# Communications Review

## Value: Getting it. Giving it. Growing it.

pwc

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*Value. You need to deliver it. Your shareholders demand it. Your customers expect it. In this issue we present articles that explore how communications companies can harness, create and expand value in an ever more complex world of interrelated risks and opportunities.*

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PwC's Communications Industry practice delivers a complete range of professional services to telecom, cable, satellite and Internet service providers across the globe. The group provides industry-focused assurance, tax and advisory services to build public trust and enhance value for its clients and their stakeholders.

Drawing on our accumulated experience, we anticipate and meet the challenges of global regulatory change, and help our clients deal with the impact of industry convergence. We continue to add measurable value to our client relationships through our leadership and innovation, which are evident in our evolving services and products.



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# *Message from the editor*

This edition of *Communications Review* is being published at a moment when the outlook for the global economy—and for the business environment for communications operators—is both fascinating and finely balanced. On the one hand, growth is powering ahead in many (especially emerging) markets following the downturn. On the other, continuing concerns over sovereign creditworthiness, especially in the eurozone, are inhibiting confidence.

The resulting mix of optimism and uncertainty is fostering a continuing sense of caution among consumers and businesses in many markets. However, for those communications providers able to identify and seize them, real and sustainable sources of value do exist. Often, seizing opportunities requires courage and an ability to think beyond the traditional boundaries of the industry and tap into what is new and previously unforeseen. For those reasons, the theme we have chosen for this issue is how to harness, create and expand value in an ever more complex world of interrelated risks and opportunities.

In the first article, “Staying relevant in a mobile data world”, authors Colin Light, Andrew Light and Vincent Teulade examine how successfully the industry has lived up to the promise of “information on the run, anytime, anywhere”. Initially, the combination of bandwidth constraints, small screens and confusing prices left consumers disappointed and often baffled. However, with all these barriers now being overcome, opportunities to unleash a new generation of mobile applications—and to create additional value for customers and shareholders—are expanding apace.

As the authors point out, content creators, service providers and handset manufacturers are all competing hard for a share of this value, by seeking to roll out innovative and compelling offerings for consumers. So far, operators have been struggling to keep up. To close the gap in this race, they will need to develop clear and cohesive strategies encompassing aspects that include the right business model, product, infrastructure and financing. With the consumer now firmly at centre stage, the way operators respond will shape their longer-term prospects—and the keys to success will lie in creating the right user experiences and in maintaining a customer-centric approach.

In our second article, we drill down into one specific area of opportunity that offers huge potential for creating value: e-health. In “Healthcare unwired”, drawn from a recent study by PwC’s Health Research Institute, authors Dan Garrett and Christopher Wasden examine what they believe are abundant opportunities for mobile communications to transform the way health applications and services are designed, developed and delivered. To capitalise successfully on these opportunities, operators must understand, as well as respond appropriately to, the attitudes, preferences and needs of stakeholders across the health industry. As the authors highlight, this is an area where operators—by enabling rapid advances in a vertical sector that is ready for and highly receptive to the technologies now available—can both capture and give a lot of value.

The next article, “Making better bets”, widens the focus to how operators can maximise the returns from their overall capital expenditure investment, in a world where capital is still at a premium. In the view of authors Gary Taylor, Trigvie Robbins-Jones and Ian Corden, companies can glean significantly higher value from their investments by applying greater discipline during the decision-making process. This means moving away from the traditional approach, based on producing reams of paperwork, and instead cutting through the fog of data to focus on the issues that really affect the value returned.

The authors prove their point by isolating and discussing four key obstacles that often cause major investments to fail to deliver the hoped-for value. They close the piece with a valuable five-step guide to best practice in optimising project capex. I believe this article makes a major contribution towards helping the industry address one of its traditional pain-points—and I urge anyone interested in these insights to contact me or the authors to find out more.

Last but not least, our fourth article sees author Brian Potterill take a step back to examine the wider effects of the global economic and fiscal environment on the rollout of ultrafast broadband services. As he points out, policymakers—especially in Europe—are seeking to encourage the availability of ultrafast broadband as part of their efforts to stimulate their economies. However, public discussions on this topic often confuse two distinct issues: universality and ultrafast broadband. Whilst both these aims have the potential to create higher value for societies and operators, the opportunities vary widely, not least between urban and rural areas.

Mr. Potterill concludes that the “digital divide” is set to stay. Urban areas can expect superfast broadband sufficient to support multiple streams of high-definition TV and competition at least at the service layer. Rural areas, in contrast, will not achieve ubiquity of broadband availability. While some rural areas will benefit from urban-type speeds, many others—with service delivered over existing copper or over wireless or satellite—will have to make do with speeds that barely support today’s mass-market applications. To serve these different market segments, incumbents will need to develop different business models.

We see value as an increasingly critical component of every business’ strategy, including our own. You may have noticed that this issue of *Communications Review* has a different look. It is the first to be published under our new brand, which focusses on value and clarity of expression. This focus makes it doubly appropriate that the theme of this issue is seeing and seizing value-creating opportunities. If you would like to discuss or comment on any of the ideas expressed in this issue, I am eager, as ever, to hear from you. So please send any comments to me at colin.brereton@uk.pwc.com, or feel free to call me on [44] (0) 20 7213 3723.

Colin Brereton
Partner
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# Staying relevant in a mobile data world

*"Information on the run, anytime, anywhere" was the promise of early versions of mobile data applications and devices. Wireless Application Protocol and other proprietary platforms seemed to offer consumers the ability to take content and the Internet with them wherever they went. Unfortunately, slow speeds and small screens, along with per kilobyte pricing that baffled consumers, meant that users' experience fell very short of the industry's ambitious promises.*

*Today, smartphones, high-speed connections, "all-you-can-eat" data tariffs and the removal of operators' walled content gardens are driving a dramatic change in attitudes to and uptake of mobile content and data. Is the dream in danger of turning into something of a nightmare for operators? Do content creators and handset makers really have everything to play for? Or are the technical and lowest-cost challenges likely to favour the big, overly innovative and creative players?*

**By Colin Light, Andrew Light and Vincent Teulade**

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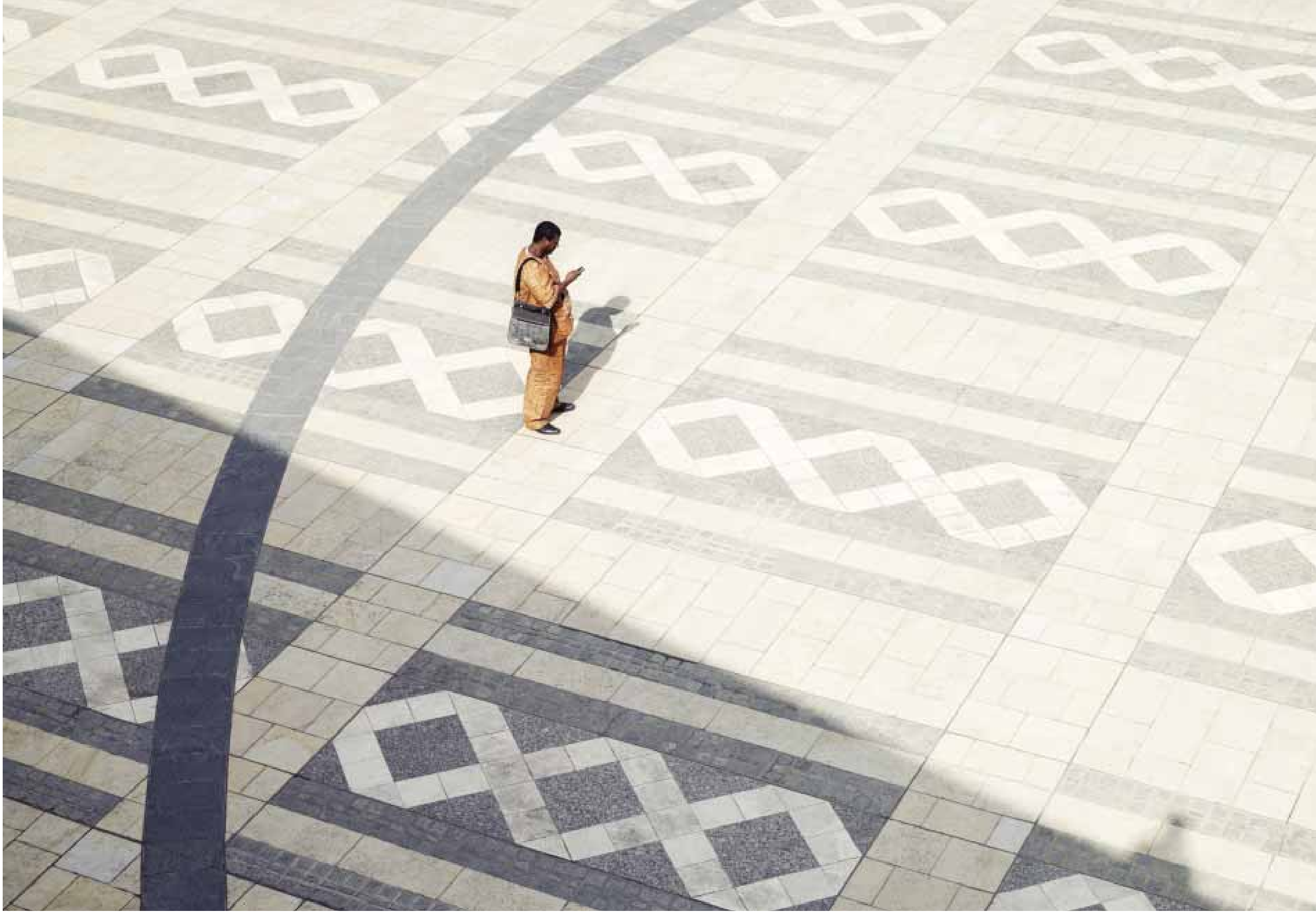
The authors wish to thank Colin Brereton and Ian Corden for their contributions to this article.

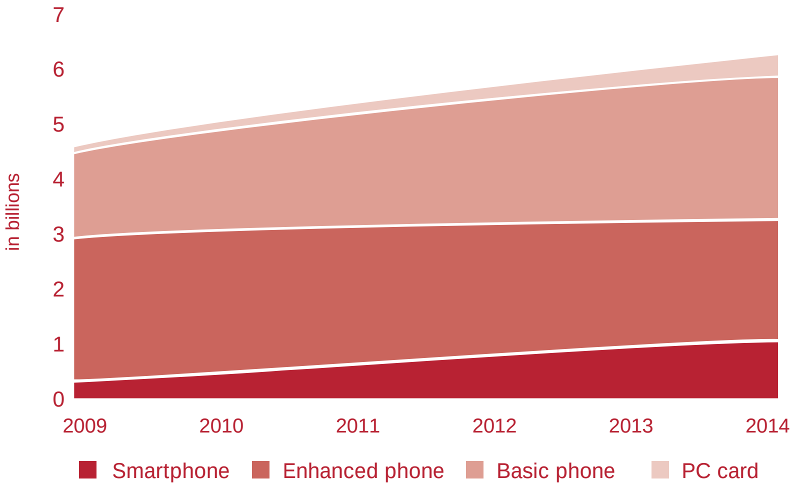


The declining unit price of voice in recent years, in both fixed and mobile markets, has led operators to innovate in services, with the data market seen as a vehicle to sustain or grow margins. Early efforts to capitalise on data services were thwarted by technologies delivering below customer expectations in terms of speed and overall browsing or downloading experience. Today, technological developments in broadband data rates and user devices are facilitating strong demand for evolving digital services.

Continuing to develop alongside the telecoms industry, content and social network service providers are bringing an increasing volume of media and application spending into the online domain. More users are connecting more often, over devices that are growing in number and sophistication, and are consuming richer content and applications that are ever more bandwidth hungry. The spectacular success of the recent smartphones with unlimited data plans has demonstrated the underlying consumer demand for these applications and services. That success drives further demand for more data and greater bandwidth.

PwC forecasts that smartphone penetration should continue to increase at the expense of enhanced handsets. We expect it to reach 17% of the global mobile-subscriber base by 2014 (55% in developed countries and 10% in emerging countries). (See Figure 1.)

**Figure 1: Evolution of mobile subscribers by device**




Source: PwC's analysis.

*"The commercial success of the iPhone has blinded most market observers; and market segmentation will become increasingly important again in the future, as not everyone wants [or] needs an iPhone or smartphone and many users need only a voice-only handset."*

**Bertrand Dupuis, head of service, Nokia**

More important than simply the penetration of devices is the fact that smartphones will become the dominant means of accessing the Internet on a portable handset. We forecast that 39% of mobile Internet subscribers will connect through smartphones by 2014, compared to only 13% today.

Of course, smartphones are by no means the whole story. While attention has been focussed on this more exciting end of the market, the needs of other users—still very much in the majority—should not be overlooked.

Nevertheless, the attractiveness of the smartphone market lies in its potential to unlock profit for original equipment manufacturers (OEMs). Apple and RIM may have, between them, a relatively small share of the global mobile device market, but their influence on the way consumers use mobile data has been profound and out of proportion to their sales. As shown in Figure 2, these companies represent 54% of the profitability of the mobile handset manufacturing market, yet only 21% of revenues and just 6% of sales.

As manufacturers target low-cost smartphones and blur the boundaries with the "enhanced handset", then the stage is set for an explosion in mobile data through creating a truly viable, mass-market Internet-access option.

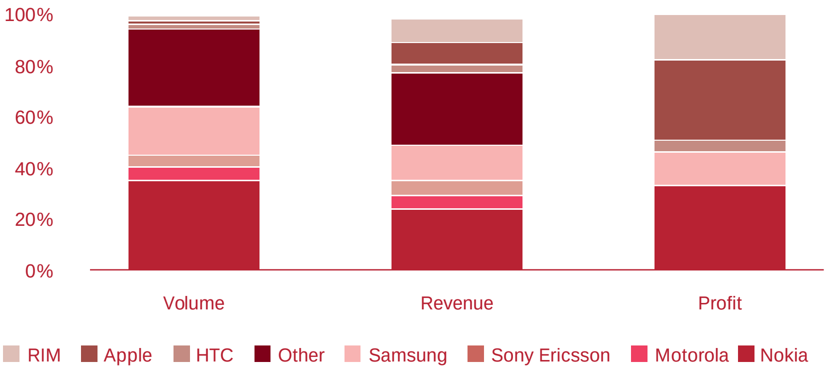
## *Riding the runaway data train*

The recent success of smartphone growth has been spectacular. In many cases, it has far outstripped operators' own data projections, some of which have been wrong by 200% to 300% or more. As a consequence, the network demands (and the funding needs) have caught many of the most successful operators by surprise.

There is a major degree of uncertainty among mobile operators about how the average mobile data traffic per user will evolve. Some anticipate a relatively stable evolution, with early adopters' above-average consumption mitigating the more modest requirements of normal users. Others expect that the average traffic per user will double every two years, as has been the case with the fixed Internet. This uncertainty is reflected in the difference between the forecasts from Nokia and Cisco shown in Figure 3.

Easy access to content has fuelled consumers in demanding more from handsets and from operators. Apple demonstrated the power of "ease of access" through the iPod, which revolutionised the digital music download market. That model has set the tone for the dramatic growth in

**Figure 2: Volume, revenue and profit breakdown (2009)**




Sources: Gartner; Credit Suisse (August 2009); PwC's analysis.

*"Apps are not the answer, per se. Phones need to get easier for people to use. As an example: the iPhone doesn't ship with a manual—it comes with the device, power adapter and a computer cable."*

**Mark Kortekaas, general manager–online technology, BBC**

mobile content and data consumption. Easy access drives demand. Unlimited data packages add fuel to the fire.

The Wireless Industry Partnership predicts that the number of smartphone users accessing application stores will quadruple by 2013. PwC forecasts that the mobile content market (excluding access) will reach €25 billion by 2014, with a significant contribution from wireless games—a large prize by any standard.

On top of this growth in traffic in the market, further pressures on networks are arising from the growth in illegal file sharing and from regulatory moves towards broadband service obligations in some jurisdictions.

The experience of certain operators illustrates the potential strain on network capacity. Operators such as AT&T in the United States and O2 in the United Kingdom, as exclusive providers of the iPhone when it was launched, experienced a sudden demand for bandwidth unleashed when consumers started using their devices for much more than simply voice and text. Both operators have publicly announced network strain brought about by concentrated data use.

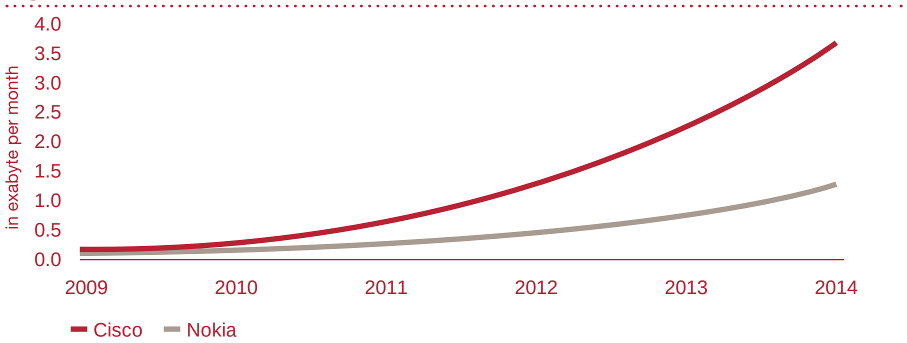
Fixed line operators have taken to throttling speeds and capacity to manage peak loading. Mobile operators also can take advantage of that approach. That kind of throttling will help manage the issues that have caused periodic network failures. It does not mitigate, however, the underlying issues of rising smartphone penetration or the mobile data bandwidth tsunami that threatens to engulf the operators in ever increasing network investment.

By introducing bandwidth throttling, operators are denying themselves the growth that they originally sought with data services to manage the cost exposure by forcing a degradation in service levels. This approach is understandable but risky, and it threatens customer satisfaction and, hence, increases the levels of churn.

## Rebalancing the rising cost of data

All network technologies, whether fixed or mobile, have performance limitations, and a major component of cost is typically in access (and backhaul) networks. Data rates typically decline as distance from the carrier's core network node increases. Consequently, coverage is tightly coupled with capacity requirements; a high minimal-user-capacity requirement usually means lower coverage for a given cost, or higher cost if coverage is to be attained as a primary objective. Whilst modern technologies allow media service data

**Figure 3: Evolution of mobile data traffic**




Source: PwC's analysis.

*"Mobile operators are playing a vital role in defining and implementing a new generation of 'smart' enabling services. The operators need to work closer with the content industry to create viable business models behind these services."*

**Gary Schwartz, chair, North American Mobile Entertainment Forum (MEF)**

to be compressed, these technologies, too, have limitations: Media can be compressed only so far (in data rate terms) before quality levels degrade beyond acceptable bounds. Finite cost means finite performance.

So what can be done at the network level? There is a mix of alternatives, from offloading—moving data traffic from the mobile wireless network to a more local radio access network and broadband backhaul, such as WiFi hotspots, femtocells, etc.—to new spectrum purchases, refarming, cell splitting and/or such network technologies as evolving HSPA and LTE. This mix will vary according to the operators' competitive positions, their legacy network and investments and requirements to differentiate propositions to different customer segments.

Fixed line broadband markets today are very much characterised by competition in speed (available data rates), with pricing levels typically set according to advertised data rates and data volume capping levels. In mobile, pricing usually is associated primarily with monthly data volume capping levels; therein, price is used to control data consumption. Pricing is also driven by market context, with factors including users' expectations, levels of competition, availability of content, level of willingness to pay and economic conditions.

As competition develops and markets mature, services trend towards commodity—forcing carriers to compete on price and basic levels of quality. Service bundling can help in the near term but tends to erode margins and is no long-term solution. Normalised pricing ($/Mbps) on fixed line Internet services in a number of countries has trended downwards over recent years (see Figure 4).

In mobile, within both pre- and post-paid segments, operators in developed countries increasingly compete by offering more minutes, text and data within the price of a top-up or monthly contract. Customers are demanding and, more important, are getting more for less or the same. Willingness to pay does not necessarily increase in line with the data rate or the volume of data consumed.

Establishing unlimited data tariffs for the new generation of smartphones was one of the keys to igniting the mobile data explosion. Now, however, it is crucial for mobile operators to learn the lessons from fixed line and "rebalance" their tariffs in order to re-establish the links between supply and demand for mobile bandwidth. With some operators announcing the end of unlimited data tariffs as they launch the next wave of smartphones, we are already seeing signs that this is happening.

However, there is no one-size-fits-all approach to this rebalancing. The greater the number of revenue generating units or "multiplay" services an operator provides to customers, then the greater the degree of flexibility the operator has to change terms and conditions or pricing levers within the bundle.

Mobile operators need to take these lessons onboard—and fast.

## *Reaching the inflection point*

The delivery of services to data-hungry devices like smartphones is driving up the costs associated with providing greater bandwidth. As users proliferate, so too will the costs of serving them, to the extent that the cost of mobile data outstrips the ability to charge at a rate that consumers are willing to pay. Arguably, we have already reached this inflection point in customer segments where the cost of supplying their mobile bandwidth exceeds the associated revenues for the operators. As data demand per user and user volumes increase, carriers will find it harder and harder to offer acceptable quality levels and pricing will come under additional pressure.

*"We need to make apps more relevant to the user. [Apps] are an extension of the user's personal device that has a range of senses: a camera to see, a microphone to hear, GPS to be location aware. It is a very different experience than on the desktop. As a result, one-third of mobile search queries will have some form of local intent."*

**Mike Schipper, product manager, Google UK**

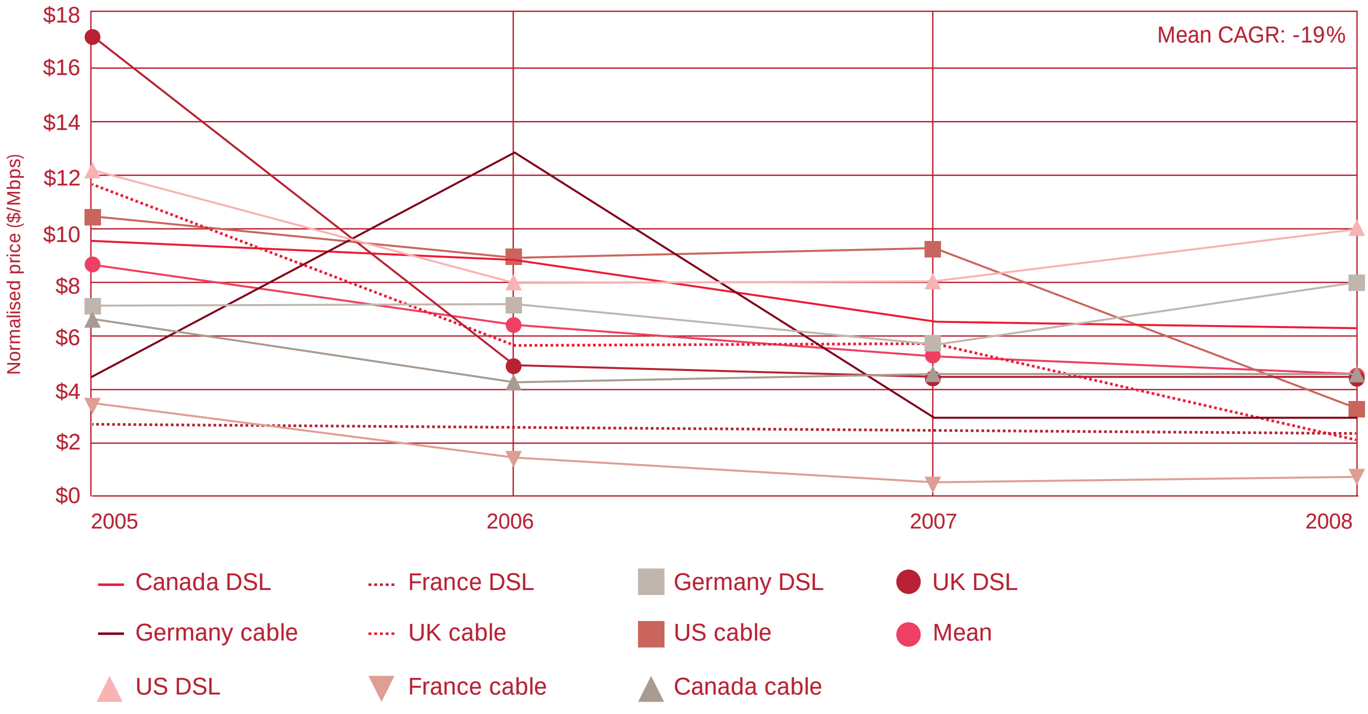
The genie is well and truly out of the bottle, and application stores have started to whet consumers' appetites for ever-increasing amounts of content and data. The question for operators is no longer whether to pursue a data-driven strategy for increasing market share and share of wallet. Instead, it is how far to push this must-have capability—and how fast?

Yet the explosion of mobile data is far from being a straightforward good news story. If operators cannot find a way to monetise content and applications across their networks, will they follow the fate of many landline operators, becoming simply commoditised infrastructure providers that struggle to find ways of extracting additional value from their customers?

We have prolific, even exponential, data growth that drives significant costs for operators, declining bandwidth value and a large, non-access revenue opportunity that could bypass the operators altogether. It is no surprise that some operators are wondering how to put the genie back into the bottle.

The objective is to create differential value in bandwidth-hungry services (e.g. video, mail downloads, streaming services), whilst maintaining compatibility with any net neutrality regulation in an operator's market. Who will be able to claim the prize is the major question. New business models—such as revenue-sharing open-application stores—are tearing down the last remnants of walled gardens and pose a significant risk that operators may miss out on the bulk of possible revenues.

**Figure 4: Trends in fixed line Internet pricing—declining value of bandwidth**




Source: Organisation for Economic Cooperation and Development; PwC's analysis, 2010.

*"Collaboration with operators has been a cornerstone of RIM's successful global expansion. Operators derive great value from their direct relationships with consumers and they are typically very good at identifying things that work well in their markets."*

**Alistair Mitchell, vice president multimedia, Research in Motion**

## *Forging new business models*

The ability to survive and thrive in an open environment will call for a range of new business capabilities. Business models are going to have to become more collaborative and will rely on cooperation between businesses that, to date, have seen others solely as fierce competitors.

Ensuring that applications are available across all platforms means developing industrialised processes for creating services that will operate natively on any one of the many different platforms that devices may use and consumers can choose from. If no single dominant standard emerges, open source environments are likely to succeed in the future.

We are likely to see the emergence of a creative coalition between operators and OEMs that will enable developers and content providers, such as games companies, to produce applications and content easily for all phones and markets.

Operators, therefore, may well need to consider incorporating the costs of conversion into their revenue-sharing arrangements with developers. The default 70/30 revenue sharing established by the Apple application store is accessible for any developer. But as operators rush (perhaps hastily) into creating their own stores, developers are left with a prolific number of operator and/or device types for which to manage and/or certify their applications. Alternatively, operators will have to bear the cost of that certification just to gain access to the revenue potential of the mobile application and content market.

The future of the operator-owned application store looks uncertain. The temptation for operators to push their own portal is strong; yet even with initiatives such as the World Mobile Congress Alliance, it requires the operators to demonstrate sufficient control or customer-intimacy in content delivery to prevent the consumer from going completely "off-portal". What is more likely is that operators will seek to balance their own offerings against those available from other providers—much like a supermarket provides consumers with a choice between its own brand and other branded goods.

## *Staying one step ahead of consumers*

Increasingly, consumers make mobile choices according to the services and content they want rather than the intrinsic merits of a particular device. Also increasingly, they will make those choices across all three screens—that is to say, across mobile, personal computers and television. For example, Facebook users routinely use both mobile and desktop applications to manage their social networking, and users now access YouTube more often from mobile devices than from desktop machines. Hulu, the video content provider, is among many in planning to expand its services to mobile. Music services, such as Spotify, Rhapsody and Last.fm, already integrate content seamlessly across desktops and personal devices.

To avoid the "off-portal" scenario described above, operators will have to leverage their existing strengths with consumers, including their long-standing relationships, their reputation for reliable service and their direct billing relationships.

Such existing characteristics may not hold the kind of differentiating creative and brand recognition that the operators' marketing divisions crave. But they do provide a potentially valuable advantage in developing deeper relationships that do more than simply connect customers to services and content.

Personalisation, location-based services and timeliness are all long-touted differentiators in the mobile content world, but intrinsically they are factors on which operators can capitalise better than most. By using the wealth of information they already have about their customers, operators can begin to offer more personalised and customised experiences, such as creating personal application bundles and monetising user data through merchandising.

*"A new retail model now exists because of social networking. A key objective of content should be to drive social action and make it easy to get or do things. Recommendations count."*

**Lee Epting, director of content, Vodafone**

That information opens up a world of revenue opportunities. The opportunities range from B2B services, such as mobile vouchers/advertising that make the best offer to an individual walking past a store; to application bundles targeted at a specific consumer, which no third-party developer could match; to the inevitably scatter-gun delivery route of an application store that might be home to more than half a million other applications.

### Leveraging the power of many and of one

The rise of social networking and viral marketing represents another major opportunity for operators—if they follow the right approach. The personal nature of mobile devices, arguably, makes them a more natural fit for social networking services than are their desktop equivalents. Recommendation and word-of-mouth are powerful drivers of consumer behaviour, as demonstrated by online retailers such as Amazon that use buyers' comments to drive recommendations and sales.

Operators already have considerable data with which to build social networks. They can use their subscriber bases to develop communication within communities, focussing on local services and content in which they understand the market and what is likely to appeal to their subscribers.

They need to understand the core of where they can add value and, in particular, how to leverage their local consumer knowledge and deep relationship skills. The operators' established, large-scale IT infrastructure, together with a wealth of data and security that consumers prize, lends itself to micro-billing and aggregated payments alike.

Enabling the social networking element is key for the operators to then be able to monetise the open application/content environment, whether by leveraging their multi-platform approaches or through their direct customer insight. More important, failing to create the link among communication, content and transactions means the operators are effectively relinquishing all control to the content providers and OEMs and resigning themselves to a bit-pipe status.

### Creating an edge—a question of control and fast actions

Operators, OEMs, developers and content creators are seeing a shift in the balance of control on multiple fronts. Content creators, service providers and handset manufacturers are all rolling out game-changing innovation to develop compelling offerings to consumers. To date, operators have been somewhat left behind.

To exploit the potential for growth and to manage risk, operators need to develop a clear, cohesive strategy across the business model, product, infrastructure and financial domains.

How operators respond in the immediate future will determine their prospects for the longer term as we enter a whole new mobile world. The consumer is on centre stage. And operators need to create the right user experiences and customer-centric approaches to maintain their relevance and their healthy share of the market.

# *Healthcare unwired*

*In the quest to develop new revenue streams, communications companies are focussing on vertical markets, where specialised services can add value to both end users and company shareholders. One of these markets is healthcare. While individuals and businesses across the health industry value chain have started to embrace communications technologies in recent years, opportunities abound for mobile communications applications and services to transform the sector.*

*The following is an excerpt from a recent study by PwC's Health Research Institute (HRI). It provides communications operators with new insights into the attitudes, preferences and needs of stakeholders across the health industry—insights that operators should consider as they evaluate and pursue opportunities in this exciting and evolving industry.*

**By Dan Garrett and Christopher Wasden**

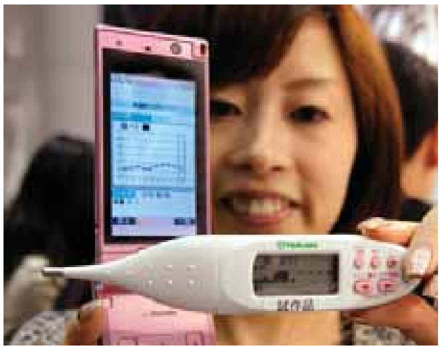
Dan Garrett is a partner and Christopher Wasden is a managing director in PwC's Health Industries practice. For more information, contact Mr. Garrett by phone at [1] 610 256 2055 or via e-mail at daniel.garrett@us.pwc.com; or Mr. Wasden by phone at [1] 646 471 6090 or via e-mail at christopher.wasden@us.pwc.com.

To download the complete study, *Healthcare Unwired: New business models delivering care anywhere*, visit www.pwc.com/us/mhealth.

Mobile technologies hold great promise for keeping people healthy, managing diseases and lowering healthcare costs. For years, telehealth has provided clinical services for individuals who lacked physical access: farmers in remote communities; soldiers near the battlefield; inmates in prison. Now, these technologies have demonstrated the ability to benefit almost any individual. Mobile devices are the most personal technology that consumers own. They enable consumers to establish personal preferences for sharing and communicating. They can enable health and wellness to be delivered through mass personalisation.

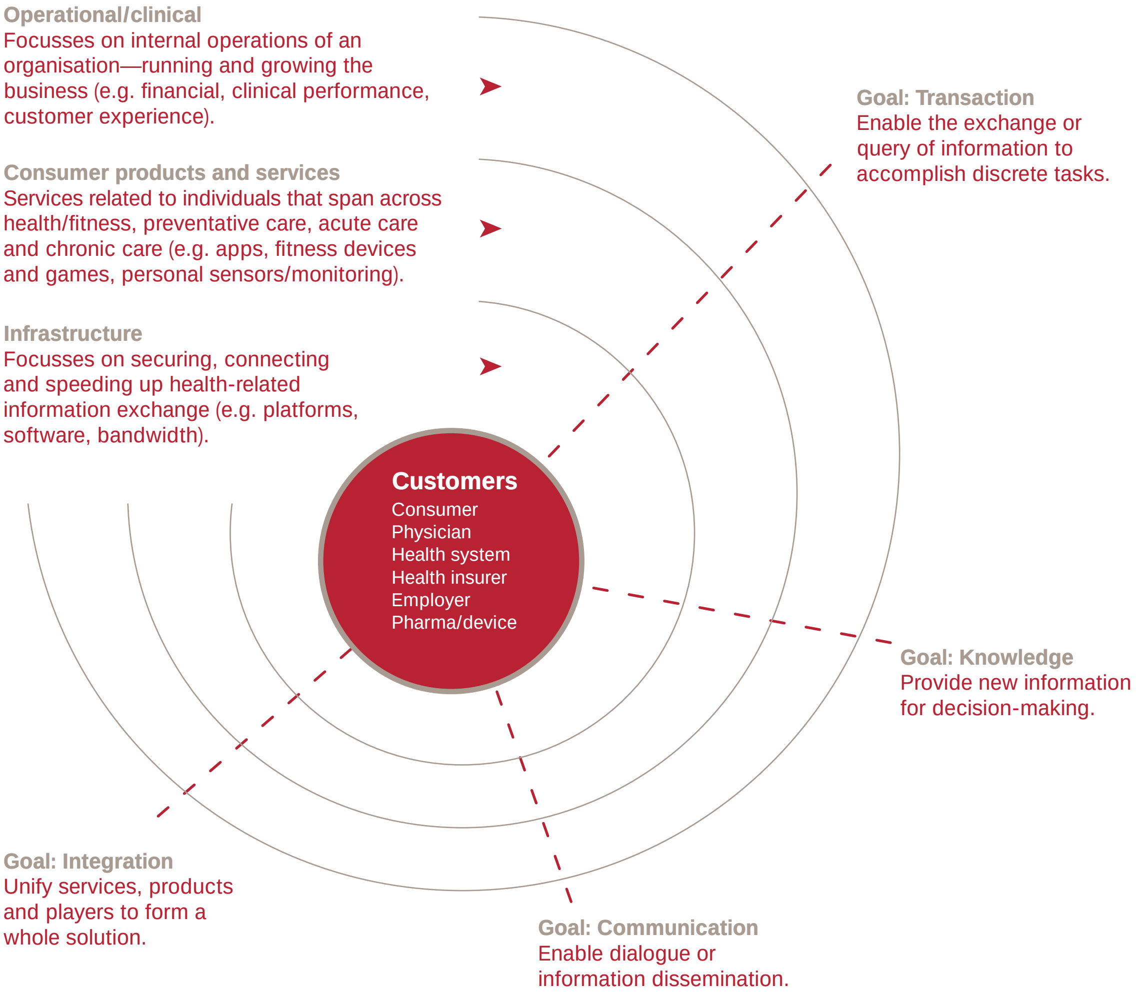
Mobile health could provide needed connections: for patients who delay care because they are too busy to wait in a doctor's office; for physicians who don't have enough time to spend with patients; for device companies that want to monitor the performance of their devices; for pharmaceutical companies that want to ensure patients are taking the medicines they need; for hospitals that don't have the capital to build more beds.

In addition, a host of new players are developing easy to use, affordable "care anywhere" devices, services, solutions and networks that are attractive to consumers. Organisations that want to play a role in making "care anywhere" a reality will need to provide real value in order for adoption to occur.



*Providers are incorporating mobile into their workflows of caring for patients, some even developing their own applications and spinning them off as businesses.*

**Figure 1: Mobile health business models**



## *Three business models for mobile health*

Mobile health encompasses a wide array of companies that sell products and services in health and wellness through technology applications. We see a plethora of pilots dotting the landscape. Providers are incorporating mobile into their workflows of caring for patients, some even developing their own applications and spinning them off as businesses. Health plans are experimenting with mobile as a way to reach out to their members for transactions and as new ways to engage them in healthy behaviours. Employers are text-messaging employees in their health promotion/monitoring campaigns. Pharmaceutical and life sciences companies are using mobile to support drug adherence.

Current business models fall into these categories (see Figure 1):

- Operational and clinical capabilities
- Consumer products and services
- Infrastructure to connect, secure and speed up information and services.

### Operational and clinical capabilities

In looking at reducing traditional healthcare costs, the focus immediately goes to providers. Physicians are generally paid by task. Their time is valuable but often wasted on tasks that could be automated, eliminated or reduced in scope through mobile health. For example, more than half of physicians surveyed by HRI said a significant portion of office visits could be eliminated through mobile health, which could improve access for patients and ease the number of in-person visits from chronic-care patients. Forty percent of physicians said they could eliminate 11% to 30% of office visits through the use of mobile health technologies like remote monitoring, e-mail or text messaging with patients.

Such shifts could rewrite physician supply and shortage forecasts for the next decade and beyond. A recent study by the Mayo Clinic's Department of Family Medicine supports this view. During the two-year study, e-visits were able to replace in-office visits in 40% of the 2,531 cases. In the study, patients logged on to a secure online portal, where they had detailed histories taken and were able to upload pictures and other files as needed. Physicians responded within 24 hours and patients could access the portal to view results.

Workflow is important to physicians because they get paid only for the patients they treat. So, they are keenly interested in efficiency. Accessing information where and when it is needed is a top challenge for physicians, according to the HRI survey.

Currently, one-third of physicians said they make decisions based on incomplete information for nearly 70% of their patients. Specialists and PCPs [primary care physicians] find that their biggest obstacle when seeing patients or running their practices is accessing information when and where they need it. Only half of physicians surveyed access EMRs [electronic medical records] while visiting and treating their patients.

Yet mobile health solutions will have to ensure that they aren't making physicians less productive. Physicians want to see exceptions in the data, not all the data. Too much information could actually slow down care. Hospitals can help the physicians who bring in patients by filtering the data they send electronically. "For example, a physician who has seen patients with chest pain that have inconsistent outcomes can query for every patient over the age of 55 who came in with chest pain and was given aspirin. This potentially allows hospitals to improve outcomes or work flows based on the data," said Johnny Milaychev, product manager of New Wave Software, a veteran clinical integration vendor.

Another example is e-prescribing, wherein physicians' most common orders are automatically populated on their devices, said Donald Burt, MD, chief medical officer of PatientKeeper, a physician information technology firm. He said that PatientKeeper's 25,000 daily physician users spend 20% of their days on mobile devices. He added that experienced nurses can post order requests on physicians' phones, and they can sign or modify them wherever they are.

## *Pharma company uses Bluetooth and nurse reminder calls to boost adherence of injectables*

In a five-year journey to reinvigorate a portfolio of generic, off-label or abandoned drugs, one pharmaceutical company found digital/mobile technology could significantly boost patients' adherence. While pharma companies typically focus on new drug development, Switzerland-based Merck Serono found that it could create double-digit growth in a pipeline of generic injectable drugs that were long off-patent. The strategy centred on "adding value to the products you already have," said Don Cowling, vice president and managing director of Merck Serono, UK and Ireland. "The future is behind us." Mr. Cowling said his team realised that the growth market for pharmaceuticals is in adherence rather than in finding new patients, since half of all scripts are never filled and half of those are never taken. "People don't buy compliance; they buy pharmacoeconomic outcome," Mr. Cowling added.

With six therapy areas of focus, including neurology, fertility and growth therapies, Merck Serono developed a smart electronic injection device with two-way Bluetooth capability that could track all injections made. Nurses made reminder calls within 30 minutes of a missed injection. For example, at one point, the number of injection-site reactions was growing in patients taking one of the therapies. After changing the needle depth requirement by 3mm, the dropout rate improved by 10%.

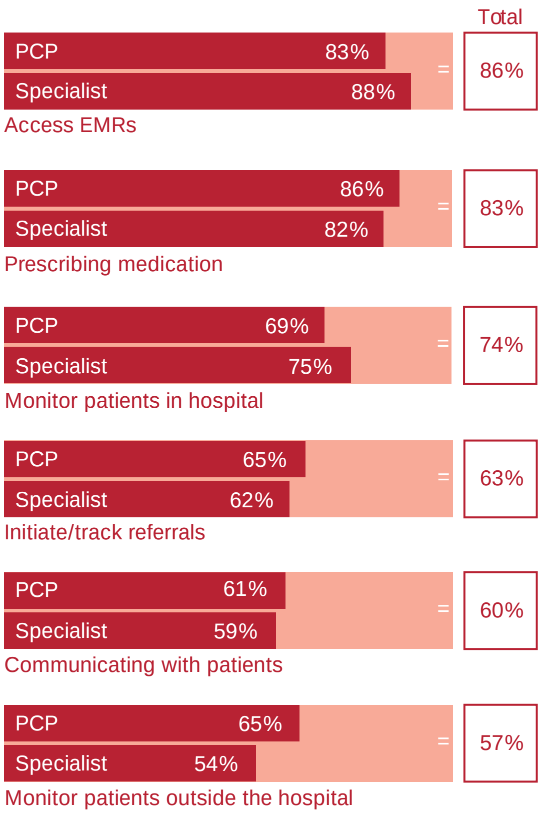
Real-time data gathering and feedback through mobile technology boosted Merck's business case for mobile health. The strategy helped the company gain over 50% of new patients for several therapy areas, grow 38% in a static growth hormone market and decrease 20% of its workforce while doubling the volume of work and creating a platform for future therapeutics to be administered.

*“The paradigm of healthcare has changed. You used to bring the patient to the doctor. Now you take the doctor, hospital and entire healthcare ecosystem to the patient.”*

**Rajeev Kapoor, former global managing director, Verizon Connected Healthcare**

Having information at their fingertips assures physicians that their time is used more effectively (see Figure 2). Of physicians who are using mobile devices in their practices, 56% said the devices expedite their decision making and nearly 40% said they decrease administrative time. Mount Sinai Hospital in Ontario, Canada, connected its physicians to EMRs through their iPhones. Its VitalHub programme has changed the way its physicians work; they pull up patients' charts, labs, medical references and radiology images. “Chart applications from leading vendors may have a robust backend, but the physician experience is weak. They are struggling with making the chart something easy to deal with. How do we help our clinicians who are going to multiple places for locating information? We go to them,” said Teek Dwivedi, chief information officer at Mount Sinai Hospital. The hospital spun out the intellectual property of VitalHub into a separate external company with plans to offer the platform model to other institutions on a commercial basis.

**Figure 2: Physician interest in performing various tasks wirelessly**




PCP: Primary Care Physician
Source: PwC HRI Physician Survey, 2010.

*Only half of consumers surveyed by HRI said they would buy mobile technology for their health, so it's important to know who these consumers are.*

## Consumer products and services

The consumer market can be a high-volume, high-value, low-price market where mild proof of efficacy can lead to rapid adoption.

People are busy, and sometimes they don't take care of themselves because they don't have the time. Individuals who delayed care more than five times during the past year because it took too long to get an appointment are more willing than those who didn't delay care to pay out-of-pocket for electronic doctor visits (58% vs. 43%). In some cases, physicians have started their own electronic medical practices in which they charge patients $50 for each consultation. Those who delayed the most care have different preferences for how they'd like their physicians to contact them for simple communication. Those who delayed more than five times prefer communication through cell phone, e-mail, text message and Facebook more than those who never delayed care during the past year. Nontraditional communication avenues and electronic doctor visits could be new ways of reaching individuals who don't engage proactively in their care.

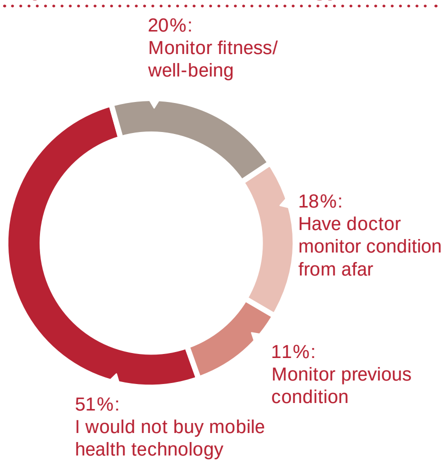
"For consumers, mobile is a synonym for independence," said Yan Chow, director of the Innovation and Advanced Technology Group at Kaiser Permanente. "I think that the ability to be independent and get data when and where you need it gives consumers a lot of freedom. Having consumers be at the centre of their own care is a concept Kaiser has been working with for a long time. It gives us the chance to build a new relationship with our members." Rajeev Kapoor, former global managing director of Verizon Connected Healthcare, added, "The paradigm of healthcare has changed. You used to bring the patient to the doctor. Now you take the doctor, hospital and entire healthcare ecosystem to the patient."

In some cases, organisations are mobilising applications that they have already hosted online. For example, Aetna made its most popular transactions, such as physician "doc" finder and claims check, available on mobile devices. "Our technology is about transparency and engagement at any level, and over time we'll build stronger relationships with our members," added Michael Mathias, Aetna's chief technology officer. "The days of mass communication are over. We can now deliver customised communication through mobile apps, online, telephonically or through the mail based on our understanding of how each member wants to be communicated with."

Only half of consumers surveyed by HRI said they would buy mobile technology for their health, so it's important to know who these consumers are. Of those, 20% say they would use it to monitor fitness/well-being and 18% want their doctors to monitor their health conditions (see Figure 3). While 40% of respondents would be willing to pay for a monthly mobile phone service or device that could send information to their doctor, they would prefer to pay less than $10 for the monthly mobile phone service and less than $75 for the device.

Mike Weckesser, director of emerging business-health solutions at Best Buy, points out the challenges of consumer price expectations related to mobile health technology. "In our consumer research, although consumers identified a price threshold, they also expected the payer to reimburse them for those purchases, thereby slanting the data."

**Figure 3: Most important reasons consumers would buy mobile health technology**




Source: PwC HRI Consumer Survey, 2010.

*In a PwC survey of hospital CIOs, 42% said they believed their device connectivity vendors were unprepared or they did not know if they were prepared to assist them with medical device interoperability.*

Though many consumers have never taken advantage of existing mobile health technologies, 85% of those who have communicated with their doctor by means other than face-to-face were satisfied with their discussion.

## Infrastructure

Hospitals are increasingly feeling the constraints of outdated wireless networks. Adequate infrastructure is needed to support high-capacity and high-bandwidth mobile systems within hospitals. New healthcare-dedicated frequencies and 4G wireless networks are some of the ways telecommunication companies are enhancing the infrastructure of hospitals to support advancements in wireless technology. While we all use multiple platforms everyday in all aspects of our lives, like Microsoft Windows, Facebook, the iPhone and the iTunes store, we rarely stop to notice what a platform is or how it works. However, such an understanding is critical to understand the type of infrastructure required to drive the innovations necessary for the adoption of mobile health and wellness solutions.

In addition, developers are focussing on platforms to allow for the greatest flexibility of applications and devices. Platforms enable many technologies and players to participate in mobile health. There are several models of platforms with key characteristics that include the core, peripherals and interfaces. As companies determine their roles in the digital world, they could become hubs into which other services connect.

### *Key infrastructure markets*

**Developing the right security.** When physicians were asked about barriers to adopting mobile health in the HRI survey, "worried about privacy and security" was the top answer, cited by one-third of PCPs and 41% of specialists. However, Bill Braithwaite, MD, who developed the HIPAA [Health Insurance Portability and Accountability Act] regulations when he was with HHS [The US Department of Health and Human Services] in the mid-1990s, suggests that data on mobile platforms can be secure with the right measures. "Multifactoral authentication provides a higher level of assurance that the user is who he or she claims to be," said Dr. Braithwaite, who is now chief medical officer of Anakam, a security software company.

"There are three factors that can be used to identify you as the proper user: something you know, something you are and something you have," added Dr. Braithwaite. "Commonly, username and password are used, but both are instances of a single factor, something you know. For stronger authentication, the user must also present a second factor, which could be something you have, such as a registered ID card or cell phone, or something you are, such as a fingerprint or voiceprint."

The financial services industry uses similar security measures for online banking along with behind-the-scenes location login monitoring. "Messaging about our banking security assurance programme is key to the customer side," said Tom Trebilcock, vice president e-business and payments at PNC Financial Services. "You need to first establish trust and assurance with the customer."

**Improving integration.** Of the physicians who are using mobile applications and devices, 63% are using personal devices that are not connected to their office or hospital IT systems. Hospitals in general have not put mobile connectivity at the top of their IT list—30% of physicians said their hospitals or practice leaders will not support the use of mobile health devices.

Joseph Kvedar, MD, director of the Center for Connected Health at Partners HealthCare in Boston, emphasised that while "sensor technology may be rapidly becoming commoditised, integration with EMR and data aggregation systems is not something we have seen done well. We need to get better at gathering information, adding logistical software to get to the intersection of all the data and population health management."

## *Health system, retailer, wireless company team to improve palliative care*

Physicians in New Jersey thought there must be a better way to ease the pain of cancer patients. After collaborative conversations with the leadership of Meridian Health System, the idea for an innovative pain journal was born. The journal's intent was to allow patients to record and communicate their pain while resting at home. With more accurate communication, physicians could better understand the pain medication needs of their patients.

The health system didn't think insurers would pay for such a device, but maybe patients might—if it was affordable. With this as a business model, an unusual but powerful collaboration came together:

- Clinical expertise: Meridian Health, a five-hospital health system in New Jersey (a teaching hospital, children's hospital, home health and rehab centres). Most of the health system's 1,600 physicians are in private practice, with half in primary care and 100 physicians on staff.
- Technology expertise: Cypak, a near field communication (NFC) company that creates consumer tools.
- Retail/tech support: Best Buy, an international retailer of consumer electronics and technical support.

The collaboration developed a product called iMPak's Health Journal for Pain, an electronic diary in which patients are given an auditory queue and answer two or three questions regarding their pain via buttons on the device. The device is a tri-fold, with each section measuring approximately four inches by six inches. During office visits, physicians download the information, or it can be downloaded at home into a web portal or personal health record. To pair with the health journal, iMPak is developing a smart pill dispenser that monitors adherence. Based on the doctors' preferences, they can be alerted to fluctuations or outliers in reporting. "This may actually allow the physician to increase the billing fee from a level three and four to a level four and five," said Sandra Elliott, Meridian Health's director of consumer technology and service development.

Including Best Buy in the collaboration was a key strategy. "We have learned that we, as a health system, don't truly understand the retail marketplace," added Ms. Elliott. "Best Buy does and people go to them for their technology. The wireless networks are going to be a major part of getting technology in the hands of consumers, and we wanted to be able to leverage Best Buy's retail knowledge as well as their Geek Squad for installation.

"As a health system, our job is to take care of people," continued Ms. Elliott. "We need to come up with strategies to get service fees and technology prices down. Our challenge is to think about how to manage an increasing patient population without building new buildings."

*"Our challenge is to think about how to manage an increasing patient population without building new buildings."*

**Sandra Elliott, Meridian Health's director of consumer technology and service development**

*Without a robust infrastructure in place, care providers cannot utilise high-bandwidth mobile healthcare technology.*

Vendors may not be ready to help either. In a PwC survey of hospital CIOs, 42% said they believed their device connectivity vendors were unprepared or they did not know if they were prepared to assist them with medical device interoperability. Such interoperability will be required in the later stages of achieving meaningful use compliance.

Telecom vendors are, however, working on interoperability for their customers. Qualcomm recently developed a cellular module that allows online health data from wearable medical devices to connect and exchange information through several interfaces. "Qualcomm's platform has the capability to link the body area network devices, like a smart Band-Aid, to personal area networks like WiFi, to wide area cellular networks and the Internet," said Don Jones, vice president of business development, health and life sciences. "You can mix and match in many different ways."

**Increasing bandwidth**. Hospitals are starting to feel the crunch of outdated wireless systems. Without a robust infrastructure in place, care providers cannot utilise high-bandwidth mobile healthcare technology. Sprint is using an infrastructure model to help providers extend their ability to provide care outside of the hospital. One partnership geared toward mobilising physicians and eliminating bandwidth constraints is with Calgary Scientific and its ResMD application. "We're taking a $100K workstation and bringing it to a mobile device like EVO that can display images such as a 3-D brain scan," said Tim Donahue, vice president of industry solutions at Sprint. "The network is as important as the device," he added. "EVO has a 1GHz processor in the device and needs a robust 3G or 4G environment to effectively use that kind of information. Even Wi-Fi networks run into capacity and mobility constraints."

*About the research*

***Healthcare unwired** is the most in-depth research to date into mobile health by PwC's Health Research Institute (HRI). HRI conducted 35 in-depth interviews with thought leaders and executives representing healthcare providers, payers, private sector technology organisations, academic medical centres, telecommunication companies, pharmaceutical and device companies, retail companies, communication firms and employers. HRI also commissioned an online survey in the summer of 2010 of 2,000 consumers and 1,000 physicians regarding their use and preference of mobile technologies in the United States. Mobile health is being defined broadly as the ability to provide and receive healthcare treatment and preventative services outside of traditional care settings.*

*Mobile health tools can include remote patient monitors, video conferencing, online consultations, personal healthcare devices, wireless access to patients' records and prescription applications using a cell phone, smartphone or wireless tablet. Our mobile discussion may also include telehealth, which is more established, and the physical/virtual integration and interoperability of devices like heart rate monitors, pulse oximeters and wireless scales.*

*PwC's Health Research Institute (HRI) provides new intelligence, perspectives and analysis on trends affecting all health-related industries, including healthcare providers, pharmaceuticals, health and life sciences and payers.*

# Making better bets

*Network operators recognise the importance of capital allocation and have teams of analysts producing reams of paper on proposed capital projects. Many executives find the sheer volume of paperwork generated comforting, reasoning that "the team must have covered all the angles here". In PwC's experience, however, the contrary is often true. Generating paperwork can be a displacement activity to avoid addressing the difficult questions: Is this investment simply propping up an unprofitable segment? What options haven't we explored? What is the evidence for our assumptions?*

**By Gary Taylor, Trigvie Robbins-Jones and Ian Corden**

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The authors wish to thank David Russell for his contribution to this article.


Much of business is about bets—bets such as taking a considered view of the future, allocating resources and managing investments to secure returns on those investments. And with an annual capital expenditures (capex) bill of US$300 billion, few industries make bets as big as telecoms does. Yet those big bets can fail, and sometimes spectacularly so: Around one-third of all discretionary projects destroy significant amounts of value, as approximately 10% of projects are abandoned before completion and only 7% create significantly more value than anticipated.

So, despite their obvious importance to operators, why do discretionary projects still go wrong so often?

Investment decisions today are conducted mostly in the spirit of a court-like advocate, cross-examination and judgement process. But rather than viewing capex planning as a recommendation-based process seeking the right answer, the better view is perhaps of capital projects as key junctures in an organisation's strategy-making journey that provide opportunities to explore the irreducible tradeoffs inherent in every allocation of resources.

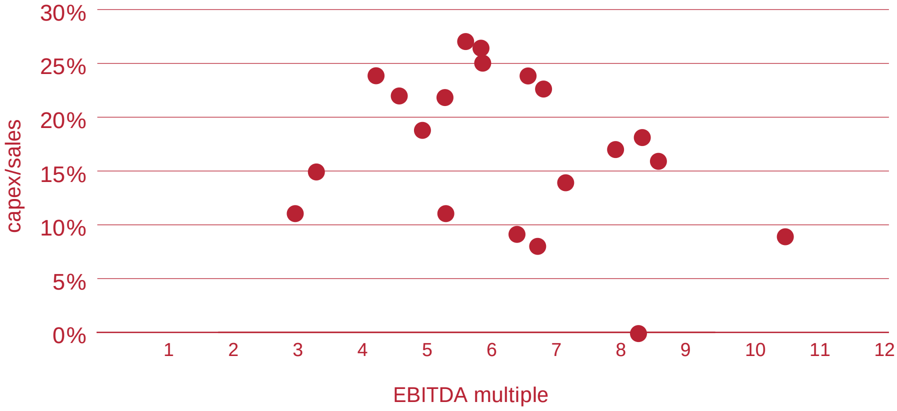
During the recession, many operators were tempted by the "easy win" of indiscriminate capex cutting ("I want 20% capex reductions from all the business units"). Ultimately, though, that won't work: Investors do not reward operators with lower levels of capex. Instead, premium valuations accrue to those who can redeploy capex away from low-growth, marginally profitable areas and restore growth in earnings before interest, taxes, depreciation and amortisation (EBITDA) and operating free cash flow. (See Figures 1 and 2 on the following page.) This distinction matters, since it redefines the scale of ambition from simply cutting capex, per se, to redeploying capex better to drive growth and returns.

## *Why do major investments fail?*

Stories abound of capex spending gone wrong, but rigorous research is thin on the ground. What little does exist, though, confirms our experience: More projects are simply abandoned (9%) than deliver above-budget returns (7%), whilst nearly another quarter of projects are "challenged" (23%), i.e. come in 20% over budget and deliver 15% less scope than planned.

*Premium valuations accrue to those who can redeploy capex away from low-growth, marginally profitable areas and restore growth in EBITDA and operating free cash flow.*

**Figure 1: Lower capex levels do not attract premium EBITDA multiples**




Sources: Capital IQ; PwC's analysis.

**Figure 2: EBITDA growth is a good predictor in valuation multiples in telecom**


Sources: Capital IQ; PwC's analysis.

Why do capital investment appraisals not improve these outcomes? It is certainly not for a lack of financial detail, persuasive proposals and legitimate challenge from investment committees. Often financial detail masks analytic rigour, proposals gloss over deeply imbedded tradeoffs and challengers start from a murky understanding of the technical, strategic and financial alternatives.

Our experience suggests that operators face four major obstacles in making most capital investments (see Figure 3). From the lack of alignment with the business strategy, to the failure to explore all options, to weak methodologies and delivery risks, most major investments simply are not fully vetted before they begin.

## *Obstacle 1: Poor alignment with business objectives*

It is a truism to say that all decision making should be linked to strategy, but sometimes the specific mechanisms for linking the two are not clear. In capital investment appraisal, asking three specific questions can help start the process.

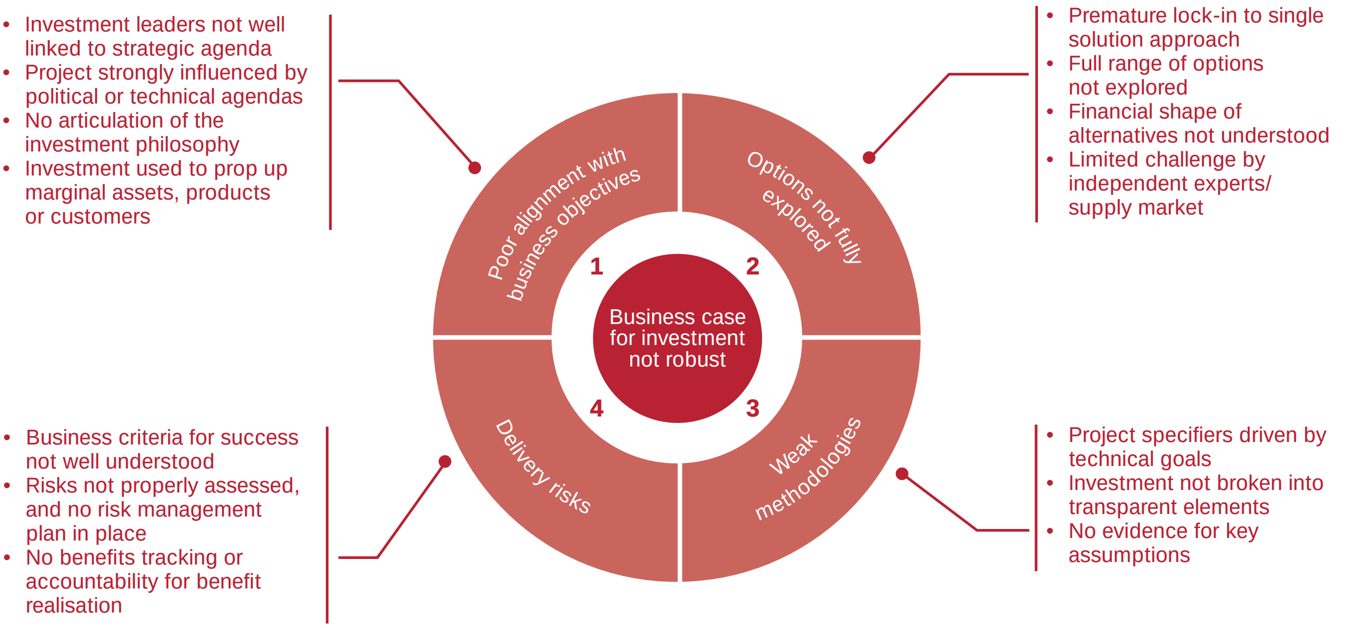
The first question to ask is: Should this investment happen at all? Almost all operators have a long tail of marginally profitable—or downright unprofitable—products, networks, customers, channels and segments. A call for additional investment in those assets is an obvious juncture at which to consider closing, migrating or consolidating. Yet network operators are notoriously slow at pruning their product portfolios, and they rarely use investment cases as a trigger to revisit those basic assumptions.

The most common reason for skipping this rather obvious step is simply the lack of good-quality information. As operators move towards all-IP networks and integrated offers, traditional costing models struggle, and—in the absence of reliable facts—capex proposals and challenges become politicised, arbitrary and inefficient.

In our experience, the antidote to politicised capex decision making is the creation of a reliable, robust and agreed fact base on the economic profitability of products, network, customers, channels and segments. When operators have taken this particular bull by the horns, the benefits are twofold: Not only is capital diverted away from low-growth, marginally profitable activities, but also the business case for network and system convergence is strengthened.

The second question to ask during the capital investment appraisal process is: Can the investment be deferred? One of the most common claims to legitimacy in investment cases is “This is necessary. The network is congested.” Often that assessment is correct, and ongoing capacity upgrades are a fact of life for all operators. However, operators regularly have hidden capacity masked by incomplete, inaccurate or unconnected databases.

**Figure 3: Why do major investments fail?**



*Operators regularly have hidden capacity masked by incomplete, inaccurate or unconnected databases.*

One major European network operator had spent more than $2.5 billion on capex since the launch. In its drive for growth, the operator had not been overly concerned with controlling costs or ensuring the financial accountability of the project managers responsible for purchasing the network assets. Consequently, the operator had very poor network inventory and infrastructure information.

The company undertook a major exercise to improve the consistency of asset data and processes between finance and operations, implementing common reporting and data control frameworks to which both networks and finance could adhere. In the immediate aftermath, this exercise prevented the operator from erroneously writing off 5% of its accumulated network asset base. The company also realised more than a $25 million improvement in the next year's capex budget as a result of identifying stranded assets, capturing unbilled services and preventing duplicate out-payments.

The third and final question operators should ask is: What is the appropriate investment philosophy? All capital investments carry an implied investment philosophy, but few make that philosophy explicit, thereby creating one of the major organisational fault lines in capital investment appraisal.

Consider an Eastern European operator who was building a VoIP business—and also was increasing capacity on its switched voice network. Engineers assumed the underlying investment philosophy for both investments was "invest for the long run", which bakes in resilience, redundancy and excellence in quality. In fact, the VoIP investment was better suited to a "speed to market, proof of concept" philosophy, and the switched voice investment simply required something "good enough for now".

All investments have irreducible tradeoffs around net present value (NPV), funding requirements, quality and speed. Simply making such tradeoffs explicit always enriches the quality of strategy making and regularly improves the allocation of scarce capital. Making better business bets in discretionary capex often works for operators who have resisted the temptation to produce volumes of financial analysis on variants of the same basic option or solution, and who instead have explored the strategic and financial shape of more fundamental alternatives.

## Obstacle 2: Options not fully explored

A regulated network operator planned to roll out a combined private mobile radio (PMR) and fixed backhaul network. Rumours hinted at a gold-plated, top-of-the-line solution, and the regulator had little confidence that every effort had been made to identify more economically efficient options. The internal finance staff had performed standard NPV analyses that cast doubt on the validity of the investment. But those analyses were no match for engineers—or the "safety-shroud wavers" who obscured the choices available by citing quality or safety as dictating only one possible solution.

A review of the investment process determined whether investment team members had themselves addressed the critical questions: Was the investment necessary at all? Could a refurbishment suffice? Could the investment be delayed? The investigation revealed that several legitimate options had not been considered, raising early warning flags that the capital was not allocated efficiently.

Articulating complex investments in clear business terms is a task that beats many investment teams. Yet it is an essential building block for identifying possible alternatives, quantifying any bells and whistles in the project scope and tracking the realisation of benefits that must follow the investment.

In the case of the regulated PMR/fixed backhaul operator, re-stating costs by business objectives was a revelation (see Figure 4). The review of the investment process highlighted that one business objective, previously considered to be of secondary importance, in fact was consuming almost one-third of the total costs. The highly technical nature of the proposal meant that the task of expressing technology investments in clear business terms was a daunting one for engineers—and beyond the scope of traditional financial analysis. Capex savings of up to 80% on a whole-life basis were identified as a result of the review.

## *Obstacle 3: Weak methodologies*

When operators make inorganic investments (i.e. mergers and acquisitions), they invariably deploy a cross-functional team to explore the financial, strategic, tax and operational aspects of the proposed acquisition. Those teams normally engage due diligence experts to ensure that no stone is left unturned in the hunt for value, and that integration specialists are tasked with delivering deal value. It is anomalous, then, that organic investments of similar sizes are not always subject to the same level of rigour.

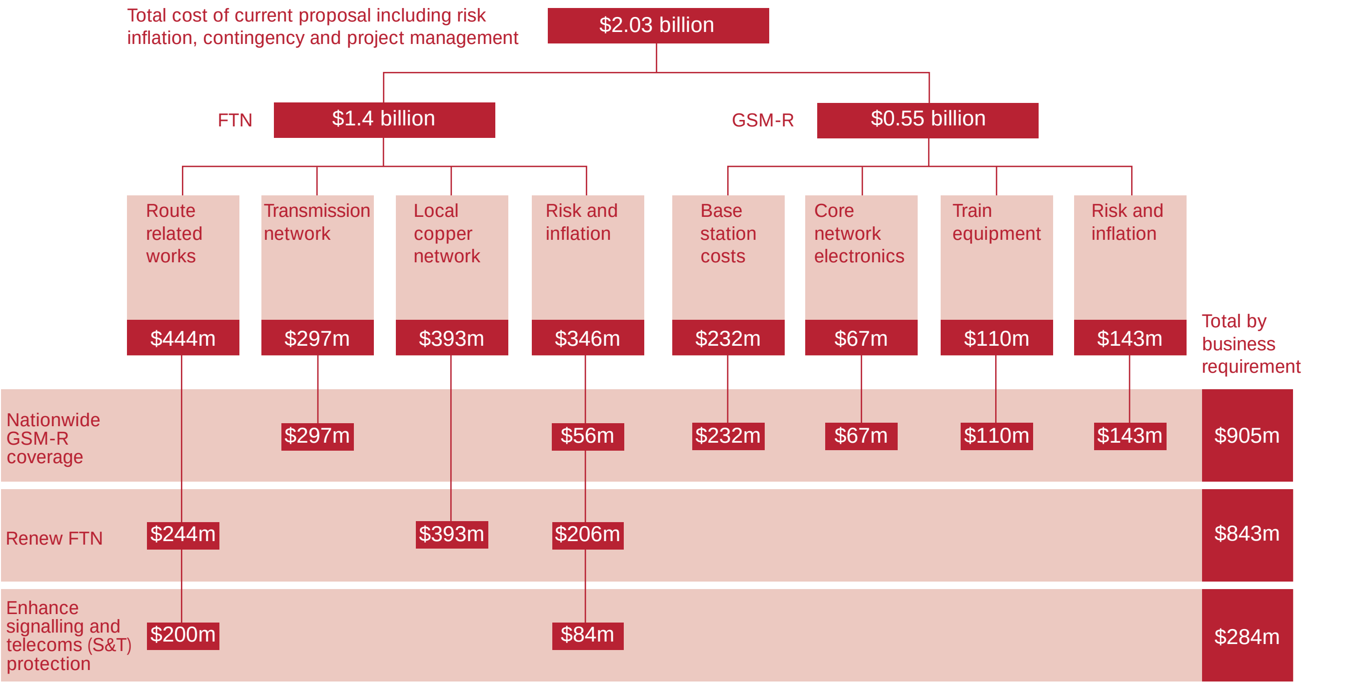
Consider one Central European operator that was planning on upgrading its access network to deliver higher-speed broadband services. Competitors had upgraded already and spoke in public of the benefits. Primary research confirmed that consumers wanted faster services, and case studies from other markets offered a precedent that made uptake likely. Network operations could point to network congestion, product management could point to competitive pressure and business planning could see that the investment was strategic.

There was just one problem: The return on the investment was poor. An initial diagnosis concluded that strategic investment actually was a euphemism for loss making.

The flaw was methodological. Because all the various parts of the business were keen that the investment be approved, they made optimistic assumptions about the speed of uptake and, hence, the additional capacity that would be required and the incremental average revenue per user that would be forecasted. The investment case confirmed that indeed the long-term penetration rates were supported by evidence, but that the rate at which that uptake occurred was not. Additional research suggested that the rate of uptake would be slower than the investment case had assumed.

Rather than impoverish the case, as its advocates had assumed, a lower rate of take-up opened up a new possibility, namely, to stage the rollout. This new option would increase the total capex bill for the project, but the investment committee was happy to agree when they realised that the deferral of the second stage of capex added five percentage points to the internal rate of return, reduced the operational risk associated with a “Big Bang” approach and improved financial control by linking the second stage capex to the success of the first stage.

**Figure 4: Looking at costs by business objective**



*Lower costs do not always make better value.*

## Obstacle 4: Delivery risks

The transition from planning to doing is one of the classic fault lines in a large organisation, making the handoff one of the more important steps in the capital investment process. Normally, procurement and project management are simply told to deliver within budget and on time. In practice, though, a well-formulated capex planning process defines the rules of engagement to help frontline staff realise the value anticipated in the investment case.

One mobile operator's site acquisition team was focussed on controlling the cost associated with new sites, even though the economics had greater reliance on the time to deployment. Lower costs do not always equal better value; but because the investment case failed to make explicit the investment philosophy, ample opportunity existed for misunderstanding and for value leaking during delivery. To avoid that outcome, the operator could improve returns by rewarding the team for effectiveness, not efficiency.

At another telecom company, the chief operations officer understood that the fault line existed. But matters were brought into sharp focus when he was charged with delivering a complex and costly next generation network programme with more than 100 component projects. By clustering each of the 100 projects around themes and objectives, procurement was better able to identify gaps and overlaps and to understand the objective behind each cluster. Understanding what conditions were must-have versus negotiable resulted in €10 million of capex savings.

## Conclusions

Capex perennially is a pain point across the industry. The ever-rising bill for new investments and the refusal of capex to generate superior returns are sources of real frustration to telecom business leaders. But despondency is not inevitable, and the battle is not futile. In our experience, rigourously applying a few key principles has the potential to generate significant levels of additional cash from major capital projects. Leading operators are using this cash as a real source of advantage, investing in new areas where superior returns are more likely, and generating the EBITDA and operating free cash flow growth that secures superior returns to investors.

**33%**

33% of all discretionary projects destroy significant amounts of value.

**10%**

10% of projects are abandoned before completion.

**7%**

Only 7% create significantly more value than anticipated.

## *Five-step guide to optimising project capex*

1

*Objectives*

**"Is the investment case clearly articulated, setting out benefits in tangible business terms?"**

- Review the investment case—Is the documentation clear and transparent, and does it define the identified business needs?
- Confirm the investment philosophy—Is the investment to deliver short-term capacity "de-bottlenecking", a gold-plated long-term solution, flexibility, maximum NPV, minimum cash funding requirements, etc.?
- Examine carefully the do-nothing option—Is the investment propping up a marginal asset, product or segment? Can the investment be deferred?
- Test the consistency of understanding—Is the understanding of the various stakeholders (investment appraisal team, business unit heads, investment committee, etc.) consistent with the rationale as expressed by the investment case?

2

*Options*

**"Has an appropriate range of solutions been considered to meet the business need?"**

- Evaluate the completeness of the possibilities considered by the investment case by comparing the suppliers and solutions considered against other options.
- Develop alternative solutions through market testing. Conduct interviews with suppliers and other purchasing organisations to identify a broader range of plausible solutions. Identify suppliers who could develop alternative solutions.

3

*Methodology*

**"Are the assumptions grounded in evidence?"**

- Assess the existing model's fitness for the purpose by assessing the arithmetic integrity, structure, completeness and transparency of the model. Check that the model is capable of performing sensitivity analyses and that it includes project risk and contingencies.
- Review the completeness of the identified costs by identifying the cost drivers (e.g. unit price and volumes, technical standards) and the appropriate allocation of costs to each identified business need.
- Check for due-diligence-grade evidence supporting key assumptions and forecasts.

4

*Delivery*

**"How will we know when we get there?"**

- Agree governance, accountability and responsibility for tracking and realising benefits and for learning.
- Check for consistency of understanding regarding the criteria for success among the various stakeholders.
- Review and challenge the risk management plan.

5

*Challenge*

**"How could we meet these kinds of challenges?"**

- Establish challenge cases by flexing unit costs and volumes in line with alternatives that have been identified to create progressively more stretching.
- Compare challenge cases with the original investment case.

# ***Broadband: One size does not fit all***

*Ultrafast broadband. There is a lot of interest—even excitement—from European policymakers eager to bring the benefits of fibre to everyone. But this interest isn't matched by action from private investors or end users—even where ultrafast broadband is available. Policymakers' expectations, consumer demand, technology, financing and regulation are all critical factors in helping operators determine how, when and where they invest. One thing is clear: We can expect very different broadband experiences in the future in urban compared to rural areas. The digital divide is set to stay.*

**By Brian Potterill**

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The author thanks Alastair Macpherson for his contributions to this article

Why are European policymakers so excited about ultrafast broadband? The principal answer is that telecommunications infrastructure is an economic enabler. Economic studies of the impact of broadband on national economies show that broadband is a foundation for economic growth, job creation, global competitiveness and a better way of life. A World Economic Forum study demonstrated a strong correlation between network readiness and global competitiveness. A World Bank study quantified the benefits of broadband: For every 10-percentage-point increase in broadband services penetration there is an increase in economic growth of 1.3 percentage points.

PwC's own research for the UK Champion for Digital Inclusion found that the total potential economic benefit from getting everyone in the United Kingdom online is more than £22 billion, far in excess of the scale of benefits from universal voice telephony. Amongst the benefits are:

- Better access to education, which could boost lifetime earnings by £10 billion.
- A £500 million economic benefit from reducing frictional unemployment.
- Government transaction costs reduced by £1 billion per annum.
- More efficiency: 3.6 million households no longer missing out on £1 billion a year of online discounts.

Governments have latched onto those benefits, along with the potential stimulus effects of infrastructure investment. State bodies at the local, national and regional levels are formulating plans to harness the effects.

For consumers, broadband has become a must-have product; that makes it largely immune to household budget cuts despite the economic pressures being felt across most other sectors. Growing demand for bandwidth has driven a virtuous circle of demand and product development. This continued growth is testimony to the success of the market, so why the continued debate? And why are policymakers still obsessed with the need to intervene?

Because of uncertainties about revenue, regulation and technology, private investors are playing a waiting game. We explore these drivers so that we can better understand the motives and strategies of the various stakeholders and can draw conclusions on the development of ultrafast broadband in Europe and the implications for all stakeholders.

*Customers don't care what their bandwidth is, they just want quality service.*

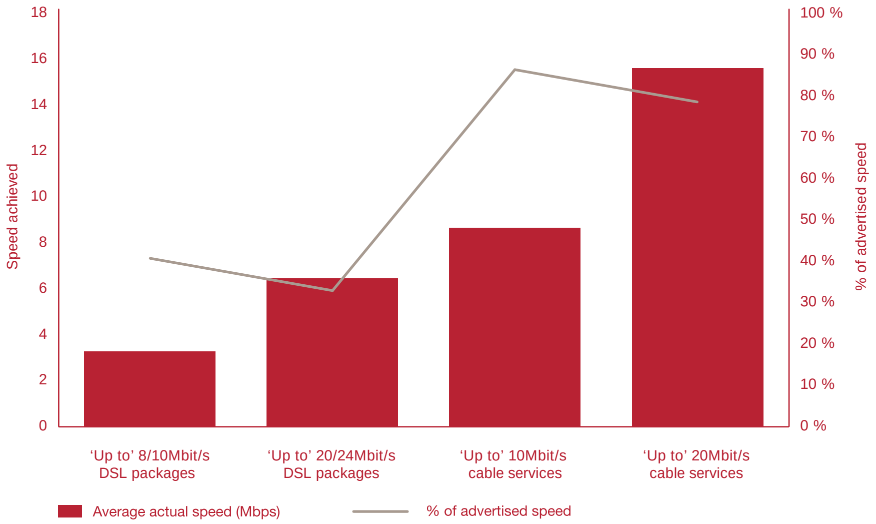
### *Who really wants broadband?*

Recent research from Cisco shows that the growing use of broadband is driven by video. In 2010, online video overtook P2P as the largest usage category, representing 26% of broadband traffic. More than a third of the top 50 sites by volume are video sites. Online video is also becoming mainstream; none of the top 50 sites featured explicit adult content, representing a shift from two years ago.

This shift in customer behaviour is important. Online video is less tolerant of network delays and requires dedicated bandwidth. Customers will demand service quality. They won't care what their bandwidth is or whether or not it is provided by fibre; they will just want the service to work.

The same research highlights that average traffic continues to grow, with "busy hour" traffic having grown 41% in 2010 over 2009 and the average broadband connection now generating 14.9 GB of Internet traffic per month. The growth in usage demand is relentless.

**Figure 1: Ofcom results highlighting difference between advertised and actual speeds on ADSL**




Sources: Ofcom; PwC's analysis.

In July 2010, Ofcom, the UK industry regulator, published research that examined the link between what customers experienced and the bandwidths being marketed. The research revealed that the average speed delivered over ADSL was only 30% to 40% of the advertised speed (see Figure 1). The reasons given to explain this difference highlight some of the technical limitations of ADSL: interference that increases with service uptake and the general degradation of service further away from the exchange. Although advertising standards regimes may vary amongst European markets, these technical limitations apply everywhere.

Separate research by Ofcom concluded that 64% of customers were unaware of their service speed. Given the absence of any correlation between advertised bandwidth and the speed customers experienced, it is hardly surprising that advertised bandwidth is not a significant driver of customer demand.

PwC's own consumer research highlights customer indifference to higher bandwidths. We used conjoint analysis to test the relative importance of different price and product attributes of broadband (see Figure 2). Although customers had a strong preference, at any given price, for an 8 Mbps product over a 2 Mbps product, they were largely indifferent between 8 Mbps and 20 Mbps.

In the UK, BT has launched its fibre broadband product under the brand BT Infinity, which offers 40 Mbps, considerably faster than the "up to 20 Mbps" available on BT's ADSL products. However, the prices of BT's Infinity products are the same as prices for its ADSL broadband—further evidence that customers are not yet prepared to pay for bandwidth.

Additional insight into demand is provided by the October 2010 Eurobarometer household survey. The survey revealed that Internet penetration continues to follow PC penetration upwards, from 49% to 57% between December 2007 and December 2009, with broadband taking an increasing proportion of Internet access. However, it is interesting to note the reasons for households having no Internet access at home. Twenty-five percent of households claimed that "no one in [the] household is interested in the Internet". Only 2% of households claimed that the absence of any broadband coverage at home was the reason for having no Internet access. A further 1% continued with dial-up for the same reason.

So, what does all this mean? There are several important insights from this analysis of demand.

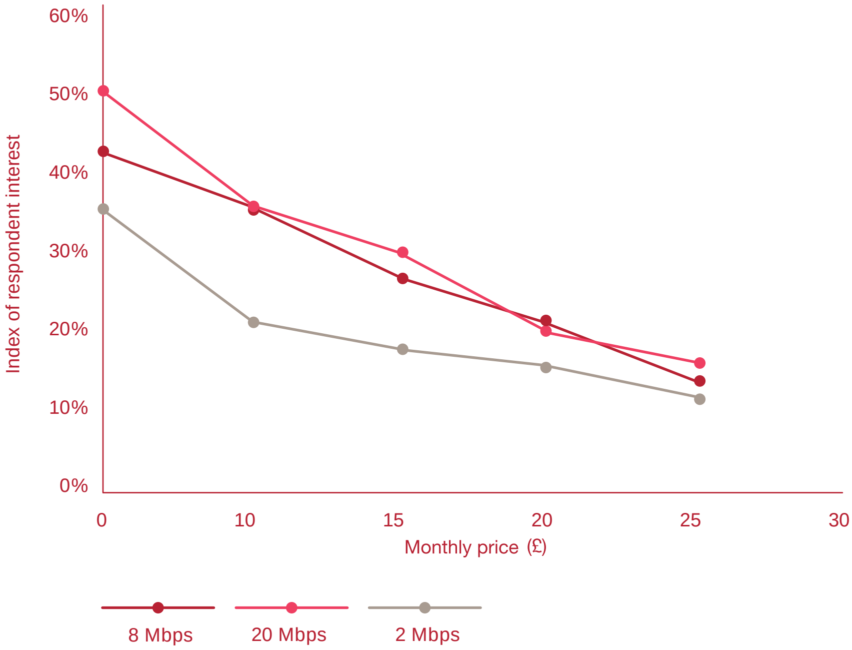
First, online video has become an important application. Customers demand service quality for the applications they use, so the delay intolerance of video is likely to lead to customers becoming far less tolerant of bandwidth constraints.

Second, customers do not value bandwidth, per se, more than they value the experience of the service. It is up to the marketers to make the link in customers' minds between bandwidth and service quality.

Third, it is difficult to envision wireless serving the typical demand for broadband. Even at today's average usage, 10 MHz using LTE (long-term evolution) could support only about 200 users, notwithstanding peak bandwidth and coverage issues. Wireless may have a role in providing broadband access, but users' experience will differ considerably from the experience of using fixed access networks.

Finally, a significant proportion of the population simply does not want Internet access at home. These households far outweigh those that are prevented from having broadband at home because of the lack of network coverage. If society would benefit from the universal adoption of broadband, addressing supply issues will help to close only a small portion of the gap.

**Figure 2: Customer price sensitivity to bandwidth**




Source: PwC's analysis.

## *Matching technology to the need*

The majority of broadband in Europe is delivered via ADSL over copper access networks originally designed many decades ago to carry analogue telephony. The principal advantage of ADSL is cost. Deployment over existing copper requires equipment at the exchange but no significant change in the copper access network. The latest standards, ADSL2+, can deliver up to 24Mb/s over 2 kilometres, but over greater distances the achievable data rate is reduced significantly. In dense DSL deployments, there can be "cross-talk" interference effects significant enough to degrade performance as more users sign up. With growing usage, the copper network is creaking at the seams.

Next generation Ka-band satellite technologies are expected to provide a significant increase in bandwidth over existing technology. However, the costs remain substantial for the provision of satellites, corresponding gateways and customer-premises equipment. Satellite broadband is delivered by using geo-stationary satellites positioned 40,000 kilometres above the equator, and the resulting round-trip latency of more than one-half second will affect the customer experience. Satellite, therefore, is likely to remain viable only in areas not reachable by using other technologies, and even there it will provide basic connectivity rather than support the types of services that customers will increasingly come to expect from the Internet.

*The costs of various technologies depend upon assumptions about coverage and capacity needs.*

Mobile operators already deliver mobile voice (GSM) coverage to populations beyond the reach of fixed broadband, and the refarming of GSM spectrum for 3G provides the opportunity for this coverage footprint to deliver mobile broadband for a relatively small additional cost. However, the economics of delivering mobile broadband are constrained by the scarcity of spectrum. Unlimited-mobile-data retail packages that fuelled customers' acceptance and uptake are now being scaled back as the growth in demand has begun to exhaust the "free" latent capacity in the mobile coverage layer.

Our analysis suggests that the incremental cost of providing mobile capacity is around €3 to €5 per GB. That amount is low enough to support current mobile data packages and usage but would make the cost and price of serving typical fixed broadband usage prohibitive.

These costs could be lowered with the availability of more spectrum. The digitising of TV is freeing up valuable low-frequency spectrum that is well suited to providing coverage in more remote areas—the so-called digital dividend spectrum.

In Australia, Telstra's 3G network runs on low-frequency spectrum that reaches 99% of the population, providing good indoor coverage. Mobile operators in Europe are pointing to their potential role in delivering broadband universal service as a reason for policymakers to limit fees for spectrum. However, many European rural areas are either in pockets or close enough to urban areas that any dedicated wireless coverage would overlap and interfere with commercial wireless coverage. Whilst commercial operators can continue to charge a premium for mobility, they are unlikely to be willing to transfer saleable mobile capacity for the provision of universal fixed broadband.

Mobile will have a role in providing universal broadband where there is a coincidence of latent capacity and incidental coverage, but dedicated wireless coverage and capacity as a substitute for fixed broadband will not provide the same price and experience that users of the fixed Internet have come to expect. Wireless is likely to be viable for providing universal broadband in only a small portion of areas.

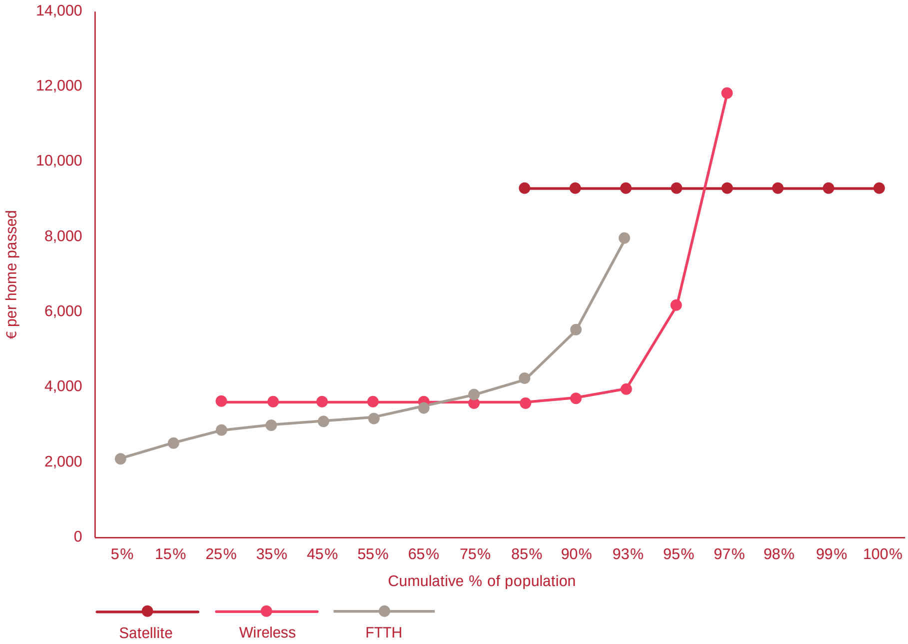
Functionally, fibre stands out amongst technologies; it can provide almost unimaginable capacity over long distances. The key limitations are the cost of deploying fibre, which typically is the cost of burying the fibre, and, to a lesser extent, the cost of the fibre cables. Both are a function of distance, which means that for more dispersed or remote populations the costs are higher.

Where spare duct from legacy copper networks exists, much of this cost can be avoided. But that is likely to be the exception rather than the rule, and fibre deployment will require considerable new digging. For any greenfield deployment, fibre would be used rather than copper; it is far more versatile than copper for a similar cost per customer. However, the challenges are whether even fibre is viable and, where copper already exists, whether the service advantages of fibre over existing technologies are sufficient to justify the investment.

Our analysis of the costs of various technologies, shown in Figure 3, highlights this challenge. In urban areas, customer density makes fibre by far the lowest-cost technology. In rural areas, subject to usage per customer, wireless becomes relatively more viable. In the remotest areas, the coverage footprint of wireless does not capture many customers, so satellite solutions become the best option. A study for the Australian National Broadband Network reached similar conclusions.

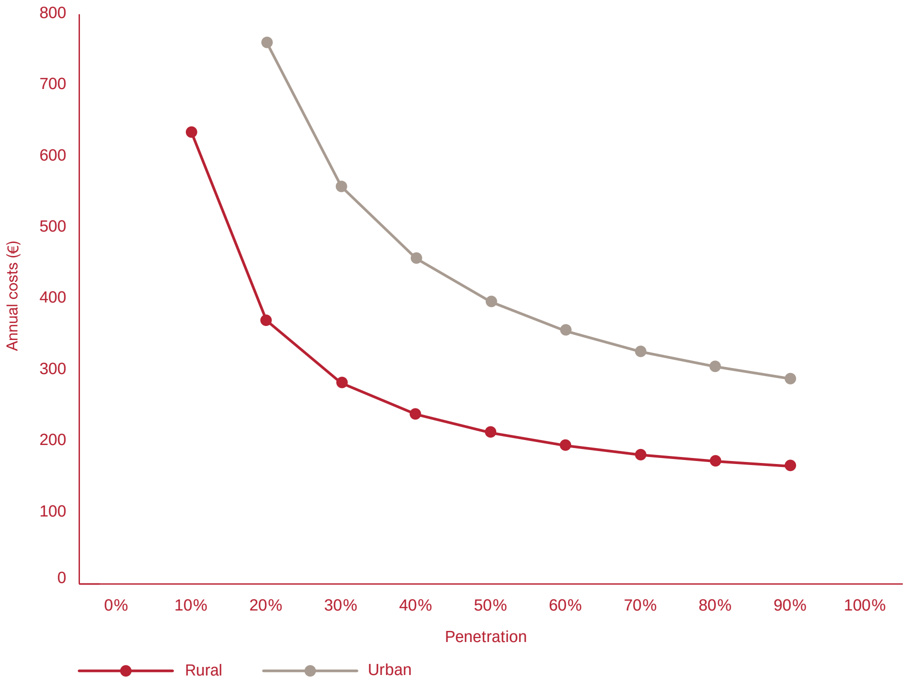
The absolute costs of various technologies depend upon assumptions about coverage and capacity needs, as each technology has different fixed and variable cost drivers. With fibre, the costs are largely a function of the number of homes passed in a particular area and less so of the number of homes actually connected. That can give rise to tremendous economies of scale, depending on uptake in a particular area (see Figure 4). Operators considering investing in fibre, therefore, must take account of the impact of competition as well as end user demand.

## Figure 3: Broadband technology costs




Source: PwC's analysis.

## Figure 4: Urban next generation access annual cost per line




Source: PwC's analysis.

## Recognising the competition factor

With economies of scale being so important, the competitive model is a critical factor in the fibre investment case.

In the United States, unbundled access, or unbundled network elements (UNE), was limited to voice and was not mandated for broadband. As a result, strong vertically integrated providers have emerged, with typically a cable TV and a telco in each urban market. In Europe, unbundled local loop (LLU) has led industry structure in a different direction, with service competition thriving on at-cost access to local access infrastructure (see Figure 5).

More detailed data from Ofcom and Virgin Media in the UK highlight how competition is polarised geographically, with cable and LLU focussing on the urban areas where customer density is the greatest. Our analysis[1](see Figure 6) suggests that BT's retail and wholesale share in the most competitive urban areas is only 10%. Although the UK is the market in which the incumbent has the lowest market share, the same characteristics of competition exist across all European markets. Incumbents are becoming wholesale access providers in urban areas.

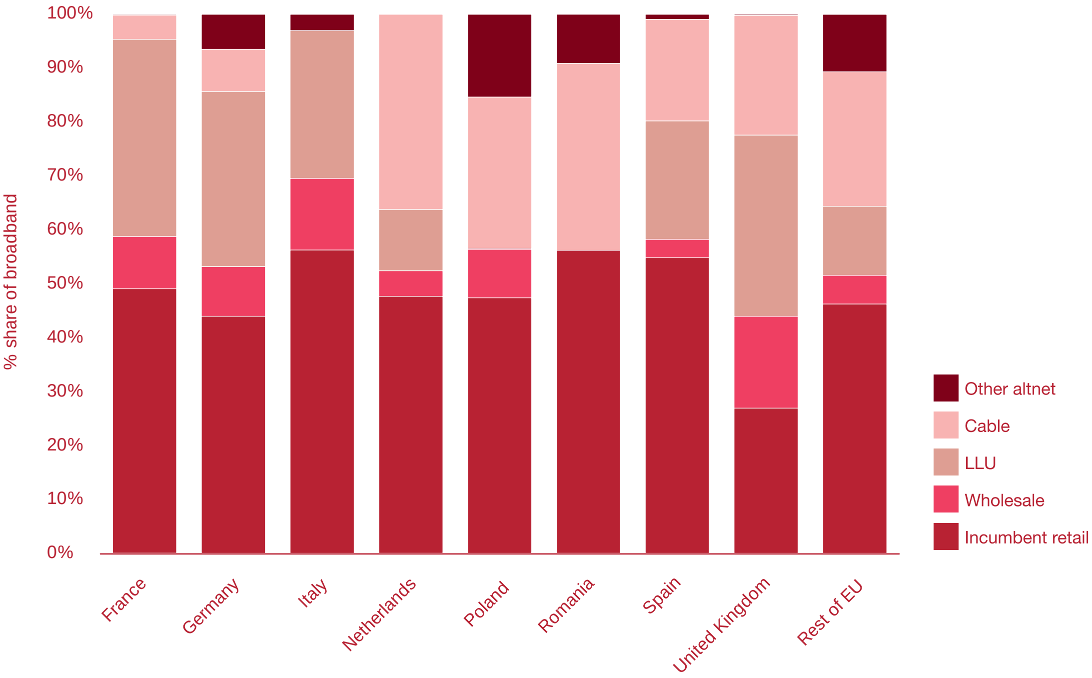
## Setting the rules

Existing industry models have evolved from a world where voice was dominant and where service competition drove higher uptake and benefits to customers through greater choice and lower prices.

In broadband today, there is a risk of a dislocation between the distribution of value and the need for investment. Content and application providers now capture a large proportion of the value, and the wider economy stands to profit from huge externality benefits. But telcos often lack the incentive to invest in the infrastructure necessary to create such value.

The success of service-based competition has left regulators a considerable challenge with next generation access: balancing the need to encourage investment with the goal of greater competition whilst not undermining the interests of the challengers who have made service-based competition such a success.

**Figure 5: Broadband market shares in the EU**




Sources: ECTA; PwC's analysis.

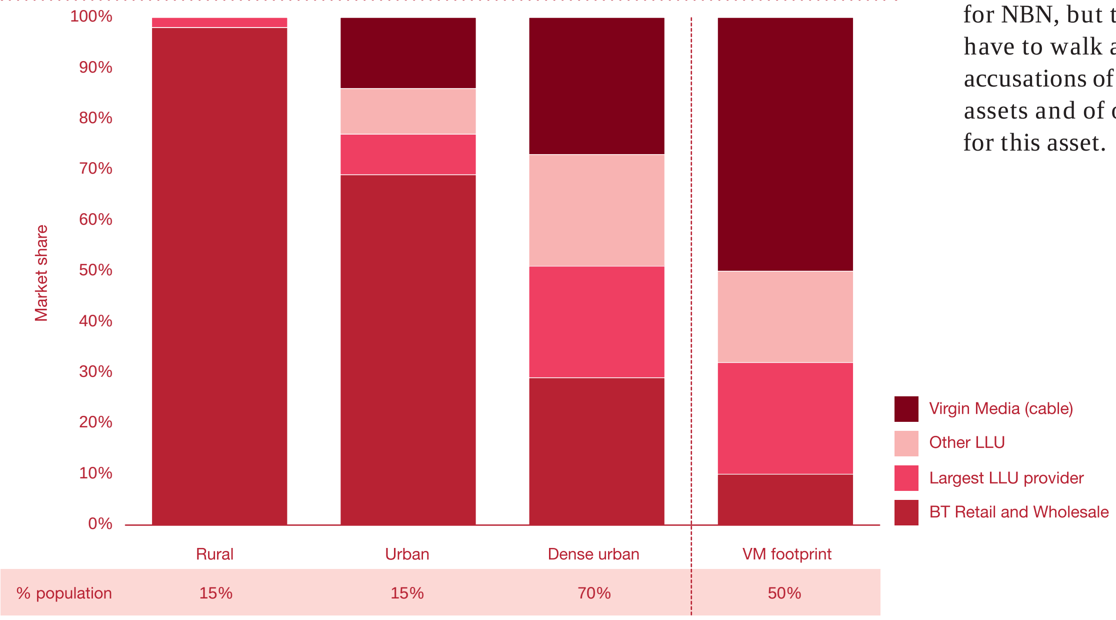
*In broadband today, there is a risk of a dislocation between the distribution of value and the need for investment.*

Impatient with the lack of private investment, governments have begun to design ambitious broadband policies for delivering universal or ultrafast broadband. For example:

- The Australian government announced its proposal for a National Broadband Network (NBN), which, for a cost of A$43 billion, would provide wholesale access and serve all households in Australia by using a combination of fibre, wireless and satellite. The two most contentious issues with this ambitious project are funding and the role of the incumbent, Telstra. The government has published a study that suggested that although private financing would not be viable initially, government funding would be temporary. That strategy may provide the political cover for substantial state funding at a time when most governments are looking for cuts. It is also a dangerous strategy, as it was upon this sort of financial logic that many telcos failed in the dot-com downturn as presumed refinancing turned out to be unrealisable.

The A$43 billion assumes greenfield development. Using Telstra's duct network would lower this cost substantially. However, Telstra's role in the NBN has yet to be clarified. As the owner of a legacy network currently delivering ADSL, Telstra is a potential competitor that could undermine the viability of NBN. But if the NBN is built without Telstra, ultimately, as customers migrate to the better service available with fibre, the value of Telstra's access network could be undermined. The solution that has the most industrial logic is for Telstra to contribute its access network as the foundation for NBN, but the government will have to walk a fine line between accusations of appropriating private assets and of overpaying Telstra for this asset.

**Figure 6: UK market shares by geography**




Sources: Ofcom; PwC's analysis.

1 Ofcom identified exchange areas as being in one of three geographic markets: where there is limited or no competition from LLU; where there is competition from one or two LLU players; or where there is competition from three or more LLU players. We have labelled these markets, respectively, rural, urban and dense urban to reflect their geographic characteristics. We have added a further category that shows those areas in which cable competition is present and have used data from Virgin Media and Ofcom to estimate market shares.

*The key for policy makers is to separate the issues: ubiquity of geographic access, or ultrahigh bandwidth.*

- In France, President Sarkozy has set an ambitious target for 70% of the French population to have access to fibre by 2020 and 100% by 2025. The estimated cost is around €25 to €30 billion. The operators are eager to capture the value added in the most profitable areas, but they will not want to invest in sparsely populated areas. A report by Senator Hervé Maurey showed that the government needs €600 million per year to finance the rural FTTH network. No decision has been announced on how this will be funded.
- The UK government has set aside £830 million for broadband development until 2017. It is widely recognised that this amount would be insufficient to deliver universal, ultrafast broadband; and although pilot areas have been announced for projects to deliver fibre to rural areas, the government has yet to publish its strategy on how it plans to achieve its target of universal broadband. BT has suggested that in return for this £830 million it would be prepared to extend its FTTx service to 90% of the population. That would provide a level of service similar to what urban areas enjoy, but it doesn't address the issue of universal service in remote areas—and there is where the real costs lie.
- Many sub-national projects have been launched, supported by a mixture of local government and EU funding. These projects have covered rural and urban areas, with some of the urban ones being challenged, unsuccessfully, by telcos under state aid rules. One of the most contentious of these is the plan by the French Département des Hauts-de-Seine to deploy municipal fibre in one of the most densely populated areas of Paris.

These developments highlight the disconnection between policy and objectives. It is the lack of universal access that stands in the way of wider economic benefits. In high cost-to-serve areas, customers either would not or could not pay sufficiently to justify the investment required to deliver service. The taxpayer, then, may have a role in unlocking this market failure.

The level of taxpayer subsidy required to meet governments' ambitions is substantial in return for an ill-defined and immeasurable dividend in the gross domestic product over an indeterminate period and over a timescale that will be too late to deliver any stimulus effect significant enough to address the current financial crisis. The key for policymakers is to separate the issues: ubiquity of geographic access, or ultrahigh bandwidth. Governments need to take stock of their ambitions.

Fibre may be the best technology to deliver universal broadband in some cases. In these cases, universal service policy will deliver ultrafast broadband, but it is not ultrafast that should be the aim of universality. The principal use of ultrafast is for entertainment, whereas many of the social and economic benefits of universality can be achieved using lower-speed broadband, which can be delivered by such other technologies as wireless and satellite.

Ultrafast broadband will be commercially viable in many urban areas. The role of policymakers should be to strike the right balance between encouraging investment and encouraging competition, so that ultrafast reaches a larger proportion of the population without enshrining a new monopoly. BT's £2.5 billion investment in FTTN/FTTH shows that strong competition in infrastructure and in services can drive investment. With cable dominant in many urban areas and much of the rest of the retail in these areas ceded to LLU players, BT risked slow decline if it did not invest. BT waited, though, until it was clear that it would not be required to offer cost-based prices for wholesale products before it made any large commitments. If BT can make the business case work with its low retail share, then other incumbents likely could do so, too.

Perhaps the issue is a lack of competitive stimulus that allows incumbents to harvest returns from legacy copper assets for longer periods. State funding in such urban areas could be misplaced, which risks crowding out private investment and distorting the market.

The European Commission has responded to the challenge and in September 2010 published its recommendations for regulating next generation access. In particular, its recommendations:

- Provide no regulatory holidays. Incumbents sought an initial period free of regulation as an incentive to invest. The EU concluded that such a holiday would risk re-establishing incumbent monopolies and would damage alternative operators.
- Allow remedies to be at the discretion of national regulatory bodies, recognising the various demand and supply conditions that exist in European countries.
- Require differing regulatory remedies for urban and for rural areas, recognising that the areas may have differing characteristics.
- Support co-investment arrangements and allow lower access prices to be set for access seekers who provide up-front commitments on long-term or volume contracts.
- Recognise that a risk premium in fibre assets should be applied when calculating cost-based prices.

These recommendations represent a loosening of regulations compared with those that applied to copper access. Remedies such as cost-based LLU (or its fibre equivalent) would no longer be mandatory, and access providers would be permitted to share risk with customers in ways that previously would have been prohibited as discriminatory.

## *What it means for you*

We can expect very different broadband experiences in the future in urban compared to rural areas. The digital divide is set to stay. Urban areas can expect ultrafast broadband, sufficient to support multiple streams of high-definition TV, and competition at least at the service layer. In rural areas, high speeds will not be ubiquitous: Some areas will benefit from urban-type speeds, but many others, with service delivered over existing copper or over wireless or satellite, will have to make do with speeds that barely support the mass-market applications of today.

In the race for ultrafast broadband, incumbents will develop different business models for these different markets. Urban will be wholesale-driven with the rollback of retail regulation to reflect the lack of dominance in the reality of the urban market structure. In rural areas, infrastructure development will require new partnership models to bring in state funding, but incumbents will retain their dominance in rural retail markets. In response to these diverging markets, incumbents should consider separating their business into separate urban and rural units as a mechanism for aligning each with its respective circumstances and to remove urban profits as a source of cross-subsidy for rural universal service.

Cable companies will thrive. Despite their emerging dominance in urban areas they continue to benefit from regulatory leniency. Where the model is one of regulated access to last mile infrastructure, it is difficult to sustain the current regulatory forbearance reserved for cable operators, but cable access regulation shows no signs of emerging.

Cable companies should consider a voluntary wholesale model. Vertically integrated companies have a cultural tendency to resist the use of wholesale channels for fear that doing so could undermine the position of their downstream retail operations. But not doing so risks neglecting the tremendous source of value that is the network—and there may be a better balance to be had, one that uses wholesale as a means of driving economies of scale in the network.

Wireless does have a part to play in universal service, but it will be difficult to ring fence core spectrum for this purpose. Operators will argue for measures that would limit spectrum prices, but that might not directly affect the contribution of wireless to universal service. Instead, regulators may choose to include service and coverage requirements in spectrum licenses.

For alternative network operators (LLU operators), regulation is pivotal. LLU-based altnets have played a key role in delivering the benefits of service competition in urban areas, but with the advent of fibre, their role will necessarily change. Risk-sharing models offer both opportunities and threats. If some altnets don't participate, they risk being squeezed by those that do. In any case, altnets should push for a continuation of the service competition model into the new technology and, going further, seek the removal of the implicit cross subsidies from urban to rural.

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