

## Creating a Fiber Future: The Regulatory Challenge

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Policymakers across the telecommunications industry want a regulatory framework that will stimulate competition in the industry while maintaining individual players' incentives to invest in network and service improvements. Industry regulators aim for a regulatory balance between competition and investment that maximizes consumer and social benefits. But as technologies and investment costs change, that point of balance moves.

Broadband technologies and investment costs are a case in point. For as long as broadband services have run largely on existing copper-based networks, regulators have focused on encouraging competition to spread those benefits as widely as possible by requiring incumbent operators to share their networks with new service providers. Now, however, fiber technologies with higher bandwidth speeds can potentially offer broadband services with far greater economic, consumer, and social benefits. Governments want fiber networks with national coverage so that all their citizens can enjoy high-speed broadband services. Operators want to build fiber networks, too, because revenues and profits from their existing networks are declining and fiber networks could potentially be a source of new income streams and lower costs. Yet fiber networks are hugely expensive to build and will be difficult to afford on a nationwide scale without some kind of regulatory concessions or subsidies from government. So, in order to maximize consumer and social benefits from high-speed broadband services, telecommunications policymakers may need, temporarily, to shift their focus from stimulating competition to facilitating the massive investment required to roll out fiber networks with national coverage.

This chapter explains the pressures on operators to build fiber networks, the related economic and regulatory obstacles standing in their way, and what those countries with widespread fiber networks have done to overcome those obstacles.

### Reasons to build fiber networks

Incumbent operators have powerful reasons to build fiber networks. These vary from country to country, but in general fall into three categories: first, governments want fiber networks for their potential to accelerate economic development and improve productivity. Second, competitive pressures from cable operators, niche fixed players, and mobile operators are mounting on fixed operators in voice and high-speed broadband markets. Third, fixed operators need to reduce costs if they are to continue to compete successfully against leaner and more efficient operators. The three categories of reasons are explored in greater details below.

### Governments and the economic benefits of fiber

Governments are keen to have nationwide high-speed broadband networks for their potential economic

**Table 1: The role of fiber networks in national agendas**

Role	Description	Examples
<b>Improve country's image</b>	Governments want to position their countries as technology leaders to: <ul style="list-style-type: none"> <li>• look better/faster and differentiate themselves from other competing nations</li> <li>• be seen as technologically advanced in order to attract FDI</li> </ul>	Singapore Hong Kong SAR Qatar United Arab Emirates Malaysia
<b>Remedy market failures</b>	Governments want to directly invest and supply fiber networks when the private sector fails to do so	Australia Singapore
<b>Increase spending</b>	Building fiber networks will help governments spend money in infrastructure while at the same time incentivizing consumer demand, especially in times of economic crisis	United Kingdom United States

Source: McKinsey analysis.

benefits: recent research shows an annual GDP increase of 0.6 to 0.7 percent for every 10 percent increase in broadband penetration.<sup>1</sup> As well as promoting economic growth, fiber networks help governments address other points high on their national agendas (Table 1). For instance, having a fiber network improves a country's image, making it appear quicker to adopt new technologies than competing nations and so more attractive to foreign investors. This has been the experience of countries including the United Arab Emirates, Singapore, Malaysia, and Qatar. According to the European Commission, fast and ultra-fast broadband access could have a similar revolutionary impact on people's lives as railways did more than 100 years ago, enabling digital innovation across businesses, health, and education. Second, it helps governments—as it has done in Australia and New Zealand—address market failures by investing directly in the fiber networks and taking care of the supply of high-speed Internet when the private sector has not done so. Third, investing in fiber networks meets the macroeconomic policy objective of governments in some countries that are emerging from the recent economic crisis to invest in useful infrastructure as a means of stimulating overall demand in the economy, as in the United Kingdom and the United States.

#### Competitive pressure from mobile and cable operators

The fixed industry is facing growing economic pressure to find new income streams as consumers use competing mobile and cable connections to access more and more services. Wireline operators across Europe saw their access line accounts fall from 192 million in 2004 to 146 million in 2008, an average yearly decline of 7 percent (Figure 1). This trend is having a strong knock-on effect on revenues and profitability: the industry in

Europe lost around €20 billion in revenues from 2004 to 2008 and €5 billion in profits over the same period. The same trend is apparent in most other countries around the world, as increasing numbers of users close their fixed voice accounts for the greater flexibility and ubiquity of mobile phone services.

The competitive pressure on fixed operators is even greater in countries that have cable infrastructure because cable companies can offer broadband speeds of up to 100 Mb/s if they have the latest DOCSIS 3.0 technology. In some countries, including Portugal and the United States, traditional fixed operators have responded by investing in fiber access technologies and are seeing their revenues increase as a result.

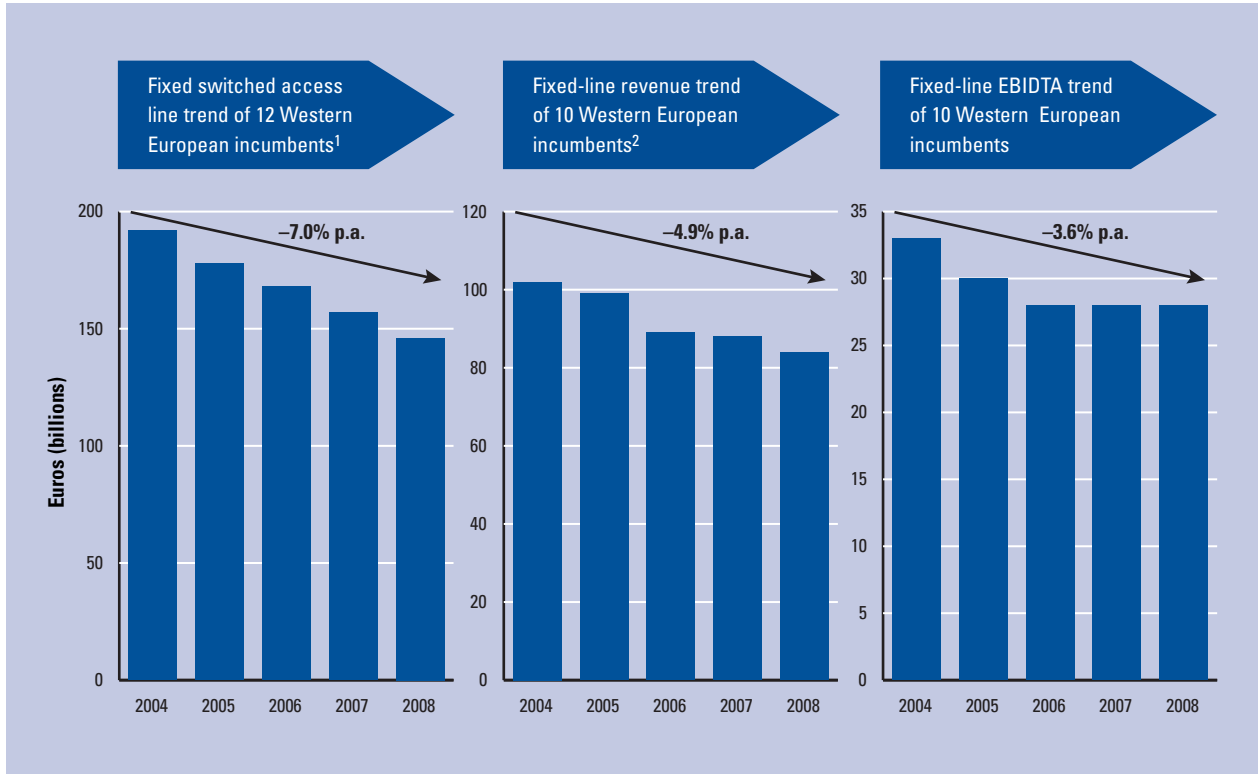
The range and attractiveness of services that high-speed broadband networks can deliver mean they represent potentially significant new revenue streams for operators that can afford to roll them out. In Western Europe, for example, although operator revenues from fixed voice services are forecasted to fall from US\$132 billion in 2006 to US\$115 billion in 2015, revenues from fiber based revenues will increase from US\$2 billion to 26 billion for the same period (Figure 2).

However, fixed incumbents must invest in fiber access technologies soon if they are to invest in them at all, because of the continuing decline in their revenues and profits. If fixed operators continue to lose access lines and revenues at the same rate as they have for the past five years, industry cash flows could be too weak to support any major investment in fiber access technologies.

#### Need to reduce costs

Fixed operators are also under increasing pressure to reduce their costs in order to compete with younger, nimbler competitors. Deploying fiber could transform their cost structures, potentially saving up to 80 percent

**Figure 1: Number of access lines, revenues and EBIDTA margins for fixed-line industry incumbents in the EU12, 2004–08**



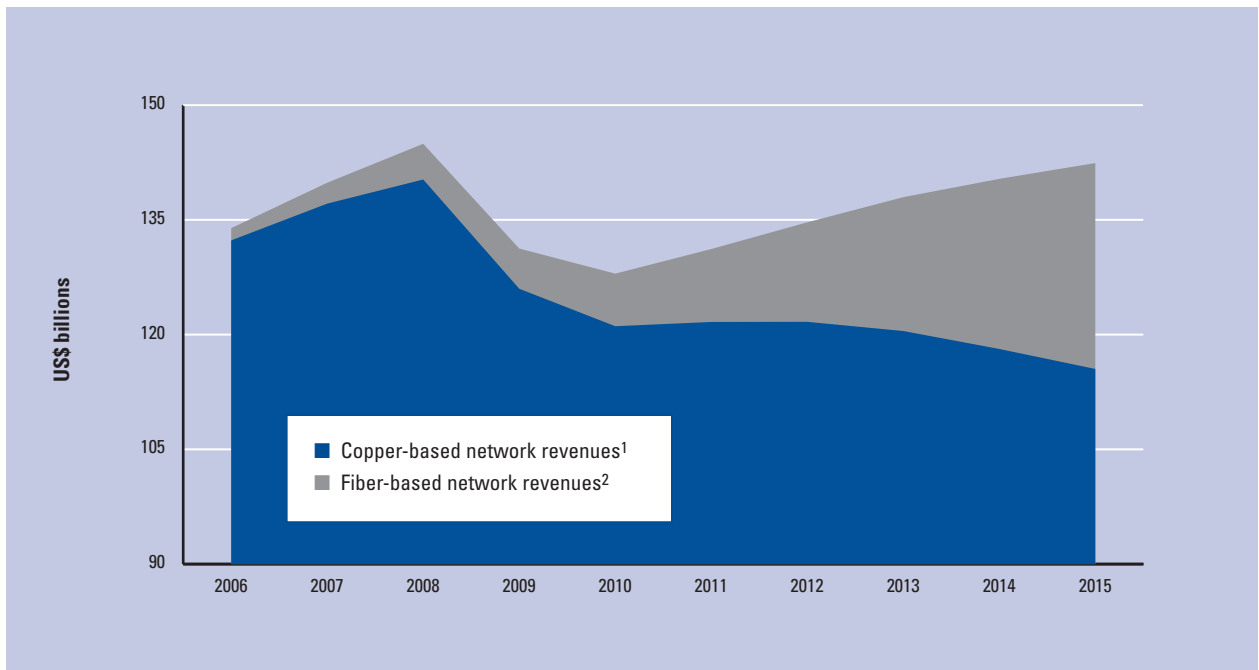
Source: McKinsey analysis.

Notes: *EBIDTA* refers to earnings before interest, depreciation, taxes, and amortization. The compound annual growth rate (CAGR) is the shown above the black arrows; CAGR figures are the average yearly decrease for this trend. The EU12 countries are Bulgaria, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, the Slovak Republic, and Slovenia.

<sup>1</sup> Domestic fixed lines for major European incumbents.

<sup>2</sup> Domestic fixed business of major European incumbents.

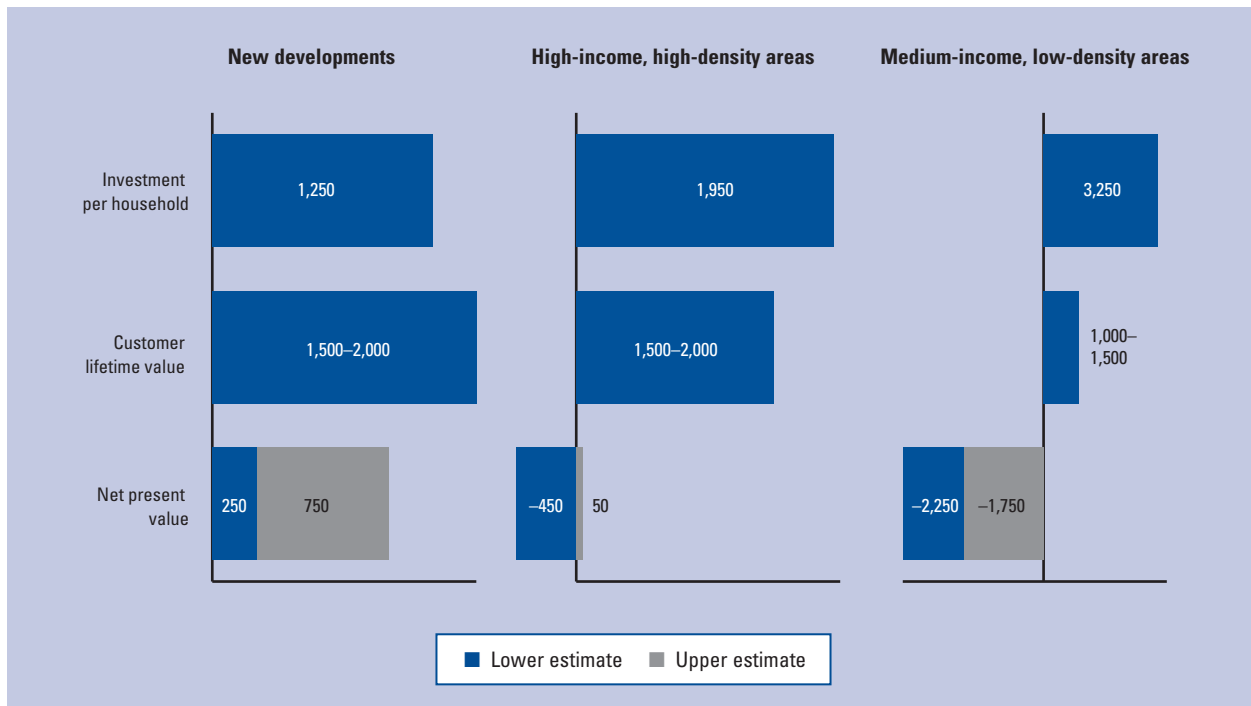
**Figure 2: The impact of fiber networks on the revenue model of the industry: Industry revenues in fixed voice and data, EU countries (US\$ billions)**



Source: Pyramid Research, 2010.

<sup>1</sup> These are revenues based on copper access networks (metered voice, voice access, and broadband); they include fixed PSTN telephony.

<sup>2</sup> These are revenues based on fiber networks, which include fiber broadband and IPTV.

**Figure 3: Fiber investments and returns, by area type (US dollars per household)**

Source: McKinsey analysis.

Notes: Margin for voice services is 70 percent, for ADSL is 45 percent, for IPTV is 30 percent, and for WACC is 15 percent. The figure assumes a 30 percent household penetration. The gap between the investments required and the customer value is large in an HSB investment and hence will require a long pay-back time of around 20–25 years. The bars are not to scale.

of their operating costs, mainly at the core and access levels of the network. However, operators are unlikely to realize most of these potential cost reductions until after their copper networks have been shut down completely.

Operational savings at the network core will come from eliminating legacy equipment and introducing soft switches, reducing floor space, simplifying network management processes and cutting maintenance costs. The remaining 30–40 percent of the potential reduction in operating costs will come from savings at the access level. Networks will need fewer, smaller exchanges, reducing their real estate costs. Installing modern and efficient equipment will also enable them to reduce their power consumption.

### Obstacles to a widespread fiber rollout by fixed operators

Given these reasons, operators should be looking forward to rolling out fiber networks. However this is not always the case, as two linked challenges are limiting their ambitions. First, the scale of investments required to upgrade copper networks to fiber-to-the-home (FTTH) is enormous, making the investment side of the business case for fiber, especially for nationwide rollouts, very challenging. Second, the returns are also uncertain. As with any new technology, operators face some risk that consumers may not immediately take up their high-speed broadband offers. More important for the uncertainty of returns, however, is regulatory

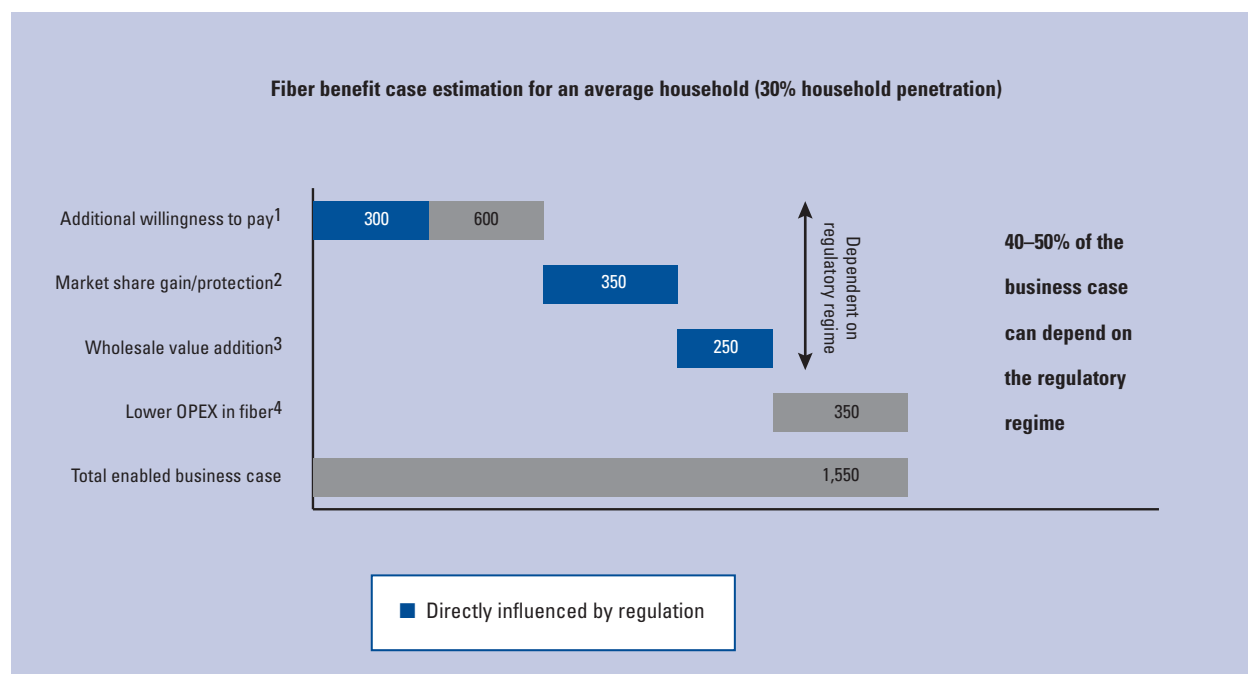
uncertainty. Each operator's business case for a fiber network depends on securing a stable income stream from the network to justify the massive investment. A stable income in turn depends on a certain regulatory regime giving operators rights to a predictable income flow from the network. But in many countries, regulatory frameworks governing the deployment of fiber networks are not yet stable. The main challenges involved in rolling out fiber networks are covered below.

### The challenge of the economics of fiber

Fiber networks are expensive to build. The European Union estimated recently that the cost of building fiber networks with a connection speed of at least 30 Mb/s to all households in its territory and connection speeds of 100 Mb/s to at least half of all households could require investment of between €180 and €270 billion.<sup>2</sup> In Australia, the government expects to invest \$A43 billion in deploying a national broadband network.<sup>3</sup>

For network operators, the high costs of rolling out fiber networks present a particularly complex economic challenge. Fiber networks built in heavily populated, high-income areas could yield modest positive returns for the network operator, although even in these areas there are the risks concerning the speed and extent of consumer take-up. In lower-density, lower-income areas, however, there is rarely any financial rationale for a private investor to roll out new fiber infrastructure.

Figure 3 shows that market forces on their own will stimulate investment in fiber network coverage only

**Figure 4: Investment (euros per household, CAPEX equivalent)**

Source: McKinsey analysis.

Notes: This analysis considers incumbent operators with both fixed and mobile business.

<sup>1</sup> Based on premium on retail price of €12/month (average over time, including inflation).

<sup>2</sup> Based on increased/protected market share and defended wholesale charges.

<sup>3</sup> Change from passive to active wholesale products.

<sup>4</sup> Forced migration to new fiber network (shut down PSTN).

in the few areas where this makes economic sense for private operators, notably greenfield, upmarket building developments where fiber deployment costs are relatively low. Private operators in emerging markets such as China, India, or the Middle East are therefore likely to roll out fiber networks of substantial size because of the natural expected expansion and upgrading of housing stock in these markets.

In more developed markets, however, where greenfield housing developments are now rare, with market forces alone it will take decades to upgrade the infrastructure to FTTH. Only in high-income, high-density areas or in areas where several infrastructure players compete will FTTH be deployed. Operators will likely roll out to most other areas a variety of lower-speed broadband options in the short term, such as broadband delivered via fiber-to-the-curb (FTTC).

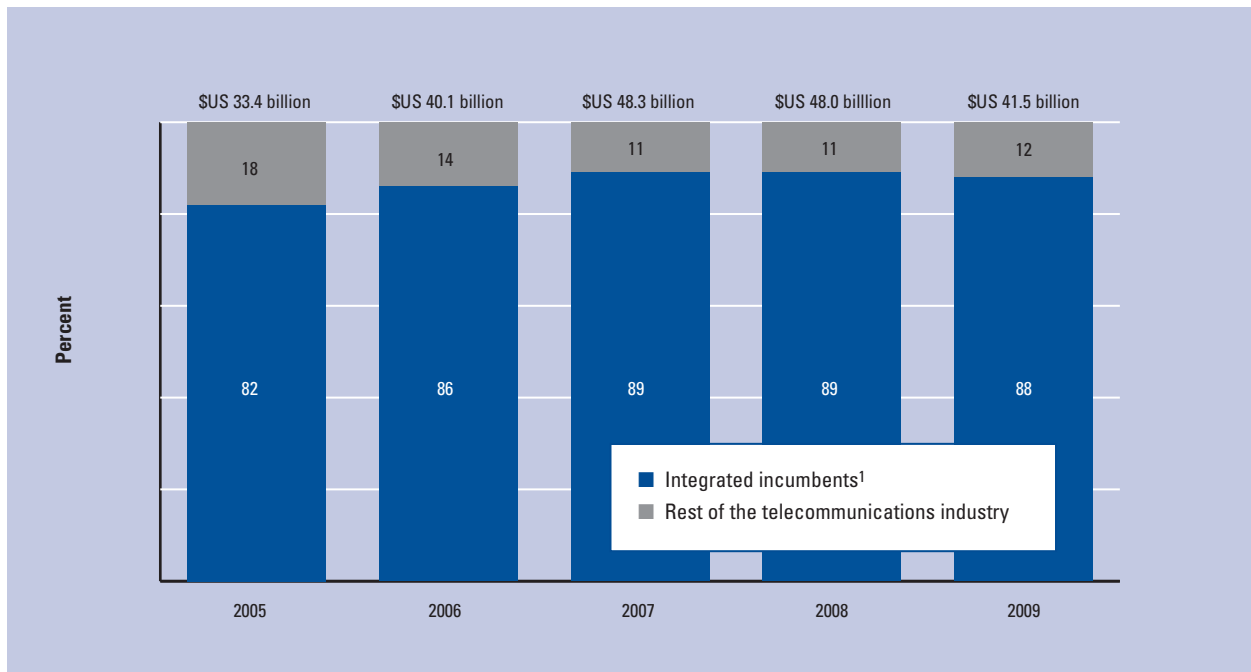
### Regulatory uncertainty

Regulations governing fiber access networks need to take into account the economic challenges for operators of deploying such networks, especially the enormous investment costs and demand risks. Consistent regulation is a necessary condition for investment in such an uncertain market context. But operators in many regions face continuing uncertainty about whether and how regulators will grant competitors access to newly built fiber networks, making returns from investment in fiber networks difficult to calculate. Telecommunications executives around the world are concerned that, absent

clear regulations enabling a robust calculation of the payoff, their approaches to investors for capital to build fiber networks will fail.

Figure 4 shows how heavily an operator's business case for deploying fiber depends on the regulatory regime. Regulation influences an operator's return on its fiber investments because it may affect consumers' willingness to pay for connection, control prices on new services, or delay savings from improved operational costs by delaying the transition from copper to fiber networks. As a result, 40 to 50 percent of a European incumbent operator's potential average return per household on investing in a fiber network depends on regulatory decisions.

Operators fear that regulators will apply to new fiber networks the old approach to broadband regulation, enforcing a wholesale regime that allows competitors to use an incumbent's network infrastructure. This kind of approach is likely to cap prices that incumbent operators can charge for wholesale fiber, significantly limiting the value of their investment in the network. Indeed, in those countries that have adopted such an approach, there has been less investment in new fiber infrastructures than governments have desired because of uncertainty about the future income streams that incumbents will earn from their investment. On the other hand, if regulators make rules to protect incumbents from competition on their new fiber networks for a given period, they can risk creating another monopoly.

**Figure 5: Distribution of US telecommunications companies capital expenditures, 2005–09**

Source: Bloomberg online database, October 2010.

Notes: The “market” for investments is driven by the incentives given to a few. Approximately 90% of these investments in the telecommunications industry in the United States are made by its 4 largest companies

<sup>1</sup> Verizon, AT&T, Sprint, and Qwest.

Regulators’ respect for a framework that promotes broadband competition is understandable. Over the past 15 years, the competition focus has worked well, reducing prices for most services, opening up networks, reducing cross subsidies, and increasing real consumer choice. But such an approach—combined with increasingly intense competition from mobile services and cable operators and the massive investment required to build fiber infrastructure—has made investment in fixed networks less attractive to incumbents just when governments want to have national fiber networks to boost economic performance.

The scale of investments required for fiber networks introduces an additional complication to fiber regulation, namely that very few industry players are of a scale that can make these investments. To illustrate, from 2005 to 2009, around 90 percent of total investments in network infrastructure in the United States were made by the four largest integrated operators in the country (Figure 5). Even operators of this size may need some additional incentive from government, in the form of a subsidy or regulatory advantage, to make the business case for building a fiber network stack up.

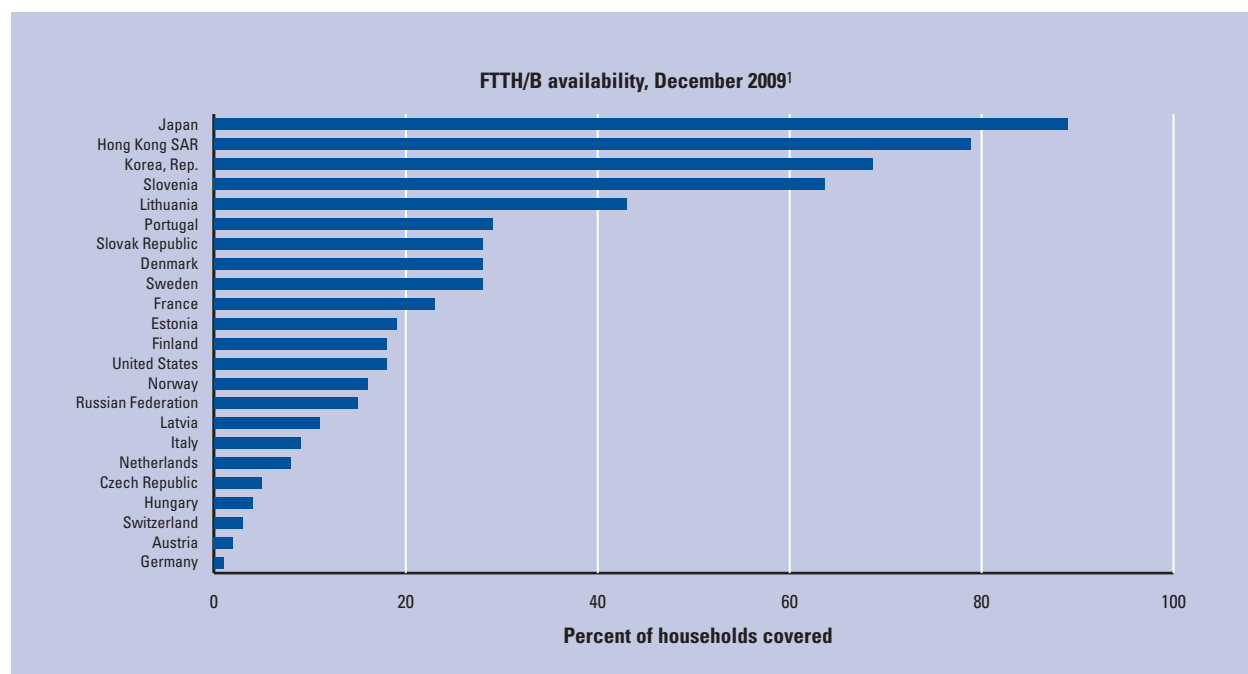
These changes in the broadband market context call for a regulatory approach that balances the need for investment more carefully against the need to support competition. Such an approach would recognize that new technologies are providing consumers with multiple means of access to voice and data services, changing competitive intensity in the industry and altering network economics. Policymakers may need to consider

offering tailored incentives to a very few, large industry players. Adapting regulatory frameworks to the new market situation may mean increased revenues for some operators in some areas, at least for a while, to stimulate investment in the fiber networks.

Regulators are already beginning to shift their focus. In the European Union, for example, Viviane Reding, former European Commissioner for Information Society and Media, stated “It is very important that the conditions to invest exist and regulatory certainty is one of those conditions. Today, the regulatory landscape in Europe is unfortunately heavily fragmented in this respect.”<sup>4</sup> This fragmentation may be one of the reasons that European countries lag behind their peers in investments in fiber. In countries with an investment-friendly regulatory approach to fiber, such as Japan, Hong Kong and Korea, Rep. (Korea), fiber rollouts are more advanced (Figure 6).

### Regulatory conditions for investment in fiber

Operators and policymakers everywhere are trying to find new regulatory compromises with the industry. Among the regulatory approaches so far devised to stimulate implementation of next-generation fiber networks, only two have resulted in widescale success: the first is to underpin returns by giving the investing operators exclusive rights to use their completed network, as in the United States; the second is to reduce the investment cost to incumbent operators by subsidizing investment in network construction, and then enforcing shared wholesale access to the completed network, as in

**Figure 6: Deployment of fiber networks in advanced telecommunications markets**

Source: FTTH Council, 2009.

Notes: FTTH/B is fiber-to-the-home/building.

<sup>1</sup> Or latest available date.

several Asian countries. A third scenario of open access with subsidies may be emerging in the European Union, though it is so recent that its success cannot yet be gauged. This section outlines these three regulatory approaches (Figure 7).

#### Exclusive rights to exploit new network assets: United States

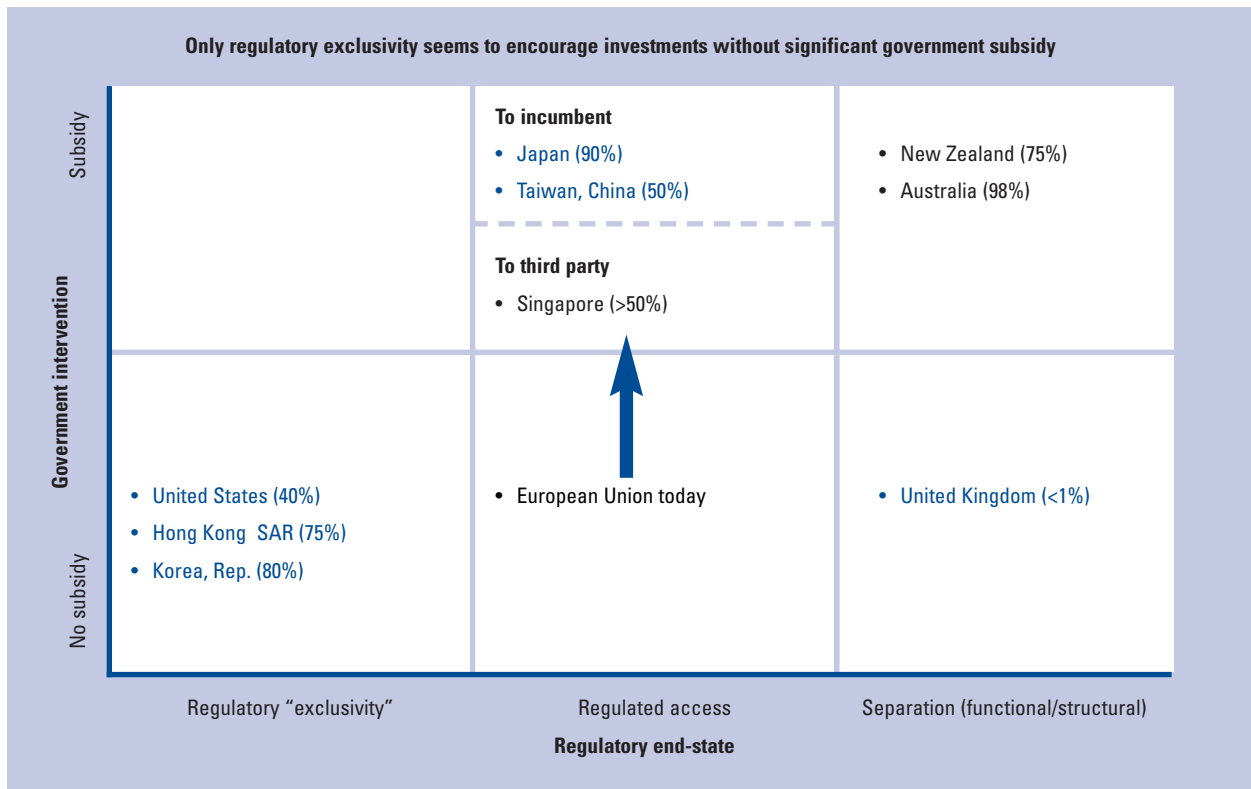
In parts of the United States and a few other countries, the rollout of new high-speed networks has been encouraged by infrastructure competition. If two competing networks exist in the same area and one operator invests in an upgrade to increase the speeds it can deliver to customers, this places pressure on the other operator to invest in an upgrade to offer comparable speeds or risk losing customers.

Infrastructure-based competition has emerged in countries such as the United States where legacy cable television networks operate alongside the copper telephone network. When these cable or hybrid fiber coaxial (HFC) networks were first built, they were dedicated to providing television services and did not compete with telephone networks. Then cable technology developed so it could deliver not only television but voice and Internet services at the same time. Cable and telecommunications operators found themselves with competing infrastructures, and have subsequently sought to match each other's performance. As the speeds available over cable have outstripped those that copper can deliver, telecommunications companies have rolled out optical fiber closer and closer to homes of customers in order

to deliver comparable performance over an ever shorter copper "last mile." The latest generation of cable technologies, DOCSIS 3.0, delivers speeds that have pushed the telecommunications companies to start connecting fiber all the way to the customer premises, doing away entirely with copper and enabling much faster speeds.

Where separately owned networks already exist, governments have tried to encourage their owners to invest in building new high-speed networks by granting them exclusive rights to exploit their newly deployed assets. In 2004, the Federal Communications Commission (FCC), the US regulatory authority, proposed that new fiber networks servicing the mass market would not be required to provide unbundled access to competitors. This contrasts with the much stronger unbundling requirements placed on copper networks under the US Telecommunications Act of 1996. The FCC felt that the strength of existing competition between cable and copper infrastructure allowed for a weaker access regime, and thus would stimulate the construction of new parallel network infrastructure without harming competition.

This form of exclusivity, along with competitive pressure from cable operators rolling out DOCSIS 3.0, provided the impetus for the construction of fiber-to-the-premises (FTTP) networks by Verizon and fiber-to-the-node (FTTN) networks by AT&T. In 2004 Verizon began deploying a US\$23 billion FTTP network capable of delivering up to 50 Mb/s download speeds and 20 Mb/s upload speeds. The network had passed 10 million premises by September 2009. In total,

**Figure 7: Approaches to widescale fiber access deployment**

Source: McKinsey analysis.

Note: Countries highlighted in blue reflect actual coverage; countries in black reflect planned coverage.

17.2 million households, or 15 percent of the United States, had been covered by FTTP deployments in September 2009, compared with only 180,000 homes at the time the access holiday was granted. Some 5.3 million US homes have now been connected to FTTP; 1.5 million homes were connected in 2009. Since 2004, AT&T has been rolling out an FTTN network capable of delivering download speeds of 18 Mb/s and upload speeds of 1.5 Mb/s. By the start of 2009, the network had passed 17 million households, and had plans to pass 30 million by the end of 2011.

Exclusivity guaranteed by regulation stimulates the expansion of high-speed broadband coverage because a guaranteed monopoly of services offered over the infrastructure means the investing operator is able to recoup its investment more easily. This advantage is likely to stimulate coverage in areas where building a network would have been uneconomic for operators if they had to allow competing service providers to use the network they had built on its completion, as is the rule under open-access regimes.

Achieving greater network coverage in this way entails a trade-off with some of the other benefits of competition. Markets that have infrastructure-based competition with no open-access regime tend to have higher prices for lower broadband service speeds than similar markets that do mandate open access. Furthermore, a regulatory "exclusivity" regime by itself is not enough

to encourage operators to extend high-speed broadband coverage to areas that will still be uneconomic to serve even for a monopoly provider: even with this benefit, both AT&T's and Verizon's high-speed networks have targeted high-income households. The United States has tried to address this challenge by investing US\$7.2 billion of government money in rolling out high-speed broadband infrastructure to areas that are essentially uneconomic for private operators to serve.

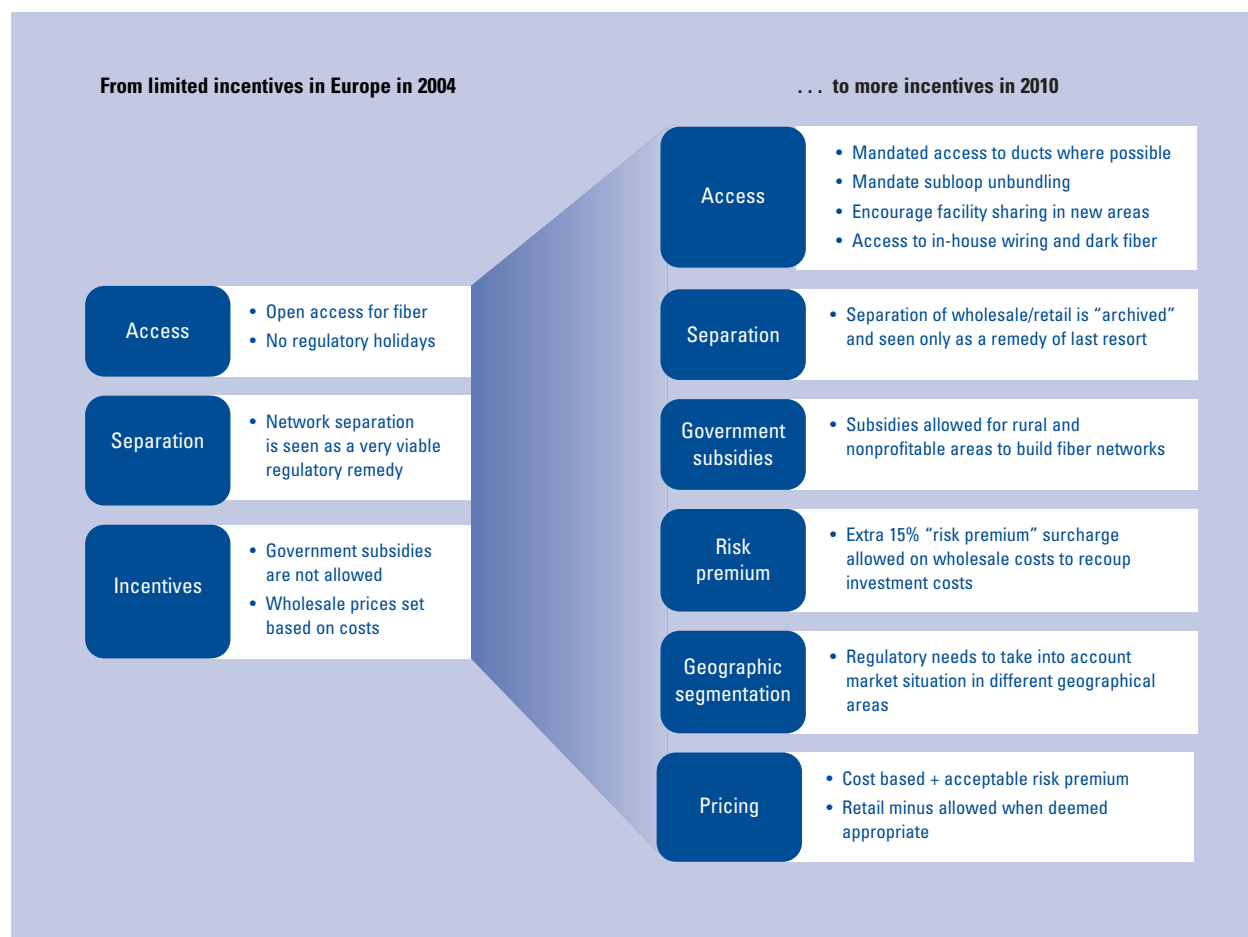
#### Government-sponsored upgrade with open access: Japan

Japan has the second-fastest average broadband speeds in the world, after Hong Kong, and the second highest penetration rate of FTTH, after Korea, at 34 percent of households. Most of this fiber network has been built by the incumbent Nippon Telephone and Telegraph (NTT), taking advantage of a package of tax incentives from the government that includes such elements as accelerated depreciation and deductions for business users, as well as low-cost loans.

The regulator mandated open access on copper in 1999, with wholesale prices set low to reflect the low costs of operating and maintaining a fully depreciated network. These measures encouraged strong competitors to develop in the DSL market, and broadband penetration grew from below 1 percent in 1999 to 66 percent in 2009. Competitive pressures from DSL, cable operators, and new smaller fiber players eventually compelled



Figure 8: Evolution of the EU copper regulatory approach



Source: McKinsey analysis; European Union, 2009.

NTT to develop an FTTP network; today, fiber is the dominant broadband access technology in Japan, having overtaken cable in mid 2008. However, the government clarified the regulatory framework that would govern the network before NTT started to raise the investment required.

NTT is required to grant access to the fiber network, but prices set by the regulator are high enough to guarantee adequate returns to NTT on its investment and prevent competitors from undercutting NTT's retail price. Regulated wholesale fiber access prices at approximately US\$55 per user per month are four to five times higher than copper local loop, reflecting the fact that the network is not yet fully depreciated. This leads to retail prices of US\$63 per month for an uncapped 100 Mb/s connection. The Japanese regulatory agencies take an active, adaptive approach and were reassessing the access regime and prices in 2010.

Through subsidies and incentives, Japan's government aimed to make FTTH available to over 90 percent of Japanese premises by 2010 as part of its *Ubiquitous-Japan* Internet policy launched in 2006.<sup>5</sup> By December 2008, 87 percent of premises had been reached.

### Evolution of the European regulatory framework

The European Union's experience illustrates the challenges regulators face in deciding how to regulate competitor access to fiber networks in a way that does not discourage investment in their development.

In 2004, there were limited incentives for operators in the European Union to build fiber networks. The "old copper" regulatory framework was applied to fiber: no regulatory reliefs for fiber networks were granted; wholesale access to fiber networks was widely mandated; enforced separation of wholesale and retail networks was seen as a powerful remedy against the dominance of incumbent operators in fixed networks, which were allowed no kind of subsidies or price flexibility on their wholesale access products.

Six years later, the European Commission has exchanged the old regulatory framework for one that recognizes the need to stimulate large-scale fiber investments differently (Figure 8). Changes to the old regulatory framework are aimed at increasing incentives for network operators to invest in fiber networks. The requirement for operators to separate their wholesale and retail businesses has been relegated to a remedy of last resort against dominance. Operators are allowed

to charge a 15 percent premium over copper wholesale access prices for fiber wholesale access, reflecting their higher investment risk. Governments are allowed to subsidize the roll-out of fiber networks to rural and unprofitable areas, and operators can adapt pricing regimes to different market contexts in different geographical areas. Last, the new regulations allow more flexibility on pricing on wholesale products.

## Conclusion

It is too soon to say whether the new regulatory approaches, such as the EU one, offer sufficient incentives and certainty to operators to stimulate the large-scale investments in fiber networks needed, but it is certainly a start in that direction.

It is clear that business as usual will not work. More innovative ways of collaborating among local and national governments, operators, and regulators will be required. Broadly, governments can act to spur demand for high-speed broadband among citizens, provide investment support for industry players, and—perhaps most important of all—put forth a compelling vision of the economic benefits of a “high fiber” future. Regulators need to find the right ways, within their economies, to balance the need for competition against the creation of an investment-friendly environment.

Fixed-line operators can recover falling revenues and improve their operating costs by deploying fiber networks. But the investments that such networks require are so large that regulatory support of some kind is essential to guarantee that they are able to make a positive business case. Regulators need to manage carefully any shift in their regulatory focus from competition to investment incentives, in order to get the balance right. But they must also avoid continuing regulatory uncertainty, which is delaying the investment in fiber networks that all sides of the industry want. Incumbent fixed operators are mindful of their duty to work with other stakeholders in the industry—government, policymakers, and competitors—to achieve national aspirations. But to achieve national fiber network coverage, governments and policymakers may need to re-examine their current approach to regulation.

## Notes

- 1 Beardsley et al. 2010.
- 2 European Commission 2010.
- 3 Australian Government 2010.
- 4 Reding 2008.
- 5 Izumi 2006.

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