

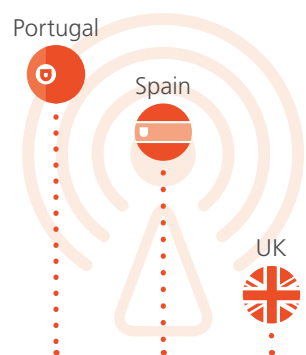
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Digital Infrastructure for our 'Connected Future'

Global infrastructure report



UK lags behind in full fibre use: **90%** in Portugal, **71%** in Spain, **4%** in UK.



Altnets continue to expand, providing promising investment opportunities.



5G set to deliver long-term opportunities.



Cross-industry partnerships set to dramatically increase: telecommunications, health, transport and financial services.

Countries to watch



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*This report is part of Connected Future.
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Foreword

With digital innovation now firmly at the forefront of our everyday life, interest in the supporting infrastructure has come sharply into focus. Although we have spent much of the recent past seeking ever-increasing capacity from existing infrastructure, it is clear that the latest and most hotly-cited innovations will most likely see us cycle back to connectivity as the key enabler of infrastructure development.

There is no debate that fibre reigns supreme when it comes to throughput. The team at euNetworks puts this as well as anyone – “fibre is and will remain the only scalable economic solution providing the crucial underlying foundation to an increasingly connected and bandwidth hungry world”. This is equally important regardless of the platform considered, be it fibre-to-the-premises (FTTP), 5G or fixed wireless – with each equally reliant on a well-connected and diverse fibre infrastructure.

Re-orientating the approach to infrastructure growth is a challenge. After years of technologically driven incremental expansions of bandwidth, it seems it is extremely difficult to secure the focused investment needed to scale up connectivity to meet the needs of modern digital innovation. A step-change is needed, but underpinned by an aligned regulatory framework, strategy and approach. It is far from clear though whether these three foundations are in place. Brief consideration of other infrastructure-intensive markets, and the experience of many other European countries,

might lead to the view that a utility-style approach provides an answer. It certainly would help address some of the shortfalls left from the prevailing, at least in the UK, competition-based approach to infrastructure development.

Bigger picture, moving from a vertical integration structure of the industry to a utility-based and open access model would allow regulatory focus to move up the ladder and competitive forces to move down, facilitating innovation at the retail level. With careful planning and forethought, the consistent and long-term rate of return of the regulated utility style owner / operator becomes increasingly attractive to investors, driving investment into the model. Can we otherwise meet our connectivity aspirations over the next 20 years?

This report is one of four supplements, expanding on the findings of our 2018 Connected Future report and our 2017 CMS Infrastructure Index. The 2019 Infrastructure Index will be available at the end of 2019.

Watch Chris Watson give his views on the digital infrastructure market



Chris Watson
Partner, Technology & Media
t. +44 20 7367 3701
e. chris.watson@cms-cmno.com



Digital

The use of digital infrastructure to provide vital connectivity at high speeds for residents and businesses around the world is nothing new, but its fast-evolving market landscape promises extensive openings for the infrastructure community over the coming years. While concession-based public-private partnerships (PPPs) rolled out by certain procurement authorities have provided a sleek transition to a new asset class, the full potential of the market goes far beyond these projects.

We have identified the following future key trends within the market:

Infrastructure investors finding opportunities in alternative network providers

The volume of transactions for broadband deals featuring infrastructure investors/players has been growing, particularly in the M&A market. A large proportion involve infrastructure funds buying into alternative networks (altnets), both active and passive networks, that are building up dark and lit fibre coverage to challenge the position of current incumbent groups.

In May this year, Antin and Goldman Sachs-managed funds bought CityFibre – the largest altnet currently operating in the UK – joining Amber, Arcus, Aviva, DIF, Cube, Infracapital and 3i in investing in the space. While these ventures are almost exclusively commercial, operating outside concession-based frameworks, long-term partnerships with existing internet service providers (ISPs) can also provide opportunities for investors. Vodafone and TalkTalk are among the groups who either partner with altnets or are actively seeking to do so.

Scale of capital committed to altnets to grow as they gain greater market share

More investors see altnets as an attractive area of investment as they scale up to create more comprehensive networks, covering larger areas. This will attract more players into the market, particularly as there is a lot of competition in traditional asset classes, making it harder for investors to deploy capital. While equity has already made moves into the area, debt providers are now beginning to follow, exemplified by Hyperoptic's recent GBP250m debt raised from a syndicate of banks including BNP Paribas, ING, RBS, Société Générale and Barclays. Partnerships with ISPs or signing up large-scale commercial customers on long-term contracts will also aid this process.

5G promises to provide continued projects in which to deploy capital over the longer term

While much of the focus is centred on rolling out fixed fibre last mile connections to customers, 5G is poised to move to centre stage over the coming years. The next generation of wireless connectivity will necessitate significant backing. A fleet of telecoms transmitters will need to be built to fully densify coverage. This process has already begun, with Wireless Infrastructure Group (WIG) among the early movers following its GBP 220m debt raise in August to finance investment in 5G-ready infrastructure.

Certain markets around the world will offer particularly enticing opportunities

Internet penetration has progressed in an uneven fashion globally, with some countries closing in on comprehensive full-fibre networks while others fall behind. Those countries which have been slower to adopt new technologies now provide a host of exciting opportunities, particularly those where demand for innovation is high, such as Romania or Italy. Singapore is at a far higher level of digital development, but its progression to the next stage of connectivity opens up vast opportunities too. Its government's Smart Nation initiative capitalises on their already advanced internet services by encouraging projects in the Internet of Things (IoT) and smart mobility fields. Mexico has also recently launched a massive nationwide initiative by tendering out a wholesale mobile network that will provide a 4G and 5G-ready service to 92% of Mexicans.



euNetworks

Jennifer Smith,
Chief Financial Officer



Richard Taylor,
General Counsel

euNetworks has seen strong growth over recent years. It is a Western European bandwidth infrastructure provider, owning and operating fibre-based networks across the region. It owns and operates 14 densely fibred metropolitan networks in key cities and also a long haul fibre network that spans 49 cities in 15 countries. It is a company that has expanded its network at pace over the last three years, and by year-end, will have lit over 25,000km of fibre in the long haul since 2015. This investment in the network is driven by the ever-growing bandwidth needs of its customers. Stonepeak Infrastructure Partners acquired a majority stake in the company in early 2018 and as part of this transaction funding was secured for increased expansion in these areas.

"Data centre to data centre traffic continues to grow, and given the footprint we own and how we develop our networks, it's an opportunity we are well placed to both serve and benefit from," says the group's CFO Jennifer Smith. "More than 80% of our revenue has connectivity to a data centre at some point in the solution."

Increased activity in this portion of the market has been observed by infrastructure players from all corners of the industry, from banks and investors to advisers and construction groups, so it is unsurprising to hear a connectivity specialist noting the same.

"We're upgrading some paths and doing route overbuilds as the bandwidth demand between some 'hyperscale' data aggregation sites continues to grow. We're also extending our network, digging new routes to new locations that are near our existing metro footprints. We're fortunate to have a network that enables us to do that and when you own the duct or sub-duct, you have more control over the economics of how you shape and develop your network," said Richard Taylor, euNetworks' general counsel.

So what impact will 5G have on a company such as euNetworks? Ultimately it's thought this will drive more data, which will be transmitted and stored around networks. But it also opens up more demand for fibre to connect up different mobile-related sites.

"The architecture towards small cells – the proliferation of a higher number of cells with a lower radius of coverage – those will need to be connected to a fibre backbone and we see that as a potentially promising area of growth," says Smith.

"Fibre is the only scalable economic solution to accommodate the multiple requirements for 5G & small cell roll-out," adds Taylor. "As fibre is agnostic of technology, operators can easily and efficiently switch and mix between fronthaul, midhaul, and

backhaul designs as 5G traffic grows. In addition 5G requires high accuracy – traffic needs to be highly synchronised at higher speed. Fibre technology allows this accuracy especially in high traffic or dense areas, in comparison with wireless technology."

The company is also bullish on how it could withstand any disruption from newer technology that may emerge over the coming years.

"Fibre is and will remain the crucial underlying foundation of the internet, catering to an increasingly connected and bandwidth hungry world," says Smith. "We're pulling new cable through parts of our network with greater fibre count – so more capacity. Continued developments in the optronics and hardware that sits on top of the fibre allows further bandwidth scale. That gives us continued growth opportunity into the future with our fibre assets."

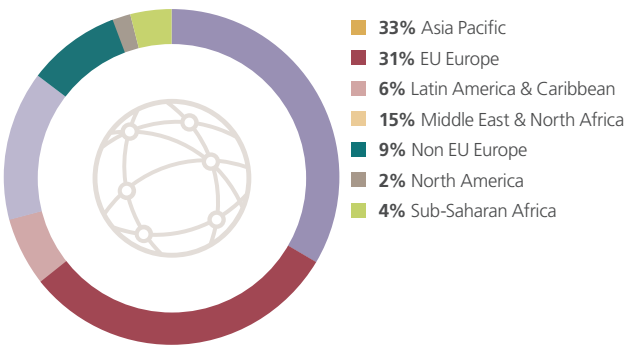
"So in terms of tech changes, we do not see anything competing with fibre as the basic building block of data connectivity. Our business is capital intensive and with various macroeconomic challenges, we could potentially face an issue at some point to feed an increase of bandwidth demand."

In the spotlight: countries to watch

The smartphone and the digital economy have made the internet an essential part of everyday life, generating a demand for instant, constant and ubiquitous connectivity. However, more needs to be invested in digital infrastructure to improve broadband access and speed, and many countries are falling behind development goals, with rural areas often experiencing the poorest connectivity levels.

Global broadband penetration rates have been identified below:

Regional penetration rate



Source: FTTH Council EU, 2018

The EU has set an objective to achieve broadband speeds of 30 Mbps for all European households and ultrafast speeds of 100Mbps for 50% of households by 2020. However, many EU member states are not on track to meet this goal, although others such as Portugal and Spain have made huge progress.

We have singled out five key jurisdictions that we think pose the greatest opportunities for investors based on past deals, local incentives and predicted future investment activity:



A rise in government and private investment

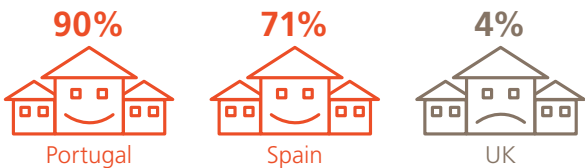
The UK has seen significant changes in recent years due to the providers in M&A activity. The leading fixed broadband providers in the UK are BT (36%), Sky (24%), Virgin Media (20%) and Talk Talk (12%).

The UK is also making progress following the launch of its GBP 400m Digital Infrastructure Investment Fund to boost full fibre networks across the country, aiming to provide access to 15m premises by 2025.

With fibre infrastructure still significantly lacking, there is a demand for improved services. Only around 4% of homes and businesses in the UK have a full fibre offering, compared to much higher rates in other EU countries where full fibre is enjoyed by 90% of homes and businesses in Portugal and 71% in Spain.

Within this market, CityFibre, Hyperoptic, Gigaclear and others have emerged strongly onto the scene. It is here that infrastructure investors have found opportunity in the UK, highlighted by the takeover of CityFibre by Antin Infrastructure and West Street Infrastructure Partners in June 2018. The wider altnet market is currently largely an equity market characterised by small, high-risk entrepreneurs.

Homes and businesses with a full fibre offering



Romania

High adoption and demand

Deregulated in 2016 and largely characterised by platform-based competition, Romania's broadband market is one of the most promising in the CEE. Despite it being ranked last for overall performance in the EC's 2018 Digital Economy and Society Index, 44% of Romanian households subscribe to ultrafast broadband according to the survey; outperforming the EU's average of 15.4%. While its broadband access rate marginally lags behind other countries, its high ultrafast adoption rate suggests it is a market that is swiftly developing, promising tangible investment opportunities over the coming years.

Broadband network owner Electrogroup Infrastructure has judged now to be the right time to conduct an IPO, with a flotation on the Bucharest Stock Exchange expected before the end of 2018.

Orange is conducting tests with Samsung and Cisco on high-speed home internet access to improve Romania's fibre-optic networks for 5G expansion. RCS & RDS (Digi Mobil) has also partnered with Ericsson to launch enhanced broadband services across its network in preparation for 5G and IoT developments.



Italy

A favourable regulatory regime to encourage investment

Although showing a low penetration of digital, the potential of the Italian market is significant. In 2015 Italy launched its strategy for high-speed broadband which has simplified its regulatory framework and incorporates investments into future-proof infrastructure.

This summer the Italian government sought to create a single company for the roll out of fibre. This solution aims to avoid costly overbuild of infrastructure as rival networks are built out by Italy's incumbent phone operator Telecom Italia and the competing broadband operator Open Fiber, in both of which the government holds stakes.

Open Fiber, the first wholesale operator in Italy owned by Enel and state lender CDP, obtained EUR 3.5bn in April 2018 from a consortium of banks for its Fibre to the home (FTTH) push, making it the largest structured finance broadband initiative in Europe, Middle East and Africa (EMEA).

Open Fiber has also partnered with Cisco Network Services Orchestrator and a consortium of operators led by Maticmind, to automate its networks for retail service providers.

TIM (Telecom Italia) has the lion's share of Italy's broadband market, occupying a 45% share.



Bahrain

A nation with a plan

Bahrain has been a leader in the telecommunications sector in the Middle East since its market liberalisation in 2002. Baltelco, Zain Bahrain and Viva Bahrain are the market leaders.

In June 2018, Viva Bahrain launched its first 5G network public showcase, which achieved gigabit speeds of up to 1.5 Gbps. This follows its system/network transformation contract with Huawei earlier in January to improve IT infrastructure and introduce wireless radio technologies as part of its 5G readiness strategy.



Singapore

Delivering the smart nation

High wired and wireless broadband penetration rates are driven by the city's 'smart nation' ambitions to integrate digital technology across households, businesses and public services, making the country a global broadband pioneer. Singtel, Starhub, M1 and TPG Telecom are market leaders.

In 2017, Singtel entered a 5G Centre of Excellence partnership with Ericsson to develop a 5G pilot network in Singapore's science, business and IT hub. The pilot network, launching in Q4 2018, aims to deliver 5G coverage with enhanced mobile broadband speed. M1 similarly announced a partnership with Huawei in June 2018 to embark on 5G trials.



Edmond de Rothschild Asset Management

Ada Cerne,
Senior Investment Director

In its position as a specialised debt fund for infrastructure projects across Europe, Edmond de Rothschild Asset Management has placed a keen eye on opportunities arising in the fibre broadband sector. Currently fundraising for the fourth edition of its BRIDGE infrastructure debt platform, the fund manager eyes deals across transport, energy (including renewables), utilities and social infrastructure, as well as telecoms where it has concluded two investments in the broadband sector.

The group is continuing to pay close attention to opening up new avenues for its business within the wider digital infrastructure space.

"In my mind I split the fibre optics developments between the government framework ones and the private initiatives, and I see opportunities in both areas," says Ada Cerne, Senior Investment Director at Edmond de Rothschild Asset Management. "For the government projects, France has been very active in holding regional tenders but this is probably now coming to an end."

"Having said that, because of the number of franchises that have been awarded, I think there are opportunities to bring those together to do portfolio refinancings so that is where France could be interesting."

Cerne also namechecks Ireland, Scotland and Germany as markets where similar, mainly rural, schemes could prove fruitful over the next year or so, whilst privately-initiated fibre developments will be much more scattered across the continent.

But private broadband transactions pose issues that might not be found in more traditional infrastructure deals where there often are long-term concession periods, offtakers, and stable cash flows sometimes even made through availability payments.

She says, "That is not the case with fibre optics where you are relying on consumer demand to generate the project's revenue. So that is the main risk that we face and we need to structure our facilities to be comfortable with that."

One remedy is to stipulate that senior debt is not able to be drawn until a specified percentage of a local catchment area has committed to using the services offered by a new fibre network.

"This is nothing new but it gives lenders the comfort that a set percentage of consumers have expressed an interest or are legally bound to take up a contract," says Cerne.

When it comes to technology risk, this is something that infrastructure lenders are also naturally keen to manage, with the pace of change in the sector potentially leading to redundancy of an existing technology in a relatively short space of time, even for government-backed PPPs.

"Although some of the concessions can be up to 30 years, usually the debt facilities for private initiatives are effectively much shorter at below 10 years. Even the facilities within concessions have incentives for the borrower to refinance after 10-12 years, so it's quite rare we have a real 30 year technology risk in terms of the debt that is issued today," says Cerne.

Another way to safeguard an outlay on a transaction is to choose wisely exactly which projects to get involved in, with rural areas likely to be later targets for disruptive technologies due to their smaller and less dense consumer markets, according to Cerne, whilst at the same time being the areas in which most investment is currently needed.

While opportunities in other areas – such as 5G and smart cities – are not imminent, investments especially in smart cities represent a very attractive asset for BRIDGE given their crucial role in supporting an interconnected economy and society.

Cerne says, "I know there are several cities that are working towards providing this kind of interconnectivity and we would love to be involved in the financing of such projects. In this respect more co-ordination between all the agents and players involved is required for what is certainly the next stage in terms of telecom transactions focus for infrastructure funds like BRIDGE."

Investment opportunities in digital

Neutral host infrastructure could unlock investment

The utility-like model of neutral host infrastructure will do away with the vertically integrated model used by the UK's larger fixed and mobile broadband providers and introduce shared infrastructure which retailers would have equal access to. The UK government's recent telecoms review concluded that neutral host infrastructure could unlock investment, address 5G deployment challenges, improve rural connectivity and reduce barriers to entry for retail service providers.

Edmond de Rothschild Asset Management's Ada Cerne highlights that technology risk is something that infrastructure lenders are keen to manage, with the pace of change in the sector potentially leading to redundancy of existing technology in a relatively short space of time. She states: "Although some of the concessions can be up to 30 years, usually the debt facilities for private initiatives are effectively much shorter at below 10 years. Even the facilities within concessions have incentives for the borrower to refinance after 10-12 years, so it's quite rare we have a real 30 year technology risk in terms of the debt that is issued today."

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Transport for London is currently running a tender process to find a neutral host operator to provide a 4G network to the London Underground.

Wireless Infrastructure Group (WIG) has participated in the development of neutral host distributed antenna systems in the UK, Spain and Portugal.

Airspan Networks, a small cell equipment supplier, has created the wholesale network carrier Dense Air to provide much the same service in European markets, including Ireland and Belgium.

“Technology risk is something that infrastructure lenders are keen to manage, with the pace of change in the sector potentially leading to redundancy of existing technology in a relatively short space of time.”

Ada Cerne
Senior Investment Director,
Edmond de Rothschild Asset Management

Rural community involvement

Widespread internet access has tremendous benefits for rural areas. However, due to low population density and a smaller customer user base, rural areas are less commercially attractive, often requiring some sort of government subsidy for infrastructure.

The UK government estimates around GBP 3-5bn of funding is needed to bring full fibre to these areas. In its 2018 Autumn Budget, the UK government pledged GBP 200m would be invested to fund the installation of full-fibre broadband in rural areas, starting with replacing aging copper lines in primary schools. This budget has been allocated from the National Productivity Infrastructure Fund.

Some countries rely on competitive bidding processes. France has the most established broadband PPP programme, largely focused on rural developments. The Grand Est project of 2017 with a capex of USD 1.3bn, involved the procurement of a FTTH network via a publicly owned fibre broadband network. The scheme drew wide interest from both equity and debt, with a selection of banks, financial institutions, telecoms groups and infrastructure funds all contributing to the financing package. France has continued to roll out further projects under its PPP programme since.

"Fibre broadband infrastructure is a real economic driver from a country perspective and rural communities are an important part of this," says Aviva Investor's Sean McLachlan. "Many people are increasingly looking to work more at or closer to home, but for many living in rural areas that's almost an impossibility."



5G and small cell densification

UK authorities aspire to put the nation at the front of the pack when it comes to 5G. Outdoor small cell networks will form a crucial backbone for this offering.

With more communication towers and small cell base stations required to support 5G, there are many opportunities for both construction and asset operation. With 5G expected to operate at higher frequencies of between 28Ghz and 39GHz, small cells will allow greater coverage at this level due to the resulting weak signals being unable to sufficiently penetrate obstacles.

Ofcom recently auctioned off the 3.4GHz band to telecoms companies for 5G use and various government-backed research initiatives are underway to encourage investment, develop technology and prepare a regulatory framework. The GBP 1bn National Productivity Infrastructure Fund has provided a GBP 700m pool of funding split between local full fibre and 5G programmes. The government is also in the process of developing a pilot 5G city as part of the 5G Urban Connected Communities project.

WIG is among the early movers in this area following its GBP 220m debt raise in August to finance investments in 5G-ready infrastructure. WIG sealed loans from Barclays, Barings, Lloyds, MetLife, RBS and Vantage Infrastructure in a demonstration of the willingness of lenders to back projects in this area.

Inter-industry and cross-industry partnerships

Communication infrastructure development necessitates various inter-industry partnerships and cross-industry partnerships. System developers and mobile operators will collaborate to lead joint builds, and anchor tenants will be needed to provide long-term committed revenue streams.

To facilitate further development, government will need to cut red tape and mediate relationships and collaborations with utilities and landowners using property and existing infrastructure to build networks.

In September 2018, SSE's telecoms division signed an agreement with the UK mobile networks Three and O2 to accelerate fibre connectivity using space in Thames Water's sewer network to pave the way for future deployment of cell sites and masts for both 4G and 5G.

Cross-industry partnerships will emerge predominantly in telecommunications, health, transport and financial services. The healthcare sector is already exploring the potential of 5G advancements with remote, robotic surgery exploiting the step-change in the speed of data transfer.

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CityFibre

Oliver Bradley,
Corporate Finance Director

In just a few short years since its foundation in 2011, CityFibre has grown to lead the pack of altnets in the UK bidding to challenge the incumbent operators in the fibre broadband sector. That growth and a tie-up with Vodafone ultimately drew the interest of infrastructure investors, with funds managed by Goldman Sachs and Antin swooping to acquire the company in April 2018.

In CityFibre the pair of new owners identified a company that would provide a large enough opportunity to deploy capital, strong potential for growth and potential for good returns.

Oliver Bradley, Corporate Finance Director at the company says, “I think what attracted them to us is we are a platform on a journey to becoming a fairly substantial utility. To build a network to five million homes requires around £2.5bn of capex and that’s a good amount of money to spend.”

The target for 5 million homes cited by Bradley is contained in the agreement with Vodafone in which the mobile phone group will make a volume-based commitment to 20% of the home and business connections due to be financed, constructed and operated by CityFibre. This is a key component to mobilising capital for the group, according to Bradley.

He says, “You can take it to banks and say, ‘here is a minimum revenue Vodafone, one of the largest telecommunications companies in the world, has given us an ironclad guarantee that if we pass the homes, they will take 20% of them.’”

“That guarantees a yield on a capex that we’re building, that gives you a worst-case scenario for your sensitivities and modelling. But, more importantly than that in my mind, is the behaviour it incentivises, because what it means is that Vodafone has a powerful financial incentive to really market and sell those connections.”

That last point will serve to ensure an alignment between both Vodafone and CityFibre’s goals and with the former being a relatively small player in the ISP market it will look to take an important chunk of market share from other groups, such as BT, Sky, TalkTalk and Virgin.

Vodafone will at first have exclusivity to offer its services over the networks CityFibre builds out. After a set period other ISPs will then be able to use the lines laid down by CityFibre.

“So the proposition to the other ISPs then becomes, why wouldn’t you come onto our network because it is a much better network than Openreach’s.” says Bradley.

“It’s cheaper than what you’ll be paying for a far inferior product, as we price competitively with the through the cabinet products that are available to them on Openreach.”

It is this competitive pricing that Bradley hopes will entice even more retail business towards CityFibre’s networks, as any ISP that takes advantage will accrue higher profit margins compared to similarly priced products hosted on the incumbent’s hardware.

Bradley also states that there will likely be an opportunity for bank debt as part of the overall funding mix, opening up a new corner of the market to this type of capital. Leveraging the equity within the business could very well help the network expand over the next few years.

“The key for us to really increase our throughput is to be building multiple towns at a time. Once we’ve got going in the twelve towns and cities that make up our first million, we’ll then be able to move to 12 more towns and cities to make up the next million and so on. We would hope to be in five million premises by the mid-2020s.”

The altnets that have emerged in the UK over the past few years have not only brought more competition into infrastructure provision, as well as more choice for consumers, but have also sped up the development of fibre broadband all across the country. This is a key argument for the existence of the altnets, according to Bradley.

“If you didn’t have companies like us, even in relatively small parts of the country, showing what could be done, I think from a consumer perspective, a government perspective and from an industry perspective, you’d be left at the mercy of what Openreach want to do, and for Openreach’s own rational reasons that probably means a slower path.”



Aviva Investors

Sean McLachlan,
Senior Director

When asked about the challenge altnets face in the UK’s monopolistic market Sean McLachlan, Senior Director at Aviva Investors, says “I think in the UK, just by the nature of how altnets have come to be, you’re looking at a different business model than most of the other European countries.

“For example, the procurement of fibre infrastructure is being done with very different models such as the 4th utility approach, very similar to regulated gas, water and electricity or PPP structures bringing private and public sectors together.”

“Fibre broadband infrastructure is a real economic driver from a country perspective and rural communities are an important part of this.

“Many people are increasingly looking to work more at or closer to home but for many living in rural areas that’s almost an impossibility,” says Aviva Investor’s Sean McLachlan.

“So, if you’re working in London and living somewhere in say West Sussex, you may have to come into London because you can’t do your work at home. Then there’s a number of clear economic benefits when you look at connecting up smaller villages and rural areas and so the demand case is very compelling, from our perspective.”

With this in mind, investors need to get comfortable with long-term risks, especially when putting fibre into premises.

“People talk about future-proofing and nothing is completely future-proof of course, but in terms of speed, fibre operates at the speed of light with excellent reliability and can be highly cost-effective”, says McLachlan.

“Fibre is a great technology for providing a pretty long-term solution to connectivity. It’s also very complementary to some of the other technologies that you see out there such as 5G.”

Chris Watson reflects on the rise of altnets



place recently, which have been setting down some markers

Chris Watson

Partner - Head of TMC, CMS

What does the future hold for digital?

Given the current and predicted growth in data traffic, the rapid expansion of IoT devices, and the emergence of new technologies, such as machine learning and AVs, the rapid evolution of broadband networks is inevitable. The anticipated capabilities of 5G will allow new technologies to break through and become mainstream. 5G networks are expected to bring improvements to the wireless space: lower costs of transmitting data, substantially higher data speeds and low latency.

Data centres

Data centres will become even more important as much of the data created and distributed across connected devices will be stored in the cloud. Significant updates may be needed to match the capabilities of fast networks. According to Next Generation Mobile Networks, 5G is predicted, compared with 4G, to reduce latency by 80% and improve reliability to near 100%, eliminating downtime.

Internet of Things (IoT)

As roll out and usage of IoT devices including wearables, smart homes and vehicles are growing, new 5G networks will become crucial to enable technology-driven infrastructure updates, given that they are capable of handling up to 100 times more connections per radio base station than 4G. This will support wider adoption of smart homes, smart cities and AV across the globe.

Autonomous vehicles

As cars capable of connecting to the internet for navigation and entertainment purposes become more widespread, the demand on mobile networks and satellites will increase. Data consumption by vehicles is likely to rise further, and new generation networks will have to satisfy that demand. As AVs and 5G networks are both in the early phases of development it is difficult to predict how these technologies will interact. However, it is safe to say that reliability and ultralow latency features of 5G could prove to be useful for vehicle-to-vehicle (V2V) and vehicle to infrastructure (V2I) communication technologies helping AVs navigate in traffic.

The Pennsylvania Broadband Initiative seeks to equip the Pennsylvania Turnpike toll road that runs across the state with fibre-optic connectivity to assist in transmitting

tolling data, traffic management and potentially making it ready for connected and autonomous vehicles.

Smart nations

It is naturally more difficult to implement ‘smart nation’ strategies across countries with greater landmass due to the increased capital requirements of more infrastructure required per capita. Smart nations give greater advantages to modern ‘city states’ which, along with having fewer administrative layers to align before a project can begin, have the advantage of a lower population than an average country, so requiring less connecting infrastructure such as transmission cables and radio towers.

Singapore leads the field, but it seems unlikely to remain unchallenged as Hong Kong and Dubai look to make advances in smart mobility, healthcare, planning and finance.

As the cost of manufacturing the related infrastructure comes down, the implementation of these strategies across greater areas will be more realistic. Countries such as Estonia and South Korea are leading the way in this area, following the digitalisation of government services in Estonia and effective promotion of smart cities in South Korea.

Singapore leads the field, but it seems unlikely to remain unchallenged as Hong Kong and Dubai look to make advances in smart mobility, healthcare, planning and finance.

Methodology

Our research aims to identify the most promising markets and jurisdictions for investment for broadband, electric vehicles, energy storage and smart mobility. Since the four sectors analysed are markedly different in terms of their maturity, research methods have been tailored accordingly. The analysis of more mature sectors, for example, digital has been more quantitative, other sectors (i.e. smart mobility) required a more qualitative approach.

The quantitative data collated has been categorised according to sector, country, financing model, transaction stage, transaction value, participant role and status, with the goal of developing advanced data-driven analytics and insights. Our main source was dataLive, inspiratia’s proprietary project database that monitors global project-financed social infrastructure, transport and renewables deals. Other sources include governments, international organisations, rating agencies, consulting firms, academic literature, newspapers, specialist press, press releases and in-depth interviews with market participants.

Our qualitative analysis was based on in-depth interviews with leading market practitioners to assess the interest of potential investors. This analysis provided insights on potential revenue streams, risks and inhibitors to successful investment, deeper understanding of the successful case studies, political support, regulatory framework, investment climate, technology maturity and gain an understanding of any other issues potentially affecting the investment landscape.

About CMS

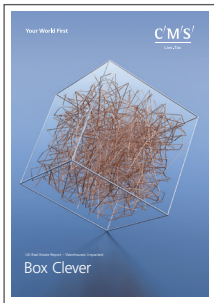
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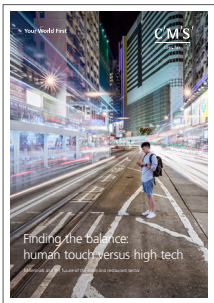
In addition to this report, we have a broad range of thought leadership papers covering major sector issues.



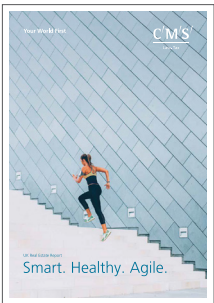
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CMS Cameron McKenna Nabarro Olswang LLP
Cannon Place
78 Cannon Street
London EC4N 6AF

T +44 (0)20 7367 3000
F +44 (0)20 7367 2000

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