December%202016%2014032017JM.pdf.
[47] http://www.cicra.gg/about-us/general-background/.
[48] See CICRA (2017), 'Annual report 2016', 31 March.

Network competition can promote the availability of innovative and differentiated services, especially when this network competition is based on different network technologies. It can also incentivise investment in innovation within the network. This may be because different technologies have different upgrade paths and timescales, and operators may gain a competitive advantage from an investment that allows them to serve changing customer requirements, such as increasing demand for bandwidth. This greater investment can lead to greater broadband coverage and penetration, higher speeds, lower retail prices, and increased consumer choice.

However, the provision of both fixed and mobile telecoms services exhibits strong scale economies and economies of demand density. These act in opposite directions, as explained in Box 3.1. In Jersey, small-scale economies increase the total costs of service provision, whereas high demand density (high population density) reduces costs. On balance, encouraging network competition (without any network sharing, in the case of mobile networks) is unlikely to be efficient or commercially feasible, as we discuss below.

Box 3.1 Scale economies versus economies of demand density in Jersey

The provision of both fixed and mobile telecoms services exhibits strong scale economies and economies of demand density. Below we explore the impact of these two effects on the cost of telecoms infrastructure in Jersey.

Scale economies mean that increasing traffic volumes tend to reduce the average cost of each minute or data carried over the network. Thus, an increase in the number of independent network operators would not necessarily lead to better outcomes for consumers and society as a whole. This is because there is a trade-off between the benefits derived from more network competition and the exploitation of scale economies.

Allowing additional network operators into the market can lead to a reduction in the exercise of market power, but might also mean higher average and marginal costs for all operators as scale economies are not fully exploited.[49] This in turn could mean higher retail prices for consumers (marginal costs affect consumer prices in a competitive market, and, for a supplier to stay in the market, prices must ensure full cost recovery in the long run). The outcome will depend on whether the benefits of having additional operators in the market are sufficient to outweigh the negative impact of any loss of economies of scale that would have materialised if there had been fewer suppliers.

The minimum efficient scale (MES) of network production—i.e. one that minimises the average cost of production and hence prices in a competitive market—will require a sufficient level of demand and hence production of the relevant service. Given the relatively small scale of the operations in Jersey, achieving the MES for both mobile and fixed networks can be challenging. This problem could be worse if there are multiple networks competing with each other, as the demand for each network's services will be smaller than if there were only one network operator.

Economies of demand density mean that the unit cost of providing telecoms services reduces with greater density of customers (i.e. the number of customers per km^2). Telecoms networks typically exhibit economies of demand density. However, average costs depend on the number of customers subscribing to the network, rather than the number of people living in an area. Jersey has a relatively high population density (819 people per km^2).[50] If this were replicated in the density of customers, it would reduce the per-customer cost of building the network (and in effect reduce the MES of that network).

Therefore, the two effects act in opposite directions: scale economies imply relatively higher average telecoms costs in Jersey; while economies of demand density imply relatively lower average telecoms costs. However, economies of both density and scale mean that, in any particular market, multiple suppliers may result in higher unit costs, and hence higher prices as demand for services will be split among different operators—leading to lower demand density and scale economies for any one operator.

3.4.1 Fixed network competition in Jersey

The cost structures of fixed telecoms services (and other telecoms markets, such as mobile and off-island connectivity) have the following general characteristics (which have a significant impact on unit prices):

- there are high, one-off sunk costs of rolling out the networks;
- these network construction costs exhibit strong economies of scale (in terms of the capacity of the network);
- there are economies of demand density;
- the operational costs of the networks are relatively small;

[49] Although, in the long term, if the new player displaces the incumbent (and becomes the only network) then costs may reduce to the efficient level. However, the costs of entering the market and displacing the incumbent (through pricing below cost) would have to be recovered from consumers in the long run. (The new player would be able to raise prices once it was the only network.)
[50] Statistics Unit (2011), '2011 census results'.

- the life of the asset is significant, but subject to potential technical obsolescence.

As noted earlier, in the fixed telecoms sector in Jersey, there is currently only one island-wide fixed network, operated by JT. JT has also been rolling out fibre network in Jersey—the Gigabit network cost JT around £50m.[51] This equates to approximately £1,600 per household activated (or connected as opposed to simply passed), assuming a 75% penetration rate (i.e. 75% of approximately 41,000 households subscribe to the fibre network). This is consistent with the costs observed in Europe.[52]

It is unlikely to be efficient or commercially feasible for an alternative operator to roll out a fibre network competing with JT's Gigabit network given that the operator would have to recover the costs of deploying such a network over a smaller proportion of households (consistent with the feedback provided by stakeholders).[53]

3.4.2 Mobile network competition in the rollout of 5G networks in Jersey

The next generation of mobile technology, 5G, will offer Gigabit speeds with lower latency and greater reliability.[54] Eventually, there will be seamless connectivity inside and outside the premises, with users enjoying one high-quality connectivity experience. Box 3.2 presents some potential 5G use cases in Jersey.

[51] Information provided to Oxera by JT.
[52] A recent study for the FTTH Council Europe calculated the cost of building fibre network across Europe, and computed how the cost per household relates to household density. While the results of this analysis should not be used to estimate the costs of building a new FTTH network, they do show that the cost of the Gigabit network is broadly in line with what can be expected for an area of Jersey's density. Jersey's household density is approximately 350 per km^2 (41,000 divided by 118 km^2). On the basis of the FFTH Council Europe calculations, we would expect the cost per household passed to be in the region of €1,000, with the additional cost per household activated (that is, actually connected to the FTTH network) in the region of €750—a total of approximately £1,500. Based on this approximate calculation, the cost of building the Gigabit network in Jersey would seem to be in line with what might be expected for an area with Jersey's household density. Fibre to the Home Council Europe (2017), 'The Cost of Meeting Europe's Future Network Needs: The cost of putting in place an infrastructure now, that will meet the Gigabit Society targets for 2025, 2035, 2045 and beyond', March, http://ftthcouncil.eu/documents/Reports/2017/FTTH%20Council%20Cost%20Model%202017_final.pdf.
[53] Following the illustrative calculation above, assuming that two networks each serve half the households, but every household could access either network, the per-household cost of deploying fibre doubles to approximately £3,200.
[54] See European Commission (2016), '5G for Europe: An Action Plan', COM(2016) 588 final.

Box 3.2 5G use cases in Jersey

Enhanced mobile broadband (eMBB) will be at the heart of the business case for 5G across the world, including Jersey. eMBB can be expected to unlock greater productivity through the mobile office, which will be important for Jersey in attracting new business to the island—the ability to seamlessly work remotely from any location in Jersey would be a pull factor to the island. It will also enable consumers to view high-quality video content (such as 4K) and enable immersive gaming experiences on the move.

However, some of the business case for 5G in other jurisdictions (such as the UK) is that it would help provide last-mile connectivity to the premises. This would not apply in Jersey as the Gigabit network will already provide excellent last-mile connectivity. In other words, eMBB use of 5G would be limited to connectivity on the move.

Other use cases are likely to 'piggy back' on the eMBB network, requiring incremental investment in network improvements, such as lower latency. 5G use cases that may apply to Jersey include healthcare and smart utilities. Regarding healthcare, 5G connectivity may be used for greater assisted living (to reduce hospital admissions); for remote healthcare, whereby patients can be treated without attending medical locations; and for preventative health, such as wearable devices that encourage healthier living. One stakeholder mentioned eHealth as a potential area for innovation in Jersey. Smart utilities encompass smart meters (in the home) and the smart grid (automated control over the utilities grids). Jersey Electricity is already rolling out smart meters (which use machine-to-machine connectivity) across Jersey using 4G.

Source: Oxera, and Real Wireless for National Infrastructure Commission (2016), 'Future Use Cases for Mobile Telecoms in the UK', October.

The potential costs of building a 5G network are discussed in Box 3.3. Based on the likely costs of a 5G network, rolling out three 5G networks on Jersey with no network sharing (as is the case with the current 4G networks) is unlikely to be commercially viable. As discussed below, the rollout of 5G in Jersey (as in many other jurisdictions) will require sharing of some networks components (such as sites, potentially antennae, and fibre backhaul) between the three existing operators.[55]

Deploying 5G in Jersey will require the following elements.

- The ability to build a very dense network of small cells. A recent study for the National Infrastructure Commission (NIC) estimated that there would need to be tens of thousands of small cells to cover urban areas in the UK.[56] Specific estimates for Jersey, depending on the use cases, are included below. However, it will be challenging for all three existing MNOs in Jersey to roll out independent very dense small-cell networks. This is one reason why the rollout of 5G networks in Jersey will require some level of network sharing, as is the case for other jurisdictions.

- High-capacity radio access networks (RAN) require high-capacity backhaul to transmit the data. Given that it may be challenging for all three existing operators to build independent backhaul networks, this is another component that may require network sharing.[57] Fibre backhaul providing Gigabit speeds will be vital for 5G networks, and this will need to be provided for many more sites in the dense small-cell network. Sharing backhaul should reduce the costs of providing fibre backhaul for 5G.

[55] It is also important to recognise that network sharing for 5G may result in network sharing for some or all other mobile technologies (i.e. 2G, 3G, 4G), to the extent that these are based on a common network infrastructure.
[56] LS Telecom (2016), '5G Infrastructure Requirements in the UK', 12 December.
[57] According to industry estimates, global mobile broadband traffic will continue increasing (possibly exponentially), and there is no reason to suspect that this will be different in Jersey. See National Infrastructure Commission (2016), 'Connected Future', 12 December, Figure 4.

- Access to sufficient spectrum. The spectrum bands for 5G in Europe have been identified, and Ofcom (responsible for spectrum management in Jersey) has released a strategy on the topic.[58] In summary, the 700MHz band (available from around 2020) will be crucial for 5G coverage, with the 3.4–3.8GHz and 24.25–27.5GHz bands providing high data capacity. Further spectrum bands may be subsequently identified for 5G. There should be sufficient spectrum available for multiple competing operators in Jersey, although this may also depend on the specific use case for the 5G network deployed in Jersey.

Box 3.3 The potential cost of building a 5G network in Jersey

Here we analyse the likely infrastructure requirements of an eMBB 5G network for Jersey by adapting NIC (National Infrastructure Commission) estimates for the whole of the UK.[59] The NIC estimated that a dense enhanced mobile broadband 5G network would require 97,350 sites across the UK. This is an increase of an order of magnitude of 9.7 on the current sites that each UK MNO has.[60]

Applying the order of magnitude (x9.7) to the number of sites that each Jersey MNO has (202 sites[61] in total across the three MNOs, so on average 67.3 sites per MNO) results in a total of 655 additional 5G sites per operator (67.3 x 9.7) to cover Jersey (assuming no network sharing). The sites would be a mixture of small cells, street furniture, rooftops and greenfield sites. The associated cost would depend on the specific topography and costs in Jersey. However, taking the implied UK average cost per site (£25,500),[62] we get a total cost of £16.7m.[63] In comparison, JT's upgrade to 4G across Jersey cost £12m in total.[64]

While we cannot verify the application of these numbers to Jersey, they illustrate the rough order of magnitude that a Jersey operator would need to invest in order to build a 5G network capable of offering eMBB services.

Other use cases (that are not eMBB) might also require additional investment in the network—these cost estimates are therefore conservative. For example, the connected cars use case would require additional investment in low-latency connectivity (that would not otherwise be delivered as part of the £16.7m investment for eMBB). These cost estimates also do not consider any additional costs regarding off-island connectivity.

We also note that Telecom Italia, the sole MNO in San Marino, has announced a 5G deployment in San Marino.[65] Technically, this plan is an upgrade to 4.5G, with some features of 5G included. According to Telecom Italia, this will involve doubling the existing number of mobile sites and installing several dozen 'small cells', linked by optical fibre and distributed throughout the whole of the territory of San Marino.[66] If we apply the doubling of base stations to a Jersey MNO's network, plus additional small cells, we get another estimate of the required 5G infrastructure—115 new sites. This would cost approximately £3m, using Ofcom's

[58] Ofcom (2017), 'Update on 5G spectrum in the UK', 8 February, https://www.ofcom.org.uk/__data/assets/pdf_file/0021/97023/5G-update-08022017.pdf.
[59] Real Wireless for NIC (2016), 'Future Use Cases for Mobile Telecoms in the UK', October.
[60] There are 40,000 existing mobile sites in the UK across four MNOs. See LS Telecom (2016), '5G Infrastructure Requirements in the UK', report for NIC, 12 December.
[61] CICRA (2017), 'CICRA commissions Channel Islands mobile mast emissions audit', Media Release, 30 May, https://www.cicra.gg/media/597549/t1281gj-media-release-cicra-commissions-mobile-mast-emissions-audit.pdf.
[62] Total cost of £2.483bn divided by the total number of sites (97,350). This is thus the average cost of all the different types of site.
[63] The cost per site may be different in Jersey than in the UK. For example, several stakeholders stated that digging costs were high in Jersey; on the other hand, the existence of the Gigabit network may lower the costs of backhaul.
[64] We also note that Sure's upgrade to 4G for Guernsey cost a reported £10m. See JT (2015), 'JT completes Jersey's first 4G network', media release, 7 May, http://www.jtglobal.com/Global/Website%20Assets/latest%20news/Jersey/2015/V8_MR_4G_completed.pdf; TeleGeography (2015), 'Sure Guernsey becomes first on island to obtain 4G concession, first sites already activated', 2 April, https://www.telegeography.com/products/commsupdate/articles/2015/04/02/sure-guernsey-becomes-first-on-island-to-obtain-4g-concession-first-sites-already-activated/.
[65] San Marino has a population of approximately 30,000 (under a third of Jersey's population) and a landmass of 61km^2 (approximately half that of Jersey), according to the World Bank.
[66] Telecom Italia (2017), 'TIM: the Republic of San Marino is the first 5G State in Europe', press note, 17 July.

estimates of the cost per 5G site.[67] This would not necessarily be a full 5G network, as Telecom Italia is creating a 4.5G network with certain 5G elements. However, it may be a large enough investment to be a fast adopter in 5G.

We note that neither of the above cost estimates (the UK-based estimate of £16.7m nor the San Marino-based estimate of £3m) takes network sharing into account. Sharing network elements would split (some of) the costs between operators, making the deployment of 5G network(s) more likely to be commercially viable. Indeed, 5G technology is expected to increase the opportunities for deeper network sharing.[68]

3.4.3 Retail competition and potential trade-offs

The above discussion suggests that achieving network competition may be challenging given the size of the market in Jersey. Hence, it may be appropriate for the telecoms strategy to focus on retail competition in fixed and mobile services.

There will be some duplication of costs among retail competitors (for example, on advertising, billing systems, and customer support). However, this could be expected to be an order of magnitude smaller than the duplication of costs if each operator rolled out its own network. This is because retail costs are generally a smaller proportion of the total costs of service provision, at around 10–20% of the retail price, with the remaining 80–90% being accounted for by network costs.

Retail competition can enable certain key benefits. It may increase consumer choice through having a larger variety of operators to use (and therefore choice on service parameters such as customer service) and a wider range of products and bundles (different firms often go for different market segments). However, this will depend on the extent to which retail competitors can differentiate their retail services (i.e. offer different speeds, data caps, etc.) based on the type of wholesale access products offered. Some may allow for more differentiation than others.

Other comparable-sized jurisdictions have taken a similar approach. The 2016 Guernsey Connectivity Review highlighted the potential for making better use of existing infrastructure, and focusing on retail competition given the size of the market. Similarly, the Bahrain Telecommunications Regulation Authority conducted a Strategic Market Review in 2014 and withdrew regulation from many retail markets while maintaining regulation of wholesale markets. The European regulatory framework also emphasises using wholesale regulation to enable retail competition (assuming that the retail market would not be competitive without wholesale access regulation) and removing retail controls.

3.4.4 Conclusion: focus on encouraging retail competition

Retail or service-level competition among operators is based on the purchase of wholesale network inputs from a single network. Retail operators use these wholesale inputs to compete in the retail markets. For retail competition to be effective, all operators would need to have non-discriminatory access to the wholesale network—i.e. on the same price and non-price terms (quality of

[67] Doubling the number of sites would be another 67 sites for a single operator. If we assume that the number of small cells in San Marino is 24 (‘two dozen’), and that twice as many would be required for Jersey (twice the landmass), 48 small cells would be required. The Ofcom/Real Wireless estimate for the average cost of a 5G site was £25,506. [Source: Real Wireless for NIC (2016), ‘Future Use Cases for Mobile Telecoms in the UK’, October.] Multiplying this by 115 sites generates a cost of £2,933,179.
[68] For example, network slicing and infrastructure as a service. See LS Telecom (2016), ‘5G Infrastructure Requirements in the UK’, 12 December, p. 96.

service) as the operator that owns and runs the network. Hence, retail competition requires a level playing field at the wholesale level.

3.5 Adoption of new network technologies: pioneer or fast adopter?

Being a pioneer means accepting the risk of being the first company/jurisdiction to roll out a certain network technology. This is different from being a fast adopter—i.e. immediate adoption once the technology is standardised.

3.5.1 Being a pioneer and potential trade-offs

Being a pioneer jurisdiction can be seen in two different ways.

The *first* is that Jersey creates the appropriate legal and regulatory framework which essentially has no (or very little) economic cost to provide. It is then 'open' for others to use Jersey as a test bed, etc., for new technologies. In this case it is the firm that takes the financial risk, and in essence its full set of (future) customers pays for this 'testing'. Adopting such policies would enhance the role for Jersey to be used as a test bed for the rollout of a new technology that creates its own economic spill over effects. There are few, if any, trade-offs in adopting such policies, and, to enable innovation in Jersey, the Government should actively adopt these policies. For example, the policies could include early access to 5G spectrum to test the technology, simplify planning rules for masts, etc.

The *second* is that there is more 'encouragement' by the Government (i.e. persuading Jersey residents) to pay for (some of) the actual infrastructure investments needed to be a pioneer in being the first to adopt new network technologies, in the form of higher unit costs. The benefits from being a technology pioneer stem from earlier adoption of new technologies, bringing forward the benefits from the new technologies, and attracting business that wants to use that technology sooner.

However, being a pioneer in adopting network technologies first in Jersey to serve Jersey residents brings two risks. First, the risk of 'getting it wrong' and investing in a new technology that does not end up being the standard/widely adopted in the rest of the world. This would leave Jersey with 'stranded' technology and more investment would be required. Second, there is no guarantee that the particular type of pioneering next generation technology (with potentially unproven use cases) will be successful in attracting businesses and industry to Jersey. The benefits of being a 'fast adopter' are that the two risks above would be substantially lessened.

Operators also tend to face greater risks when deploying new unproven technologies. The technology may not work as planned and the deployment costs are likely to be higher in the early stages of a new technology rollout than in the case of a fast adopter. This is because the unit cost of technology falls through time as lessons are learnt on how to deploy the technology efficiently. A fast adopter could also 'fast follow' only a sub-set of new technologies through time—i.e. it could leapfrog and adopt only the efficient and proven versions of the technology that represent a significant improvement on that already deployed.

We note some previous instances when Jersey has been a pioneer in the application space (based on providing an appropriate legal framework), which are consistent with it being a fast adopter in network technologies. Examples include the following:

- Jersey was the first jurisdiction to regulate virtual currencies for anti-money laundering purposes;[69]
- Jersey's trusts law was truly innovative when it was first crafted, and was a significant influence in Jersey building a world-class reputation and establishing a market-leading position;
- Foundations (an innovative company incorporation scheme) is another good example. Jersey was the first to introduce the product, although also a follower of innovation by other jurisdictions. The product was essentially adapted from a number of existing products.

3.5.2 5G as an example of being a fast adopter

The smaller land area of Jersey is also an advantage in pursuing a fast-adopter strategy. One stakeholder estimated that the deployment of the 3.5GHz band, a key 5G spectrum band, in urban areas in Jersey would take two months, with rural areas taking another four months. Another stakeholder also mentioned a timeframe of six months.[70]

Six months is a relatively short time period to roll out 5G, and reflects the relatively small size of the island. This suggests that a fast-adopter strategy may still enable the development of innovative solutions to address the changing requirements of business and consumers—for example, in developing innovative applications that use the network as opposed to the network technology itself.

The cost of rolling out 5G in Jersey should be of the same order of magnitude as for 4G (see Box 3.3). In addition, rapid spectrum release for 5G would be necessary for Jersey to be a fast adopter of 5G technology, as illustrated by the Isle of Man's rollout of 4G.

The Isle of Man was ahead of the Channel Islands in releasing spectrum for 4G usage (2013) and coverage obligations were applied to the licences.[71] This led to 4G networks being deployed in the Isle of Man before Jersey (by 2014).[72] However, the Isle of Man was a follower (rather than a pioneer or fast adopter) in this respect. 4G networks had been deployed worldwide since 2011, and much of the investment and technology uncertainty had been resolved.

Finally, we note that the UK is aiming to be a test bed and pioneer of 5G technology. The UK's 5G strategy will achieve this through some government funding (£16m) and tackling barriers to infrastructure sharing.[73] Jersey could closely follow these developments and build on its proximity to the UK to be a fast adopter of this technology.

[69] Jersey Finance (2016), 'Jersey Strengthens Financial Crime Regulation with Extension to Cover Virtual Currency', 24 October, https://www.jerseyfinance.je/news/jersey-strengthens-financial-crime-regulation-with-extension-to-cover-virtual-currency#.WZG8PORK2Uk.
[70] This is the timeline after planning permissions have been received, and it is not clear whether this would involve a new network of small cells or the upgrade of existing sites.
[71] Communications Commission (2013), 'Consultation on the Licensing of 4G Mobile Services and Notice of Proposed Modification to Existing Licences', 1 July, https://www.gov.im/media/1357281/consultation-on-the-licensing-of-4g-mobile-services.pdf.
[72] Techworld (2014), 'Manx Telecom hails Isle of Man as country with best 4G coverage', 7 August, http://www.techworld.com/news/data/manx-telecom-hails-isle-of-man-as-country-with-best-4g-coverage-3535341/.
[73] Department for Culture, Media & Sport and HM Treasury (2017), 'Next Generation Mobile Technologies: A 5G Strategy for the UK', March, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/597421/07.03.17_5G_strategy_-_for_publication.pdf.

3.5.3 Conclusion: be a fast adopter not a pioneer in network technologies, but provide the legal and regulatory framework to enable Jersey to be used as test bed

Based on the above discussion, the focus on being a fast adopter seems appropriate given the size of the island and hence the relatively quick timeframe within which a new network technology could be deployed and adopted. This also reduces any potential loss from not being the first mover (pioneer), as the relevant technology can be rolled out very soon after.

At the same time, the Government should actively adopt policies to enable innovation in Jersey. For example, such policies could include early access to 5G spectrum to test the technology, simplify planning rules for masts, etc.

3.6 Social policy objectives: delivered by the telecoms sector or directly by government?

It is useful to distinguish between social policy objectives and universal service obligations. The latter require telecoms operator(s) to make available certain defined services to all (or nearly all) consumers so that the prices charged are the same irrespective of the location of the customer (or, if not the same, do not fully reflect cost differences). The telecoms sector is typically required to provide a universal service.

The emphasis of recent universal service obligation policies is on broadband connectivity. For example, the European Commission has proposed to make affordable basic broadband access a universal service,[74] and the UK government is currently consulting on what broadband universal service obligation to impose to ensure 100% connectivity.[75]

In addition to access to services, universal service obligations may include policies relating to retail pricing, such that customers not able to afford basic communications services are provided these services at a subsidised price. Such social policies (e.g. in the form of subsidies) need not be delivered from within the telecoms sector, but can relatively easily be delivered by the direct targeting of the relevant group by another party (for example, the government).

3.6.1 Current trade-offs

JT currently delivers a number of non-commercial services ('social policies'), although it may not be explicitly mandated or required to do so. This may be because there is an expectation from the Government that JT continues to provide these services, or it may reflect JT's role as the former incumbent monopoly operator.

Prime Talk

Prime Talk is the largest 'social policy' currently delivered by JT. It provides line rental at £2.25 per month, rather than the full retail price of £13.50 per month for those households with someone aged 65 and over.[76] As far as Oxera is aware, there is no clear government policy that requires JT to offer Prime Talk, which

[74] European Commission (2016), 'State of the Union 2016: Commission paves the way for more and better internet connectivity for all citizens and businesses', Fact Sheet, 14 September. Accessed 8 December 2017. http://europa.eu/rapid/press-release_MEMO-16-3009_en.htm
[75] DCMS (2017), 'Broadband Universal Service Obligation: consultation on design', July. Accessed 8 December 2017. https://www.gov.uk/government/consultations/broadband-universal-service-obligation-consultation-on-design
[76] Prime Talk has been closed to new customers since July 2015. See https://www.jtglobal.com/Jersey/Personal/Landline/Coreline/Prime-Talk/.

costs JT about £1.2m per year and has 9,300 subscribers (approximately 20% of households).[77] There also does not seem to be a clear statement of what Prime Talk is *designed* to achieve, although it clearly does deliver a benefit to those pensioner households that are eligible.

This generalised benefit to eligible pensioner households has to be traded off against some material downsides to the policy. One of the trade-offs is that the policy distorts and reduces retail competition. This is because the 20% of households who are currently eligible to subscribe to Prime Talk are much less likely to buy services from other operators, given the subsidised price for Prime Talk. Another consequence is that the cost of Prime Talk has to be recovered from somewhere. The two groups where this can come from are either other customers (~£33.00 per annum per customer on average, if it is all recovered from other domestic customers) or from shareholders (i.e. in this case, the Government of Jersey). All else equal, in both cases Prime Talk operates as a hidden subsidy (also reducing funding transparency and Government shareholder value) to pensioner households from the rest of the population.

There are also questions in terms of whether Prime Talk is well targeted. It is not means-tested and aims to deliver legacy voice services. If the social concern is that some pensioners may be excluded from telecoms services because of affordability concerns, it would make economic sense to means-test the benefit, and apply any subsidy to access to broadband, which is likely to be important for residents going forward. For all these reasons, Prime Talk does not appear to be fit for purpose.

Other social policies

JT currently also delivers other 'social policies'. Although the costs involved in delivering these services are less than those of Prime Talk, some of these services may also be better delivered directly by the Government—for example, the emergency services fielding service provided by JT, which provides an answer and forward service for 999 calls to the appropriate service (fire, police, ambulance, coast guard). The technology and staff costs to JT for this are about £100,000 per year, although the main issue here is setting up a control centre with appropriately trained staff to field emergency calls, a function not usually provided by telecoms companies.

Another service includes phone box upkeep (the cost, for all the phone boxes across Jersey, is around £85,000 per year).[78] The relevance of this service should be reconsidered as usage decreases, and residents and citizens have increased access to mobile services.

To resolve these trade-offs, it is important that the Government sets out explicitly whether there are social policy objectives that it wants pursued in the telecoms sector. Once these are clearly defined (if there are any), the most effective way to deliver them can be worked out.

[77] JT Group (2016), 'Annual Report and Audited Financial Statements 31 December 2015', R.64/2016, http://www.statesassembly.gov.je/AssemblyReports/2016/R.64-2016.pdf http://www.statesassembly.gov.je/AssemblyQuestions/2017/(139)%20Dep%20Martin%20to%20TR%20re%20operating%20losses%20of%20JT%20on%20its%20subsidy%20for%20senior%20citizens.pdf.
[78] JT also uses some of the public payphone booths as mobile sites. See, for example, Millbrook Kiosk http://masts.digimap.je/PDFs/CICRA%20Mast%20Audit%20-%20Millbrook%20Kiosk%20(Jersey)%20v2.0.pdf.

3.6.2 Conclusion: no reason for social policies that do not require the delivery of telecoms infrastructure to be delivered by the telecoms sector

Objectives that require the delivery of telecoms infrastructure will generally have to be delivered by the telecoms sector. An example is the objective that all households have access to 1Gbps (symmetric) connections by 2020.

There is no reason for social policies that do not require the delivery of telecoms infrastructure to be delivered by the telecoms sector. Instead, it is usually more effective for these to be delivered directly by the Government in a way that avoids the identified market distortions and trade-offs.[79]

For example, the social objective of affordability could be achieved via means-tested subsidies for residents unable to afford connectivity to access services such as e-Gov and e-Health. This has the advantage of minimising market distortions as eligible recipients could use, for example, Government vouchers to purchase services from any retail service provider. It would also increase the funding transparency and costs involved in delivering these social services, which should allow for cost–benefit analysis to help determine what, if any, the appropriate social policy objectives should be.

3.7 Ensuring high levels of off-island resilience

Resilient off-island connectivity is of great importance to the economy of Jersey. Unreliable off-island telecoms links would make Jersey much less attractive as a location for many, if not all, of the main economic activities currently carried out in Jersey (e.g. Jersey's position as an international financial services centre). However, the trade-off is that high levels of network resilience are costly to provide.

3.7.1 Current trade-offs

For quality and resilience reasons, at least two independent routes that can both carry the total capacity may be required (as some forms of failure result in complete failure of the cable, and may take a significant time to repair).

As explained in Oxera's 2017 report on business connectivity, the cost structure of undersea cables indicates that there are significant economies of demand density.[80] For telecoms circuits to reach Jersey, a significant part of the cable required will be used to provide services to Jersey and Guernsey only. Notwithstanding the fact that the economies of both Jersey and Guernsey are likely to have relatively high demand for telecoms services, the subsea cables connecting Jersey to the UK (and France) can serve only a relatively small population compared with, say, the majority of the core UK network(s), which will have a larger population sharing the use of that infrastructure.

Hence, there is an ongoing cost to resilient off-island connectivity. For example, laying new cables to add resilience will incur high costs—the cost to JT of building the Liberty cable in 2005 was approximately £6m. This is likely to increase the average costs of off-island connectivity as the existing and forecast demand for off-island connectivity will be split among more undersea cables than is currently the case.

[79] Although in theory it is possible to design ways of delivering social objectives through the service suppliers, in practice it is often extremely complex if distortions of competition are to be avoided.
[80] Oxera (2017), op. cit.

Bringing additional capacity on line would require some additional expenditure, but nothing like as much as laying a new cable.[81] The subsea cables have the economic characteristic that the marginal cost of additional capacity is lower (potentially much lower) than the average cost of the full capacity. The application of this characteristic to the Jersey market means that, as all types of demand for capacity on the subsea cables increase, the average unit cost falls.

We note that there seems to be sufficient off-island resilience at present. As noted earlier, on 28 November 2016 there was an unusual incident where the anchor of a ship in the English Channel accidentally cut cables 7, 8 and 9. We understand that all IP traffic was seamlessly re-routed through the CIEG submarine cable to France.

3.7.2 Conclusion: promote the availability of sufficient capacity/cables to ensure seamless off-island connectivity

Creating a framework that can simultaneously achieve optimal investment decisions (in off-island connectivity) and allow service providers to recover their total (efficient) costs is not trivial. Given this complexity, the optimal solution may be a case-by-case approach, with coordination between the Government and service providers to address off-island connectivity where it is material to the economy.

Ultimately, decisions over whether existing cables should be upgraded or new cables should be laid may be commercial on the part of operators. However, the interests of the commercial operators and the Government may not always be perfectly aligned. The Government should therefore monitor that there is always enough spare capacity in off-island links for the seamless resilience of connectivity.

3.8 Conclusion on strategic objectives and Government's shareholder value in JT

Thus far we have come to four conclusions regarding trade-offs, as summarised below:

- focus on encouraging retail competition (section 3.4);
- be a fast adopter not a pioneer in network technologies (section 3.5);
- social policies that do not require the delivery of telecoms infrastructure need not be delivered by the telecoms sector (section 3.6);
- promote the availability of sufficient capacity/cables to ensure seamless off-island connectivity (section 3.7).

We now briefly explore the potential effect of these conclusions on the Government's shareholder value in JT. While some of JT's revenue streams may be reduced if the proposed strategic objectives are adopted, others will not be affected or may increase. There are also a number of positive factors for JT if the telecoms strategy is adopted.

On-island business and revenues are likely to be affected. Fixed retail revenues may decrease as regulated wholesale access to the Gigabit network levels the playing field and allows JT's competitors to gain some retail market share. However, this should be at least partially offset by the fixed wholesale revenues

[81] Oxera (2017), op. cit.

that JT will receive from wholesale access seekers, and by cost reductions in the provision of retail services as JT's retail market share reduces.

Table 3.1 illustrates the proportion of fixed retail revenues that may be at risk from opening JT up to greater retail competition. As shown, JT generated a total of ✂ from the retail fixed voice in 2016, and broadband markets. A loss of ✂ market share across in these markets would cost JT a total of around ✂, assuming that the lost retail lines are converted into wholesale access lines charged at 80% of the retail value. The 20% estimate is based on the CICRA price control on wholesale leased-line broadband products, which is set at the retail price minus 20%.[82]

A greater reduction in retail market share, a lower wholesale access charge, or a lower proportion of retail line conversion into wholesale access lines would result in a greater loss of revenue.

Table 3.1 Illustrative impact of JT losing 10% retail market share and instead supplying these lines in the wholesale market

	Fixed voice retail market	Broadband retail market
JT 2016 retail revenues (£m)	✂	✂
JT 2016 market shares (£m)	✂	✂
Therefore a loss of 10% market share would affect JT's retail revenue by (£m)	✂	✂
Corresponding increase in wholesale access revenues (assuming retail costs are 20% of cost stack and wholesale access charges are set at 80% of the retail price) (£m)	✂	✂
Potential net effect on JT revenues	✂	✂

Note: Based on share of fixed voice traffic. This analysis also assumes that the market sizes do not change over time.

Source: Oxera calculation based on JT data.

JT's off-island revenues are unlikely to be affected. For example, JT provides communications services to the multinational company, Kraft Heinz, and offers M2M connectivity to business in Africa.[83] In 2015, ✂ of JT's revenue came from its off-island activities, up from under ✂ in 2011.[84] Data supplied by JT suggests that off-island revenues in 2016 accounted for ✂ of the total.

The effect on JT's mobile revenues is harder to predict since this will depend on the type of NSA between JT, Sure, and Airtel; how this affects the operators' relative competitiveness; and the investments in the NSA made by the different network operators. However, any NSA will lead to some network cost savings, especially in rolling out new services and in ongoing operating expenditure. These cost savings should flow through to Jersey customers (in aggregate).

A number of factors resulting from the strategic objectives could be expected to have a positive impact on JT. This could include cost savings, higher revenues and a better investment climate resulting from more regulatory certainty and pursing a fast-adopter strategy instead of a network technology pioneer strategy.

[82] CICRA (2015), 'Review of the price control for wholesale on-island leased lines: Jersey', Consultation and Initial Notice, CICRA 15/08, 19 March, http://www.cicra.gg/media/2058/t1097gj-consultation-and-initial-notice-wholesale-on-island-leased-lines-jersey.pdf http://www.cicra.gg/media/3081/t1097gj-media-release-conclusion-of-business-connectivity-review.pdf.
[83] JT (2017), 'JT's Annual review 2016/17'.
[84] JT (2016), 'Annual review 2015/16'.

- If social policy is delivered directly by the Government, JT would save the costs of delivering these services (as reported in section 3.6).
- A mobile NSA should also result in network cost savings in the deployment of future mobile technologies such as 5G and in the ongoing operating costs of running the network.
- A focus on wholesale regulation of the Gigabit network will provide for regulatory certainty and allow for competition on the merits in the retail market, although there may be some increase in regulatory compliance costs for JT.
- Finally, the successful implementation of the telecoms strategy could be expected to result in higher economic growth in Jersey (than would otherwise be the case). This should lead to greater potential demand for JT services, more intensive use of its network, and hence higher revenues for JT, especially in the context of generally increasing demand for connectivity (e.g. growing mobile data usage per person in Jersey).

Based on the discussion above, it is not a priori the case that the Government's shareholder value in JT will decrease if the proposed strategic objectives are adopted, such as encouraging retail competition and focusing on wholesale regulation of the Gigabit network. Next, in section 4, we outline specific policy recommendations based on these conclusions.

4 Policy recommendations

This section presents Oxera's key recommendations to help implement the telecoms strategy identified in the previous section.

Based on the trade-offs discussed above, we identify the following policy recommendations organised under five policy principles for the telecoms strategy.

1. Promote the path to next generation connectivity through:
    a. being a fast adopter of next generation technologies building on current advanced digital infrastructure (section 4.1.1);
    b. maximise the advantage of the Gigabit rollout (section 4.1.2);
    c. adopting policies to encourage mobile network sharing and rollout of mobile next generation technologies such as 5G (section 4.1.3);
    d. Ofcom continuing spectrum management, and Jersey coordinating with the UK and Guernsey on the delivery of specialised services such as TETRA (section 4.1.4).
2. Promote retail competition (not network competition) as the most effective way of delivering the benefits of next generation connectivity to consumers and businesses (section 4.2).
3. Set out clearly any universal service obligations and deliver social policies from the telecoms sector only when it is efficient to do so and the costs/funding are transparent (section 4.3).
4. Ensure resilience of off-island connectivity (section 4.4).
5. Measure the delivery of the telecoms strategy with the help of KPIs (section 4.5).

Coordination with Guernsey is important for many of these telecoms sector policies. For example, the delivery of the Channel Islands' emergency services and off-island connectivity should be coordinated, as this would result in greater resilience for both Jersey and Guernsey. Regarding mobile spectrum, the current arrangement between CICRA and Ofcom means that spectrum management policies are consistent across the Channel Islands (for example, spectrum is awarded on a pan-Channel Islands basis). This should continue. Coordination with Guernsey on regulation of the telecoms sector would also help to ensure that JT, Sure, Airtel and other operators get similar wholesale access to networks in Jersey and Guernsey.

4.1 Promote the path to next generation connectivity building on current advanced digital infrastructure already in place

This should be done through four specific policies (described in sections 4.1.1 to 4.1.4).

4.1.1 Being a fast-adopter of next generation technologies

The Government should:

- adopt, as a general principle, proactive policies to encourage investment in next generation technologies that have been tested elsewhere. This should include adopting technology neutrality, where different technology options

are available. We provide below specific policy recommendations in the context of leveraging the JT Gigabit network and encouraging the rollout of mobile next generation technologies such as 5G. In all cases, this would require greater network investment by telecoms operators. Policies that undermine investment incentives for these operators should be avoided;

- minimise regulatory and legal barriers for private enterprises to use Jersey as a test bed—for example, by providing required government authorisations quickly and flexibly.

The Government will have to work closely with industry and the regulator to identify technologies to deploy and ways in which next generation technologies such as 5G can be rolled out as quickly as possible.

4.1.2 Maximise the advantage of the Gigabit rollout

Ensure that:

- all new builds are connected to the Gigabit network—this will require builders and developers to install suitable in-building wiring and to coordinate with JT or other operators to connect the new builds to the Gigabit network;

- there is universal access to symmetric 1Gbps speeds on JT's Gigabit network, in line with the Digital Policy Framework.

4.1.3 Adopting policies to encourage mobile network sharing and rollout of mobile next generation technologies such as 5G

Network sharing is usually done on the basis of commercial agreements. The various forms of network sharing are explained in Box 4.1 below.

The Government (and CICRA where appropriate) should use the following levers to encourage mobile network sharing (also essential for the rollout of 5G) leaving the operators to decide the details of the NSA. The Government could also play a role in encouraging these discussions on network sharing via its ownership of JT.

The policy levers to encourage mobile network sharing include:

- ensuring, through regulation, efficient and effective access to spectrum, and to high-capacity Gigabit fibre backhaul;

- reducing barriers from planning rules/legislation to build new mobile sites (taking account of relevant health and environmental considerations), and ensure that any necessary planning process is efficient, timely and reflects Jersey's interests;

- releasing the required spectrum in a timely manner, and make available spectrum innovation licences in Jersey for experimentation in conjunction with Ofcom. Going forward, Ofcom will be awarding spectrum in the UK that is likely to be used for 5G (e.g. the 3.4–3.8 GHz band). In some cases there may be scope for CICRA to recommend the awarding of 5G spectrum ahead of the UK—for example, if an Ofcom spectrum award for the UK is delayed by legal action. In any case, it may be useful for CICRA to publish a 5G spectrum roadmap (as Ofcom has done).[85] This would give operators clarity

[85] Ofcom (2017), 'Update on 5G spectrum in the UK', 8 February, https://www.ofcom.org.uk/__data/assets/pdf_file/0021/97023/5G-update-08022017.pdf.

over the likely timetable of spectrum release. We note that CICRA's 2017 work programme referred to its plan to 'prepare the regulatory landscape in advance of further release of spectrum capacity (referred to as 5G)';[86]

- encourage (or at least place no administrative obstacles in the way of) network sharing through spectrum award rules, planning rules and/or modernising telecoms licences;
- ensure that the costs of accessing buildings, infrastructure, and land for telecoms network deployment should not be a barrier to deploying new sites.

Box 4.1 Models of mobile network sharing

Mobile network sharing occurs between multiple operators. While there is a continuum between the degrees of network sharing, the following four categories provide a useful taxonomy (albeit there are grey areas between them). In general, greater degrees of network sharing increase the cost savings.

- **Site sharing**. Operators share sites, but not the physical infrastructure on the sites, such as masts or cabinets. This reduces certain costs (e.g. site rental costs might be split between the operators). However, multiple masts are required on each site.
- **Passive sharing**. Operators share sites and the physical infrastructure (masts, cabinets). Some operating costs, such as the cost of air-conditioning cabinets, are also often paid for jointly under passive sharing. Antennae are also sometimes shared under passive sharing. Passive sharing typically reduces costs through lower capital expenditure (e.g. site build costs) and lower operating expenditure (e.g. lower electricity and maintenance costs). Therefore passive sharing involves fewer masts than site sharing but may require larger masts (as each mast has to host more equipment).
- **Active sharing**. Also called MORAN sharing, active sharing involves operators sharing active network equipment in addition to passive network sharing. Active network equipment typically includes antennae, the radio station, and any other network equipment directly involved in the transport of data traffic on the site. Active sharing reduces capital expenditure (less equipment needs to be installed) and operating expenditure (lower electricity and maintenance costs). It may involve smaller masts than passive sharing (as less equipment is required on each mast).
- **Spectrum sharing**. Operators share spectrum in addition to active network sharing. Also known as spectrum pooling, it means that operators do not separately utilise their own spectrum holdings. However, operators are less able to differentiate their services (although some differentiation is possible as they do not share their core networks). Spectrum sharing is deployed to further reduce the costs of building and running the networks.

Active sharing is the most common form of sharing across Europe, and according to Huawei:

> In Europe, the region with most shared networks this far, MORAN is used in most cases. The main reasons for this are restrictions on spectrum sharing and operators' preference for keeping some degree of independence on RAN level. MOCN [spectrum sharing] is the preferred solution in particular in the Nordic countries. One reason for this could be that the regulators in the Nordic countries have the view that as long as there is full competition between the operators in the retail side of the business, there is no need to restrict the extent of network infrastructure and spectrum sharing.

Source: Oxera based on Huawei Technologies Co. Ltd (2015), 'Network Consolidation Cooperation for Business Success', p. 8.

4.1.4 Ofcom continuing spectrum management, and Jersey coordinating with the UK and Guernsey on the delivery of specialised services

It is recommended that:

[86] CICRA (2016), '2017 Work Programme', Information Note, 16/55, December, https://www.cicra.gg/media/4218/cicra-2017-work-programme.pdf.

- Ofcom continues the specialised task of spectrum management for Jersey, given the regulator's larger scale compared with CICRA, and the resource constraints faced by CICRA;
- Ofcom also continues to manage spectrum for Jersey post-Brexit. Decisions on spectrum use allocations and technical standards for operating specific spectrum frequencies are made at a European and global level, and the UK will have to continue to follow these decisions. The current arrangement between CICRA and Ofcom also ensures that Jersey and Guernsey have consistent spectrum management policies. This should continue;
- CICRA should ensure better coordination and communication with Ofcom on the specialised spectrum requirements for Jersey, if any;
- a cautious policy of moving emergency services (TETRA) to 4G and 5G networks after commercial solutions have been tried and tested in the UK and/or other jurisdictions seems appropriate (given the essential nature of emergency services). It is also essential that any change to the delivery of these services in Jersey be coordinated with Guernsey.

4.2 Promoting retail competition (not network competition) as the most effective way of delivering the benefits of next generation connectivity to consumers and businesses

It is recommended that CICRA should:

- ensure that JT supplies other operators with wholesale access to the Gigabit network on a FRAND basis, and that wholesale access seekers get access to wholesale products, which allow access seekers to compete on differentiated retail services. This FRAND access should include fibre backhaul for mobile services;
- use this regulatory focus on the Gigabit network in order to review and publish its prioritisation principles and outline additional resources required, if any, to conduct its duties including implementing the telecoms strategy. CICRA should ensure that it uses these principles to determine which cases to pursue and to clearly explain its decisions.

This will require the Government, CICRA and the industry to collaborate in implementing the policy, and will involve regulation focusing on delivering effective wholesale access to the Gigabit network.

We note that FRAND does not imply providing wholesale access at a loss, but rather ensuring that such access is provided on the same terms and prices to JT retail and other retailers, and that wholesale access prices are set at the appropriate level to ensure continued rollout and sufficient funds for future upgrades and maintenance of the network.

The potential options for providing wholesale access can vary from less intrusive to more intrusive: from using accounting separation and a MST (margin squeeze test) to functional/structural separation and charge controls. Box 4.2 describes these options for expository purposes. The relevance of any of these potential options would need to be proportionate to the specific relevant market failures, necessitating a careful assessment of competitive market conditions.

Best-practice regulatory principles indicate that more intrusive forms of regulation, such as structural separation, should be considered as instruments of 'last resort', to be used only when other (less heavy-handed) forms of regulation

have not been effective in addressing market failures. Indeed, structural separation is an extreme solution as it involves a costly and risky transition that requires the creation of a wholly new company. It also results in the weakest incentives to invest and innovate for the network division (which, in turn, may require further regulatory intervention). Crucially, once implemented, the structural separation can be very expensive to undo. In the specific case of Jersey, the conditions for adopting any 'heavy handed' form of intervention do not appear to be present at this time.

Box 4.2 Models of vertical separation

In practice, the types or degrees of separation can be thought of along a spectrum, but the following four types provide a good taxonomy (of increasing separation).

- **Accounting separation**—the least intrusive form of separation, this involves the incumbent keeping separated accounts for its network and retail divisions. This form of separation typically has the purpose of informing price controls and/or monitoring the incumbent's compliance with non-discriminatory obligations on wholesale pricing. Transparency over wholesale and retail costs, provided by accounting separation, is used in the implementation of regulatory MSTs. A margin squeeze is a form of anti-competitive pricing whereby a vertically integrated provider sets wholesale and retail prices such that an efficient retail market competitor cannot effectively compete (the competitor's retail margin is 'squeezed'). MSTs are used by regulators to detect such margin squeezes.
- **Chinese walls**—the incumbent maintains an integrated organisation. Risks of non-price discrimination are usually addressed through a set of rules that the incumbent must follow, especially about the way in which information is used and spread across the organisation. The rules may be reinforced by physical separation of offices, or secured areas within office buildings, as well as by different management structures, especially for the management of regulated and unregulated products. Specialist support functions, such as legal or IT, would generally remain as single organisational groups.
- **Functional separation**—the network division runs at arm's length from the rest of the incumbent. It has all the functions and staff required to operate as a stand-alone business. This means that, in addition to having separate accommodation for all its staff, its management incentives are solely in relation to the performance of the new division, and it could have limited staff movement between the divisions. It probably has a new brand and Internet domain, as well as separate product-specification handbooks and service-level agreements. Assets, both tangible and intangible, are assigned between the divisions, but capital is still raised at the group level.
- **Structural separation**—the network division becomes a separate company. It therefore has to have explicit contracts with other companies, including the incumbent, for every activity it does not perform itself. It also needs to have all the organisational/support activities highlighted above for financial separation. As well as the assets, equity and debt would have to be assigned to the new company.

4.3 Clearly set out any universal service obligations and deliver social policies from the telecoms sector only when it is efficient to do so and the costs/funding are transparent

The Government should:

- set out whether there are sector-related social policy objectives that it wants to pursue. The existing social telecoms service delivered by JT (Prime Talk) is not fit for purpose as it is not well targeted and distorts retail competition. If a sector-related social policy is deemed to be required then it should be targeted, competitively neutral and with transparent funding. The social policy need not necessarily be delivered from within the telecoms sector. The Government should be well placed to deliver the policy by directly targeting the relevant group;

- ensure that all citizens and residents benefit from improved connectivity (for example, that they are all able to access services such as e-Gov and e-Health). A means-tested social policy delivered directly by the Government could be used to assist customer segments that are not able to afford competitively priced services;
- agree with JT on a delivery mechanism for the 999 call fielding service (for example, the setting-up of a suitable control centre to receive and direct calls);
- modernise licence obligations to reflect changing user needs and to support the goals of the telecoms strategy. For example, the number of phone boxes could be reduced or repurposed for other uses such as WiFi hotspots,[87] and a unified licensing regime could be introduced.

However, given the presence of the three 4G networks with very good island-wide coverage, and the Gigabit network, the benefits of free public WiFi for Jersey residents are not obvious, and we do not recommend the Government subsidising a public WiFi rollout.

4.4 Ensure the resilience off-island connectivity

The Government should adopt:

- an explicit 'resilience policy' to ensure that there is always enough spare capacity in off-island links for the seamless resilience of connectivity. This will require:
  - monitoring current usage of off-island links;
  - monitoring that there is sufficient route diversity—for example, that, where feasible, not all off-island cables connecting Jersey to the UK are in close proximity to each other and vulnerable to the same catastrophic event;
- a formal mechanism to be used in the event of a connectivity failure. For example, this would mean that, in the event of a loss of an undersea cable, there is a defined protocol and established lines of communication across operators and Government to manage the resilience of connectivity. This should be established in consultation with the relevant operators.

The publishing of certain KPIs (as laid out in section 4.5.8) should help industry and Government take decisions on investments in off-island connectivity (including the timing of such investments).

We note that the Government will require ongoing access to telecoms expertise to implement the telecoms strategy—i.e. to coordinate/consult with industry, CICRA, and various Government departments to plan next steps and ensure that these are implemented in accordance with the telecoms strategy.

4.5 Measuring outcomes: use appropriate KPIs developed in consultation with the industry

A number of KPIs should be developed and regularly reported to measure progress towards the strategic objectives of the telecoms policy. The publishing

[87] In parts of London, for example, BT has partnered with urban innovation company, Intersection, to transform its phone boxes into new digital street units. See BT 'Free superfast wi-fi and free calls: Find out about our InLink UK units', available at http://home.bt.com/tech-gadgets/tech-news/inlinks-from-bt-street-units-offering-ultrafast-wi-fi-phone-calls-and-digital-services-launch-in-london-11364190731615.

of these KPIs should aim to encourage transparency and investment in Jersey, as well as facilitate consumer choice. The KPIs should cover the mobile network(s); fixed wholesale access provided by JT; the retail market; digital industry development; and off-island connectivity.

These KPIs should be developed after industry consultation: different stakeholders in Jersey will value different metrics. Some indicative areas are presented below.

4.5.5 Mobile network KPIs to measure mobile connectivity delivered by the NSA and/or individual mobile networks

The quality of the mobile networks should be published and reported on a regular basis. This will enable consumers to make informed choices about their mobile provider. Mobile network KPIs include network coverage (by technology), average and peak data speeds, proportion of dropped calls, time taken to connect to a call, and other usage metrics. For example, Ofcom publishes an interactive coverage map, as well as coverage statistics.[88] In June 2017, it published a report on consumer experience of mobile services from its new downloadable app.[89] KPIs include successful data downloads, download speed, latency, dropped call rate. Ofcom also conducts 'drive tests', whereby it measures network performance using consumer handsets.[90]

4.5.6 Fixed wholesale access KPIs once the Gigabit wholesale access regime is set out by CICRA

Wholesale access KPIs to measure FRAND access for all retailers. For example, time taken to connect homes when requested by JT retail and other retailers, time taken to correct faults, etc. The details of these KPIs should be consulted on by CICRA, with consultation on the appropriate wholesale access regime for access to JT's Gigabit network.

In the UK BT is required to report some KPI data,[91] some of which is also published by the Office of the Telecommunications Adjudicator.[92] These KPIs include times to offer a requested service and repair times, as well as the number of wholesale lines (by type of technology). Ultimately, BT has to offer its retail competitors wholesale inputs on equivalence of inputs terms, which means that there is a level playing field in the retail market.[93]

4.5.7 Fixed and mobile retail market KPIs to measure the level of retail competition

Retail market KPIs to measure retail market competition could provide information on the state of competition and inform consumer choice—covering

[88] Ofcom, 'Mobile and broadband checker', https://checker.ofcom.org.uk/mobile-coverage.
[89] Ofcom (2017), 'The consumer mobile experience: Measuring consumer experience of using mobile services', 16 June, https://www.ofcom.org.uk/__data/assets/pdf_file/0005/103010/Consumer-mobile-experience.pdf.
[90] Ofcom (2016), 'Smartphone Cities: Measuring 4G mobile broadband and voice performance', 16 December, https://www.ofcom.org.uk/__data/assets/pdf_file/0009/101430/Smartphone-Cities-phase-4-reissued-270416.pdf.
[91] Details of the KPIs published by BT can be found on the following websites: http://btplc.com/Thegroup/RegulatoryandPublicaffairs/Ourundertakings/KeyPerformanceIndicators/KeyProductPerformanceIndicators/nga.htm; https://www.btwholesale.com/pages/static/help-and-support/regulatory.htm; http://btplc.com/Thegroup/RegulatoryandPublicaffairs/Ourundertakings/KeyPerformanceIndicators/KeyProductPerformanceIndicators/llu1d.htm https://www.openreach.co.uk/.
[92] Office of the Telecommunications Adjudicator (2017), 'Key Performance Indicator August 2017, http://www.offta.org.uk/charts.htm.
[93] Openreach, 'Ensuring a level playing field for all', https://www.openreach.co.uk/orpg/home/aboutus/equivalence/equivalence.do.

retail market shares, days to switch providers, diversity of retail offers in terms of price points, speed, data allowance, etc. For example, Ofcom publishes comprehensive data on customer complaints on all telecoms operators. This is quite detailed, and includes how long customers have to wait on the line to speak to someone.[94]

CICRA already publishes detailed results of consumer satisfaction surveys, and market share statistics.[95]

4.5.8 Off-island connectivity KPIs to measure off-island capacity and resilience

It may be useful to consider KPIs on the quality and reliability of off-island connectivity. For example, the number of faults and the time taken to address them. In addition, the capacity and number of different links could be reported and regularly updated as investments are made in off-island connectivity. This information could better inform business consumers and encourage strong competition in the off-island connectivity market.

Given that resilience of off-island connectivity has been a success story for the Channel Islands, this data could encourage business to come to Jersey. Such KPIs could be introduced after industry consultation to ascertain the most useful and informative measures.

[94] Ofcom (2017), 'Service quality of telecoms providers revealed', 12 April, https://www.ofcom.org.uk/about-ofcom/latest/features-and-news/service-quality-telecoms-providers.
[95] CICRA (2016), 'Telecoms Customer Satisfaction Survey: Results from May 2016 Survey', July, https://www.cicra.gg/media/3937/t1243gj-report-telecoms-customer-satisfaction-survey-results-may-2016.pdf; CICRA (2017), 'Telecommunications Statistics and Market Report 2016', 15 June, https://www.cicra.gg/media/597622/t1265gj-report-telecoms-statistics-2016.pdf.

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https://www.btwholesale.com/pages/static/help-and-support/regulatory.htm.

http://btplc.com/Thegroup/RegulatoryandPublicaffairs/Ourundertakings/KeyPerformanceIndicators/KeyProductPerformanceIndicators/llu1d.htm.

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Millbrook Kiosk http://masts.digimap.je/PDFs/CICRA%20Mast%20Audit%20-%20Millbrook%20Kiosk%20(Jersey)%20v2.0.pdf.

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A2 Previous Oxera reports

A2.1 A review of the Jersey regulatory and competition framework?

Available here:

https://www.oxera.com/Latest-Thinking/Publications/Reports/2015/A-review-of-the-Jersey-regulatory-and-competition.aspx

A2.2 Business connectivity: Jersey to the UK

Business connectivity: Jersey to the UK

Note prepared for States of Jersey

February 2017

1 International connectivity of Jersey

1.1 Background

There has been a long-running complaint in Jersey that the prices of international connectivity (i.e. private circuits) are 'too high'. A market analysis undertaken by CICRA in 2014 concluded that, although there might be issues with the market for private circuits in Jersey itself, in relation to the international connectivity part of the network none of the three suppliers were dominant.[96] As a result, no regulatory action was proposed for this market.

However, given that the price of international private circuits is determined to a significant extent by the costs of the international parts of the circuits (and not the parts physically located in Jersey), the States of Jersey has asked Oxera to establish the cause of the apparent price differential and, if possible and at a high level, to establish whether there is indeed a possibility that prices are 'too high'.

This note sets out the findings of Oxera's investigation, based on the relationship between the prices (revenues) and costs involved in providing private circuit connectivity between Jersey and London.

Subject to some significant caveats CICRA's comparison of the prices available in other jurisdictions suggested to them that 'the price of higher capacity off island connectivity is relatively high when compared with higher capacity connectivity from other island locations [to London]'.[97]

However, the cost structure of providing private circuits (and, indeed, other physical network-based telecommunications services) indicates that there are significant economies of demand density. For telecommunication circuits to reach Jersey, a significant part of the cable required will be used only to provide services to Jersey and Guernsey. Notwithstanding the fact that the economies of both Jersey and Guernsey are likely to have relatively high demand for telecommunications services, the majority of the core UK network(s) will have a larger population sharing the use of that infrastructure. In particular, the subsea cables that connect Jersey to the UK (and France) have a relatively low population that they can serve.[98]

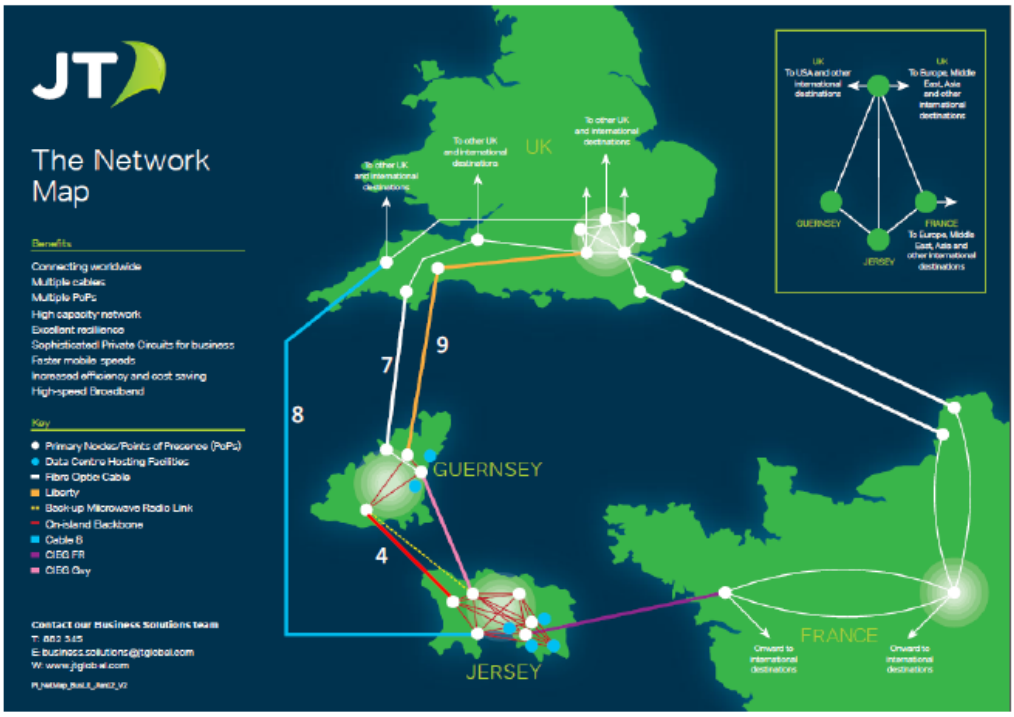
[96] CICRA (2014), 'Business connectivity market review: Jersey. Initial Notice and Response to Consultation', 5 August. See p. 1.
[97] CICRA (2014), 'Business connectivity market review: Jersey. Consultation', 8 April, page 80.
[98] A crude example of this effect is that, notwithstanding the smaller population in Cornwall, the resident population there is five times that of Jersey. In addition, a significant part of the telecommunications

The analysis that follows looks at the impact of costs and cost structure for the supply of private circuits/leased lines between Jersey and the UK.

2 International connectivity of Jersey

Jersey is connected to the UK and Europe (France) by a number of subsea cables. Figure 2.1 shows the main connection routes of JT (in schematic form).

Figure 2.1 Main JT undersea cable connections



Source: JT.

These physical connections are owned and operated by a number of entities, and are made available to telecommunication service providers in a number of ways. Table 2.1 sets out the ownership and use pattern of these physical cables.

Table 2.1 Ownership of main cables

Cable	Route	Capacity	Ownership (%)			
			JT	BT	Sure	Vodafone
4	Jersey–Guernsey	✂	✂	✂	✂	✂
7	Guernsey–UK	✂	✂	✂	✂	✂
8	Jersey–UK	✂	✂	✂	✂	✂
9 (Liberty)	Guernsey–UK	✂	✂	✂	✂	✂
CIEG-Gu	Jersey–Guernsey	✂	✂	✂	✂	✂
CIEG-Fr	Jersey–France	✂	✂	✂	✂	✂
HUGO South	Guernsey–France	✂	✂	✂		✂
HUGO North	Guernsey–UK	✂	✂	✂		✂

Source: JT; Sure; and Analysys Mason (2016), 'Guernsey Connectivity review', 25 April.

In order to create a private circuit between two points—one in Jersey and one in the UK—a number of elements would be required in addition to the subsea cable

infrastructure in Cornwall can be shared with international traffic destined beyond Cornwall, as a number of transatlantic cables make landfall in Cornwall.

capacity. In particular, additional connectivity would be required from the premises in Jersey to the Jersey landing point; connectivity in the UK between the landing point and the Point of Presence (PoP) in the UK network of the service provider; and a circuit from the PoP to the premises in the UK. Conventionally, the 'international' circuit is the section that runs from PoP to PoP (or, in Jersey, the landing point), while 'tails' are the circuits from the PoP to the customers' premises. This note is primarily concerned with the international circuits rather than the tails, and the subsea cable part of the international circuits in particular.

In many (but not all) cases the subsea cable is owned by a consortium of telecommunications companies that share the capacity (see Table 2.1 above). Economically, the consortium can be thought of as a joint venture, with the parties owning a fixed share of the capacity and contributing to both the fixed/capital costs and running costs on the basis of their ownership share. Such an entity does not itself make a profit, but is treated as a cost. It follows that, generally, the costs to the owners of the cable do not vary by usage, but are fixed (although they may vary from year to year—for example, if a cable breaks and has to be repaired).

Past common practice was for members of the consortium to own and control the cable independently at each end, with a nominal change of ownership somewhere around the midpoint of the cable (i.e. in the middle of the sea). As a result, access to the landing terminals is likely to be under the direct control of the telecommunications company at each end of the subsea cable.

However, more recently other models have arisen and complete ownership of the end-to-end cable by a single telecommunications company is now reasonably common, as is complete ownership by third parties that then sell the capacity to telecommunications companies (often on long-term contracts with a single up-front payment, although other structures exist).

For telecommunications companies that own (or partly own) subsea cables, there is likely to be a substantial capital cost in actually laying the cable. For the Jersey to UK route (landing point to landing point), the capital cost of building the Liberty cable was in the order of ✂ (in 2005). This cost is largely independent of the ultimate capacity of the (fibre optic) cable, so these cables will tend to be built with significant excess (raw) capacity, in order to cater for future expansion of demand (even when the precise quantum of that additional demand is very uncertain).

There will also be some ongoing costs associated with the undersea cable. In addition, these cables are vulnerable to breakage, and individual repair costs can be significant and unpredictable.

Indeed, on 28 November 2016, there was an unusual incident where the anchor of a ship in the English Channel cut cables 7, 8 and 9 (see Figure 2.1). We understand that all IP traffic was seamlessly re-routed through the CIEG submarine cable to France.

In the UK, capacity from the landing point to the PoP will generally be provided by a UK-based telecommunications operator, and that market will generally be competitive as there are a number of physical network providers with links between the landing points and the relevant PoPs.

This way of providing end-to-end connectivity results in a cost structure with the following general characteristics:

- the subsea cables have high, one-off sunk costs;
- these construction costs exhibit strong economies of scale (in terms of the capacity of the cable);
- the operational costs of the subsea cables are relatively small, but occasionally high in a particular year;
- the life of the asset is significant, but subject to potential technical obsolescence (and possibly catastrophic failure);
- for quality and resilience reasons, two independent routes that can both carry the total capacity may be required (as some forms of failure result in complete failure of the cable, and may take a significant time to repair);
- other significant parts of the transmission path (outside Jersey) will tend to be bought from other suppliers in competitive markets on an annual cost basis;
- the home tails use infrastructure that is largely shared with other services provided by the telecommunications company.

3 Application to Jersey

A relatively simple, high-level economic analysis can be undertaken of the provision of business connectivity. Table 3.1 shows approximately how the economics breaks down.

Table 3.1 Approximate annual operational costs and revenues: private circuit provision from Jersey to the UK (JT) (£)

Cable used	Purchased telecoms services UK (and Guernsey)	Cable 'operational' costs	UK tails (purchased from UK operators)	Jersey tails and retail costs	Total
4	✂	✂			
7	✂	✂			
8	✂	✂			
9	✂	✂			
CIEG-Gu	✂	✂			
CIEG-Fr	✂	✂			
Total costs	✂	✂	✂	✂	✂
UK private circuit revenues					✂
Operational surplus					✂

Note: Operational costs include the costs of the cable ship and fisheries services due to JT, and the cost of the use of equipment in the London PoP. The costs of Jersey tails and the retailing function for JT have been estimated by Oxera. Information based on 2014 and 2015 data.

Source: JT; Oxera estimates.

In operational terms, the surplus earned on the provision of private circuits is in the order of ✂. However, this analysis does not yet take into account the capital costs of the circuits being used.

Table 3.2 sets out a simplified analysis of the economic costs of the use of the capital required to build the cables (or, in the case of the CIEG cables, the capital costs of the IRUs). The capital cost of the cables (as new) is estimated from the cost to JT of building the Liberty cable in 2005 (cable 9 in Figure 2.1). As indicated, the cost of this was approximately ✂. It is assumed that cables 7

and 8 cost approximately the same amount and that cable 4 (that runs between Jersey and Guernsey) cost ✂. JT's shares of these cables are ✂ (see Table 2.1 above), so the total cost (new) to JT of all these cables is around ✂. In addition, the IRUs relating to the two CIEG-based connections cost ✂ for ten years' use. Cables 4, 7, 8 and 9 are assumed to have a 30-year life span. Finally, JT estimates that private circuits represent about ✂ of the total traffic on these cables.

The annual costs of using this capital at three weighted average costs of capital (WACCs) are set out below, with the more detailed underlying calculations set out in Appendix A1.

Table 3.2 Approximate annual cost of the use of the capital needed to build subsea cables at a WACC of 5%, 7.5% and 10% (£m)

Cable used	Cost new	JT's share	Private circuits' share	Annual depreciation (straight line)	Cost of capital employed with WACC		
					5%	7.5%	10%
4	✂	✂	✂	✂			
7	✂	✂	✂	✂			
8	✂	✂	✂	✂			
9	✂	✂	✂	✂			
CIEG-Gu	✂	✂	✂	✂			
CIEG-Fr	✂	✂	✂	✂			
Total	**21**	**12.1**	**6.66**	**0.30**	**0.17**	**0.25**	**0.33**
Total cost—use of capital and depreciation					**0.46**	**0.55**	**0.63**
Total operational costs (from Table 3.1)					**2.2**	**2.2**	**2.2**
Total costs					**2.7**	**2.8**	**2.9**

Source: JT, Oxera estimates.

As Table 3.1 and Table 3.2 set out, the revenues being derived from UK private circuits (£2.8m) approximate the costs (£2.7m-£2.9m) of providing the service, according to a highly simplified methodology.

The point of this exercise is not to show that the prices are precisely correct (which would require a much more in-depth analysis), but that the prices (and hence revenues) are not wildly out of line with the costs of providing these services.

As indicated above, the cost structure of subsea cables means that, when laying a cable (or, indeed, laying a cable designed primarily to carry electricity), because the additional cost of laying additional telecommunications capacity is very low, the cables themselves will often have much more capacity than the current demand. Improvements in transmission technology can also mean that, even after the physical cable has been laid, the capacity of the cable can be increased by changing the technology at both ends.

Actually bringing that capacity on line will require some additional expenditure, but nothing like as much as laying a new cable. The subsea cables therefore have the economic characteristic that the marginal cost of additional capacity is lower (potentially much lower) than the average cost of the full capacity.

The application of this characteristic to the Jersey market means that, as all types of demand for capacity on the subsea cables increase, the average unit

cost falls. In simple terms, if the demand for capacity on the subsea cables doubled, the impact on unit costs would imply a reduction in the order of 10-15%. (See Appendix A2 for the detailed calculation involved.)

This cost structure, in which there are economies of density of demand and the degree of sharing of fixed-cost assets has a significant impact on unit prices, is also manifest in other parts of the telecommunications market. Although charges for normal calls are now very complex (as a result of bundling and the proliferation of diverse calling plans), call charges from the UK to the Channel Islands will tend to be higher than call charges within the UK.[99] Normal call charges are averaged within the UK, but private circuit prices are less so, and there are a number of competitive suppliers of such circuits. However, within this market some private circuits with one end in an area of low population density are much more expensive than circuits between areas of high population density. The ratio of available prices can be as high as 3:1 (see Appendix A3 for examples). This pattern of prices also suggests that the economies of density are significant.

4 Implications for public policy

Assuming that the high-level analysis set out above is correct, the relatively high price of international private circuits between Jersey and the UK arises from the relatively low total demand between the two jurisdictions, and the cost of the cables used. In order for the telecommunications service suppliers to be able to recover their costs, average prices for connectivity will have to be higher than those that would apply where the infrastructure was shared among a greater demand.

However, from a pure economic efficiency perspective, this deviation from setting prices on the basis of forward-looking incremental costs raises the issue that there may be activities that could locate in Jersey and would be a boost to the island economy, but which do not do so because the input prices they face, when set at average costs, are too high. If faced with input prices set at incremental costs, the location decision might be different. The same logic also applies to the expansion decisions of existing businesses.

Whether this is actually a significant issue in relation to business connectivity will depend on the sensitivity of the location decisions of companies to the price of this particular input. That, in turn, is likely to be dependent on the proportion of input costs that connectivity represents, and alternative locations where the business could realistically be situated. For existing businesses, the differential in the ability to expand will similarly depend on the materiality of the business connectivity costs in their final product/service price and the competition from alternative locations faced by the business.

Furthermore, the 2016 submarine cable incident highlights the importance of investing in resilience (with links to the UK and France) to ensure that services provided to existing (and potential) businesses located in Jersey are not materially impacted when such rare events occur.

Creating a public policy framework that can simultaneously achieve optimal location/expansion decisions of companies and allow telecommunication service providers to recover their total (efficient) costs is not trivial. Given this complexity, the optimal solution may be to adopt a case-by-case approach, with coordination between the government and service providers to address this particular issue

[99] For example, see the BT residential price list, http://www.productsandservices.bt.com/consumer/assets/downloads/BT_PhoneTariff_Residential.pdf.

where it is material to the economy. Ideally, such an approach would also be implemented in a way that did not unduly distort competition between telecommunications providers or between those using business connectivity as a significant input.

A1 Calculation of cost of using capital: detail

A1.1 Methodology

This appendix sets out the methodology used to calculate the approximate cost of using the capital base of the cables set out in Table 2.1.

Two techniques have been used. The first method (Method 1) is reported in Table 3.2. The second method (Method 2) is used as a cross-check on the results of Method 1.

Method 1

Method 1 approximates an annual cost of using an asset by calculating an annual depreciation cost (using a straight-line depreciation profile) for an estimated life of that asset. In the case of owned subsea cables, this is assumed to be 30 years. In the case of IRUs, this is the life of the IRU (which in this case is ten years).

The annual depreciation cost is then added to the cost of the capital that is tied up in the asset. This is assumed to be, on average, 50% of the cost of the new asset (or, in the case of the IRU, the lump sum paid upfront for that IRU). The 50% figure reflects the straight-line depreciation profile adopted. The annual cost of the use of this average capital employed is calculated by multiplying the average by the WACC, which for the purpose of these calculations is assumed to lie somewhere between 5% and 10%. (Hence the cost is calculated using 5%, 7.5% and 10%)

Method 2

Method 2 calculates an internal rate of return (IRR) using a simulated investment scenario. It is assumed that all the cables are created (or IRUs bought) on day 1, and that the cables have no value at the end of year 30. At the beginning of years 11 and 21, further IRUs are also purchased. By simulation, the uniform annual return needed to produce an IRR of 5%, 7.5% and 10% over the 30 year period is established.

A1.2 Results: Method 1

Table A1.1 sets out the calculation of the annual depreciation amount relevant to private circuits.

Table A1.1 Calculation of annual depreciation charge

Cable	Cost new (£m)	JT's share (%)	JT's share (£m)	Private circuits' share (✂) (£m)	Life of asset years	Annual depreciation (straight line) (£m)
4	✂	✂	✂	✂	✂	✂
7	✂	✂	✂	✂	✂	✂
8	✂	✂	✂	✂	✂	✂
9	✂	✂	✂	✂	✂	✂
CIEG-Gu	✂	✂	✂	✂	✂	✂
CIEG-Fr	✂	✂	✂	✂	✂	✂
Total	**21**		**12.1**	**6.66**		**0.295**

Source: JT, Oxera calculations.

Table A1.2 sets out the calculation of the annual cost of capital at the three WACCs of 5%, 7.5% and 10%, and then combines these with the annual depreciation value in Table A1.1.

Table A1.2 Calculation of annual cost of using the capital employed

	Cost new (£m)	JT's share (£m)	Private circuits' share (✂) (£m)	Average over life of assets	Annual cost WACC		
					5%	7.5%	10%
	21	12.1	6.65	3.33	0.166	0.250	0.333
Annual depreciation (£m)					0.295	0.295	0.295
Total annual cost (£m)					**0.462**	**0.545**	**0.628**

Source: JT, Oxera calculations.

A1.3 Results: Method 2

Table A1.3 sets out the parameters for IRR calculations.

Table A1.3 Parameters for the IRR calcultion (£m)

	Initial capital spend	Capital spend year 11	Capital spend year 21	Total annual revenue required for an IRR of:		
				5%	7.5%	10%
All cables	21	2	2	0.906	1.138	1.385
Share for private circuits ✂				✂	✂	✂

Source: JT, Oxera calculations.

A1.4 Comparison of results

The results from the IRR simulation are consistently higher than the results of the simplified straight-line depreciation plus a return on an average of half the 'as new' cost. It is therefore likely that the simplified calculation is slightly over-estimating the return on capital for any given level of annual revenue. However, as indicated in the main report, the purpose of this analysis is to try to establish at a broad level of generalisation whether the prices in the market for private circuits are cost-reflective. On this basis, the conservative approach provides an appropriate comparison for these purposes.

A2 Impact on units costs of increases in demand for capacity on the subsea cables

Table 3.1 indicates that the operational expenditure for private circuits is approximately ✂ annually, of which around ✂ relates to the subsea cables directly. The annualised capital cost of the cables is approximately ✂. As a result, the costs of the subsea cables represent around ✂ out of a total cost of around ✂, or approximately 25%. These cable costs are almost entirely independent of the use of the cable, and doubling the use of the cable would therefore halve the unit cost. Halving 25% of the total cost would result in a reduction in the total unit cost of 12.5%.

In addition, there are likely to be some other areas of activity with economies of scale or density (for example, the Jersey tails) that would tend to increase the reduction in unit costs as demand increased.

A3 Examples of the variation in private circuit prices

There are a number of automatic websites that will return prices for private circuits between two postcodes in the UK. Table A3.1 shows a sample of the returns generated in March 2015 from the 6 Degrees Group website.

Table A3.1 Automatically generated private circuit prices in the UK

Location end A	Location end B	One off connection cost (£)	Annual rental
Central London	Aberystwyth (Ceredigion, West Wales)	3,053	9,992
Central London	Bangor (Gwynedd, North West Wales)	3,053	9,992
Glasgow	Tarbert (Argyll & Bute, Scotland)	2,000	42,186
Central London	Tarbert (Argyll & Bute, Scotland)	3,053	39,935
Central London	Newport (Isle of Wight)	3,053	12,318
Central London	Penzance (Cornwall)	3,053	10,892
Central London	Fishguard (Pembrokeshire, South West Wales)	4,553	14,886
Glasgow	Inverness (Highland, Scotland)	2,000	12,243
Exeter	Central London	3,053	9,992

Note: Site-to-site leased lines, 100Mbps (fibre), three-year term.

Source: 6 Degrees Group, http://www.6dg.co.uk/products/connectivity/internet-access-leased-line/.

www.oxera.com