June 14, 2012

Via Electronic Filing
Marlene H. Dortch, Secretary
Federal Communications Commission
445 Twelfth Street, SW
Washington, D.C. 20554

Re: *Written ex parte presentation, WC Docket 10-90; WT Docket 10-208; AU Docket 12-25.*

Dear Ms. Dortch:

Mobile Future respectfully submits to the Commission the attached study, *Rural Mobile Services Deployment in the U.S.: The Challenges in an International Context*, by Michael Kende and Matthew Starling of Analysys Mason. The paper examines the unique challenges facing deployment of mobile wireless network infrastructure in the rural areas of the United States still lacking wireless broadband coverage.

Key findings of the study include:

- The U.S. has led France, Germany, Italy, Spain, and the U.K. in terms of population coverage by mobile networks at 3G or above, since approximately 2008; and,
- The most sparsely distributed 1% of the U.S. population lies with 1.8 million square miles of the country's total land area – more than twice the size of France, Germany, Italy, Spain and the U.K.

The report also details several options to overcome the challenges of rural deployment in the United States. These options include funding mechanisms such as the Connect America Fund, as well as licensing conditions that ensure spectrum is available to companies that are best able to deploy advanced networks.

Mobile Future urges the Commission to take into account the significant leadership the competitive U.S. wireless industry has provided in expanding mobile network coverage despite high investment costs and unique geographical challenges. As wireless providers seek to invest in more and faster wireless broadband infrastructure, Mobile Future believes that additional spectrum is critically needed to aid in these efforts. History has proven that as more spectrum becomes available, wireless companies invest to build it out and deploy new services and

products. Therefore, Mobile Future believes it is essential for the industry-wide need for additional spectrum to remain a top Commission priority, acting quickly to help spur continued innovation and investment.

Pursuant to Section 1.1206 of the Commission's rules, a copy of this letter is being filed via ECFS with your office. Please do not hesitate to contact the undersigned with any questions.

Respectfully submitted,

/s/ Jonathan Spalter

Jonathan Spalter, Chairman
Allison Remsen, Executive Director
Rachael Bender, Policy Director
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Attachment

White Paper for Mobile Future

Rural mobile services deployment in the US: the challenges in an international context

By Michael Kende and Matthew Starling

May 2012

Ref: 21231-103

analysys mason

Contents

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1 Executive summary

This white paper has been prepared by Analysys Mason Limited ('Analysys Mason') on behalf of Mobile Future, in order to examine the challenges facing the deployment of network infrastructure for mobile services in the United States, based on population and geography.

Analysys Mason has analyzed data on the population and geographic coverage by mobile networks in eight other members of the G20 that have a similar level of economic development to the United States: Australia, Canada, France, Germany, Italy, Japan, South Korea, and the United Kingdom (UK). Our analysis indicates that:

- The comparatively large size of the population of the United States (over 300 million) and its extensive land area (over 3.5 million square miles) pose significant challenges to the deployment of network infrastructure for mobile services across the country. In fact, to cover any given proportion of the US population with mobile services, the mobile networks deployed must cover a larger area than in our eight other benchmark countries, as shown below in Figure 1.1.

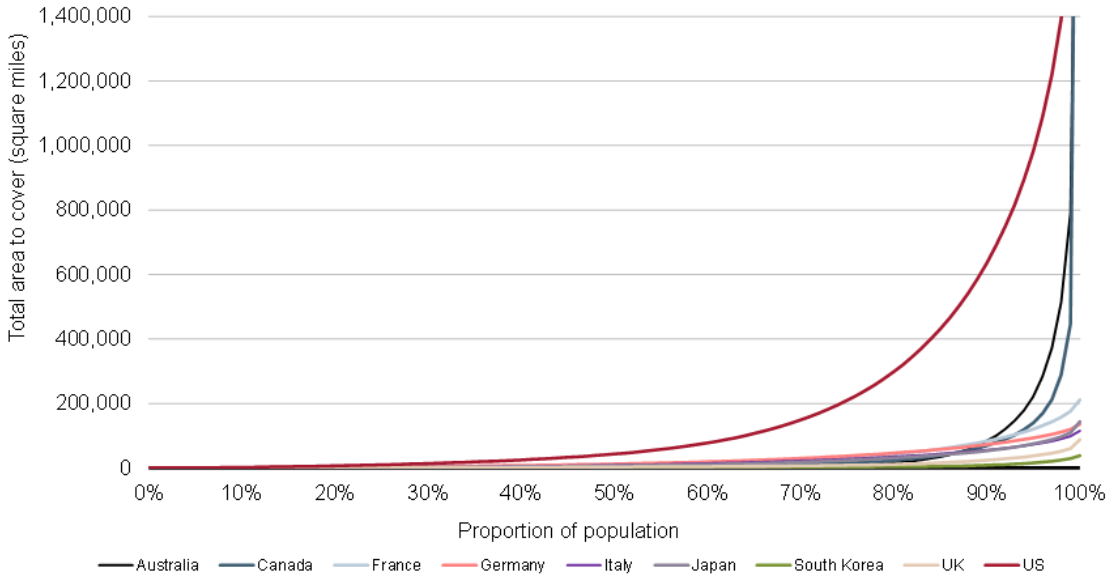

Figure 1.1: Total area to cover by proportion of population [Source: Analysys Mason]

- However, in spite of the high investment costs required to cover the large areas of low population density, the United States has been consistently ahead of France, Germany, Italy, Spain and the UK in terms of population coverage by mobile networks, since approximately 2008. This has included overtaking the geographic coverage of all five countries in only two years, as shown below in Figure 1.2. Furthermore, operators in the United States have invested significantly more in mobile networks than operators in the other five countries in the period 2006–2010.

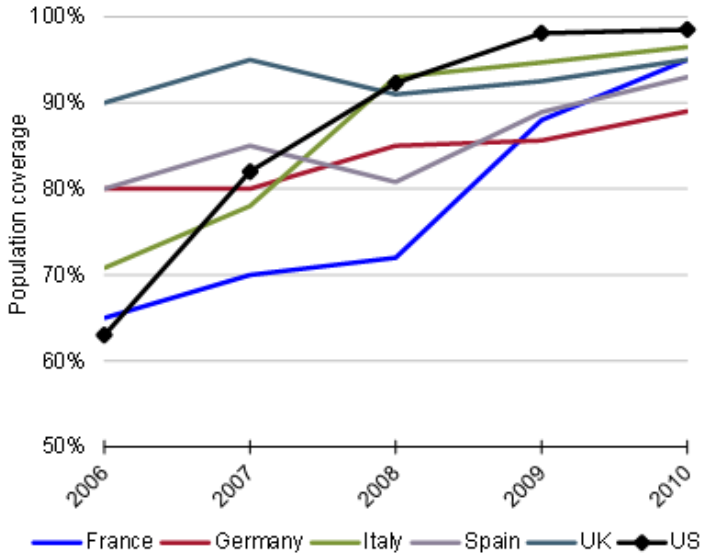

Figure 1.2: Development in population coverage of networks at 3G or above in the United States and a selection of European countries [Source: IDATE, FCC Mobile Wireless Competition Reports]

- How much further the population coverage by mobile networks at 3G or above can be extended remains unknown, since the final 1–2% of the population will require vast quantities of area coverage. In particular, the last 1% of the US population lies within approximately 1,880,000 square miles of the US land mass. Although some of this area will be entirely unpopulated, a significant proportion will still require network deployment in order to achieve coverage of this last 1%. It should be noted that 1,880,000 square miles is more than twice the size of France, Germany, Italy, Spain and the UK combined. We illustrate this area compared to the rest of the United States in Figure 1.3 below. Covering a significant proportion of this remaining area will require even greater investment than that of the previous five years, which will present a significant challenge. There are several options that could help overcome this challenge, such as funding through mechanisms such as the Connect America Fund, along with licensing conditions that would ensure that spectrum is awarded to the companies best able to deploy networks.

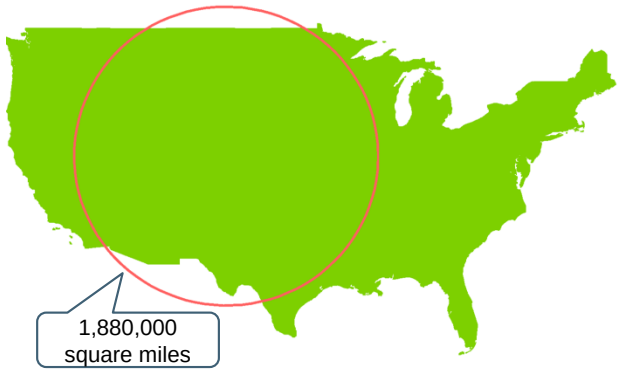

Figure 1.3: Illustration of equivalent area containing the last 1% of the US population [Source: Analysys Mason]

2 Description of findings

Analysys Mason has analyzed data on population as well as the geographical distribution of this population, for a selection of countries, and compared their characteristics to those of the United States. We have then further compared the population coverage in these countries by mobile networks using 3G technology or above.[1] Finally, we examine the investment implications of the US network requirements.

2.1 Overview of countries considered

In this white paper, the countries that we have compared for the purposes of our geo-demographic analysis have been Australia, Canada, France, Germany, Italy, Japan, South Korea, the United Kingdom and the United States. All of these countries are highly developed economies within the G20, as indicated by measures such as gross domestic product (GDP) per capita and the United Nations' Human Development Index (HDI)[2], as shown in Figure 2.1.

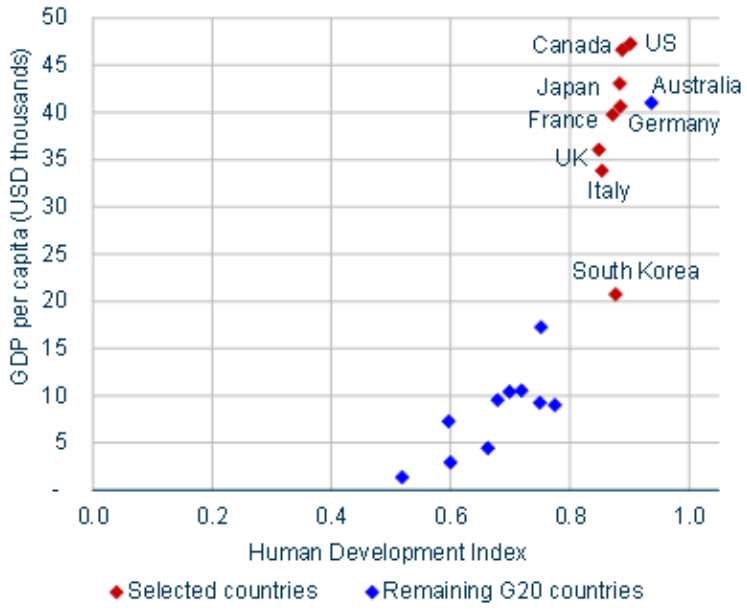

Figure 2.1: HDI and GDP per capita for the G20, excluding the European Union, in 2010 [Source: United Nations Development Programme, CIA World Factbook]

1 Therefore, in this white paper, W-CDMA, HSPA, LTE, mobile WiMAX, CDMA2000 EV-DO and CDMA2000 EV-DO Revision A are within scope.

2 HDI captures life expectancy at birth, mean/expected years of schooling and gross national income per capita. For 2010 values, see http://hdr.undp.org/en/media/HDR_2010_EN_Table1.pdf.

For each country, we have identified a dataset that splits the land mass into as many regions as possible with associated population and area statistics. These sources are summarized below.

Dataset	*Approximate number of regions*	*Total area (square miles) of regions*	*Population as of mid-2011*	*Source of regional data*
Australia	1300 statistical local areas	2,968,700	21,770,000	MapInfo
Canada	5400 census sub-divisions	3,481,800	34,030,000	Statistics Canada website
France	36,500 communes	211,500	65,310,000	MapInfo
Germany	14,000 municipalities	135,500	81,470,000	MapInfo
Italy	8100 municipalities	115,200	61,020,000	MapInfo
Japan	1900 municipal districts	143,800	126,480,000	Statistics Bureau website
South Korea	1400 eup/myeon	38,200	48,750,000	KSMA website
United Kingdom	9300 postcode sectors	88,200	62,700,000	MapInfo
United States	33,200 postcode areas	3,530,400	313,230,000	US Census Bureau website

Figure 2.2: Summary of geo-demographic sources used [Source: Analysys Mason, CIA World Factbook]

2.2 Geographic and demographic characteristics

Using the datasets specified above, we have separately calculated a population-area curve for each country. These curves can be assumed to represent the order of regions in which a mobile network will be deployed, since it can be seen as economically rational to deploy coverage in the most densely populated areas first (to provide service to as many subscribers as possible with as few base station installations).

For each country, we have derived these population-area curves by:

- calculating the population density (population per square mile) for each of the regions specified in Figure 2.2
- ordering the regions by population density, starting with the most densely populated
- determining the cumulative population and cumulative area for these ordered regions.

The curves generated for each country are shown below in Figure 2.3.

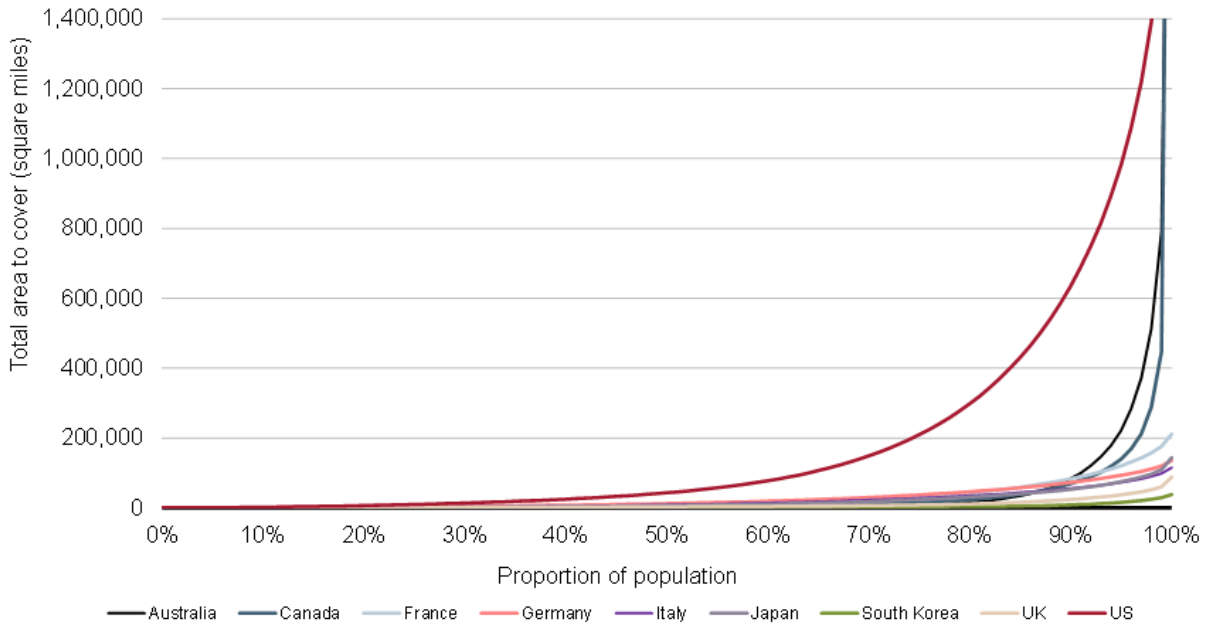

Figure 2.3: Total area to cover by proportion of population [Source: Analysys Mason]

As can be seen above in Figure 2.3, the population-area curve for the United States lies above those of the other eight countries in our benchmark. This means that, in order to reach any given percentage of the US population with mobile services, the mobile network deployed must cover a larger area than in these other countries. This will generally mean that a larger number of radio network sites are required in the deployment, leading to higher capital costs. Moreover, the population-area curve increases significantly faster than those of the other eight countries, meaning that the difference in area becomes extremely large at proportions of population close to 100%.[3]

It should also be noted that the full population-area curve is not shown for the United States in Figure 2.3 because of the scale: it is only that part of the curve up to approximately 98% of population. The remainder of the curve indicates that:

- the penultimate 1% of the US population (between 98% and 99%) lies within 260,000 square miles of the country's total land area
- the most sparsely distributed 1% of the US population (between 99% and 100%) lies within 1,880,000 square miles of the country's total land area.

[3] The exception is Canada, which almost catches up with the United Sates in area terms at more than 99.5% of population.

The latter is more than twice the size of France, Germany, Italy, Spain and the UK combined. We illustrate this area by the red circle superimposed on the United States in Figure 2.4.

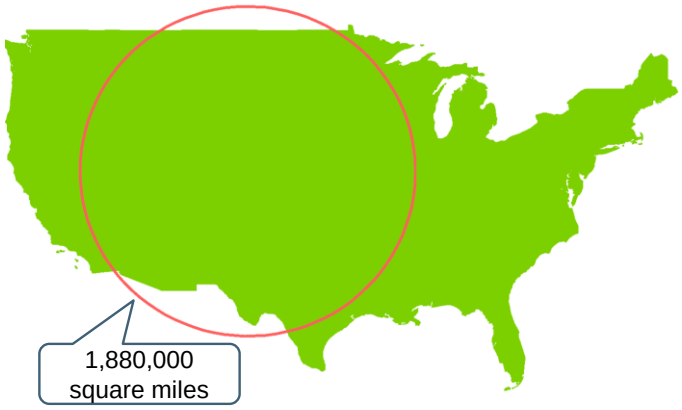

Figure 2.4: Illustration of equivalent area containing the last 1% of the US population [Source: Analysys Mason]

Not only must the mobile networks in the United States cover a larger area, but the total population served by them is significantly larger than that of the other eight countries. This is shown below in Figure 2.5, which illustrates the population-area curves from Figure 2.3 in absolute terms. In particular, the United States has a population double that of the next most populous country in our benchmark (Japan).

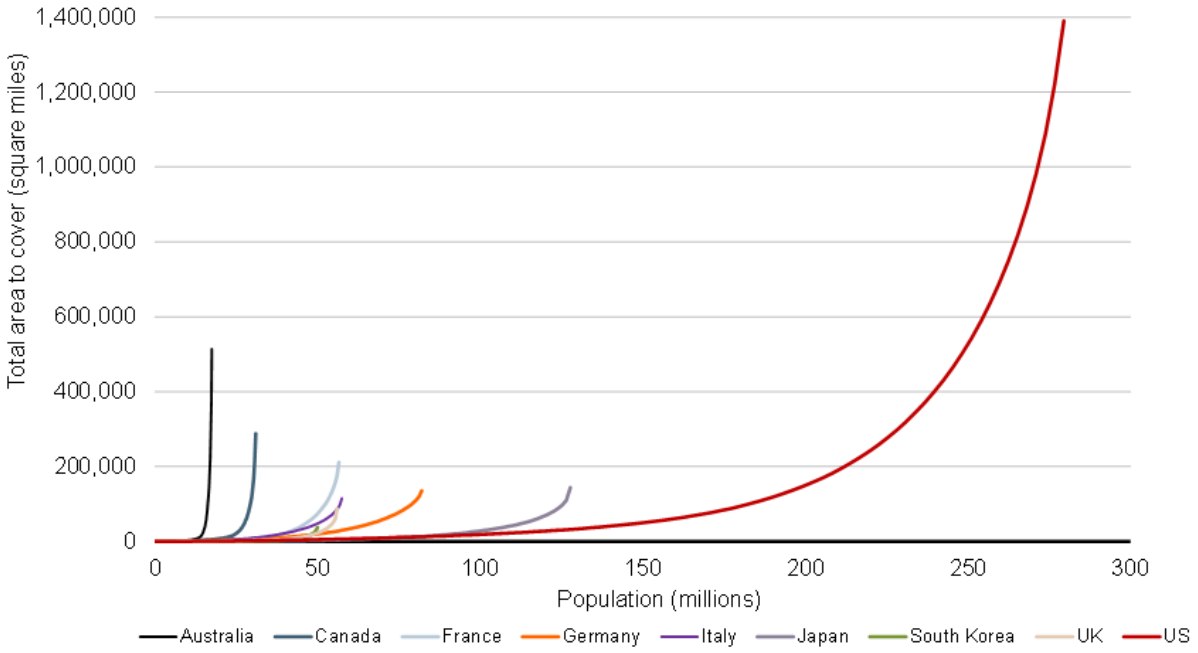

Figure 2.5: Total area to cover by population: up to 98% of the population for Australia, Canada and the United States; 100% of the population otherwise [Source: Analysys Mason]

As in Figure 2.3, the last 2% of the population in the United States is not illustrated so as to keep a sensible scale.

2.3 Population coverage characteristics

As described in Section 2.2, the distribution of the US population can pose a significant challenge for domestic mobile network deployments, since to reach a given proportion of the total population requires significantly higher area coverage than in our selection of eight other countries.

Despite this, information from market analysis firm IDATE indicates that the coverage by networks in the United States as a whole was only exceeded by a small number of countries in Europe in 2010. The coverage by such technologies in Europe and the relative position of the United States is shown in Figure 2.6.

Population coverage	*Countries*
100%	Denmark, Finland, Malta, Sweden
99–100%	Ireland, Latvia, Luxembourg, Netherlands
98–99%	Belgium, Portugal, **United States**
95–98%	Austria, Cyprus, France, Italy, United Kingdom
90–95%	Estonia, Greece, Spain
85–90%	Czech Republic, Germany, Norway
80–85%	Bulgaria, Hungary, Iceland, Lithuania, Slovenia
Below 80%	Poland, Romania, Slovakia

Figure 2.6: Comparison of population coverage in 2010 with networks using 3G or above[4] between the United States and Europe [Source: IDATE, FCC's Fifteenth Mobile Wireless Competition Report]

In particular, by the end of 2010, only eight European countries had superior population coverage using these technologies (a larger proportion of the US population is covered compared with Belgium and Portugal, which are the other two countries in the 98–99% category above). Many of these eight countries are extremely small in terms of area, making ubiquitous coverage relatively easy to achieve.

It should be noted that, although Sweden is a larger country in area terms relative to the rest of this group, it was also amongst the first countries in which there was a significant 3G network deployment. This was in part driven by the very specific nature of the award process. Held in 2000 by the national regulatory authority PTS, the licenses were awarded by a beauty contest rather than an auction. The license award was judged significantly based on each operator's proposed level of population/area coverage and speed of network roll-out, while the application fee for the license was minimal and the same for all applicants.

[4] In the case of the United States, this coverage value includes W–CDMA, HSPA, mobile WiMAX, CDMA2000 EV-DO and CDMA2000 EV-DO Revision A technologies

If we focus on the five European countries within our selection in Section 2.1, then the United States has gone from having the lowest population coverage in 2006[5] to the highest population coverage in 2008 and thereafter, as shown in Figure 2.7 below.

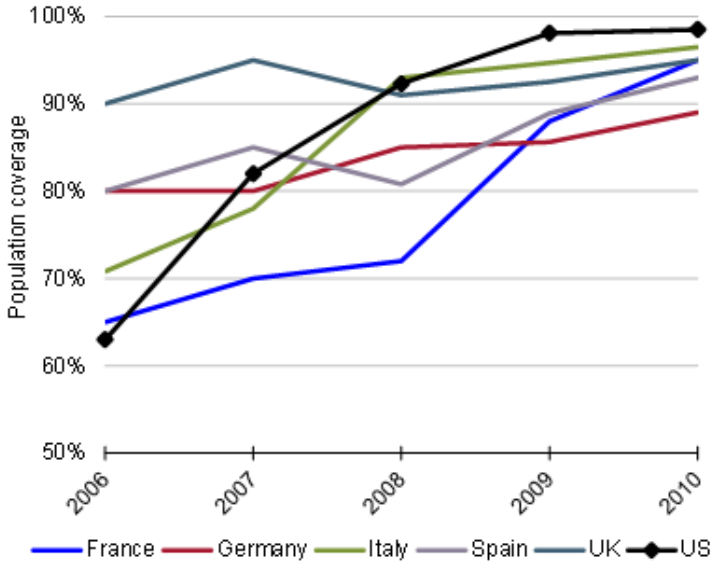

Figure 2.7: Development in population coverage of networks at 3G or above in the United States and a selection of European countries [Source: IDATE, FCC Mobile Wireless Competition Reports]

Significant increases in population coverage have therefore been achieved in the period 2006–2008, despite having to cover so many square miles of land compared to the other five countries. In fact, the population-area curve in Figure 2.3 indicates that to increase population coverage from 63% to 98% in the United States, as achieved from 2006 to 2010, requires that up to an additional 1,300,000[6] square miles of area was covered. This is greater than the combined area of France, Germany, Italy, Spain and the UK.

Data from EITO also indicates that, in the period 2006–10, United States operators have consistently invested significantly more in mobile network infrastructure than operators in France, Germany, Italy, Spain and the UK. This remains true in per-subscriber terms, as shown below in Figure 2.8. This demonstrates the financial implication of the US population distribution shown above – on average, more must be invested per subscriber than in the other countries examined.

5 The 11th FCC *Mobile Wireless Competition Report* indicates the coverage of W-CDMA/HSPA to be 20.2% of the population and that of CDMA 1X EV-DO/EV-DO Rev.A to be 62.6% of the population. The overall coverage of all four technologies is not given, so it has been estimated as the larger of these two values.

6 This will be an upper bound of the area coverage, since this assumes that the postcode areas we have used in deriving the population-area curve are always fully covered.

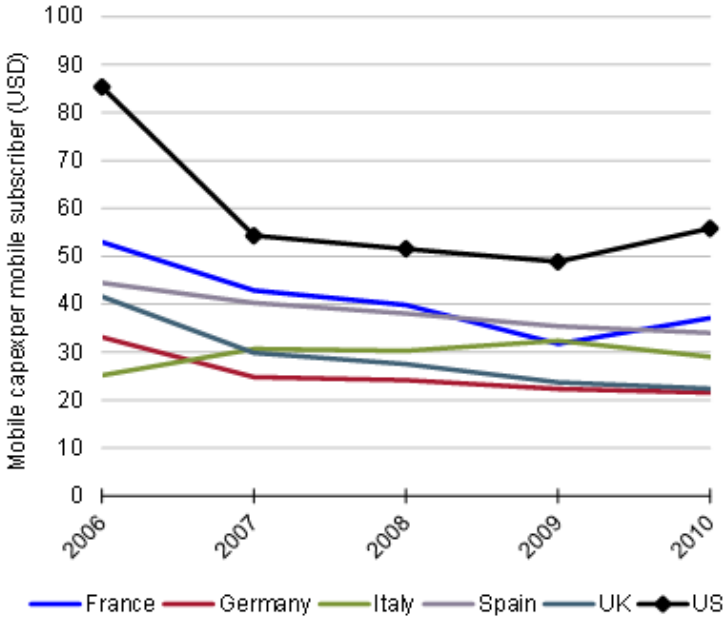

Figure 2.8: Total mobile capex per mobile subscriber for our benchmark countries [Source: EITO in collaboration with IDATE]

In addition, note that the Federal Communications Commission (FCC) *Mobile Wireless Competition Reports* indicate that mobile network coverage as a whole has become increasingly competitive since 2006.[7] Figure 2.9 indicates the proportion of the population that is covered by at least one, three, five or seven mobile network providers, respectively, during the period 2006–2010. In particular, the population covered by five or more providers has increased significantly in the period. Therefore, the increased population coverage indicated in Figure 2.7 is being achieved by multiple network providers.

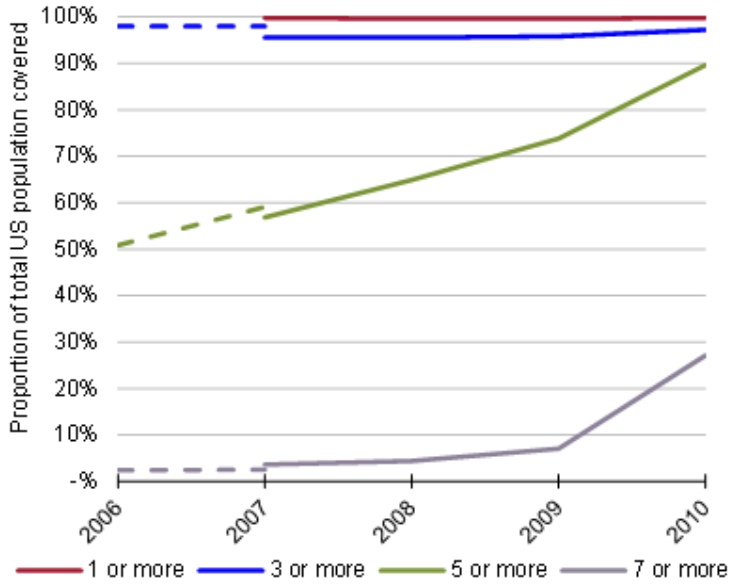

Figure 2.9: Development in 'competitive mobile coverage' of all mobile network providers in the United States since 2006 [Source: FCC Mobile Wireless Competition Reports]

[7] The dotted lines indicate that data in 2006–2007 are from the 11th and 12th *Mobile Wireless Competition Reports* and are based on county-level data, whereas all later years are based on census block-level data. No county-level data is provided for population coverage by one or more providers in 2006/2007, meaning that there is no red dotted line presented on Figure 2.9.

Since 2009, several mobile network operators in the United States (including Verizon, AT&T, Sprint and T-Mobile) have been undertaking significant upgrades and expansions of their networks with more advanced deployments, including LTE and other fourth-generation (4G) mobile architectures.

2.4 Conclusion

Our analysis shows that the large size of the population of the United States (over 300 million) and its extensive land area (over 3.5 million square miles) pose significant challenges to the deployment of network infrastructure for mobile services across the country. In fact, to cover any given proportion of the US population with mobile services, the mobile networks deployed must cover a larger area than in these other benchmark countries.

However, in spite of the significant investment required to cover the large areas of low population density, the United States has been consistently ahead of France, Germany, Italy, Spain and the UK in terms of population coverage by mobile networks at 3G or above, since approximately 2008. This has included overtaking the population coverage of all five of these countries in only two years, as well as exceeding the total investment (even on a per-subscriber basis) in each of these five countries in order to reach the additional subscribers.

Given these remaining challenges to provide mobile services to the most rural parts of the US population, but in light of the significant progress made in recent years, there are several options that can facilitate continued improvement in coverage. These include funding through mechanisms such as the Connect America Fund, along with licensing conditions that would ensure spectrum is awarded to the companies best able to deploy networks.

Appendix A About us

Analysys Mason would like to thank Mobile Future for its support in preparing this white paper. Analysys Mason is responsible for all the data and analysis contained in this paper.

A.1 Authors

This white paper is co-authored by Michel Kende, Partner at Analysys Mason, and Matthew Starling, Manager at Analysys Mason.

Michael Kende is a Partner at Analysys Mason and co-head of the Analysys Mason Regulation Practice. He is an economist by training, with a Ph.D. from the Massachusetts Institute of Technology (MIT). After MIT, he spent five years as a professor of Economics at INSEAD, a business school near Paris, before joining the Federal Communications Commission (FCC). At the FCC, Michael was the Director of Internet Policy Analysis, where he was responsible for managing a wide range of policy analyses and regulatory decisions on Internet policy (including interconnection), broadband deployment, and mergers.

Michael joined Analysys Mason in 2000. He has worked with operators and regulators in six continents, in both developed and developing countries, providing advice on a variety of mobile issues. His experience includes projects relating to spectrum assignments, mobile deployments, voice over Internet Protocol (VoIP) and broadband policy. His clients have included the World Bank, the IDA in Singapore, OSIPTEL in Peru, AT&T, and the European Union.

Matthew Starling is a Manager and a member of the Regulation practice in Analysys Mason's Cambridge office. Matthew joined Analysys Mason in 2005 and his primary area of expertise is in the cost modeling of telecommunications networks (both mobile and fixed). He has worked on such projects in both Europe and in other jurisdictions worldwide. He also has significant experience in the use of geographical information system (GIS) software packages for detailed analysis.

Matthew has a Master of Mathematics (MMath. First-Class Honors) from the University of Warwick in the UK.

A.2 About Mobile Future

Mobile Future is a coalition of cutting-edge technology and communications companies, consumers and a diverse group of non-profit organizations, working to support an environment which encourages investment and innovation in the dynamic wireless sector. Our mission is to help inform and educate the public and key decision makers in business and government on the broad range of wireless innovations that are transforming our society and the nation's economy. For more information, please visit www.mobilefuture.org.

A.3 About Analysys Mason

Analysys Mason is a trusted adviser on telecoms, media and technology (TMT). We work with our clients, including operators, regulators and end users in a variety of ways to assist and improve their market performance. With over 250 staff in 12 offices, we are respected worldwide for our exceptional quality of work, independence and flexibility in responding to client needs. For 25 years we have been helping clients in more than 100 countries to maximize their opportunities, through both our consulting and research divisions. For more information about our services, please visit www.analysysmason.com.