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Enabling A Competitive Mobile Sector in Emerging Markets Through the Development of Tower Companies

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Sharing mobile network infrastructure through specialized companies called towercos is a business model with the potential to accelerate access to quality mobile connectivity for individuals and businesses in emerging markets. A significant number of developing countries have yet to adopt this model, however, and many others continue to struggle with competition issues within their tower markets. This note provides the rationale and policy options for a light regulatory regime that can enable the entry and sustainable development of a dynamic market for towercos in emerging markets. The note also discusses the evolution of the towerco model into small cells and distributed antenna systems, both of which help enable high-speed mobile connectivity technologies like 4G and 5G.

Key findings

- An analysis of 56 towerco markets suggests a positive correlation between the market success of the towerco business and the development of mobile connectivity markets. Recognizing that markets with significant penetration of the towerco business model are richer and more advanced than markets without the model; 4G population coverage is 10 percentage points higher; median download speed is 2.2 Mbps higher; the price of mobile Internet, in percentage of monthly income, is 1 percentage point lower; and markets are 13 percent less concentrated.
- The tower colocation market remains nascent or fairly concentrated in most emerging markets: At the end of 2020, an estimated four in ten emerging market (EM) countries had no active towerco. This was particularly true in the Sub-Saharan Africa and Middle East and North Africa regions. Further, more than half of countries in the remaining EM regions have only one large towerco.
- Critical regulatory challenges related to the tower markets in emerging markets include: (i) limited competitiveness of the market for mobile connectivity; (ii) legal barriers to entry arising from licensing and business regulations specifically dedicated to towercos; (iii) monopoly or potential abuse of market dominance in tower markets; and (iv) lack of carrier-neutrality.
- Policy options to address these challenges need to be tailored to the development stage of the tower markets, and include: (i) registration-based licensing systems; (ii) improved business regulations through a level playing field between towercos and real estate companies in terms of fees for rights of way, and a removal of restrictions on ownership; (iii) access regulation through publication of reference offers and enforcement of nondiscriminatory remedies; (iv) ex-post regulation of exclusive dealing agreements between towercos and mobile network operators; and (v) stimulation of demand for tower colocation through the encouragement of tower sharing or swaps, attaching geographical coverage and performance level commitments to spectrum licenses, and through environmental regulations and power policy.
- To enable expansion of towercos in small cells and distributed antenna systems (DAS), these policy options could be enhanced by measures to (i) eliminate barriers to rapid deployment; (ii) limit local costs and fees; (iii) limit municipal-level barriers to the deployment of small cells sites; and (iv) promote open radio access networks.

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Towercos: Trends, Business Models and Drivers

Over the past decade, the mobile telecom industry in both developed and emerging economies has witnessed the entry of specialized companies focused on the management of mobile network infrastructure such as towers and small cell sites.

These companies are called towercos, and they can result from (i) a joint venture between mobile network operators (MNOs) such as in the case of China Tower Corporation (CTC)¹ or Indus Towers²; (ii) entry of independent companies, often through sale-and-leaseback agreements with MNOs (which account for about 56 percent of all deals)³; or (iii) in joint ventures with MNOs (for example, Helios Towers and Tigo/Millicom in Africa). In all three cases, the towerco business model involves the construction or acquisition of mobile infrastructure to be leased back to MNOs on an open-access basis (carrier-neutral).⁴

The towerco business model is gaining momentum across emerging markets, though there are large disparities across countries and regions (Figure 1). As of 2020, three in four mobile towers in emerging markets were managed by towercos. The South East Asia region has the highest share of towers managed by towercos (91 percent), primarily driven by the 100 percent rate in China. This is followed by South Asia (76 percent), primarily driven by 84 percent in India; and Latin America (59 percent), primarily driven by Brazil (70 percent) and Mexico (90 percent).

Despite a significant penetration of towercos in Nigeria (78 percent), the overall penetration rate is less than 50 percent in Sub-Saharan Africa (SSA), largely because of limited growth in vast connectivity markets like South Africa (37 percent) and Kenya (27 percent), and no towerco in more than half of SSA countries, where regulatory entry barriers and the dominance of incumbent players may be stifling the market. Market concentration, as measured by the Herfindahl Hirschman Index, is on average 20 to 25 percent higher in these countries.⁵ Most countries across the Europe and Central Asia (ECA) region host at least one towerco, but their growth has remained limited, resulting in penetration of just 21 percent. The Middle East and North Africa region is the least penetrated, primarily due to the limited presence of towercos in most countries there.

Towercos typically enter a market through an anchor client and grow through colocation, build-to-suit (BTS), and acquisition. An anchor client is typically the first MNO with a long-term contract, including a discount on the lease rate of each tower shared with another MNO. Colocation involves the provision of access to several MNOs (tenants) on the same tower, while BTS involves the construction of new towers for the purpose of network rollout by an anchor

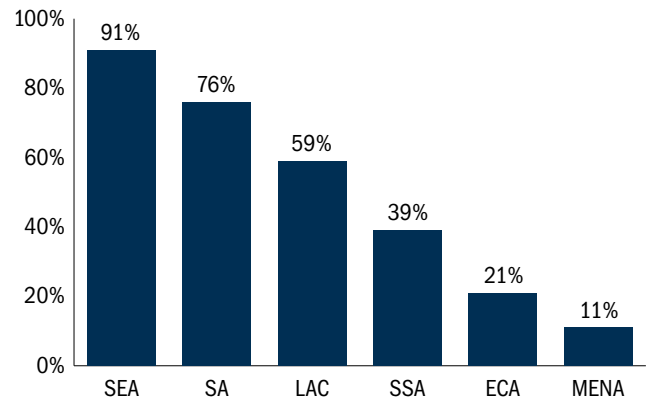


FIGURE 1 Share of Towers Managed by Towercos in Emerging Markets in 2020

IFC estimates based on data from TowerXchange. Regions are defined as follows: SEA or South East Asia includes China, Indonesia, Malaysia, and Vietnam. SA or South Asia includes India, Pakistan, Bangladesh, and Nepal. LAC or Latin America includes Brazil, Mexico, Peru, and Argentina. SSA or Sub-Saharan Africa includes Nigeria, South Africa, Kenya, Cameroon, and Ghana. ECA or Europe and Central Asia includes Eastern European countries like Russia and Ukraine as well as Central Asia countries like Turkey and Kazakhstan. MENA or Middle East and North Africa includes Algeria, Egypt, and Morocco, as well as Afghanistan, Iraq, and Lebanon.

client. Joint ventures towercos secure the participating MNOs as their anchor clients; independent towercos secure their anchor clients by acquiring a portfolio of towers from MNOs or securing a BTS contract. Both grow by increasing the number of tenants per tower (tenancy ratio), securing BTS contracts, acquiring new portfolios of towers from MNOs, or consolidating the tower market through acquisition of smaller towercos.

The towerco business model has gained momentum as MNOs seek to improve profitability and balance sheet strength.⁶ These rationales can be grouped into a number of demand- and supply-side drivers. Key demand-side drivers include:

- **Rising investment in mobile infrastructure and network equipment** stemming from exponential demand for data, growth of the platform economy in emerging markets, emergence of mission-critical industrial wide area networks (WANs), and more stringent geographical coverage requirement for high-speed mobile broadband network (4G and above). By facilitating infrastructure sharing, towercos generate capex savings for MNOs, and tower sale/leasebacks reduce investment risks related to network expansion, enabling prudent CAPEX deployment policies.⁷ In China, CTC was formed as a joint venture between MNOs to overcome the cost of 4G network rollout. In Senegal, the entry of Helios Towers was partly driven by the tighter timeline of 4G network

rollout mandated by the regulator, a factor common to several emerging markets.

- **Increasing competition intensity** resulting in tighter profit margins for MNOs. By facilitating infrastructure sharing, the towerco model can also generate operating expense (opex) savings (e.g., sharing of the cost of electricity, land rents, and site maintenance cost),⁸ which can alleviate a continuous drop in the revenue per user for MNOs and therefore improve profitability. In Nigeria and Ghana, MNOs (MTN, Airtel, and Etisalat) carved out their towers to independent towercos (IHS, ATC, and Helios Towers) partly in response to increasing competition intensity.
- **Technological change** affecting the structure of mobile network infrastructure. 5G connectivity, for instance, requires specific macro towers as well as small cells.⁹ Rural connectivity involves innovation in network infrastructure by relying on “light or low-cost towers.”¹⁰ Keeping pace with these technological changes can divert MNOs from improving the quality of connectivity service. Expansion of Phoenix Tower in Brazil and Guodong Towers in China is partly driven by demand for small cells. In Africa, Africa Mobile Networks deploys “light towers” more suitable to rural connectivity.
- **Emerging network deployment challenges** such as the increasing cost of energy and the complexities of deploying towers in some EMs (such as rights of way and obtaining construction permits in urban areas) further stimulate the demand for tower colocation services.

On the supply side, towercos have gained interest in the mobile market due to limited cost of entry and economies of sharing. By securing anchor clients, towercos limit the cost of entry and therefore minimize uncertainty around the viability of their investment. Furthermore, they benefit from economies of sharing stemming from the near-zero marginal cost of colocation: once a tower is erected for sharing purposes, adding a tenant entails minimal cost but generates substantial revenue.

The Role of Towercos in Expanding Digital Access

Towercos can accelerate access to quality mobile connectivity for individuals and businesses by increasing competitiveness in the mobile sector. By supporting infrastructure sharing, the towerco model generates opex and capex savings for MNOs, leaving more capital for technological innovation and investment in other infrastructure and equipment.¹¹

Another key role for towercos is accelerating technological development by deploying and upgrading towers to the next generation technology. The rollout of 4G and addition

of 5G, and their implications for tower design, are also expected to shape the role of towercos in the design of future networks. Furthermore, by limiting unnecessary duplication of mobile base stations (antennas), towercos can contribute to improve the environmental sustainability of the mobile industry through reduced energy consumption—diesel—especially in off grid sites.

There is a correlation between the market success of the towerco business and the development of mobile connectivity markets. A comparison of market outcomes between 56 low- and middle-income countries with and without a successful towerco business is generally positive (Figure 2).¹² Recognizing that markets with towercos are typically richer and often have more sophisticated regulatory environments, the availability of quality mobile connectivity, proxied by population coverage of 4G and median download speed, is higher in markets with the towerco business model than in markets without it. 4G population coverage is 10 percentage points higher and median download speed is 2.2 Mbps higher. Affordability of mobile connectivity, measured by the cost of a medium basket of mobile broadband plan, is better in markets with the towerco business model than in those without: price, measured in percent of income, is 1 percentage point lower.

Further, countries with the towerco business model have less concentrated mobile markets than those without it: the market concentration index is 13 percent lower. Access to mobile connectivity is also higher in countries with towercos than in those without: mobile internet penetration rate is 3 percentage points higher in markets with tower sharing than in those without.

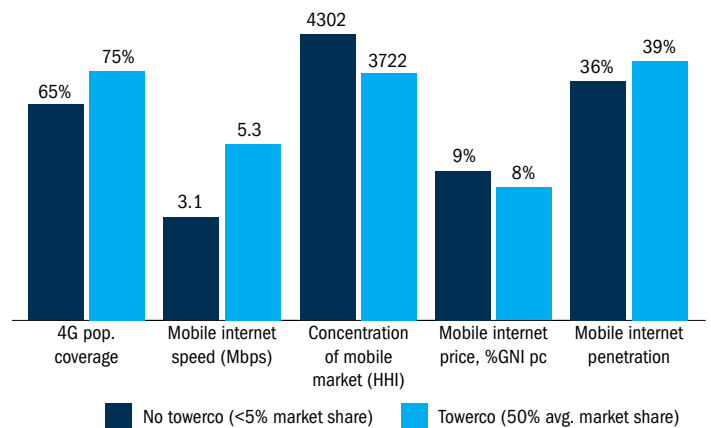


FIGURE 2 Towercos and Mobile Connectivity

Source: IFC, based on data from GSMA Intelligence, ITU, TowerXchange and Ookla in 2019. The chart is shown for illustration purpose, no specific scale applies. Mean values based on data from 56 low/middle income countries, of which 23 have nascent towerco markets, i.e., less than 5% of towers are managed by towercos.

Regulatory Challenges

The degree of development of tower markets in EMs varies substantially, and an estimated four in ten EMs have no active towerco, many of them in SSA and MENA (Figure 3). In the remaining EMs with a towerco, the market is fairly concentrated: 33 host only one towerco or the second largest towerco has less than 20 percent market share. Only three EMs—Indonesia, Myanmar, and Russia—have three towercos with at least a 20 percent market share.

In nascent tower markets, major regulatory challenges involve providing the enabling environment for the entry of towercos in order to level the playing field among MNOs, and accelerating the rollout of high-speed mobile networks. Such challenges can arise due to a number of factors, including:

- **Limited competitiveness** of the market for mobile connectivity, with a dominant MNO reluctant to be the anchor client of a towerco, or collusion among MNOs to prevent the emergence of independent towercos, or with a lack of incentives to invest in new generations of mobile technologies.
- **Legal barriers to entry** arising from licensing specific to towercos. Licensing fees and royalties, as well as business regulations, may impose higher entry costs to prospective towercos. The towerco model is already burdened by stringent civil engineering requirements, so a complex and expensive licensing regime only makes the model more difficult and expensive to develop.
- **National security** considerations of digital infrastructure, including towers, may result in the imposition of stringent requirement for local ownership, thereby deterring the entry of multinational towercos.

In concentrated tower markets, the key regulatory challenges involve promoting competition and investment in tower infrastructure. These challenges typically arise from:

- **One or a few companies dominating the market.** The tower market exhibits decreasing returns to scale beyond a certain number of towers,¹³ leaving room for more than one towerco, especially in large markets.¹⁴ Yet dominance can emerge due to the role of anchor that MNOs play: large anchor client may result in a large towerco. In smaller markets there may be limited scope for more than one towerco. Further, multi-market contacts, whereby a towerco has contracts across several countries with the same MNO, may limit any potential exercise of monopoly power.¹⁵
- **Type of business model.** The type of business model can also influence the market structure of the tower sector.

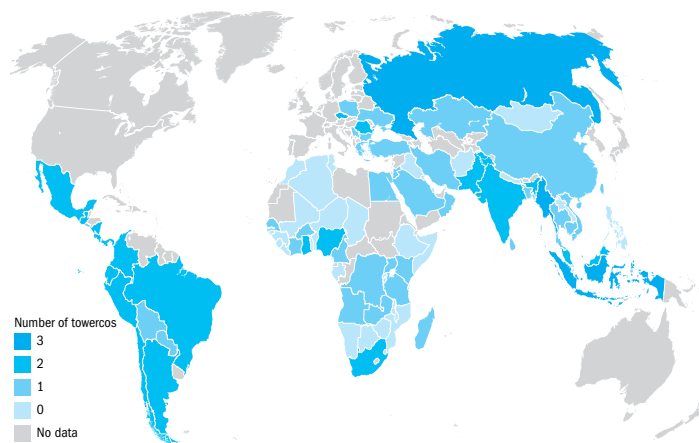


FIGURE 3 Number of Towercos in Emerging Markets in 2020

Source: IFC estimates based on data from TowerXchange. This chart presents the number of towercos with at least 20 percent market shares.

Unlike acquisitions, build-to-suit contracts are likely to bring new towercos into the market that compete on price. Leased rates are locked in many markets because of the original acquisitions involved.

- **Poor carrier neutrality**, i.e., limited or discriminatory access to towers by MNOs. Towercos owned by MNOs or formed as joint ventures between MNOs can result in poor carrier neutrality; for example, with regard to how savings from additional tenants are shared. Poor carrier neutrality limits the competitiveness of the mobile market through a lack of a level playing field among MNOs.

Policy Options to Enable the Entry and Growth of Towercos in Emerging Markets

Regulatory trends

In a competitive mobile market with adequate investment incentives for MNOs, no specific regulatory intervention is needed to trigger the entry of towercos. A competitive mobile market, especially with open and nondiscriminatory access to infrastructure, would raise investment in mobile infrastructure and therefore stimulate demand for tower colocation services and, together with the supply-side drivers, enable entry of towercos without any specific regulatory interventions.

For example, in competitive mobile markets across the European Union or the United States, towercos comply with a light-touch regulatory environment. In particular, no license or regulations apply to towercos beyond regular business registration requirements. General provisions related to infrastructure sharing are often accompanied

by a dispute resolution mechanism whereby the regulator intervenes only in the absence of a commercial agreement between the MNOs engaged in infrastructure sharing. As of 2020, both regions hosted more than 20 towercos with more than 1,000 towers.¹⁶ Top players include Cellnex Telecom and Telxius across the European Union, and Crown Castle International and American Tower in the United States.

Some EMs have seen the entry of towercos in the context of a minimal regulatory burden, but most EMs have introduced specific regulations. Latin America and the Caribbean (LAC), a region with close to 60 percent of mobile towers managed by more than 10 towercos with more than 1,000 towers, has no major regulations pertaining to the tower market segment. The formation of the joint venture towerco in India emerged without any specific regulations.

However, in other EMs, especially in SSA, MENA and SA, a number of regulatory measures are attached to the entry of towercos (Figure 4):¹⁷

- **Licensing.** Attribution of licenses specifically created for tower operators (Bangladesh and Myanmar); limits on the number of licenses (Nigeria); or monopoly licenses coupled with minimum investments requirements (Egypt). Licenses might still be justified in emerging markets, especially those with low regulatory capacity, to avoid fly-by-night operators, and to ensure regulatory compliance with technical regulations and standards. However, in these cases, concerns about towerco qualifications can be achieved by preserving a light regulatory approach.
- **Fees.** Licenses typically come with fees and royalties that may consist of an initial fee plus recurring fees based on revenue share. When license fees are considered, they should be affordable, not duplicative, and of a different nature than for MNOs given the wholesale nature of the towerco business. For example, instead of paying a license fee, the towerco can be asked to deposit a refundable guarantee, to be released upon completion of an investment milestone.
- **Access regulation.** This includes a review and/or approval of business plan (Pakistan, Ghana, Malaysia,

	India	Pakistan	Indonesia	Ghana	Nigeria	Bangladesh	Egypt	Chile	Malaysia	Namibia	Myanmar
Licensing		√			√	√	√			√	√
Access regulation		√	√	√	√		√		√	√	
Business regulation	√	√	√	√	√	√	√	√	√		√

FIGURE 4 Towercos Regulation in Selected Emerging Markets in 2020

Source: IFC based on data from Delta Partners and TowerXchange.

and Chile); or the publication of master lease agreement comparable to reference offer (India, Nigeria).

- **Business regulation.** This involves regulations such as capitalization requirements, often combined with limitations on foreign ownership and requirements for minimum track record in other markets; and national security laws may take control over essential infrastructure.

Recent developments in the Egyptian mobile market illustrate an emerging trend in entry regulations of towercos in EMs. In Egypt, towercos would pay an upfront license fee, and annual license fees in percentage of turnover, with a secured performance bond, a minimum local ownership and track record, and a rollout obligation in the initial years. In addition, leasing of space to third parties would need approval from the local regulator. This has resulted in limited towerco activity in the country.¹⁸ Other emerging markets such as Chile and India do not provide for any licensing and access regulation requirements.

Toward a regulatory framework for towercos in EMs

General policy options to address towercos' regulatory challenges can be grouped by the development stage of the tower markets (Table 1).

In nascent tower markets:

- The presence of a dominant MNO may be overcome by awarding a mobile infrastructure license to a multinational or regional towerco. By leveraging economies of scale from other markets,¹⁹ a multinational or regional towerco can enter a market serving smaller MNOs as anchor clients, before gradually building scale through competition and innovation. By providing a level playing field between MNOs, such entry can support the expansion of smaller MNOs,

Regulatory Challenges		Options
Nascent tower markets		
Limited competitiveness of the mobile market	Presence of a dominant MNO	Towerco license a multinational/regional towerco with one of the smaller MNOs as the anchor client
	Risk of tacit collusion among MNOs of similar size	Introduce environmental regulations to encourage demand for tower colocation, or integrate with power policy
	Lack of investment incentives for MNOs	<ul style="list-style-type: none"> • Spectrum allocation, and geographical coverage commitments in spectrum licensing • Regulation that promotes co-build or independent towercos particularly in rural areas, e.g., tax exemption in those areas or immediate access to USF
Legal barriers to entry in tower market	Licensing	Reduce license fees and royalties to administrative cost levels, enforce agile and burdenless registration-based licensing systems as opposed to licensing
	Business regulation	Level playing field with businesses across the economy, remove restriction on ownership (local and/or foreign), commercial negotiation of quality of service
Concentrated tower markets		
Potential abuse of dominance	Monopoly towerco or joint dominance in the tower market	<ul style="list-style-type: none"> • Improving the competitiveness of the mobile market, or raise incentive to invest in mobile networks • Ex-post review of exclusive dealing agreements between towercos and MNOs, moving from cost-plus to cost-minus approach to access regulation
Carrier-neutrality	MNO-owned towercos	Access regulation: Enforce equivalence of inputs and outputs, whereby terms of access and quality of service are the same between the MNO and its tower colocation clients
	JV among a limited number of MNOs	Access regulation: Publication of reference offer

TABLE 1 Regulatory Challenges and Policy Options

Source: IFC.

thereby rebalancing market shares and improving the competitiveness of the mobile market.

- The risk of tacit collusion among MNOs of similar size, and refusal to share by dominant MNOs, can be overcome through (i) enforcement of environmental regulations such as minimum distance between towers and limits to tower duplication; and (ii) power policies such as target shares of energy consumption from renewable sources. Such regulations can stimulate demand for tower colocation.
- Lack of investment incentives can be alleviated through larger spectrum allocation to MNOs, especially in the low bands, and geographical coverage and performance level obligations to MNOs. Increasing the spectrum allocation enables MNOs to provide more capacity for a given level of investment in mobile networks. Unlike population coverage, geographical coverage requirements and performance level obligations can stimulate

demand for colocation services due to the high cost of network rollout in rural areas. Further, regulation that promotes co-building of towers or independent towercos, particularly in rural areas, can overcome limited investment incentives from MNOs.

- Legal barriers to entry arising from licensing can be minimized by aligning license fees and royalties with administrative cost levels, and enforcing registration-based licensing systems.
- Business regulation should seek to level the playing field between towercos and real estate companies by removing restrictions on ownership, which supports commercial negotiation of quality-of-service agreements between towercos and MNOs.

In concentrated tower markets:

- Monopoly market power can be alleviated by improving the competitiveness of the mobile market through the

policy options described above. To the extent that the structure of the tower market reflects that of the retail mobile market, an improvement in the competitiveness of the latter helps increase the demand for tower colocation, potentially enabling entry of competitor towercos.

- Abuse of dominance in the tower market can be overcome through interventions by competition authorities or sector regulators in areas such as exclusive dealing agreements between towercos and MNOs, and access regulation, when relevant.²⁰ Open and non-discriminatory bidding of tower colocation can enable the growth of smaller towercos. However, an effective implementation of these remedies depends on the capacity of the regulator to assess abuse of dominance, and depends on a balance between consumer and social welfare.
- Carrier-neutrality issues arising from MNO-owned towercos or joint ventures can be alleviated through regulation of access to towers, a mandatory publication of reference offer by towercos, or through ex post remedies such as equivalence of inputs and outputs between the MNOs in cases of proved abuse of dominance. Under equivalence of inputs, MNOs owning a towerco would be required to provide access to their towers under similar contractual terms as their connectivity branches. Under equivalence of outputs, MNOs owning a towerco would be required to provide access to their towers to ensure similarity of quality of services between competitors and their own connectivity branches.

More generally, the competitiveness of the towerco market segment can be constrained by the evolution of other essential complementary infrastructures such as wholesale backbone networks and data centers. As such, a broader assessment of market conditions, and potentially of regulatory interventions, beyond towercos may be needed in some instances to support a competitive towerco market segment.

Implication of Small Cells and Distributed Antenna Systems for Towerco Regulation

The towerco business model is evolving with an expansion to non-tower infrastructure to support the rollout of small cells and distributed antenna systems as part of 4G rollout and the transition to 5G.²¹ 5G introduces enhanced mobile broadband, massive machine, and low latency communications,²² and requires large amount of spectrum (and new spectrum bands), as well as important investments in densification of towers and large number of small cells—up to ten times more sites. Across emerging markets, several towercos are providing colocation services for small-cell sites (e.g., newsstands, street light poles,

bus stations). Examples include Phoenix Towers in Brazil, Guodong Towers in China, and Helios Towers in Africa.

Small cells and DAS offer a range of opportunities for towercos through business model innovation.²³ Potential innovations include (i) a passive small cell model, whereby the towerco generates a portfolio of small-cell sites including power, backhaul to the site and operation and maintenance; and (ii) a “small cell-as-a-service” model, whereby the towerco invests and deploys the passive and active components of small cells and offers connectivity as a service.

This business model innovation is increasing the urgency of existing regulatory challenges such as rights of ways, local permits, and fiber backhauling. A successful expansion of towercos in small cells and DAS business requires matching local demand with adequate supply of locations at reasonable cost, securing all required permits in adequate time, and providing sufficient backhaul (fiber) capacity. However, high access fees due to the uniqueness of each location, regulations on site permits, complexity of the site approval process,²⁴ and challenges to fiber deployment can affect innovation by towercos, with potential implications for the availability and full potential of 5G networks, platforms, services, and applications.

A number of regulatory practices from advanced and emerging markets illustrate how towerco regulation may adapt to small cells and DAS, recognizing that more innovative policies will be needed in this fast-evolving sector.

Areas of policies include:

- **Elimination of barriers to rapid deployment** by streamlining site-permitting standards, applying “zero-rating” to public sites,²⁵ and increasing the timelines of the approval process. In the United States, the Federal Communications Commission recently updated environmental and historic preservation rules, put in place guardrails to address outlier fees and delays imposed at the state and local level, and streamlined the process for swapping out utility poles to add wireless equipment. As a result, infrastructure builds accelerated at a record pace: In 2016, U.S. providers built just 708 new cell sites; in 2019, they built over 46,000, a 65-fold increase.²⁶
- **Limiting local costs and fees:** fees should be no greater than “reasonable” costs of processing applications and managing rights of way. Also, removal or reduction of “non-fee” requirements, for example on aesthetics or buried cabling.
- **Considering the municipal level,** by reducing the number of touchpoints, avoiding duplication of processes and of

fees, agreeing to transparent and predictable processes and fees, instituting single point of contact and one-stop shops, limiting the municipality's right to unreasonably object, and reducing rental cost all the way to zero-rating in public spaces (e.g., Singapore).

- **Promotion of Open Radio Access Network:** ORAN enables network function virtualization and can create demand for small-cells sites and DAS by creating a multi-supplier solution that allows MNOs to separate between hardware and software components with open interfaces and hosting software that controls and upgrades networks in the cloud.

In general, as suggested by recent analyses,²⁷ ex post regulatory intervention may be justified in the case of the emergence of a market structure with a smaller number of

mobile access networks (RANs) in highly dense and high-income areas.

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¹ A joint venture between China Mobile, China Telecom and Unicom in 2014.

² A joint venture between Barathi Group and Vodafone in India in 2007.

³ IFC's estimate based on deals data from TowerXchange between 2018 and 2020 and covering 67 countries across all regions.

⁴ Certain towercos can manage a portfolio of towers for an MNO without the ability to independently rent access to alternative MNOs. Such business model is out of the scope of this note. In general, any arrangement that is not conducive to the sharing of access to mobile infrastructure under an open and nondiscriminatory basis is out of the scope of this note.

⁵ IFC estimates based on data from the GSMA Intelligence—from a total of 87 countries.

⁶ Strusani, Davide and Georges V. Hounghonon. 2020. "Accelerating Digital Connectivity Through Infrastructure Sharing." *EM Compass Note 79*, IFC, February 2020. https://www.ifc.org/wps/wcm/connect/publications_ext_content/ifc_external_publication_site/publications_listing_page/emcompass-note-79-digital-infrastructure-sharing

⁷ Ibid.

⁸ Ibid.

⁹ Grijpink, Ferry, Alexandre Ménard, Halldor Sigurdsson, and Nemanja Vucevic. 2018. "The Road to 5G: The Inevitable Growth of Infrastructure Cost", February 23, 2018.

¹⁰ GSMA. 2019. "Closing the Coverage Gap - How Innovation Can Drive Rural Connectivity."

¹¹ Strusani, Davide and Georges V. Hounghonon. 2020.

¹² Markets with successful towerco business model are defined as those with at least 5 percent of towers managed by towercos. Based on our sample, the market share of towercos is on average 50 percent.

¹³ Best practices suggest a threshold around 1,000 towers.

¹⁴ Four out of ten emerging markets have at least two large towercos—e.g., Ghana, Colombia and Malaysia. A large towerco has at least 20 percent market share.

¹⁵ In Africa, IHS has signed sale-and-lease back contracts with MTN across several countries, including Nigeria, Rwanda and Zambia.

¹⁶ TowerXchange, Issue 26.

¹⁷ Sousa, Joao and Diego Heinrich. 2019. "Infrastructure Regulation: Overview and Impact on TowerCos." *The Delta Perspective*, April 2019

¹⁸ TowerXchange, 2020. "NTRA Announces New Framework for Egyptian Towerco Licence - 6,000 New Towers to be Built in the Next Three Years." <https://www.towerxchange.com/ntra-announces-new-framework-for-egyptian-towerco-licence/>

¹⁹ For instance, the number of towers managed is only weakly related to the size of the towerco, i.e., the number of staff.

²⁰ Under a cost-minus approach, the regulator sets a price ceiling. This provides an incentive for the towerco to minimize cost through higher tenancy ratio.

²¹ The future of towers is they can become nexus for interconnection (IXP) and cloud infrastructure (data centers) with a bigger role for TowerCos; or they can remain principally focused on physical/passive stuff, with due attention to shared resources like power and security and backhaul.

²² Hounghonon, Georges V., Carlo Maria Rossotto, and Davide Strusani. 2021. "Enabling Private Investment in 5G Connectivity: An Assessment of Challenges and Policy Options." *EM Compass Note 102*, IFC, April 2021.

²³ Casademunt, Francesc and Joao Sousa. 2018. "Towercos: How Not to Miss The Small Cell Opportunity." *The Delta Perspective*, August 2018

²⁴ This often involves regulations from several stakeholders, e.g., the national regulator, local administration and community and special groups of interest.

²⁵ An alternative approach could be to set in place commercially viable models, for example by setting a municipal company to offer easy access, reasonably priced bundled sites.

²⁶ TeleGeography. 2021. "FCC Commissioner Identifies Future 5G Bands, Boasts of Tower Turnaround", March 17, 2021

²⁷ Cave, Martin, 2018. "How Disruptive is 5G?" *Telecommunications Policy*, vol. 42(8), pp. 653–658.