

by

Louay Abou Chanab
abouchanab_louay@bah.com

Bahjat El-Darwiche
el-darwiche_bahjat@bah.com

Ghassan Hasbani
hasbani_ghassan@bah.com

Mohamad Mourad
mourad_mohamad@bah.com

Telecom Infrastructure Sharing

Regulatory Enablers and Economic Benefits

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The liberalization of a country's telecom industry can enable economic growth across various sectors, but its success depends on regulatory policies that are conducive to the development of competition. One element of such a policy would be the creation of regulatory and economic incentives that encourage the sharing of infrastructure among telecom companies as a key lever to foster competition and optimize investments. Operators may perceive the economic benefits and adopt a collaborative approach autonomously; however, a clear policy, a commercially friendly price-regulation mechanism, and tailored regulatory safeguards may be necessary to successful infrastructure sharing.

These measures are especially necessary now. While liberalized markets with effective regulatory structures have traditionally observed several forms of infrastructure sharing, including co-location and national roaming, more advanced forms are emerging. They involve various passive and active network components, provide significant revenue-generation opportunities for incumbent operators, and facilitate the development of virtual operators and next-generation service providers. International experience suggests that favorable regulation and economic incentives have enabled such developments in infrastructure sharing.

Challenges in Telecom Regulation

The telecom sector, which is a vital economic growth enabler, has witnessed major developments over the past two decades. Governments and regulators worldwide are challenged to meet policymakers' objectives for their respective sector-development programs. Generally, successful telecom-sector development programs rely on four key regulatory pillars:

- **Transparency.** Ensure that regulatory authorities publish relevant information, exercise their powers impartially, and give interested parties the opportunity to comment on and to shape the telecom sector.
- **Efficiency.** Lay down measures that prevent unnecessary barriers to trade in services, disciplines that are not overly burdensome, rules that justify requests for information, and most important, efficient means of applying and enforcing regulatory decisions.
- **Independence.** Set directives to ensure that the regulatory body is separate from and accountable to all telecom market participants and that it functions in an impartial manner.
- **Nondiscrimination.** Administer directives and obligations in a transparent, nondiscriminatory, and competitively neutral manner and develop an effective appeal mechanism.

Given the universality of these regulatory standards, many challenges faced by governments and regulators are common; invariably, potential solutions generate controversy. Within the telecom industry, some of the most significant challenges include the following:

- **Interconnection Regulation.** The main tool to facilitate the entry of new players to a telecom market is interconnection with existing operators. Interconnection regimes are known to require extensive regulatory intervention.
- **Access Regulation.** Access regulation is created mainly to support entrants to the fixed telecom market and to regulate the unbundling of an incumbent's local loop. Access regulation has created a significant number of disputes, as it has sometimes been seen as undermining an incumbent's place in the market.
- **Competition Safeguards.** Incumbents and new entrants may reach certain market-share thresholds that would present them with substantial market power or even dominance, which in turn would allow them to squeeze out smaller players; competition safeguards protect the interests of smaller players and new entrants.
- **Infrastructure Sharing.** While new entrants tend to build their own networks, regulators favor faster deployment and investment optimization in the telecom sector. Infrastructure sharing limits duplication and gears investments toward underserved areas, product innovation, and improved customer service.

In the early stages of liberalization, the subject of infrastructure sharing receives diverse interpretations from stakeholders: Regulators perceive it as a medium to grow competition, incumbents as a potential source of revenues—if, indeed, they absolutely must offer it—and new entrants as a given right that should come at an affordable price. As a result of these potentially conflicting perspectives, infrastructure sharing necessitates cooperation among competitors and explicit involvement by regulatory authorities to

enforce implementation. In more mature telecom markets, where service-based competition has reached advanced stages, infrastructure sharing is emerging as a new business model, favored by both incumbents and new entrants.

Getting Along: The Advantages of Sharing

Policymakers and regulators must strike a balance between their hope to offer better services at affordable prices through increased competition and their desire to create favorable conditions for attracting investments. While some may perceive strong competition as an inhibitor of investment, others tend to link competition to investments insofar as without the right investments, service offerings will not develop as they otherwise would in a competitive state.

Telecom operators' spending has traditionally been dominated by considerable investments in technology and network deployment. Given that such investments are fixed, sunk, and irreversible, they represent a high risk factor. The risk is compounded by the need, for both fixed and mobile operators, to continuously adopt new technologies and upgrade infrastructure. While fixed network operators are now migrating to next-generation networks, most mobile network operators have already deployed third-generation (3G) infrastructures. Therefore, infrastructure sharing can reduce this risk for operators by spreading it among several players.

Another advantage of infrastructure sharing is its impact on competition. One school advocates that infrastructure sharing creates forms of collusion and prevents real competition. At first glance, this position may seem sensible. However, as a precondition for competition, infrastructure sharing does not induce collusive behavior when managed properly. Growing competition and encouraging new entrants may, in fact, be impossible if infrastructure sharing is not mandated and enforced. In the long term, competition will rely on infrastructure sharing as a critical tool, or even a prerequisite, for growth.

Estimating the Savings

Telecom operators generally appreciate infrastructure sharing due to the cost savings it generates. Case studies illustrate the potential savings in different markets: In India, for example, an estimated 240,000 towers are needed over the next three years. Analysis indicates that capital expenditure savings could reach US\$4 billion if operators achieve double tenancy on deployed sites by 2010.

In one Middle Eastern example, two competing operators require an average of 3,500 towers each to achieve optimal coverage. Should they decide to share 50 percent of their towers, they could reach capex savings in the range of US\$250 million over the next three years.

Finally, in one fixed-network sharing case, multiple cost components would be affected and optimized if two or more operators share their network. Set-up costs could be reduced by as much as 40 percent, and utilization costs could be reduced by 20 percent.

In response to this reality and the investment risk associated with infrastructure deployment, policy-makers and regulators resort to different models of infrastructure sharing to meet the following set of imperatives:

Reduce investment requirements. Investment is spread over the operators sharing their infrastructures rather than being sustained by only one operator. Optimized investment will contribute to better sustainability of telecom operators and will justify higher investments in the long term, given the lower risk. Telecom equipment vendors estimate that sharing may reduce infrastructure costs for operators by as much as 40 percent.

Offer a new source of revenues. In liberalizing markets, incumbent operators could generate significant revenues from infrastructure sharing, which in certain cases can exceed 15 percent of operators' total revenues.

Release capital for strategic investments. Spinning off the network into an independent company allows incumbents to focus on customer-facing activities while releasing cash for new strategic investments.

Decrease the barriers to market entry for new players. When infrastructure sharing is enforced, markets become significantly more attractive to new players. Such players can enrich competition while investing effectively.

Shift the focus to service innovation instead of network deployment. By alleviating the pressure of network deployment from a financial and an operational perspective, infrastructure sharing allows operators to turn their attention to improved innovation, better customer service, and eventually better commercial offerings and healthier competition.

Expand investments to less dense areas and meet universal service targets. Infrastructure sharing helps operators undertake network expansion in rural areas, using the savings generated by investing less in denser areas. This also has an important policy dimension, given its significant contribution to meeting preset universal service targets.

Optimize the use of scarce national resources, namely rights of way. Infrastructure sharing in its simpler forms will lead to better use of scarce national resources, such as rights of way, and in its more complex forms will allow a better use of spectrum.

Reduce negative environmental impact. Although environmentalists show limited support for telecom network deployment, infrastructure sharing typically receives the backing of many conservation groups because less network buildup means fewer negative environmental impacts.

How It Works: Forms of Infrastructure Sharing

Infrastructure sharing is relevant for fixed and mobile operators alike. The structural separation between infrastructure and service provisioning seen in the United Kingdom and now in Sweden showcases how fixed-line operators can leverage infrastructure sharing to optimize the use of their networks. Yet it was the mobile sector that paved the way toward mature

infrastructure sharing models worldwide. Therefore, our evaluation will mainly examine forms of infrastructure sharing in mobile networks.

Infrastructure sharing can take different forms, as operators choose to share network components that are either active or passive (see Exhibit 1).

Telecom operators' spending is divided almost equally between passive and active components, but this balance is expected to change over time, given the declining cost of telecom equipment and the constant increase in the cost of passive components, including property acquisition and construction materials. In a few years, the cost of passive components is expected to rise significantly, further justifying increased sharing.

Another element of infrastructure sharing is the distinction between the main forms of sharing and their variations. The three dominant forms—site sharing, network sharing, and spectrum sharing—have been joined over time by three variations—mobile virtual network operators (MVNO), national roaming, and tower companies.

Site Sharing

In this basic form of sharing, operators agree to share available infrastructure, including site space, buildings and easements, towers and masts, power supply, and transmission equipment. Site sharing is suitable for densely populated areas with limited availability; expensive sites, such as underground subway tunnels; and rural areas with high transmission and power costs.

Site sharing is the simplest form of infrastructure sharing and is most likely to be accepted by competing operators. The key challenges are for incumbent operators to accept the opening of the infrastructure to other players and for new operators to trust that incumbents will provide them with the appropriate access to sites without deliberate tactical delays to prevent them from rolling out their networks effectively. Enforcing such cooperation is a major challenge to regulatory authorities.

Exhibit 1

Examples of Mobile Infrastructure Components

Active Components	Passive Components
1. Base Stations	1. Towers
2. Microwave Radio Equipment	2. Shelters
3. Switches	3. Electric Supply
4. Antennas	4. Easements
5. Transreceivers	5. Ducts

Source: Booz Allen Hamilton

Network Sharing

Sharing base station equipment and sharing common networks, both circuit-switched and packet-oriented domains, are other forms of infrastructure sharing. Operators typically share the RBS, RNC, mobile services switching center/visiting location register (MSC/VLR), and serving GPRS support node (SGSN). Each operator, however, has its own individual home network that contains the independent subscriber databases, services, subscriber billing, and connection to external networks.

Network sharing requires additional planning and deployment efforts to accommodate each participating operator's capacity needs.

Spectrum Sharing

Spectrum sharing, also known as spectrum trading, is a model that has recently developed in mature, regulated environments and that entails operators leasing their spectrum to other operators on commercial terms. Because spectrum is a scarce resource that is often underutilized by one operator in a given area, sharing is a viable option for two or more operators.

MVNOs

MVNOs typically have no network and no rights to spectrum. Although some advanced MVNOs will build parts of their core network needs, they typically rely on infrastructure sharing to get access to subscribers and offer services. MVNOs clearly demonstrate the positive impact of infrastructure sharing on competition, given that the advent of MVNOs intensified competition and led to more innovation and better customer service.

National Roaming

Mandatory national roaming is a form of infrastructure sharing that allows new operators, while their networks are still being deployed, to provide national service coverage by means of sharing incumbents' networks in specific areas. While national roaming is generally introduced with a sunset clause, it could be made permanent in specific locations. National roaming accelerates competition by allowing new players to launch their services within shorter time frames.

Tower Companies

Infrastructure problems can also be addressed by the growth of existing tower management companies and the launch of new ones. The tower companies' business model consists of acquiring wireless infrastructure for operators and managing it. The economics are strongly driven by co-location of

operators on sites. Tower management companies usually enjoy scalable and long-term recurring revenues with contracted annual escalations. They also benefit from low churn rates and low operating and capital costs. Tower management companies thus can ensure fair treatment of new entrants while providing financial benefits to the incumbents by buying the latter's infrastructure and managing it, hence lowering operating expenses in the long run.

Relevance and Applicability of Infrastructure Sharing

The telecom market in its various stages of liberalization, from monopoly to full liberalization, may leverage different forms of infrastructure sharing. Site sharing, network sharing, and national roaming are relevant in the early stages of liberalization, when a new entrant is building its network; these initiatives facilitate rollout and allow the new entrant to significantly reduce time

Exhibit 2

Examples of Mobile Infrastructure Sharing

Country	Date	Operators	Details
Sweden	March 2001	Tele2 and Telia	The two operators agreed to set up a joint venture company and deploy a nationwide 3G network. As of 2005, they had one of the largest shared 3G networks in the global telecom industry.
Sweden	May 2001	Hi3G and Europolitan	The joint venture was tasked to deploy a 3G network covering the 70 percent of population outside major cities. Orange later joined the joint venture.
Germany and the United Kingdom	June 2001	BT and Deutsche Telekom	The two operators agreed to share parts of their 3G networks. The main outcome was a roaming deal in the UK between BT Cellnet and One2One in small cities and rural areas.
Spain	October 2003	Telefónica and Yoigo	The two operators agreed on an infrastructure-sharing deal for both urban and rural areas.
Australia	August 2004	Hutchison 3G Australia and Telstra	The two operators agreed on network sharing and committed to joint ownership and operation of H3GA's existing 3G radio access network.
Spain	November 2006	France Telecom (Orange) and Vodafone	The agreement focused on rural areas with fewer than 25,000 inhabitants. The agreement is expected to reduce costs by as much as 40 percent.
India	February 2007	Hutchison Essar and Bharti Airtel	Vodafone (Hutch Essar) and Bharti entered into an MOU covering a comprehensive range of infrastructure-sharing options in India. A regulatory proposal to further share infrastructure throughout India followed in April 2007.
United Kingdom	February 2007	Orange and Vodafone	The two operators announced plans to share their radio access network across the United Kingdom.
International	February 2007	T-Mobile	T-Mobile indicated intent to focus on network sharing as a growth strategy but excluded the United Kingdom from its plans.
Spain	July 2007	Telefónica and Yoigo	Five-year renewal of the 2003 contract.

to market. As markets develop, other forms of sharing might become equally relevant—namely spectrum sharing, MVNOs, and tower companies—to prompt a new wave of growth in the telecom sector. Nevertheless, in mature markets, all different forms of sharing may simultaneously coexist and contribute to the overall efficiency of telecom operators.

Global Examples of Infrastructure Sharing

Infrastructure sharing started materializing officially in 2001 with a few deals reaching successful conclusions. With the hype of 3G licensing in Europe and the big investments made in license acquisition, many operators were under pressure to share deployment costs and thus share infrastructure. More recently, infrastructure agreements have started developing at a faster pace both within and outside the European zone (see Exhibit 2).

Interesting supplementary examples of infrastructure sharing include the buildup of infrastructure by independent third parties for lease and use by different operators. A relevant case in the mobile domain is the work of a major telecom equipment vendor in Tanzania. The vendor opted for a groundbreaking move and is building infrastructure in rural areas for use by the country's four mobile operators: Vodacom, Millicom, Zantel, and Celtel.

National roaming offers another example of a trend that is on the rise, as illustrated by many European examples (see Exhibit 3). This trend is also developing in the Middle East, where legal provisions mandating national roaming have already been introduced in Egypt, Jordan, Morocco, Oman, Saudi Arabia, Turkey, and the United Arab Emirates.

Keys to Success

Success is a joint effort between operators and regulators. Operators need to acknowledge the economic benefits of sharing their infrastructure, while regulators need to develop an incentive-based policy to develop and grow sharing agreements on a level playing field.

There are numerous cases in which operators were able to define the economic benefits and thus adopted infrastructure-sharing agreements autonomously (see Exhibit 2). Nevertheless, in other cases, regulatory intervention is necessary and should address four dimensions: regulatory policy, pricing regulation, regulatory safeguards, and policy enforcement.

Regulatory Policy

Telecom regulatory authorities should issue a policy encouraging infrastructure sharing and should collaborate with local authorities and municipalities to support and facilitate the deployment of shared infrastructure.

The policy should encourage incumbents and new entrants to balance their shared network rollout. Incumbents should make the network components to be shared publicly available through reference offers that specify the components' available capacity and geographic locations.

Exhibit 3
European Countries Mandating National Roaming

	Legal Provision Governing National Roaming for 3G/2G	Legal Provision Governing National Roaming for 3G/3G
Austria	✓	
Belgium	✓	
Denmark	✓	✓
Finland	✓	
France	✓	✓
Greece	✓	✓
Ireland	✓	
Italy	✓	✓
Luxembourg	✓	✓
Netherlands	✓	✓
Spain	✓	✓
Sweden	✓	
United Kingdom	✓	

Source: Booz Allen Hamilton

Ideally, the policy would also encourage setting up a joint committee comprising the different operators in the market to plan further rollout and reserve capacity for future expansion and growth plans.

Telecom laws would typically provision clauses to facilitate, mandate, or empower the regulator to enforce infrastructure sharing, as many countries in Europe and the Middle East—including Austria, Finland, Germany, Portugal, Bahrain, Saudi Arabia, Tunisia, and the United Arab Emirates—have done already.

Jordan, Nigeria, and India offer recent examples of regulatory policy enforcing passive infrastructure sharing. Jordan reinforced its infrastructure-sharing requirements by issuing a regulatory statement in 2005 that reiterated the regulator's commitment to sharing and suggested that it would issue decisions on a case-by-case basis to enforce any feasible arrangement. Nigeria issued a complete policy that listed the passive network components to be shared (including rights of way, masts, poles, ducts, space in buildings, and electric power) in 2006. Finally, India issued a policy in 2007 to initiate infrastructure sharing in Delhi and Mumbai on a trial basis. Contingent on the success of these trials, infrastructure sharing will be made mandatory across the country.

Pricing Regulation

Infrastructure sharing should be based on cost-based prices while allowing operators to recoup investments and maintain their growth strategy. Regulators should work with operators to determine prices using known cost-based calculation methods.

Existing network elements should be priced individually, allowing requesting operators to choose and pay for only those network elements they need. On the other hand, the rollout cost of new networks, or that of increasing existing capacity, should be shared by both the incumbent and the requesting operators on fair terms. Late entrants to an infrastructure-sharing deal should reimburse existing partners for any shared investment before being given access to the network. In this context, Nigeria clearly recommends cost-based pricing for infrastructure sharing. Jordan is also in

favor of cost-based prices for interconnection services, including shared infrastructure, and is recommending the adoption of incremental costing methodologies like long-run incremental cost (LRIC).

Finally, late entrants to an infrastructure-sharing deal should reimburse existing partners for any shared investment before being given access to the network.

Regulatory Safeguards

The regulator should ensure that infrastructure sharing abides by the general regulatory standards discussed earlier: transparency, efficiency, independence, and nondiscrimination.

In more specific terms, the safeguards should ensure the following:

- Capacity is sold on a first-come, first-served basis, and the regulator intervenes to ration scarce resources when necessary.
- Unused capacity is returned and operators refrain from ordering excess capacity. Penalties could apply in cases in which orders surpass the utilized capacity by a certain percentage.
- Operators must log infrastructure-sharing activities diligently to keep track of actions undertaken, whether for a potential regulatory audit or simple review.
- Physical separation of shared network components (for example, installing fences between the active components of two operators) can be used to prevent sabotage. However, such precautions should not interfere with efficient sharing.

Jordan and Nigeria, for instance, included regulatory safeguards when introducing infrastructure-sharing regulation. They both advocate appropriate capacity balancing and the adoption of a first-come, first-served approach.

Policy Enforcement

Disputes and limited compliance are inevitable in today's increasingly complex telecom sector. While regulators are encouraged to manage by incentives, they still need recourse to sanctions when operators fail to comply. They also must have the ability to

intervene to resolve disputes, actively working to reach positive conclusions. Regulators should clearly define dispute-resolution procedures, allowing operators to request their intervention in clearly defined circumstances while abiding by a transparent and timely process.

Regulators should continuously monitor compliance and analyze any failure to comply. The typical telecom legislation empowers regulators to sanction operators if a failure to comply is intentional, but the more common modern approach is to incentivize operators toward compliance. Nevertheless, regulators should make use of all the tools at their disposal.

Jordan, India, and Nigeria have all made provisions in their published regulations to resolve any disputes arising from infrastructure-sharing negotiations. Additionally, the Netherlands provides an example in which the National Regulatory Authority intervened following a dispute between two mobile operators (KPN and Dutchtone) and enforced site sharing.

Conclusion

Infrastructure-sharing regulation has proven to be a critical lever contributing to the growth of the telecom sector. Operators should closely examine the economic benefits and develop their internal positions on the subject. Regulators, on the other hand, should encourage infrastructure sharing and issue necessary policies to ensure effective adoption and alignment by competing operators.

Both fixed and mobile operators should consider infrastructure sharing as a medium to save costs and focus more attention on customer-facing activities, in which innovation and differentiation are the main competitive advantages. In the longer term, traditional operators could leverage infrastructure sharing as a new vehicle for growth. This could be achieved by

structurally separating all or part of their network assets or spinning out network provider companies. A trend in this direction is starting to materialize in Europe, where both British Telecom in the UK and TellaSonera in Sweden have already adopted separation models. Talks about potential infrastructure separation ventures are also underway in France, Italy, and New Zealand. This trend is expected to further develop as regulatory pressures, the deployment of IP-based next-generation networks, service integration and convergence, and the emergence of disruptive, service-based business models are leading to the commoditization of basic telecom services. Telecom operators and traditional operators will be faced with a strategic choice: Concentrate on high-value retail business or focus on wholesaling facilities services.

Regulators should carefully consider what infrastructure-sharing forms to mandate. Passive network components are more commonly shared and are considered a good starting point for infrastructure-sharing obligations. Many obstacles prevent operators from growing the number of passive components in their networks—such as high property prices and continuously increasing construction costs—and it is becoming increasingly difficult to obtain permits to erect towers and masts. This approach can be facilitated by encouraging the use of professional tower- and site-management companies as trusted independent entities to manage such infrastructure on behalf of operators in the market.

Regulators should introduce necessary safeguards and enforcement tools. To ensure compliance and successful adoption of infrastructure-sharing obligations, regulators should assess and communicate the overall benefit of infrastructure sharing and ready themselves to resolve eventual disputes.

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Louay Abou Chanab is an associate with Booz Allen Hamilton based in the Middle East. He specializes in the reform of telecom sectors, including liberalization strategies, policy setting, licensing regimes, and regulatory levers. He can be reached at 961-1-336433 or abouchanab_louay@bah.com.

Bahjat El-Darwiche is a principal with Booz Allen Hamilton based in the Middle East. His focus includes telecom-sector development and regulatory management, corporate growth strategies and program management, and new operating and business models. He can be reached at 961-1-336433 or el-darwiche_bahjat@bah.com.

Ghassan Hasbani is a vice president with Booz Allen Hamilton based in the Middle East. He specializes in telecom, particularly markets assessment, investments strategies, mergers and acquisitions, business development, and CFO and CEO agendas. He can be reached at 961-1-336433 or hasbani_ghassan@bah.com.

Mohamad Mourad is a senior associate with Booz Allen Hamilton based in the Middle East. He focuses mainly on mergers and acquisitions, business development, and corporate strategy in the telecom sector. He can be reached at 961-1-336433 or mourad_mohamad@bah.com.

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