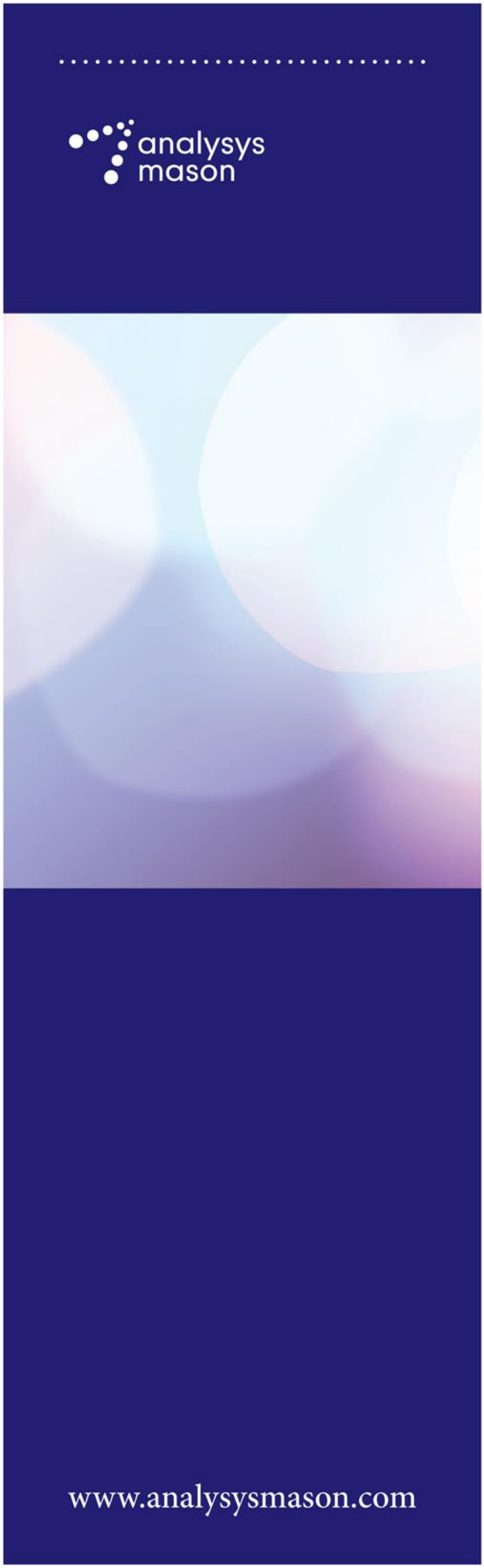

Report for BT

International benchmark of superfast broadband

29 November 2013

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Contents

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1 Executive summary

There is an ongoing debate about the UK's performance relative to other countries for superfast broadband, highlighted most recently in the UK Government Public Account Committee's review of funding for rural broadband.[1] This is an important debate, with similarities to the one in the early 2000s when first-generation, or basic, broadband, was the focus. Back then, some commentators were suggesting that the UK was falling behind its international peers with serious socio-economic consequences. The reality was different: the UK became one of the leading countries in first-generation broadband in terms of availability, competition and pricing. The question this report aims to address is as follows: is the UK falling behind its international peers in *superfast* broadband?

This report provides a series of benchmarks relating to superfast broadband in the UK compared to a selection of countries in Europe,[2] together with other countries that are known for their well-developed broadband networks. The six EU countries covered are: France, Germany, Italy, the Netherlands, Spain and Sweden (with the UK we use the term "EU7"); and the other countries are Japan, South Korea and the USA. In this report, superfast broadband means fixed[3] connections with downstream bandwidth of at least 30Mbit/s. As such, this report also provides guidance on the UK's progress towards the European Commission's Digital Agenda for Europe 2020 target that all Europeans should have access to Internet speeds of at least 30Mbit/s.[4]

The report presents factual data to 2012. We also provide Analysys Mason's forecasts[5] to 2018 for some of the benchmarks. Included in this report are:

- Actual benchmark data and projections for:
  - superfast broadband coverage (i) nationwide and (ii) distribution across different geographical areas
  - take-up of superfast broadband.

1 See http://www.publications.parliament.uk/pa/cm201314/cmselect/cmpubacc/474/47402.htm.

2 Annex A includes some basic indicators for the European countries, including population, land area, population density, GDP and GDP per capita.

3 This report only considers fixed connections. While some mobile technologies may be able to support peak downstream speeds greater than 30Mbit/s, we do not believe they will be able to provide comparable service to fixed technologies.

4 This report focuses on superfast broadband and therefore we do not directly address the other Digital Agenda target of at least 50% take-up of Internet connections of 100Mbit/s or above. However, we do in this report consider the availability of higher speed services (greater than 30Mbit/s) and future bandwidth requirements.

5 The forecasts provided are largely based on Analysys Mason's published market forecasts, in particular the report "FTTx roll-out and capex worldwide: forecasts and analysis 2013–2018." These forecasts have been updated for this report where new data has been made available since a report was published (http://www.analysysmason.com/Research/Content/Reports/FTTx-rollout-capex-forecasts-May2013-RDTW0/#.UksIAIakp3s).

- Actual benchmark data for:
  - downstream bandwidth
  - the retail price of superfast broadband services
  - the competitive intensity of the broadband market.

Overall, the UK does very well on most superfast broadband benchmarks (see Figure 1 below); on coverage and downstream bandwidth it outperforms France, Germany, Italy and Spain (with the UK we use the term "EU5"). The UK only lags the Netherlands which, unlike the other EU markets considered in this report, has near-national cable coverage. The UK government's strategy to improve rural broadband also serves to promote the UK's position in the EU7. The UK market is also highly competitive, as demonstrated by the competitive intensity benchmark. The UK's retail prices are in line with those in the EU7 when line rental charges are taken into account, noting that some cable offers are broadband-only for which no line rental charge is required. Of the incumbent operators considered, BT offers the lowest retail price. Take-up in the UK is expected to evolve in line with most other EU7 countries: the Netherlands and Sweden are expected to retain their lead, largely because superfast broadband services were launched earlier than in the other EU countries considered.

Figure 1: Summary of the current position of superfast broadband in the UK compared to EU7 benchmark countries, data varies between end 2012 and 2013 [Source: Analysys Mason, 2013]

Benchmark	UK position relative to EU7	UK position relative to EU5	Comments on UK's position relative to EU7
Superfast coverage – nationwide, all networks (2012)	2nd	1st	The Netherlands has near-national superfast broadband coverage as a result of cable. Virgin Media's superfast broadband coverage in the UK is around 48%, and we do not expect any significant cable expansion in the foreseeable future
Superfast coverage – nationwide, incumbent operator networks (2012)	4th	2nd	By mid-2013, the UK is second only to the Netherlands
Average measured downstream bandwidth (2013)	3rd	1st	The UK has the highest speeds in the EU5, but is behind the Netherlands and Sweden, due largely to the Netherlands' extensive cable coverage and Sweden's relatively high coverage of FTTH/B
% of fixed broadband connections with downstream connections above 10Mbit/s (2013)	2nd	2nd	78% of broadband connections in the UK have access to downstream speeds above 10Mbit/s, second only to France (89%)
Retail prices for superfast broadband (2013)	4th	3rd	UK superfast broadband prices are in line with the EU7 average. Only EU7 cable operators offer prices that are lower than those in the UK, and this is mainly due to broadband-only offers where no additional line rental charge is required

Benchmark	UK position relative to EU7	UK position relative to EU5	Comments on UK's position relative to EU7
Retail prices for superfast broadband from incumbent operator (2013)	1st	1st	BT has the lowest retail prices of the EU7 incumbent operators
Competitive intensity of broadband market (2013)	1st	1st	The mix of BT Retail, Virgin Media, Sky and TalkTalk make the UK market more competitive than any other in the EU7
Take-up of superfast broadband as percentage of premises (2012)	3rd	1st	Only the Netherlands and Sweden have higher adoption rates. This is due in part to cable operators automatically upgrading subscribers from lower speed packages to superfast packages
Take-up of superfast broadband as percentage of available connections (2012)	3rd	1st	The Netherlands and Sweden have higher adoption rates than the UK largely because superfast connections have been available for longer

Figure 2: Summary of the expected position of superfast broadband in the UK compared to EU7 benchmark countries, end 2018 [Source: Analysys Mason, 2013]

Benchmark	Expected UK position in 2018 relative to EU7 *(position compared to 2012/13)*	Expected UK position in 2018 relative to EU5 *(position compared to 2012/13)*	Comments on UK's position relative to EU7
Superfast coverage – nationwide, all networks	2nd (=)	1st (=)	As before, this is a result of the near-national cable coverage in the Netherlands. We expect the gap between the UK and the next closest country (Germany) to widen due to the UK government's funding to support deployment to 95% of premises
Superfast coverage – nationwide, incumbent operator networks	1st (↑)	1st (↑)	We expect BT to have greater coverage than any other EU7 incumbent operator by 2018, assisted by BDUK's rural programme
Take-up of superfast broadband as percentage of premises	3rd (=)	1st (=)	Take-up is linked to the duration for which superfast broadband has been available. The UK is expected to be behind the Netherlands and Sweden, which have both had superfast networks available for longer
Take-up of superfast broadband as percentage of available connections	4th (↓)	2nd (↓)	We expect the UK to remain behind the Netherlands and Sweden. Germany is only just marginally ahead (0.5% difference) of the UK in our projection

Over the next five years we expect the UK to considerably narrow the gap in the benchmarks compared to non-EU countries that are known for their well-developed broadband networks. By 2018, the UK's 95% superfast broadband coverage is expected to exceed the USA (85%) and Japan (94%), and fall just short of South Korea (98%). The UK is also expected to have closed the gap for adoption of superfast broadband. We forecast that by 2018, 51% of UK premises will subscribe to a superfast connection, 10% lower than Japan. This compares well with the end of 2012, when adoption levels in the UK were 30% lower than in Japan. The relatively high take-up of superfast broadband in South Korea, Japan and the USA is due in part to cable operators that have upgraded their network to superfast speeds. These operators have automatically migrated subscribers to higher speed packages, an upgrade that is more costly and takes longer to implement for incumbent operators.

In addition to the benchmark analysis, we have looked at the effectiveness of public funding to support superfast broadband. We have compared the UK government's strategy with a selection of countries where there are large-scale, government-sponsored initiatives, namely Australia, Japan, New Zealand, Singapore and South Korea. These initiatives have generally been FTTH-dominated, and resulted in major structural changes to the telecoms market. This contrasts with the UK government's more gradualist, rural-focused approach which costs significantly less, provides greater leverage of private-sector capital, while still providing extensive coverage. This approach is resulting

in more FTTC deployments that, while not as capable as FTTH, are expected to meet bandwidth demand for the foreseeable future (also included in this report), particularly when copper enhancement technologies such as vectoring are taken into account.

Finally, we considered a hypothetical case where the UK followed an FTTH-led investment strategy rather than the current FTTC-led strategy of BT. FTTH would support much higher speeds (both downstream and upstream), but is significantly more expensive, and would take substantially longer to deploy. Based on the rate of large-scale FTTH deployments in other countries, we estimate that, if the UK had taken this route in 2008[6], it would have contributed 10–15% to the total UK superfast coverage (i.e. in additional to cable coverage) in mid-2013, compared to 56% from FTTC. Based on our estimates of bandwidth demand for the foreseeable future, the FTTC-led strategy seems to have been the rational one. However, over the long term, a mix of technologies including FTTH will undoubtedly be needed.

6 BT first announced its plans for FTTC investment in 2008. The original BT press release is no longer available. Analysys Mason's comment on this announcement can be found at http://www.reuters.com/article/2008/07/15/idUS145068+15-Jul-2008+BW20080715.

2 Introduction

This report provides a series of benchmarks relating to superfast broadband in the UK compared to a selection of countries in Europe, together with other countries that are known for their well-developed broadband networks. The six EU countries covered are: France, Germany, Italy, the Netherlands, Spain and Sweden (with the UK we use the term "EU7"); and the other countries are Japan, South Korea and the USA.

In this report, superfast broadband means fixed connections with downstream bandwidth of at least 30Mbit/s.

This report is structured as follows:

- *Supply of superfast broadband*. Section 3 compares the availability of superfast broadband in the UK based on:
  - Actual benchmarks and projected figures for superfast broadband coverage (i) nationwide and (ii) the distribution across different geographical areas
  - Actual benchmark data for downstream bandwidth
  - Actual benchmark data for retail prices
  - The competitive intensity of the broadband market.

- *Demand for superfast broadband*: Section 4 looks at the demand for superfast broadband, based on:
  - Actual benchmarks and projected figures for take-up of superfast broadband
  - Bandwidth requirements over the next five years, to consider how well suited the UK's superfast broadband networks are to meet the needs of consumer demand.

- *Use of public funds to support superfast broadband.* Section 5 examines the use of public funds in other countries and compares the cost to the government and the outcomes achieved.

- *Implications of an alternative UK scenario based on FTTH*. Section 6 explores an alternative scenario in which BT invested in a nationwide fibre-to-the-home (FTTH) network, instead of its actual VDSL/FTTC strategy. We examine the potential cost of such an FTTH roll-out, assess the likely speed of implementation, and compare this hypothetical network with the actual network today.

3 Supply of superfast broadband

This section considers various aspects of the *supply* of superfast broadband in the UK compared to the benchmark countries, including coverage, bandwidth available, prices and level of competition. The *demand* for superfast broadband is discussed in Section 4.

3.1 Overall coverage of superfast broadband

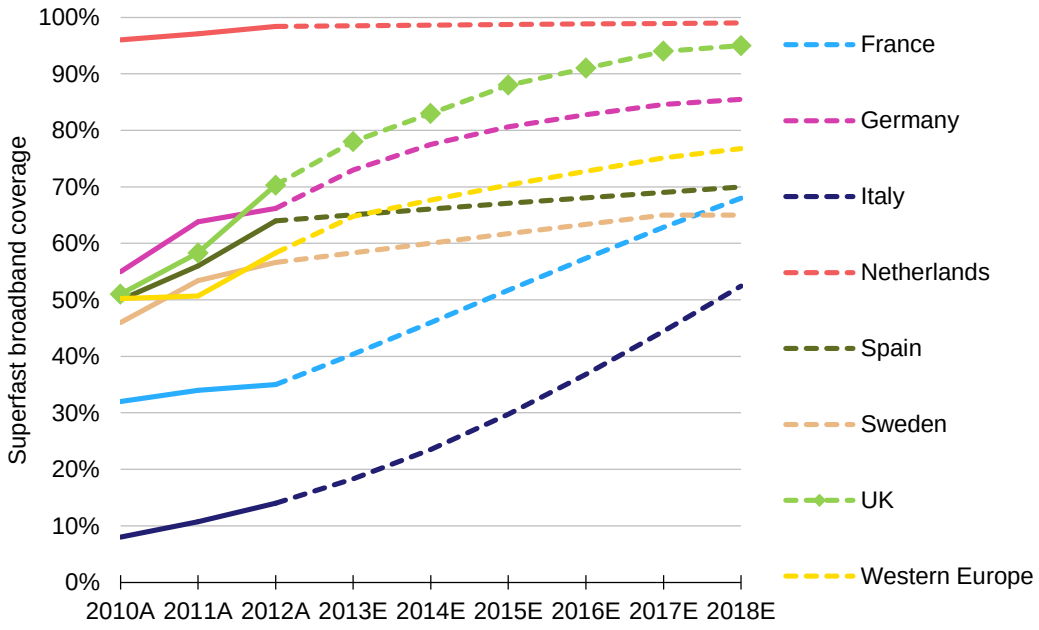
At present, the overall coverage of superfast broadband of the UK is above most European countries and is expected to improve over time, with the UK being second only to the Netherlands by 2018.

Overall coverage of superfast broadband including all fixed network technologies

Here we compare current and future coverage of superfast broadband in the benchmark countries, including all mass-market,[7] fixed network technologies that can deliver downstream speeds of over 30Mbit/s. The relevant technologies are cable (using the DOCSIS 3.0 standard), VDSL/FTTC and FTTH. Figure 3 compares the coverage for the EU7. The figures refer to the percentage of premises passed by at least one superfast broadband network.

[7] Leased lines are not considered in this analysis.

Figure 3: Coverage of superfast broadband (% of premises passed) including all fixed network technologies, EU7, 2010–18 [Source: European Commission, Analysys Mason,[8] 2013]



At the end of 2012, 70%[9] of UK premises were passed by at least one superfast broadband network.[10,11] Only the Netherlands had greater coverage than the UK at that time. Moreover, the UK's coverage was also significantly higher than the Western European[12] average of 58%. Only the Netherlands is expected to have greater superfast coverage in 2018 than the UK, by which time the UK is expected to maintain its position well above the Western European average of 76%.

Analysys Mason expects that by the end of 2018, 95% of UK premises will have access to superfast broadband, driven by BDUK's rural broadband, taking account of the additional GBP250 million of government funding to enable coverage to reach 95% of premises[13].

8 2011 and 2012 actual data for all countries is taken from the European Commission except for France where Analysys Mason data, which aligns more closely to ARCEP data (see http://www.arcep.fr/index.php?id=12114&L=1), was used. We believe the differences in Analysys Mason and European Commission data are due to the different treatment of EuroDocsis 2.0B in Numericable's network. According to Numericable (see http://numericable.com/images/pdf/Base-amf-depose.pdf) around half of its network uses EuroDocsis 2.0B, which is capable of 100Mbit/s. As the network is capable of >30Mbit/s, Analysys Mason has classed it as superfast broadband. 2010 data is based on Analysys Mason figures.

9 In its August 2013 Communications Market Review, Ofcom stated that superfast coverage was available in 73% of postcodes by mid-2013. See http://stakeholders.ofcom.org.uk/binaries/research/cmr/cmr13/2013_UK_CMR.pdf.

10 As of mid-2013, based on Ofcom data, around 31% of UK premises had access to superfast broadband networks from both Openreach and Virgin Media, 25% were passed by Openreach's superfast network and 17% passed by Virgin Media's cable network.

11 As of mid-2013, Virgin Media's superfast cable network covered approximately 48% of UK premises. We do not anticipate any significant future network expansion by Virgin Media.

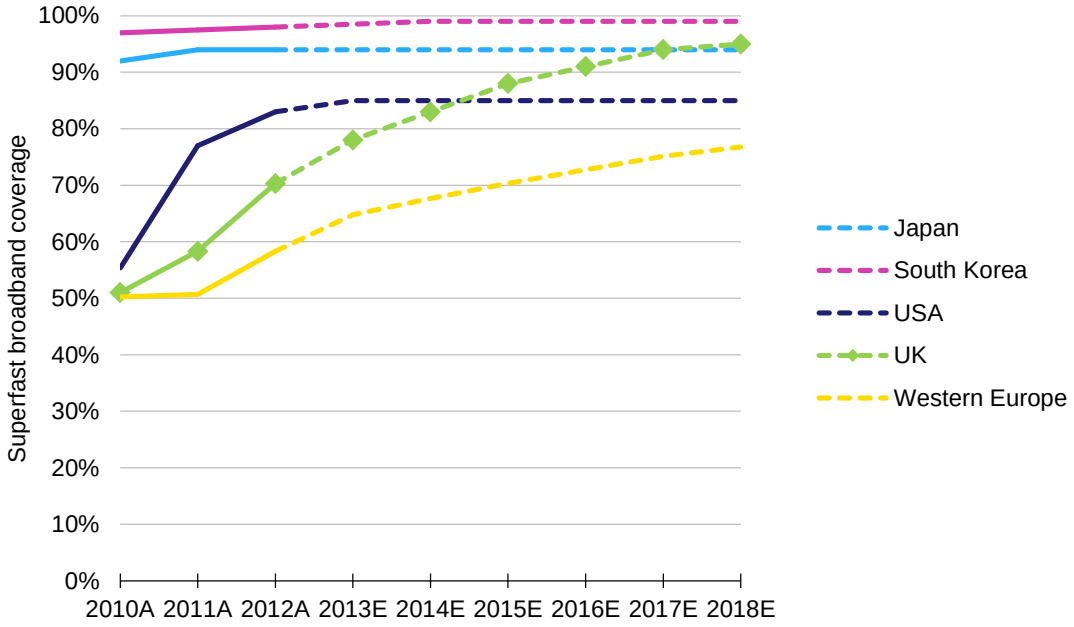
12 This is all Western Europe countries, not just the EU7.

13 In June 2013, the UK government's Department of Culture, Media and Sport announced an additional GBP250 million of funding to increase coverage to 95% of UK premises. See https://www.gov.uk/government/news/14-million-more-premises-to-get-superfast-broadband-after-250-million-capital-investment.

In both the actual and projected cases, the Netherlands leading position is driven by its near-national coverage of cable, a situation that is not the case in any of the other EU markets considered. Italy, with no cable at all, is expected to continue to have the lowest level of coverage of the EU7 by 2018.[14]

Figure 4 compares the UK with the three non-European benchmark countries, and includes the Western European average for reference.

Figure 4: Coverage of superfast broadband (% of premises passed) including all fixed network technologies, UK and non-European benchmark countries, 2010–18 [Source: Analysys Mason, 2013]



At the end of 2012, the UK's coverage was below the USA (83%), Japan (94%) and South Korea (98%). However, by 2018, we expect that the UK will have greater coverage than the USA[15] and Japan, whilst being slightly lower than South Korea. The UK will have closed the gap with Japan from 24% at the end of 2012 to be ahead by 1% by the end of 2018. The USA also benefits from a relatively high coverage of superfast broadband due to cable networks (passing 85% of premises). The different levels of superfast broadband coverage across the countries considered can be explained by a combination of the following factors:

- *Infrastructure competition and in particular high levels of cable coverage*. For example, the Netherlands has near-national cable coverage and at least five operators with superfast broadband infrastructure. This has provided competitive pressure for the incumbent operator, KPN, to upgrade its own network. In the UK, Germany and the Netherlands, the respective incumbents

14 We note that, at the time of writing, there is considerable uncertainty about Telecom Italia's future ownership and strategy (see, for example, http://www.ft.com/cms/s/0/8e4f0072-2c2b-11e3-acf4-00144feab7de.html#axzz2h33gzUL5) and this may affect any future investment plans in superfast broadband. The forecast in Figure 4 is Analysys Mason's best estimate of the future investment plan based on previous announcements.

15 The USA projection of around 85% coverage is driven by the cable footprint, which we do not expect to increase materially in size over time. Furthermore, based on announcements from AT&T and Verizon, we do not expect any material rural fibre deployment outside the cable footprint.

have focused on FTTC/VDSL, which is relatively fast to deploy and costs significantly less than FTTH, whilst also meeting foreseeable future demand for bandwidth.

- *Geography and population density*. The coverage of the Netherlands by superfast broadband is also due to the country's favourable geography and distribution of population (being a relatively small, densely populated country). Other countries with similar characteristics include Belgium and Malta, which also have high superfast broadband coverage.

- *Government support*. The superfast networks in South Korea and Japan were built with both direct and indirect government support (see Section 5). Government support is also a key factor in the projected high levels of coverage in the UK, although the absolute amount of funding available means that an incremental approach, rather than a major step change, will be possible. The French government has also stated its commitment to funding superfast roll-out and this has been factored in our forecasts. Whilst not in our benchmarks, other governments, including in Australia, New Zealand and Singapore, have developed much more interventionist strategies, and these are discussed further in Section 5.

Superfast broadband coverage of incumbent operators

The coverage provided by BT is high when compared to that of incumbent operators in Europe and beyond, and by 2018 is expected to be amongst the best in the world.

The performance of BT is strong when compared with other EU7 incumbent operators (Figure 5) and with other incumbent operators outside Europe (Figure 6).

Figure 5: Coverage of superfast broadband (% of premises passed) provided by incumbent operators, UK and selected other European countries, 2010–18 [Source: Analysys Mason, 2013]

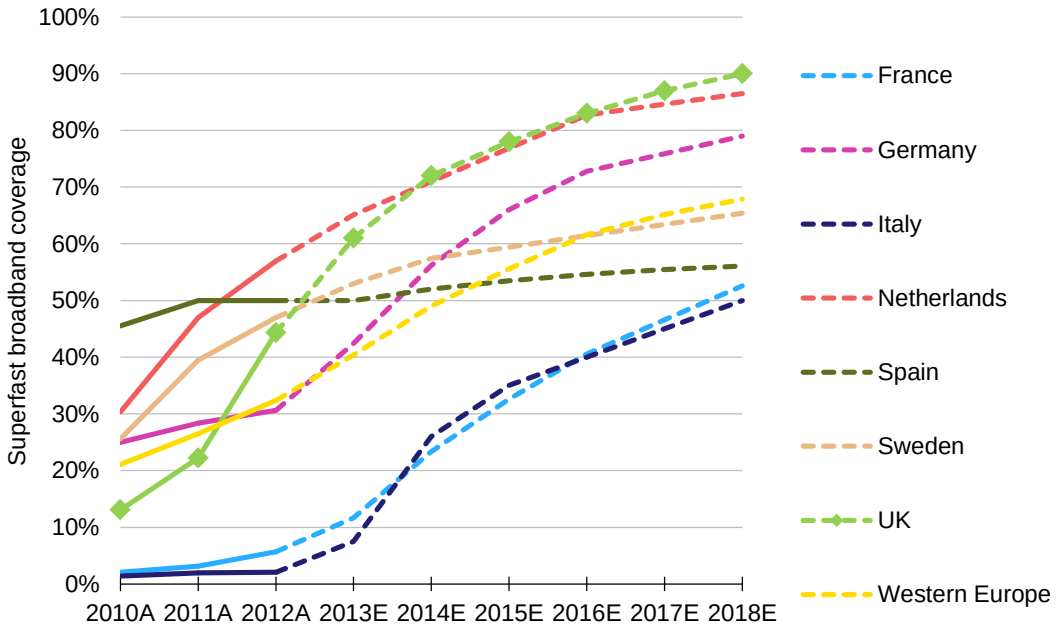
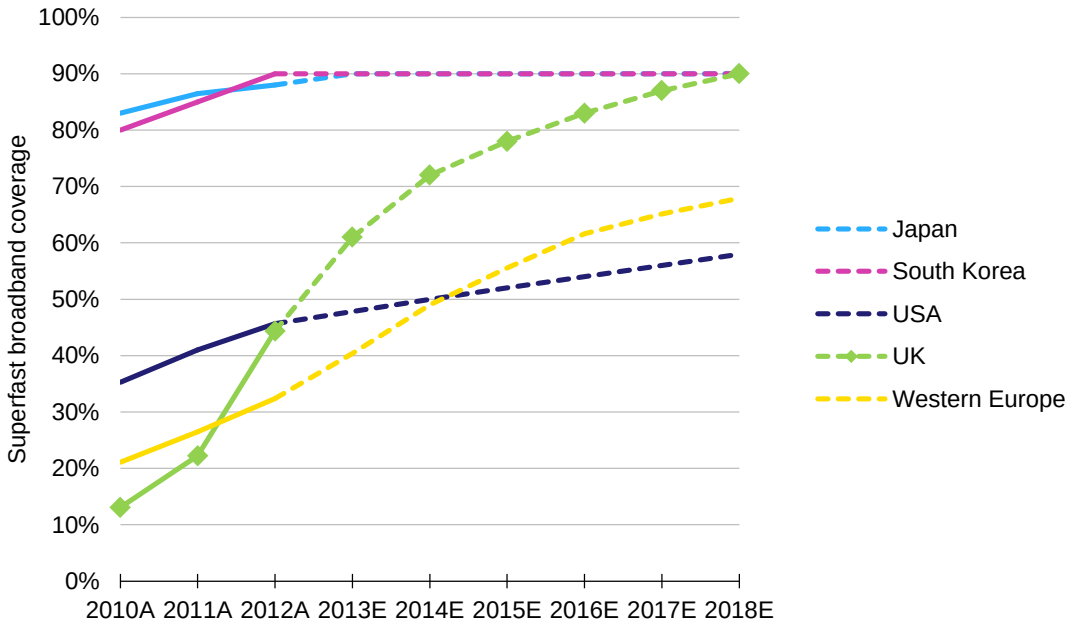


Figure 6: Coverage of superfast broadband (% of premises passed) provided by incumbent operators, UK and selected other non-European countries, 2010–18 [Source: Analysys Mason, 2013]



Of the seven European incumbent operators considered, BT is expected to just surpass KPN from 2014, and maintain this leading position to 2018, helped by BDUK's rural programme. However, it should be noted that in these projections we have not taken account of the UK government's additional GBP250 million to reach 95% coverage as it is not possible at this stage to determine which operator (or operators) will be successful in providing this coverage.

Based on current spending plans, only the UK, Germany and the Netherlands are expected to have incumbent operator superfast coverage of over 70% by 2018.

Outside Europe, the main superfast networks in South Korea and Japan have been built by the incumbent operators, and coverage at the end of 2012 was already 88% and 90% respectively. By 2018, we expect the UK to have reached a higher position (95%).

3.2 Geographical distribution of superfast broadband coverage

In reaching 95% of premises by 2018, superfast broadband will be deployed in sparsely populated areas across the UK, driven by BDUK's rural programme, resulting in an incremental increase in coverage that is only bettered by France (whose performance is mainly due to its late start deploying in such areas).

Generally, superfast broadband networks are deployed in urban areas first as these areas present the most favourable economics, and in most cases, infrastructure competition is more prevalent here. The following two charts show estimates for the geographical distribution of superfast broadband coverage in the EU7. These are necessarily estimates as there is no single, reliable source for such data. We note that the European Commission's Digital Agenda scoreboard includes one approach to

measuring rural coverage which is based on a simple population density threshold (rural being areas with less than 100 inhabitants per square kilometre[16]). However, such an approach tends not to capture population clustering that occurs in rural areas. For this reason, we have used Eurostat's latest urban/rural typology[17] which includes three classifications: urban, intermediate (where clustering can be prevalent) and rural. Using this typology, the UK population is considered to be 71% urban, 26% intermediate and 3% rural; the result of this is that we believe all of the superfast broadband deployments by 2012 were in areas classified as urban using the Eurostat typology. The UK also contrasts markedly with other countries such as France and Germany which have a significantly smaller proportion of urban areas.

We have grouped intermediate and rural together in our analysis, and this broadly aligns with the concept of the 'final third' in the UK. However, it should be noted that other commentators may take different approaches to urban and rural classification and therefore care is needed when comparing results.

Figure 7: Estimated geographical distribution of coverage (% of premises passed), 2012 [Source: Analysys Mason, 2013]

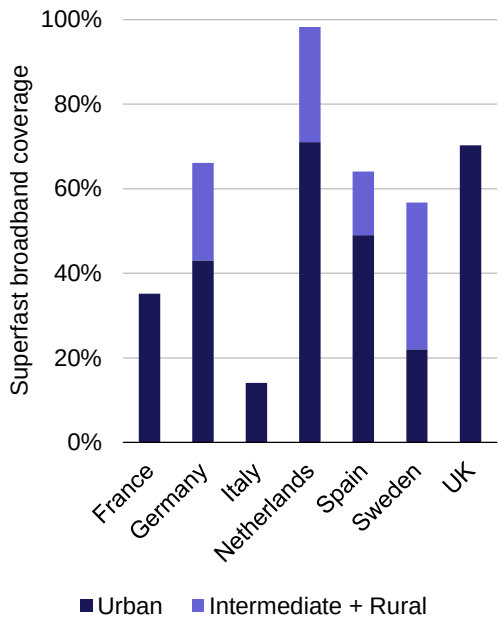
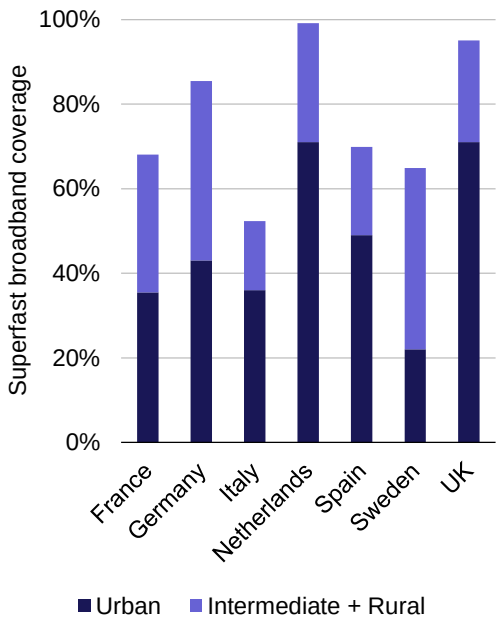


Figure 8: Estimated geographical distribution of coverage (% of premises passed), 2018 [Source: Analysys Mason, 2013]



It is difficult to draw hard conclusions from this given the quite varied nature of the EU7. However, we would expect that almost all of the future projected superfast broadband roll-out across all the EU7 will be intermediate areas, and this will be driven by a mix of commercial roll-out and government support (as in the case of the UK and as expected in France). It is notable that Germany, the Netherlands, Spain and Sweden already have significant amounts of superfast broadband coverage in

16 Using this approach, at the end of 2012 the UK was second only to Germany for rural superfast broadband coverage (18% vs. 26%).

17 See for example: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Urban-rural_typology.

intermediate areas today, driven we believe by population clustering that makes the economic case for deployment more favourable. France shows the biggest improvement in terms of intermediate and rural coverage, although this is mainly due to it having no coverage in these areas in 2012. Italy is notable in that it is the only country where we anticipate a significant improvement in urban coverage, simply as its starting point is low when compared with the other EU7 countries. For countries with truly rural or remote areas, it would seem likely that a mix of technologies, and potentially government funding, will be needed to provide full coverage.

3.3 Average downstream bandwidth available

In terms of average broadband speed, the UK is one of the best-performing European countries, although it is behind some international benchmarks. We expect this gap to reduce over time as superfast broadband is rolled out and adoption increases.

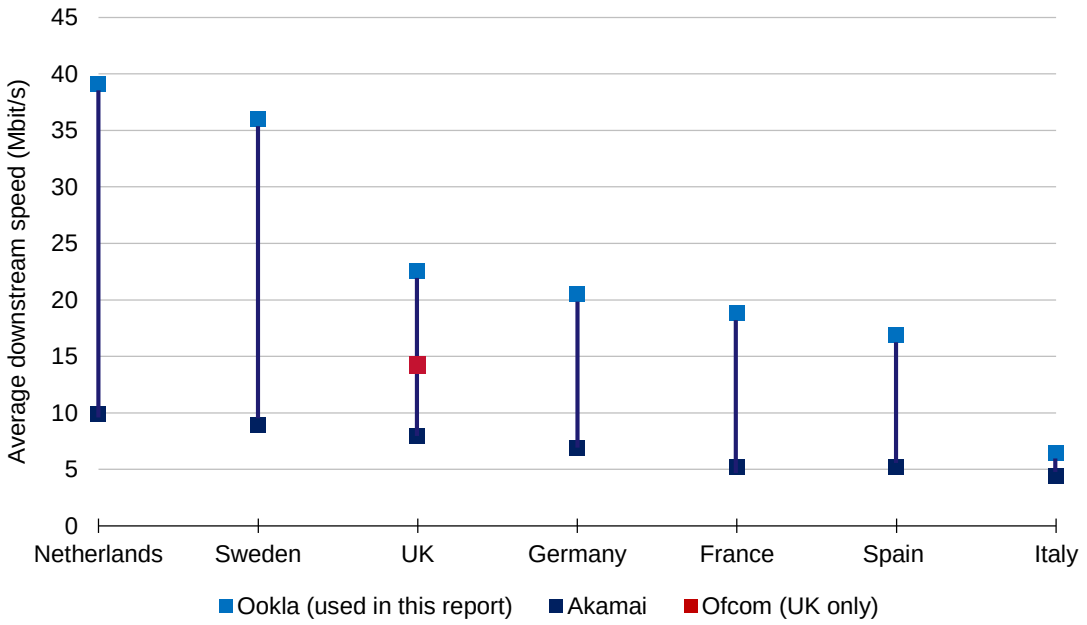
There are a number of sources which claim to measure actual, average downstream bandwidth. Both Ookla and Akamai provide results for all the countries of interest in this report. While the results from these two organisations are very different (as shown in Figure 9 below), with Ookla systematically being much higher than Akamai, the ranking of countries is similar. For example, both sources agree on the three countries with the highest speeds – Japan, South Korea and the Netherlands, and the three countries with the lowest speeds – Italy, Spain and France. For the UK, Ookla[18] suggests 22.6Mbit/s where Akamai[19] suggests 7.9Mbit/s. This compares with Ofcom's own research which suggests 14.7Mbit/s, which is between Ookla and Akamai's estimates.

Since Ofcom does not provide results for other countries, we have chosen to use the estimates of Ookla for comparison, as shown in Figure 10. As can be seen, Japanese consumers have access to the highest fixed broadband speed (41.1Mbit/s on average), while those in Italy have the lowest speeds (6.5Mbit/s). The UK's average of 22.6Mbit/s lies in the middle of our benchmarks, being slightly below the average speed for all countries (excluding the UK) of 26.5Mbit/s, but almost identical to the average for EU7 countries (excluding the UK) of 23.0Mbit/s.

18 As of 4 September 2013. The Ookla value is a 30 day rolling mean and so the value changes over time.

19 From Akamai 'The State of the Internet', 1Q2013 report, available at: http://www.akamai.com/dl/akamai/akamai_soti_q113.pdf?WT.mc_id=soti_Q113.

Figure 9: Illustration of the variability of average downstream speed measurements [Source: Analysys Mason, 2013]



Average connection speeds reflect, relatively closely, the availability (see Section 3.1) and take-up (Section 4.1) of superfast broadband (with Japan and South Korea being the best performing countries and Italy the worst) but are also affected by the price of superfast services (see Section 3.4). Accordingly, as superfast broadband becomes increasingly available in the UK, we would expect average downstream bandwidths to improve, both in absolute terms and relative to other countries.

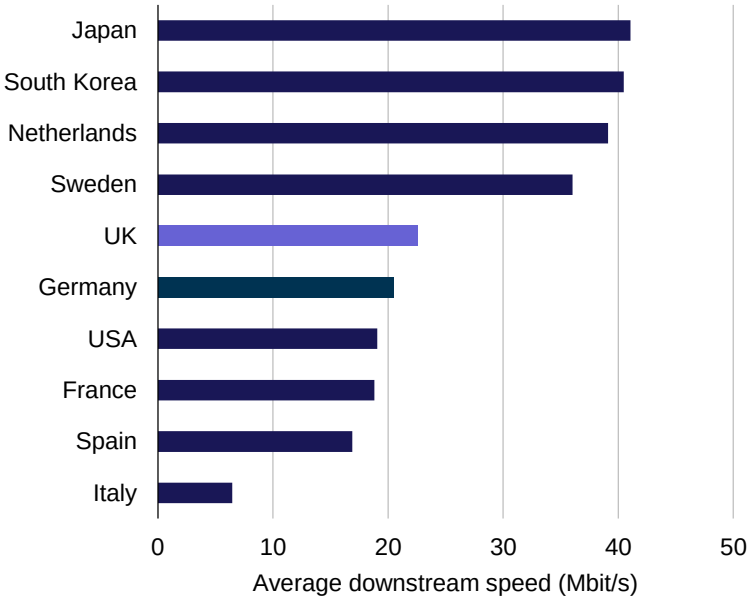


Figure 10: Average measured downstream speeds in benchmark countries, 2013 [Source: Ookla, 2013]

An alternative method of assessing the downstream speeds available is to consider the proportion of connections that have more than a certain speed. Figure 11, based on the European Commission's Digital Agenda scoreboard, shows the percentage of broadband connections in the EU7 that have speeds greater than 10Mbit/s (non-European countries were not included in the EC's measures). By this measure, the UK ranks second behind France. We believe France does well on this measure due to the early adoption of local-loop unbundling and deployment of ADSL2+ in that market, including in some rural areas where government support was available.

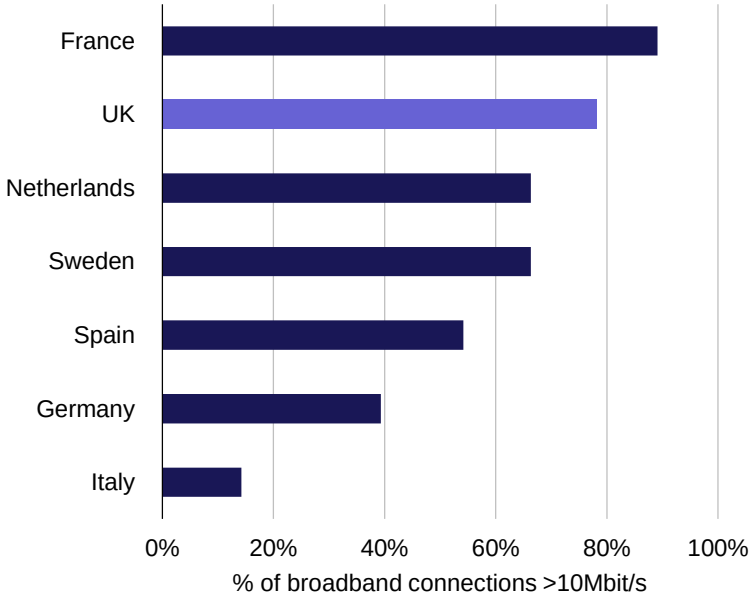


Figure 11: % of fixed broadband connections with downstream connections above 10Mbit/s [Source: European Commission Broadband Indicators, 2013]

3.4 Retail price of superfast broadband

Consumers in the UK are paying similar prices for superfast broadband to consumers in other markets. Out of the incumbent operators in our study, BT Retail offers the lowest price.

In this subsection, we compare the retail prices of superfast broadband. Two prices are considered:

- the overall lowest retail price for a superfast broadband service
- the lowest retail price for a superfast broadband service provided by an incumbent operator.

We have only included services that have no restrictions on total downstream volumes, and we have only considered standard offers, excluding any special offers or promotions. To enable as reasonable, like-for-like comparison we have included all of the costs that a consumer would incur for a superfast

broadband connection[20] and as such the prices shown include the monthly access fee (including line rental where required[21]) and any monthly equipment rental fee (where applicable). Installation fees or equipment purchase fees have been amortised over a 48-month period[22] and included in the monthly price. All prices are taken from December 2012. We have not weighted prices based on purchasing power parity.

Overall lowest price for a superfast broadband service

Figure 12 compares the lowest prices in our European benchmark countries and the USA.[23] The lowest-priced package is found in Germany, where Unity Media offers a service for GBP16.70 per month. The USA is the most expensive country among those considered: there, the lowest priced superfast broadband service is from Time Warner Cable and costs over GBP40 per month. Part of the reason for the high prices in the USA is that superfast broadband services always include TV as part of the bundle (i.e. it is not possible to take TV out of the bundle). Of the lowest priced European offers, only Numericable in France included TV as part of the package. In the UK, the lowest priced offer is from TalkTalk and costs GBP26.20 per month. It is notable that the three lowest priced offers in the EU7 are provided by cable operators for which there is no additional line rental charge, unlike the offers based on incumbent operators' networks.

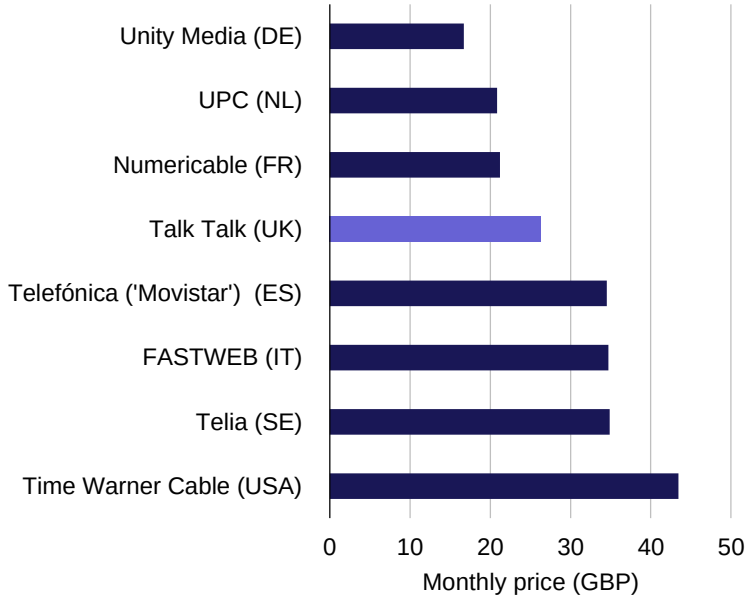


Figure 12: Lowest monthly price for superfast broadband[24] in selected benchmark countries, December 2012 [Source: Analysys Mason, 2013]

20 Ofcom's International Communications Market Report 2012 takes a different approach to our analysis, notably excluding line rental, which can lead to different results. In Ofcom's analysis, the UK at the end of 2012 had the lowest 'best offer' superfast broadband pricing when compared with France, Germany, Italy, Spain and the USA.

21 Some of the cable-based superfast broadband offers are provided on a broadband-only basis, i.e. without a voice service, in which case the customer does not pay an additional line rental charge. This is not the case for case for superfast broadband offers on incumbent operators' networks.

22 We have used a 48-month period as the average broadband contract lasts around four years.

23 We do not have comparable retail price data for Japan and South Korea.

24 Note that some of these services do not include voice as part of the package.

Lowest price for a superfast broadband service provided by an incumbent operator

Figure 13 shows the prices of the lowest priced superfast broadband offers from the incumbent operators in the EU7 and in the USA. BT Retail has the lowest price of all incumbent operators considered: its lowest priced service is the equivalent of GBP34.00 per month, slightly lower than offers from France Telecom (GBP34.20) and Telefónica (GBP34.50). BT Retail's price is 10% lower than the average price in the six European benchmark countries (GBP37.70).

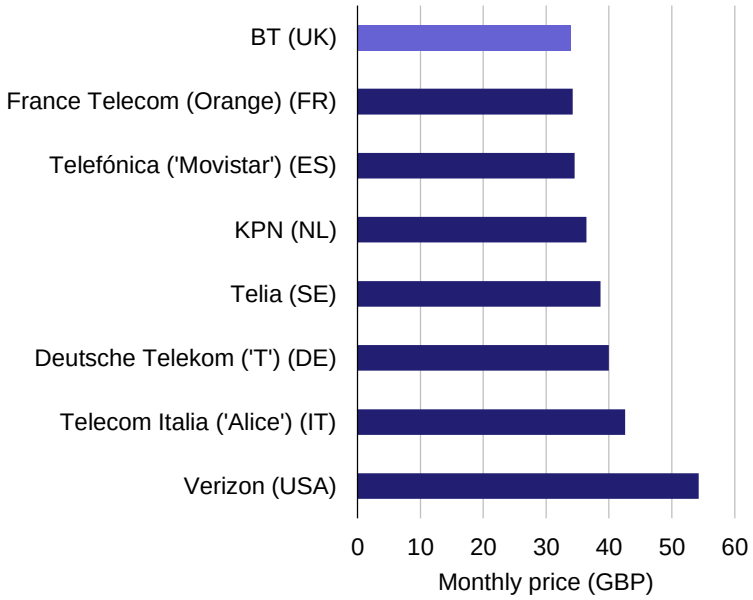


Figure 13: Lowest monthly price of superfast broadband service[25] offered by an incumbent in selected benchmark countries, December 2012 [Source: Analysys Mason, 2013]

3.5 Intensity of competition in the broadband market

The UK has the most competitive broadband market of any of the countries considered when measured in terms of competitive intensity.

In order to assess the competitive intensity in the benchmark countries, we have compared the Herfindahl–Hirschman Index (HHI) in each country. The HHI is a measure of market concentration:[26] a market with only one operator will have an HHI of 1; the lower the HHI, the greater the level of market competition.[27] Note that as we do not have data for market shares relating specifically to the superfast broadband market, we have used figures for the overall broadband market as a proxy, and therefore this analysis is approximate only. We note that other providers of broadband in the UK, such as Sky and TalkTalk, have only recently started selling superfast broadband products. As such, the

25 Most incumbent operators include fixed voice services bundled with superfast broadband. The prices compared here all include a fixed voice service.

26 HHI is calculated by squaring the market share of each operator in a market and summing the results.

27 There is no standard definition of what constitutes a highly concentrated market. However, the US Department of Justice generally classifies markets in three types (see section 5.3 of http://www.justice.gov/atr/public/guidelines/hmg-2010.html#5c) as follows: HHI below 0.15 is an unconcentrated market; between 0.15 and 0.25 is a moderately concentrated market; and above 0.25 is a highly concentrated market.

supply of superfast broadband today is more concentrated than the overall broadband market, with BT Retail and Virgin Media as the main suppliers. However, we expect this level of concentration to fall over time as the new providers gain market share of superfast connections.

As can be seen in Figure 14 below, the UK has the most competitive broadband market of all the countries in this study.[28] This high level of competitive intensity in the UK is a combination of a number of factors including the evolution of the cable network and associated upgrades to enable superfast broadband services, regulatory interventions by Ofcom, and government focus. These factors have helped to encourage provision of superfast broadband from BT Retail, Virgin Media and operators such as Sky and TalkTalk, and other smaller retail providers that use Openreach's access network.

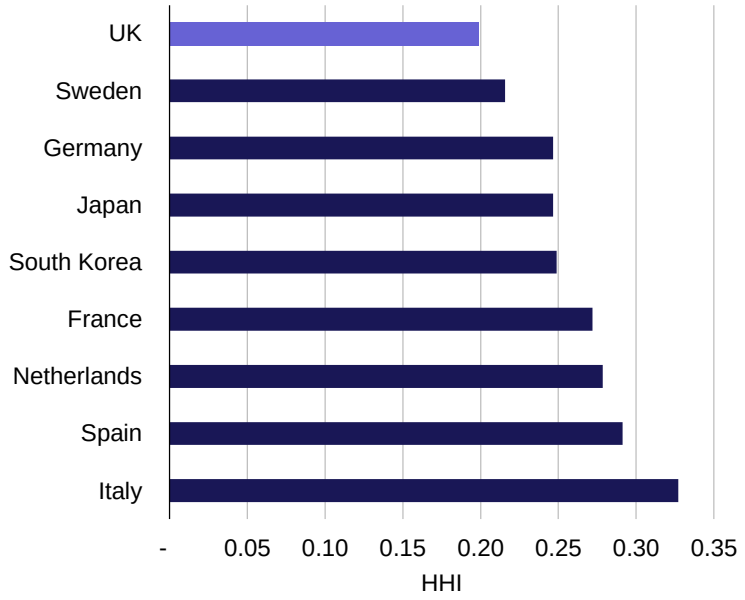


Figure 14: HHI for broadband market in benchmark countries, 2012 [Source: Analysys Mason 2013]

[28] The USA does not provide a suitable benchmark as its market structure is different from that in the UK and other EU countries.

4 Demand for superfast broadband

This section considers the demand for superfast broadband in the UK compared to the benchmark countries. We consider two different ways of assessing the level of take-up: (i) the overall proportion of premises that subscribe to a superfast broadband service, and (ii) the proportion of premises passed by a superfast broadband network that subscribe to a superfast broadband service. We also provide an illustration of potential future bandwidth requirements over the next five years.

4.1 Take-up of superfast broadband

The current take-up of superfast broadband in the UK is similar to other European markets. We expect future take-up to remain in line with other markets.

Superfast broadband adoption as a percentage of premises

Figure 15 shows the percentage of all premises that have a superfast connection in the UK compared to the EU7 and Western Europe, while Figure 16 shows the same data for the selected markets outside Europe.

Figure 15: Superfast broadband take-up as a percentage of all premises, UK and European benchmark countries, 2010–18 [Source: Analysys Mason, 2013]

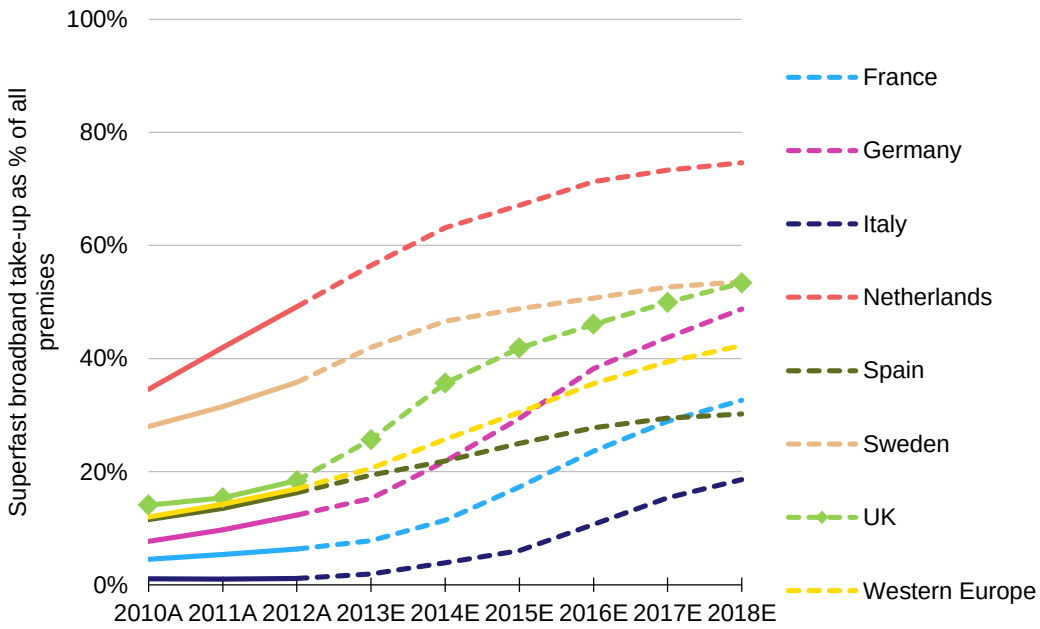
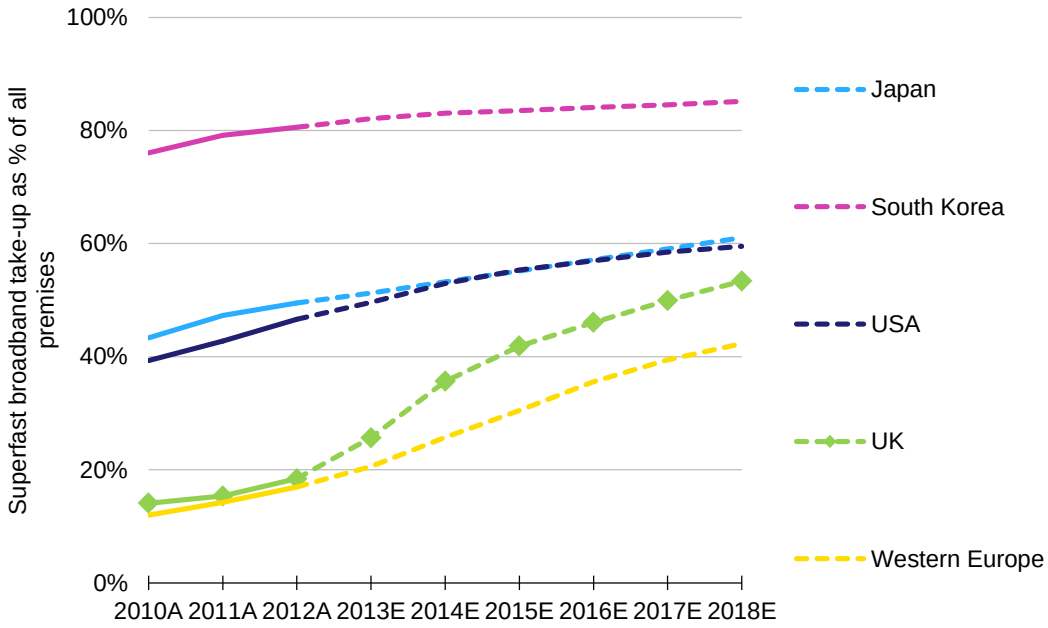


Figure 16: Superfast broadband as a percentage of all premises, UK and non-European benchmark countries, 2010–18 [Source: Analysys Mason, 2013]



For countries where superfast broadband networks have been available longest, notably the Netherlands and Sweden, take-up is higher. We expect the UK to maintain its third position in the EU7 by 2018, although the Netherlands is significantly above the UK. Sweden is currently significantly above the UK as well, although we expect that gap to lessen due to the UK's greater expected superfast broadband coverage. Before 2012, take-up of superfast broadband in the UK had been similar to the European average: at the end of 2012, take-up was 18% in the UK compared to an average of 17% in Western Europe. By 2018, we forecast that 51% of UK premises will have superfast broadband, higher than the average Western European level of 42%.

Looking at the non-European benchmarks, take-up of superfast broadband in the UK has so far been significantly lower than in Japan, South Korea or the USA. The UK will close the gap over the next five years; in 2018 Analysys Mason expects take-up in the UK to be around 10% lower than in Japan and the USA, and 35% lower than South Korea. We believe that the main reason why Japan, South Korea and the USA had higher levels of take-up than the UK in 2012 is simply the length of time that superfast broadband networks have been available.

Superfast broadband adoption as a percentage of available superfast connections

As an alternative measure of superfast broadband adoption, we have also looked at take-up in terms of the percentage of premises passed by a superfast broadband network that subscribe to a superfast broadband service. This is illustrated in Figure 17 below. Once again, take-up of superfast broadband in the UK is similar to the European average. At the end of 2012, 26% of the total available superfast broadband connections in the UK were 'active' (i.e. customers were paying for the superfast broadband service), compared to the European average of 29%. By the end of 2018, we forecast that

the UK will be in line with the European average, with 58% of available superfast broadband connected. Sweden is notable in that its long history of having superfast broadband networks available has resulted in its leading position on this benchmark.

Figure 17: Superfast connections as a % of total available connections, UK and European benchmark countries, 2010–18 [Source: Analysys Mason, 2013]

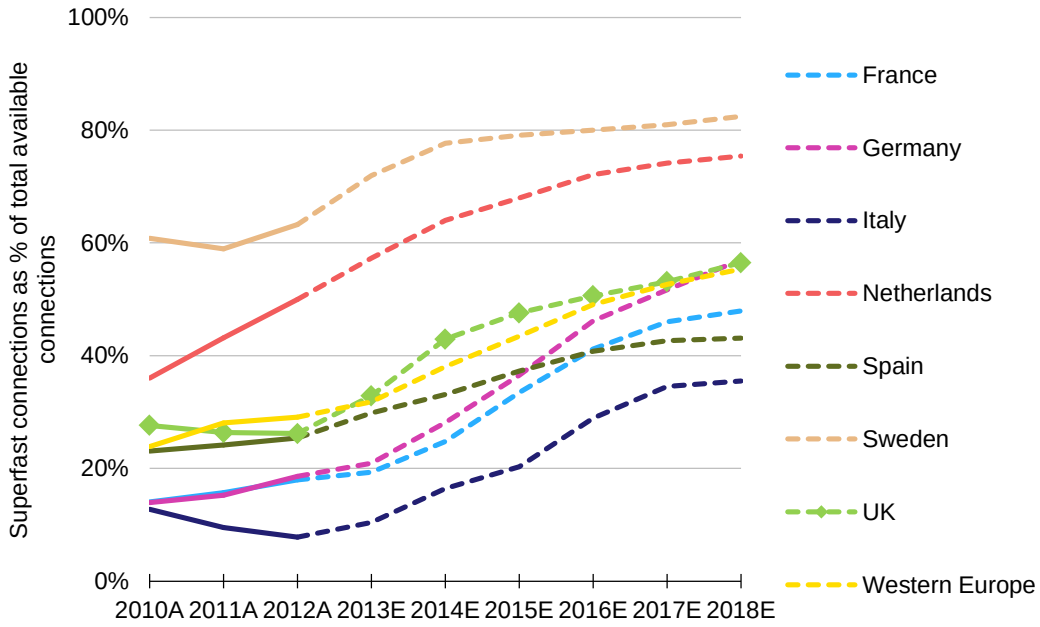
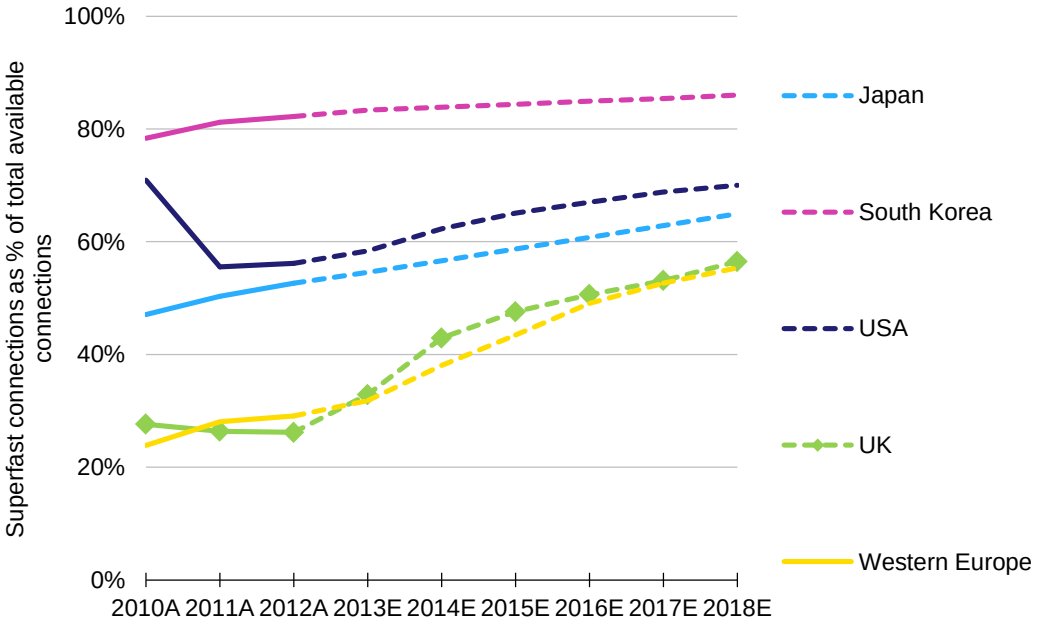


Figure 18: Superfast connections as a % of total available connections, UK and non-European benchmark countries, 2010–18 [Source: Analysys Mason, 2013]



4.2 Future bandwidth requirements

VDSL/FTTC, the technology used by most European incumbent operators including BT, is expected to be sufficient to meet expected bandwidth requirements over the next five years.

In this report, we do not intend to provide a comprehensive and detailed projection of how bandwidth demand might develop, by service or application, over time. Instead we present a simplified illustration based on the likely main driver of bandwidth demand, i.e. media services, which includes YouTube, catch-up TV services like the BBC's iPlayer, and other video-content dominated applications which could potentially include unicast or multicast TV services. We believe this illustration is valid for the next five years.

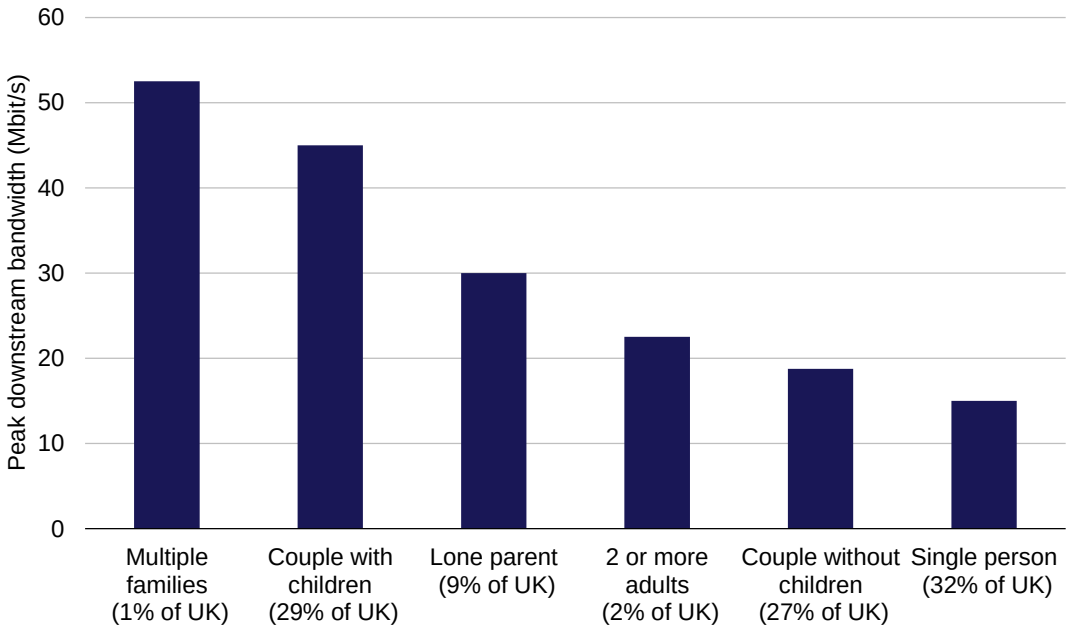
In this case, the key drivers of peak bandwidth demand are the number of potential concurrent media streams per household and the bandwidth per stream. We have the streams per household varying from 1.0 for single-person households to 3.5 for households with multiple families (this category accounts for only 1% of UK households). The assumed bandwidth per stream is 10Mbit/s, which broadly represents high-definition 1080p resolution. Clearly, higher-resolution streams such as 4K or 8K would increase the bandwidth per stream, although future compression technologies would temper the increase. Also, greater use of local storage (e.g. time-shifting using a PVR) could serve to reduce the number of streams per household.

In addition, we provide an allocation for other services, set as 50% of the total bandwidth required for the concurrent media streams. In the highest demanding household type, this allocation results in an additional 17.5Mbit/s, which is a significant additional amount for non-media-related applications; in the lowest demanding household type, the addition is 5Mbit/s.

The resulting bandwidth requirements are shown below, ranging from 15Mbit/s to 52.5Mbit/s[29]. This illustration suggests that, in the foreseeable future at least, the current use of VDSL/FTTC by many incumbent operators, including BT, is likely to be sufficient to meet most consumers' needs.

[29] The Broadband Stakeholders Group report, *Domestic demand for bandwidth*, published on 5 November 2013, arrives at similar conclusions. It calculates that the median household's bandwidth requirements in 2023 will be 19Mbit/s. More details, including links to the report and the underlying model, can be found at http://www.broadbanduk.org/2013/11/05/bsg-publishes-new-model-for-analysing-domestic-demand-for-bandwidth/

Figure 19: Illustrative peak downstream bandwidth requirement (Mbit/s) over the next five years, UK; figures in brackets are household type as a percentage of all UK households [Source: Analysys Mason, 2013]



5 Use of public money to fund superfast broadband

When compared with other, more interventionist strategies around the world, the approach taken in the UK is expected to deliver a good outcome for consumers, especially when considering the amount of government funding available.

The UK government's rural broadband programme is arguably the most geographically expansive superfast broadband intervention project in Europe. However, there are a number of other broadband projects in European countries, notably in Germany, Italy, Spain and Sweden (and to a lesser extent, France), which have been granted State-aid approval by the European Commission. These projects tend to be at a local or regional level, where the absolute amount of public funding involved is significantly lower than that being provided in the UK. Furthermore, information on total project costs and public funding is not always available in the public domain, and hence comparison with the UK is not straightforward.

In addition to these European projects, there are a number of other, high profile, international projects for which we are able to get a sense of the scale of investment that governments have committed to superfast broadband networks:

- *Australia* – the projected cost of the National Broadband Network (NBN Co) is AUD40 billion (GBP23 billion), of which around AUD27 billion (GBP15 billion) is planned to be provided by the government. However, due to the change of government in September 2013, NBN Co's strategy may change, which could affect the government's contribution to the initiative. As such, the results shown below for Australia could be subject to significant error.

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

- *Singapore* – the government is providing grants of up to SGD750 million (GBP375 million) to the OpenNet consortium (led by the incumbent operator, SingTel) to build the Next Generation National Broadband Network (NGNBN) and a further SGD250 million (GBP125 million) to Nucleus Connect, the operating company (led by StarHub, the cable operator). The private sector is expected to invest SGD200–300 million (GBP100–200 million). From January 2013, the network was required to meet all requests for fibre connections in Singapore (i.e. to provide universal service).

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

The following two charts compare the government initiatives in Australia, New Zealand and Singapore with the UK. We have estimated the government investment as a proportion of the total investment (i.e. including commercial investment), which is an indicator of the 'intensity' of government investment in delivering a superfast broadband outcome, measured here in terms of coverage, although it does not reflect the different technologies that will be used to provide that coverage.

For the purposes of this comparison, for the UK we have assumed that BDUK's GBP530 million is matched (1:1) by local authority funding, giving a total of GBP1.06 billion, and we have assumed that BT will invest an additional GBP750 million, in addition to the GBP2.5 billion it has stated for superfast broadband upgrades in commercially viable areas.

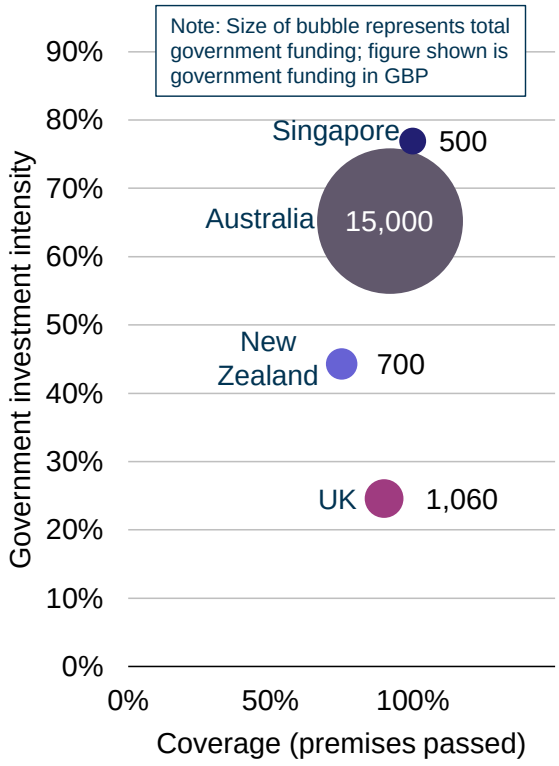


Figure 20: Total government funding in GBP (shown as size of bubble, with value alongside) plotted against government funding intensity and coverage for selected countries [Source: Analysys Mason, 2013]

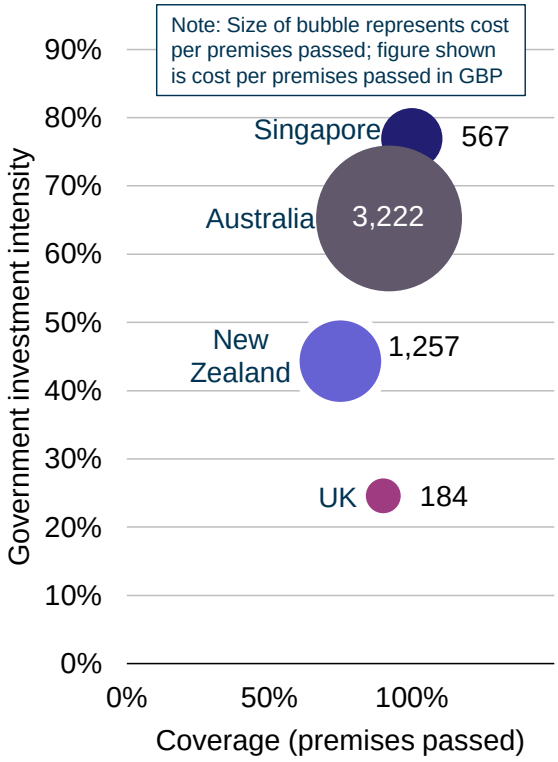


Figure 21: Cost per premises passed in GBP (shown as size of bubble, with value alongside) plotted against government funding intensity and coverage for selected countries [Source: Analysys Mason, 2013]

It is evident that the UK has taken a much more gradualist strategy to intervention in the market, focusing on rural areas, whereas the other three countries considered have undertaken national-scale initiatives, with significant amounts of FTTH deployed or planned to be deployed; these initiatives also have far-reaching impacts in terms of market structure. The approach taken in the UK costs significantly less, provides greater leverage of private-sector capital, whilst still providing very extensive coverage of superfast broadband. Furthermore, as we previously illustrated, this approach is likely to meet most consumers' requirements in terms of demand for bandwidth over the next five years, particularly when copper enhancement technologies such as vectoring are taken into account.

6 Implications of an alternative UK scenario based on FTTH

If five years ago BT had chosen FTTH instead of FTTC,[30] it is likely that BT's superfast broadband coverage would be significantly lower than it is today.

As an alternative way to examine the current situation of superfast broadband in the UK, in this section we assess the costs and timeframes of a counterfactual scenario in which BT chose to implement a fully, fibre-based (FTTH) access network, rather than focusing on a VDSL/FTTC[31] network. The chart below shows our forecast of how the roll-out of a full fibre network would have progressed compared to the actual roll-out of BT's superfast network. Clearly, our forecast for this hypothetical network is subject to a high degree of uncertainty, but is based on comparisons with other countries with large-scale FTTH roll-outs such as Japan and South Korea.

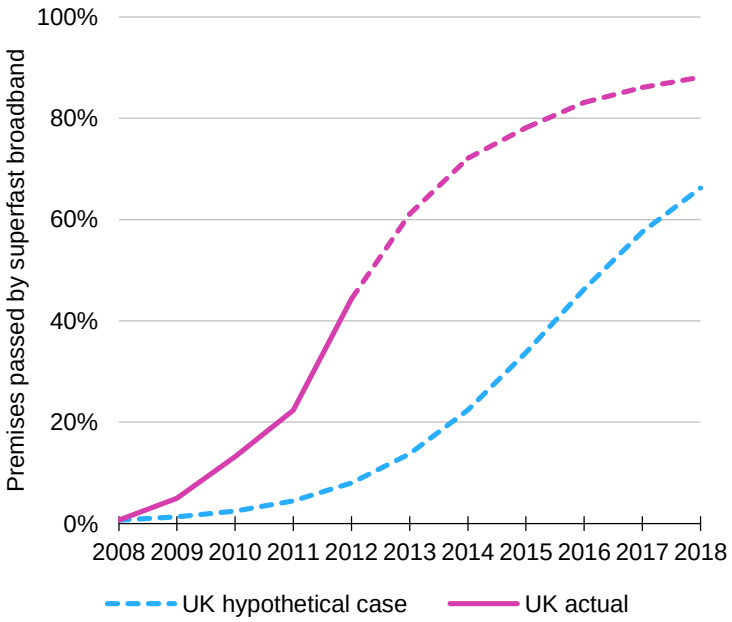


Figure 22: Percentage of premises passed by superfast broadband in the UK, actual VDSL/FTTC roll-out compared to hypothetical FTTH roll-out [Source: Analysys Mason, 2013]

BT's actual superfast network currently covers around 56% of premises (as of mid-2013). In contrast, the coverage of the hypothetical FTTH network would be significantly lower, estimated to be only 10–15% of premises. Even after ten years of network build, we believe that the FTTH network would be unlikely to cover more than two-thirds of premises, and achieving 95% coverage would be likely to take at least 15 years.

30 This assumes that BT could have financed such a network roll-out at that time.

31 We note that BT is planning to deploy FTTH in a small number of select areas as parts of its main superfast broadband roll-out.

In terms of cost, based on previous work that Analysys Mason has performed for the Broadband Stakeholders Group,[32] we estimated that the FTTH approach would cost a total of GBP25–29 billion.[33] In the same study, we estimated the total cost of a national VDSL/FTTC network to be around GBP5 billion.

In this hypothetical FTTH case, there are other factors to consider:

- The slow roll-out of FTTH would mean that there would be less choice of superfast broadband providers at the retail level; consumers who did not want to take cable would therefore only have a choice of retail provider for basic (exchange-based DSL) broadband.

- ADSL2+ (the DSL technology continuing to be used over the remaining copper lines) would likely be inadequate for some users by 2018. Reports commissioned by the FCC in the USA and Ofcom in the UK show that usage levels (gigabytes per month) are already severely constrained on connections with speeds below about 10Mbit/s. This minimum bandwidth requirement will increase over time.

- The roll-out of an FTTH network would require a sufficiently skilled resource pool. This could lead to further increases in costs or potential delays if there are significant resource constraints.

- The FTTH business model depends strongly on copper switch-off which raises a number of regulatory and technical issues.

- A large number of premises in rural areas might be excluded from access to superfast broadband for many years to come. Although wireless networks may offer NGA-like *speeds* to mobile-type users, they are likely to struggle to match the levels of *consumption* exhibited by fixed-type subscribers.

Even if the UK had gone down the FTTH route in 2008, it is possible that this decision would later have been reversed. Until recently, France was one of the countries with the strongest emphasis on FTTH, yet in April 2013, the French regulator ARCEP sanctioned the use of VDSL on the local loop for the first time, and the first commercial VDSL/FTTC services will be available before the end of 2013. Roll-outs of VDSL/FTTC will focus on areas not targeted for FTTH deployment in the near term, and in this way the adoption of VDSL/FTTC should help to speed up the availability of superfast broadband across France. We expect that, by the end of 2013, Orange (France Telecom) will only provide superfast broadband to 12% of premises, compared to the 61% of UK premises covered by BT.

32 See http://www.broadbanduk.org/fibrecosts.

33 These estimates were based on a take-up rate (excluding cable) of 50%, which is in line with the projections in this report for 2018.

Annex A Basic indicators for European countries

The table below presents a range of demographic and economic indicators for the EU7 countries considered in this report.

Figure A.1: Basic indicators for selected European countries [Source: Analysys Mason, 2013]

	Population (million)	Population relative to UK	Land area (sq km, thousand)	Land area relative to UK	Average population density (inhabitants per sq km)	Average population density relative to UK	GDP at market prices (EUR billion, purchasing power standard)	GDP per capita (EUR per capita, purchasing power standard)
France	65.3	103%	634	257%	103	40%	1,802	27,589
Germany	81.8	129%	357	145%	229	89%	2,566	31,358
Italy	60.8	96%	302	122%	201.5	78%	1,534	25,217
Netherlands	16.7	26%	34	14%	494.5	193%	549	32,827
Spain	46.8	74%	509	206%	92	36%	1,125	24,036
Sweden	9.5	15%	412	167%	23	9%	311	32,806
UK	63.5	100%	247	100%	256.8	100%	1,800	28,341
Source:	*Eurostat (2012)*	*Calculated*	*Inferred*	*Calculated*	*Eurostat (all 2011 except UK 2010)*	*Calculated*	*Eurostat (2012)*	*Inferred*