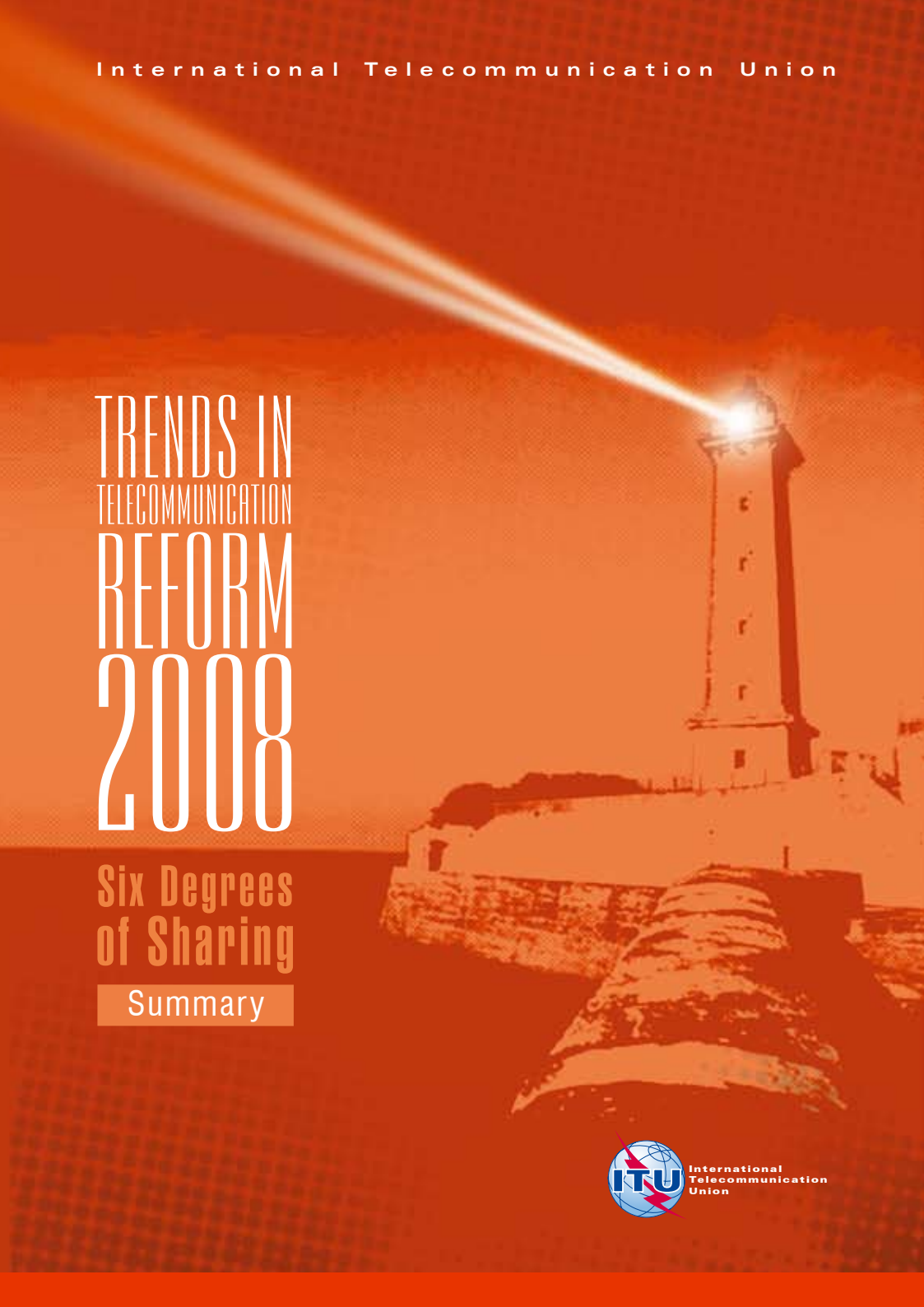
International Telecommunication Union

TRENDS IN TELECOMMUNICATION REFORM 2008

Six Degrees of Sharing

Summary



International Telecommunication Union

International Telecommunication Union
Place des Nations
CH-1211 Geneva, Switzerland

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INTRODUCTION

The Telecommunication Development Bureau (BDT) of the International Telecommunication Union (ITU) is pleased to present the ninth edition of *Trends in Telecommunication Reform*, an integral part of ITU/BDT's ongoing dialogue with the world's ICT regulators. The theme of this year's edition of *Trends* – "Six Degrees of Sharing" – encapsulates new market and regulatory strategies that optimize and maximize investment in broadband networks and ICT equipment and services. Past editions of ITU's *Trends in Telecommunication Reform* have explored key regulatory issues such as interconnection, universal access and licensing of domestic service provision. These issues can be seen as making up a first wave of regulatory reform that has been vital to growing the ICT sector in developing countries. This edition, however, addresses a newer, second wave of regulatory reforms designed to promote widespread, affordable broadband access.

In a way, many regulatory practices can be viewed as sharing. What is new and innovative is their application to meet the needs of developing countries. What is the same is that they use time-tested, pro-competition tools, such as the regulation of essential or bottleneck facilities, transparency, and the promotion of collocation and interconnection.

Sharing options are also being closely examined among regulators in developed countries. Regulators in those countries are now facing the difficult task of encouraging efficient deployment of next-generation networks (NGNs) to meet bandwidth-hungry consumers' needs, while maintaining a pro-competitive environment that fosters the emergence of new, innovative players.

This year's edition comprises eleven chapters under the global theme of infrastructure sharing:

- Chapter One provides an ICT market and regulatory overview for 2008, to set the stage for the chapters to come;
- Chapter Two defines sharing broadly, focusing on the many ways in which networks and support infrastructure can be shared to promote affordable network access and competition;
- Chapter Three explores the mechanisms and policies for extending access to national fibre backbones in developing countries;
- Chapter Four discusses the sharing of mobile networks and support infrastructure, such as towers, poles, ducts and rights of way;
- Chapter Five moves beyond network sharing to explore new techniques and radio spectrum sharing policies designed to meet the escalating demand for spectrum needed to provide a growing range of wireless services;
- Chapter Six delves into the issues driving the liberalization and sharing of international gateway facilities, including undersea cables, cable landing stations and satellite assets;
- Chapter Seven turns to an exploration of functional separation as a regulatory means to break up network bottlenecks and place retail service provision on a level competitive footing;
- Chapter Eight takes a novel perspective on sharing, exploring international roaming as the "sharing" of customers by wireless operators in different countries;
- Chapter Nine discusses sharing in a convergence context, as Internet Protocol television (IPTV) and mobile television evolve into new media for content distribution;
- Chapter Ten looks at sharing from an end-user perspective, as policy-makers and equipment manufacturers create opportunities for ICT access by multiple users, either sequentially or simultaneous by – effectively creating "end-user sharing";
- Finally, Chapter Eleven ties it all together in a conclusion and takes a look ahead.

1 MARKET AND REGULATORY TRENDS

A vibrant ICT sector faces tough economic times

The year 2008 saw growth in mobile networks and subscribers rise to an all-time high, reaching an estimated 4 billion mobile subscribers worldwide[1]. A growing array of broadband wireless systems are now available, opening the way for users in developing countries to access the Internet on mobile phones and other handheld devices. At the same time, more developing countries were deploying national fibre backbones and backhaul networks to transport their growing data-rich traffic. In addition, several new international submarine cable networks were set to connect developing countries to the global network of Internet backbones – just as a group of high-tech entrepreneurs were working to revive plans for a constellation of broadband satellites for the developing world.

Then came September 2008, and with it the exploding global financial and credit crisis. The dramatic events of autumn called into question whether the necessary financing would remain available to ensure that the positive trends in the ICT sector would continue. Indeed, financing network growth may have just become a lot tougher. As could be expected, the bad financial news in September and October sparked a handful of announcements that planned network upgrades would be postponed.

Analysts' predictions on the impact of the financial crisis on the telecommunication sector ranged from the optimistic – predicting only a slight impact through 2009 – to a decline of nearly 30 per cent in capital expenditures in the year ahead. But even the most dour prognosticators noted that everything depended on the severity of the financial crisis, which was still unfolding in late 2008.[2]

Fixed-line service holds steady; Mobile service grows rapidly

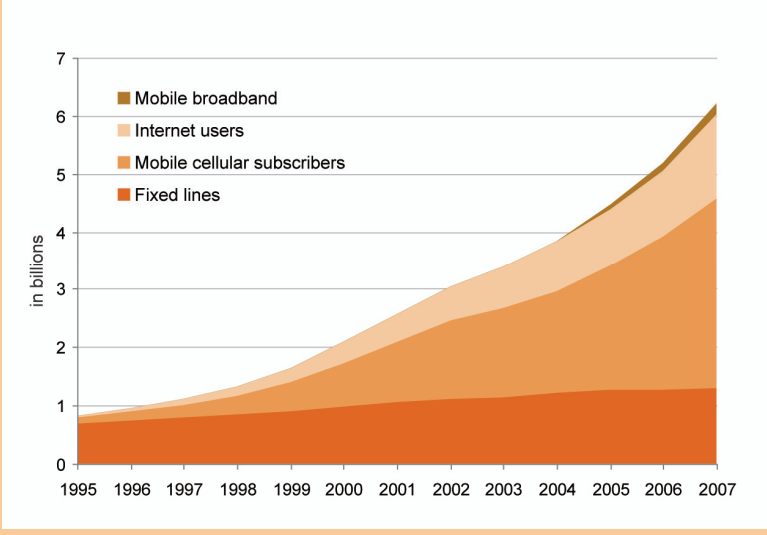
Fixed-line market penetration remains comparatively low in most developing countries, at an average of 13 per cent by end of 2007 even though the developing world accounted for 58 per cent of the world's 1.3 billion fixed phones lines in 2007. In fact, this segment of the market showed a decline in developed countries and just a slight increase in some developing countries. Overall, it is fair to say that fixed-line penetration worldwide stagnated in 2007.

Mobile penetration, however, continued to show high growth rates – enough to reach an estimated 61 per cent of the world's population (some 4 billion subscribers) by the end of 2008. Moreover, by the beginning of the year, more than 70 per cent of the world's mobile subscribers were in

developing countries. Five years earlier, in 2002, those subscribers had been less than 50 per cent of the world total. Africa remains the region with the highest growth rate (32 per cent between 2006 and 2007).

Figure 1.1: Worldwide ICT growth

Growth in fixed lines, mobile cellular subscribers, estimated Internet users and subscribers to mobile broadband networks, in billions, 1995-2007



Source: ITU World Telecommunication/ICT Indicators Database.

High-speed, broadband access trends upward

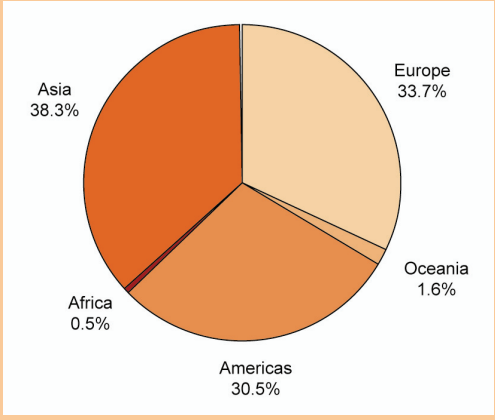
ITU's Internet and broadband data suggest that more and more countries are going high-speed. By the end of 2007, more than 50 per cent of all Internet subscribers had a high-speed connection. Dial-up is being replaced by broadband across developed and developing countries alike. In developing countries such as Chile, Senegal, and Turkey, broadband subscribers represent over 90 per cent of all Internet subscribers.

At the same time, major differences in broadband penetration levels remain, and the number of broadband subscribers per 100 inhabitants varies significantly between regions. While fixed broadband penetration stood at less than 1 per cent in Africa, it had reached much higher levels in Europe (16 per cent) and the Americas region (10 per cent) by the end of 2007.

The difference in the uptake of broadband is also reflected by the regional distribution of total broadband subscribers (see Figure 1.2). Despite significant broadband uptake in developed countries, a vast majority of developing countries still lag behind, especially those with low-income economies.

Figure 1.2: The broadband divide

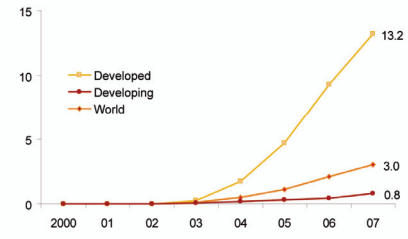
Broadband subscribers by region, 2007



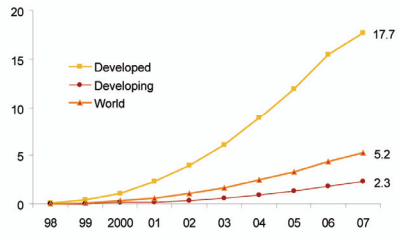
Source: ITU World Telecommunication/ICT Indicators Database.

Figure 1.3: Fixed and mobile broadband evolution in developed and developing countries

Mobile broadband subscribers per 100 population, 2007



Fixed broadband subscribers per 100 population, 2007



Note: ITU's definition of "Mobile broadband" covers mobile cellular subscribers with access to data communications at broadband speeds (minimum of 256 kbit/s).

Source: ITU World Telecommunication/ICT Indicators Database.

The shift to all-IP environments

Probably the best example of the "all-IP" move is the rise of Voice-over-Internet-Protocol ("VoIP") services. In the last few years, VoIP services have continued to grow strongly. Even if they were not as "disruptive" to traditional telephony as had been predicted, VoIP offerings have proved to be some of the most successful Internet applications. Over the past two years, the market presence of VoIP has surged forward, although at a slower growth rate than in 2005. More importantly, it is steadily replacing traditional public switched telephone network (PSTN) lines in many developed and some developing countries.

Both in France[3] and Japan[4], about one-third of all fixed lines were VoIP lines at the end of 2007. According to some market analysts, the global number of VoIP subscribers reached 80 million in 2008.[5] It is worth noting that business users constitute an increasing share of the total number of subscribers worldwide. Of course, the regional distribution of those subscribers varies, depending on the cost of traditional fixed-line communications as well as the regulatory treatment of VoIP and of the international gateway for PSTN long-distance calls.

Mobile broadband markets grow in importance

Today, a number of mobile markets, both in developed and developing economies, are saturated or close to saturation, whereas broadband penetration rates are still relatively low in many countries. The combination of these two factors has given a major push to the rise of mobile broadband offerings over the last year. The number of mobile broadband subscribers reached 167 million at the end of 2007, driven by 18 per cent growth since 2006.[6] The market is being stoked by robust competition among new and emerging technologies, such as the 2.5G and 3G, as well as the emerging "3.5 G" or 4G families of technologies: *high-speed packet access* (HSPA), WiMAX, and *long-term evolution* (LTE).

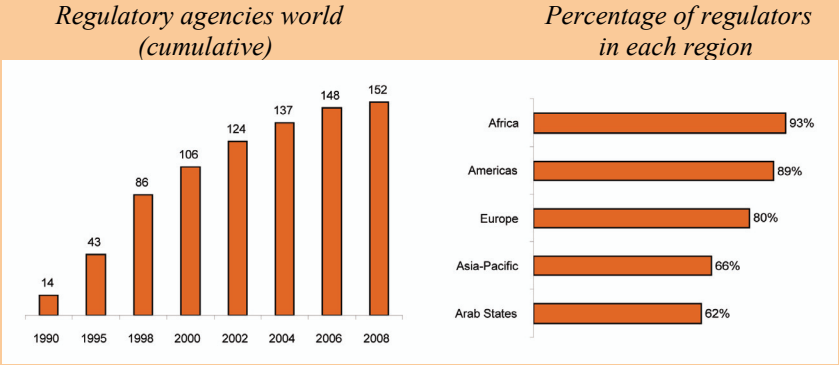
Changes in regulatory practices

The first wave of sector reforms in developing countries, starting in the late 1990s, attempted to create more transparent and stable legal and regulatory frameworks, with an emphasis on establishing national regulatory authorities and opening certain market segments, such as mobile voice, to competition. The goal was to attract investment and make progress toward universal access to basic telecommunication services. Drastic changes in the sector have since flowed from technological innovation, convergence of services, and growing

competition. These changes may now require a further regulatory shift to open more market segments to competition and update licensing and spectrum management practices in order to foster growth in broadband networks and converged services. A rise in competition and new service providers will also require an enhanced focus on dispute resolution.

As of October 2008, 152 countries had created a national regulatory authority for their ICT and telecommunication sectors. Africa now has the highest percentage of countries with a separate sector regulator (93 per cent) followed by the Americas (89 per cent) and Europe (80 per cent). The Arab States and Asia-Pacific number 66 per cent and 62 per cent, respectively (see Figure 1.4). Since 2007, two new ICT regulators had been created: the Regulatory Authority for Posts and Telecommunications in Guinea and the Vanuatu Independent Telecommunications Regulator. Two additional agencies were being established in the Arab States and at least one more was planned in Africa.

Figure 1.4: The number of regulatory authorities, globally and by region



Source: ITU World Telecommunication Regulatory Database.

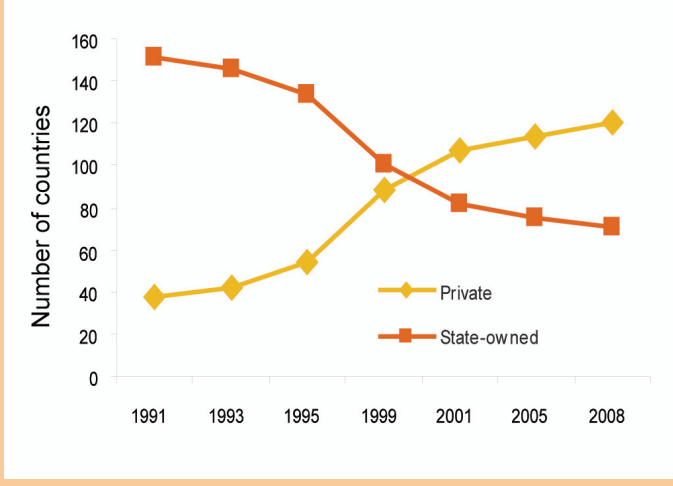
Private ownership and competition trends

By mid-2008, 125 ITU member countries had a privately-owned, or partially privatized, national fixed-line incumbent (see Figure 1.5). The regions with the highest percentage of private ownership are Europe (78 per cent), the Americas (74 per cent), and Asia-Pacific (53 per cent). Although a majority of countries in Africa and in the Arab States still have state-owned incumbents (53 per cent and 52 per cent, respectively), a number of countries in these regions have embarked on the privatization path.

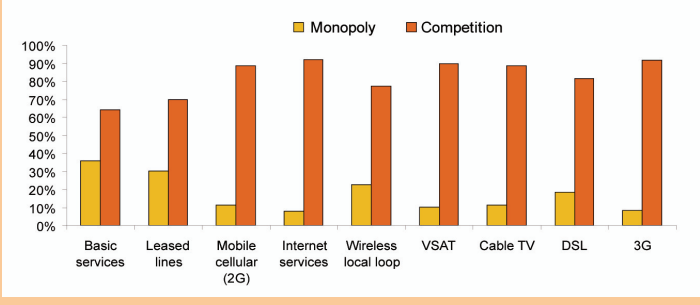
Algeria, Guinea and Mali have announced plans to privatize their incumbent operators in the coming year. Will these privatizations suffer from the current global economic and financial crisis? While it is hard to predict the long-term impact this crisis will have on the ICT sector, there is certainly the possibility that it will affect the flow of capital into privatizations in developing countries.

Figure 1.5: Ownership of the fixed-line incumbents, globally, and competition in selected services, worldwide, 2007

Status of fixed-line incumbents, worldwide, 1991-2008



Status of competition



Source: ITU World Telecommunication Regulatory Database.

Markets steadily continue to open to competition. Mobile (2G as well as 3G and beyond) and Internet services continue to be the most competitive markets, while fixed-line services are increasingly becoming competitive, as well. Only 40 countries had authorized competition in the provision of basic telecommunication services in 1997, but a decade later the number had risen to about 110 countries.

Encouraging effective competition has proved to be the best way to promote ICT sector development and consumer accessibility. Liberalization of access to international facilities is another trend taking place in developing countries, especially in Africa. Countries that have liberalized international gateways have seen prices fall and quality of service improve. Liberalization includes licensing or authorization of multiple players for the provision of international gateway services and opening up cable landing stations to competition.

Looking at ensuring competitive access to essential facilities, one of the recent developments in policy-making is the concept of "equivalence of inputs", which holds that all market players should enjoy the same access to essential facilities.[7] Remedies such as accounting separation appear inadequate, in some cases, to ensure non-discriminatory access to incumbents' networks. The European Commission, for example, is searching for more effective measures – including functional separation as a last-resort remedy. This is discussed in greater detail in Chapter 7 of the 2008 edition of *Trends*.

2 EXPLORING OPTIONS FOR SHARING

Why sharing, why now?

The single biggest reason to adopt sharing is to lower the cost of deploying broadband networks to achieve widespread and affordable access to ICTs. Developing countries can leverage the technological, market and regulatory developments that have led to an unprecedented uptake in mobile voice services to promote widespread and affordable access to wireless broadband services and IP-based national fibre backbones, as well.

Promoting widespread broadband access costs real money. Deploying mobile base stations or fibre backbone networks to reach rural areas may be uneconomical if each service provider must build its own network. Likewise, laying fibre to every home, building or street cabinet – the goal of many developed countries – may be unattainable if operators act alone. Companies can, however, share some infrastructure but compete in providing services. With an effective legal and regulatory framework and the right incentives, the critical factor in creating new, affordable broadband access and backbone networks will be government willpower.

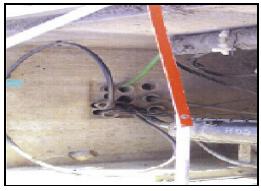
Sharing does not mean abandoning market liberalization or universal access practices. On the contrary, further market liberalization is required, for example, in international gateway markets, and to allow a new range of market players to meet the pent-up demand for broadband services. Universal access practices also can be refined and improved. All sharing practices – and infrastructure sharing, in particular – are integral parts of a competitive regulatory framework. Infrastructure-sharing regulations, whether mandatory or optional, are usually included in a country's interconnection framework, although they are occasionally contained in operators' licensing agreements.

Passive and active infrastructure sharing

Infrastructure sharing takes two main forms: passive and active. *Passive infrastructure sharing* allows operators to share the non-electrical, civil engineering elements of telecommunication networks. This might include rights of way or easements, ducts, pylons, masts, trenches, towers, poles, equipment rooms and related power supplies, air conditioning, and security systems.

Figure 2.1: Key elements of passive infrastructure for fibre networks

Passive infrastructure sharing
(non-electronic components)



Ducts

Trenches

Cables
Ducts
Splitters
Shelters
Generators
Air-conditioning equipment
Diesel electric generator
Battery
Electrical supply
Technical premises
Easements, ducts and pylons

Note: This is a non-exhaustive list including inter-modal network elements.
Source: Jim Forster, ITU and ARCEP[8].

These facilities and systems all vary, of course, depending on the kind of network. Mobile networks require tower sites, while fibre backhaul and backbone networks require rights of way for deploying cables, either on poles or in trenches. International gateway facilities, such as submarine cable landing stations, can be opened for collocation and connection services, allowing operators to directly compete with each other in the international services market.

Access to physical ducts, masts/poles (in the case of power transmission lines), and rights of way are key potential passive network elements for encouraging the rollout of national fibre infrastructure through sharing. This has two aspects, one relating to cost and the other affecting speed of action. National governments, municipalities and state-owned enterprises frequently charge considerable sums of money for rights of way that allow operators to carry out physical trenching of ducts.

Active infrastructure sharing involves sharing the active electronic network elements – the intelligence in the network – embodied in base stations and other equipment for mobile networks and access node switches and management systems for fibre networks. Sharing active infrastructure is a much more contested issue, as it goes to the heart of the value-producing elements of a business. Many countries have restricted active infrastructure sharing out of concern that it could enable anti-competitive conduct, such as collusion on prices or service offerings.

Table 2.1: Key elements of active infrastructure

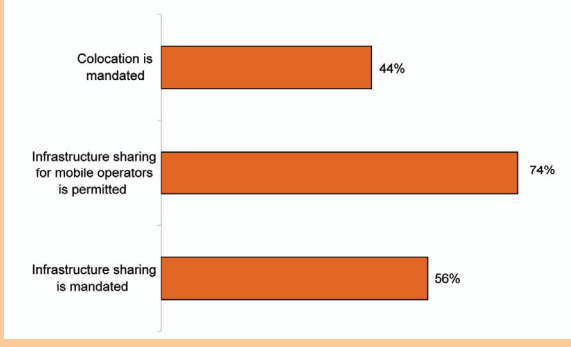
Active infrastructure sharing (Electronic components)	Optical network unit (ONU) Access node switches Management systems Broadband access remote server (BRAS) Coarse or dense division multiplexing Software (core network systems like billing)

Source: T. Cohen, ICASA, South Africa, and R. Southwood, Balancing Act, United Kingdom.

These concerns remain valid, but they have to be weighed against advances in technology and applications that enable service providers to differentiate their offerings in the market. In addition, for some remote and less accessible areas, the risks of active infrastructure sharing have to be balanced against the alternative of having no services at all. Regulators may at least allow active infrastructure sharing for a limited time, until demand for ICT services grows to support multiple network operators.

Regulators and policy-makers may elect to adopt only one kind of infrastructure sharing, or they can implement many options simultaneously. Some regulatory frameworks today may authorize passive infrastructure sharing, for example, while prohibiting active infrastructure sharing. Some regulators simply have not addressed the issue – neither explicitly authorizing nor prohibiting infrastructure sharing.

Figure 2.2: Percentage of countries mandating or permitting infrastructure sharing, worldwide, 2007



Source: ITU World Telecommunication Regulatory Database.

3 EXTENDING ACCESS TO FIBRE BACKBONES

Complementing efforts to improve local access

A critical aspect of promoting wider broadband use is ensuring that national fibre infrastructure is affordable. While competition at the international level has often driven down the price of bandwidth, national bandwidth prices in developing countries are set by one or two providers and, as a result, often remain high.

Increasingly, the sharing of infrastructure by telecommunication operators, based on a model of open access, is one option attracting greater policy attention. While liberalized markets already have numerous models of infrastructure sharing, such as collocation, national roaming and local loop unbundling, other forms of sharing are also starting to emerge that involve sharing both the "passive" and "active" elements of the network. However, effective enabling regulation and policy are critical to facilitate such arrangements.

Infrastructure-sharing regulation and policy must address two broad issues that are often viewed as the stumbling blocks to speedy roll-out of national telecommunication infrastructure:

- Opening up access to "bottleneck" or "essential" facilities, where a single dominant infrastructure operator provides or leases facilities.
- Promoting market investment in deploying high-capacity infrastructure to unserved or underserved areas.

Box 3.1: What is *open access*?

Open access means the creation of competition in all layers of the network, allowing a wide variety of physical networks and applications to interact in an open architecture. Simply put, anyone can connect to anyone in a technology-neutral framework that encourages innovative, low-cost delivery to users. It encourages market entry from smaller, local companies and seeks to prevent any single entity from becoming dominant. Open access requires transparency to ensure fair trading within and between the layers, based on clear, comparative information on market prices and services.

*Source: Info*Dev, 2005.

Broadband services and the infrastructure on which they depend have become recognized as an essential input to business, education, health care and participation in the information economy. A developed broadband infrastructure is a pre-requisite for increased investment in any community.

In economic terms, access to a national broadband fibre network is as important a priority as building an effective national transportation network. Given the central role that ICTs play in the information economy, many argue that broadband access is a "public good" similar to roads and railways. Without broadband access, developing countries run the risk of enlarging the "digital divide" and becoming second- or third-class nations within the global order. Having competitively priced national broadband access has become an important criterion of global competitiveness.

The role of government

Government has a key role to play in facilitating the most effective use of infrastructure assets, identifying parts of the country where there are gaps, and getting coverage extended to them. Moreover, governments, together with regulators, can establish effective regulatory frameworks and regimes that promote effective use and sharing of networks. Designing a regulatory framework may depend on whether the national backbone provider competes with other service providers for end users (and therefore has every incentive to block competitors) or whether the backbone provider does not serve end users (and therefore has every incentive to sell as much capacity as possible to those who do). In the former case, the regulatory response could be to treat the backbone network as an essential facility, including regulating prices for access as well as establishing uniform collocation and connection terms for all market players seeking access to the backbone. In the latter, it may be sufficient to revise licensing frameworks to authorize one or more new entrants to enter the backbone market and to work with local government officials to secure rights of way to lay the fibre backbone network. Local governments could be encouraged to provide rights of way, for example, in exchange for connecting schools and hospitals to the high-speed backbone network.

4 MOBILE NETWORK SHARING

Rolling out mobile networks involves intensive investment and sunk costs, potentially leading to high mobile-service prices. Mobile infrastructure sharing is one alternative for lowering the cost of network deployment, especially in rural, less populated or economically marginalized areas. Mobile infrastructure sharing may also stimulate the migration to new technologies and the deployment of mobile broadband networks, which are increasingly seen as the best way to make broadband Internet access available to the majority of the world's population. Mobile sharing may also enhance competition among operators and service providers.

Passive mobile sharing

For mobile sharing, the passive elements are defined as the physical network components that do not necessarily have to be owned or managed by each operator. Instead, these components can be shared among several operators. The provider of the infrastructure can either be one of the operators or a separate entity set up to build and operate it, such as a tower company. The passive infrastructure in a mobile network is composed mainly of:

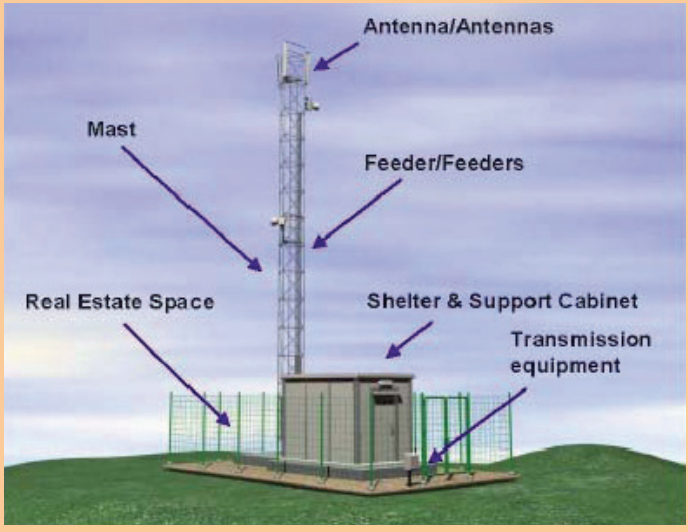
- Electrical or fibre optic cables;
- Masts and pylons;
- Physical space on the ground, towers, roof tops and other premises; and
- Shelter and support cabinets, electrical power supply, air conditioning, alarm systems and other equipment.

A collection of passive network equipment in one structure for mobile telecommunications is generally called a "site." Therefore, when one or more operators agree to put their equipment on (or in) the same site, it is called "site sharing" or "collocation."

Active mobile sharing

In addition to sharing passive infrastructure, operators may also share active elements of their wireless networks. The "active elements" of a wireless network are those that can be managed by operators, such as antennas, antenna systems, transmission systems and channel elements. Operators may share those elements and keep using different parts of the spectrum assigned to them. Although active infrastructure sharing is more complex, it is technically possible. Equipment manufacturers can supply packages that have expressly been designed for active mobile sharing.

Figure 4.1: Passive mobile sharing: Options available in site sharing



Source: Telecom Regulatory Authority of India (TRAI), Recommendations on Infrastructure Sharing.

It is clear that network-sharing agreements may benefit operators and the general public. They help operators avoid costs for building or upgrading redundant network sites and allow them to gain additional revenue streams from leasing access. Operators also can achieve considerable savings in rent, maintenance and transmission costs. They may also achieve economies of scale by combining operating and maintenance activities.

Network sharing may further help operators to attain better coverage, since they may choose to use only those sites that provide deeper and better coverage, decommissioning sites with poor coverage possibilities. Network-sharing agreements may also bring substantial environmental benefits, by reducing the number of sites and improving the landscape.

There are obstacles to be overcome, of course, when dealing with network-sharing agreements. From an economic and practical point of view, network sharing is a complex process that requires substantial managerial resources. Therefore, regulators should analyse the potential benefits to be generated by network sharing on a case-by-case basis, taking into account the specific characteristics of each market involved.

5 SPECTRUM SHARING

Spectrum sharing encompasses several techniques – some administrative, some technical and some market-based. Spectrum can be shared in several dimensions: time, space and geography. Limiting transmission power is also a way to permit sharing among low-power devices operating in the spectrum "commons" – as with *dynamic spectrum access*, which takes advantage of power and interference reduction techniques. Sharing can also be accomplished through licensing and/or commercial arrangements involving spectrum leasing and trading.

As the demand for spectrum increases and available frequency bands become more congested, especially in densely populated urban centres, spectrum managers are exploring diverse paths to sharing frequencies:

- Using administrative methods, including in-band sharing;
- Creating new, secondary market mechanisms, such as spectrum leasing and spectrum trading;
- Adopting unlicensed or spectrum "commons" approaches; and
- Encouraging use of low-power radios or advanced radio technologies, such as ultra-wideband or multi-modal radios.

Increasingly, spectrum managers will have to resort to new techniques and technologies to allow spectrum sharing. In theory, all bands can be shared, using combinations of administrative means (setting geographic separation buffers and channelization plans) and technical solutions (SDR and cognitive radio, as well as smart antennas). Power limits and more robust receivers are also key factors.

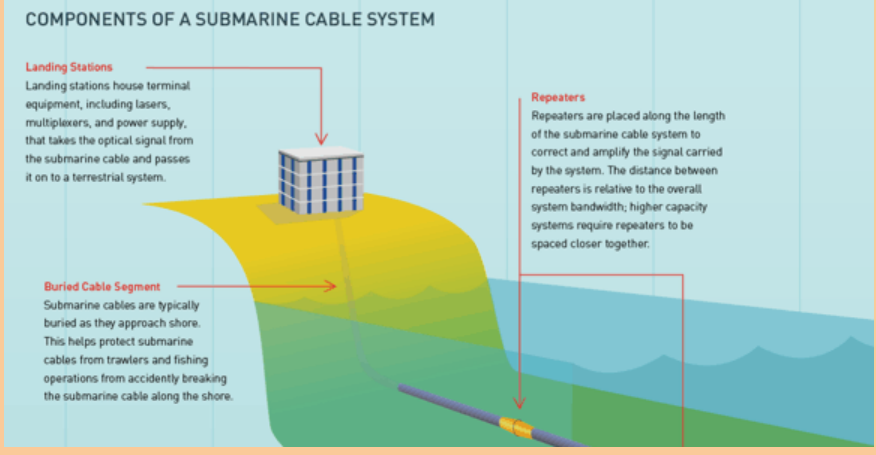
Interference, however, cannot be eliminated and so must be managed. Identifying interference management models that support spectrum sharing under either administrative, market-based or spectrum "commons" approaches will remain an ongoing requirement and challenge for spectrum managers. Their goal is to develop an appropriate regime that protects user rights and finds the right balance for flexibility and innovation, along with service neutrality. Finding that balance and structuring the appropriate response will continue to be debated. Spectrum managers and regulators can successfully implement spectrum sharing by combining vision, commitment and careful planning, altering their spectrum allocation and assignment policies to permit greater flexibility and access to spectrum resources.

6 INTERNATIONAL GATEWAY LIBERALIZATION

The importance of IGW liberalization

Broadband Internet access has become commonplace and increasingly affordable in many areas of the world, but that is not yet the reality for most residents of developing countries. Broadband services are either unavailable, or they are almost prohibitively expensive, constituting a barrier to meaningful entry into the global information economy. Yet, without greater demand, the market for broadband services in many developing countries will remain stunted, crippling the broad-based social and economic growth that comes from joining the information society.

Figure 6.1: The terrestrial option: Submarine cable systems



Source: TeleGeography, at: www.telegeography.com/products/map_cable/

High prices for broadband access are tied to a lack of access to international network capacity. One way that countries can cut through the capacity conundrum is through liberalization of international gateway (IGW) facilities. The international cable and satellite systems that link multiple countries reach choke points as they are "landed" within each destination. These choke points are the facilities that aggregate and distribute international traffic to and from each country. In some countries the IGW is controlled by a fixed-line incumbent that charges monopoly prices for all international traffic,

including Internet traffic, making services too expensive for end users and stifling demand.

Liberalizing access to these gateway facilities through infrastructure sharing can lower infrastructure costs while multiplying the amount of international capacity available to operators. The result can be a rapid ramp-up of international traffic, coupled with lower prices for international communications. More affordable services, in turn, can generate greater demand, resulting in more consumers on the network.

7 FUNCTIONAL SEPARATION

Functional separation is one of the most drastic and potent regulatory remedies in a regulator's arsenal. There are enormous implications, not just for the incumbent but also for the regulatory agency in charge of its implementation and enforcement. This chapter explores functional separation, its ramifications and when, how – or indeed, whether – to implement it.

Functional separation is a recent response by regulators and governments to the serious problem of anti-competitive, discriminatory behaviour by incumbents. It has arisen from a concern that existing rules and remedies are inadequate to deal with the problem. In particular, the focus of concern is often the incumbent's ownership of bottleneck network infrastructure and its abuse of that control to harm competitors' ability to provide broadband services.

Functional separation is sometimes also known as operational separation. The term applies to the fixed-line business of incumbent operators, and it entails:[9]

- Establishing a new business division, which is kept separate from the incumbent's other business operations;
- Capitalizing and empowering this new, separate business division to provide wholesale access to the incumbent's non-replicable (or bottleneck) assets, which competitors need in order to compete with the incumbent in downstream retail markets; and
- Requiring the separate wholesale division to supply network access (and support services) to competitors, along with the incumbent's own, remaining retail divisions, on a non-discriminatory basis.

Often, the incumbent sets up not just a network operations division, but also a wholesale services division, which then can purchase access to the bottleneck assets and resell them to retail operators. The bottom line is that wholesale access and services are made available to the competitors and the incumbent's retail operations on an equal basis.

So far, implementation of function separation has been limited mainly to a small number of developed countries, although it appears to be gaining currency in several other countries.

8 INTERNATIONAL MOBILE ROAMING

International mobile roaming services allow customers of one mobile network operator to use mobile services when travelling abroad. These services are enabled by a direct or indirect (either through a broker or aggregator) relationship between the "home" and "visited" operators. In effect, international roaming is a form of sharing. Operators can multiply the range of their service offerings around the world by essentially borrowing access to operators' networks in other countries. They can then give their customers seamless service wherever they travel – at a price, of course.

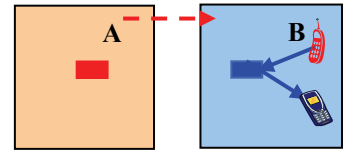
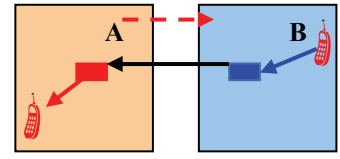
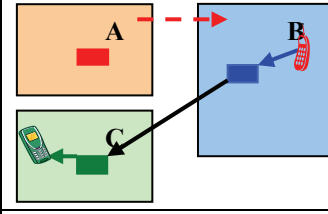
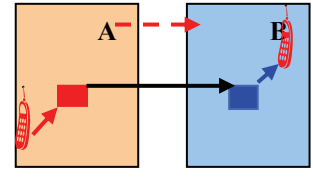
International mobile roaming revenues now constitute a significant portion of mobile operators' revenues and profits. Telecommunication analysts[10] estimate that international mobile roaming generates approximately 5-10 per cent of operators' revenues globally[11] (in some cases up to 15 per cent[12]), and constitute an even bigger slice of their profits. Because customers lack any viable alternative to international mobile roaming services (especially those who must make mobile international calls, such as business users), customers continue to use these services even in the face of high tariffs. Therefore, the subject of international mobile roaming charges is now of great interest to many governmental organizations.

After analysing international mobile roaming costs and actual prices charged, regulators might choose one of the following strategies:

- No direct regulation of any international mobile roaming tariffs;
- Regulating wholesale international mobile roaming rates only;
- Regulating retail international mobile roaming charges only;
- Regulating both wholesale and retail international mobile roaming rates.

The different strategies regulators can choose to address international mobile roaming charges are analysed in Chapter 8 of this edition of *Trends*. It also identifies the pros and cons of each of these strategies recognizing that upcoming next-generation networks, and the move to mobile IP networks, could change the status quo, making the roaming problem less relevant

Table 8.1: Cost structures of international mobile roaming services

Call type	Cost elements	Illustration
Call inside a visited country A traveller from country A goes to country B and makes a call to a subscriber of country B. Note that countries A and B may or may not be in a region where international roaming prices are regulated.	Mobile origination in country B + *[National transit in country B]* + Mobile or fixed termination in country B + Roaming-specific costs + Retail-specific costs	
Call from a visited country to the home country A traveller from country A goes to country B and makes a call back home to a subscriber of country A. Note that countries A and B may or may not be in a region where international roaming prices are regulated.	Mobile origination in country B + International transit + Mobile or fixed termination in country A + Roaming-specific costs + Retail-specific costs	
Calls from a visited country to a third country A traveller from country A goes to country B and makes a call to a subscriber of country C. Note that countries A, B, and C may or may not be in a region where international roaming prices are regulated.	Mobile origination in country B + International transit + Mobile or fixed termination in country C + Roaming-specific costs + Retail-specific costs	
Receiving a call in a visited country A traveller from country A goes to country B and receives a call from either country. Note that countries A and B may or may not be in a region where international roaming prices are regulated.	Mobile termination in country B + International transit + Roaming specific costs + Retail-specific costs	

Note: In some cases, international transit services might be used several times. For example, if a subscriber of country A goes to country B and makes a call to a subscriber of country C, which is visiting country A at the moment of the call. This would lead to one mobile origination, two international transits (country A – country C, country C – country B), one mobile or fixed termination plus roaming-specific and retail-specific costs. For a detailed explanation, please refer to Falch, M., Henten, A., Tadayoni, R. (2007), *Regulation of international roaming charges: the way to cost based prices?*

9 IPTV AND MOBILE TV

Convergence: Sharing broadband technologies

For countries struggling with the appropriate means and incentives to foster broadband development, the introduction of video services by fixed telecommunication providers may prove to be a key facilitator for such deployment. Traditional telecommunication operators are upgrading their facilities to obtain more bandwidth capacity in order to offer video services and acquire a new revenue stream. These new video offerings are positively affecting the roll-out of new broadband networks. As a result, the provision of IPTV services has the potential to not only increase competition in the video marketplace, but also to advance the broadband access goals of many countries.

Mobile television (mobile TV) is also being introduced in a number of countries. Unlike most video services offered by 3G mobile operators, mobile TV allows a user to view live television channels, not just downloads. For mobile providers looking for ways to maintain and increase growth, mobile TV is a new avenue to increase their average revenue per user (ARPU) through added content and services.

What is IPTV?

IPTV is defined as the provision of video services (for example, live television channels, near video-on-demand (VoD) or pay-per-view) through an IP platform. However, some define IPTV services to encompass all the possible functionalities that can be provided over an IP platform. For example, some equate IPTV services with multimedia services, a category that can include television, video, audio, text, graphics, and data.[13] This encompasses not only one-way video broadcasting services but also ancillary interactive video and data services, such as VoD, web browsing, advanced e-mail, and messaging services.

What is mobile TV?

Mobile TV is the wireless transmission and reception of television content – video and voice – to platforms that are either moving or capable of moving. Mobile TV allows viewers to enjoy personalized, interactive television with content specifically adapted to the mobile medium. The features of mobility and personalized consumption distinguish mobile TV from traditional television services. The experience of viewing TV over mobile platforms differs in a

variety of ways from traditional television viewing, most notably in the size of the viewing screen.

There are currently two main ways of delivering mobile TV. The first is via a two-way cellular network, and the second is through a one-way, dedicated broadcast network. Each approach has its own advantages and disadvantages.

Regulatory issues with IPTV and mobile TV

The introduction of IPTV and mobile TV services presents regulatory issues-linked to convergence of the ICT and broadcasting sectors. IPTV and mobile TV provide new platforms and devices to distribute digital television and multimedia offerings. But regulators are often uncertain whether the new offerings should be considered broadcasting, telecommunication, or information services – or whether they should be exempt from regulation altogether.

Operators of IPTV and mobile TV services, however, need a clear set of rules that will create the adequate environment for investment and deployment of their networks and services. Regulatory classifications will have a direct impact on issues such as market entry, licensing, content regulation, ownership requirements, geographic coverage (nationwide, regional or local licences), regulatory fees, and other obligations.

10 END-USER SHARING

Sharing ICT technologies is a common behaviour among people around the planet. People share for a variety of reasons ranging from economic to pedagogical concerns. When they do it intentionally, as part of the usual or normal operation of a service or application, we call this *end-user sharing*. To be sure, this kind of sharing is commonly a by-product of lower income levels, weak infrastructures, scarcity, or want. But this does not hide the fact that technologies are programmed for sharing.

Figure 10.1: Many users for one computer

Source: M.L. Best.

End-user telephone sharing has been the most common form of two-way communication sharing among end users – at least in the form of public payphones. Until recently, public phone boxes were common in low- and high-income contexts alike. But today, in many countries, mobile phones have increasingly been replacing public payphones although public phone facilities remain common in many low- and middle-income settings. End users in most African countries are likely, in the foreseeable future, to continue obtaining telephony access primarily through public access facilities – whether they are

booths managed by telecommunication operators or privately-managed tele-shops.[14]

Some analysts argue that sharing mobile phones can act "as an infrastructure service; a financial sector service (virtual currency, electronic accounts or banking); a market, weather and health information exchange mechanism; and an investment sector service."[15] Basic text messaging is perhaps the simplest and most common value-added phone service. Today, tens of billions of SMS text messages are sent every month.

A promising area for mobile end-user sharing is financial and banking services, often referred to as "m-commerce". Basic mobile financial services could include access to secure savings accounts, non-interest credit opportunities, currency management, fund transfers and cash delivery. M-commerce has the potential of removing the biggest obstacle for commercial banks to serve low-income communities: the high transaction costs associated with very modest-sized accounts. Mobile banking (and digital banking, more broadly) has been shown to significantly lower transaction costs compared with brick-and-mortar banking.

Figure 10.2: A multi-point system with multiple mice for a single PC

Source: Microsoft Research.

End-user computer sharing

Many aspects of computer system design discourage end-user sharing. Indeed, the term *personal computer* illustrates how hostile to sharing these technologies may be. But some researchers are attempting to turn the personal computer into something that can be more easily shared by communities of users.[16]

Advanced content sharing

Moving beyond the sharing of physical hardware, there is a world of computer-mediated, Internet-enabled websites and applications. These are virtual "places" where end users share content and build cybercommunities on popular, so-called social network sites. End users have come to share personal narratives,[17] World-Wide-Web bookmarks and other online content,[18] pictures,[19] movies,[20] online encyclopedias,[21] and, really, anything and everything about themselves.[22] Additionally, many of these technologies are also available on mobile platforms. But the worldwide reach of each of the major social network players is hardly uniform.

Here again, regulators have a critical role to play in the development of robust end-user sharing experiences. The properties of sharing are explored in greater detail in Chapter 10 of this edition of *Trends*, as well as the ways that ICTs can encourage and enhance sharing, business models and applications that are predicated on end-user sharing and the role of the regulator as it relates to sharing.

11 CONCLUSION

The forward-looking exploration of sharing mechanisms may serve the global ICT sector well, especially in the face of the potential broad economic downturn. Sharing offers numerous potential business strategies and regulatory approaches designed precisely to make more economically efficient use of network assets.

At its best, an approach based on the Six Degrees of Sharing will lower market-entry barriers and reduce and share network build-out and maintenance costs for investment in ICT networks and services. The idea is to move toward a second wave of sector reform in developing countries. There is a growing recognition among regulators – reflected in the discussions of sharing – that the rise of viable competition, and the extension of universal access – will depend on a savvy application of new rules and mechanisms based on the real-world circumstances found in each market. This would be true in any economic scenario – but it is even more crucial in the current economic environment.

Initially developed as a set of strategies to extend broadband network access in developing markets, Six Degrees of Sharing may now have even broader appeal if, as it appears possible, the sources of capital for network investment suffer a temporary drought. Indeed, it may become increasingly necessary for policy-makers and regulators to adopt sharing strategies to make their markets that much more amenable to the shrinking pool of investment dollars. The first wave of sector reform has demonstrated that huge pent-up demand exists for telecommunications and ICT services, and that consumers are willing to pay for these services no matter how small their income. This demand continues to grow for new ICT services made possible by technological and commercial innovation. What has changed is that potential investors will no doubt have to work harder to attract financing. Cutting costs, by adopting the sharing strategies explored in the 2008 edition of *Trends in Telecommunication Reform*, promises to help make limited financing resources go further to make the dream of an "information society" a reality.

[1] According to ITU projections.

[2] Telcos Planning Ahead for an Economically Troubled 2009, 9 October 2008, at: www.cellular-news.com/story/34060.php

[3] iLocus, 5 August 2008, at: www.ilocus.com/2008/08/64_voip_subscribers_in_france.html

[4] Ovum, VoIP becoming mainstream in Korea and Japan, 21 January 2008, at: www.ovum.com/go/content/c,377,73689

[5] Infonetics Research, through *VoIP News*, 1 March 2008, at: www.voip-news.co.uk/2008/03/01/80-million-worldwide-voip-subscribers-in-2007/

[6] ITU World Telecommunication/ICT Indicators Database, at: www.itu.int/icteye

[7] Taylor, J. (2006), Openreach – an open network for all. Dream or reality? www.pts.se/Archive/Documents/SE/061129_Presentation_Joanna_Taylor_9.pdf

[8] See: www.arcep.fr/fileadmin/reprise/communiques/communiques/2007/slides-confpresse-ftth-281107-eng.pdf

[9] The expression "incumbent operators" is used throughout the chapter. However, non-incumbent operators with significant market power may also be considered candidates for functional separation.

[10] *The Economist* (3rd May, 2007), "When in Roam: Regulation is not the only thing driving down the cost of making calls abroad".

[11] Data for international mobile roaming revenues, costs and traffic are not often made publicly available by operators or provided to regulators.

[12] INTUG submission to ERG, "The wholesale national market for international roaming; possible remedies", May 2003, at: www.intug.net/submissions/ERG_roaming.html

[13] See ITU-T IPTV Focus Group definition.

[14] McKemey, K., Scott, N., Souter, D., Afullo, T., Kibombo, R., & Sakyi-Dawson, O. (2003), *Innovative Demand Models for Telecommunications Services*, London, UK: Gamos, Ltd.

[15] Davis, K., and Ochieng, C. (2006), "ICTs as Appropriate Technologies for African Development". In IFC / FT (Ed.), *Business & Development: The Private Path to Prosperity*.

[16] In particular, we note the work of Microsoft Research in India.

[17] e.g. www.blogger.com or www.twitter.com

[18] e.g. www.digg.com or del.icio.us

[19] e.g. www.flickr.com

[20] e.g. www.youtube.com

[21] e.g. www.wikipedia.com

[22] e.g. www.myspace.com

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