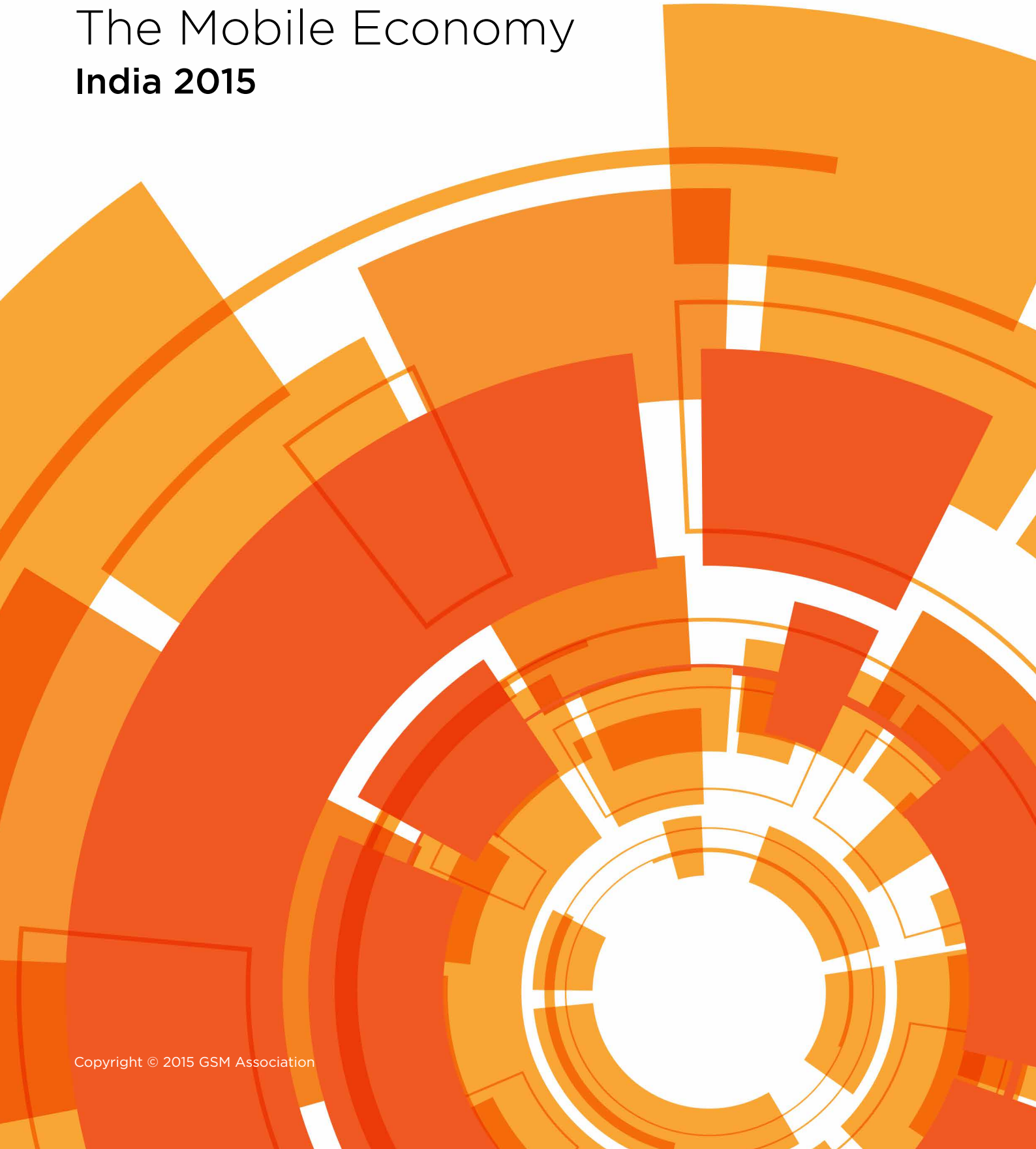
The Mobile Economy
India 2015



The GSMA represents the interests of mobile operators worldwide, uniting nearly 800 operators with more than 250 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and internet companies, as well as organisations in adjacent industry sectors. The GSMA also produces industry-leading events such as Mobile World Congress, Mobile World Congress Shanghai and the Mobile 360 Series conferences.

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Executive Summary

The mobile industry in India has scaled dramatically over recent years to become one of the country's biggest success stories. With over half a billion mobile subscribers, the Indian market is already the second largest in the world. Technology migration is under way and accelerating, with more than 40% of mobile connections forecast to be running over mobile broadband networks by 2020.

India is already the third-largest smartphone market in the world. There were 185 million smartphone connections as of mid-2015, and a further half a billion new connections will be added by 2020. The sheer scale of this market is attracting both local and international manufacturers, with a number of the latter looking to shift handset manufacturing to India. A local smartphone manufacturing ecosystem focussed on producing low-cost but high-specification smartphones will play a vital role in meeting the needs of local consumers.

The Indian mobile market is unique from a global perspective, with 12 active mobile operators. It is by some distance the most competitive market in Asia Pacific. Voice pricing is already low by international standards. Although data traffic is growing strongly, operators are handicapped in their efforts to monetise this by the high cost of spectrum and the limited amount of spectrum allocated for mobile services.

Reflecting these challenges, mobile operator revenue growth is set to slow, with a compound annual growth rate (CAGR) of around 6% forecast out to 2020. Operators are committed to significant capital investment to improve mobile broadband network coverage and capacity. Capex over the last four years has totalled more than INR119,205 crore ($18 billion).

Despite operators' efforts to minimise capex and operating costs through network sharing and managed services agreements, pressure remains on their operating margins. A move to consolidation and more sustainable market structures is vital if operators are to continue to support this magnitude of investment, deliver the ongoing improvements in network speed and capacity, and bring connectivity to the 60% of the Indian population that still has no access to a mobile phone.

Mobile already makes a significant contribution to economic growth and job creation in India. In 2014, the mobile industry was responsible for 6.1% of India's GDP, a contribution that amounts to nearly INR8 lakh crore ($120 billion) of economic value added. Continued growth in mobile internet connectivity over the coming years means mobile's contribution will grow at a faster rate than the economy as a whole, generating 8.2% of India's GDP by 2020.

The mobile ecosystem directly provided employment to 2.2 million people in India in 2014, of which 300,000 were in the formal economy and 1.9 million in the informal sector. More than 800,000 new jobs will be directly created by mobile operators and the rest of the mobile ecosystem over the next six years, bringing the total number of directly supported jobs in both the formal and informal sectors to 3 million by 2020. More than 2 million jobs will also be supported in the broader economy.

In 2014 the industry made a contribution of INR88,000 crore ($14 billion) to the funding of the Indian public sector, a figure that by 2020 will grow to INR122,000 crore ($22 billion). These figures exclude the proceedings obtained by the Indian government through spectrum auctions. The 2014 and 2015 spectrum auctions have generated government revenues of more than INR1.75 lakh crore ($28 billion).[1]

Innovative mobile solutions are helping to provide underdeveloped, underserved and low-income populations across the country with the opportunity to overcome socio-economic challenges, particularly in the areas of financial inclusion, health and education.

The Digital India initiative, which looks to empower 1 billion subscribers by providing Internet access to all and make broadband a utility for every citizen, has broad support in the telecoms industry. To date, there has been too much emphasis on employing fibre and unlicensed spectrum, rather than harnessing the potential of mobile technologies and services to cover the last mile. Mobile operators and the broader mobile ecosystem have the capacity to make a much greater contribution and are seeking a greater role in the overall program.

If both the longer term transformative potential of the mobile ecosystem and the objectives of the Digital India initiative are to be realised, increased broadband capacity will be key. The quality and coverage of a country's telecoms infrastructure is now a key competitive differentiator in the global economy. Broadband connectivity is already delivering significant benefits in markets across Asia, in both economic and social terms. The immediate priority in India is to attract the major investment required to further roll out mobile broadband networks that are accessible and affordable, which in turn requires the provision of more internationally harmonised spectrum. Only then will the country be able to meet the targets of the Digital India program.

As well as increasing supply, India's government and telecoms operators can work together to help overcome key barriers to demand for mobile broadband services, such as a lack of awareness, availability of local content and digital literacy. For example, the public and private sectors could jointly promote the development of appropriate skills, and make available a broad selection of digital content in local languages, including e-government services.

Now is the time to create a forward-looking, flexible and fair regulatory and licensing framework that will attract the investment India's digital economy needs. If they work together, India's policy-makers and the mobile industry can deliver a Digital India.

1. Conversions to US dollars based on spot rate for September 2015

MOBILE ECONOMY INDIA

Unique subscribers and SIM connections

2014
453m
36% PENETRATION RATE

2020
734m
54% PENETRATION RATE

8.4% CAGR 2014-20

CONNECTIONS*
*Excluding M2M

2014 **944m**
74% PENETRATION RATE

2020 **1.3bn**
94% PENETRATION RATE

5.5% CAGR 2014-20

Accelerating moves to mobile broadband networks and smartphone adoption

Mobile broadband connections to increase

11% 2014 → 2020 **42%**

Data traffic to grow by a **CAGR of 66%** over the period 2014-2019

Smartphones

2014
149m
2020
690m

By 2020, there will be **690m** smartphones, growth of **541m** from the end of 2014

Data growth driving revenues and operator investments

Operator recurring revenues

2015 **INR1.8 LAKH CRORE**

2020 **INR2.5 LAKH CRORE**

2014-20 **6%** CAGR

Capex over the last four years totalled more than

INR119,205 CRORE

Mobile contributing to economic and social development in India

Delivering digital inclusion to the still unconnected populations

Mobile internet penetration 22% in 2014, 44% in 2020

Delivering financial inclusion to the unbanked populations

14 live services in the country as of June 2015

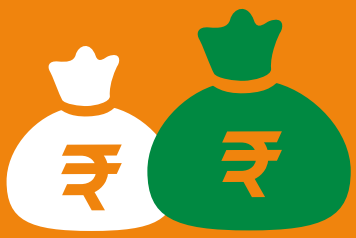
Delivering innovative new service and apps

Number of M2M connections to reach 25m by 2020

Mobile industry contribution to GDP

2014 **INR7.7 LAKH CRORE**

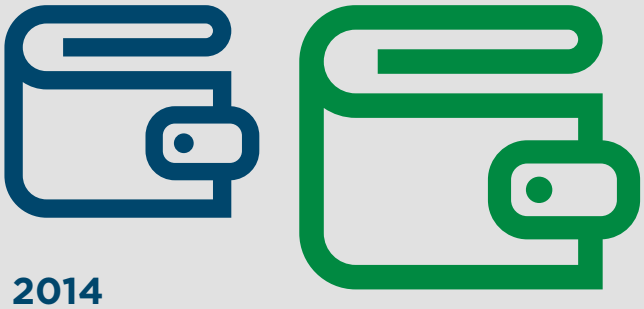
2014 **6.1% GDP**



2020 **INR14 LAKH CRORE**

8.2% GDP in 2020

Public funding



2014
INR88,000 CRORE

2020
INR122,000 CRORE

Mobile ecosystem contribution to public funding before spectrum proceeds

Employment

Jobs directly supported by mobile ecosystem

2.2m JOBS 2014

3m JOBS 2020

Plus an additional **2 MILLION** indirect jobs supported by 2020

1 Indian mobile market overview

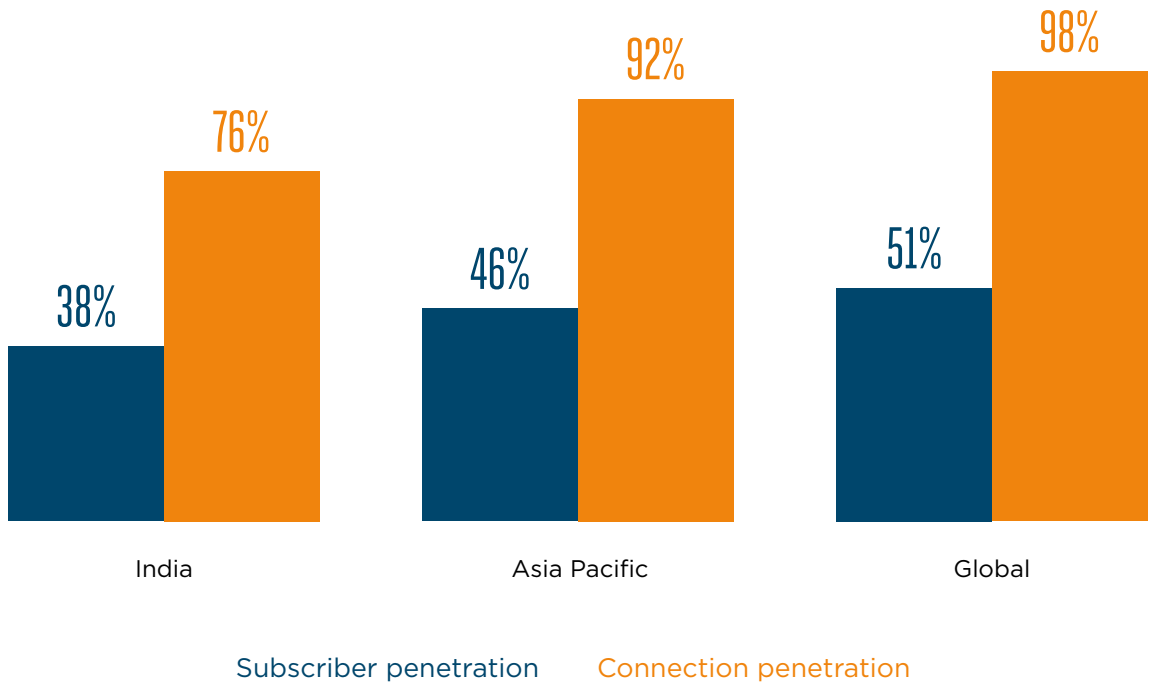
1.1 Second largest mobile market in Asia, but a long way from saturation

India had 482 million unique subscribers[2] and nearly 1 billion connections[3] (excluding M2M) as of the second quarter of 2015. It is the second biggest mobile market in the world in terms of subscribers, second only to China. The Indian market accounts for a quarter of Asia Pacific's unique subscribers and connections, and 13% of the global subscriber base.

However, India has a unique subscriber penetration of less than 40%, slightly below the regional average figure of 46%. This underscores the longer term subscriber growth potential in the market, but also the challenge for both operators and policy-makers in the country to connect the unconnected populations.

Source: GSMA Intelligence

Subscriber and connecton penetration rates, Q2 2015

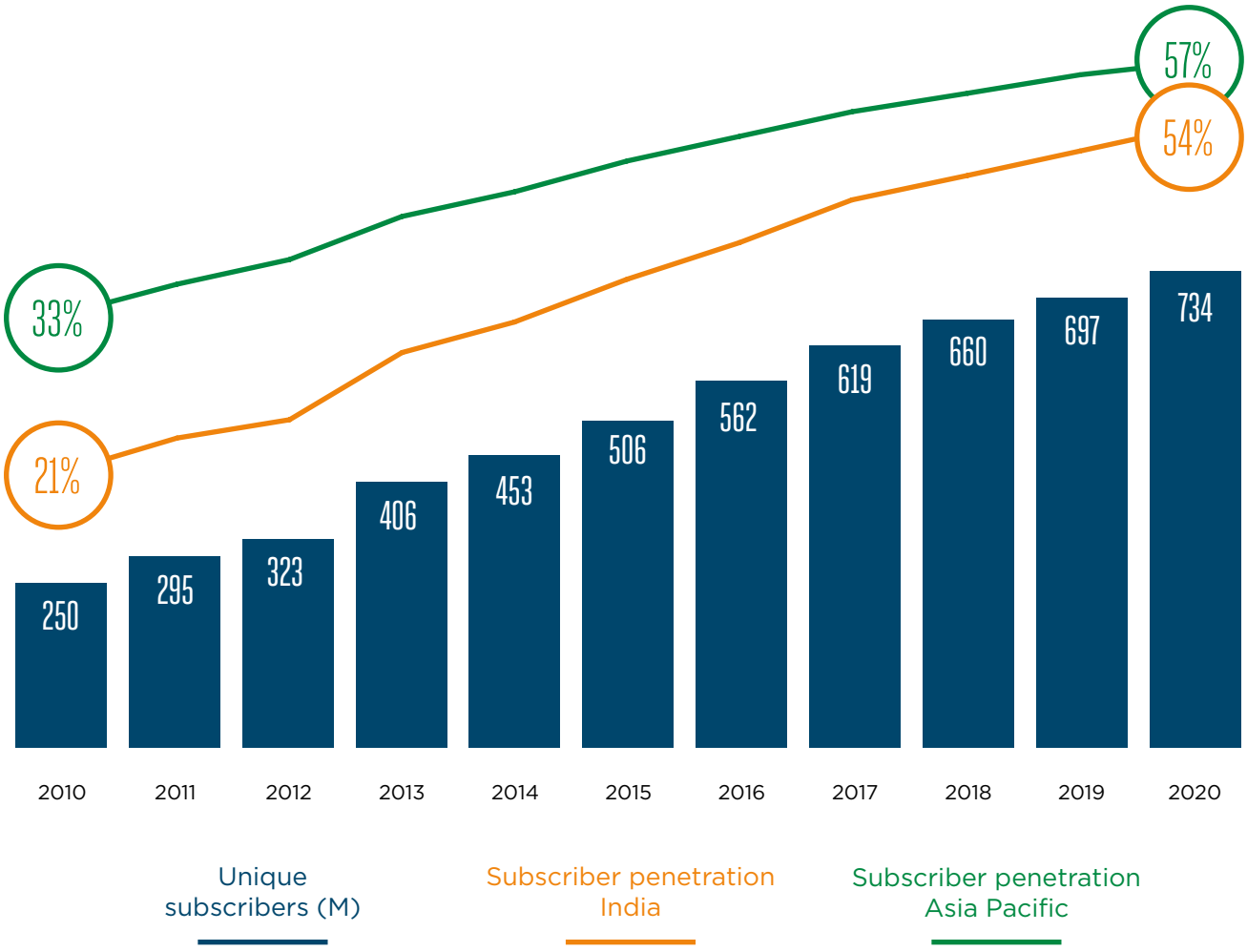


2. Total unique users who have subscribed to mobile services at the end of the period.
3. Total unique SIM cards (or phone numbers, where SIM cards are not used), excluding cellular M2M, that have been registered on the mobile network at the end of the period.

India will add 250 million new subscribers over the period to 2020, equivalent to nearly half of the forecast subscriber growth in Asia Pacific over the next five years. As a result, India's share of total subscribers in the region will rise to 30% by the end of this decade, while unique subscriber penetration will grow by 17 percentage points. Subscriber growth will be significantly faster than in the broader region, narrowing the penetration gap with the regional average.

Source: GSMA Intelligence

Unique subscriber growth in India

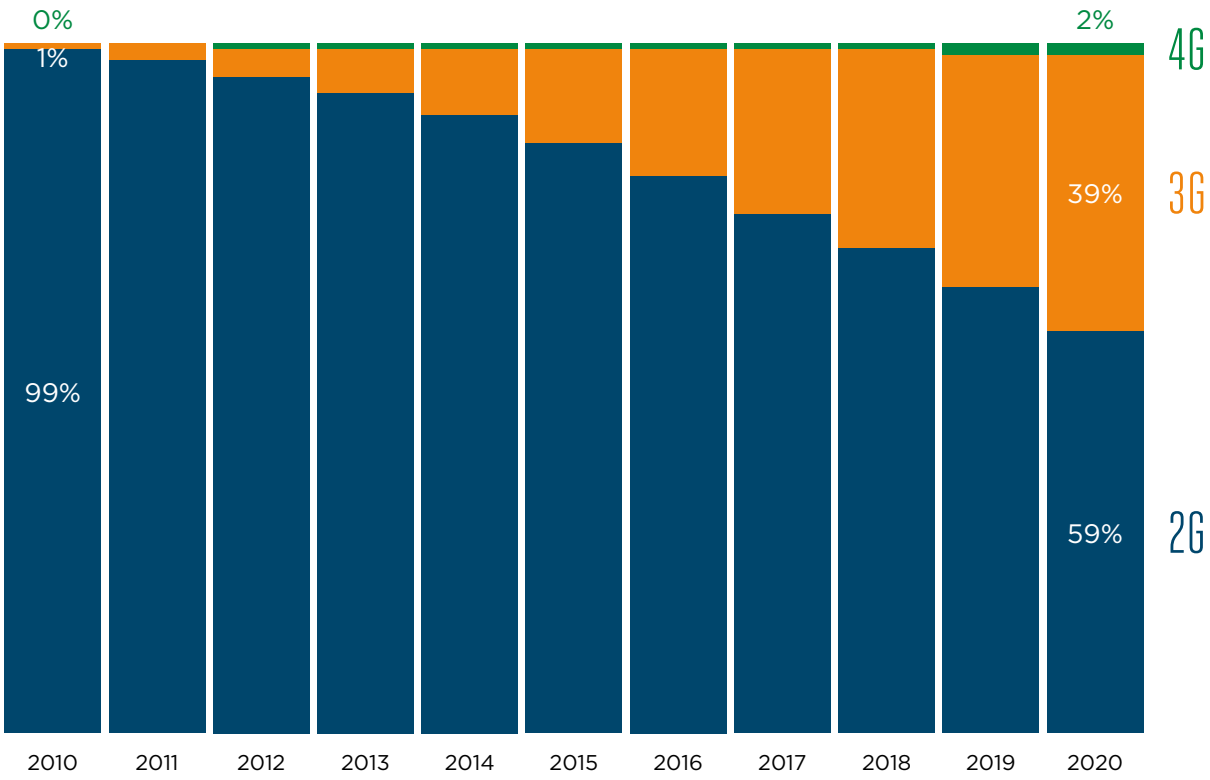


1.1.1 The move to 3G is accelerating, helped by network sharing

The migration to higher speed 3G services has continued apace since the formal launch of 3G services in India in 2009. 3G accounts for 12% of total connections and will rise to almost 40% by the end of this decade. Operators have significantly reduced the cost of 3G data services since launch, and together with the rapid expansion of 3G network coverage these have been crucial to the growth of 3G connections in India. Network sharing has played a key role in increasing network coverage cost-effectively. In a little over five years since the launch of the first commercial 3G network in India, 3G network coverage has now reached three-quarters of the population.

Source: GSMA Intelligence

Technology mix: percentage of total connections



The growth trajectory of 3G services in India mirrors that of many other countries in the region, despite the relatively late arrival of the technology. However, to date the Indian market has seen limited rollout and adoption of LTE/4G networks. As of mid-2015, less than 1% of connections in India were running over 4G networks, compared to the regional average of more than 11%.

An obstacle to the take-up of 4G in India has been the lack of relevant spectrum (both the right spectrum bands and amount of spectrum licensed). The lack of affordable, harmonised spectrum in the sub-1 GHz coverage bands has been a major factor in limiting the deployment of 4G networks in India, along with the high cost of spectrum, which makes it difficult for operators to build a viable business case for investment in network deployments.

However, a number of operators have launched (or are about to launch) 4G services, and domestic and international manufacturers have released more affordable 4G devices. Airtel has expanded its 4G services to 296 cities across the country, with services priced at the same level as 3G. Airtel is using the 2300 MHz band, as will new entrant Reliance Jio, which aims to build out its network to initially cover more than 5,000 towns and cities. Other operators such as Vodafone and Idea are in the process of launching 4G using 1800 MHz spectrum.

The continued migration to mobile broadband services, more affordable tariffs and devices, and growing uptake of new apps and services are all driving strong data traffic growth in India. Airtel's mobile data traffic grew by 95% in the year to September 2014, and Reliance Communications recorded data traffic growth of 75% over the same period. According to the latest Cisco Visual Networking Index (VNI) forecast, annual mobile data traffic in India will grow 13-fold between 2014 and 2019, a CAGR of 66%.

1.2 The rise of new ecosystem players is redefining the mobile industry in India

Local ecosystem players have emerged across different parts of the mobile value chain, notably device manufacturing and content development, to compete with established global players operating in the market. The main attraction for the products and services developed by these firms is their tendency to address pertinent challenges faced by the local consumer, especially around content, usability and cost.

1.2.1 Local device vendors are helping to accelerate smartphone adoption

Smartphones account for around 20% of total mobile connections in the Indian market, lower than the regional average of 40%. However, in absolute terms, India is already the third-largest smartphone market globally, with 185 million connections as of mid-2015.

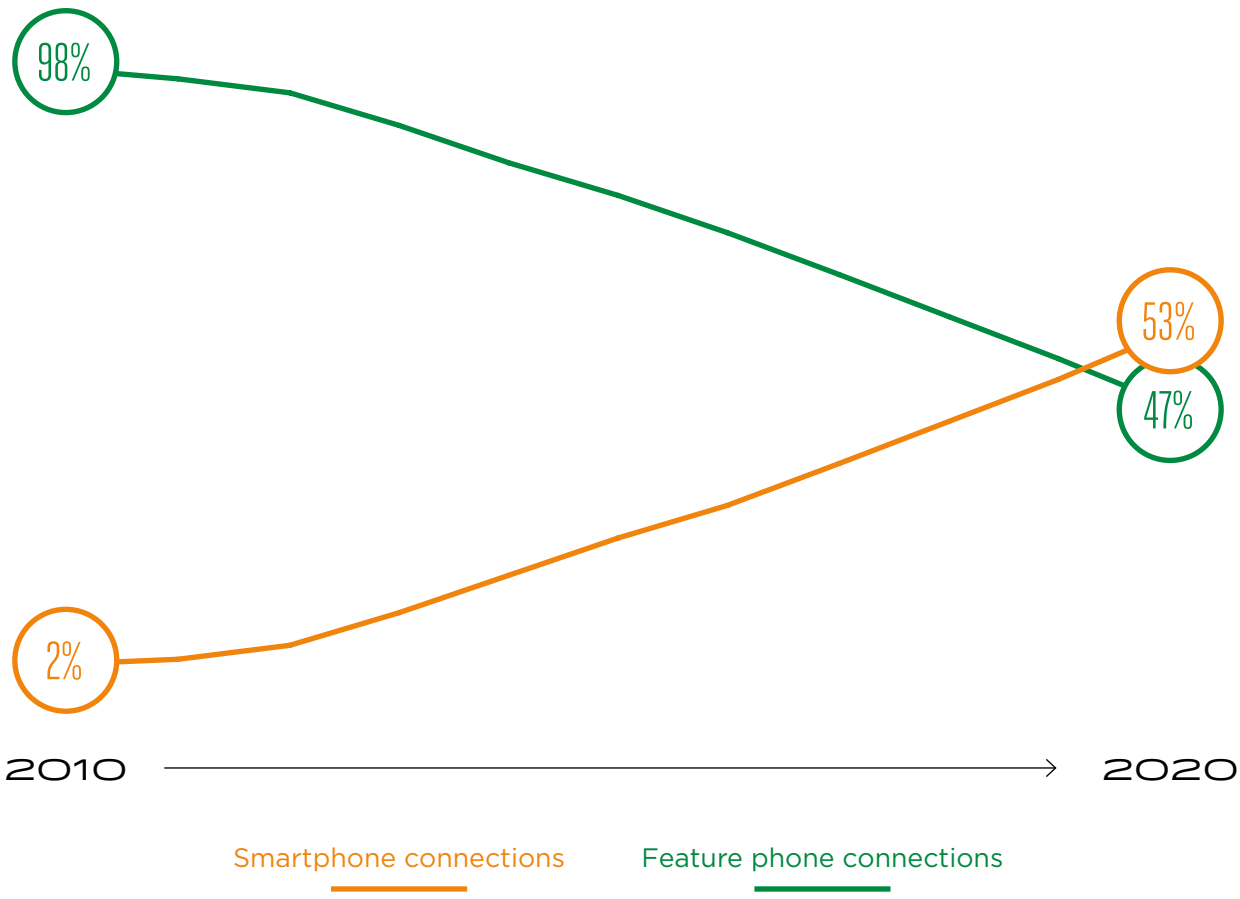
The main challenges faced by local consumers looking to upgrade from feature phones to smartphones are the cost of devices and the affordability of data services. The sheer size of the smartphone market has already attracted a range of local and international manufacturers; several overseas manufacturers have announced plans to shift production to the Indian market. The emergence of a local smartphone manufacturing ecosystem focussed on producing low-cost smartphones will play a vital role in meeting the demand for higher specification devices, a development that is in line with the government's 'Make in India' drive to encourage local manufacturing. This is already having a significant impact on the market: the average selling price (ASP) of smartphones in India has almost halved since 2011, to less than INR15,000 in 2015.

Despite the notable rise in smartphone adoption since the launch of 3G networks, feature phones remain an essential part of the mobile landscape that will be vital to connecting the large rural population.

Source: GSMA Intelligence

Smartphone adoption on the increase

Percentage of connections

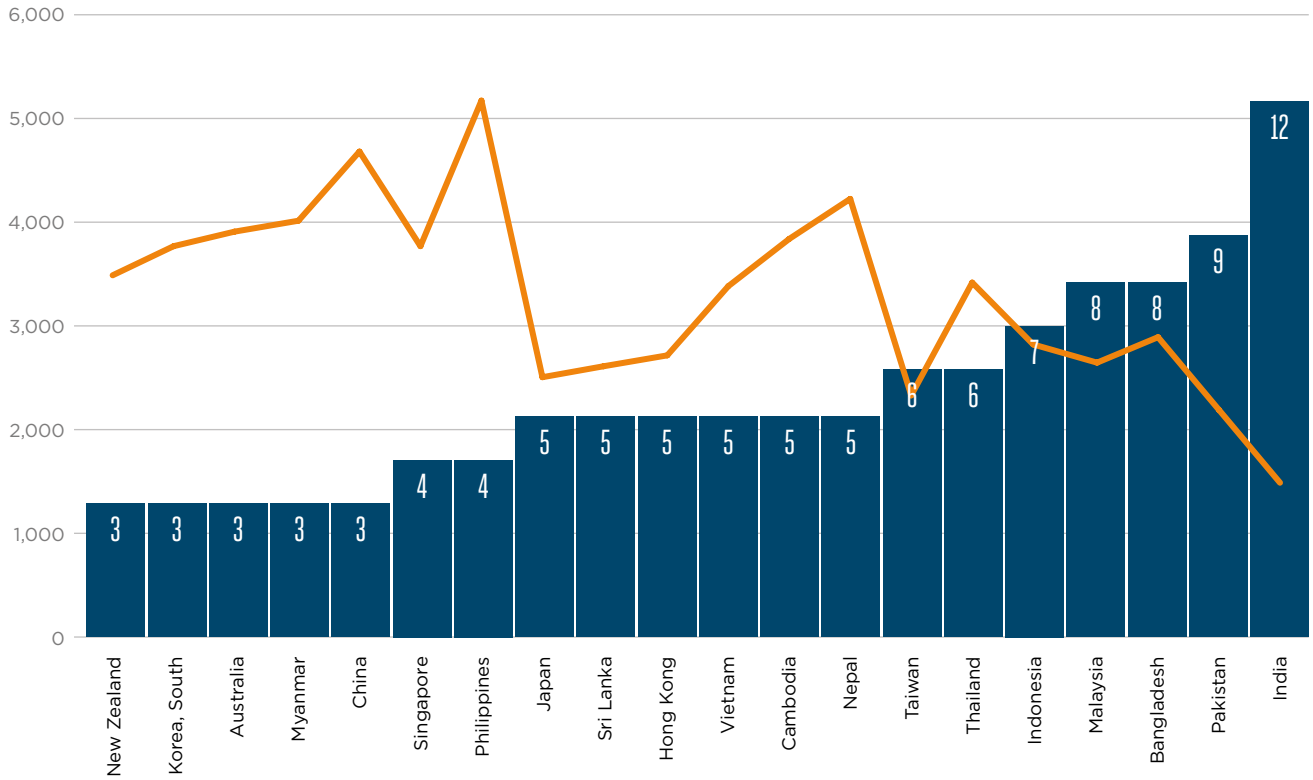


1.3 Market dynamics: a highly competitive market

India's mobile market is highly competitive; it has 12 active mobile operators and a Herfindahl-Hirschman Index[4] (HHI) of less than 2,000. India is by some way the most competitive of the 20 largest markets in Asia-Pacific. The country is divided into 22 telecoms zones, called 'circles', with the number of operators present in each circle ranging from six to 10. Reliance Jio plans to launch commercial operations by the end of 2015. The operator has a nationwide unified licence and plans to provide 4G services across the 22 circles.

Source: GSMA Intelligence

Competitive intensity is high in India



Market competition has caused prices to drop. Call tariffs in India are now among the lowest in the world. India had the fourth lowest subscriber ARPU in Asia Pacific as of the second quarter of 2015. While the impact of low tariffs is partially offset by relatively high voice usage (India has the second highest minutes of use – MOU – after China, in Asia Pacific with 376 minutes), there is limited scope for MOU to rise further due to the growing use of online communication services provided by internet players.

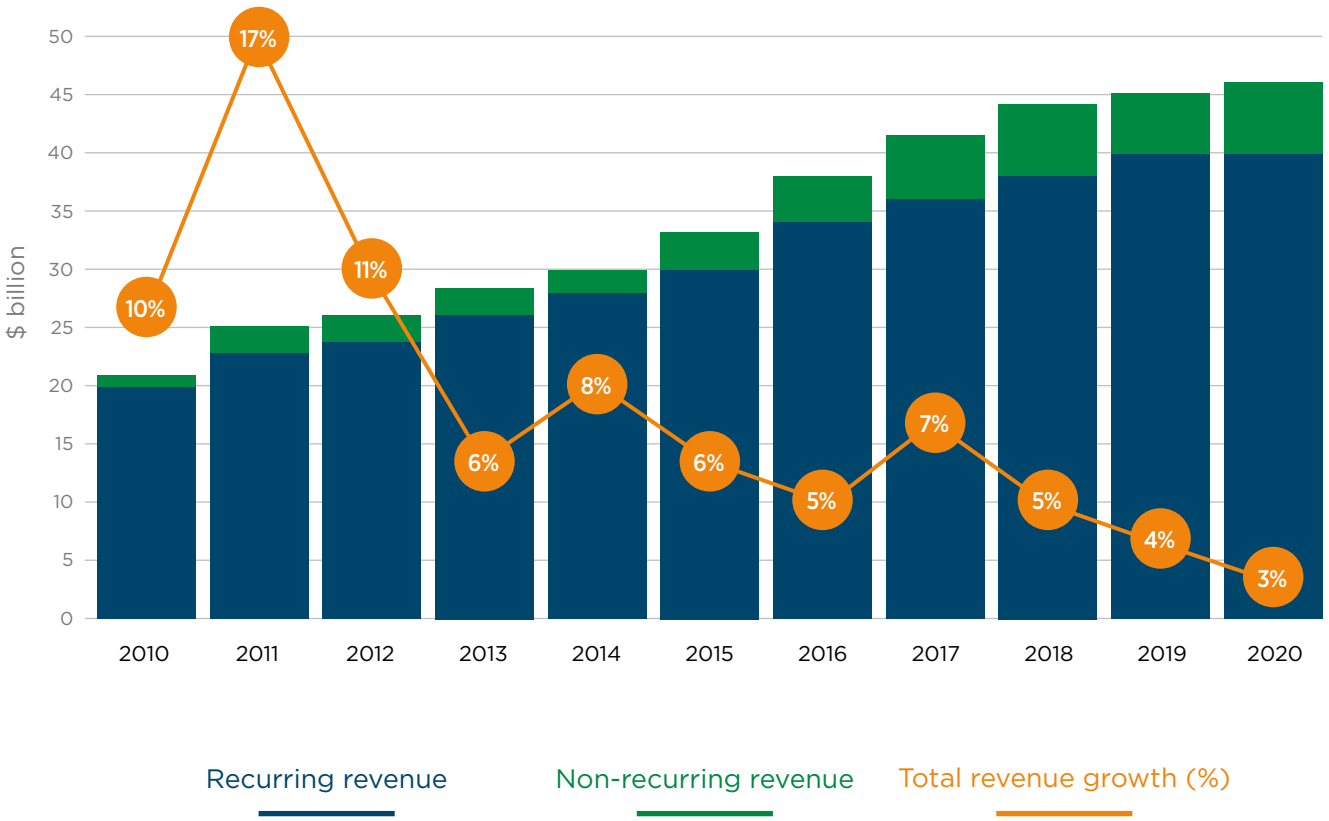
4. HHI: A commonly accepted measure of market concentration, represented on a scale of 0 (evenly distributed competition) to 10,000 (no competition)

1.3.1 Competition and new messaging services continue to weigh on revenue growth

Revenue growth in India's mobile market has moderated significantly over the last decade from more than 30% in the mid-2000s to single digits in the last three years. In 2014, operators recorded total revenue of $29.8 billion, a 6% increase on the previous year. Recurring revenue growth has seen the biggest decline in recent years, driven by a combination of intense price competition and the increasing cannibalisation of operators' traditional services by online communications services. Recurring revenue growth will pick up in 2017, partly due to forecast connections growth over the next two years, but will trend downwards again in the latter part of this decade due to slowing subscriber growth and the ongoing impact of competitive pressures.

Source: GSMA Intelligence

Indian mobile operator revenue trends



Although the uptake of smartphones provides an opportunity for data revenue growth, mobile operators in India have so far reported limited revenue contribution from data services. One challenge for operators is the need to recover the high costs of spectrum; operators bid around $18 billion in the latest round of spectrum auctions in March 2015. Competitive pressures and low income levels also mitigate against the ability of operators to pass these costs onto consumers. As a proportion of recurring revenues, average data service revenues are slightly below 15%, compared to more than 30% in advanced countries in the region. The challenge for operators is to continue to monetise the growth in data traffic and the uptake of data-centric services by consumers.

Over recent years, operators have also made significant investments in building out mobile coverage and upgrading to mobile broadband; capex over the last four years totalled in excess of $18 billion. Capex is likely to increase going forward, as operators invest further in network coverage and increasingly in 4G network deployments. Capex levels in India are also influenced by the absence of efficient spectrum allocations, which makes it more capital intensive to add network capacity. Several operators including Idea Cellular and Bharti Airtel have recently increased their guidance for capex levels for the current financial year.

1.3.2 Margin erosion and spectrum costs are likely to stimulate market consolidation

Despite operators' efforts to minimise capex and operating costs through network sharing and managed services agreements, there is growing pressure on their operating margins due to sluggish revenue growth and competitive challenges. EBITDA margins have also come under pressure from the cost requirements of coverage expansion to underserved areas. Although there has been some recovery in margins over recent years, they remain below the developing market average. The outlook remains uncertain, with a new entrant launching and the possible introduction of MVNOs to further increase competitive intensity.

Competition has played an important role in making mobile services affordable to end users over recent years. However, operators may need to move to more sustainable business models through consolidation if they are to justify the high levels of investment required to support mobile broadband network expansion. Unlike India, the majority of emerging markets have only three or four mobile operators, as is also the case in Europe and the US. Although regulators and policy-makers in many markets have been concerned about the impact of consolidation, research by Frontier Economics for the GSMA has highlighted that the right market structures can incentivise mobile broadband investments that deliver both lower unit prices and improved quality[5]. The research found that the main driver of lower prices in emerging markets over the last ten years has been investment, rather than market competition. Ensuring that the industry structure supports investment in mobile markets should be an important aim for policy-makers.

The large number of operators in India also limits the amount of spectrum available to each operator. The resulting spectrum scarcity in a highly fragmented market leads to higher network deployment costs, as operators need to build more cell sites to improve service quality. The market will only consolidate if regulatory policies enable such an environment, particularly around issues such as spectrum transfer.

5. Assessing the case for in-country mobile consolidation in emerging markets, GSMA, 2015

2

The role of mobile in delivering innovation and Digital India

The Indian mobile industry has come a long way since the first mobile call was made in 1995 – from mobile phone ownership being viewed as a luxury to becoming a utility. The Indian mobile industry is already helping to deliver a growing and innovative mobile ecosystem, which is transforming not only how people communicate but increasingly how they do business.

The India government has recognised the potential of digital technologies to address some of the socio-economic challenges in the country with the launch of its Digital India initiative. This looks to empower 1 billion subscribers by providing Internet access to all and make broadband a utility for every citizen. The lack of alternative (fixed line) infrastructure in the country means that mobile technology will play a central role in the realisation of the Digital India initiative.

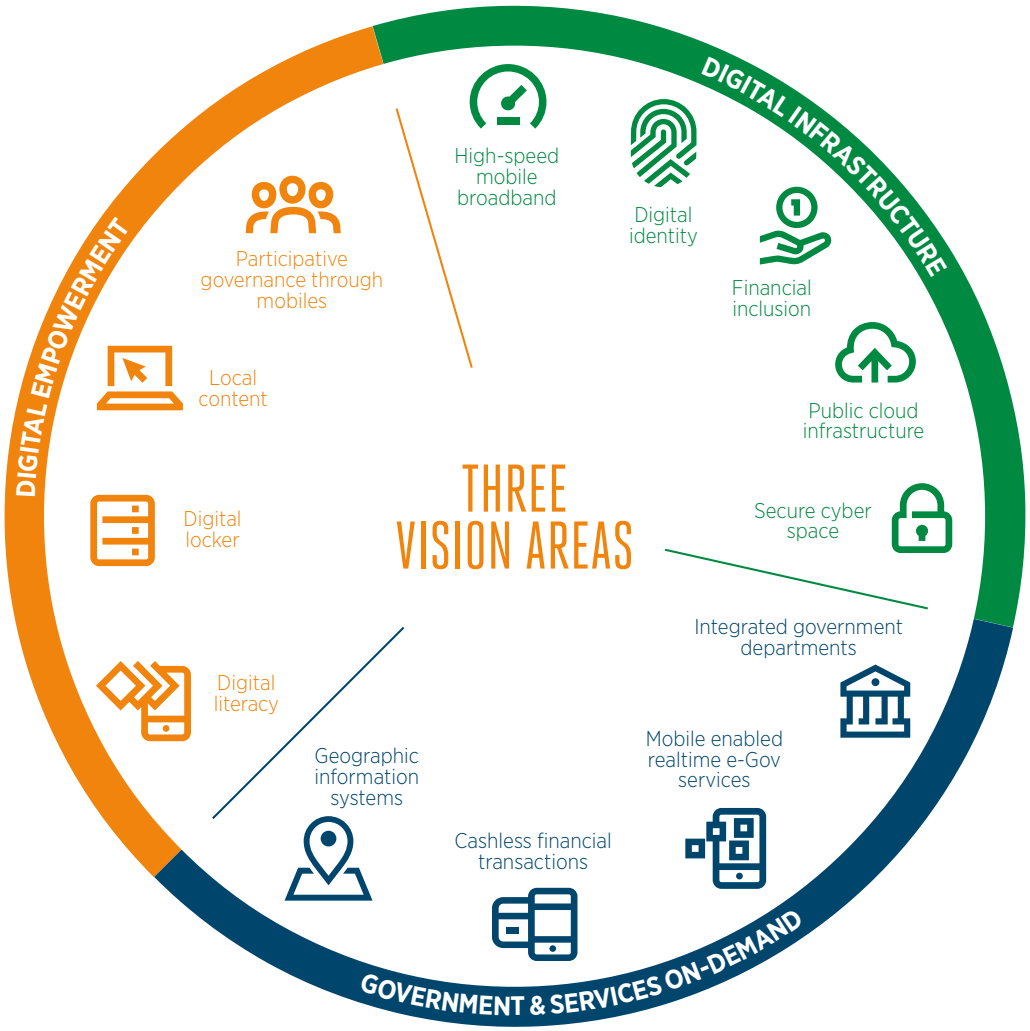
2.1 Digital India: a government initiative to build a digital economy

Digital India pulls together many existing schemes that will be restructured and re-focussed for greater impact.

Under the plan, the government has identified three key areas and nine pillars as shown in the chart

Source: GSMA Intelligence, Department of Electronics and Information Technology, India

Building Digital India through mobile



NINE PILLARS				
	Broadband Highways *Broadband for all*	**Public Internet Access Programme** *Ongoing programme*	**Electronics Manufacturing** *Existing structures inadequate*	**e-Governance** *Critical for transformation*
IT for jobs *Ongoing and new schemes*	**eKranti** *Ongoing programme to be revamped with new elements*	**Universal Access to Mobile connectivity** *Ongoing programme*	**Information for all** *Utilise existing infrastructure*	**Early harvest programmes** *To be completed within a year*

This programme was envisaged by the Department of Electronics and Information Technology (DeitY), which will be responsible for overall coordination of the project. The government is playing an active role in the implementation of Digital India, with the Prime Minister of India heading the monitoring committee, along with an advisory group chaired by the Minister of Communications & IT and an apex committee chaired by the Cabinet Secretary. The government has estimated that the overall cost of implementing the programme could amount to nearly INR100,000 crore for ongoing schemes and around INR13,000 crore for new schemes and activities.

Mobile operators in India have already taken steps to participate in the implementation of Digital India. In July 2015, operators including Airtel, Reliance Group and Aditya Birla Group (Idea Cellular), committed to investing INR450,000 crore in network rollout, and broadband and Wi-Fi deployment to facilitate the delivery of various services under the initiative. Mobile technology and the activities of key ecosystem players, including operators, handset manufacturers and content developers, are all helping realise the Digital India initiative.

However, mobile operators and the broader mobile ecosystem have the capacity to make a much greater contribution and are seeking a greater role in the overall program. In particular, the wider deployment of mobile broadband, and more affordable mobile services, will be key in allowing the country to meet the targets of the program.

2.2 Building Digital India through mobile

2.2.1 Digital inclusion

Mobile technology will play a major role in realising the Digital India vision, with mobile already the dominant platform for internet access in the country. There is a lack of alternative infrastructure, with fixed broadband penetration in India standing at only 2.5%. In contrast, 60–90% of the population (depending on the circle) have access to at least a 2G service. The increasing deployment of higher speed mobile broadband technologies is supporting a variety of feature-rich content and value-added services. By working closely with mobile operators, the government is more likely to realise the goals of the Digital India programme.

The number of individuals accessing the internet over mobile devices has expanded from less than 100 million subscribers in 2010 to nearly 300 million at the end of 2014. The penetration of mobile internet has seen a more than threefold increase over this period, reaching 24% of the population by mid-2015. This figure will almost double again in the next five years to reach 44% of the population by 2020, with around 600 million mobile internet subscribers by this date.

However, despite the impressive progress, this will still leave a huge digital divide in the country. By the end of the decade, more than half of the population will still lack internet access, with most of the excluded population living in rural areas. There is also an important gender gap to be addressed; women in India are 36% less likely to own a mobile phone than men[6], which equates to 114 million Indian women.

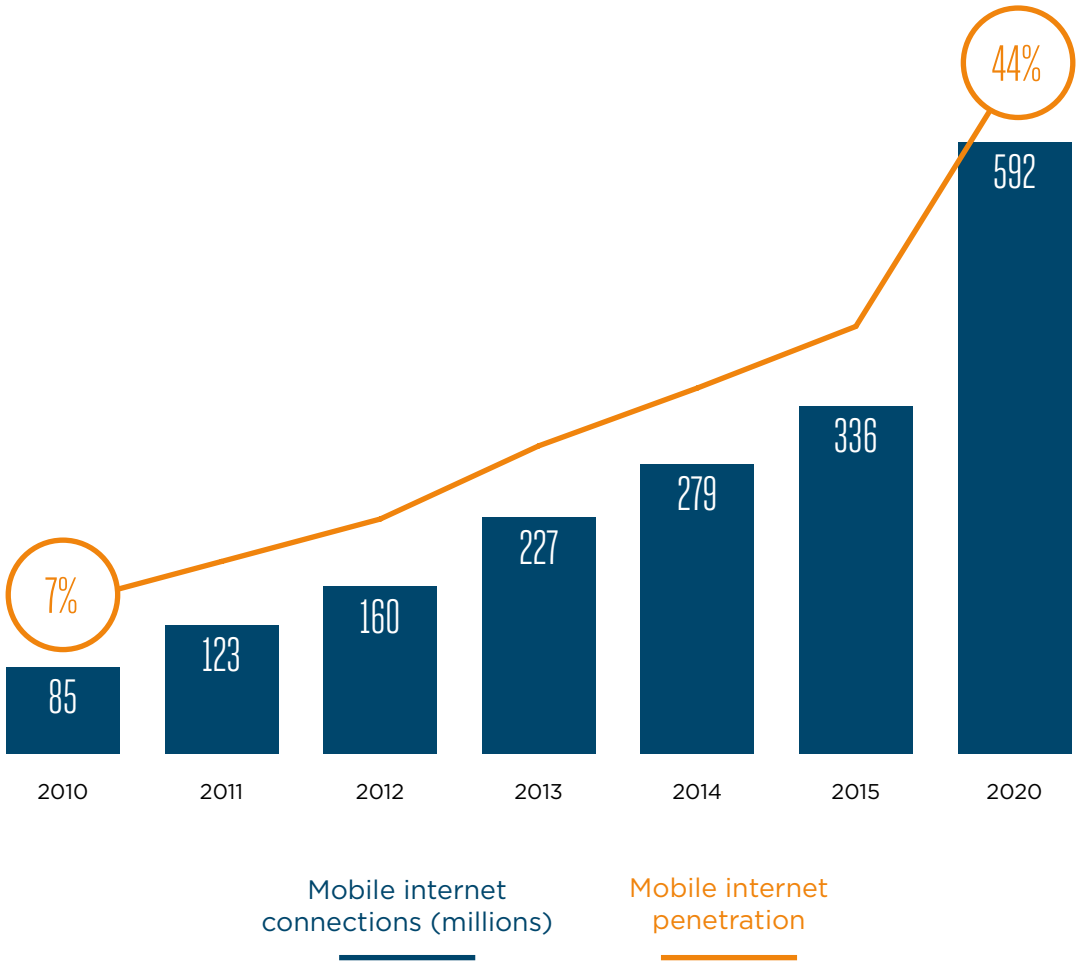
6. Bridging the gender gap: Barriers to mobile access and usage in low- and middle-income countries, GSMA, 2015

The GSMA launched its Digital Inclusion programme in April 2014 to help expand mobile connectivity and to increase mobile internet adoption by addressing the key barriers to mobile internet access, both in India and across the world:

- **Network infrastructure and policy:** increasing network coverage to currently unserved areas.
- **Affordability and taxation:** the combination of low incomes, cost of devices, charging fees, and data plan payments creates an affordability barrier to accessing the mobile internet. This issue is compounded by government taxes and fees, such as airtime and handset taxes.
- **Digital literacy and local content:** Illiteracy, digital illiteracy and lack of internet awareness are challenges to mobile internet adoption. The availability of content that is both in the local language and locally relevant can play a vital role in the adoption of the mobile internet.

Source: GSMA Intelligence

Mobile internet trends in India



2.2.1.1 Building network infrastructure in underserved areas

Network coverage remains a key barrier to further increasing mobile internet access in India, with much of the still unconnected population living in rural or remote areas. Nearly 70% of the Indian population lives in villages, but overall urban teledensity (mobile and fixed line) is still significantly higher than in rural areas. According to the Ministry of Communication and Information Technology, nearly 10% of Indian villages had no mobile coverage from any of India's mobile operators as of March 2015. The majority of these are in the states of Odisha, Arunachal Pradesh, Jharkhand and Madhya Pradesh.[7] Rural coverage is lower for mobile broadband networks, therefore excluding a significant proportion of the population from the benefits of mobile internet that can transform their lives.

A combination of a difficult terrain, characterised by mountains and sparsely populated farmlands, high energy costs and low income levels often makes it uneconomical for mobile operators to expand coverage to rural communities using conventional network deployment strategies. A recent report by the GSMA analysed three broad strategies to address the coverage gap, namely network sharing, government support and alternative technologies (such as drones, balloons or satellites)[8]. The first two are particularly relevant to the Indian market.

One strategy that has proved successful in India is voluntary network sharing (passive and active). India was one of the first countries in Asia to adopt network sharing, with the Department of Telecommunications modifying operators' licence conditions in 2007 to allow passive sharing, and again in 2008 to allow active sharing. The Tower and Infrastructure Providers Association (TIPA), a body representing telecoms tower companies (towercos), estimates that India needs a minimum of 200,000 additional towers to ensure robust connectivity for voice calls and data services, which at an average cost of INR5 lakh per tower will require investment of about INR10,000 crore to bridge the coverage gap.

A number of towercos such as Bharti Infratel, Indus Towers, Viom Networks and Reliance Infratel have since emerged as key players in the infrastructure market, controlling 70% of the overall tower count of around 400,000. Tower sharing has stimulated investment and competition in India's tower market, with a four-fold increase in the number of towers between 2007 and 2014. For the operators, this has resulted in significant capex and opex savings, as well as considerable improvements in quality of service as passive and active network sharing have helped boost capacity in areas of high demand.

Aside from tower sharing, mobile operators are employing a variety of solutions to tackle the challenge of off-grid connectivity, including the use of green options such as solar, wind, water, biomass and fuel cells to power cell sites in remote communities. Such alternative energy sources can significantly reduce energy costs, which are the biggest cost component in off-grid cell sites that rely on diesel generators. For example, Idea Cellular has been pioneering the use of renewable energy, particularly solar, to power off-grid cell sites and so reduce both costs and carbon emissions.

7. 10% of Indian villages have no mobile coverage, TeleGeography, 2015
8. Closing the network 'coverage gaps' in Asia, GSMA Intelligence, 2015

2.2.1.2 Making mobile internet affordable

While network coverage is key to making services available, take-up of these services is affected by their cost. A report by telecoms regulator TRAI shows that rural consumers spend considerably less than their urban counterparts on mobile services, mainly due to affordability issues[9].

The cost of ownership of a mobile phone (which covers all the costs associated with both owning a phone and accessing mobile services[10]) is a key factor in mobile internet adoption, particularly in India where nearly one-third of the population (360 million people) lives below the poverty line. Data tariffs in India, at 0.5–0.7 cents per MB, are among the lowest in the world, but a significant proportion of the population is unable to afford this for regular internet use due to low disposable incomes.

Aside from data tariffs, the declining cost of smartphones bodes well for smartphone adoption in India. Around 20% of mobile connections in the country are now smartphone-based, and this is expected to rise to more than 50% by 2020. The growing number of local handset manufacturers, as well as the presence of international players focused on the lower-end price segments, should further improve handset affordability.

Taxation can act as a barrier to improving the affordability of services, as taxes on mobile services for consumers increase their price, while sector-specific levies on operators (including the high cost of spectrum in India) reduce the funds available for investment.

9. Telecoms Sector in India: A Decadal Profile, TRAI, 2012
10. These cost components include handset costs, connection costs and average costs for calls, SMS and data usage, including the taxes levied on them

2.2.1.3 Increasing digital literacy and local content

Consumer literacy (basic, digital, internet and mobile internet)[11] is essential to understanding a mobile phone's user interface, reading its display and using its keyboard. Nationally, almost a quarter of Indian adults do not know how to read and write. Eleven states in the country, accounting for more than half of India's population, have literacy levels that are below the national average. The Internet and Mobile Association of India (IAMAI) estimates that almost 90% of the country's population is digitally illiterate. A recent report from GSMA Connected Women reported that Indian women also have lower levels of digital literacy and confidence than men. For example, 38% of female respondents were worried about making mistakes and losing money on their phone while using a new function and 34% of females did not know how to use a mobile or use the more complex features.

There are 22 officially recognised languages in India and, according to a report by IAMAI, 45 million users access content in their local language, equivalent to more than a third of active internet users. Mobile operators and ecosystem players have begun to address this challenge. For example, Google has created the Indian Language Internet Alliance, in partnership with news and media companies in the country, to attract Hindi-speaking users to the Web. Meanwhile, Micromax is working with local app developers to increase the number of local language apps.

> "The Internet is not of use to me. I would rather spend my money on a gas cylinder – it's more useful. It's a hobby for people with big money who want to buy shoes and shirts, and chat"
>
> **A non-user, rural India**
>
> *Source: Mobile internet usage challenges in Asia — awareness, literacy and local content, GSMA 2015*

The digital divide in India is compounded by a lack of awareness about the benefits of the internet. A recent report by GSMA Intelligence and the GSMA Digital Inclusion programme showed that many non-users lack awareness of internet uses and available content. Consequently, they do not feel the internet is relevant or useful to them, and associate the utility of the internet with just entertainment, passing time and posturing.[12] Creating awareness around the benefits of the internet and the availability of useful services covering a wide range of subjects, such as agriculture, education and healthcare, is crucial to bringing more people online.

Operators are playing an active role in addressing these challenges. For example, Uninor (now Telenor India) launched the 'Internet on Wheels' initiative to educate people about the benefits of the internet and increase adoption of mobile internet in rural areas in India. A branded van will be travelling across rural areas of Uttar Pradesh, Bihar & Jharkhand, Andhra Pradesh, Maharashtra and Gujarat to teach customers about the mobile internet, how to access it on feature phones, how to navigate on a smartphone and how data packages work.

Telenor India has also opened more than 200 customer education hubs (Grahak Shiksha Kendras) to train customers on mobile services. These centres will act as knowledge and awareness centres where existing and potential customers can get information on Telenor India's voice and internet services. In these hubs, any query related to mobile phones can be resolved. Telenor India developed an in-house curriculum to train the customer relationship executives, 50% of whom are women, at the hubs. Telenor India plans to increase the number of hubs to 500 by the end of 2015.

Idea has been running various campaigns at a national level to educate people on the potential of the mobile internet and to make it more relevant to individuals' lives. This has been supplemented by campaigns at a regional and local level, with the company providing mobile-based training on using the internet.

11. Digital Inclusion, GSMA, 2014
12. Mobile internet usage challenges in Asia — awareness, literacy and local content, GSMA Intelligence, 2015

In the southern state of Karnataka, Idea organised a programme called 'Idea Internet Santhe', conducting events across 10 small towns and making available activated data-bundled SIM cards for users. In another region the company launched 'Idea Buddy', a form of talent contest aimed at college students to find the individuals with the highest levels of internet knowledge. A key element of the programme was workshop sessions that explained the various aspects of the internet. The company also targeted colleges that had a large population of students from lower income groups, as well as female-only colleges, to address the lower uptake of mobile internet and data services in these groups.

The government in India is also playing an active role. The National Digital Literacy Mission aims to provide ICT training to 1 million people initially – one in every eligible household in selected 'blocks' in each state of the country. Around 90% of these will be entitled to government support for training fees, with the rest supported by industry players and NGOs.

2.2.2 Mobile delivering financial inclusion

Financial inclusion is still a significant challenge in India. According to World Bank Findex data (2014), nearly half of the adult population in India do not have a bank account and over 90% of the villages do not have a commercial bank branch. The absence of formal banking services is a key reason behind the reliance on an informal cash-based economy, which is typically unsafe, inconvenient and expensive. Mobile technology is being used in more than 89 countries across the globe to deliver secure, convenient and affordable financial services to the unbanked. In India, mobile technology is crucial to two key areas of the Digital India initiative:

- providing infrastructure as a utility to citizens to support mobile money and mobile-enabled bank accounts
- making governance and services available on-demand by making financial transactions electronic and cashless.

Only 2.4% of adults in India currently have a mobile money account, compared to nearly 6% in Pakistan and an average of 2.6% in South Asia. In the past, regulatory barriers have prevented the mobile money industry in India from realising its full potential. However, Indian mobile operators are well equipped to help address the challenges around financial inclusion, building on their existing relationships with customers, their experience of managing distribution across more than 2 million point-of-sale outlets in India, and their control over the SIM card and data channels.

Recent regulations issued by the Reserve Bank of India (RBI)[13] for differentiated bank licences aim to 'further financial inclusion by providing (i) small savings accounts and (ii) payments/remittance services to the migrant labour workforce, low income households, small businesses, other unorganised sector entities and other users, by enabling high-volume, low-value transactions in deposits and payments/remittance services in a secured technology-driven environment.' In August 2015, the RBI granted 'in-principle approval' to 11 applicants to set up payment banks, out of which five have mobile operators at their core: Aditya Birla Nuvo (Idea), Airtel M Commerce Services, Reliance Industries (Reliance Jio), Dilip Shanghvi (Telenor India) and Vodafone mPesa. The approval is valid for a period of 18 months, during which time the applicants will have to comply with requirements and guidelines to obtain the full licence and begin banking business.

Furthermore, the government has now prioritised financial inclusion in the country through 'Pradhan Mantri Jan Dhan Yojana' (literally translated as the 'Prime Minister's Public Wealth Scheme'), which was launched in August 2014 and saw more than 160 million savings accounts opened within a year. It is important to note here that financial inclusion does not stop at merely opening accounts. It is also necessary to ensure that the underserved population are able to transact in a safe and convenient manner under the scheme.

13. Guidelines for Licensing of Payments Banks, Reserve Bank of India

2.2.3 Digital identity

The Indian government is keen to increase the level of interaction with its citizens through the efficient delivery of public services, the timely dissemination of relevant information, and citizens' participation in government through feedback on various public and private services. The first step in this process is for the government to provide India's 1.2 billion population with an official identity to have accurate data throughout the lifetime of every individual, from birth registration and healthcare services during childhood, through education, employment and tax services during school and working age, and pensions and social benefits in retirement.

To achieve this, the Indian government launched the Aadhaar project, the world's largest national identification project, in 2010 to authenticate the identity of citizens through a unique identification number. This is stored in a centralised database and linked to both demographic and biometric information. Nearly 800 million identification numbers, equivalent to 70% of the population, had been issued as of June 2015. Furthermore, more than 100 million bank accounts have been linked to Aadhaar ID numbers, enabling the government to electronically transfer social aid to beneficiaries' bank accounts, cutting down wastage in social security schemes. The acceptance of Aadhaar as a valid form of ID by state agencies will form the foundation for the government's plans to enable mobile banking and other digital services by linking citizens' mobile numbers to their Aadhaar numbers.

> 'Aadhaar number, mobile number and bank account number are the three important pillars of the Digital India programme. We will link all of them together to provide a flawless solution, where people can easily perform transactions using their mobile phones.'
>
> **RS Sharma, Former Secretary, Department of Electronics & Information Technology, India**

Mobile operators can play an important role in supporting the government's digital identity efforts through solutions that leverage the high level of trust they enjoy among customers. One such solution is the GSMA-backed authentication solution, Mobile Connect. The solution enables mobile phone users to conveniently create and manage a universal identity that will securely and safely allow them to access mobile and digital services such as e-commerce, banking, health and entertainment, as well as e-government portals, via their mobile phones.

> 'I dream of a Digital India where ICT-enabled citizen-government interface is incorruptible.'
>
> **Prime Minister Narendra Modi**

Through the deployment of Mobile Connect in India, mobile operators wish to further enhance and enable the active use and security of the country's digital ecosystem in a way that respects individuals' personal data. In doing so, operators plan to establish a new position in the digital ecosystem that creates a new authentication and personal data business based on providing value and building trust with the consumer.

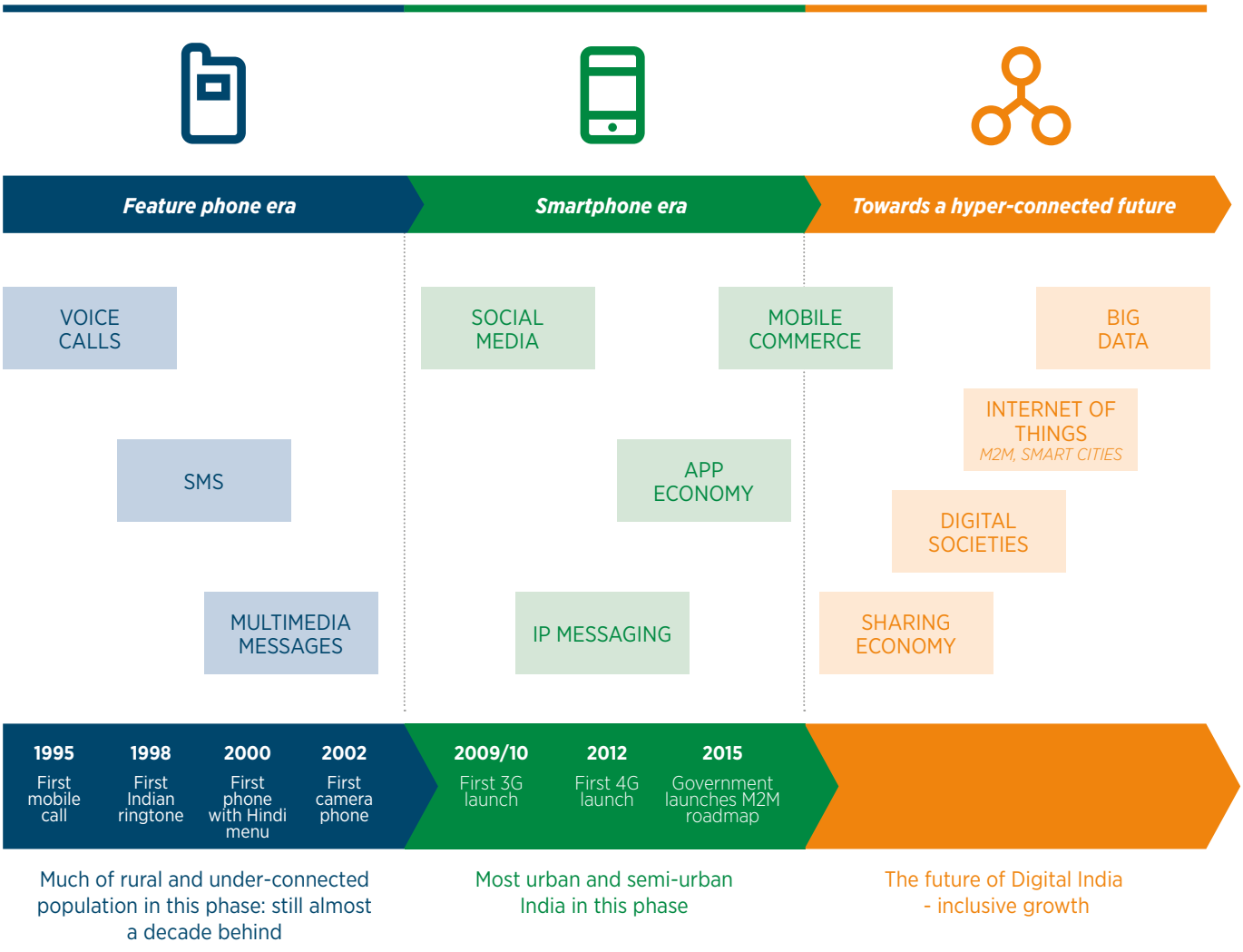
2.3 Innovation: mobile is changing the landscape of India's digital industry

Increasing mobile broadband network coverage and growing smartphone adoption are driving the uptake and use of new applications and services on mobile phones. Social media and online communications applications are examples of services that have grown rapidly in recent years. A growing proportion of the Indian population now access social media sites on mobile phones, with platforms such as Facebook, Twitter and Whatsapp proving popular. Social media sites were widely used for political campaigning in the last general election.

India is now at an inflexion point in terms of the digital transformation of the economy, with local tech start-ups growing throughout the country.

Source: GSMA Intelligence

Evolution of mobile industry in India



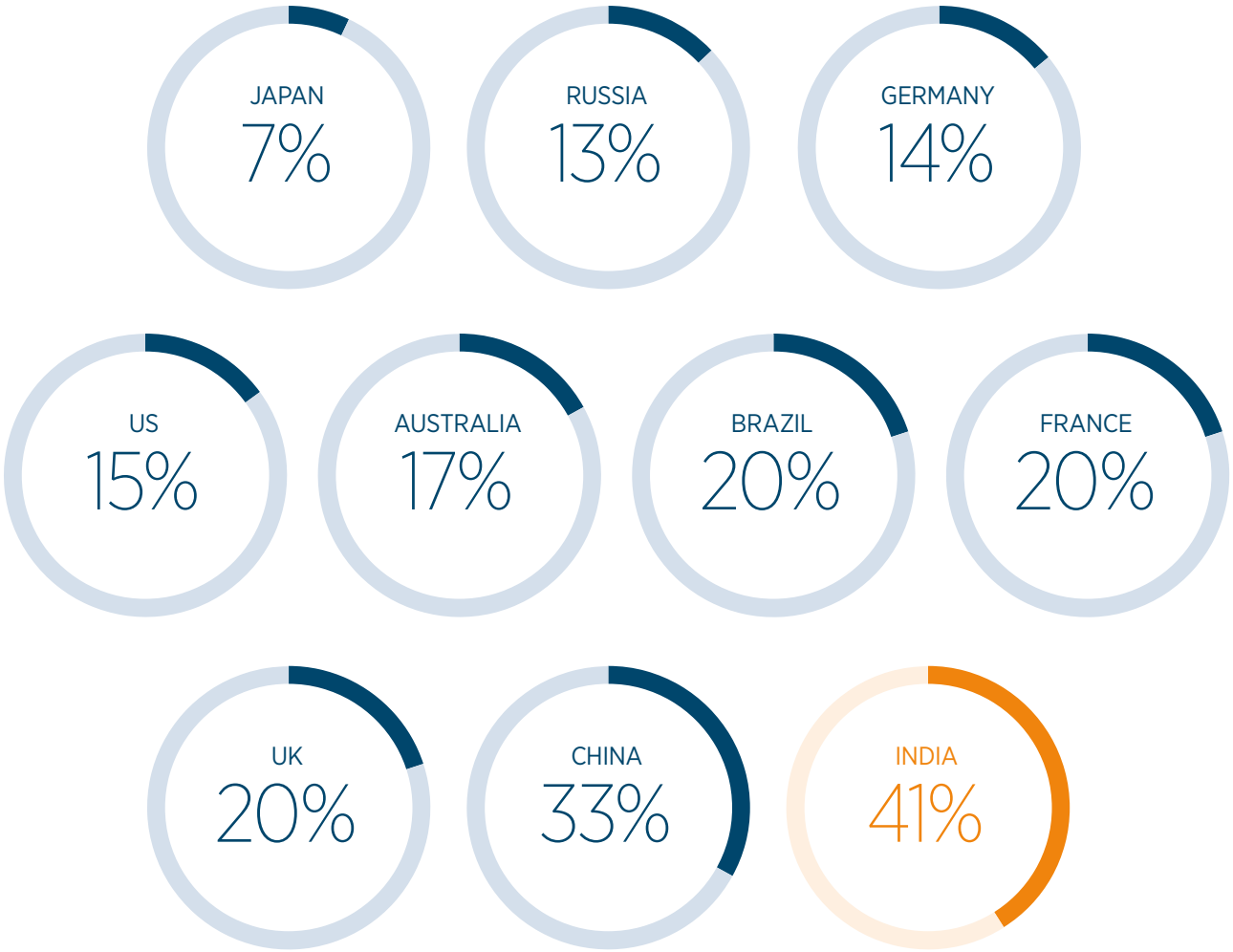
2.3.1 Mobile commerce

The online commerce market in India has seen significant growth in recent years, growing at a CAGR of 34% over the period 2009–2014 to reach a total value of $16 billion in 2014. This is expected to reach $22 billion by the end of 2015[14]. Growth has been fuelled by rising disposable income levels as well as increasing internet access.

Mobile commerce has changed the face of the Indian online commerce industry in the last two years. Mobile accounted for more than 40% of total e-commerce sales in 2014, led by travel and retail services, compared to less than 20% in the UK and the US[15]. Developing a mobile (sometimes mobile-only) strategy has been top of the agenda for many of the leading e-commerce players in the country over the last two to three years.

Source: Various websites, Business Standard, Economic Times

41% of India's e-commerce sales in 2014 over mobile



14. Internet and Mobile Association of India (IAMAI), CRISIL, Gartner, PwC analysis and industry experts
15. Kleiner Perkins Caufield and Byers (KPCB)

2.3.2 Internet of Things

The Internet of Things (IoT) describes the coordination of multiple machines, devices and applications connected to the internet by multiple networks. Mobile is expected to be a key enabling technology for IoT, acting as an aggregator or hub to connect a range of devices and offering wide-area connectivity. Forecasts from Machina suggest that the total number of connected IoT devices in India, using a range of different technologies, could reach more than 1 billion by 2020. This is expected to be led by the utilities, automotive, transport & logistics and financial services sectors. There is also likely to be an important role in improving access to government services. According to a study by the Department of Electronics and Information Technology (DeitY), the value of the IoT industry in India could reach $15 billion by 2020, equivalent to 5–6% of the overall global IoT industry.[16]

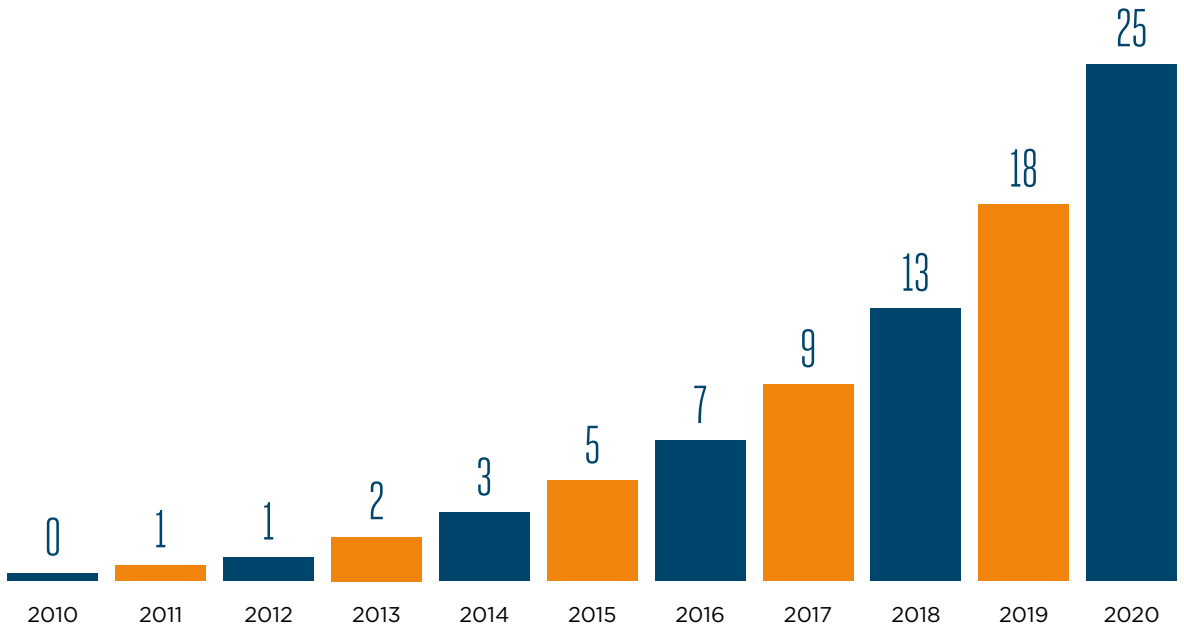
India is the third biggest market in Asia Pacific in terms of machine-to-machine (M2M) connections. The total number of cellular M2M connections in India will increase at a CAGR of 40% for the period 2014–2020.

16. Growth of Internet Users in India and its Impact on our life, data.gov.in

Source: GSMA Intelligence

Cellular M2M connections in India

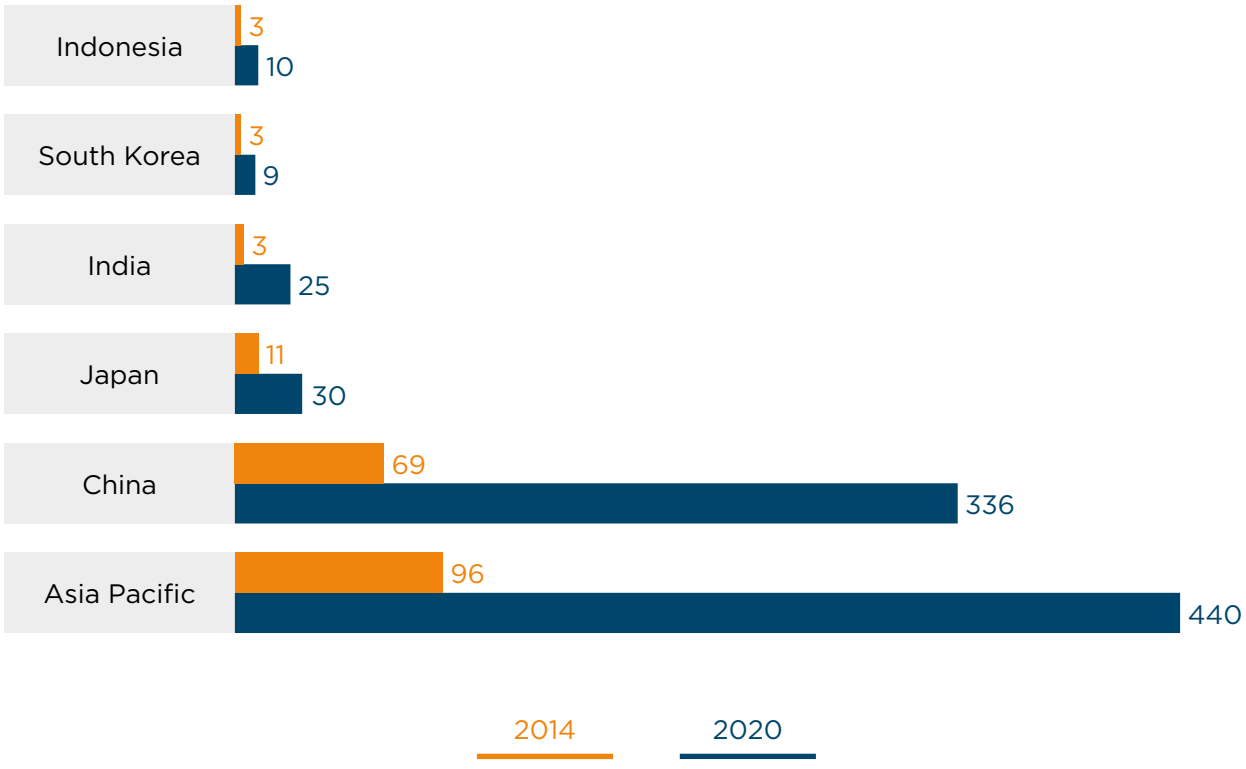
Million



Source: GSMA Intelligence

Cellular M2M connections in selected countries

Million



M2M is central to the Indian government's overall digitisation objectives. The government has released a roadmap for M2M communications that includes initiatives such as releasing a national M2M numbering plan in 2015, forming an M2M service provider registration process, and issuing guidelines for SIM transfer and international roaming. The government will also include M2M devices in the Preferential Market Access policy that gives additional weight to indigenously made products to support the 'Make in India' agenda.

The M2M roadmap feeds into the government's plan to transform around 100 existing cities into smart cities. In April 2015, the Cabinet approved the initiative and a five-year budget of INR48 billion. As part of the project, each selected city will get INR1 billion every year for five years from the central government, while state and local governments will be required to match these resources by at least 50%. Smart cities will be selected based on their ability to improve quality of life and provide a sustainable environment by using technology.

Mobile operators in India have supported the implementation of M2M technology by providing basic connectivity and helping bring innovative M2M solutions to market. The need to improve cost efficiencies and address logistical challenges in the second most populous country in the world will help drive the M2M market to the next phase of development. However, effective policy making and regulations, along with innovative and scalable business models, need to be in place to help achieve these goals and create new revenue streams for stakeholders.

'M2M has great potential to transform India and is going to be a key enabler for the government vision of Digital India, Make in India and proposed smart cities in India.'

Ravi Shankar Prasad, Minister for Communications & Information Technology

"When the government's 100 Smart City project, Digital India plan and Smart Energy project get executed, the kind of expected IoT devices that will be in India for deployment would be in excess of multiple millions in three to five years."

KS Viswanathan, Vice President for Industry Initiatives at Nasscom

2.3.3 Improving access to basic services through innovative mobile applications

Mobile technology can play an important role in improving access to basic services that can empower individuals living in hard-to-reach communities across India. The majority of India's population lives in these areas, but in many areas the lack of basic infrastructure excludes them from several public services that can generally improve their wellbeing.

With a wide range of pressures and demands on government budgets, mobile technology has emerged as a vital tool in providing services to people in currently underserved areas. The range, content and specification of mobile-enabled services have expanded considerably in the last few years.

Agriculture: Reuters Market Light (myRML)

myRML uses mobile technology to help Indian farmers make informed decisions. It provides easy access to personalized and unbiased agriculture insights, and the latest updates on market prices, weather, news, and crop advice based on their location and in their preferred language. The service is available in nine languages: Hindi, Bengali, Gujarati, Kannada, Marathi, Punjabi, Tamil, Telugu and English.

Utilities: NextDrop

NextDrop provides water supply alerts to residents in the twin towns of Hubli-Dharwad in Bangalore, using a simple Android app. With the support of the Bangalore Water Supply and Sewerage Board and GSMA Mobile for Development Utilities funding, this system has been deployed across 40% of Bangalore. NextDrop is already providing more than 75,000 people in Hubli-Dharwad with timely and reliable information about their water supply.

Women safety: FightBack

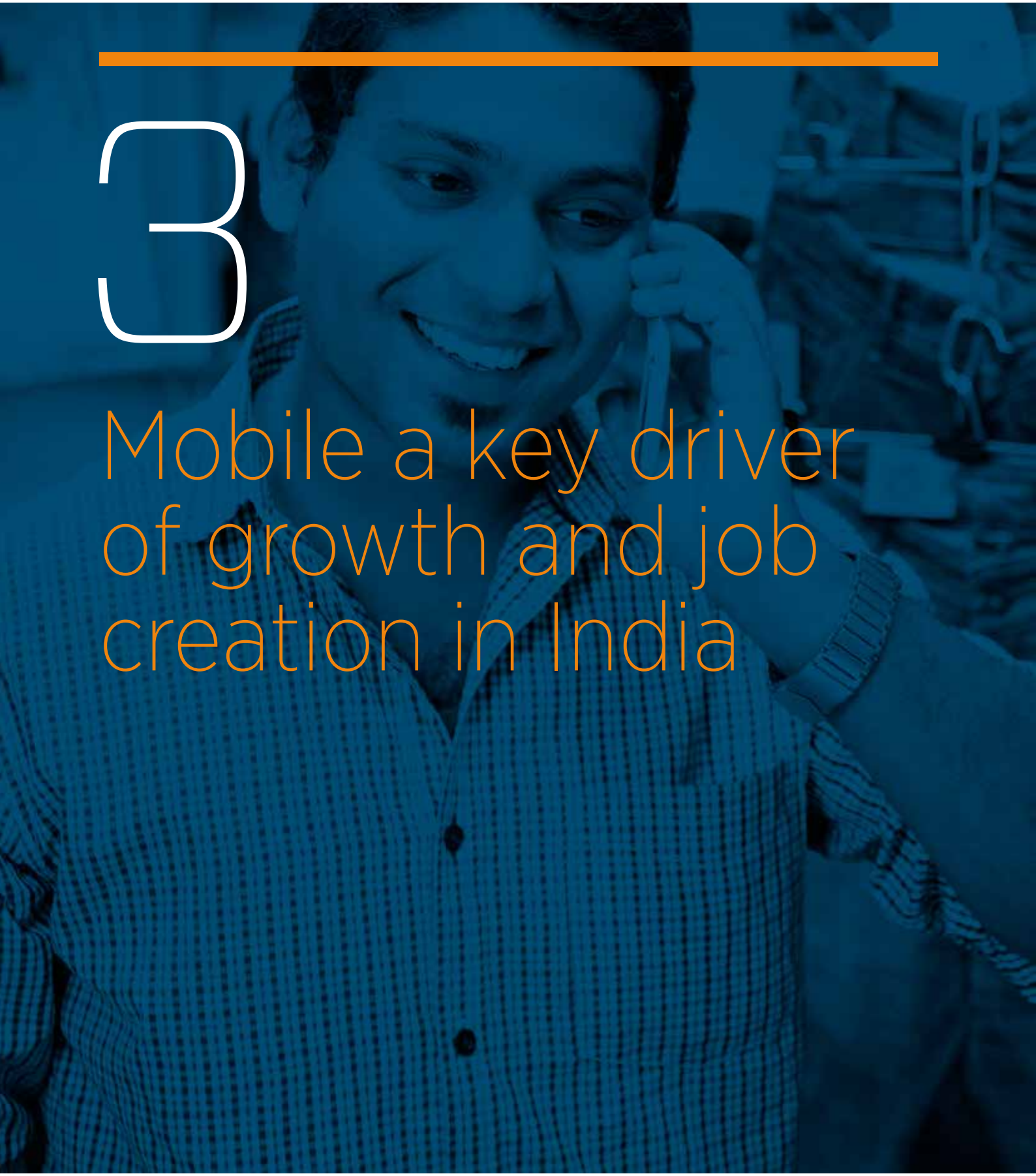
The app FightBack enables users to quickly send an alert in an emergency. By pressing a simple button (and then confirming), SOS SMS and emails, GPS coordinates, and location maps are automatically sent to preselected contacts. The app has had more than 100,000 downloads and is now available in 22 Indian states, providing a sense of security for women and other vulnerable people.

Encouraging women to use mobile: Project Sampark

Uninor (now Telenor India) launched Project Sampark in August 2014 with a pilot phase covering up to 370,000 people in the Aligarh district. It aims to address the barriers that discourage women from accessing mobile phone services. The project includes marketing and awareness campaigns, and using women promoters to sell mobile services. The Bandhan pack includes two SIM cards. Recharging either SIM adds credit to the other, so that when a male member of the family tops up this can also benefit a female member. Telenor India is now evaluating rollout of the project to other circles with similar challenges.

Entrepreneurship and work: LaborVoices

LaborVoices helps employers identify and solve problems in their supply chains before they become critical by enabling them to instantly poll workers on their safety and working conditions through their mobile phones. The users (workers) can call into LaborVoices SmartLine and answer a series of questions about issues that interest the supplier, such as wages, health, safety, child labour and abuse. Users can call into the system 24x7 free of charge and leave feedback using their mobile phone keypad. This data can be translated into meaningful insights for the employers. LaborVoices is active in several countries in the region, including Bangladesh and China.



3 Mobile a key driver of growth and job creation in India

3.1 The economic contribution of the mobile ecosystem in 2014

The direct economic contribution to GDP of mobile network operators and the mobile ecosystem is calculated as the value added generated by companies operating in the mobile ecosystem in India. In 2014, the total value added generated by the mobile ecosystem was INR250,000 crore (2% of GDP), with the greatest economic contribution among all mobile ecosystem players coming from mobile operators, with a total direct impact of INR126,000 crore, or around 1% of GDP.

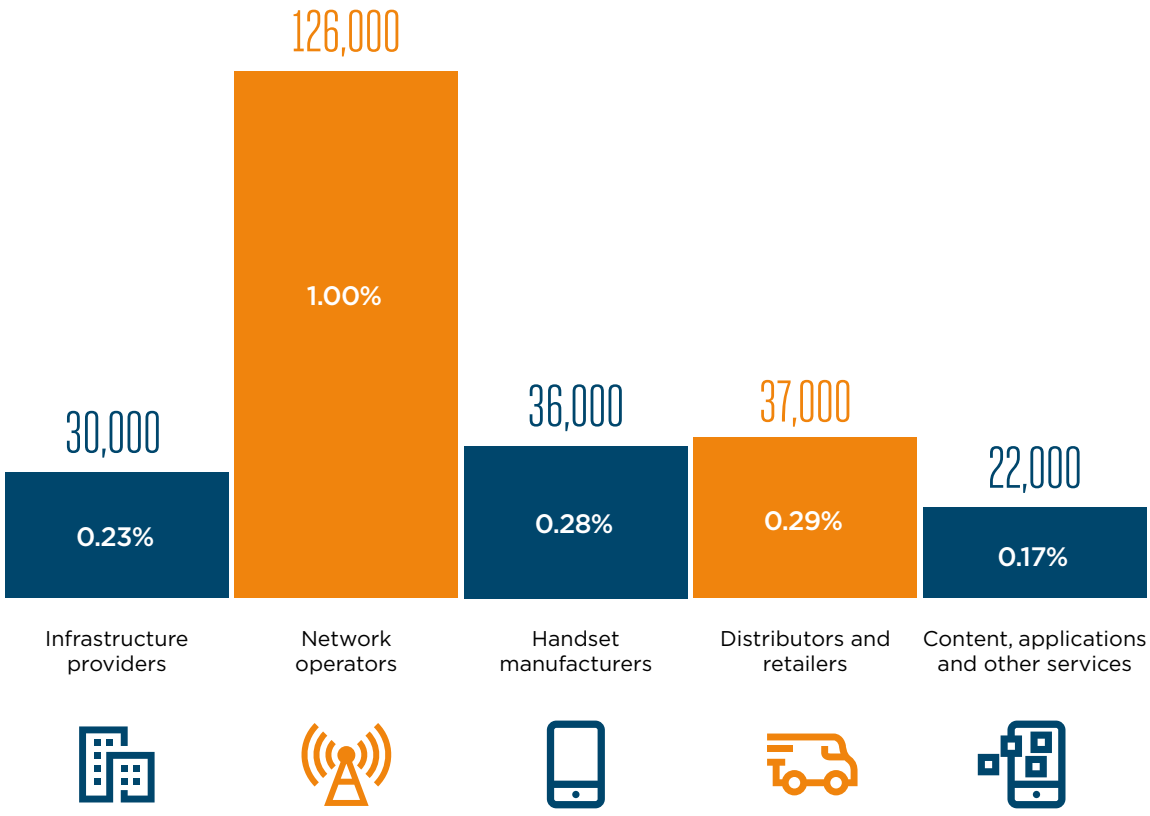
Beyond mobile network operators, India has a solid and vibrant mobile ecosystem, with all the four ecosystem industries considered in our analysis generating significant economic activity in 2014:

- the fast-growing mobile content and apps services sector generated nearly INR22,000 crore in 2014
- the largely established and consolidated Indian mobile towers and infrastructure sector generated just under INR30,000 crore
- the renascent Indian handset manufacturing sector generated INR36,000 crore
- the still largely informal mobile retail sector generated approximately INR37,000 crore in value added.

Source: GSMA Intelligence

Direct GDP contribution of the mobile ecosystem

INR crore; % 2014 GDP



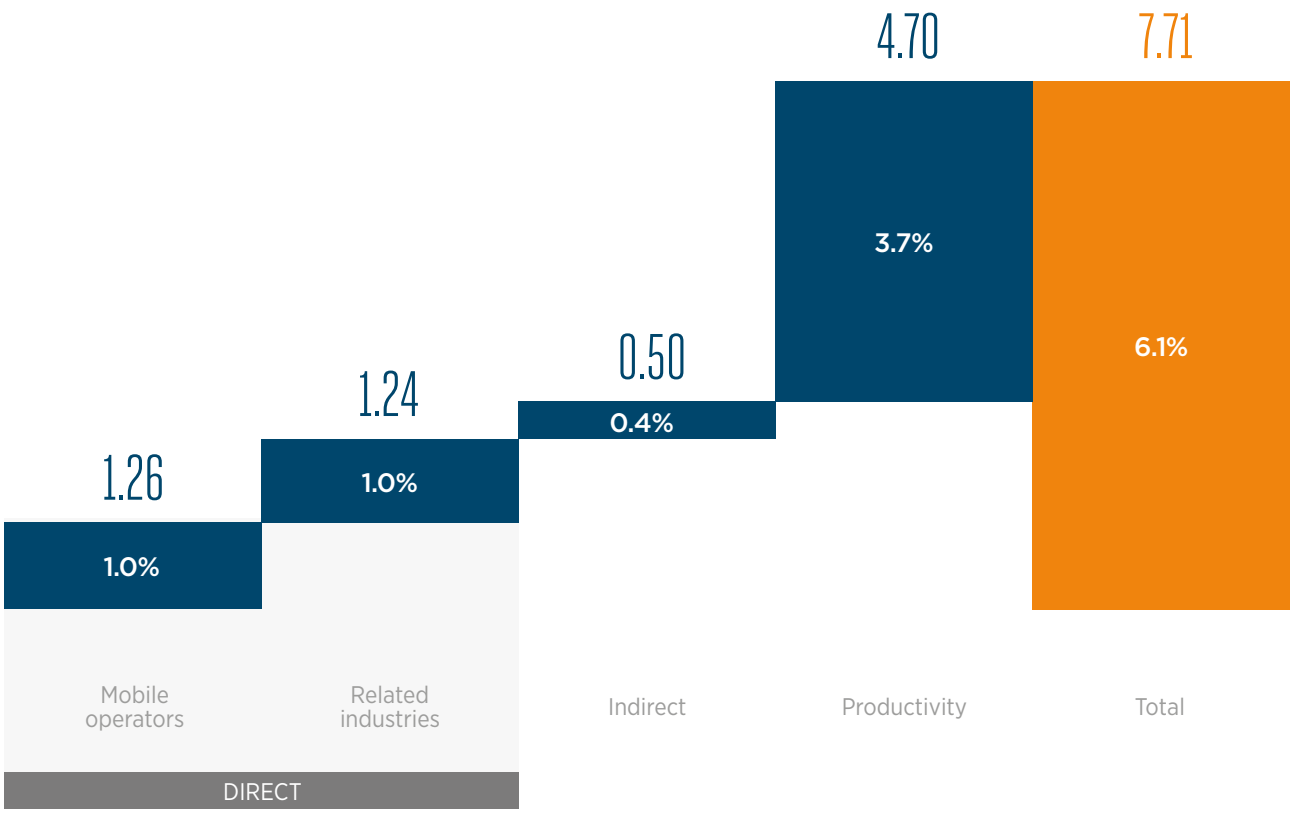
As mobile operators and the ecosystem purchase inputs and services from their providers in the supply chain, a multiplier effect on other Indian businesses is produced, generating sales and economic value added in other sectors and industries. For example, distribution and transport companies draw part of their revenues from supporting the operations of tower companies when upgrading and expanding their mobile internet networks. The same effect can be observed in many other sectors of the economy, including energy, retail and professional services such as finance or insurance. We conservatively estimate that a value added of around INR50,000 crore (0.4% of GDP) was generated through these indirect impacts in India in 2014.

Finally, mobile technology has transformed the way economic activity is carried out in many sectors of the economy, easing ways of doing business and allowing more efficient ways to communicate and access information. The productivity impacts brought about by the widespread adoption and use of mobile technology by individuals, businesses and governments generated approximately INR4.7 lakh crore in 2014, an estimated 3.7% of India's GDP. Overall, considering direct, indirect and productivity impacts, in 2014 the mobile industry supported a total contribution of INR7.7 lakh crore to the Indian economy in value added terms, equivalent to 6.1% of India's total GDP.

Source: GSMA Intelligence

Total (direct, indirect and productivity) contribution to GDP

INR lakh crore; % 2014 GDP



3.2 Employment contribution of the mobile industry

In 2014 mobile operators and the ecosystem provided direct employment to approximately 2.2 million people in India. We estimate that approximately 1.9 million people were employed in the informal sector through the retail and distribution of mobile technology, primarily mobile handsets. Formal employment in the mobile ecosystem reached approximately 300,000 in 2014, with the largest employment numbers in the content, applications and services sector, with approximately 150,000 jobs. A large number of jobs in this sector are on a part-time or self-employed basis[17].

Indian mobile network operators also employ a significant amount of people, estimated at 67,000 in 2014. Handset manufacturers and the formal retail sector (large retailers, small chains and increasingly also general retailers) generated slightly lower numbers of jobs (46,000 and 33,000 jobs respectively), although the figures in both cases could increase in the next few years if emerging trends continue. A number of mobile manufacturers have reported plans to open or strengthen their presence in India, while the formal retail sector is also growing and expanding faster than traditional retailing.

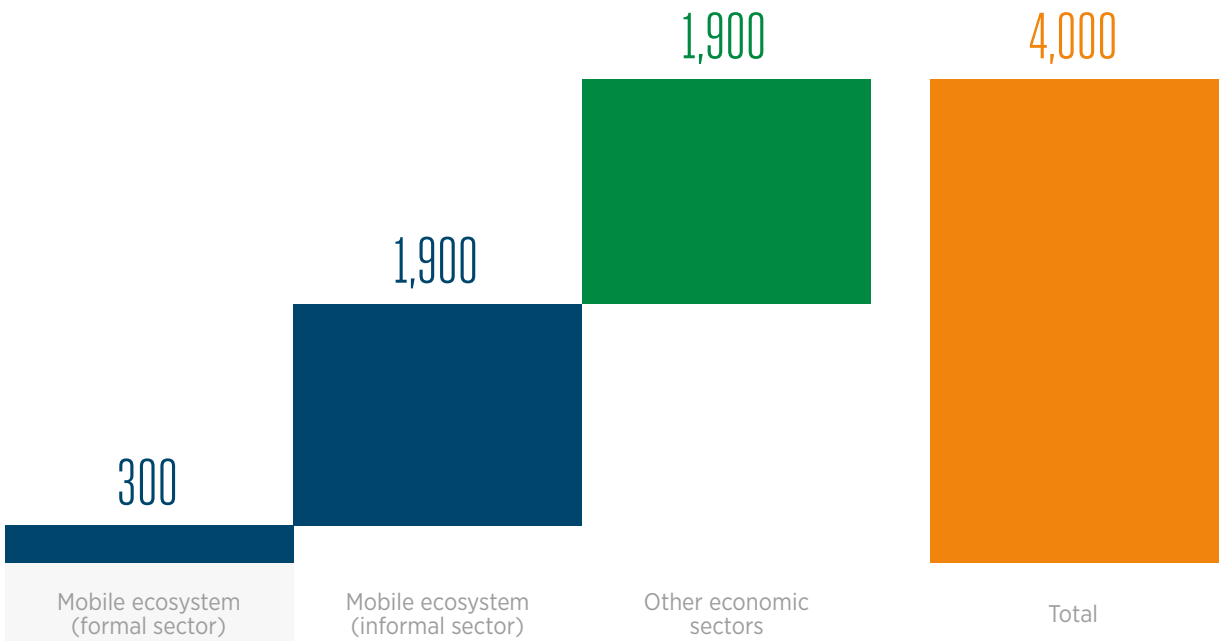
Further to the employment that is sustained within the ecosystem, additional jobs were also indirectly supported in other industries, as the ecosystem generated demand and jobs in other sectors that benefit from the activity of the mobile industry, in particular in the direct supply chain. We estimate that in 2014 around 1.9 million jobs were indirectly supported in this way, bringing the total impact (both direct and indirect) of the mobile industry to around 4 million jobs in 2014.

17. IAMAI, ICRIER (2015) recently estimated that 75,000 app development jobs existed in India in 2014. We have not verified the robustness of that figure. The estimate presented here of 150,000 jobs includes, in addition to application development jobs, other jobs directly supported by the mobile content and services segment such as admin, research, media and advertisement jobs.

Source: GSMA Intelligence

Total employment impact of the mobile industry

(000s of jobs)



151,000	Content, applications and services
67,000	Operators
46,000	Handset manufacturing
33,000	Distribution and retail (formal sector)
12,000	Infrastructure

3.3 Public funding contribution in 2014

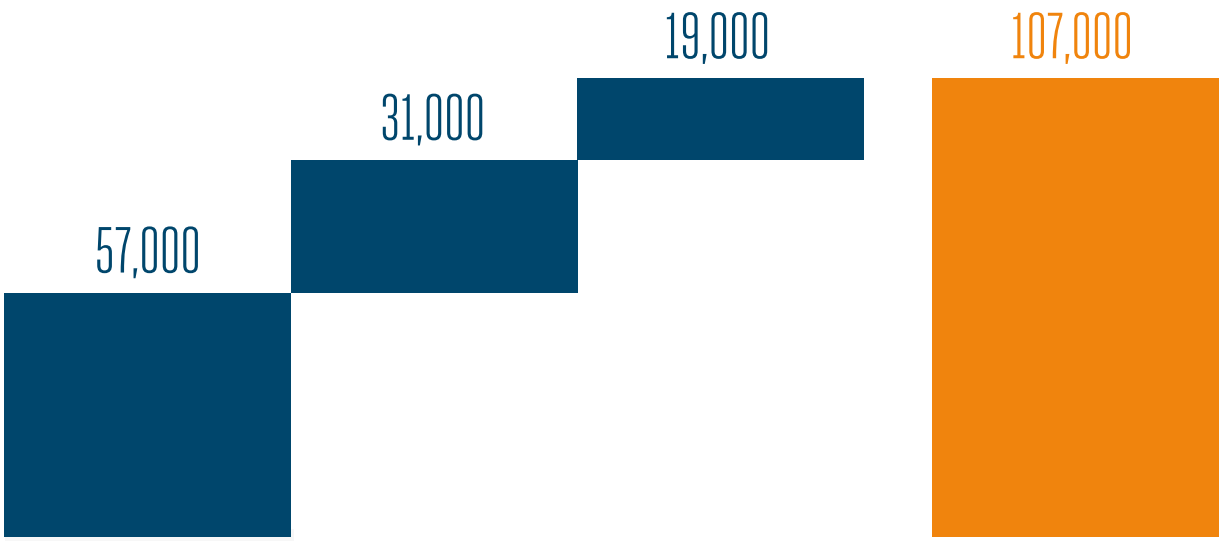
The mobile ecosystem also makes a highly significant contribution to the funding of the Indian public sector, with approximately INR1.1 lakh crore in 2014. This contribution comprised INR57,000 crore in general taxation, INR31,000 crore in mobile-specific taxation[18], and payments of INR19,040 crore for the licencing of spectrum acquired through the 900 MHz and 1800 MHz auctions in 2014[19].

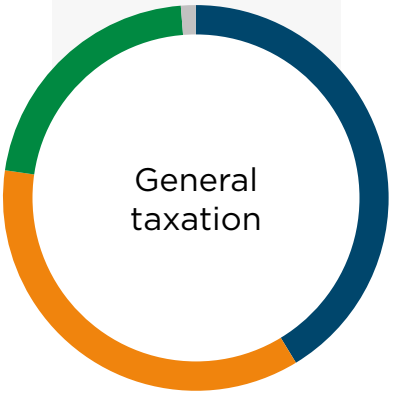
18. Regulatory fees in the form of the universal service obligation, licence fees and spectrum fees.
19. Note that the total amount of spectrum payments required for the licencing of 900 MHz and 1800 MHz spectrum auctioned in 2014 is higher, at over INR61,000 crore in total. The figure attributed to 2014 above is only a fraction of the overall figure and reflects the actual cash payment required from Indian operators in the year, with the remainder of the total cost required in subsequent years.

Source: GSMA Intelligence

Total contribution to the funding of Indian public sector, mobile ecosystem

INR crore, 2014



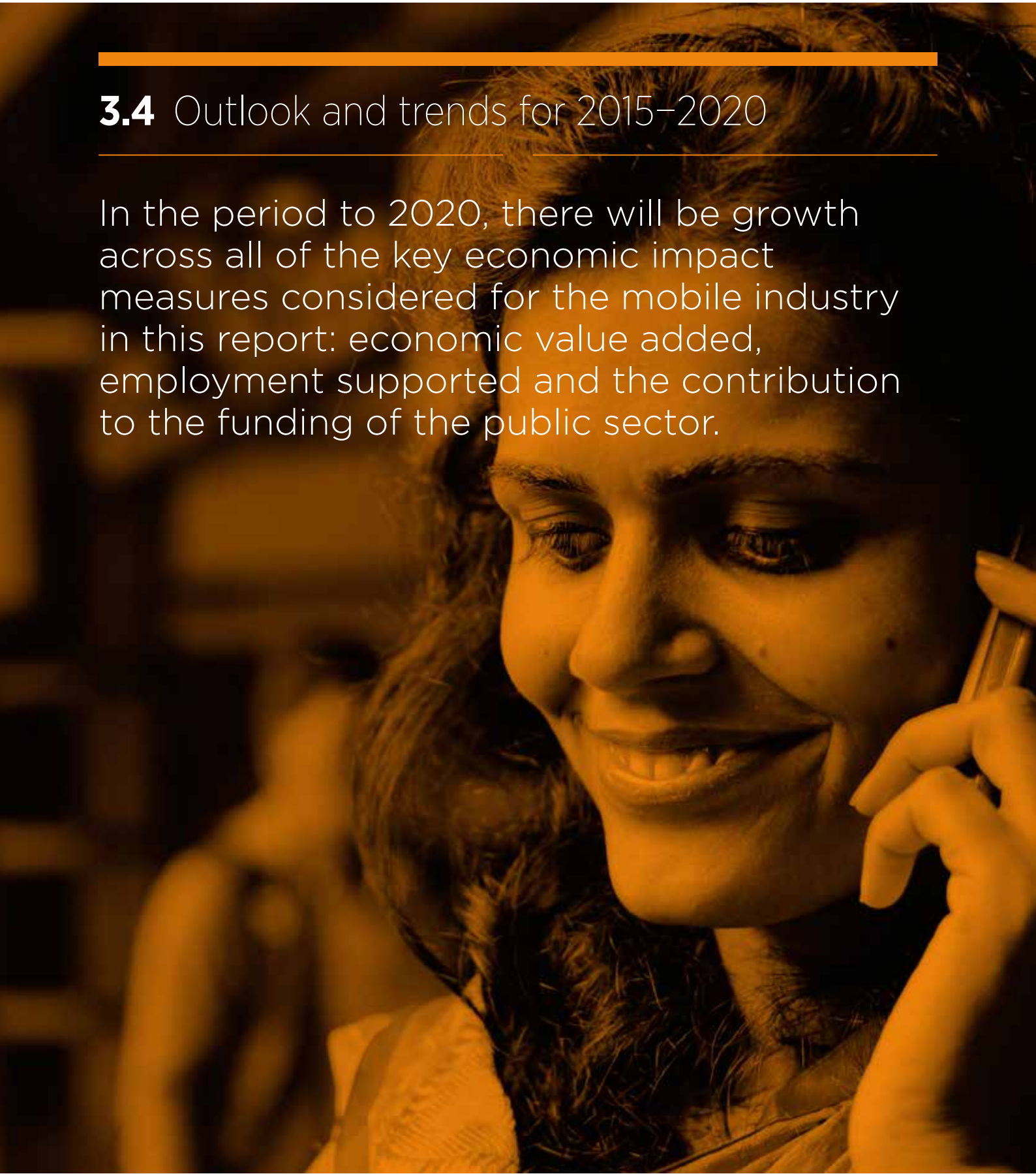


41%	Mobile services VAT
36%	Corporation tax
22%	Handset VAT
1%	Employee income and social security

Note: Spectrum payments reflect actual cash payment required from Indian operators in 2014, with over INR61,000 crore required in total.

The above contribution in 2014 does not include payments expected from mobile operators as a result of the multi-band spectrum auctions in March 2015 involving 800, 900, 1800 and 2100 MHz, which should generate in total for the Indian government more than INR1 lakh crore from mobile operators[20].

20. There is a one-off upfront payment; operators then have the option of paying the balance in 10 annual instalments, after a two-year payment moratorium



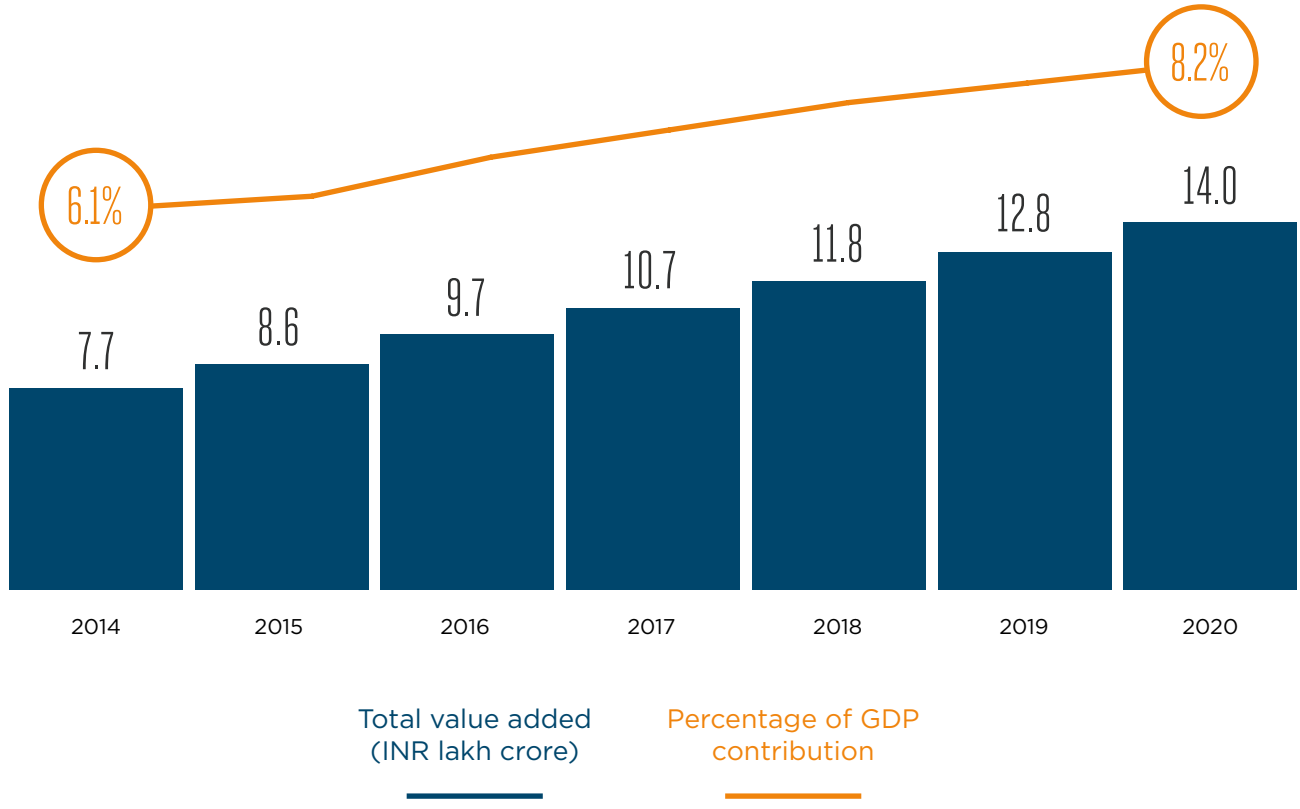
3.4 Outlook and trends for 2015–2020

In the period to 2020, there will be growth across all of the key economic impact measures considered for the mobile industry in this report: economic value added, employment supported and the contribution to the funding of the public sector.

In value added terms, a total economic value of INR14 lakh crore will be generated by 2020 in the form of salaries, profits and tax payments, almost double the figure for 2014. This increased contribution reflects the fact that the mobile ecosystem will experience faster growth than the rest of the economy. As a result, the total contribution of mobile technology as a percentage of GDP is forecast to increase from 6.1% in 2014 to 8.2% in 2020. There could be upside to these forecasts if both the government and regulators adopt some of the enablers outlined in this report, and if the key ambitions of the Digital India programme are realised.
Most of this growth will be driven by the boost to business productivity and economic output resulting from previously unconnected citizens becoming first-time internet users, with virtually all of this additional connectivity provided through mobile networks. Internet connectivity is directly linked to greater productivity and economic growth, and the large increase in the number of internet users will be the key driver of the transformation in the productivity of the Indian economy over this period. There may be upside to these forecasts if a more supportive regulatory environment is put in place and this helps realise the government's Digital India initiative.

Source: GSMA Intelligence

Outlook to 2020



The total number of jobs both directly and indirectly supported by the ecosystem will also grow significantly in the period to 2020. The numbers will increase to just over 3 million and 2 million respectively by 2020. The public funding contribution of the mobile ecosystem will reach more than INR120,000 crore by 2020 in real terms if tax rates and regulatory fee rates remain at current levels, up from just just under INR90,000 crore in 2014. This figure is in all likelihood an underestimate of the future total contribution of the mobile ecosystem to the funding of the Indian public sector, since it does not include the proportional part of payments from the 2014 and 2015 auctions, as well as the proceeds from any future spectrum auctions that may occur between 2015 and 2020.

4

Regulatory enablers for Digital India

India's policy-makers and mobile operators share a common agenda. The government's Digital India programme, which is aiming to transform the country into a digitally empowered society and knowledge economy, is closely aligned with the goals of the country's mobile industry. Creating a Digital India depends on giving both entrepreneurs and employees high-quality connectivity. India's mobile operators are striving to extend broadband to many more people and communities. Faced with challenging economics and terrain, mobile operators need a regulatory environment that attracts investors and encourages innovation.

There are a number of key steps that policy-makers can take to create a forward-looking, flexible and fair regulatory and licensing framework:

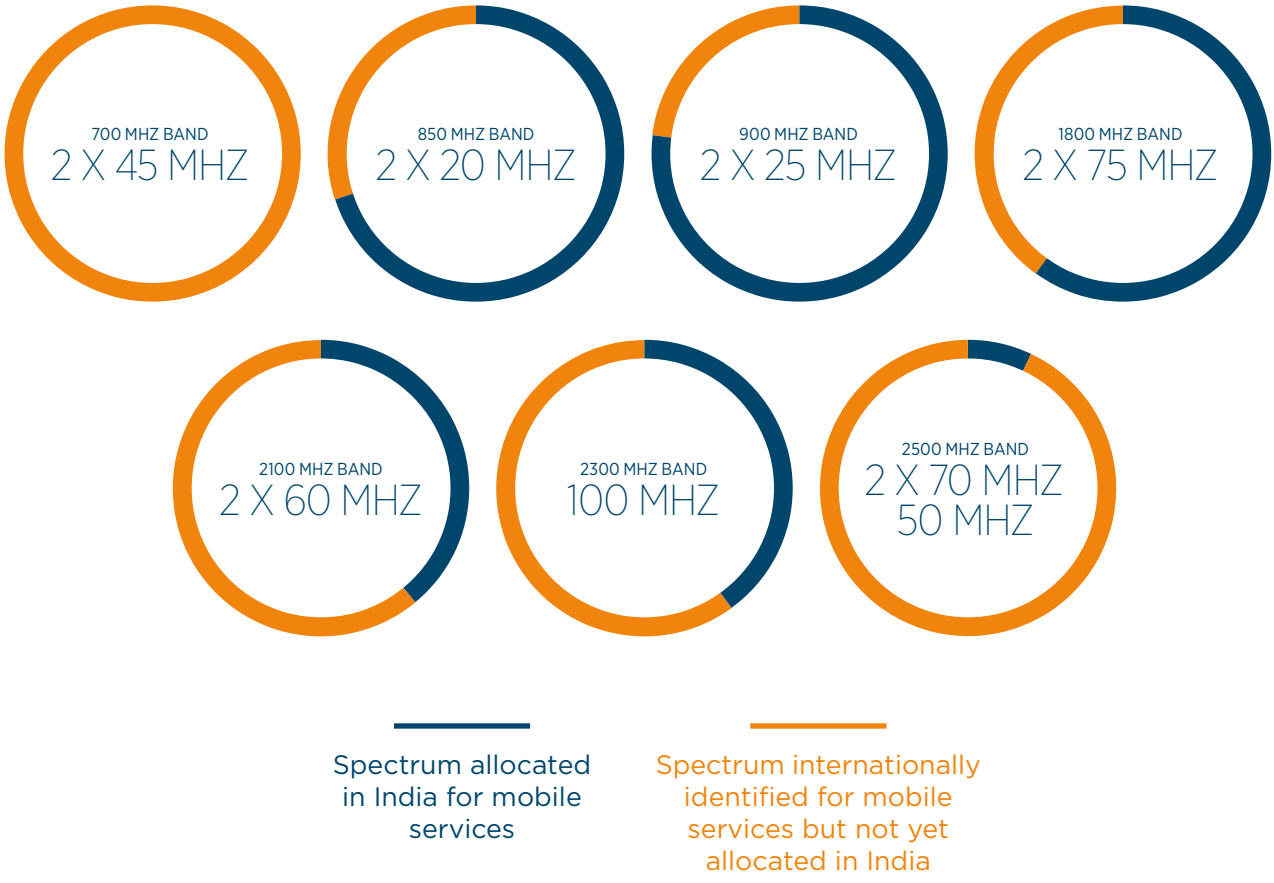
- Make sufficient internationally harmonised spectrum available on reasonable terms.
- Remove barriers to network infrastructure deployments.
- Adjust taxes and licence fees to increase the affordability of mobile broadband services and the ability of operators to invest in their networks.
- Level the playing field between Internet players and telecoms operators.

4.1 The fundamental importance of spectrum

To maximise the economic and social benefits for India's citizens, spectrum needs to be in the hands of those able to use it most productively. To date, India has allocated significantly less spectrum per subscriber than most other countries, either developed or developing, to mobile services. With a modest allocation of spectrum split between 12 licensees, it is difficult for individual mobile operators to meet peak demand for traffic on their networks.

Source: GSMA Intelligence, DoT

Spectrum assignment in India

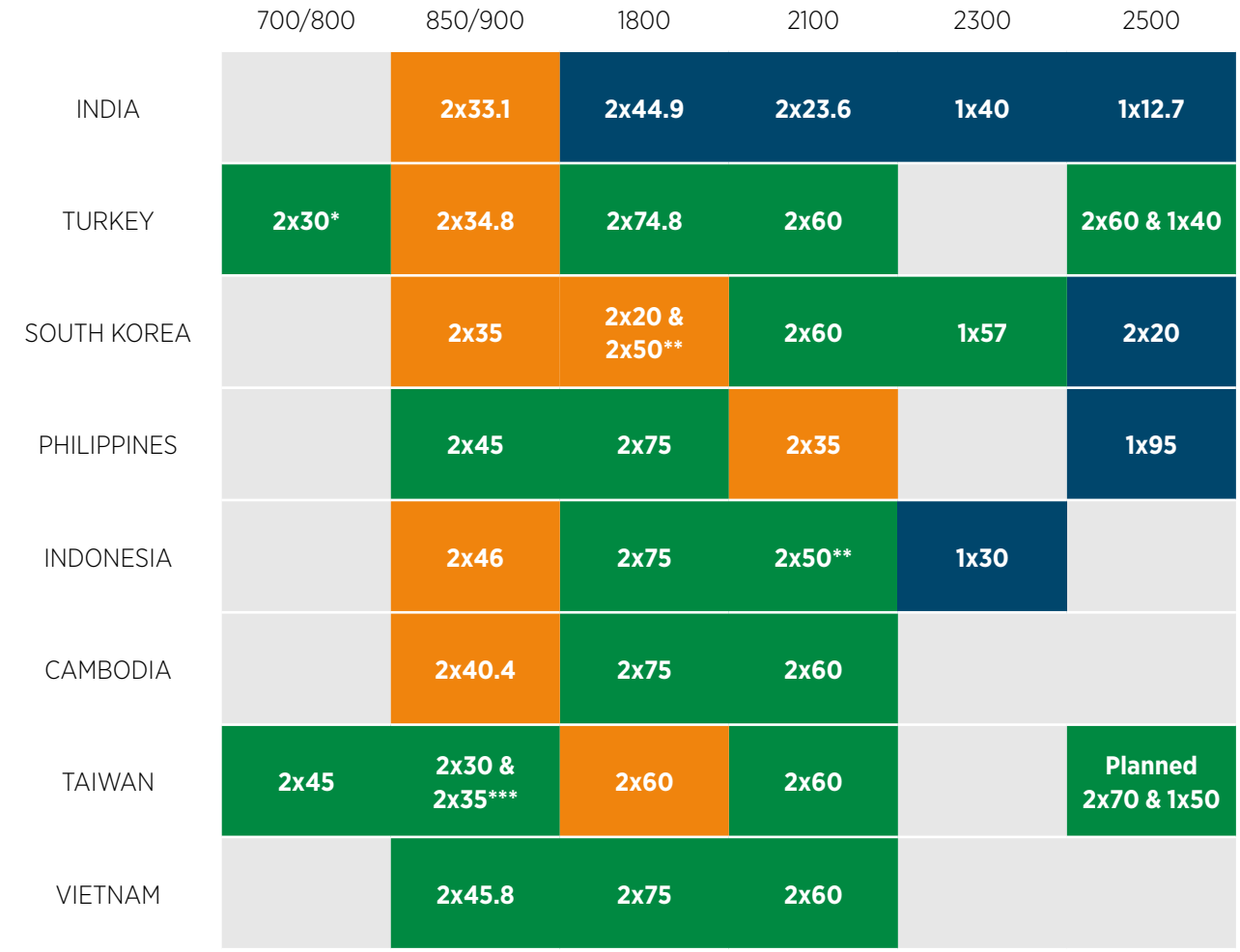


Note : Values based on averages across circles

Source: GSMA Intelligence, DoT

Spectrum licensed to mobile operators in selected Asia Pacific countries

MHz band



*European band plan
** Additional 2x10 MHz will be auctioned
*** Asymmetric assignment for uplink and downlink frequencies

(Note: Allocation for India is average spectrum assigned per service area)

In India, fast increasing use of mobile broadband, applications, content and services means mobile operators are going to need to be able to employ significantly more spectrum than they do today. If sufficient spectrum is not available, mobile networks will become increasingly congested, frustrating consumers and curbing companies' productivity.

4.1.1 Licensing more internationally harmonised spectrum

India's mobile operators still have access to only a fraction of the spectrum that has been identified globally for mobile services. Although the government is set to provide additional spectrum before the end of the current financial year, more spectrum will be needed in the near future.

The amount of spectrum required in each national market varies depending on levels of data demand and national priorities, but the GSMA's research suggests that, on average, a total of 1600–1800 MHz should be identified for mobile services. Given the density of major cities in India, and its technology-savvy population, the GSMA believes the spectrum available for mobile services in India needs to be at the high end of this range. Unlicensed spectrum is not an adequate substitute, as it creates an uneven playing field and can quickly become congested, leading to interference between services.

By 2020 more than half a billion mobile connections in India will be running on mobile broadband networks. Achieving this figure, and ensuring further growth in future, will depend on mobile operators gaining access to additional spectrum, especially in the 2100 MHz band. The government needs to take urgent steps to migrate current users, mainly defence, from the 2100 MHz band to make the remaining spectrum available for mobile communications in line with the internationally harmonised band plan. It is encouraging that the government has indicated its intention to make more spectrum in this band available. India also needs to harmonise the 1800 MHz band, which is highly fragmented.

The next step is to prepare a clear roadmap for the release of the 700 MHz band for mobile services, which is already being deployed in some countries. This low-frequency spectrum, structured in line with the Asia-Pacific Telecommunity (APT) band plan, can enable cost-effective coverage of large geographic areas, so will play an important role in extending mobile broadband coverage. Contrary to most markets, in India this band is not occupied by broadcasting and can therefore be made available for mobile usage. This is an advantage that India should capitalise on to ensure the full frequency (2 x 45 MHz) is licensed to expand mobile coverage across the country. To increase digital inclusion, India's policy-makers should also consider offering subsidies, such as a reduction in licensee fees, to operators that achieve a specific coverage threshold.

A key constraint for operators is that reserve prices in India have historically been set on the high side. As a general rule, new spectrum needs to be licensed via a well-designed auction process with a reasonable reserve price. It is particularly important to make available sufficient spectrum so that the auction realises a true market price, rather than an excessive price driven by scarcity. The more mobile operators pay to license spectrum, the less money they have available to build out networks. As the digital economy becomes increasingly important to India's future prosperity, the government needs to prioritise the rollout of broadband over plugging short-term gaps in the fiscal deficit.

4.1.2 Preparing for the next decade

Looking further out, India will also need to make more internationally harmonised spectrum available to fulfil its Digital India ambitions. Given the time it can take for spectrum to be allocated, cleared and then licensed, the World Radiocommunication Conference 2015 (WRC-15) plays a critical role in determining whether mobile broadband services can continue to drive socio-economic growth over the next decade. As a major player on the global stage, India will be an influential voice at WRC-15, which is charged with identifying additional spectrum for mobile broadband by 2020 and beyond.

The GSMA is proposing that WRC-15 identify four frequency ranges to mobile broadband:

- **Sub-700 MHz UHF (470–694 MHz):** In countries with a large geographic area such as India, the spectrum below 700 MHz will be important for providing extensive and affordable mobile broadband coverage in rural areas beyond 2020. This band is already allocated to mobile services in Asia-Pacific. Licensing these bands for mobile services, thereby preventing interference and wasting valuable frequencies, is the most efficient way to harness this valuable spectrum for the greater good.
- **L-band (1350–1400 MHz and 1427–1518 MHz):** This band is capable of delivering additional capacity and coverage over relatively large areas, including inside buildings. It is the most supported band across all continents, with some European countries already auctioning part of the band in 2015. This band has the potentially to be harmonised globally, generating major economies of scale for the mobile industry and its customers.
- **2.7–2.9 GHz:** This band, which is underutilised, particularly in South Asia, would provide important extra mobile capacity, and its proximity to 2.6 GHz will facilitate the fast deployment of extra capacity to the existing cell sites.
- **C-band (3.4–3.8 GHz and 3.8–4.2 GHz):** The size of this band offers a unique opportunity to identify a significant portion to deliver very fast mobile broadband services in India's dense urban areas.

A WRC-15 decision to allocate these bands for mobile services is essential for subsequent international harmonization that will lower the cost of equipment, enable roaming and reduce international interference. At the same time, national administrations will have the flexibility to release the amount they choose to meet national demand when necessary.

As the mobile ecosystem needs time to develop appropriate devices and network equipment, it is important for the government to publish a spectrum roadmap that provides clarity for the industry and investors. India's device manufacturing industry will also benefit from a clear spectrum roadmap, bolstering the government's 'Make in India' initiative and strengthening the country's manufacturing base.

4.1.3 Liberalising the spectrum market

One of the key factors holding back uptake and usage of mobile broadband in India is spectrum fragmentation. The 1800 MHz band, for example, is highly fragmented. Some operators have 5 MHz blocks of spectrum, which cannot be effectively used for LTE service. The introduction of a well-designed spectrum trading and sharing framework would ensure that the limited spectrum available for mobile services is used to its full potential to the benefit of India's consumers and businesses.

Through spectrum trading and less restrictive spectrum caps, mobile operators could assemble the contiguous blocks of spectrum they need to provide mobile broadband services efficiently and effectively. As India's regulators have noted, spectrum trading would also provide a mechanism through which a telecoms company could exit the sector, while enabling more specific and targeted reallocations of spectrum than can be reached through mergers and acquisitions. Otherwise, some key blocks of spectrum will continue to be underutilised.

The government of India has approved both Spectrum Sharing and Spectrum Trading guidelines which could help intensify the use of the mobile band frequency resources to the benefit of society and consumers. However, the government should avoid imposing counterproductive licensing fees, while rules should be sufficiently flexible to enable mobile operators to efficiently match supply to demand. If India can fully liberalise its spectrum market, there will be major economic benefits, which will ultimately increase and broaden the country's tax base.

4.2 Building the networks India needs

Several obstacles are slowing the deployment of broadband. These obstacles include limited availability of power, the rules governing electromagnetic fields (EMFs) and the patchwork of local regulations relating to rights of way for building infrastructure. For India's consumers, this means gaps in coverage, dropped calls and lower data rates.

Worldwide, many governments have introduced initiatives to make it easier to deploy antenna sites. By way of example, in January 2015 the US FCC adopted the Acceleration of Broadband Deployment Report and Order. This aims to streamline the construction of antenna sites in many ways including providing definitions for co-locations and modifications that must be approved by states and municipalities. In the UK, the government is consulting on measures to improve coverage in rural areas, including allowing taller structures. The federal and state governments in Australia will invest about AUD190 million in partnership with industry to deliver the first phase of the Mobile Black Spot programme. This programme will deliver new handheld coverage to 68,600 square kilometres and new external antenna coverage to over 150,000 square kilometres. Over 5,700 kilometres of major transport routes will receive new handheld or external antenna coverage.

4.2.1 Addressing barriers to network deployments

In an increasingly digital economy, the mobile industry needs standardised guidelines, consistently enforced throughout the country, for the deployment of base stations and fibre.

The first key step is to introduce explicit and consistent planning approval processes for mobile base stations across India, thereby ensuring networks can be deployed without lengthy delays. The government should consider introducing mechanisms to reduce bureaucratic inefficiencies, including 'one-stop shop' approvals, fixed decision periods and simplified procedures for co-locations and modifications to existing sites. The costs of obtaining approval certificates from municipalities have reportedly increased by 500% in recent years and this should be reviewed.

India is now taking much-needed steps to simplify its rights-of-way policies to enable faster deployment of the cables required to connect base stations to the telecoms network and ultimately the Internet. Again, the procedures and charges for rights of way, which can be very expensive and time-consuming, need to be streamlined and standardised across India.

The government also needs to do more to ensure telecoms networks have access to a reliable power supply, particularly in rural areas, at preferential rates that reflect the fundamental role of connectivity in India's economy and telecoms infrastructure sector status. The Department of Telecommunications' guidelines for state governments on the installation of masts stress that electricity should be provided as a priority, but in reality this often does not happen. The decision of the Kerala State to allow mobile network infrastructure to be established on government land and buildings demonstrates how state governments can reduce the barriers to network deployment.

4.2.2 Allaying health concerns

Highly restrictive regulations on EMF exposure also constitute a major barrier to network deployments. GSMA analysis[21] with data from Telecom Italia (Italy) and P4/Play (Poland) found that restrictive EMF limits in those two countries result in €620 million in additional capital expenditure and €127 million in additional operating costs.

As India's Minister of Communications and Information Technology Ravi Shankar Prasad has recognised, there is a need for clear and objective information about the health effects of mobile radiation. India would benefit from adopting global radiofrequency exposure standards, which are designed to be protective of all persons. In 2012 India reduced exposure limits for base stations to one tenth of international guidelines.

Medical experts have debunked the view that India needs special restrictions on EMF exposure beyond those recommended by the World Health Organization. "Radiation from mobiles and mobile towers pose no threat to health or cause cancer as it is commonly believed," Delhi Medical Association president Anil Agarwal said at a press conference held on 27 September 2014 at the India Habitat Centre in New Delhi. "There are no empirical findings to establish that mobile tower radiation causes cancer or any such diseases. The radiation emitted is just too weak to be harmful." The current EMF research program being coordinated by the Indian Science and Engineering Research Board would benefit from greater cooperation with international researchers who could share their expertise on the specific methods needed for high-quality EMF studies.

Earlier in 2014 a committee set up by order of the High Court of Allahabad, Lucknow Bench, to look into EMF radiation concerns found there was no conclusive evidence of the dangers from mobile phone towers and that greater efforts should be made to reduce fears caused by misinformation.

21. Economic Impact of stricter EMF limits on the Rollout of Mobile Broadband Networks in Poland and Italy, GSMA, 2014

4.2.3 Making services more affordable

Although the country's mobile industry is offering some of the lowest tariffs in the world, the industry and its customers pay a relatively high level of taxes and fees. In India, consumer taxes are 23.3% of the total cost of mobile ownership, while mobile-specific taxes account for 10.3% of the total cost of mobile ownership[22]. As affordable devices and services are crucial to delivering the Digital India programme, the government needs to consider how to phase out sector-specific taxes and fees that increase prices for consumers and weaken the business case for deploying broadband infrastructure.

In general, the revenue raised through taxation on digital services and devices is likely to be less than the broader economic returns resulting from greater adoption and usage. Excessive taxation limits the positive impact of mobile broadband on economic and social development, employment, productivity and the lives of citizens. For example, spectrum usage charges are superfluous and harmful when the value of spectrum is already being more than captured by the auction mechanism.

The government should also review the universal service fund (USF) mechanism to determine whether it is effectively supporting the provision of broadband. Research by the GSMA has found that many universal service funds set up to support the rollout of broadband actually have the opposite effect, as they typically levy fees on the telecoms sector and damage the business case for investment in new infrastructure.

Through levies on operators, India's USF has already accumulated significant funds (with a balance of over INR40,000 crore as of September 2015[23]). Although government agencies are now using some of these funds to deploy a fibre-optic network, the money could be more efficiently and effectively used to provide financial incentives to telecoms operators to expand coverage. India has one of the world's highest USF levies at 5% of operators' revenues compared to, for example, 1% in Brazil and 2% in Colombia. Given the large funds accumulated to date, the rate of the revenue-based charges should ideally be reduced.

22. Digital inclusion and mobile sector taxation 2015, GSMA, 2015
23. Source: Universal Service Obligation Fund (USOF), Department of Telecommunications

4.3 Ensuring a level playing field

India's licensing and regulatory framework was designed at a time when the Internet was just emerging, there were no smartphones and hardly any of the new online communication service platforms. This framework needs to be adapted for a Digital Age in which many industries and sectors are now overlapping and converging. To provide clarity for consumers and enable fair competition, governments around the world need to pursue regulatory neutrality, whereby the same services are governed by the same rules.

India needs to modernise its regulatory framework to treat equivalent services in the same way, providing the same level of protection for consumers and not disadvantaging a particular type of provider.

4.3.1 The impact of online communications services

The widespread deployment of mobile broadband networks is enabling online communications services to provide voice calls, messaging, content and other services in competition with mobile operators. Several of these services have become major players in the Indian market, and have begun to erode the voice and messaging revenues that mobile operators rely on to support and facilitate the rollout and expansion of broadband services. For example, India has nearly 100 million WhatsApp users, more than a tenth of the global user base.

In the absence of a fair regulatory and commercial solution, particularly for online communications services, India's telecoms networks will not attract sufficient investment and this could delay realising the vision of the Digital India programme. Competition from online communications services has led to a significant decline in revenue for telecoms operators. The operators are, at the same time, investing heavily in networks and the acquisition of spectrum, while paying licence fees and spectrum usage charges, to meet the escalating demand for connectivity. Online communication services are not subject to the same level of costs of doing business.

There is also a significant imbalance in the regulatory requirements that apply to telecoms operators and new online communications services. These include record keeping and interconnection, adherence to quality of service, security safeguards, connectivity to emergency services, transparency, lawful interception, privacy and other requirements. These regulatory obligations apply to telecoms operators, but not to the new entrants providing similar services.

In light of these major disparities, India needs to modernise its regulatory framework so that no single entity or type of entity is at a disadvantage. A single, consistently applied framework covering all competitors, regardless of the technology they use or the type of provider, should govern India's digital service providers.

4.3.2 Net neutrality – getting the balance right

A key factor in determining whether India can fulfil its digital ambitions will be its approach to net neutrality – the subject of an ongoing government consultation. The concept of net neutrality means different things to different stakeholders. For India's mobile operators, net neutrality refers to the principle that the Internet should be an open platform for freedom of expression, innovation and socio-economic development. In this context, regulators' primary objective should be to maintain an open Internet in which service diversity, competition and consumer choice are paramount.

4.3.3 Traffic management is essential

To deliver the breadth and quality of services customers want, mobile operators need to be able to manage their networks efficiently. In practice, that means different types of traffic have to be treated differently. It is unrealistic and counterproductive to treat real-time services such as video and voice calls in the same way as delay-tolerant services such as email and messaging. If every data packet waits in the same queue, regardless of the service requirements, the consumer experience will suffer as calls will drop and video will buffer.

Traffic management can also improve the end-user experience in other ways. For example, mobile operators can optimise video services by compressing data, adapting content for mobile screens, while reducing the cost to the consumer. In India, where spectrum is scarce and networks are congested, video compression is a key tool for mobile operators.

There are many other reasons why some data traffic needs to be managed. These include blocking illegal content, meeting security safeguards, protection of minors and prevention of spam. Traffic management may also be used to route calls to emergency services, take appropriate action when a customer exceeds their contractual data-usage allowance, or to offer charging models that allow customers to choose the service or application they want.

Traffic management may also be used to provide higher quality services to organisations that need highly reliable or low latency connectivity. As healthcare providers, automotive manufacturers, local governments, transport providers and many other companies increasingly harness connectivity to serve their customers better, mobile operators need to ensure they can deliver the requisite quality of service. Regulators also need to bear in mind that traffic management is an evolving discipline, characterised by continual innovation to efficiently utilise network capacity and ensure quality for the end user. Mobile operators complement their investment in network capacity with active network management.

Active network management does not, of course, mean that the Internet is distorted or that customers are not able to enjoy content, services and applications of their choice. Traffic management does not imply blocking a specific content or application provider on the network. It simply means that services work better and networks run more efficiently. Regulations that prohibit traffic management, or prescribe a limited set of permissible cases, simply aren't future-proof and could harm innovation, investments and the quality of experience for users.

4.3.4 The case for commercial flexibility

An overly congested or degraded network is not in the interests of operators or end users. The internet is typically a two-sided market and operators should have the flexibility to offer commercial propositions to both sides, namely end-users and third-party content and application providers. Different pricing models associated with different service attributes should not be viewed as harmful to consumers. The availability of a variety of service packages – that combine different prices, quality and bundled content – increases the choice available to consumers and allows them to choose the package that best suits them. The freedom to agree commercial arrangements with other content and application providers, through managed services and zero-rated practices, encourages the development of innovative services and sustainable business models.

Such commercial models are common business practices in other industries, promoting competition and generally enhancing economic efficiency and societal welfare. For example, the zero-rating of specific services, where data usage related to a specific service (e.g. video streaming) does not count against an end-user's data consumption allowance or result in metered data consumption charges, can encourage consumers to use the Internet and to try new services without worrying about data consumption costs. Zero rating and sponsored data models are aligned with the principle of the open Internet and benefit consumers and competition.

4.3.5 Competition is proving effective

The competitive mobile market in India is delivering choice, innovation and value-for-money for consumers. A competitive market, rather than ex-ante regulation, is the best way to ensure that the internet remains a platform for growth and innovation. At this stage, when the technologies, services and commercial models of the internet ecosystem are evolving, the best way to deal with the debate on net neutrality in India is to let the market find balanced solutions to meet consumer expectations. Operators should continue to have the flexibility to offer a variety of tariffs to consumers and agree commercial arrangements with content and application providers. The existing legal and regulatory framework in India provides authorities with adequate safeguards to address potential concerns that may arise.

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