

Report for GSMA

Assessment of Economic Impact of Wireless Broadband in India

Discussion Document

December 2010

The development of wireless broadband can bring significant benefits for the Indian economy

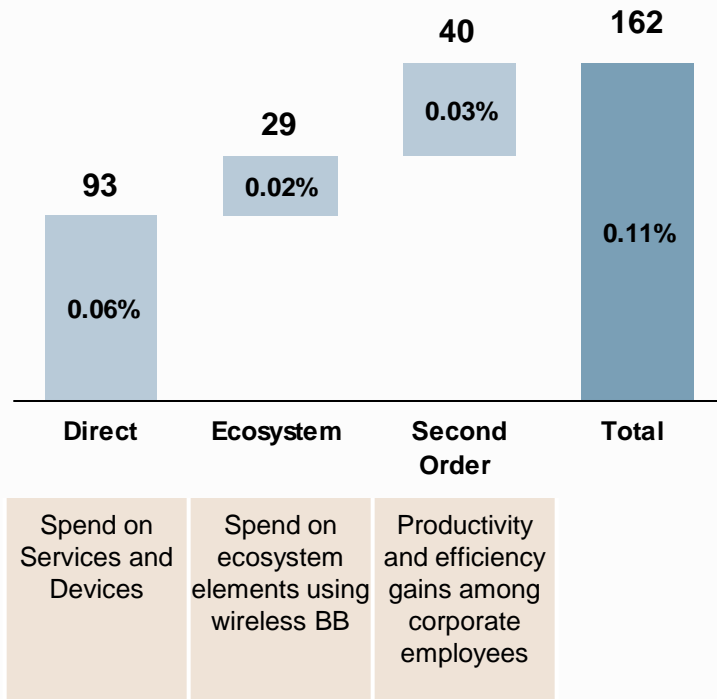
- Key findings:
 - ♦ Increase in broadband penetration of 1% will contribute INR 162 bn, or 0.11% to Indian GDP in 2015
 - ♦ Allocation of additional 5 MHz of 3G spectrum will increase BB penetration by 3.3% of population and enhance GDP by INR 538 bn in 2015
- Analysys Mason has prepared this report for GSMA to assess the direct and indirect economic impact of wireless broadband in India
- Broadband connectivity is being increasingly seen as an integral driver of improved socio-economic performance
- Recent econometric studies have quantified the direct impact on productivity and economic growth suggesting that an increase in broadband penetration of 1% could result in 0.1% productivity gain¹
- These surveys, however, have emphasised the need to create an ICT 'eco-system' to realise significant and wide-reaching productivity gains
- The Indian government has developed clear objectives in its National Broadband consultation paper² in line with policies established in developed and emerging economies
 - ♦ Target of 100 million broadband connections by 2014
- The Indian demographics with a large rural population suggests that the development of a robust wireless broadband ecosystem will be key to meet government's objectives
- Addressing the latent demand for broadband services will also support the development of strong Indian players across the value chain

Definitions of key terms used in this presentation

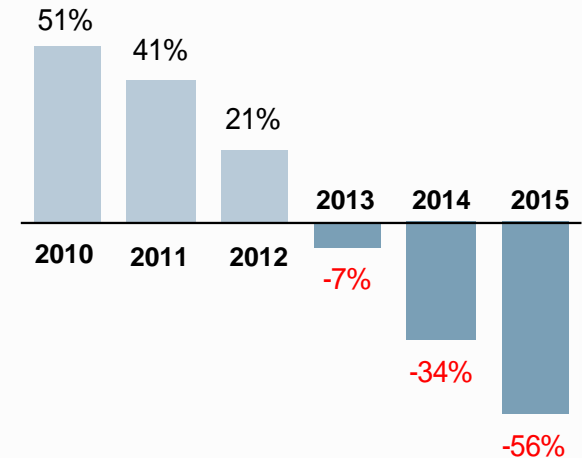
Terms	Definitions
Wireline	Lines of copper / cable / fiber deployed underground or overhead for voice / internet services
Fixed Broadband – Wireline	Data connection (≥ 256 Kbps download or upload speed) over wireline infrastructure
Fixed Broadband – Wireless	Data connection (≥ 256 Kbps download or upload speed) over wireless transmission accessed from a fixed location, primarily using WiMAX 802.16-2004 / 802.16.d technology
Wireless Broadband	Data connection (≥ 256 Kbps download or upload speed) over wireless transmission primarily using WCDMA, HSPA, LTE, CDMA EV-DO, TD-SCDMA and WiMAX 802.16.e technologies
Internet Users	Unique users accessing internet from private / shared / corporate connection
Wireless Broadband Users	Unique users accessing wireless broadband services from private / shared / corporate connection
Consumers	Individuals accessing broadband services from residential premises or SOHO (Small Office, Home Office) & unorganized sector (whose activities / data collection is not regulated under any legal provision) businesses
Enterprises	Includes large businesses and SMEs in the organized sector (for which statistics are available from budget documents or reports, or whose activities or data collection are regulated under a legal provision)
Direct Impact	Consumer and enterprise spend on devices and services for accessing wireless broadband
Ecosystem Impact	Revenues generated by the telecom and adjacent industries from value added services / other services enabled by wireless broadband access
Second Order Impact	Increase in economic productivity of the work force as a result of access to wireless broadband services

Increase of 1% in wireless broadband penetration will contribute 0.11% (INR 162 bn) to Indian GDP in 2015

Impact on GDP by 1% Increase in Wireless Broadband Penetration (INR bn, 2015)



Spare Spectrum Availability Based on Existing Spectrum Allocation²



Assumptions

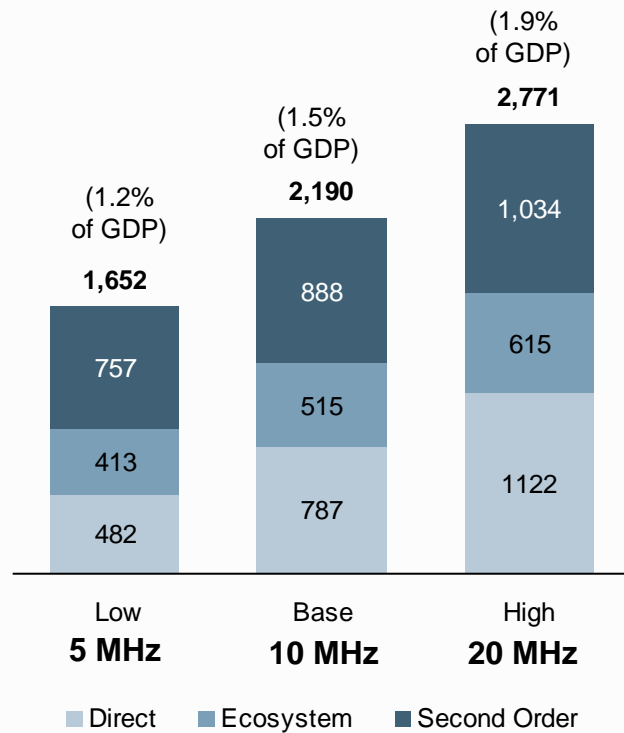
	2010	2011	2012	2013	2014	2015
Bandwidth per user ¹ (Kbps)	383	570	916	1,414	1,978	2,476
Allocated bandwidth (MHz)	5.0	5.0	5.0	5.0	5.0	5.0

Note: 1. Average subscribed bandwidth per user; 2. Estimated 7.5 Mbps capacity available for data per 3G cell site, after adjustment for allocation of voice

Source: Analysys Mason

Allocation of additional 5 MHz will increase BB penetration and enhance GDP by INR 538 bn in 2015

Total Impact on GDP by Scenarios of Spectrum Allocation (INR bn, 2015)



Key Metrics for Scenarios of Spectrum Allocation (2015)

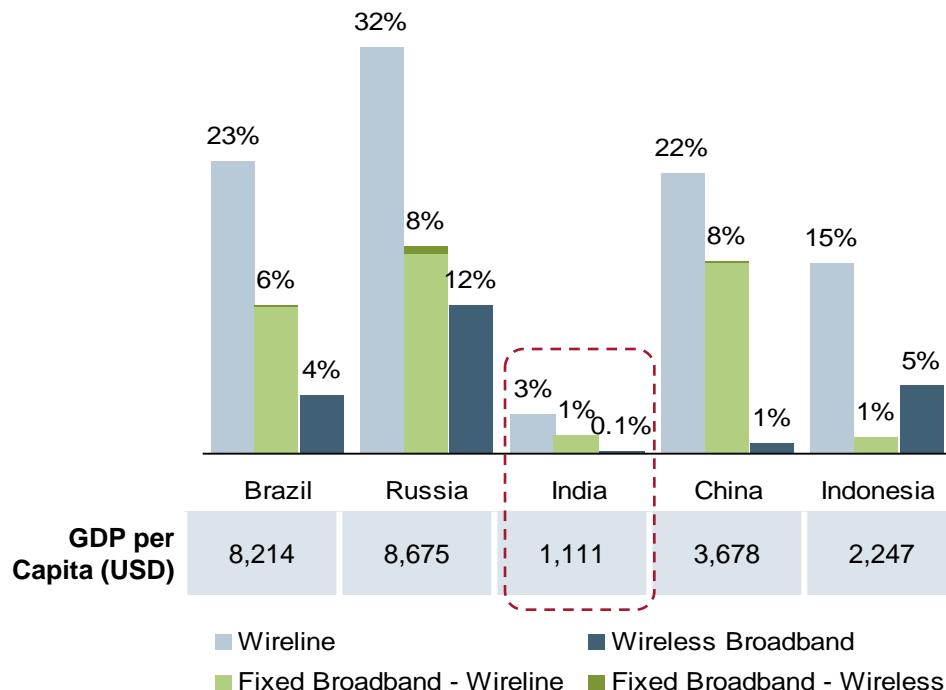
Scenarios	Allocated Bandwidth ¹	Wireless BB Penetration ²	Wireless Broadband Users ³
Low	5 MHz	9.2%	117 mn
Base	10 MHz	12.5%	158 mn
High	20 MHz	16.1%	204 mn

Note: 1. Assuming consolidation among operators by 2015, additional bandwidth allocation requirement for existing 3G license holders; 2. Based on spectrum allocation, penetration reflects the number of users that can be supported by data cell sites; 3. Includes residential and corporate users separately

Source: Analysys Mason

India lags in broadband penetration among BRIC nations due to affordability issues and an under-developed wireline base

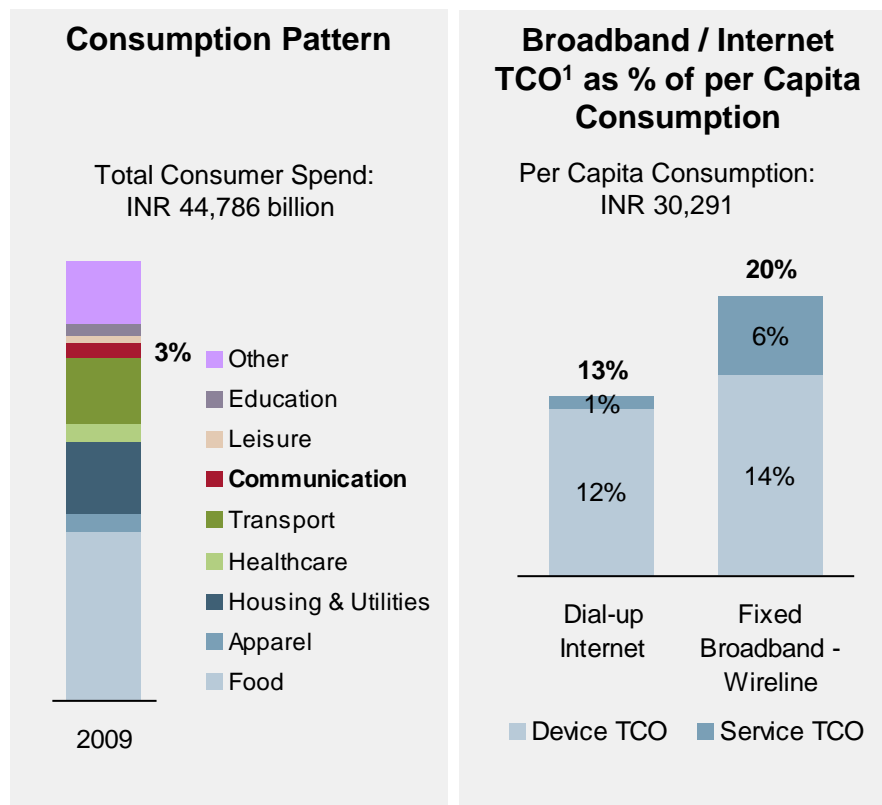
BRIC Countries & Indonesia: Broadband and Wireline Penetration by Access Technology (2009)¹



- India has a significantly lower wireline penetration as compared to other emerging countries, implying a weak infrastructure base for wireline based broadband deployment
- Lower GDP per capita results in service and device affordability issues, thus limiting penetration to the consumer, professionals segments and student population through direct / shared access
- Overall low broadband penetration has resulted in the absence of an ecosystem (content, applications, service models and device categories), which can address the mass market requirement

The TCO for broadband services requires a significant percentage of consumer spend on communications

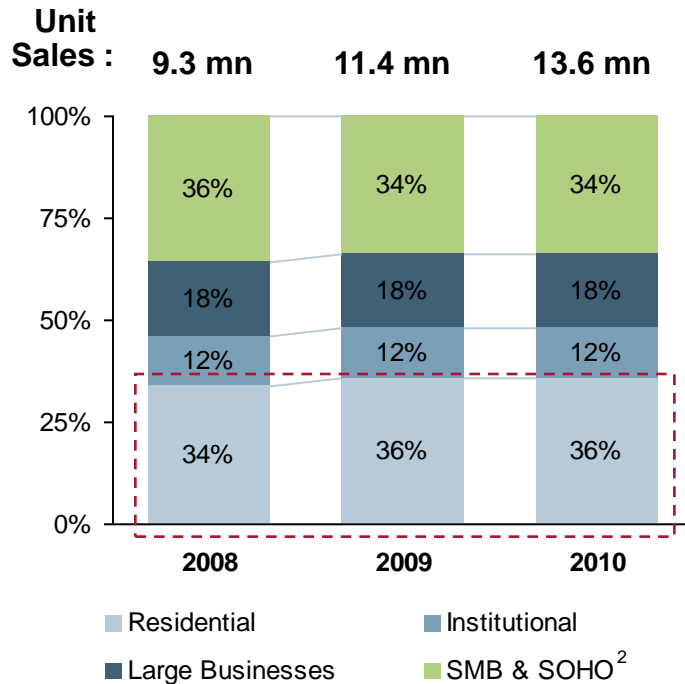
Consumer Spend on Communications & Broadband in India (2009)



- While each connected consumer (at teledensity of 48%) spent an average ~ INR 2,000 in 2009 on communications, the minimum cost of using a fixed broadband connection was ~ INR 6,000
- The high TCO is a result of the high device cost as % of consumer wallet
- Indian broadband service ARPU is comparable with other countries while the per capita incomes are much lower
 - ♦ The average monthly household income of a regular online Indian is 3.2 times higher than the national average
 - ♦ Broadband ARPU for India is USD 12 (INR 600), China USD 8 and Russia USD 15

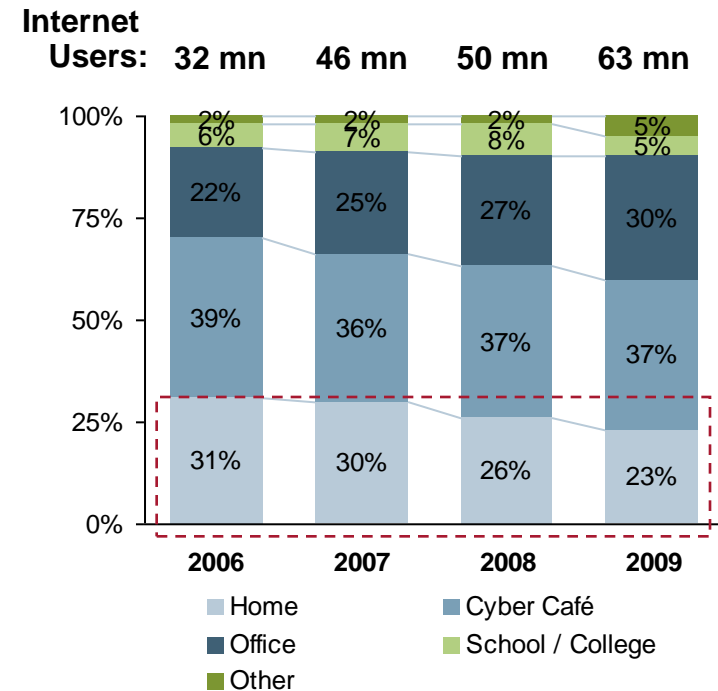
Further, the utility of residential internet is limited due to demand side issues, with office / shared usage picking up

PC Unit Sales Mix Across Segments



- Residential PC sales have remained stagnant at around 30%, with laptop sales picking up marginally

Internet Access Points for Urban Users¹



- Internet access from home is declining due to limited PC base and affordability / utility issues

Note: 1. Includes claimed internet users – individuals to have used internet at any point in the past; 2. SMB: Small & Medium Businesses, SOHO: Small Office Home Office

Source: Analysys Mason, IDC, IMRB

Deployment of new access lines for fixed broadband services is time consuming and yields unattractive returns

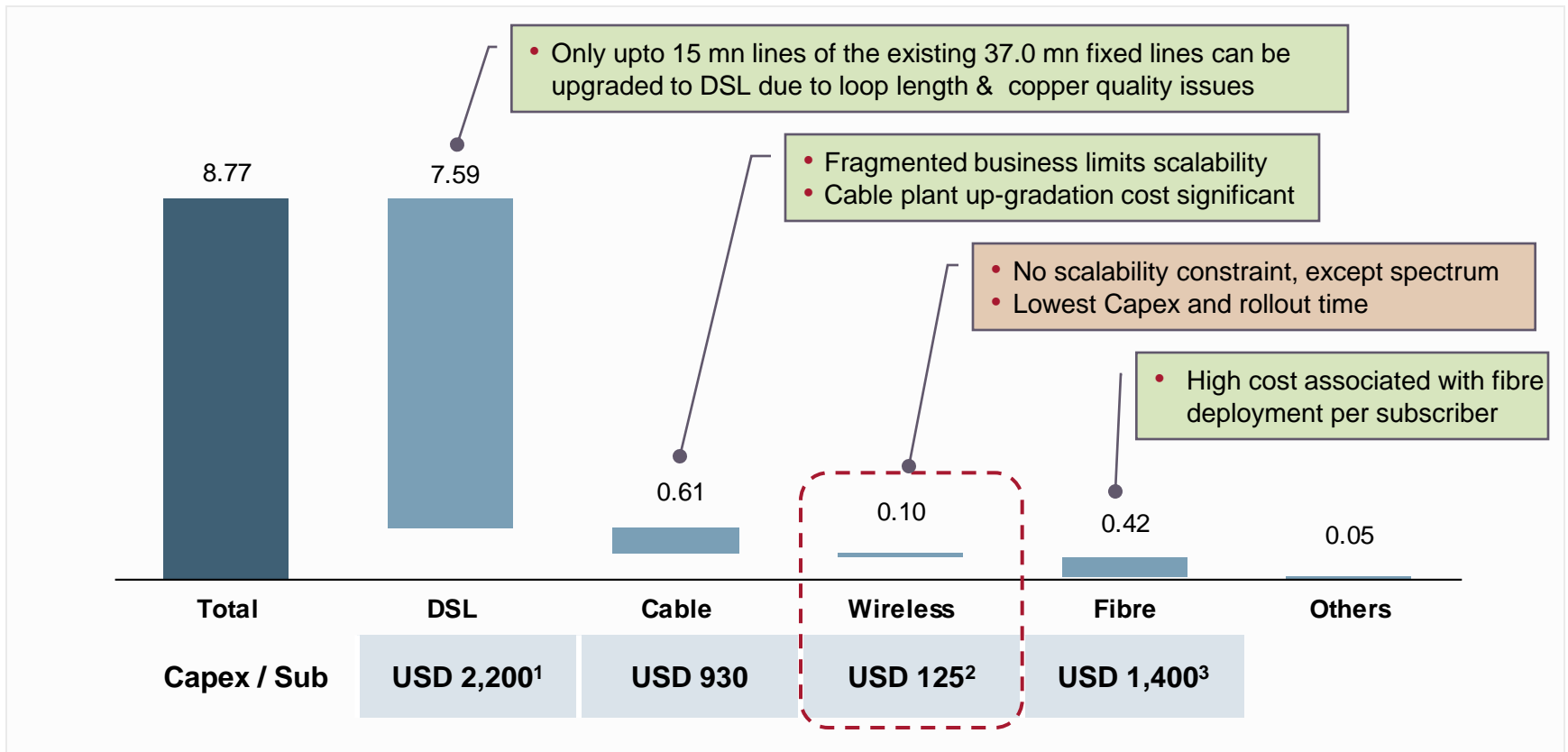
Comparative Evaluation of Deploying Broadband Technologies in India

Technology	Time to Deploy	Capex per Sub
DSL (FTTN) Existing Line	Low	USD 799
DSL (FTTN) New Line	High	USD 2,200
FTTH	High	USD 2,540
FTTB	Medium	USD 1,390
WiMAX (802.16.e) ¹	Low	USD 133
HSPA ¹	Low	USD 125

- Deployment of new FTTx lines for offering broadband services to individual homes does not make viable business case due to high cost of getting Right of Way (RoW) permission and execution
- The Capex gets rationalized only for FTTB deployments for MDUs² at a triple play ARPU level, but number of MDUs remain limited
- Existing DSL connections are concentrated in urban areas, with top 20 cities accounting for 70% of current wireline broadband connections

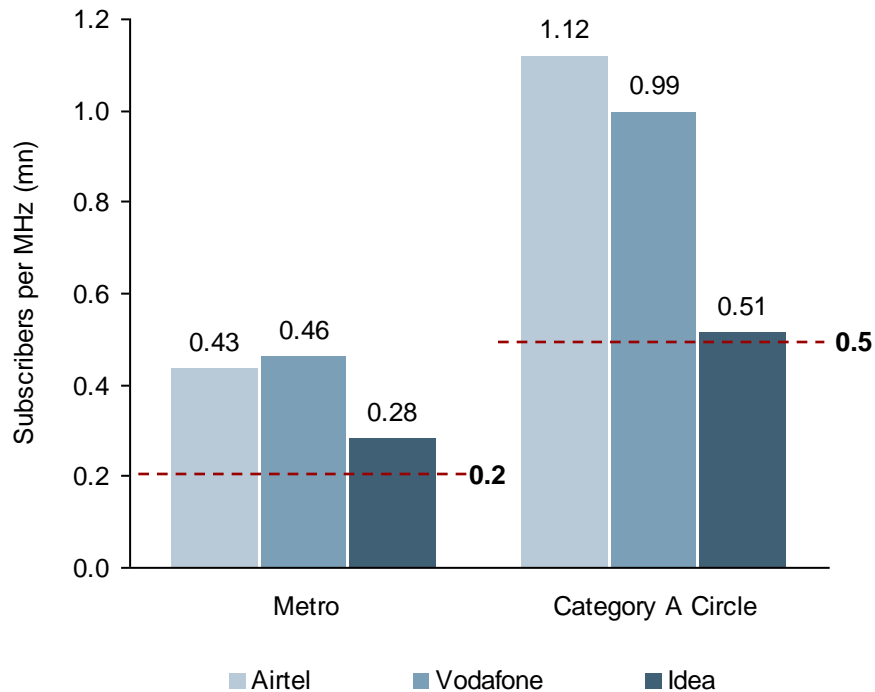
Wireless broadband deployment is scalable as compared to fixed line technologies such as xDSL, Cable and Fibre

Broadband Lines in India Split by Technologies, 8.77 mn (Mar'10)



However, with severe spectrum congestion in voice services, carriers find it difficult to spare capacity for wireless data

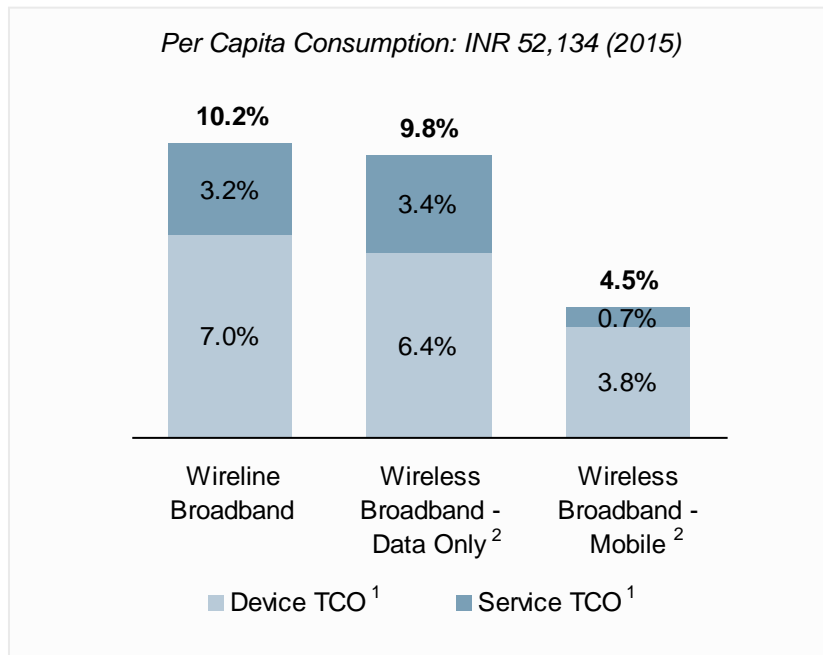
Subscribers per MHz for GSM Carriers in Metro and Category A Circle¹
QE-Mar 2010



- Almost all major GSM carriers are already facing spectrum congestion in the metro areas for offering basic voice services, and do not have network capacity to offer EDGE based data services
- With the allocation of 3G and BWA spectrum, some of the voice congestion will get relieved, and operators will have spare capacity to offer data services
- However, 3G spectrum allocation is only 5 MHz and will only be able to support limited number of wireless broadband users as some will be used to solve the voice congestion issues

With economies of scale, wireless broadband offering will become more affordable for the mass market consumers

Broadband / Internet TCO¹ as % of per Capita Consumption (2015)



Assumptions for TCO Calculations: Entry Level Device and Service Pricing (INR, 2015)

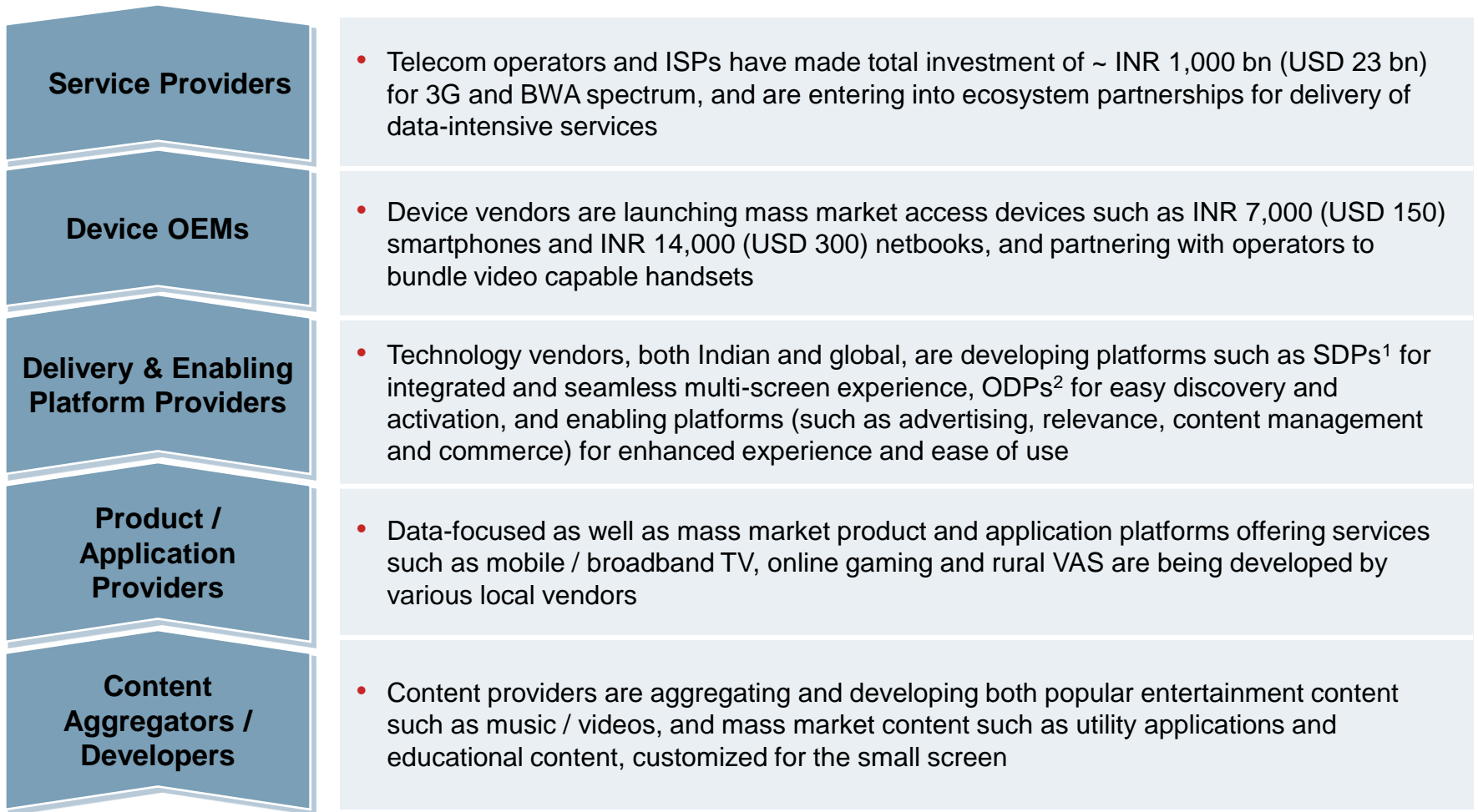
	Wireline Broadband	Wireless BB - Data Only ²	Wireless BB - Mobile ²
Device Type	Desktop	Embedded Netbook	Smartphone
Device Cost (INR)	8,000	10,000	5,000
Device Lifetime (years)	3	3	2.5
Modem Cost (INR)	2,000	-	-
Modem Lifetime (years)	2	-	-
Monthly Service Charge – Entry Level (INR / month)	125	150	30

- Entry level service pricing is expected to be slightly higher for wireless broadband offerings, which is expected to reduce further with higher adoption and competition among operators
- Device cost for fixed and wireless broadband offerings will be similar by 2015

Note: 1. Annual Total Cost of Ownership: includes depreciated entry-level cost of PC & modem and entry level service charges for data usage; 2. Data only wireless broadband usage refers to access over a PC, while mobile usage refers to that over a mobile phone, with a WCDMA / HSPA connection bundled with voice services

Source: Analysys Mason, Industry Inputs, Company Websites

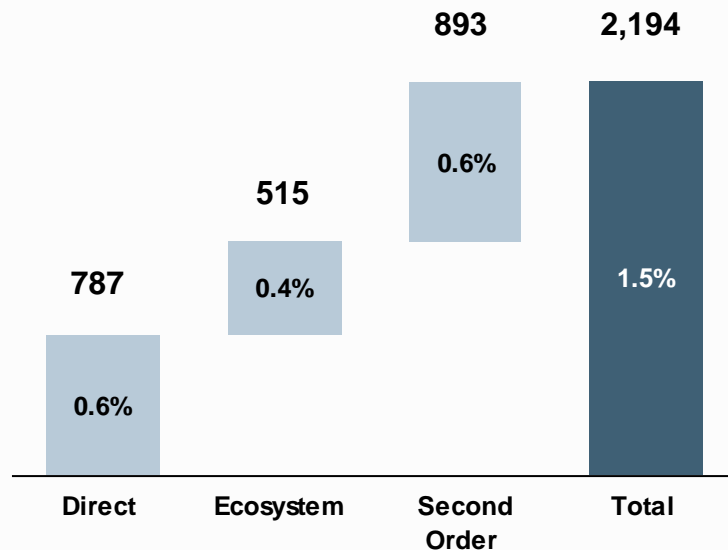
The service delivery ecosystem is developing rapidly to address the opportunity from wireless broadband services



Our estimates suggest that wireless broadband will have an overall impact of USD 51 bn in 2015, comprising 1.5% of GDP

Total Impact on GDP by Wireless Broadband in 2015 (INR bn)

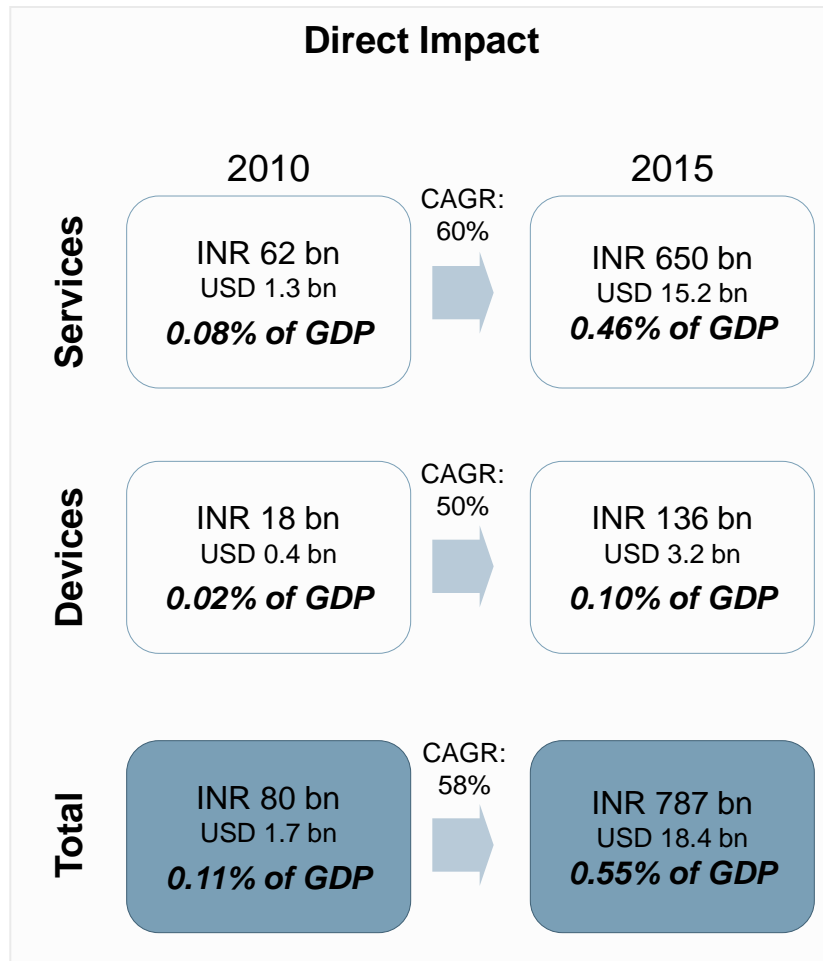
All calculations assume 'Base' scenario with allocation of total 10 MHz spectrum to all 3G operators



- Based on our assessment of latent demand, the specific socio-economic pattern of India and international comparison, the contribution of wireless broadband industry in India could reach USD 51 billion in 2015, equivalent to 1.5% of GDP
 - ♦ With increase in 10% wireless broadband penetration, an incremental revenue of INR 1,622 bn (1.1% of GDP) is generated
 - ♦ Other studies such as by World Bank in 2009 estimate an economic growth impact of 1.21% of GDP for developed countries and 1.38% of GDP for developing countries for 10% increase in broadband penetration
- Nominal GDP of India is expected to grow at a CAGR of 14% from 2010 to 2015
- With the ecosystem maturity, wireless broadband penetration will increase from 0.8% in 2010 to 12.5% in 2015

Increase in broadband penetration will have a direct revenue impact of INR 787 bn (0.55% of GDP) in 2015

Direct Impact



Key Metrics – Direct Impact of Wireless Broadband Penetration

Parameter	2010	2015
Wireless broadband users (million)	10	158
Penetration of population	0.8%	12.5%
Wireless broadband service ARPU (INR / month)	523	343
Households with wireless broadband connection (million) ¹	6	72
Businesses with wireless broadband connection (million) ¹	1.4	4.0

The growth in wireless broadband services spend will be driven by increase in consumer base & enterprise penetration

1

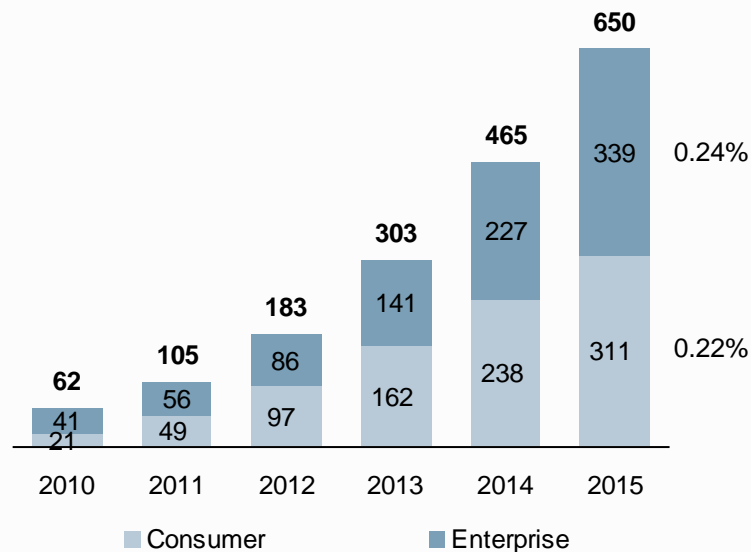
Services

Projections for Consumer and Enterprise Spend on Wireless Broadband Services (INR billion)

2010:
0.08% of GDP

CAGR: 60%

2015:
0.46% of GDP



- Global industry trends show the growing importance of non-voice services including content and entertainment, financial services and advertising
- Share of non-voice revenues has the potential to reach ~30% of operator revenues by 2015
 - ♦ In 2009, non-voice revenues comprised only 9% of total telecom revenues, of which voice-based VAS / CRBT and SMS had 87% share
- Wireless broadband user base has the potential to grow at a CAGR of 74% to comprise 86% share of broadband users by 2015
 - ♦ In 2009, only 19% of broadband users were accessing applications from a wireless system

The market for wireless devices will be driven by consumer-centric devices and will see local vendors expanding globally

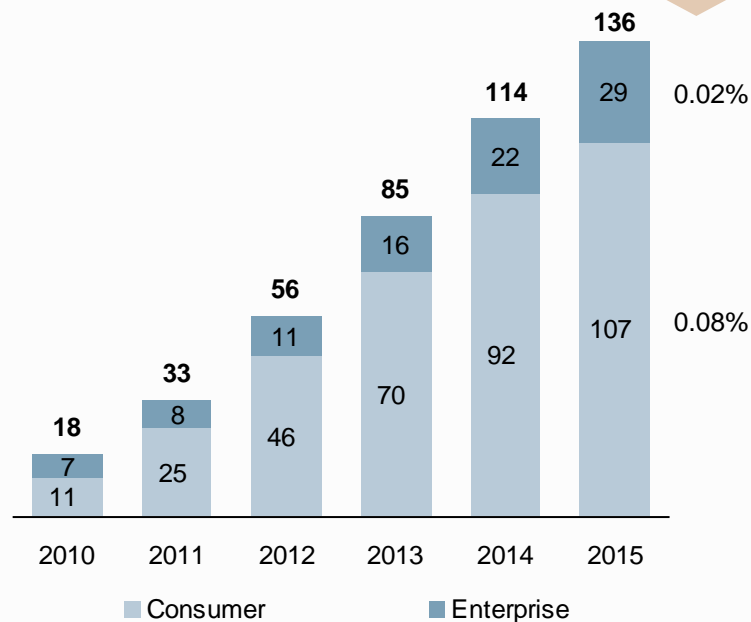
2 Devices

Projections for Consumer and Enterprise Spend on Wireless Broadband Devices (INR billion)

2010:
0.02% of GDP

CAGR: 50%

2015:
0.10% of GDP



- Global trends in mobile handsets, tablets and eBooks suggest increasing use of wireless for online content consumption
 - ◆ Share of these devices in global electronic device shipments is expected to increase from 32% share in 2010 to 39% in 2012
- The size of the Indian device market will allow the emergence of global players
- Indian brands such as Micromax, Spice and Videocon have an increasing share of the mobile handsets market – 22% in QE-Mar2010 from 7% in QE-Mar2009
- These players are expected to increase investments in local manufacturing and expand their markets globally

Increasing penetration of wireless broadband will have a significant impact on the broadband ecosystem revenues

Ecosystem Impact

Wireless BB Ecosystem	Description ¹	Drivers in India	Wireless BB Revenue (INR bn)
1 Consumer / Retail	<ul style="list-style-type: none"> It includes: <ul style="list-style-type: none"> M-Commerce M-Entertainment <ul style="list-style-type: none"> M-content M-gaming M-app M-Advertising 	<ul style="list-style-type: none"> Larger reach of mobile medium compared to PC / laptops is the key driver for growth of retail consumption on mobile in India Availability of devices such as smartphones and touchscreen phones at affordable price point Lack of capacity on 2G network for data intensive entertainment content such as Mobile videos 	<p>2010: 9 2015: 187 CAGR: 82%</p> <p>Legend: m-Advertising, m-Entertainment, m-Commerce</p>
2 Financial Service	<ul style="list-style-type: none"> It consists of M-Banking and remittances using wireless BB 	<ul style="list-style-type: none"> Banking penetration in India remains concentrated in urban areas enabling players such as Fino, Eko to provide banking solution based on mobile to rural market Poor user experience for financial services on 2G network through SMS / voice / GPRS access 	<p>2010: 16 2015: 205 CAGR: 67%</p> <p>Legend: m-Banking</p>
3 Social Services	<ul style="list-style-type: none"> It includes services such as learning, healthcare and governance accessed on wireless mode 	<ul style="list-style-type: none"> Tech enabled social service market in India is currently very underpenetrated with no strong player Emerging innovations in both hardware and software to drive adoption Easy access to time consuming processes such as Passport form submission 	<p>2010: 2 2015: 63 CAGR: 101%</p> <p>Legend: m-Learning, m-Health, m-Government</p>
4 Corporate / Verticals	<ul style="list-style-type: none"> Use of wireless BB for farming, utilities such as M2M and for enterprise solutions 	<ul style="list-style-type: none"> Enterprise spending priorities are shifting from cost optimization to supporting business growth Farmers are depending on online applications for significant costs savings & to generate additional revenues Lack of capacity on 2G network resulting in poor user experience 	<p>2010: 6 2015: 60 CAGR: 60%</p> <p>Legend: m-Farming, m-Enterprise, m-Utilities</p>

Note: 1. 'm' refers to wireless broadband enabled services accessed through wireless broadband connection over mobile handsets or PCs

CAGR

Source: Analysys Mason, Industry Inputs

Larger reach of mobile compared to PC / laptops is the key driver for growth of retail consumption on mobile in India

1

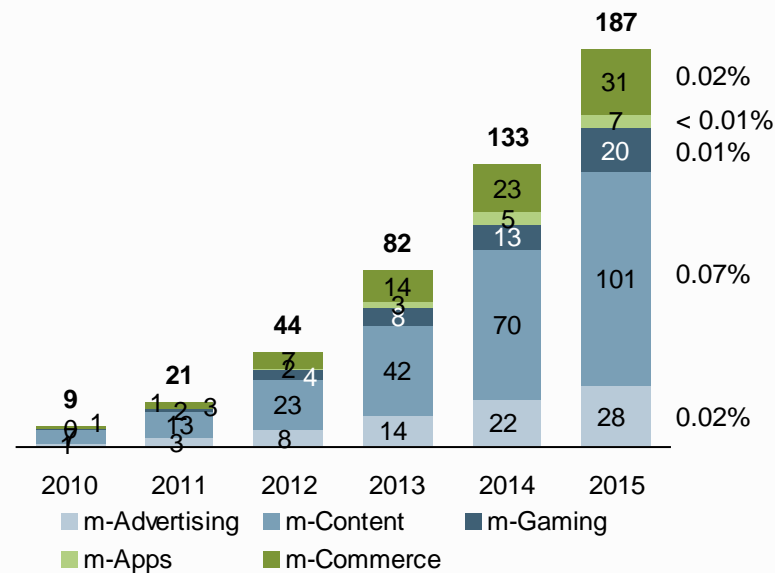
Retail

Wireless Broadband Ecosystem Revenues from Retail (INR billion)

2010:
0.01% of GDP

CAGR: 82%

2015:
0.13% of GDP



- **m-Advertising:** The nascent mobile advertising market in India will benefit from the increasing role of ecosystem players
- **m-Content:** Increasing carrier focus on VAS content promotion and emergence of experimental business models by D2C players are key drivers for wireless content in India
- **m-Gaming:** The Indian digital gaming market is still nascent but has significant growth potential owing to the recent initiatives by players such as innovative pricing models
- **m-Apps:** With the launch of operator app stores, there is significant potential for Indian app developers to achieve global scale
- **m-Commerce:** m-Commerce market in India is expected to grow as the focus from banks and carriers increases, with mobile reach

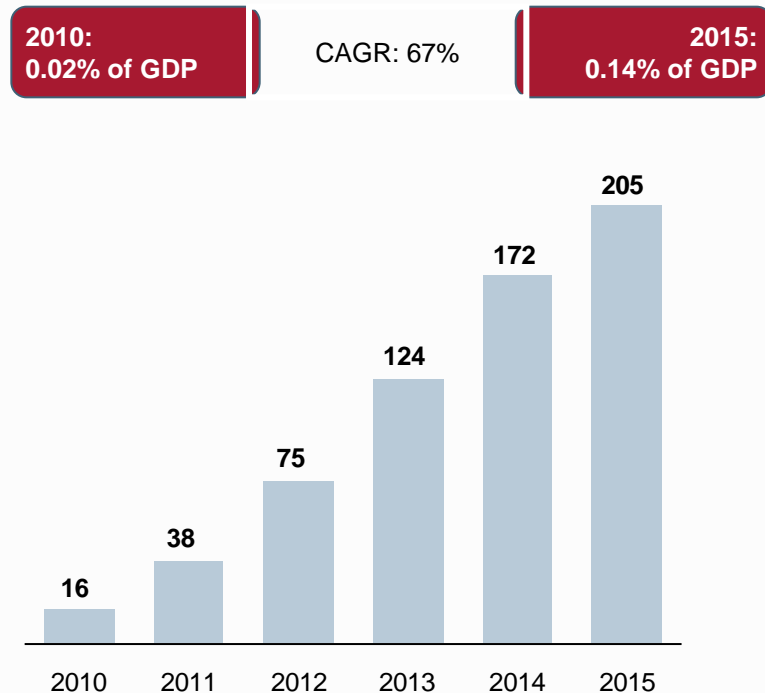
Note: 1. 'm' refers to wireless broadband enabled services accessed through wireless broadband connection over mobile handsets or PCs

Source: Analysys Mason

Financial services have the potential to generate INR 205 bn in revenues for the wireless broadband ecosystem

2 Fin. Service

Wireless Broadband Ecosystem Revenues from Financial Services (INR billion)

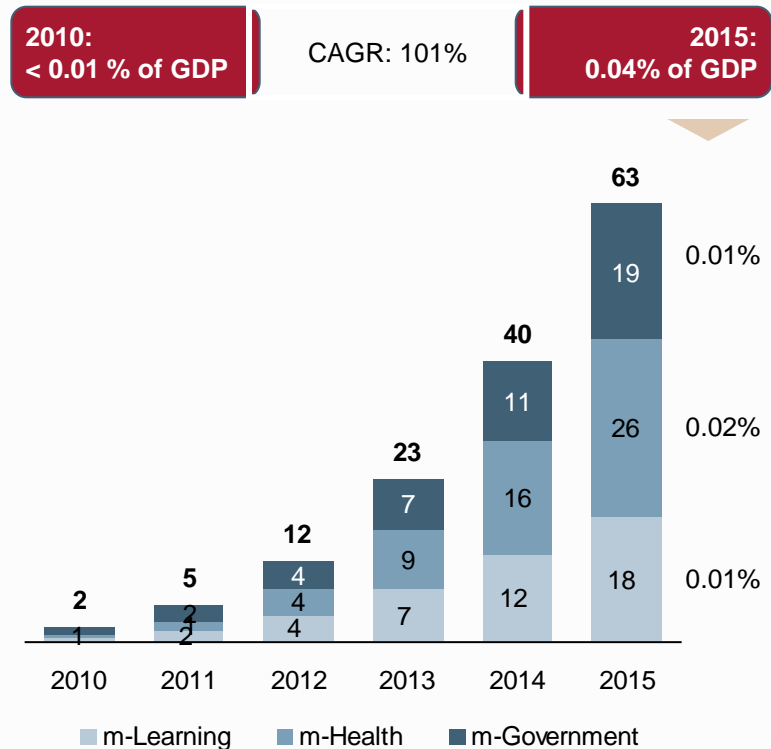


- Users of mobile banking and related services, globally, is forecasted to grow at a CAGR of 59.2 % to reach 894 million users in 2015
- Inward overseas remittance in India is expected to dominate the remittance market with a share of 55% of the total market in 2013
- Regulations in India currently permits only bank to bank and PO to PO transfers
 - ◆ Bank account to bank account remittance through mobile or online has no transaction fees as compared to Post office remittance
 - ◆ Use of mobile banking services for cross border inward and outward transfers is strictly prohibited

Tech enabled social service market in India is currently very underpenetrated with no strong player

3 Soc. Service

Wireless Broadband Ecosystem Revenues from Social Services (INR billion)



- **m-Learning:** The technology enabled education market in India is currently at a very nascent, but is expected to grow significantly with the initiatives taken by government such as National Knowledge Network. Emerging innovations in hardware and software will further fuel the growth of mobile learning
- **m-Health:** In India, operators have launched basic health services, and government bodies in partnership with private players are using mobile primarily for health data collection and provide treatment support
- **m-Government:** Government of India have launched a National e-Governance Plan to provide governance services as part of 27 Mission Mode Projects (MMPs) and 8 components online. Government IT spend is estimated to constitute 1% of the total state budget expenditure

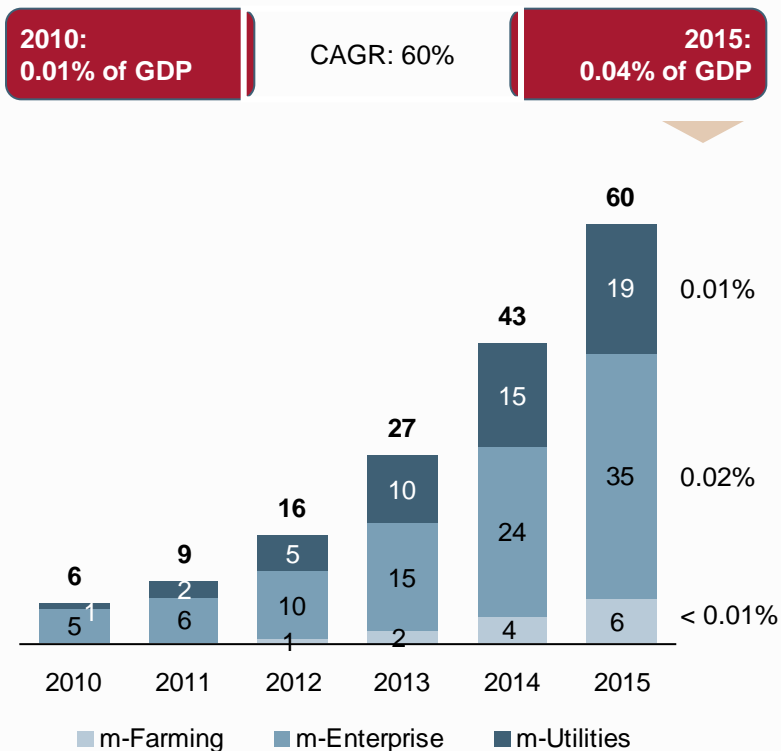
Note: 1. 'm' refers to wireless broadband enabled services accessed through wireless broadband connection over mobile handsets or PCs

Source: Analysys Mason

Mobile corporate service helps enterprises and users to enhance productivity, connectivity and competitive advantage

4 Corp. Service

Wireless Broadband Ecosystem Revenues from Corporate Services (INR billion)



- **m-Farming:** Utility will drive adoption of m-farming services in India as the existing users claim to achieve cost savings and increase revenues
- **m-Enterprise:** Emergence of system integrators coupled with better device / smartphone and data ecosystem will drive Indian enterprise mobility apps market
- **m-Utilities:** In India M2M utility applications such as smart meters and remote video surveillance have seen major adoption
 - ♦ Power utility companies such as Reliance Infrastructure and Tata Power are deploying CDMA-enabled smart meters
 - ♦ With high speed 3G HSPA connectivity combined with the latest compression technologies, CCTV solution companies can provide rapid access to good quality recordings from any location strengthening the nations security

Note: 1. 'm' refers to wireless broadband enabled services accessed through wireless broadband connection over mobile handsets or PCs

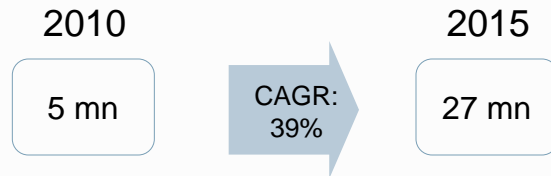
Source: Analysys Mason

Wireless broadband will have an industry productivity impact of INR 888 bn (0.62% of GDP) in 2015

2nd Order Impact

Estimation of Impact on Productivity due to Wireless Broadband

Working Population with Wireless Broadband Connectivity¹



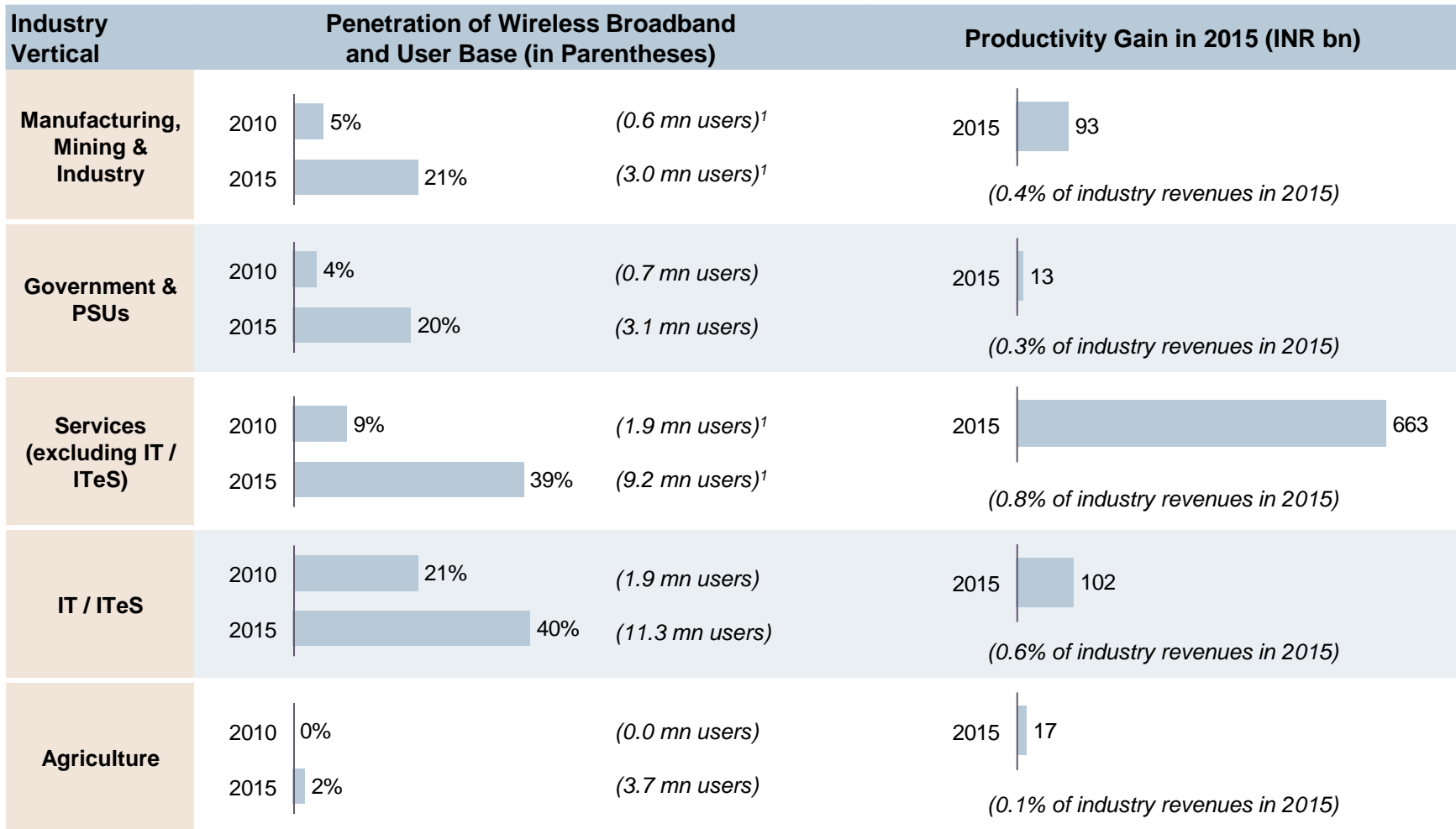
Increase in Industry Productivity in 2015

INR 888 bn
(USD 21 bn)
0.62% of GDP

Industry-wise Impact on Productivity due to Wireless Broadband (2015)

Industry Vertical	Industry Contribution to GDP in 2015	Share of Increase in Productivity in 2015
Manufacturing, Mining & Industry	17%	11%
Government & PSUs	3%	1%
Services (excluding IT / ITeS)	57%	75%
IT / ITeS	11%	11%
Agriculture	12%	2%
Total	100% (INR 143 trillion)	100% (INR 0.89 trillion)

The service industry including IT/ITes will benefit the most from wireless broadband services

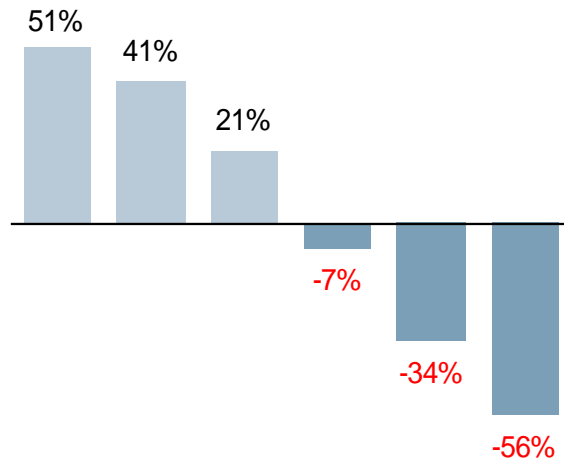
2nd Order Impact


Note: 1. Comprises organized sector employees only (employees with enterprises for which statistics are available from budget documents or reports, or whose activities or data collection are regulated under legal provision)

Source: Analysys Mason, EIU, Euromonitor, NASSCOM, CII-PWC Report on IT/ITeS Industry

However, the lack of spectrum will be a formidable constraint to realizing the broadband potential

Spare Spectrum Availability Based on Existing Spectrum Allocation²



Assumptions

	2010	2011	2012	2013	2014	2015
Bandwidth per user ¹ (Kbps)	383	570	916	1,414	1,978	2,476
Allocated bandwidth (MHz)	5.0	5.0	5.0	5.0	5.0	5.0

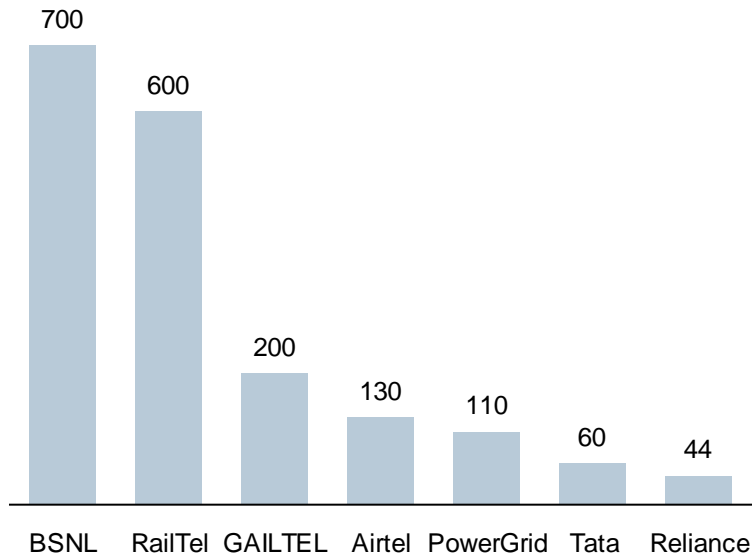
- The current spectrum allocation will not support the projected number of broadband users
- A high level analysis based on projected demand per user, available spectrum and current network coverage indicates that the operators will not be able to serve more than ~65 million subscribers without significant additional investments in sites
 - ♦ The associated investments for smaller cell size and more dense coverage is unlikely to make the take-up of broadband in suburban and rural areas economically viable

Note: 1. Average subscribed bandwidth per user; 2. Estimated 7.5 Mbps capacity available for data per 3G cell site, after adjustment for allocation of voice

Source: Analysys Mason

Additionally, lack of backbone infrastructure severely restricts deployment of broadband services

Number of Cities Covered with Fibre Backbone by Service Providers in India



- All the service providers have extensive coverage of fibre backbone in metros / tier I cities¹ (top 8 cities)
 - With the exception of BSNL (which covers all the 700 cities) and Railtel, all the other service providers have extremely low coverage in other cities
- Rural areas have extremely poor coverage, with only BSNL and Railtel covering a few thousand gram panchayats²
 - ♦ BSNL covers about 28,000 gram panchayats out of a total 265,000³
 - ♦ All mid-sized / small villages currently remain uncovered by any service provider

Note: 1. Includes top 8 cities with population > 4 mn and total income > INR 100 bn; 2. Gram panchayats are local governments at the village or small town level in India with minimum population of 300; 3. 2002 estimate for total gram panchayats

Source: Analysys Mason, Company Websites

A clear policy roadmap for allocation of additional spectrum is required to help achieve this growth potential

Frequency Bands & Key Issues

3.3GHz	Existing Allocation and Availability
2.5GHz	Future Roadmap ¹ / Satellite Interference
2.3GHz	Capacity Constraint ²
2.1GHz	Capacity Constraint / Future Roadmap
1800MHz	Capacity Constraint
900MHz	Capacity Constraint
800MHz	Capacity Constraint
700 MHz	Future Roadmap
450MHz	Future Roadmap

Digital Dividend Spectrum

- Future Roadmap: Future allocation of various frequency bands is not clear making it difficult for carriers to plan network rollout and establish their technology roadmap for services
- Digital Dividend: Lower frequency bands such as 450 MHz and 700 MHz are best suited for providing rural broadband services and can substantially reduce roll-out cost
- Existing Allocation & Availability: Better coordination between different Govt departments tracking where / how much spectrum is being used, and thus support re-farming to increase total capacity available and allow more efficient allocations
- In addition, there are other policy constraints such as Right of way, active infrastructure sharing, mandate provision of fiber capacity and inclusion of Microwave for backhaul

Note: 1. Future Roadmap refers to frequency band with no existing allocation for commercial usage and can be used for offering wireless broadband services; 2. Capacity constraint refers to frequency band already allocated and with no spare capacity available

Source: Analysys Mason

Analysys Mason Limited
BD - 4th Floor, Big Jo's Tower
Netaji Subhash Place, Pitampura
New Delhi 110034
India
Tel: +91 11 4700 3100
Fax: +91 11 4700 3102
www.analysysmason.com