Road to 5G: calibrating the right environment for Digital India

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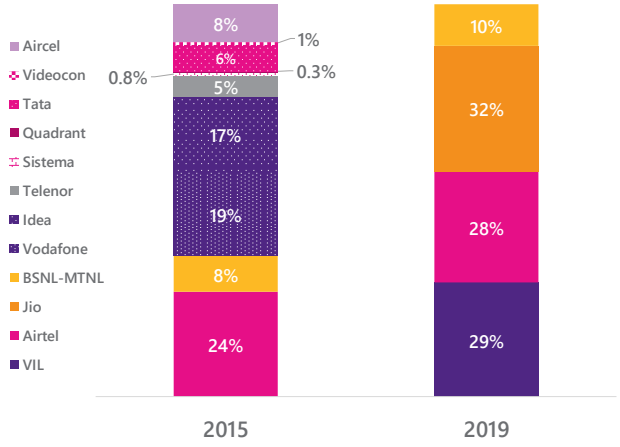
With the 5G era just around the corner, policymakers around the world have outlined ambitious national objectives for the digital economy. Specific targets are often set for the underpinning infrastructure and India is no exception. The India mobile industry has experienced a series of challenges in recent times – from a protracted price war, market consolidation to the Supreme Court order on overdue levies – which have altered the market landscape significantly. Delivering on the envisioned 5G outcomes and associated economic benefits will require an enabling policy environment and regulatory solutions that address the needs of industry players and consumers alike.

A market reshaped in recent years

In the last five years, the Indian mobile market has witnessed significant changes. From an extremely fragmented marketplace with more than 10 private operators at one point operating in different licensed service areas, there is now a much consolidated marketplace with three main players – Bharti Airtel (Airtel), Vodafone Idea (VIL) and Reliance Industries (Jio) – and the state-owned operator Bharat Sanchar Nigam Limited and Mahanagar Telephone Nigam Limited (BSNL-MTNL).

The entry of Jio in 2016 – with its initial strategy of free voice and data services, followed by low-priced service packages – has shaken up the market and triggered this wave of consolidation. With the falling subscriber base and decreasing revenues, many operators had to either shut down, sell or merge their operations as Figure 1 illustrates.

Figure 1: Market shares by subscriptions



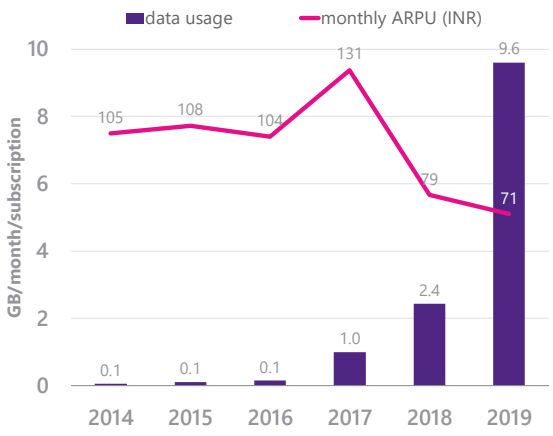
Source: TRAI

The global telecommunications sector has seen its fair share of mergers and acquisitions in recent years. For most telecoms operators, consolidation usually leads to improvements in market position, better growth prospects and gains in competitive advantages. However, in the India context such benefits have been scarce to date, particularly in the case of Airtel and VIL who have had to expand their 4G coverage and manage network integration while facing pressure on tariffs against a fast-expanding Jio.

A question of long-term sustainability

India is one of the world's fastest growing markets for mobile broadband – the GSMA forecasted a 3% growth per annum from 750 million unique subscribers at the end of 2018 to 920 million by 2025. Much of this will be driven by the recent expansion of 4G LTE networks as the base of 4G connections grows. By 2020 the number of 4G connections were expected to overtake legacy 2G and 3G connections. Mobile data growth has risen sharply since 2016 while average revenue per user (ARPU) has declined in the same period. Data demand between 2014 and 2019 has increased by 160 times to reach 9.6 GB/month/sub in 2019. Ericsson projects monthly data traffic per user to increase to around 24 GB.[1]

Figure 2: Data usage and ARPU trends (2014-2019)



Source: TRAI

While Jio's entry has translated into benefits for consumers in the short term, the bruising price war was clearly unsustainable. The recent hike in tariffs by the three main players[2] suggests a stabilisation in the market environment and a return to future revenue growth, driven by the rise in 4G penetration. However, as a result of the recent Supreme Court ruling on the running licence fee dispute,[3] Airtel and VIL are now reported to be facing financial distress which could further jeopardise the market dynamics and future 5G developments.

National policy objectives

The government's National Digital Communications Policy 2018 has set ambitious targets to be achieved by 2022. These include: broadband for all; creating four million additional jobs; 8% contribution to India's GDP up from 6% in 2017; and scoring in the top 50 in ITU's ICT Development index.

Specific to 5G, the Department of Telecommunications' (DoT) steering committee has identified three key priorities – rolling out efficient, early and pervasive 5G networks; building India's industrial and R&D capacity to support 5G roll-out; and expanding the manufacturing base of 5G network equipment with specific recommendations across various regulatory, policy, technology and application domains.[4]

What are the key challenges for 5G?

Just as 4G paved the way for the digital economy in India, 5G has the potential to be as transformative, especially for enterprises and in sectors such as manufacturing, education, finance, healthcare and agriculture. Delivering on the promises of 5G will require favourable policies and regulatory framework.

The challenges associated with 5G in terms of business cases, infrastructure requirements and underlying economics are well-recognised.[5] While these are by no means unique to India, the challenges are exacerbated by the market and regulatory conditions in India. Below we discuss some of the key aspects which need to be addressed by both government and industry in order to pave the way for 5G in the coming years.

1. Ensuring 5G spectrum supply

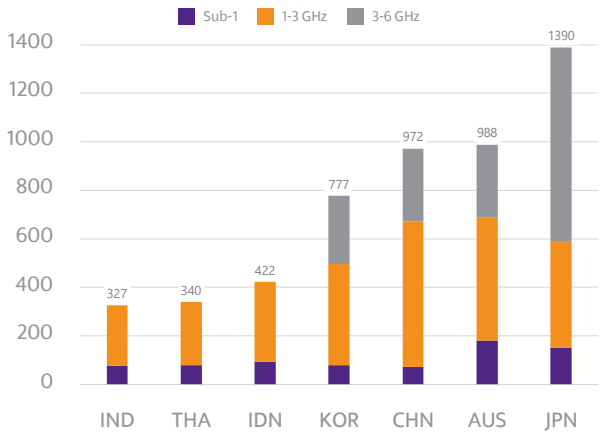
Spectrum is the critical input for mobile service provision. Unlike 4G where operators were able to rely, at least in part, on the refarming of existing spectrum, such as 900 MHz and 1800 MHz, for 4G deployment, 5G requires large, contiguous blocks of spectrum particularly at the mid-band (1-6 GHz) and high-band (>6 GHz) frequencies to meet 5G performance specifications.[6] The assignment of new bands will be necessary.

While 5G will eventually be deployed over a range of frequency bands in the long term, the focus so far has mainly been a handful of bands, namely 700 MHz, 3.3 – 3.8 GHz (C-band), 26 GHz (24.25 -27.5 GHz) and 28 GHz (26.5 – 29.5 GHz).[7] Among these, the C-band (3.3-3.8 GHz) spectrum has been earmarked by the mobile industry as the key band for 5G enhanced mobile broadband (eMBB) services. Many countries have either completed, or are preparing for, the award of this band. In India, it is expected that up to 300 MHz in the 3.3 – 3.6 GHz range will be put up for auction later in 2020, alongside the 700 MHz and several existing bands (850, 900, 1800, 2100, 2300, 2500 MHz). Plans for the 26 GHz (24.25 – 27.5 GHz) band are still unclear.

Since 2012 there have been five auctions in India for a variety of frequency bands and each one has ended up with a significant amount of unsold spectrum despite the operators' clear need for additional spectrum, which suggests that the reserve prices were too high in most instances.[8] In other words, the market-clearing price (equilibrium price) was not achieved in most circumstances. The practice of using previous reserve prices as a guide in determining reserve prices for new auctions, of the same or new spectrum, is thus questionable, particularly where those auctions have failed to produce market clearing prices.

In terms of spectrum assigned for mobile (IMT), India has lagged behind the other major economies in the Asia Pacific region as illustrated in Figure 3 below. With 4G, operators in India were able to mitigate spectrum constraints by refarming 2G and 3G spectrum. Given growing 4G demand and the 5G bandwidth requirements, access to new bands (700 MHz and C-band) will be essential for the first phase of 5G rollout.

Figure 3: Spectrum assigned for IMT (end-2019)



Source: Plum Consulting

Thus, a successful outcome in the upcoming auction particularly in relation to the 700 MHz and 3.3-3.6 GHz bands will be a crucial first step. To this end, reserve prices should be decoupled from those of previous auctions and should instead be set conservatively to take into consideration recent industry developments and national policy objectives and the considerable investment required to deploy 5G networks.

2. Licensing of 5G to address user needs

Unlike previous generations of mobile technology, 5G is envisaged to serve a multitude of applications with heterogenous performance and spectrum requirements.[9] Techniques such as Software Defined Networking (SDN) and

Network Function Virtualisation (NFV) will allow 5G connectivity to be much more flexible, simultaneously addressing different use cases. From the regulatory perspective this is likely to require new approaches to spectrum award and authorisation.

With the variety of frequency bands identified for 5G – low (sub-1 GHz), mid (1-6 GHz) and high (above 6 GHz), this form of geographic licensing may no longer for appropriate for the types of use cases in the 5G era. New users (industry verticals) and applications will not necessarily require spectrum access on a wide geographic scale. Often these will be on a limited, highly localised basis and may involve a range of frequency bands. For example, agriculture uses may require wide area coverage in rural areas and so require spectrum below 6 GHz, but other industrial applications, such as those in indoor environments may be better suited to mmWave bands.

The range of options being considered by regulators to address these vertical markets include:

- **Spectrum leasing** – where the mobile network operator (MNO) leases some of their spectrum which they have identified will not be required in the short to medium term at a specific location, generally on a commercial basis, to another user. For MNOs there is the advantage of income generation from spectrum that would otherwise be unused. The disadvantage is that they continue to be responsible for meeting all their licence conditions for the leased spectrum. The new user may also not find such arrangements attractive due to the terms of leasing and cost.
- **Spectrum sharing solutions** – this is similar to leasing but in this case the regulator will issue a licence for the specific spectrum and location, and the conditions to be met by the new user. For example, Ofcom has adopted this approach in the UK for already licensed bands (3.8-4.2 GHz, 2.3 GHz, 1800 MHz) to support innovative use.[10] Another option is Dynamic Spectrum Access (DSA) where the usage of a band at a location can be determined through use of a geo-location database, possibly with beacons or sensors, before being utilised and so avoid interference to the primary or other licensed users.[11]
- **Identifying spectrum specifically for new users**. Such an approach will either require the regulator to sub-divide the country into smaller geographic areas or award and licence on the basis of, for example, a per base station area that is coordinated by the regulator. For mmWave bands it may be possible to adopt a light licensing or General Authorisation approach where new users coordinate amongst themselves, or if DSA is possible through the use of a database.

With 5G, there is no 'one size fits all' licensing solution. Instead, a range of licensing approaches, including licence exempt spectrum, will be necessary. As new 5G use cases, not just eMBB, are starting to emerge, it will be timely for the TRAI to review its licensing approaches and consider new forms of spectrum access to cater to innovative uses in new 5G bands.

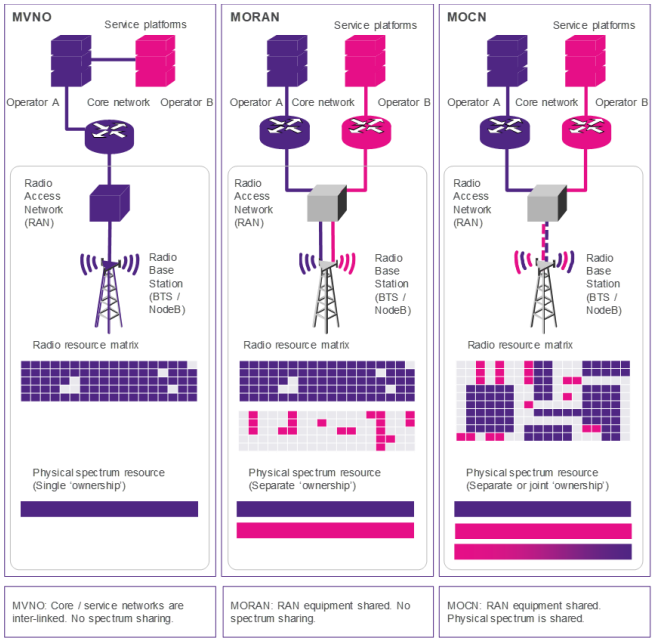
In India, spectrum rights for mobile are assigned by Licensed Service Area (LSA) – there are more than 20 LSAs. It may also make sense to simplify the current LSA regime to allow more contiguous holdings across the whole of India for existing mobile bands, as well as 700 MHz and 3.3-3.6 GHz. Given the pan-India operations of the existing players (Airtel, Jio, VIL), service- and technology-neutral licences on a nation-wide basis will provide more flexibility to operators and allow them to better plan their network rollout.

3. Leveraging on network sharing

Network sharing is not a new concept; MNOs in many countries already engage in network sharing to reduce capital and operating costs, particularly in rural areas where the benefits of cost savings exceed the competitive advantages that one can gain through service differentiation in the self-deployment case.

The economics of 5G will necessitate more extensive and deeper forms of network sharing, potentially involving not just passive network components (e.g. masts, sites, power supply), but also active network elements in the radio access network including spectrum. Active sharing, such as Multi-operator radio access network (MORAN), Multi-operator core network (MOCN) and other forms of multi-tenancy, neutral hosting solutions will be expected to feature heavily in the 5G environment.

Figure 4: Examples of network sharing options

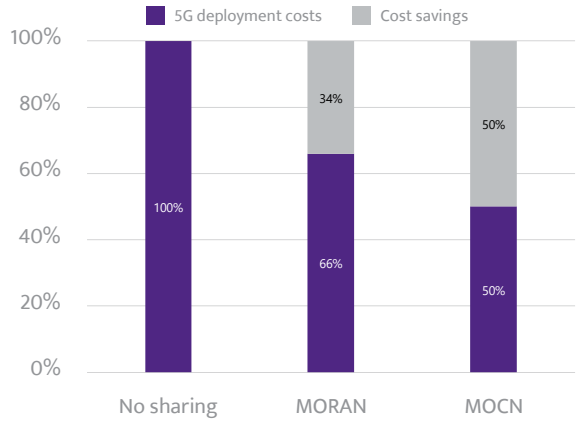


Source: Plum Consulting

Analysis undertaken by Plum on 5G deployment in the C-band suggests that network sharing between two operators could lead to savings of around one-third to half in 5G deployment costs compared to a situation with no network sharing as illustrated in Figure 5. Network and infrastructure sharing should

be encouraged given the considerable benefits which should help accelerate 5G deployment through the underlying policy and regulations. However, the complexity of these arrangements due to their implications on business strategy, commercial objectives and network planning suggest that these should be left to commercial agreement between MNOs rather than mandated by regulatory authorities.

Figure 5: Cost savings from network sharing



Source: Plum Consulting

For MNOs the initial phase of 5G eMBB will be driven by expansion of coverage. This is likely to require a densification of networks which is an essential feature of 5G, and better access to high capacity backhaul links (fibre or microwave). Reducing the regulatory or administrative barriers to small cell deployment will help to improve the mobile industry's ability to deploy denser networks quickly and lowering deployment costs.

The simplification and harmonisation of application and approval processes for planning permits, access to land, buildings and street furniture will be essential. This will require greater closer coordination among government departments, sector regulators and operators.

Conclusion

The introduction of 5G will precipitate changes in the structure of the mobile industry and there will be implications on the nature of competition. On the supply side, 5G networks will be characterised by fewer radio access networks as a result of more extensive network sharing. At the same time, demand for connectivity, particularly from new 5G use cases, will be much more varied with a multitude of service requirements.

These developments represent a departure from the way mobile networks are run and regulated to date – as vertically integrated competing networks. Regulatory authorities will have to face the tricky challenge of ensuring effective competition in the 5G environment to deliver benefits to the economy and society. There will need to be a change in spectrum management approach and a level of flexibility in licensing not required previously. Whilst on one hand, there is a case to ensure a degree of infrastructure or facilities-based competition to maintain incentives for market players to invest in new technology, optimise the use of spectrum and expand network coverage it is also necessary to encourage service-based competition to bring about greater choice and innovation.

The road to 5G is akin to a marathon, rather than a sprint to the finish-line, and deployment will be gradual over a number of stages and specific to use cases. For network operators, success will depend on a combination of managing deployment costs while adapting their businesses to cater to 5G enterprise uses. For regulators, greater flexibility in spectrum management in relation to licensing and pricing will be needed to cater for all 5G users. At the same time, appropriate steps to maintain effective competition should be considered, while recognising the investment challenges of 5G.

[1] Ericsson Mobility Report, November 2019.
[2] The Economic Times. *Low tariff regime over, telcos up rates by 40-50 per cent.* New article, 2 December 2019.
[3] In October 2019, the Supreme Court passed verdict on the long running licence fee dispute regarding the 'revenue base' on which regulatory levies are payable. Based on this Airtel and VIL are expected to have to pay around INR 350 billion and INR 530 billion respectively.
[4] Department of Telecommunications. Making India 5G Ready. Report of the 5G High Level Forum, 23 August 2018.
[5] Cave, M (2018). How disruptive is 5G? *Telecommunications Policy,* 42, 653-658.
[6] The GSMA has recommended 80-100 MHz per operator in the mid-band spectrum range and around 1 GHz per operator in the high-band range.
[7] Some alternatives in the mid-band range such as 2.6 GHz and 4.9 GHz have been considered although these are so far not as harmonised
[8] See Table 1.1. TRAI. Recommendations on Auction of Spectrum in 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, 2500 MHz, 3300-3400 MHz, 3400-3600 MHz Bands. 1 August 2018.
[9] For example, see 5G Americas. 5G Spectrum Recommendations, April 2017.
[10] Ofcom. Statement: Enabling wireless innovation through local licensing. 25 July 2019.
[11] Examples include TV White Spaces and the Citizens Broadband Radio Service (CBRS) in the 3.5 GHz band in the US.