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 gain

- 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 paper 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

<table>
<thead>
<tr>
<th>Terms</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wireline</strong></td>
<td>Lines of copper / cable / fiber deployed underground or overhead for voice / internet services</td>
</tr>
<tr>
<td><strong>Fixed Broadband – Wireline</strong></td>
<td>Data connection (&gt;=256 Kbps download or upload speed) over wireline infrastructure</td>
</tr>
<tr>
<td><strong>Fixed Broadband – Wireless</strong></td>
<td>Data connection (&gt;=256 Kbps download or upload speed) over wireless transmission accessed from a fixed location, primarily using WiMAX 802.16-2004 / 802.16.d technology</td>
</tr>
<tr>
<td><strong>Wireless Broadband</strong></td>
<td>Data connection (&gt;=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</td>
</tr>
<tr>
<td><strong>Internet Users</strong></td>
<td>Unique users accessing internet from private / shared / corporate connection</td>
</tr>
<tr>
<td><strong>Wireless Broadband Users</strong></td>
<td>Unique users accessing wireless broadband services from private / shared / corporate connection</td>
</tr>
<tr>
<td><strong>Consumers</strong></td>
<td>Individuals accessing broadband services from residential premises or SOHO (Small Office, Home Office) &amp; unorganized sector (whose activities / data collection is not regulated under any legal provision) businesses</td>
</tr>
<tr>
<td><strong>Enterprises</strong></td>
<td>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)</td>
</tr>
<tr>
<td><strong>Direct Impact</strong></td>
<td>Consumer and enterprise spend on devices and services for accessing wireless broadband</td>
</tr>
<tr>
<td><strong>Ecosystem Impact</strong></td>
<td>Revenues generated by the telecom and adjacent industries from value added services / other services enabled by wireless broadband access</td>
</tr>
<tr>
<td><strong>Second Order Impact</strong></td>
<td>Increase in economic productivity of the work force as a result of access to wireless broadband services</td>
</tr>
</tbody>
</table>
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)

<table>
<thead>
<tr>
<th></th>
<th>Direct</th>
<th>Ecosystem</th>
<th>Second Order</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spend on Services and Devices</td>
<td>93</td>
<td>29</td>
<td>40</td>
<td>162</td>
</tr>
<tr>
<td>Spend on ecosystem elements using wireless BB</td>
<td>0.06%</td>
<td>0.02%</td>
<td>0.03%</td>
<td>0.11%</td>
</tr>
</tbody>
</table>

Spare Spectrum Availability Based on Existing Spectrum Allocation

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocated bandwidth (MHz)</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Assumptions

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth per user¹ (Kbps)</td>
<td>383</td>
<td>570</td>
<td>916</td>
<td>1,414</td>
<td>1,978</td>
<td>2,476</td>
</tr>
</tbody>
</table>

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

Key Metrics for Scenarios of Spectrum Allocation (2015)

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Allocated Bandwidth</th>
<th>Wireless BB Penetration</th>
<th>Wireless Broadband Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>5 MHz</td>
<td>9.2%</td>
<td>117 mn</td>
</tr>
<tr>
<td>Base</td>
<td>10 MHz</td>
<td>12.5%</td>
<td>158 mn</td>
</tr>
<tr>
<td>High</td>
<td>20 MHz</td>
<td>16.1%</td>
<td>204 mn</td>
</tr>
</tbody>
</table>

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
## Contents

**Executive Summary**

- Overview of Broadband Services in India
- Impact of Wireless Broadband on GDP
  - Direct Impact: Industry Revenues and GDP
  - Ecosystem Revenues and GDP
- Second Order Impact / Externalities: Socio Economic Metrics and GDP

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

- 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

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

<table>
<thead>
<tr>
<th>Country</th>
<th>Wireline</th>
<th>Wireless Broadband</th>
<th>Fixed Broadband - Wireline</th>
<th>Fixed Broadband - Wireless</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>6%</td>
<td>4%</td>
<td>23%</td>
<td>2%</td>
</tr>
<tr>
<td>Russia</td>
<td>8%</td>
<td>12%</td>
<td>32%</td>
<td>1%</td>
</tr>
<tr>
<td>India</td>
<td>3%</td>
<td>1%</td>
<td>11%</td>
<td>1%</td>
</tr>
<tr>
<td>China</td>
<td>8%</td>
<td>15%</td>
<td>22%</td>
<td>1%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>5%</td>
<td>8%</td>
<td>1%</td>
<td>1%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GDP per Capita (USD)</th>
<th>Brazil</th>
<th>Russia</th>
<th>India</th>
<th>China</th>
<th>Indonesia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8,214</td>
<td>8,675</td>
<td>1,111</td>
<td>3,678</td>
<td>2,247</td>
</tr>
</tbody>
</table>

Source: Analysys Mason, TeleGeography, Wireless Intelligence, EIU

Note: 1. Penetration as % of population; 2. Wireless broadband includes WCDMA, HSPA, CDMA EV-DO and TD-SCDMA
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

Note: 1. Annual Total Cost of Ownership: includes depreciated entry-level cost of PC & modem and entry level service charges
Source: Analysys Mason, TRAI, Euromonitor, JuxtConsult, Compay websites
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

<table>
<thead>
<tr>
<th>Unit Sales</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.3 mn</td>
<td>36%</td>
<td>34%</td>
<td>34%</td>
</tr>
<tr>
<td>11.4 mn</td>
<td>18%</td>
<td>18%</td>
<td>18%</td>
</tr>
<tr>
<td>13.6 mn</td>
<td>12%</td>
<td>12%</td>
<td>12%</td>
</tr>
</tbody>
</table>

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

Internet Access Points for Urban Users

<table>
<thead>
<tr>
<th>Internet Users</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>32 mn</td>
<td>22%</td>
<td>25%</td>
<td>27%</td>
<td>30%</td>
</tr>
<tr>
<td>46 mn</td>
<td>39%</td>
<td>36%</td>
<td>37%</td>
<td>37%</td>
</tr>
<tr>
<td>50 mn</td>
<td>31%</td>
<td>30%</td>
<td>26%</td>
<td>23%</td>
</tr>
<tr>
<td>63 mn</td>
<td>6%</td>
<td>7%</td>
<td>8%</td>
<td>5%</td>
</tr>
</tbody>
</table>

- 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

<table>
<thead>
<tr>
<th>Technology</th>
<th>Time to Deploy</th>
<th>Capex per Sub</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSL (FTTN)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Existing Line</td>
<td>Low</td>
<td>USD 799</td>
</tr>
<tr>
<td>New Line</td>
<td>High</td>
<td>USD 2,200</td>
</tr>
<tr>
<td>DSL (FTTN)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FTTH</td>
<td>High</td>
<td>USD 2,540</td>
</tr>
<tr>
<td>FTTB</td>
<td>Medium</td>
<td>USD 1,390</td>
</tr>
<tr>
<td>WiMAX (802.16.e)</td>
<td>Low</td>
<td>USD 133</td>
</tr>
<tr>
<td>HSPA¹</td>
<td>Low</td>
<td>USD 125</td>
</tr>
</tbody>
</table>

• 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

Note: 1. Does not include cost of spectrum; 2. Multi Dwelling Units
Source: Analysys Mason, Industry Inputs
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)**

- Only up to 15 mn lines of the existing 37.0 mn fixed lines can be upgraded to DSL due to loop length & copper quality issues
- Fragmented business limits scalability
- Cable plant up-gradation cost significant
- No scalability constraint, except spectrum
- Lowest Capex and rollout time
- High cost associated with fibre deployment per subscriber

<table>
<thead>
<tr>
<th>Technology</th>
<th>Capex / Sub</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>8.77</td>
<td></td>
</tr>
<tr>
<td>DSL</td>
<td>7.59</td>
<td></td>
</tr>
<tr>
<td>Cable</td>
<td>0.61</td>
<td></td>
</tr>
<tr>
<td>Wireless</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>Fibre</td>
<td>0.42</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>0.05</td>
<td></td>
</tr>
</tbody>
</table>

**Capex / Sub**

- **DSL**: USD 2,200¹
- **Cable**: USD 930
- **Wireless**: USD 125²
- **Fibre**: USD 1,400³

**Note:**

1. DSL Capex per sub comprises of cost for FTTN New Copper line while for existing line Capex per sub is USD 800.
2. Wireless Capex per sub includes HSPA capex per sub.
3. Capex per sub for Fibre comprises of FTTB connection.

Source: Analysys Mason, TRAI
However, with severe spectrum congestion in voice services, carriers find it difficult to spare capacity for wireless data.

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.

---

Note: 1. Dotted line indicates DoT Criteria for maximum number of subscribers per MHz (at 10 MHz spectrum for GSM and 5 MHz for CDMA)

Source: Analysys Mason, TRAI
With economies of scale, wireless broadband offering will become more affordable for the mass market consumers

**Broadband / Internet TCO\(^1\) as % of per Capita Consumption (2015)**

<table>
<thead>
<tr>
<th></th>
<th>Wireline Broadband</th>
<th>Wireless BB - Data Only(^2)</th>
<th>Wireless BB – Mobile(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Device Type</strong></td>
<td>Desktop</td>
<td>Embedded Netbook</td>
<td>Smartphone</td>
</tr>
<tr>
<td><strong>Device Cost (INR)</strong></td>
<td>8,000</td>
<td>10,000</td>
<td>5,000</td>
</tr>
<tr>
<td><strong>Device Lifetime</strong></td>
<td>3</td>
<td>3</td>
<td>2.5</td>
</tr>
<tr>
<td><strong>Modem Cost (INR)</strong></td>
<td>2,000</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Modem Lifetime</strong></td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Monthly Service Charge – Entry Level (INR / month)</strong></td>
<td>125</td>
<td>150</td>
<td>30</td>
</tr>
</tbody>
</table>

- 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

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

### Service Providers
- Telecom operators and ISPs have made total investment of ~ INR 1,000 bn (USD 23 bn) for 3G and BWA spectrum, and are entering into ecosystem partnerships for delivery of data-intensive services

### Device OEMs
- Device vendors are launching mass market access devices such as INR 7,000 (USD 150) smartphones and INR 14,000 (USD 300) netbooks, and partnering with operators to bundle video capable handsets

### Delivery & Enabling Platform Providers
- Technology vendors, both Indian and global, are developing platforms such as SDPs\(^1\) for integrated and seamless multi-screen experience, ODPs\(^2\) for easy discovery and activation, and enabling platforms (such as advertising, relevance, content management and commerce) for enhanced experience and ease of use

### Product / Application Providers
- Data-focused as well as mass market product and application platforms offering services such as mobile / broadband TV, online gaming and rural VAS are being developed by various local vendors

### Content Aggregators / Developers
- Content providers are aggregating and developing both popular entertainment content such as music / videos, and mass market content such as utility applications and educational content, customized for the small screen

---

Note: 1. SDPs: Service Delivery Platforms; 2. ODPs: On Device Portals
Source: Analysys Mason, Industry Inputs, Company Websites

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

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

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

Source: Analysys Mason, Industry Inputs
Increase in broadband penetration will have a direct revenue impact of INR 787 bn (0.55% of GDP) in 2015

**Key Metrics – Direct Impact of Wireless Broadband Penetration**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>2010</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wireless broadband users (million)</td>
<td>10</td>
<td>158</td>
</tr>
<tr>
<td>Penetration of population</td>
<td>0.8%</td>
<td>12.5%</td>
</tr>
<tr>
<td>Wireless broadband service ARPU (INR / month)</td>
<td>523</td>
<td>343</td>
</tr>
<tr>
<td>Households with wireless broadband connection (million)(^1)</td>
<td>6</td>
<td>72</td>
</tr>
<tr>
<td>Businesses with wireless broadband connection (million)(^1)</td>
<td>1.4</td>
<td>4.0</td>
</tr>
</tbody>
</table>

Note: 1. Includes households and businesses with multiple connections and users

Source: Analysys Mason, Industry Inputs
The growth in wireless broadband services spend will be driven by increase in consumer base & enterprise penetration

- 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

Source: Analysys Mason
The market for wireless devices will be driven by consumer-centric devices and will see local vendors expanding globally.

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.

Source: Analysys Mason
Increasing penetration of wireless broadband will have a significant impact on the broadband ecosystem revenues

<table>
<thead>
<tr>
<th>Wireless BB Ecosystem</th>
<th>Description</th>
<th>Drivers in India</th>
<th>Wireless BB Revenue (INR bn)</th>
</tr>
</thead>
</table>
| **Consumer / Retail** | • It includes:  
  - M-Commerce  
  - M-Entertainment  
  - M-gaming  
  - M-app  
  - M-Advertising | • 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 | 2010: 9  
  2015: 187 |
| **Financial Service** | • It consists of M-Banking and remittances using wireless BB | • 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 | 2010: 16  
  2015: 205 |
| **Social Services** | • It includes services such as learning, healthcare and governance accessed on wireless mode  
  • 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 | 2010: 2  
  2015: 63 |
| **Corporate / Verticals** | • Use of wireless BB for farming, utilities such as M2M and for enterprise solutions | • 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 | 2010: 6  
  2015: 60 |

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

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

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

- 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

Source: Analysys Mason
Tech enabled social service market in India is currently very underpenetrated with no strong player

- **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

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

Estimation of Impact on Productivity due to Wireless Broadband

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 mn</td>
<td>27 mn</td>
</tr>
<tr>
<td>CAGR: 39%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Increase in Industry Productivity in 2015

INR 888 bn (USD 21 bn)

0.62% of GDP


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

Note: 1. Includes retail wireless broadband connections used for official / business purpose and corporate connections
Source: Analysys Mason, EIU, Euromonitor, NASSCOM, CII-PWC Report on IT/ITeS Industry
The service industry including IT/ITes will benefit the most from wireless broadband services

<table>
<thead>
<tr>
<th>Industry Vertical</th>
<th>Penetration of Wireless Broadband and User Base (in Parentheses)</th>
<th>Productivity Gain in 2015 (INR bn)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2010</td>
<td>2015</td>
</tr>
<tr>
<td>Manufacturing, Mining &amp; Industry</td>
<td>5%</td>
<td>21%</td>
</tr>
<tr>
<td></td>
<td>(0.4% of industry revenues in 2015)</td>
<td></td>
</tr>
<tr>
<td>Government &amp; PSUs</td>
<td>4%</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>(0.3% of industry revenues in 2015)</td>
<td></td>
</tr>
<tr>
<td>Services (excluding IT / ITeS)</td>
<td>9%</td>
<td>39%</td>
</tr>
<tr>
<td></td>
<td>(0.8% of industry revenues in 2015)</td>
<td></td>
</tr>
<tr>
<td>IT / ITeS</td>
<td>21%</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>(0.6% of industry revenues in 2015)</td>
<td></td>
</tr>
<tr>
<td>Agriculture</td>
<td>0%</td>
<td>2%</td>
</tr>
<tr>
<td></td>
<td>(0.1% of industry revenues in 2015)</td>
<td></td>
</tr>
</tbody>
</table>

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.

- 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 ~80 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.

**Spare Spectrum Availability Based on Existing Spectrum Allocation**

**Assumptions**

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth per user¹ (Kbps)</td>
<td>383</td>
<td>570</td>
<td>916</td>
<td>1,414</td>
<td>1,978</td>
<td>2,476</td>
</tr>
<tr>
<td>Allocated bandwidth (MHz)</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

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

- 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

---

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

- BSNL: 700
- RailTel: 600
- GAILTEL: 200
- Airtel: 130
- PowerGrid: 110
- Tata: 60
- Reliance: 44

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**

<table>
<thead>
<tr>
<th>Frequency Band</th>
<th>Key Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3GHz</td>
<td>Existing Allocation and Availability</td>
</tr>
<tr>
<td>2.5GHz</td>
<td>Future Roadmap¹ / Satellite Interference</td>
</tr>
<tr>
<td>2.3GHz</td>
<td>Capacity Constraint²</td>
</tr>
<tr>
<td>2.1GHz</td>
<td>Capacity Constraint / Future Roadmap</td>
</tr>
<tr>
<td>1800MHz</td>
<td>Capacity Constraint</td>
</tr>
<tr>
<td>900MHz</td>
<td>Capacity Constraint</td>
</tr>
<tr>
<td>800MHz</td>
<td>Capacity Constraint</td>
</tr>
<tr>
<td>700 MHz</td>
<td>Future Roadmap</td>
</tr>
<tr>
<td>450MHz</td>
<td>Future Roadmap</td>
</tr>
</tbody>
</table>

**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
Contents

Executive Summary

Overview of Broadband Services in India

Macroeconomic Overview of India

Demand Side Analysis

Supply Side Analysis

The Wireless Broadband Ecosystem

Socio-economic Impact of Wireless Broadband

Imperatives for Stakeholders in the Indian Wireless Broadband Industry
The macroeconomic conditions are improving the prospects for broadband adoption in India

- Indian economy has experienced a high growth rate despite the global economic downturn, and is expected to sustain a strong GDP growth in the next ten years. Main drivers of higher growth rate of economy are improving demographics, structural reforms and globalization

- India is highly populated country with population density of 387 persons per sq km. India’s population has crossed 1 billion mark and is growing at a rate of 1.4% every year
  - This growth mainly comes from rural areas. More than 70% of Indian population are in rural areas, which has major concerns such as poor infrastructure, lower income level and illiteracy to address for better broadband penetration
  - The low literacy rate in India remains a medium-term constraint for the broadband market due to limited relevance of content and lack of language knowledge
  - Demographics of India population, however, is favorable for the adoption of broadband and data services. 35% of population is between 15 to 35 years of age and this group has the maximum internet users

- With the sustained growth of economy and favorable demographics, the income level of households will increase, expanding the middle class segment. This will lead to livelihood enhancement, increase in consumption and further growth of economy

- Service sector contribution to GDP is increasing substantially with rapid urbanization, expansion of public sector, awareness and adoption of ICT and increased demand for consumer services such as healthcare and education

- With increase in income levels and population growth, the consumption per household also increases. Share of communication in consumption spent per household is expected to increase with a CAGR of 6%
India has seen a sustained economic growth and is expected to outpace China’s GDP growth by 2013-15

- Indian economy has been growing at high rate, reaching about 8.8% nominal GDP growth in the last quarter
- This level of growth is expected to be sustained for the next few years, with improving demographics, rising income levels, structural reforms and globalization
  - It is expected that India’s GDP will accelerate to a sustainable rate of 9 to 10% by 2013 - 2015, exceeding the average growth rate of 7.3% over the past 10 years
  - India's GDP is expected to quadruple over the next ten years and the country is likely to become a USD 4 trillion economy by 2020

Source: Analysys Mason, Reserve Bank of India, EIU, Industry Inputs
India’s population of 1 billion is growing at 1.5%, although population density varies significantly across states.

- India has 17% of the world's population, which is growing at the rate of 1.5%, as compared to China (0.5%), Russia (~ -0.1%) and Brazil (1.3%%) from 2010 to 2015.

- The low population density of 387 persons per sq km makes serving rural areas a challenge for the broadband industry.

Source: Analysys Mason, EIU
Population mix remains skewed in favor of rural population – challenging the economics of broadband

- Rural population has lower income level, and hence the affordability of broadband service becomes an issue
  - On average, nominal urban earnings are 40% more than rural earnings
  - About 42% of population in India is below the poverty line¹
- Rural areas have poor infrastructure and accessibility, making it difficult to increase wireline based broadband penetration
  - Out of total 9 million broadband subscribers at the end of April 2010, only 5% are in the rural areas
  - There has been improvement in rural road connectivity, increasing from about 40% in 2004 to about 70% at the end of 2008

Note: 1. Below Poverty Line households are defined as those earning less than USD 1.25 per day
Source: Analysys Mason, TRAI, Euromonitor
Although literacy levels are improving with government initiatives, yet India is significantly behind its peers.

- Government in India is taking initiatives to improve literacy in India
  - Karnataka state government launched ‘Saakshar Bharat Scheme’ to improve literacy rate in Karnataka from the present 66.6% to 80% by 2012
  - Illiteracy rate has been reduced with the help of national educational schemes such as “National Literacy Mission” and “Sarva Shiksha Abhiyan”

- Computer literacy also remains low and language constraint limit the relevance of content currently available
  - English literate population is only 91 million and the total computer literates are only 87 million
  - Only 1.8% of all Indians (20 million) prefer to read in English

**BRIC Countries: Adult Literacy Rate**

<table>
<thead>
<tr>
<th>Year</th>
<th>Brazil</th>
<th>Indonesia</th>
<th>India</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>64%</td>
<td>72%</td>
<td>80%</td>
<td>96%</td>
</tr>
<tr>
<td>2007</td>
<td>64%</td>
<td>72%</td>
<td>80%</td>
<td>96%</td>
</tr>
<tr>
<td>2008</td>
<td>64%</td>
<td>72%</td>
<td>80%</td>
<td>96%</td>
</tr>
<tr>
<td>2009</td>
<td>64%</td>
<td>72%</td>
<td>80%</td>
<td>96%</td>
</tr>
</tbody>
</table>

**BRIC Countries: Literate Population (Mn)**

- China: 1,038
- India: 544
- Indonesia: 155
- Brazil: 134

Note: 1. Literacy rate taken as percentage of literate adults in populations of age above 15 years
Source: Analysys Mason, Euromonitor
However, increasing share of youth population, is expected to significantly drive utility and relevance of broadband

- Adoption of technologies and services is high among the youth segment, as most of the internet content is focused on the age group of 18-35 years
- Internet is primarily used by the youth segment for entertainment (downloading videos & music), social networking, micro-blogging and consumption of user generated content

**BRIC Countries: Share of Population by Age Segment in the Year 2009**

<table>
<thead>
<tr>
<th></th>
<th>Brazil</th>
<th>Russia</th>
<th>India</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-14 yrs</td>
<td>7%</td>
<td>33%</td>
<td>13%</td>
<td>26%</td>
</tr>
<tr>
<td>15-34 yrs</td>
<td>15%</td>
<td>13%</td>
<td>5%</td>
<td>10%</td>
</tr>
<tr>
<td>35-64 yrs</td>
<td>35%</td>
<td>35%</td>
<td>29%</td>
<td>28%</td>
</tr>
<tr>
<td>65+ yrs</td>
<td>26%</td>
<td>37%</td>
<td>29%</td>
<td>17%</td>
</tr>
</tbody>
</table>

**Age Distribution of Regular Internet Users in India, 2009**

- 2% (13-18 yrs)
- 38% (19-24 yrs)
- 44% (25-35 yrs)
- 10% (36-45 yrs)
- 4% (46-55 yrs)
- 2% (Above 55 yrs)

Source: Analysys Mason, Euromonitor, JuxtConsult India Online Report: 2009
Average real household income in India is expected to triple from 2005 to 2025, encouraging higher consumption.

With the growth of economy, the income level of households also increases.

- Average real household disposable income is set to grow from 113,744 Indian rupees in 2005 to 318,896 Indian rupees by 2025 at a CAGR of 5.3%.

- Growth in Indian incomes and consumption will deliver substantial societal benefits, with further increase in service consumption, declines in poverty and the growth of a large group of middle income households.

Note: 1. Low income segment includes HH earning less than INR 200,000 in a year, middle Income segment includes HH earning between INR 200,00 to INR1,000,000 per year, and high income segments include HH earning above INR 1,000,000.

Source: Analysys Mason, McKinsey Global Institute.
With higher productivity and sustained economic growth of India, the disposable income will increase.

- Income growth is dependent on the overall economic growth in coming years
  - Main drivers for the increase in income levels include sustained growth of the Indian economy, favorable demographic trends, and stable foreign exchange rates
  - Conducive business environment backed by structural reforms and globalization have led to increase in productivity and income levels

**BRIC Countries: Personal Disposable Income - Nominal (USD billion), 2009**

- Brazil: 1,016
- Russia: 756
- India: 1,082
- China: 2,166

**BRIC Countries: Growth in Personal Disposable Income (Real Terms)**

- Brazil
- Russia
- India
- China

Source: Analysys Mason, RBI, EIU
Economic development will be supported by an increase in contribution of services to the GDP

With the limited scope of growth in the agriculture and industry segment, growth in GDP will be driven by the services sector

- Growth in agriculture and industry sector is declining, and the GDP growth momentum is coming from services sector which is growing at ~15% per annum

- Main reasons behind the growth of services include rapid urbanization and increased demand for intermediate and final consumer services
  - ICT services have increased their share in service sector GDP from 6% in 2001 to 10% in 2008

Source: Analysys Mason, RBI
With improved income level of households, spent on communication and other services is expected to go up.

Main drivers for increased consumption are rising incomes, population growth and substantial savings.

The increased purchasing power enables consumer to spend higher on services such as healthcare, personal products.

- Spent on Food & beverages is constant, and its share to consumption decreases.
- Communications accounts for around 2% of spending currently and is expected to witness fastest CAGR of over 6%.
Executive Summary

Overview of Broadband Services in India
- Macroeconomics of India

Demand Side Analysis
- Supply Side Analysis

The Wireless Broadband Ecosystem

Socio-economic Impact of Wireless Broadband

Imperatives for Stakeholders in the Indian Wireless Broadband Industry
Affordability of broadband remains limited due to high device costs – the industry to focus in increasing utility of services

- Rural areas are under-penetrated with ~30% share of total wireline / wireless voice connections
- Number of fixed internet users is further limited in rural areas, while it is growing rapidly in tier III / IV cities, driven by the youth segment accessing primarily through cyber cafes
- Broadband services as percentage of per capita income is high compared to other countries, though ARPU is similar, indicating concentration of broadband connectivity among high-income urban areas
- Mobile handsets have a strong potential to drive broadband penetration owing to lower cost of ownership as compared to PC-based access as well much higher device penetration
- Current usage of internet is focused on mails, SNC, information search and entertainment, with lack of localized online content as another constraint to broadband utility for the masses
- Internet usage for utilities such as financial transactions is extremely limited with significant impact potential
- Broadband has a significant role to play in extending the reach of education and healthcare facilities to the masses, as well as enhancing labor productivity through enablement of tele-working at home or during commute
- Governance is another major area currently challenged with consumer inconvenience, high processing timelines and Government overheads which can be significantly reduced through technology-enablement
This macroeconomic context results in a low affordability and utility of broadband services, which impacts adoption.

- **Currently**, the broadband penetration is just 0.74% compared to overall teledensity of 52.74% (QE-Mar’10)

- **Affordability issues**
  - High TCO as % of overall per capita spend
    - High device pricing

- **Relevance and Utility issues**
  - Literacy issues
  - Lack of content in regional languages
  - Lack of relevant mass market content

---

**BRIC Countries: % Penetration of Internet and Broadband Service**

- **Brazil**: 41% Broadband, 5.8% Internet
- **Russia**: 14% Broadband, 6.4% Internet
- **India**: 9% Broadband, 0.5% Internet
- **China**: 23% Broadband, 6.0% Internet

*Source: Analysys Mason, RBI*
The spend on broadband services as % of per capita income is high compared to other countries, though ARPU is similar

- Broadband ARPU in India is estimated at ~ INR 600 (USD 12), which is similar to some of the other countries in Asia
- The high ARPU to GDP ratio is a result of the high income disparity between urban and rural areas
- Most of the broadband users are concentrated in urban centers with much higher income levels as compared to other areas

**BRIC Countries: ARPU (USD) and ARPU as a % of GDP per Capita**

- **India**: ARPU (USD) 13.3%, ARPU as % of GDP per Capita 12.3%
- **China**: ARPU (USD) 9.6, ARPU as % of GDP per Capita 3.1%
- **Russia**: ARPU (USD) 16.9, ARPU as % of GDP per Capita 2.3%
- **Indonesia**: ARPU (USD) 14.7, ARPU as % of GDP per Capita 7.8%

Source: Analysys Mason, RBI
TCO for broadband services currently has significant share of consumer wallet, though this will come down by 2015

Entry-level TCO\(^1\) as % of Overall per Capita Consumption (2009 and 2015)

<table>
<thead>
<tr>
<th></th>
<th>2009</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Per Capita Consumption:</td>
<td>Per Capita Consumption:</td>
</tr>
<tr>
<td></td>
<td>INR 30,291</td>
<td>INR 52,134 (2015)</td>
</tr>
<tr>
<td></td>
<td>Dial-up Internet</td>
<td>Fixed BB - Wireline</td>
</tr>
<tr>
<td>Device TCO</td>
<td>13%</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td>Fixed BB - Wireline</td>
<td>Fixed BB - Wireline</td>
</tr>
<tr>
<td>Service TCO</td>
<td>20%</td>
<td>14%</td>
</tr>
<tr>
<td></td>
<td>1%</td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td>12%</td>
<td>14%</td>
</tr>
<tr>
<td></td>
<td>10.2%</td>
<td>9.8%</td>
</tr>
<tr>
<td></td>
<td>3.2%</td>
<td>3.4%</td>
</tr>
<tr>
<td></td>
<td>7.0%</td>
<td>6.4%</td>
</tr>
<tr>
<td></td>
<td>4.5%</td>
<td>0.7%</td>
</tr>
<tr>
<td></td>
<td>3.8%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wireline BB</td>
<td>Wireless BB - Data Only</td>
</tr>
<tr>
<td></td>
<td>20%</td>
<td>14%</td>
</tr>
<tr>
<td></td>
<td>3.2%</td>
<td>3.4%</td>
</tr>
<tr>
<td></td>
<td>7.0%</td>
<td>6.4%</td>
</tr>
<tr>
<td></td>
<td>4.5%</td>
<td>0.7%</td>
</tr>
<tr>
<td></td>
<td>3.8%</td>
<td></td>
</tr>
</tbody>
</table>

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

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

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 connection bundled with voice services

Source: Analysys Mason, Company websites
With a much higher base of data-enabled devices, handsets have a strong potential to drive broadband penetration.

<table>
<thead>
<tr>
<th>Items</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential Desktops</td>
<td>8.3</td>
<td>9.9</td>
</tr>
<tr>
<td>Residential Laptops</td>
<td>1.7</td>
<td>2.5</td>
</tr>
<tr>
<td>Wireless Data Cards ¹</td>
<td>2.1</td>
<td>3.5</td>
</tr>
<tr>
<td>Data Enabled Handsets</td>
<td>101¹</td>
<td>149¹</td>
</tr>
<tr>
<td>GPRS Active Subs</td>
<td>30</td>
<td>44</td>
</tr>
</tbody>
</table>

- Residential PC (desktops & laptops) penetration stands at only 6% of total households, while internet connections as % of PC base is about 60%.
- Wireless data cards are currently used primarily by businesses and serve primarily as a back-up connectivity option in the absence of fixed internet connectivity.

Note: 1. Includes enterprise connections

Source: Analysys Mason, TRAI, IMRB, Industry Inputs
The current usage pattern of internet is very entertainment centric and does not address key mass market applications.

- The current usage pattern is focused on communication and entertainment and is similar to the global usage pattern.
- This is due to the high end user segment accessing the internet today, as well as lack of spectrum / bandwidth to drive applications.
- Key applications which can significantly scale with 3G and BWA include:
  1. Vernacular websites and content
  2. Online financial transactions
  3. Healthcare services for remote areas
  4. Distance education and e-learning
  5. Tele-working and commute working
  6. Enterprise mobility applications
  7. Tech-enabled Government services

Source: Analysys Mason, RBI
Availability of local online content remains limited, but can help in expanding the reach of internet to the mass market.

**Status of Local Language Internet Users (Share of Total Internet Users)**

- While 87% Indians prefer to browse in local languages, only 42% visit any local language websites due to lack of relevant content in regional languages.

**Indian Language Websites (2008)**

- Limited number of local language sites reflects the lack of localized online content to which is relevant for the mass market consumers.

Source: Industry Inputs, Analysys Mason
Use of internet for financial transactions and banking is extremely limited, but has a significant impact potential

Status of Banked Population and Net Banking Users (2009)¹

<table>
<thead>
<tr>
<th></th>
<th>Total (mn)</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Bank Accounts</td>
<td>361</td>
<td>31% (of Total Population)</td>
</tr>
<tr>
<td>Net Banking Users</td>
<td>23</td>
<td>6% (of Bank Accounts)</td>
</tr>
<tr>
<td>Urban Adults with Bank Account</td>
<td></td>
<td>60% of Urban Adults</td>
</tr>
<tr>
<td>Rural Adults with Bank Account</td>
<td></td>
<td>39% of Rural Adults</td>
</tr>
</tbody>
</table>

- Broadband offers a significant opportunity to enable financial inclusion to address the unbanked population in India
- Wireless broadband will be the key to virtual accounts and money transfer for the unbanked poor

Usage of Internet for Commerce / Transactions (2009)

- Online Tickets as % of Total Rail Reservations
  - India: 34%
  - US: 6.00%
- Online Retail as % of Total Retail Sales in India and US
  - India: 0.06%
  - US: 6.00%

- Currently online transactions in India are restricted primarily to travel reservations
- Online retail transactions are extremely low and broadband penetration can play a significant role in e-enabling retail in India

Note: 1. Estimates based on 2007 numbers
Source: Industry Inputs, Analysys Mason
Tele-medicine based initiatives have a significant role to play in addressing the poor state of healthcare infrastructure

### Key Challenges in Healthcare Delivery in India

<table>
<thead>
<tr>
<th>Urban</th>
<th>Semi-Urban</th>
<th>Village</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Hospital" /></td>
<td><img src="image2" alt="Primary Heath Centre &amp; Sub-Centre" /></td>
<td><img src="image3" alt="Village Dispensary" /></td>
</tr>
<tr>
<td><img src="image4" alt="250 Kms" /></td>
<td><img src="image5" alt="10 – 15 Kms" /></td>
<td></td>
</tr>
</tbody>
</table>

- **High cost of private healthcare, resource limitation and sub optimum utilization**
  - Only 0.7 hospital beds per 1,000 population
  - Only 5-6 Docs per 10K population
  - Very high cost of private healthcare for mass market customers
  - 70% of hospitals and 40% of hospital beds are in private sector

- **Limited resources and inadequate manpower & infrastructure**
  - 1 PHC for 30K population
  - PHC has only 4-6 patient beds; 1 Medical Officer
  - 1 PHC for 6 Sub-Centers
  - 1 Sub-Centre for 5K population
  - Sub-Centers have only 2 health workers

- **No access to quality healthcare at a village level, requiring long travel times**
  - Large distances in rural and remote areas
  - Access to only 1.4 dispensaries for 100K villagers
  - Only 0.36 hospital beds per 100K villagers
  - Very basic care available
  - Unaffordable cost of private care in towns

### Increased reach to rural & remote areas
- Telemedicine: remote diagnosis, monitoring and treatment of patients in rural / remote areas at the Sub-Centre and PHC level
- Access to specialist consultation to supplement advice from PHC

### Timely access to critical information
- Emergency support and guidance to health workers and medical officers

### Increased efficiency for medical practitioners
- Electronic Medical Records (EMR) and Hospital Information Systems (HIS) enable real time documentation and information sharing

---

*Note 1: PHC – Primary Health Centre
Source: Analysys Mason*
Extending the reach of education services to the mass market requires technology as the key driver.

**Distance Education and E-learning Markets (2009)**

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total students enrolled in higher education</td>
<td>13 mn</td>
</tr>
<tr>
<td>Total students enrolled in distance learning programs</td>
<td>3.5 mn</td>
</tr>
<tr>
<td>Potential Revenue from distance learning</td>
<td>USD 850 mn</td>
</tr>
<tr>
<td>% Share of online in distance learning</td>
<td>3.5%</td>
</tr>
<tr>
<td>Addressable market opportunity for domestic e-learning</td>
<td>USD 30 mn</td>
</tr>
</tbody>
</table>

- The growing distance learning market will benefit from e-enablement, offering convenience and mobility to the end user.
- IGNOU and other universities are already experimenting with some of these models.

**State of Vocational Training in India**

*Share of labor force receiving vocational training*

- **India**: 8%
- **Korea**: 96%
- **Japan**: 85%
- **Germany**: 86%
- **Canada**: 88%
- **Mexico**: 25%

- India’s fast growing services sector is expected to create large employment opportunities.
  - Meeting this requirement will involve extending the reach of vocational training to the mass market by leveraging broadband.

Source: Industry Inputs, ILO, Analysys Mason
Broadband enabled applications such as tele-working can have a significant impact on labor productivity

- The expanding IT and ITeS industry in India is facing a shortage of skilled workforce, increase in infrastructure costs and travel time.
- Broadband penetration can address these constraints by supporting tele-workers / home workers.

### Potential for Tele-workers / Home Workers

**Workforce requirement by IT-BPO Sector (mn)**

- 60% in Tier-I Cities
- 10.0
- 2.5
- 2009
- 2020
- 90% in Tier-I Cities

### Global Comparison for Commute Time

**Average Commute Time (mins)**

- Global Average: 40
- India Average: 29
- Commuters with over 90 mins Commute Time
- Global: 20%
- India: 26%

- India has high commute time, primarily in the Metros, with increasing emergence of sub-urban areas for residential use.
- High-speed wireless broadband connectivity can help consumption of multiple broadband based services in a mobile environment.

Source: Industry Inputs, NASSCOM, Analysys Mason
Indian SMBs have a low ICT spend currently, and a large latent potential for broadband enabled cloud computing play.

- India has low ICT spend by enterprises as compared to its peers.

Source: Industry Inputs, Gartner, EIU, Analysys Mason
E-enabled governance will impact consumer convenience and processing timelines, and reduce Government overheads

<table>
<thead>
<tr>
<th>Demand Drivers</th>
<th>Description</th>
<th>Supporting Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convenient access and lower cost for citizens / businesses</td>
<td>• E-enabling Government processes result in significant reduction in direct as well as indirect cost to citizen</td>
<td>Number of trips to Government offices</td>
</tr>
<tr>
<td></td>
<td>• Direct cost savings for citizens is in the range of INR 50 – 100 per transaction</td>
<td>Manual: 8.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Online: 2.0</td>
</tr>
<tr>
<td>Reduction in processing time of requests</td>
<td>• Computerization of departments enable faster access to the data thus reducing processing time for the service delivery</td>
<td>Processing time for registering a deed (days)</td>
</tr>
<tr>
<td></td>
<td>• Waiting time at government offices decreases to 20% - 40% as compared to manual system</td>
<td>Manual: 15.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Online: Same day</td>
</tr>
<tr>
<td>Rural empowerment and reduction in overheads for schemes such as NREGA</td>
<td>• E-enabling processes such as identity verification and payment disbursement to rural workers can empower the poor as well as reduce leakage of funds</td>
<td>% NREGA funds misused or diverted¹</td>
</tr>
<tr>
<td></td>
<td>• With ~INR 40,000 Cr being allocated annually for NREGA, huge amounts can be saved from leakage</td>
<td>Manual: 30% - 60%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Online: &lt;10%</td>
</tr>
</tbody>
</table>

Note: 1. Based on survey by *Outlook* in two Indian states, and report by V V Giri National Labour Institute
Source: Industry Inputs, News Articles, Analysys Mason
Due to inherent barriers in the fixed segment, mobile broadband will drive broadband growth

- At the moment broadband penetration is low and remains concentrated in urban areas
- DSL currently dominates the existing BB market but in future it will lose its dominant positions. Fixed line penetration is low (37 million lines in 2009) and the quality of copper is too low to upgrade it to provide DSL services
- Cable BB is contained to the urban areas and will remain a niche technology. Cable market is highly fragmented. Lack of scale makes business case for rural deployment very weak. In addition to that, cable operators have no incentives to upgrade their networks due to existing revenue share framework
- Fixed wireless services, such as WiMAX, are concentrated in urban areas and target high ARPU clientele such as corporate sector. High cost of rural roll out and spectrum capacity limitations hindered the growth so far. However, the recent BWA spectrum allocations are likely to boost the growth
- Mobile broadband already contributes a significant proportion of total broadband connections. With the recent 3G auction and given the constraints in the fixed broadband segment, mobile broadband is likely to drive broadband growth
- The government needs to resolve a number of issues, such as spectrum policy, to further stimulate broadband growth. In addition to that, it launched a number of programs to accelerate broadband penetration in rural areas
## Summary: Supply Side

### Broadband Technology

<table>
<thead>
<tr>
<th>Capex per Sub</th>
<th>HSPA</th>
<th>WIMAX</th>
<th>EVDO</th>
<th>DSL</th>
<th>FTTB</th>
<th>CABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>USD 125¹</td>
<td></td>
<td></td>
<td></td>
<td>~USD 2,200²</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time to Rollout</th>
<th>HSPA</th>
<th>WIMAX</th>
<th>EVDO</th>
<th>DSL</th>
<th>FTTB</th>
<th>CABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spectrum Availablity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spectrum Availablity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Easy up-gradation of existing CDMA sites</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RoW Issues</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RoW Issues</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LCO Unwillingness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Realizable throughput</th>
<th>HSPA</th>
<th>WIMAX</th>
<th>EVDO</th>
<th>DSL</th>
<th>FTTB</th>
<th>CABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.8 Mbps per Site</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 Mbps per Site</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5 Mbps per Site</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 Mbps per Line</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 Mbps per Line</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 Mbps per Line</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ARPU potential</th>
<th>HSPA</th>
<th>WIMAX</th>
<th>EVDO</th>
<th>DSL</th>
<th>FTTB</th>
<th>CABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bundling Possibility</th>
<th>HSPA</th>
<th>WIMAX</th>
<th>EVDO</th>
<th>DSL</th>
<th>FTTB</th>
<th>CABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broadband &amp; Voice bundling possible</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Only Broadband offering possible</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Only Broadband offering possible</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triple Play offering possible</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triple Play offering possible</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triple Play offering possible</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: 1. Does not include cost of spectrum; 2. Capex per sub taken for new line, for existing line the cost is USD 800 including cost of up-gradation of backhaul from central office to node.

Source: Industry Inputs, Analysys Mason

Favorability of parameter: High ☻☻☻☻☻☻ Low ☻☻☻☻☻☻
The broadband market is currently dominated by DSL, but this is not scalable due to copper quality and loop length issues

- DSL accounted for 87% of all fixed broadband connections in 2009
- Cable is a niche service targeting mainly urban areas

<table>
<thead>
<tr>
<th>Broadband Lines Split by Technologies, mn (Mar ’10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>8.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Upgradeable DSL Lines and Required Investments (USD mn): BSNL and MTNL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Items</td>
</tr>
<tr>
<td>----------------------------</td>
</tr>
<tr>
<td>Total Lines (mn)</td>
</tr>
<tr>
<td>Total Households</td>
</tr>
<tr>
<td>Upgradeable Lines (mn)</td>
</tr>
<tr>
<td>Lines Already Upgraded</td>
</tr>
</tbody>
</table>

- Of the existing 32 mn BSNL/MTNL’s fixed lines, only 15 mn lines can be upgraded to DSL due to poor copper quality and other infrastructure issues

Source: Analysys Mason
Cable TV, which usually drives cable BB adoption, is already lagging behind due to competition and head start by DTH, which strengthened its positions in digital TV segment.

- Cable TV, which usually drives cable BB adoption, is already lagging behind due to competition and head start by DTH, which strengthened its positions in digital TV segment.

**Cable industry is likely to remain focused on offering video service due to significant operational and investment issues**

<table>
<thead>
<tr>
<th>1</th>
<th>Fragmented cable industry and absence of players with scale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Over 7,000 MSOs and 60,000 LCOs in cable industry</td>
</tr>
<tr>
<td></td>
<td>• Top 7 MSOs account for only 30% of overall TV households</td>
</tr>
<tr>
<td></td>
<td>• 70% of cable households served by non-aggregated LCOs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2</th>
<th>LCOs have no incentive to upgrade the network</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• The existing regulatory framework on revenue share does not incentivize cable operators to upgrade their networks</td>
</tr>
<tr>
<td></td>
<td>• Currently cable operators under-report about 75-80% of their revenues thus reducing the base subject to revenue sharing</td>
</tr>
<tr>
<td></td>
<td>• Network upgrade implies that their share of revenues will drop from the current 70-75% to 20% and will have to pay more to MSOs and broadcasters</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3</th>
<th>High costs associated with cable network upgrade (DOCSIS)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• For the existing DOCSIS technology, capex per sub for upgrading network to provide BB services remains as high as USD 900</td>
</tr>
</tbody>
</table>

Source: Analysys Mason
Current WiMAX offerings are not to serve the retail segment, but LTE deployments are expected to address this market

- High capex per sub and LOS requirement does not make a strong business case for service providers to target lower ARPU retail customer (CPE for current FDD 802.16d WiMAX deployment costs ~ INR 10 000 and requires physical installation of external antenna with near line of sight)

- However, TD-LTE deployment will take time (~1 year) as the ecosystem is not mature for large scale deployments

### WiMAX Subscribers in 2009 (Thousand)

<table>
<thead>
<tr>
<th>Provider</th>
<th>Market Position</th>
</tr>
</thead>
</table>
| RCOM     | • WiMAX network covers ten cities  
           • Plans to continue to expand the network based on the spectrum received in the recent BWA auction |
| Tata     | • Was the first operator to launch WiMAX services in May 2007  
           • Its WiMAX network covers ten cities  
           • At launch Tata set a target of launching WiMAX BB targeted at corporate segment in 115 cities and residential – in 15 cities |
| Others   | 23              |
|          | 6               |
| RCOM     | 29              |

Source: Analysys Mason
Currently 3G data services market is dominated by CDMA EVDO operators

Mobile BB 3G Data Cards in 2009 (Thousand)

- **Reliance**
  - EVDO data cards offerings in top 35 cities
  - Bundles EVDO data cards with netbooks with 2 year lock-in period
  - ARPU ~ INR 700 (Oct ’09)

- **Tata**
  - High speed EVDO based data services in limited to 8 cities
  - Bundles EVDO data cards with HP Pavilion Notebooks
  - ARPU ranges between INR 600 – 700

- **MTS**
  - EVDO-based MBlaze mobile broadband service is available in 19 cities
  - The operator offers bundles of EVDO data cards with HP Pavilion notebooks

- In addition to the 3G (WCDMA and CDMA 1x EVDO) datacards, approximately 1.3 million 2G (GPRS) datacards are used in India indicating a latent demand for data services

Source: Analysys Mason, Industry Inputs
Contents

Executive Summary

Overview of Broadband Services in India

Impact of Wireless Broadband on GDP

Direct Impact: Industry Revenues and GDP

Second Order Impact: Ecosystem Revenues and GDP

Third Order Impact / Externalities: Socio Economic Metrics and GDP

Stakeholder Imperatives
We have assessed the broader impact of the industry

Wireless Broadband Ecosystem

Demand-side Analysis

Supply-side Analysis

1. Mobile Service Delivery
   - Revenue Impact

Consumers / Retail

Financial Services

Social Services

Corporate / Verticals

2. Revenue Impact

3. Socio-economic Impact
   - Employment
   - Productivity Gains / Social Benefits
   - Contribution to Economic Growth

Source: Analysys Mason
The availability of wireless access for broadband will change the nature of the industry

- In 2009, a third of the broadband base consisted of corporate customers.
- The residential market, however, will be the key driver of growth with a compound annual growth rate (CAGR) of over 50% in the next five years.
- In 2009, only 20% of the broadband users were accessing applications from a wireless system.
- Supply-side constraints, however, make wireless a more compelling access system.
- The broadband base accessing services through a wireless system are projected to increase by more than 70% CAGR over the next five years.

Source: Analysys Mason
The wider availability of wireless systems will lower the cost of entry and enable a strong take-up of broadband.

**Direct Impact**

- Prior to the spectrum auctions, the share of wireless system was below that of international peers.
- Lower costs of handsets and services will significantly lower the entry cost and the average revenue per user (ARPU) for wireless broadband systems.
- By 2015, the majority of the broadband market will be provided by wireless access systems.
- The total spend on wireless access systems will be in excess of USD 18 billion by 2015 – with ~17% in equipment and devices.

**Wireless Broadband Spend (USD billion) and Nominal ARPU (USD)**

- **Broadband Spend**
  - USD billion
  - 2010 2011 2012 2013 2014 2015
  - Share of Wireless
  - Services
  - Equipment

- **Wireless Broadband Spend (USD billion)**
  - 2010 2011 2012 2013 2014 2015
  - USD billion
  - Services
  - Equipment

- **Nominal ARPU (USD)**
  - 2010 2011 2012 2013 2014 2015
  - USD / Month
  - Services
  - Equipment

Source: Analysys Mason
We have assessed the broader impact of the industry

Demand-side Analysis

Supply-side Analysis

Wireless Broadband Ecosystem

Mobile Service Delivery

1 Revenue Impact

Consumers / Retail

Financial Services

Social Services

Corporate / Verticals

2 Revenue Impact

3 Socio-economic Impact

Employment

Productivity Gains / Social Benefits

Contribution to Economic Growth

Source: Analysys Mason
The service delivery ecosystem is developing rapidly to address the opportunity from wireless broadband services

**Ecosystem**

<table>
<thead>
<tr>
<th>Service Providers</th>
<th>• Telecom operators and ISPs have made total investment of ~ INR 1,000 bn (USD 23 bn) for 3G and BWA spectrum, and are entering into ecosystem partnerships for delivery of data-intensive services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device OEMs</td>
<td>• Device vendors are launching mass market access devices such as INR 7,000 (USD 150) smartphones and INR 14,000 (USD 300) netbooks, and partnering with operators to bundle video capable handsets</td>
</tr>
<tr>
<td>Delivery &amp; Enabling Platform Providers</td>
<td>• Technology vendors, both Indian and global, are developing platforms such as SDPs(^1) for integrated and seamless multi-screen experience, ODPs(^2) for easy discovery and activation, and enabling platforms (such as advertising, relevance, content management and commerce) for enhanced experience and ease of use</td>
</tr>
<tr>
<td>Product / Application Providers</td>
<td>• Data-focused as well as mass market product and application platforms offering services such as mobile / broadband TV, online gaming and rural VAS are being developed by various local vendors</td>
</tr>
<tr>
<td>Content Aggregators / Developers</td>
<td>• Content providers are aggregating and developing both popular entertainment content such as music / videos, and mass market content such as utility applications and educational content, customized for the small screen</td>
</tr>
</tbody>
</table>

Note: 1. SDP: Service Delivery Platforms; 2. On-Device Portals
Source: Analysys Mason, Industry Inputs
The development of a wireless broadband ecosystem will have a significant direct revenue impact

Wireless Broadband Ecosystem

Mobile Service Delivery
- m-access
- m-devices

Consumers / Retail
1. m-commerce
2. m-content
3. m-gaming
4. m-apps
5. m-advertising

Financial Services
6. m-banking

Social Services
7. m-learning
8. m-health
9. m-government

Corporate / Verticals
10. m-enterprise
11. m-farming
12. m-utilities

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

Source: Analysys Mason
Mobile coupons, social media, customer service are the top mobile commerce trends that retailers are focusing on in 2010

- Mobile coupons market is currently most advanced in Japan and Korea
  - Mobile coupons will be used by nearly 200 mn mobile subscribers globally by 2013
  - Developed nations of the Far East, North America and Western Europe are forecast to account for the major part of the market by 2013

- Pay-Buy-Mobile is MNO led GSMA initiative for using mobile phones to make fast, secure payments in a retail environment using Near Field Communications (NFC)/ contactless technology
  - 34 of the world’s largest MNOs such as AT&T, China Mobile, NTT DoCoMo, O2, SMART are serving more than 1.3 billion customers with Pay-Buy-Mobile initiative, to create & define a global approach to enable NFC payment services on mobile phones

Source: Analysys Mason
There are multiple existing players in the mobile payments value chain in India who can scale up with BB services launch

### Mobile Payment Value Chain and Economics

<table>
<thead>
<tr>
<th>Role</th>
<th>Players</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Banks / Credit card companies integrating with m-commerce platform&lt;br&gt;• M-commerce platform provider that does the end to end integration across all the entities&lt;br&gt;• Provides payment gateway or mobile mall functionalities&lt;br&gt;• Application / solution distribution entities, e.g. Airtel is distributing mChek&lt;br&gt;• Usage channel for mobile payment, e.g. payment using mobile number for online shopping&lt;br&gt;• Merchants accepting mobile number as payment instrument</td>
</tr>
<tr>
<td></td>
<td>• SBI&lt;br&gt;• HDFC&lt;br&gt;• VISA&lt;br&gt;• MasterCard&lt;br&gt;• Itz Cash&lt;br&gt;• mChek&lt;br&gt;• Paymate&lt;br&gt;• Oxicash&lt;br&gt;• Ngpay&lt;br&gt;• ItzCash&lt;br&gt;• Airtel&lt;br&gt;• HDFC Bank&lt;br&gt;• IRCTC&lt;br&gt;• ngpay&lt;br&gt;• mChek: SMS based&lt;br&gt;• Paymate: can be used at retail outlets and uses IVR for confirmation&lt;br&gt;• Utility companies&lt;br&gt;• Airline companies&lt;br&gt;• Retail stores&lt;br&gt;• Online malls</td>
</tr>
</tbody>
</table>

### Access Channel

- Mobile
- Online
- Retail

### Distribution Partner

- Banks
- Merchants
- D2C

### Banks / Electronic Card Payment Gateway Enablers / Stored Value Providers

- 1% - 2%

### M-commerce Solution Provider

- 1% - 18%

Note: 1. For mobile payment gateway providers, the merchants give 1-2% of the transaction value. However, mobile malls such as ngpay get retail margins depending on the product (~20% for flowers and ~5% for airlines ticketing).

Source: Analysys Mason, Industry Inputs
m-commerce can be a INR 31 bn value chain opportunity contributing to about 0.02% of GDP by 2015

**Market Growth Drivers**

- **Reach**: Larger reach of mobile medium compared to PC / laptops (635 mn mobile subs vs. 16 mn internet subscribers in FY 2010)
- **Convenience**: Ability to perform transactions anytime, anyplace is a major reason that is likely to drive m-commerce
- **Telecom Carrier Interest**: Carriers are exploring m-commerce as a new VAS revenue stream
- **RBI Guidelines**: Regularization of mobile banking & payments sector has enabled the development of an ecosystem

**m-commerce Value Chain Revenue through Wireless Broadband (INR bn)**

- **2010**: <0.01% of GDP
- **CAGR**: 111%
- **2015**: 0.02% of GDP

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenue (INR bn)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>1</td>
</tr>
<tr>
<td>2011</td>
<td>3</td>
</tr>
<tr>
<td>2012</td>
<td>7</td>
</tr>
<tr>
<td>2013</td>
<td>14</td>
</tr>
<tr>
<td>2014</td>
<td>23</td>
</tr>
<tr>
<td>2015</td>
<td>31</td>
</tr>
</tbody>
</table>

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

Source: Analysys Mason, Industry Inputs
Content producers are extending their franchises and now play a larger role in the broadband value chain

- The importance of multiplatform content has led to content producers adopting a 360-commissioning model, adapting content for the Internet, the mobile, social media and gaming.

- However, producers face increasing complexity and costs in creating and managing multiple versions of content for consumption on several platforms and a growing number of devices.

Source: Analysys Mason, Industry Inputs
Consumer applications revenue in Europe will grow from EUR 4.2 bn to EUR 6.8 bn, with games as the main growth driver.

- Traditional personalization content is giving way to games and other rich content services.
- Personalization revenue will decline from EUR 2.2 billion in 2009 to EUR 1.9 billion in 2015. The market for ringtones and wallpapers is in semiterminal decline because of the increasing availability of free content through the mobile web and the repurposing of MP3 files.
- Games’ share of consumer applications revenue will grow from 18% to 28% over the forecast period.
- Video’s share will increase from 5% in 2009 to 9% in 2015, its revenue increasing from EUR 200 million to almost EUR 600 million.
- The increasing popularity of streamed music subscription services, such as Spotify, will drive an increase in music services’ share of revenue, from 3% to 9% over the forecast period. Music revenue will grow from EUR 100 million in 2009 to EUR 600 million in 2015.

Source: Analysys Mason, Industry Inputs
There are multiple existing players in the mobile content space in India who can scale up with broadband adoption

<table>
<thead>
<tr>
<th>Role in Value Chain</th>
<th>Technology Platform Enablers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content Developers</td>
<td>• Owns the consumer</td>
</tr>
<tr>
<td>Content Aggregators</td>
<td>• Owns the consumer</td>
</tr>
<tr>
<td>VAS Product / Application Developer</td>
<td>• Multiple content delivery channels, each suitable for different types of content or used across bearer channels</td>
</tr>
<tr>
<td>Carriers</td>
<td>• IN platforms and postpaid billing systems of carriers</td>
</tr>
<tr>
<td>D2C</td>
<td>• A negligible number of D2C providers also have non carrier billing options</td>
</tr>
<tr>
<td>Carrier Billing</td>
<td></td>
</tr>
</tbody>
</table>

**Players**
- Rajshri
- Indiatimes
- Hungama
- OnMobile
- One97
- Spice Digital
- Comviva
- Phonytunes
- Airtel
- Vodafone
- Apple
- Indiatimes
- Airtel
- Vodafone
- RCom
- Idea

**Note:** 1. Includes STK / UTK

Source: Analysys Mason, Industry Inputs
m-content can be INR 101 bn value chain opportunity contributing to about 0.07% of GDP

m-content Revenue Realization on Wireless Broadband (INR bn)

Market Growth Drivers

Services
- Increasing focus on VAS promotion by carriers, especially new entrants
- Due to absence of any emerging “killer application”, carriers will maintain their focus on basic, popular, network dependent VAS such as CRBT/RBT

Device
- Consumers lack awareness of 3G enabled devices and services and are unlikely to discover value proposition of 3G, unless OEMs invest in ATL promotions

Business Models
- D2C models may emerge to bypass carrier billing but scalability will be an issue
- Mobile ad based models will continue to remain in an experimental stage and will not emerge as a significant alternate monetization model

Demand Side
- Challenges around consumer awareness & discovery of content, lack of availability of regional and local content will continue

Note: 1. ‘m’ refers to wireless broadband enabled services accessed through wireless broadband connection over mobile handsets or PCs
Source: Analysys Mason, Industry Inputs
Global online and mobile gaming market stands at ~ USD 20 billion and is growing at a significant rate

- Smartphones and touchscreen phones will realize the potential market for more sophisticated mobile games.

- End users are prepared to pay for games:
  - ~ 50% of the top-10 iPhone App Store downloads in Jan 2010 were games.

- In-game monetization is more developed on fixed platforms, but the same techniques will be applied for mobile:
  - The most basic form of in-game monetization is the freemium proposition, where the initial gaming is available without cost, user pay for advanced features in the game.

Source: PWC
The Indian digital gaming market is still nascent but has significant growth potential owing to the recent initiatives.

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Initiatives by Indian Games Publishers and Operators</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affordability</td>
<td>• Offering ad supported free games</td>
<td>Ad Based Games</td>
</tr>
<tr>
<td></td>
<td>• Innovative pricing models e.g. pay per play model, try and buy for INR 10 etc</td>
<td></td>
</tr>
<tr>
<td>Consumer Experience</td>
<td>• Developing rich game content (e.g. 3D games)</td>
<td>Exclusive Rights</td>
</tr>
<tr>
<td></td>
<td>• Customizing games for low end handsets and for easy download on slow speed 2.5G network</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Developing games for various available technology platforms e.g. Java, BREW, Symbian, Flash</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• International partnerships to offer a variety of popular Hollywood and action games</td>
<td></td>
</tr>
<tr>
<td>Content Discovery &amp; Availability</td>
<td>• Offering easy to discover and navigate game catalogues on their WAP portals and websites</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Allowing side loading of games to mobile phones through their websites</td>
<td>Side Loading from Websites</td>
</tr>
</tbody>
</table>

- Currently only ~ 10 mn users download games on their mobile handsets in India
- This number can grow significantly with better user data experience for the capability to download richer gaming content as well as to play multi-player games

Source: Analysys Mason
m-gaming can be INR 20 bn value chain opportunity contribution to about 0.01% of GDP

- Better capabilities of 3G enabled handsets will allow game publishers to create high quality games thus generating more interest for mobile games
- Introduction of a variety of pricing models and micro transactions will further drive the growth in user base
- Operator and D2C app stores by content aggregators and publishers will enable easy content discovery and delivery

**m-gaming Revenue Realization on Wireless Broadband (INR bn)**

<table>
<thead>
<tr>
<th>Year</th>
<th>2010: &lt;0.01% of GDP</th>
<th>CAGR: 112%</th>
<th>2015: 0.01% of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>0</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>2011</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>2012</td>
<td>4</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>2013</td>
<td>8</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>2014</td>
<td>13</td>
<td></td>
<td>13</td>
</tr>
<tr>
<td>2015</td>
<td>20</td>
<td></td>
<td>20</td>
</tr>
</tbody>
</table>

Note: 1. ‘m’ refers to wireless broadband enabled services accessed through wireless broadband connection over mobile handsets or PCs
Source: Analysys Mason, Industry Inputs
Mobile advertising is expected to grow significantly across major international markets

- The mix of mobile advertising is likely to change, as larger-screened mobile devices facilitate more search-related advertising revenue.
- Mobile advertising achieves much higher click-through rates than the 1–2% from most online ads.
- Although advertising revenues should continue to grow, increasing fragmentation of audiences present a challenge to service providers, leading to increasing use of pay-models.

Source: PWC, 2009
The nascent mobile advertising market in India will benefit from the development of a robust ecosystem

<table>
<thead>
<tr>
<th>Advertiser</th>
<th>Ad Agency</th>
<th>Ad Network</th>
<th>Ad Server / Platform</th>
<th>Mobile Publisher</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICICI</td>
<td>Lowe</td>
<td>admob</td>
<td>OnMobile</td>
<td>Yahoo! India</td>
<td>Airtel</td>
</tr>
</tbody>
</table>

### Traditional Role in Value Chain
- Initiates the demand through promotion, sales and lead generation
- Assists advertisers with their media buying strategy
- Develops creative for ads
- Ad aggregation
- Ad inventory management
- Offer consumer profiling & targeting engine
- Perform ad response monitoring
- Content delivery platforms
- Enables ad insertion
- Ad delivery over different bearer channels
- Owns subscriber data

### Evolving Roles
- Will use mobile advertising for brand & product promotions, CRM and couponing
- Evolution of performance based metrics
- Building up of in-house, dedicated sales teams for handling branded inventory
- Enhanced targeting and recommendation capabilities across various bearer channels and platforms
- Building large user database that can be profiled & targeted
- Enabling rich media based ads by adoption of 3G
- Seamless sharing of subscriber database across the value chain

### Wireless broadband will enable delivery of rich media based ads, and enhance the role of the advertising ecosystem in addressing the growing opportunity as well as shift to better revenue shares from the operator

Source: Analysys Mason, Industry Inputs
m-advertising can be INR 28 bn value chain opportunity contributing to about 0.02% of GDP

With increasing number of mobile data active users, WAP inventory (page views per month) is likely to grow from 5 bn in 2010 to over 40 bn by 2015, with over 70% contribution of 3G subscribers.

With better profiling information available with telcos ecosystem participants through deployment of profiling platforms will enhance CPMs (cost per thousand impressions).

Growth in demand for infotainment content and corresponding growth in ad-subsidies will further enhance the mobile advertising market.

Note: 1. ‘m’ refers to wireless broadband enabled services accessed through wireless broadband connection over mobile handsets or PCs
Source: Analysys Mason, Industry Inputs
The global mobile apps market is already a billion-dollar industry, and is expected to grow significantly

- The global apps market is growing rapidly
- Estimates for total app store revenues in 2009 range from USD2 billion to USD9 billion
- Apple accounts for ~95% of the market, demonstrating that consumers are willing to pay for mobile apps
- Currently, apps are offered primarily by smartphone OEM and OS vendor app stores, who retain 30% of the revenues and transfer the rest to developers

Source: Analysys Mason
With the launch of operator app stores, there is significant potential for Indian app developers to achieve scale

<table>
<thead>
<tr>
<th>Operator App Store</th>
<th>App / Platform Providers</th>
<th># Apps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airtel APP CENTRAL</td>
<td>cellmania</td>
<td>71,000 (July 2010)</td>
</tr>
<tr>
<td>vodafone APP-STORE</td>
<td>carvato mobile</td>
<td>800 (March 2010)</td>
</tr>
<tr>
<td>Reliance Communications</td>
<td>Cellular危害非常伟大</td>
<td>~70,000 (April 2010)</td>
</tr>
<tr>
<td>Idea MOBSTORE</td>
<td>spice</td>
<td>14 Services across 7 Categories (July 2010)</td>
</tr>
<tr>
<td>AIRCEL FLYpp</td>
<td>Infosys</td>
<td>-</td>
</tr>
</tbody>
</table>

- Currently, the Indian mobile apps market is estimated at less than 1% of the global market, limited primarily by penetration of smartphones, and poor data experience for users.
- Launch of app stores by Indian operators is expected to drive adoption, facilitated by launch of 3G services.
- This will provide opportunity for the large and fragmented local app developer community to develop India specific apps for the mass market and grow to the scale of global players.
- This will also help Indian platform providers such as Spice and Infosys to address the global mobile apps market.

Source: Analysys Mason, Industry Inputs
m-apps can be INR 6.6 bn value chain opportunity for domestic market, contributing to less than 0.01% of GDP

- With launch of high speed 3G data services by private operators by 2010 end, user experience is expected to improve significantly and thus drive adoption of rich video based applications
- With increasing penetration of smartphones & feature phones, uptake of apps will increase
- Moreover, availability of free apps are expected to facilitate customer experimentation and eventually lead to regular usage of app store, thus increase data service adoption

**m-apps Revenue Realization on Wireless Broadband (INR bn)**

- 2010: <0.01% of GDP
- 2015: <0.01% of GDP
- CAGR: 102%

**Note:** 1. ‘m’ refers to wireless broadband enabled services accessed through wireless broadband connection over mobile handsets or PCs
2. Source: Analysys Mason, Industry Inputs
Users of mobile banking and related services is forecasted to grow at a CAGR of 59.2% to reach 894 million users in 2015.

Initiatives Around the World wrt Mobile Banking

- **U.K.**
  - Vodafone partners with multiple banks to provide mobile banking services

- **Germany**
  - Visa and Nokia partner on pilot for German bus system

- **Europe**
  - NFC Forum created with over 70 members participating

- **Japan**
  - More than 15M subscribers to NTT DoCoMo’s mobile wallet including transit application through Suica partnership

- **South Korea**
  - Over 80% of merchants have contactless POS terminals

- **South Africa**
  - MTN Banking takes off for only $6M in development cost

- **Philippines**
  - More than 6M mobile payment transactions per day

- **DRC**
  - More than 3M transactions a month on Celpay

Source: Analysys Mason
Smaller player will benefit with enhanced broadband coverage for transaction authentication in the rural areas

Financial Inclusion Value Chain and Revenue Share

- **Banks**
  - Indian Banks expanding to the unbanked population

- **Banking Solution Provider**
  - Banking solutions for the unbanked consumer; additional capabilities such as mobile payment, money transfer may be supported

- **Business Correspondent**
  - The BC is an agent of a specified bank and is authorized to undertake transactions on behalf of the bank
  - MFI provides loans to the unbanked population

- **Micro Finance Institute**
  - Outlets to provide various kinds of transaction services such as cash deposit, cash withdrawal, transfer of money and payment of utility bills

- **Customer Service Point**
  - Per txn. fees

**Major Players**

- Government banks
- Eko
- Fino
- A little world
- India Post
- SKS Microfinance
- Retail Outlets
- India Post

**Note:** 1. Mobile banking model is emerging. Currently Eko offers mobile banking for the unbanked. Banks pay 7% commission on the deposits. The arrangement between banks and BC varies on a case by case basis

Source: Analysys Mason
m-remittance can be INR 205 bn value chain opportunity for domestic market, contributing to about 0.14% of GDP

### m-banking & remittance on Wireless Broadband (INR bn)

| Year | Value (INR bn) | Growth Rate
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>16</td>
<td>0.02% of GDP</td>
</tr>
<tr>
<td>2011</td>
<td>38</td>
<td>75</td>
</tr>
<tr>
<td>2012</td>
<td>124</td>
<td>172</td>
</tr>
<tr>
<td>2013</td>
<td>172</td>
<td>205</td>
</tr>
<tr>
<td>2014</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CAGR: 67%

2015: 0.14% of GDP

#### Service Description

**Remittance**
- Domestic and overseas remittance service from/to mobile
- Can be transfers to and from linked bank accounts, credit/debit cards, prepaid cards, stored value wallets, or at retail outlets e.g. Obopay
- Unofficial channel also used for small transaction values by overseas worker due to convenience; for smaller transaction values, mobile remittance will be preferred

**Financial Inclusion**
- Banking penetration remains concentrated in urban areas
  - Only 41% of bank branches are located in rural areas though 65% of population is rural
  - Banks are offering mobile banking to profitably serve rural areas in partnership with business correspondents (BC)
  - Eko as SBI BC has launched banking services; mobile number is treated as account number and money can be deposited/withdrawn from an Eko cash-point

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

Source: Analysys Mason
Increased adoption of mobile devices will help mLearning to gain popularity within the learning education segments.

Drivers for Mobile Learning

- Mass Market Content Distribution Channel
- Large Growing Buyer Demographic
- Powerful Internet Connected Convergent Devices
- New Mobile Learning Dev Tools & Delivery Platforms
- Explosion of New Learning Apps & Content
- Technology Suppliers
- Content Suppliers

Target Users of Mobile Learning

- Corporate
  - Organization-wide policies, procedures
  - Compliance trainings
  - Sales material
- Education
  - Collaborative projects and fieldwork
  - Podcasting
- Defense
  - Training on new arms & weapon for defence
- NGO / Rural
  - Literacy initiatives

The growth of mobile learning is being driven by emerging innovations in both hardware and software as well as by changes occurring in the training field, such as reorganizing training to fit mobile abilities and managing the resulting virtual teams.

Source: TCS White Paper
Companies offering online learning can scale with increased benefits to masses

**Tech Enabled Learning Value Chain and Revenue Share**

<table>
<thead>
<tr>
<th>Players</th>
<th>Roles</th>
<th>Content Providers / Aggregators</th>
<th>Services 2</th>
<th>Portals</th>
<th>Infrastructure 1</th>
</tr>
</thead>
</table>
| • Govt. Universities  
  • IGNOU  
  • SNDT  
• Private Universities  
  • Amity  
  • Training Institutions  
  • NIIT | • Provide the backend content for courses | • Create and package content customized by device to create e-learning modules (online and/or mobile) | • Delivered, tracking & managing education systems – range from managing content to distributing courses & offering features for online collaboration | • Distribution and delivery channel for content | • Distribution and delivery channel for content |
| • Elicitus  
  • authorGen  
  • Educomp | • Provide the consulting, technical and support services | • Provide the consulting, technical and support services | • Provide the backend content for courses | • Distribution and delivery channel for content | • Distribution and delivery channel for content |

Note: 1. Infrastructure includes both hardware and software solutions and support
2. Services refers to hosting and managed services, consulting and other technical support services

Source: Analysys Mason
m-learning can be INR 18 bn value chain opportunity for domestic market, contributing to about 0.01% of GDP

Government Focus:

- Increasing spend on ICT\(^1\) and other technology enabled initiatives such as the National Knowledge Network

Educational Institutes:

- Educational institutions increasingly moving towards online courses and multimedia aids in teaching
- Market is currently very underpenetrated

User Convenience:

- End user flexibility in terms of time, duration and location of study
- Multimedia enabled teaching makes learning more interesting for kids

---

Note: 1. ICT: Information and Communication Technology; 2. ‘m’ refers to wireless broadband enabled services accessed through mobile handsets or dongles

Source: Analysys Mason
m-health applications vary from remote data collection to clinical applications in healthcare management

There are many m-health applications but they can be grouped as follows:

- remote data collection and disease monitoring – e.g. applications that relay information (such as vital indicators) from patients’ monitoring devices to a central server via a mobile network
- treatment compliance – e.g. SMS-based applications to remind patients to take drugs
- diagnostic and treatment support – e.g. consultations over mobile phone; this application targets rural areas in developing countries with lack of access to medical services
- education and awareness – e.g. SMS-based applications to dissemination information re health
- clinical applications – e.g. those which assist in healthcare management, e.g. Vodafone’s SMS for Life in Tanzania service – a mobile stock ordering system that ensures supplies of anti-malaria drugs at rural healthcare centres

Source: Analysys Mason
In India, operators have launched basic services, and government bodies are using mobile primarily for health data collection & treatment support

<table>
<thead>
<tr>
<th>Area</th>
<th>Provider</th>
<th>Service Offerings</th>
<th>Monetization</th>
<th>Partner</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B2O2C</td>
<td>Reliance Communications</td>
<td>• Doctor-on-Call</td>
<td>• Transaction (Reliance subscribers - INR 15/min, Tata Indicom subscribers – INR 9/min )</td>
<td>HealthcareMagic.com</td>
<td>Provides consultation on acute, chronic and emergency cases</td>
</tr>
<tr>
<td>G2O2C</td>
<td>Airtel</td>
<td>• Virtual Blood Bank Service</td>
<td>• Free</td>
<td>Blood Banks such as Jeevan Hospitals</td>
<td>Toll free number to get information on blood bank</td>
</tr>
<tr>
<td>G2B2C</td>
<td>Media Lab Asia</td>
<td>• Open source software application on PDA to collect medical and demographic data</td>
<td>• Funded</td>
<td>Dimagi, Inc AIIMS</td>
<td>System currently records and manages data from over 70,000 patients</td>
</tr>
<tr>
<td>B2B2C</td>
<td>Jiva Institute - TeleDoc</td>
<td>• Prescription and treatment to patients in remote villages through the use of mobile phone</td>
<td>• Funded</td>
<td>Soros Foundation</td>
<td>More than 1,500 patients</td>
</tr>
</tbody>
</table>

Source: Analysys Mason, News Articles, Industry Inputs
m-health can be INR 26 bn value chain opportunity for domestic market, contributing to about 0.02% of GDP

- It was estimated that out 828 million of rural population only 27% is using mobile services in 2010 generating a 225 million addressable market for treatment support m-health applications

- Wireless remote monitoring services remain restricted due to high cost of device and service charges, making it affordable to very high income end-users only
  - Biotronik, a home monitoring system for patients with Biotronik implantable cardiac devices was recently launched in India. Only CardioMessenger device alone costs INR 150,000 (USD3000) and there are also additional services charges

**m-health Revenue Realization on Wireless Broadband (INR bn)**

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>&lt;0.01%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.02%</td>
</tr>
<tr>
<td>CAGR</td>
<td>125%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Analysys Mason; (1) http://openmed.nic.in/1265/01/skm12.pdf

Note: 1. ‘m’ refers to wireless broadband enabled services accessed through wireless broadband connection over mobile handsets or PCs
m-government services offer a plethora of applications

Communication

- **Singapore** – SMS alerts for a variety of e-services such as: renewal of road tax, medical examinations for domestic workers, passport renewal notifications, season parking reminders, and parliament notices and alerts.
- **Dubai (UAE)** - Dubai Public Prosecution offers an SMS service that allows clients, including the transacting public, lawyers and prosecutors, to inquire about cases, times of sessions, resolutions, and the status of proposals and requests drafted by the Public Prosecution.

Transactions and Payments

- **UK** – a number of towns and cities are adopting the pay-by-phone scheme when motorists can pay for parking via SMS.
- **Oman** – Municipality of Muscat introduced m-parking services in 2007.
- **Johanessburg (South Africa)** - Motorists can find out if they have outstanding traffic fines, summonses or warrants of arrests through SMS.

Public Sector Operations

- **Norway and Sweden** – the respective tax authorities introduced a service that allows taxpayers to file tax returns by SMS. Tax Authority personnel fills the forms and sends them to taxpayers for confirmation; tax payers can confirm by SMS, which the authority counts as filing electronically.

Citizen Participation

- **Estonia** – in December 2008, the parliament passed the bill which enabled electorate to vote via mobile phones in national elections in 2011.
- **Philippines** – PAYBIR service allows a taxpayer to file income tax returns by SMS. Taxpayers can also pay tax of up to R10,000 via SMS.

- **UK** – a number of towns and cities are adopting the pay-by-phone scheme when motorists can pay for parking via SMS.
- **Oman** – Municipality of Muscat introduced m-parking services in 2007.
- **Johanessburg (South Africa)** - Motorists can find out if they have outstanding traffic fines, summonses or warrants of arrests through SMS.

Source: Analysys Mason
The Indian government is focusing on e-governance & mobile enablement is only a small element of the project roadmap

- 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

- However, from the 27 MMPs only agriculture-related MMP include elements of m-governance

Source: Analysys Mason
m-government can be INR 19 bn value chain opportunity for domestic market, contributing to about 0.01% of GDP

- M-government segment is a subset of e-government market and the letter is a part of the total government IT spend.
- The government IT spend is estimated to constitute 1% of the total state budget expenditure
  - An annual IT spend per capita is INR 110 (USD 2.4) in 2010
- Currently, m-government applications contribute a miniscule amount of total IT spend. As discussed previously, the government focuses more on the e-government than m-government applications
- However, we expect that the situation is set to change and more transaction and information related mobile applications will be adopted in India

**m-govt Revenue Realization on Wireless Broadband (INR bn)**

- 2010: <0.01% of GDP
- 2015: 0.01% of GDP
- CAGR: 82%

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

**Source:** Analysys Mason
The global enterprise applications market is huge and is shifting fast towards network technologies

- Enterprise spending priorities are shifting from cost optimization to supporting business growth led by emerging economies.

- Growth is driven by innovation in applications like telephony, messaging and conferencing based on fast-moving networking technologies (such as SIP) that will facilitate UC and enhance business processes.

- The market structure is increasingly being influenced by market-disrupting influences of SaaS, cloud-based services, open-source software and Web 2.0 technologies.

Source: Analysys Mason
Emergence of system integrators & device capabilities will drive Indian enterprise mobility apps market

System Integrators
- System integrators are emerging in India to help guide enterprise organizations on the integration of mobile and workflow
  - System integrators are partnering with industry specific mobile app developers & network providers to offer customized mobility applications to enterprises

Platform Agnostic Applications
- Platform agnostic applications solve the issues on interoperability and allow the enterprise to choose the operator, vendor and the type of handset
  - Nokia & Microsoft, tied up in March 2008 to provide Silverlight* on S60 and S40 enabled devices
    - Silverlight is a cross-browser, cross-platform plug-in for delivering next-generation rich interactive applications

Current EMA Implementation by Enterprises in India
- Productivity applications such as SFA and CRM have the potential to drive substantial growth, as they constitute higher spend per enterprise
- Emergence of system integrators coupled with better device / smartphone and data ecosystem will help grow these segments

Source: Analysys Mason, Industry Inputs
m-enterprise can be INR 35 bn value chain opportunity for domestic market, contributing to about 0.02% of GDP

- **Productivity:** Enterprise focus on productivity will drive investment in various systems and tools
- **Connectivity:** Employers are also on the lookout for better ways to keep them connected to their workplace
- **Competitive advantage:** With increasing competition, companies are looking for ways to improve their execution speeds and customer response times
  - Currently under-penetrated applications such as CRM and ERP will benefit from this trend and enhance overall market growth

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

Source: Analysys Mason, Industry Inputs
m-farming applications are increasingly popular in many countries

**SENEGAL**
- Manobi and a mobile operator Sonatel launched an SMS-based service that provides market price and meteorological information to farmers and fishermen.
- It was extended to include geolocation and GPS mapping services, for example, fleet vehicle tracking, search and rescue services.
- The service costs around USD5 per month, plus the cost of SMS. The company claims its overall monthly ARPU is around USD30, of which USD12 go to Manobi and USD18 to Sonatel.

**PHILIPPINES**
- The Department of Agriculture launched the PRESYO & PANAHON to provide farmers and fishermen with a five-day weather forecast and information on prices of basic commodities in the Manila metro area.
- The Department also funded a Nutrient Manager tool which allows to get farming advice and recommendations on the types and amounts of fertilizer needed. The service is based on IVR and generates an automated SMS with the relevant information.

**KENYA**
- SMS Sokoni project provides commodity price information via SMS for a fee. The project is run by the Kenya Agricultural Commodities Exchange (KACE), a private firm, in partnership with mobile operator Safaricom.
- DrumNet - Transaction platform linking small holder farmers to markets, finance and information.

**UGANDA**
- Google Trader - A user-generated trading bulletin that via SMS matches buyers and sellers of agricultural produce and commodities as well as other products. Developed by MTN Uganda and AppLab.
- RATIN SMS - Commodity prices from various terminal markets within East Africa via SMS. Currently, it is available in Kenya, Uganda and Tanzania but will soon be available in Rwanda and Burundi too.
- INFOTRADE Mobile - Up-to-date agricultural prices via SMS

Source: Analysys Mason
Multiple types of m-farming apps are being introduced and are gaining adoption

<table>
<thead>
<tr>
<th>Service</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reuters - Market Light</td>
<td>• ‘Reuters Market Light’, a mobile information service for Indian farmers, offers commodity pricing information for nearby markets, news and weather updates; It had 0.25 mn subs in 12 000 villages in Dec 09 in 13 states, including Maharashtra, Punjab and Haryana</td>
</tr>
<tr>
<td>Rcom - Commodity Quotes</td>
<td>• ‘Commodity Quotes,’ an application that provides information on commodities across Commodity exchanges and ‘mandis’ in India</td>
</tr>
<tr>
<td>HFCL Infotel - Mandi Bhav</td>
<td>• Provide commodity rates such as vegetables, fruits, food grains, pulses and spices from 12 major wholesale markets across Punjab. Available to both landline and mobile users</td>
</tr>
<tr>
<td>Tata Indicom – Mandi Bhav</td>
<td>• Provides details on trading platform, weather information and expert advice to rural consumers; offers information collated from around 3,000 local commodity markets in India on around 500 products; it delivers information in 9 languages including Hindi, English and Marathi</td>
</tr>
<tr>
<td>Lifelines India</td>
<td>• Voice based service, provides information on various farming needs such as seeds, fertilizers etc; Offers expert advice to farmers on ways of improving input efficiency by encouraging Integrated Pest Management (IPM) methods; it is implemented in 700 villages across 4 states in India and is used by 100 000 farmers; on average, it receives 450 calls per day</td>
</tr>
<tr>
<td>IKSL provided by Airtel and IFFCO</td>
<td>• Provides information on farming techniques, weather forecasts, dairy farming, animal husbandry, rural health initiatives and fertilizer availability etc.</td>
</tr>
<tr>
<td></td>
<td>• Sends 5 voice based sms/day related to mandi prices; 48,000 farmers enrolled for the service as of April 08</td>
</tr>
</tbody>
</table>

Source: Analysys Mason
m-farming can be INR 6 bn value chain opportunity for domestic market, contributing to less than 0.01% of GDP

- In India, 68% of total households depend on farming for their livelihood
- Our estimates show that at least 300,000 farmers used m-farming applications in India at the end of 2009
  - This implies that 0.2% of households dependent on farming, and where at least one member of the household was consuming mobile services, were using m-farming applications
- Users of m-farming applications claim to achieve significant costs savings and to generate additional revenues as a direct result of using the applications
- Utility will drive the adoption. We expect that 31 million farmers will use m-farming services by 2015, bringing the total market value to INR 6.3 billion (USD 0.15 billion)

Note: 1. 'm' refers to wireless broadband enabled services accessed through wireless broadband connection over mobile handsets or PCs
Source: Analysys Mason
m-utilities market segment is dominated by such applications as smart meters and telemetrics.

- The M2M market is diverse and consists of many technologies and applications that enable machines and other traditionally non-computing remote devices and sensors to interconnect with back-end IT infrastructure in a largely automated fashion.
- Statistics quoting the size of the M2M market vary hugely owing partially at least to variations in the definition of M2M. The revenue calculations traditionally include M2M hardware, M2M communications and M2M services.
- In Europe, M2M deployments were dominated by energy meters and telematics applications.
- IDATE reports that cellular M2M market stood at EUR14 billion in 2009 and will grow at a CAGR of 23% to reach EUR32 billion in 2014.
  - M2M SIMs are forecast to represent 2.5% of all mobile SIMs in 2014.

Source: IDATE (2009); Analysys Mason
In India such M2M applications as smart meters and remote video surveillance have seen some adoption

- In India, most of the current CCTV installations are being carried out in urban areas and within a premise such as shopping mall, commercial complex, business establishments and schools.
- To strengthen the security of the metropolis after the 26/11 terror attacks, Maharashtra Government is considering to install 5,000 CCTV cameras across Mumbai.
- Using high speed 3G HSUPA connectivity combined with the latest compression technologies, CCTV solution companies can provide rapid access to good quality recordings from any location.
  - MEL Secure Systems, one of the leading developer of CCTV surveillance and security solutions, has launched a new range of 3G rapid deployment CCTV cameras.
- Power utility companies such as Reliance Infrastructure and Tata Power are deploying CDMA-enabled smart meters.
  - These companies are expected to deploy such meters for high usage industrial and commercial subscribers.
  - As of June 09, Reliance Infra has deployed CDMA-based modems, serially attached to digital meters for 4,916 substations / distribution transformers, 2,687 streetlights, 12,590 high-value customers and 57 receiving stations / grid stations.
- In Delhi, Grinpal Energy Management is deploying smart meters and advanced metering infrastructure. It aims to have 500,000 meters installed in the Tata region by the end of 2010.

Source: Analysys Mason
m-utilities can be INR 19 bn value chain opportunity for domestic market, contributing to about 0.01% of GDP

<table>
<thead>
<tr>
<th>Year</th>
<th>m-utilities Revenue Realization on Wireless Broadband (INR bn)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>&lt;0.01% of GDP</td>
</tr>
<tr>
<td>2011</td>
<td>1</td>
</tr>
<tr>
<td>2012</td>
<td>2</td>
</tr>
<tr>
<td>2013</td>
<td>5</td>
</tr>
<tr>
<td>2014</td>
<td>10</td>
</tr>
<tr>
<td>2015</td>
<td>15</td>
</tr>
</tbody>
</table>

CAGR: 85%

- **2015**: 0.01% of GDP
- **2010**: <0.01% of GDP

CAGR: 85%

- We expect that for every mobile service user (voice and data), there will be 1.3 SIM cards by 2015
- M2M SIMs in India are expected to contribute 2.3% of all SIMs by 2015, which is in line with the global estimate of 2.5% in 2014
- The growth will be primarily driven by applications such as smart meters, video surveillance and such telemetry applications as vehicle tracking
- We expect that by 2015 the Indian market for M2M applications will grow to INR 19 billion (USD 0.43 billion)

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

Source: Analysys Mason
In summary, mobile access will remain the main source of revenue for operators – VAS will be a key differentiator.

- Operators are diversifying their non-voice portfolio.
- Voice and messaging services will continue to account for a majority of revenue, however, mobile data access services will enable a host of new applications.
- Global industry trends show the growing importance of non-voice services including content and entertainment, financial services and advertising.

Source: Analysys Mason
The development of a wireless broadband ecosystem will have a significant revenue impact.

Wireless Broadband Ecosystem

<table>
<thead>
<tr>
<th>Mobile Service Delivery</th>
<th>Consumers / Retail</th>
<th>Financial Services</th>
<th>Social Services</th>
<th>Corporate / Verticals</th>
</tr>
</thead>
<tbody>
<tr>
<td>m-access</td>
<td>m-commerce</td>
<td>m-banking</td>
<td>m-learning</td>
<td>m-enterprise</td>
</tr>
<tr>
<td>m-devices</td>
<td>m-content</td>
<td></td>
<td>m-health</td>
<td>m-farming</td>
</tr>
<tr>
<td></td>
<td>m-gaming</td>
<td></td>
<td>m-government</td>
<td>m-utilities</td>
</tr>
<tr>
<td></td>
<td>m-apps</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>m-advertising</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

Source: Analysys Mason
We have assessed the broader impact of the industry

**Wireless Broadband Ecosystem**

**Demand-side Analysis**
- Mobile Service Delivery
  - Revenue Impact

**Supply-side Analysis**
- Consumers / Retail
- Financial Services
- Social Services
- Corporate / Verticals
  - Revenue Impact

**Socio-economic Impact**
- Employment
- Productivity Gains / Social Benefits
- Contribution to Economic Growth

Source: Analysys Mason
## Contents

- Executive Summary
- Overview of Broadband Services in India
- The Wireless Broadband Ecosystem
- **Socio-economic Impact of Wireless Broadband**
- Imperatives for Stakeholders in the Indian Wireless Broadband Industry
Wireless broadband will have an industry productivity impact of INR 888 bn (0.62% of GDP) in 2015

Estimation of Impact on Productivity due to Wireless Broadband

Working population with wireless broadband connectivity¹

<table>
<thead>
<tr>
<th>Year</th>
<th>Working Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>5 mn</td>
</tr>
<tr>
<td>2015</td>
<td>27 mn</td>
</tr>
</tbody>
</table>

CAGR: 39%

Increase in industry productivity in 2015

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


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

Note: 1. Includes retail wireless broadband connections used for official / business purpose and corporate connections

Source: Analysys Mason, EIU, Euromonitor, Frost & Sullivan, NASSCOM, CII-PWC Report on IT/ITeS Industry
The service industry including IT/ITeS will benefit the most from wireless broadband services

<table>
<thead>
<tr>
<th>Industry Vertical</th>
<th>Penetration of Wireless Broadband and User Base (in Parentheses)</th>
<th>Productivity Gain in 2015 (INR bn)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing, Mining &amp; Industry</td>
<td>2010: 5% (0.6 mn users)</td>
<td>2015: 21% (3.0 mn users)</td>
</tr>
<tr>
<td></td>
<td>2015: 93 (0.4% of industry revenues in 2015)</td>
<td></td>
</tr>
<tr>
<td>Government &amp; PSUs</td>
<td>2010: 4% (0.7 mn users)</td>
<td>2015: 20% (3.1 mn users)</td>
</tr>
<tr>
<td></td>
<td>2015: 13 (0.3% of industry revenues in 2015)</td>
<td></td>
</tr>
<tr>
<td>Services (excluding IT/ITeS)</td>
<td>2010: 9% (1.9 mn users)</td>
<td>2015: 40% (9.2 mn users)</td>
</tr>
<tr>
<td></td>
<td>2015: 663 (0.8% of industry revenues in 2015)</td>
<td></td>
</tr>
<tr>
<td>IT / ITeS</td>
<td>2010: 21% (1.9 mn users)</td>
<td>2015: 102 (11.3 mn users)</td>
</tr>
<tr>
<td></td>
<td>2015: 102 (0.6% of industry revenues in 2015)</td>
<td></td>
</tr>
<tr>
<td>Agriculture</td>
<td>2010: 0% (0.0 mn users)</td>
<td>2015: 2% (3.7 mn users)</td>
</tr>
<tr>
<td></td>
<td>2015: 17 (0.1% of industry revenues in 2015)</td>
<td></td>
</tr>
</tbody>
</table>

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, Frost & Sullivan, NASSCOM, CII-PWC Report on IT/ITeS Industry
Wireless access system will be significant contributors to India economic growth

- Incremental broadband spend on wireless systems is expected to reach ~USD 20 billion in 2015 growing at a CAGR of 82% over the next 5 years.

- Incremental revenue for the broader wireless ecosystem is projected to exceed USD 12 billion by 2015

- 120,000 to 140,000 new employment opportunities are expected to be created by the telecom industry (service providers, handset vendors, equipment vendors and VAS value chain players) by 2015

- The overall contribution of the wireless broadband industry will reach 2.3% of GDP over the next five years with an incremental contribution close to 1%

- The indirect contribution to economic growth through productivity increase will reach close to USD 80 billion

- The projected impact cannot be fulfilled with the current spectrum allocation – operators will experience capacity constraints by 2013
Contents

Executive Summary

Overview of Broadband Services in India

The Wireless Broadband Ecosystem

Socio-economic Impact of Wireless Broadband

Imperatives for Stakeholders in the Indian Wireless Broadband Industry
The contribution of wireless broadband is in line with international experience

- Recent economic surveys have assessed the impact of the broadband industry on the economy
- Based on the literature reviewed, the wireless broadband industry will have an impact of over USD100 billion over the next five years or 0.8% of GDP

<table>
<thead>
<tr>
<th>Broadband Penetration</th>
<th>Country Type</th>
<th>Economic Growth (GDP)</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-percentage-point increase in broadband penetration</td>
<td>High income economy</td>
<td>1.21%</td>
<td>World Bank 2009</td>
</tr>
<tr>
<td></td>
<td>Medium-low income economy</td>
<td>1.38%</td>
<td></td>
</tr>
<tr>
<td>Broadband-related growth in 2006 in European countries</td>
<td>Less-developed knowledge societies</td>
<td>0.47%</td>
<td>European Commission 2008</td>
</tr>
<tr>
<td></td>
<td>Quickly developing countries</td>
<td>0.63%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Large industries</td>
<td>0.70%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Advanced knowledge societies</td>
<td>0.89%</td>
<td></td>
</tr>
<tr>
<td>70% household penetration</td>
<td>15 EU countries</td>
<td>1%</td>
<td>TRA 2008</td>
</tr>
<tr>
<td>90% household penetration</td>
<td></td>
<td>1.6%</td>
<td></td>
</tr>
<tr>
<td>10-percentage-point increase in mobile penetration</td>
<td>India</td>
<td>1.2%</td>
<td>ICRIER, 2009</td>
</tr>
</tbody>
</table>
Indirect benefits will be significant as broadband is a key driver of change for productivity improvements

- The broadband market has a multiplier effect on the overall economy, as presented below

<table>
<thead>
<tr>
<th>Broadband Penetration</th>
<th>Country Type</th>
<th>Increase in Productivity</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1Percentage-point increase in broadband penetration</td>
<td>Medium or high ICT</td>
<td>0.1%</td>
<td>LECG, 2009</td>
</tr>
<tr>
<td>10% increase in broadband penetration</td>
<td>US</td>
<td>0.46%</td>
<td>Crandall, Jackson - “Net Impact Study”, 2008</td>
</tr>
</tbody>
</table>

- Based on the literature reviewed, the wireless broadband industry could deliver productivity increase in the order of USD 80 billion over the next five years
However, the lack of spectrum will be a formidable constraint to realizing the broadband potential

- 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

Assumptions

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth per user (Kbps)</td>
<td>383</td>
<td>570</td>
<td>916</td>
<td>1,414</td>
<td>1,978</td>
<td>2,476</td>
</tr>
<tr>
<td>Allocated bandwidth (MHz)</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

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 cities\(^1\) (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 panchayats\(^2\)
  - BSNL covers about 28,000 gram panchayats out of a total 265,000\(^3\)
  - 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

<table>
<thead>
<tr>
<th>Frequency Bands</th>
<th>Key Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3.3GHz</strong></td>
<td>Existing Allocation and Availability</td>
</tr>
<tr>
<td><strong>2.5GHz</strong></td>
<td>Future Roadmap¹ / Satellite Interference</td>
</tr>
<tr>
<td><strong>2.3GHz</strong></td>
<td>Capacity Constraint²</td>
</tr>
<tr>
<td><strong>2.1GHz</strong></td>
<td>Capacity Constraint / Future Roadmap</td>
</tr>
<tr>
<td><strong>1800MHz</strong></td>
<td>Capacity Constraint</td>
</tr>
<tr>
<td><strong>900MHz</strong></td>
<td>Capacity Constraint</td>
</tr>
<tr>
<td><strong>800MHz</strong></td>
<td>Capacity Constraint</td>
</tr>
<tr>
<td><strong>700 MHz</strong></td>
<td>Future Roadmap (Digital Dividend Spectrum)</td>
</tr>
<tr>
<td><strong>450MHz</strong></td>
<td>Future Roadmap</td>
</tr>
</tbody>
</table>

- **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