Socio-economic impact of allocating 700 MHz band to mobile in Asia Pacific

India

THE BOSTON CONSULTING GROUP

Executive summary

The impending switchover from analogue to digital broadcasting across the Asia Pacific presents a unique opportunity to impact the future development of countries in the region

- India is not currently using 698-806 MHz band[1] for broadcast and has a great opportunity to shape development by being a first mover

Allocation of the 698-806 MHz band[1] to mobile broadband is expected to increase adoption, especially among rural users

- Significantly lower capex and network costs should accelerate rollout and reduce cost to end users

This will generate incremental economic benefit (relative to alternate uses, e.g., broadcasting)

- Positive GDP impact (via increased productivity)
- Incremental job and new business creation
- Increased tax revenues

Increased adoption will also bring significant social benefits, helping address rural-urban inequality

- Accessible education
- Improved healthcare
- Financial inclusion

To fully realise these benefits, two conditions need to hold

- *Sufficient bandwidth:* The 698-806 MHz band must be allocated to mobile broadband in each country
- *Technical harmonization:* The 2x45 MHz bandplan adopted by APT must be implemented across the region, to benefit from economies of scale in equipment and handsets

1. Referred to as 700 MHz band

Agenda

Introduction and methodology

Adoption

Economic benefits

Social benefits

Implications for governments and regulators

Switchover to digital broadcasting presents opportunity to reallocate key block of spectrum across Asia Pacific

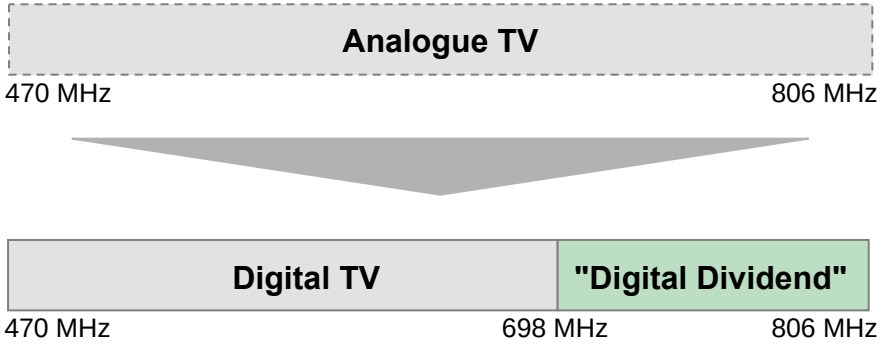
With digitalization, a large portion of the lower UHF band can be freed up...

Today, half of the lower Ultra High Frequency band is used for analogue broadcasting

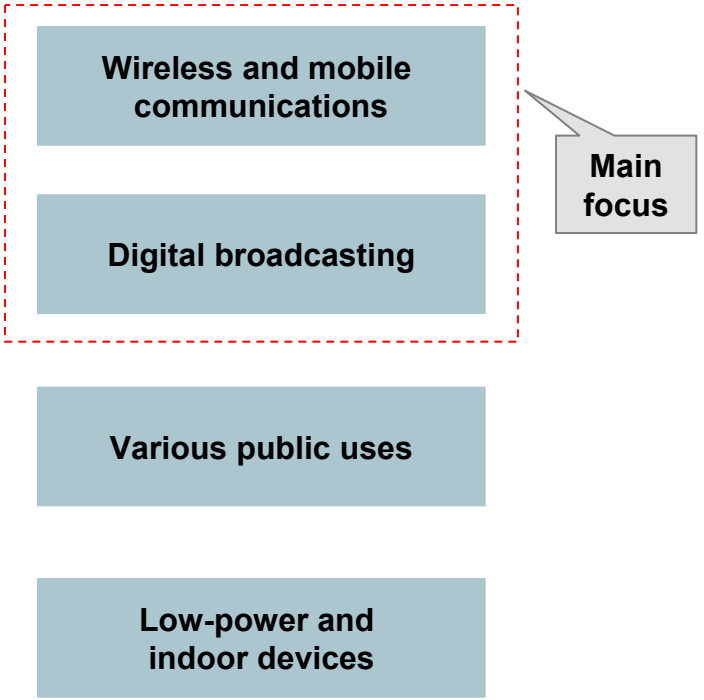
- For most of Asia Pacific, the 470-806 MHz[1] band is used to broadcast analogue television

With digital switch-over, all current channels can be transmitted in a much narrower band

- Studies show that 25% or less of the current spectrum can be sufficient[2] to carry current channels digitally



...presenting a "Digital Dividend" of alternative uses in the 698-806 MHz band[3], e.g.:



India has a great opportunity to take a leading position as it does not have terrestrial broadcasting in 700 MHz band

1. With some variations between countries, some go up to 880 MHz 2. Ofcom's Digital Dividend Review concludes all of UK's 368 MHz of analogue broadcasting could be carried in 40 MHz
3. Referred to as the 700 MHz band
Source: Association for International Broadcasting; GSMA

India is in a unique position to shape development of mobile broadband in the 700MHz band

Not needing to digitize current terrestrial broadcasting...

India currently utilizes the 700 MHz band for various public use

Countries across Asia Pacific will switch over to digital television in the next 2-10 years, e.g.:

- Australia: 2013
- Indonesia: 2014-2018
- Korea: 2012
- Malaysia: 2015

Most countries likely to allocate 700 MHz band to mobile broadband

- 2x 45 MHz harmonized band plan agreed by the 9th Meeting of the APT Wireless Forum in Sep 2010

... could create significant first-mover advantage in Asia Pacific

Implementing the APT band plan could kick-start the market ahead of other countries

- Possibility to shape the market and technical development
- Reach economies of scale in network equipment and handset manufacturing

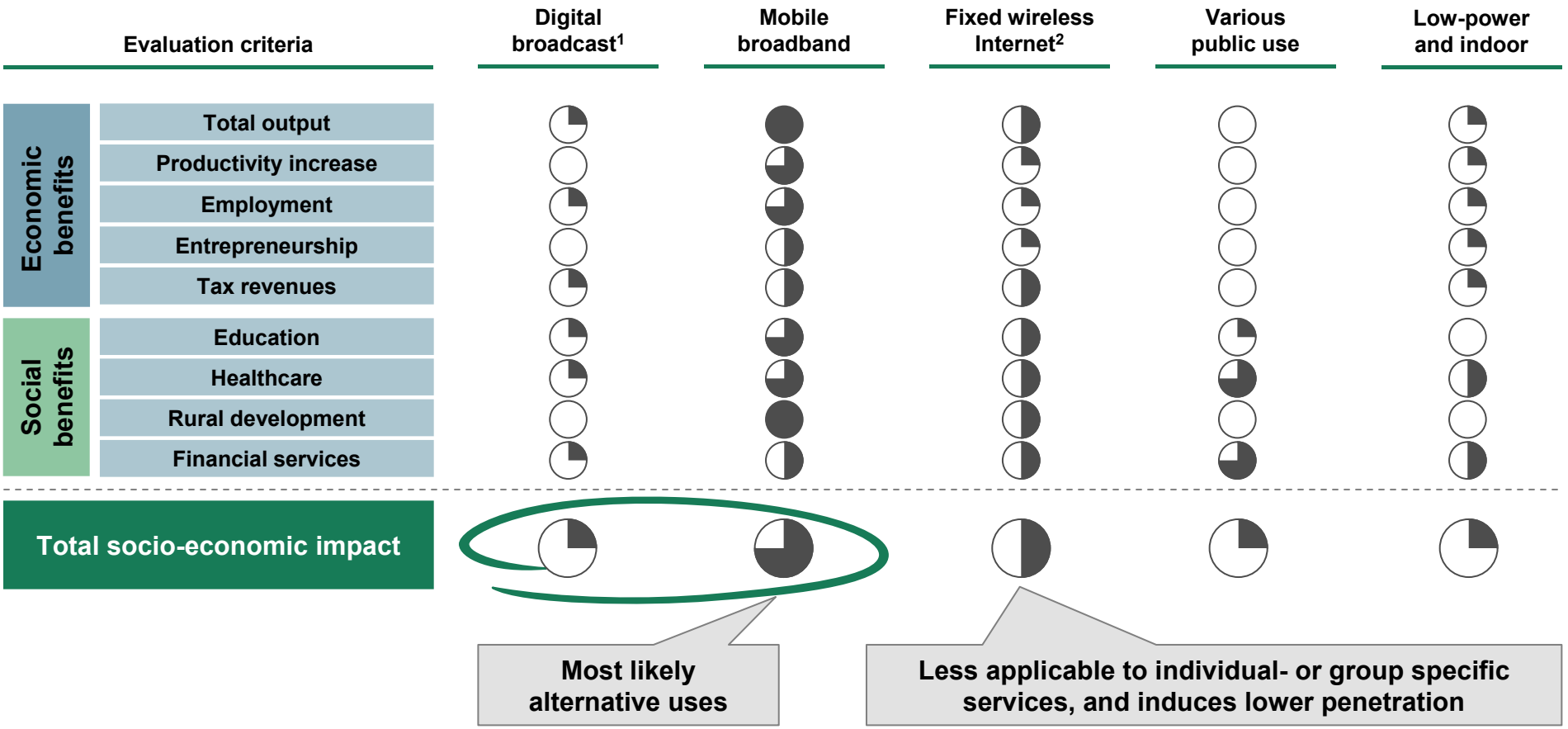
Opportunity to greatly reduce cost of service and make broadband widely available in India

- Handset and service cost important barrier of uptake
- Can take leading position due to India's size and first mover advantage
- Cooperation with neighbors needed to achieve full economies of scale benefits

For conservativeness, alternative use will be modeled as broadcasting, as it will have the highest potential impact[1]

1. India currently uses the 700 MHz band for various public use, for which it is difficult to estimate socio-economic impact. Broadcasting is modeled as an upper bound of alternative use
Source: GSMA; Telecom Regulatory Authority of India

Mobile broadband likely to deliver superior socio-economic impact compared to broadcasting and other uses...



○ No incremental benefit compared to baseline ● High incremental benefit compared to baseline

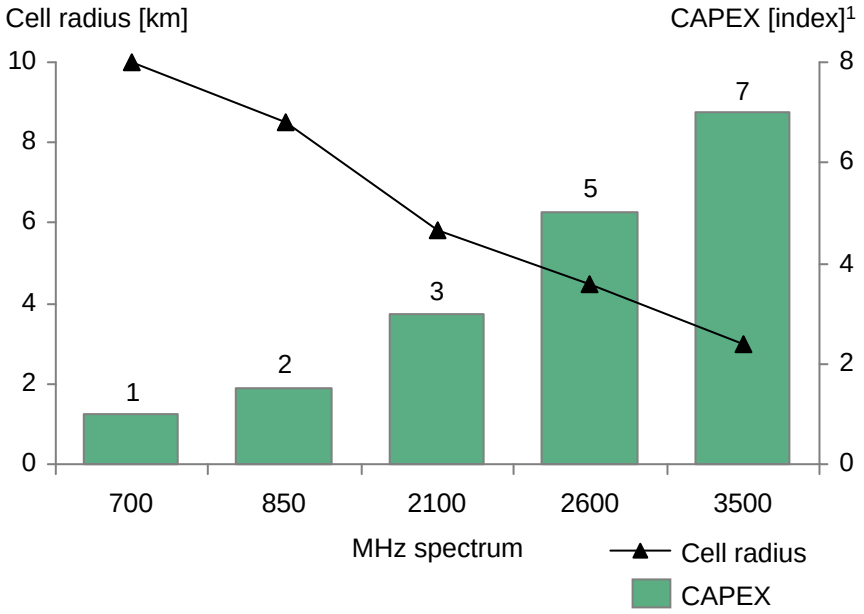
1. Extending number of channels beyond today's analogue which will be switched over 2. E.g. WiFi, WiMAX 3. Including emergency services, disaster warning and recovery
Source: Expert interviews; BCG analysis

... as 700 MHz band has unique characteristics making it ideal for roll-out of mobile broadband in rural areas

The 700 MHz band provides an optimal combination of range and data capacity

Significantly lower build-out cost can provide access to rural and difficult-to-reach areas

- At 700 MHz the signal covers a reception radius of 10 km, compared to ~6km for 2,100 MHz
- Implies up to 70% lower infrastructure investments needed versus 2,100 MHz



This will enable significant benefits if allocated to mobile broadband

Greater coverage and lower service costs would greatly improve customer accessibility

- Rural areas with previously limited coverage
- Low-income households who could not afford internet
- Entrepreneurs and small companies

Substantial economic impact from increased productivity and new business activity

- Increase productivity for businesses and agriculture
- Spur entrepreneurship and employment
- Benefit from infrastructure investment & taxes

Significant social benefits, especially in rural and less developed areas

- Enhance healthcare and education
- Facilitate rural development
- Provide access to information and entertainment

1. E.g. using the 2100 MHz band will require 3 times as many base stations
Source: SCF Associates; GSMA; Expert interviews; BCG analysis

700 MHz band can also help overcome common barriers to Internet adoption ...

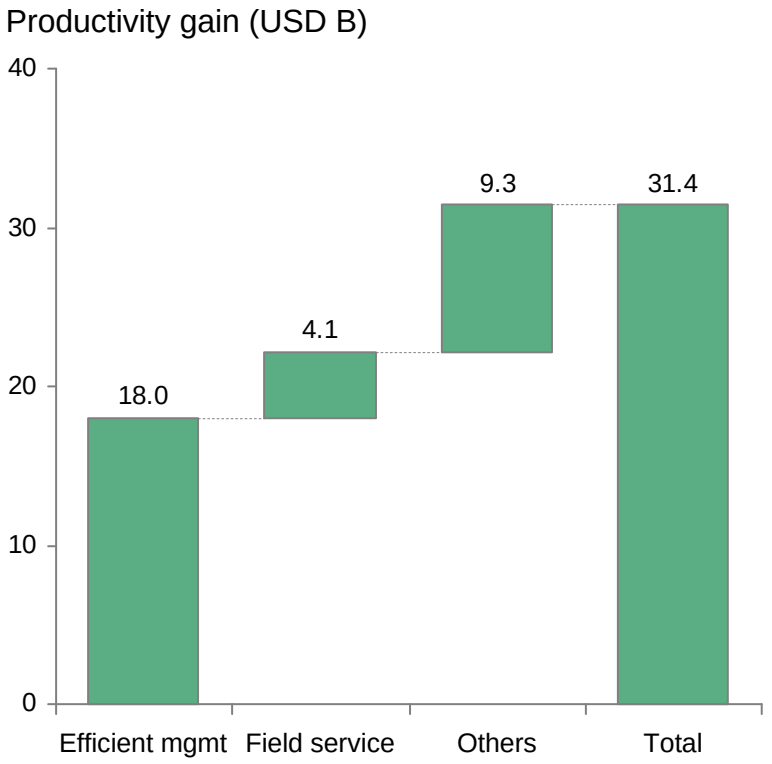
Infrastructure availability	**More rapid roll-out, with significantly larger rural footprint** • 700 MHz band has propagation characteristics highly suitable for rural and less densely populated areas	✓
Affordability	**Cost of service will be reduced, improving affordability for the poor** • Halving CAPEX requirements to establish network coverage can lower cost of service by approximately 5-10%, benefiting low income groups	✓
Perceived value of relevant content	**Availability of local content and services will be improved short-term** • Infrastructure investments and uptake likely to boost local content and service development ecosystem	✓
Literacy/ IT literacy	**Usage capabilities and trust in services will to be built up over time** • General and technical education made available to the individual likely to improve general literacy and IT skills over time	✓ Long-term

... and can complement fixed BB to boost business adoption and increase the productivity benefit

Complementary benefits of wireless broadband ...

Efficient management & documentation	• Accessing email on-the-go can save 30 minutes / day • Data synchronization reduces demand for paper documentation
Field service automation	• Real-time location information and least-distance routing allows field service workers to save time and fuel
Sales force automation	• Real-time access to inventory reduces risks of unfulfilled orders • Real-time updating of customer records improves customer relationship management
Others	• Virtual network office reduces need for staff at headquarters • Replacement of landlines with VOIP also saves cost

... helped U.S. realize productivity gain of USD 31B in '05[1]

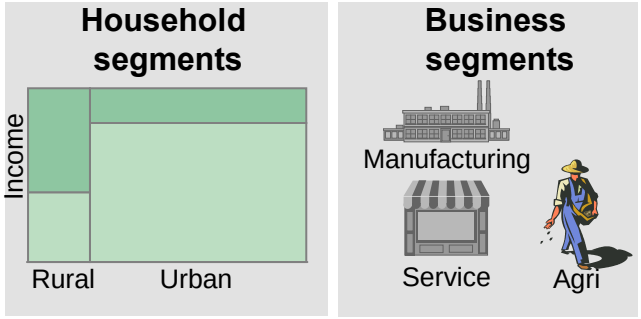


1. Based on 25% wireless BB penetration among enterprise users of telecom services

Source: The Increasingly Important Impact of Wireless Broadband Technology and Services on the U.S. Economy - Roger Entner 2008; BCG analysis

Study builds on rigorous cost-benefit analysis to estimate incremental adoption uplift from mobile broadband

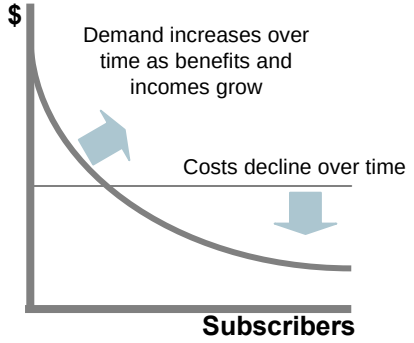
Cost-benefit analysis of businesses and households

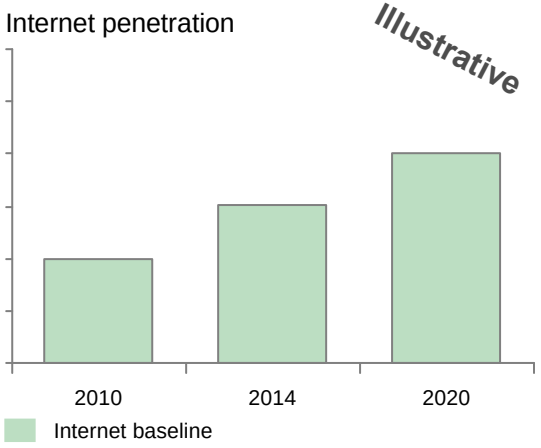


Costs
- Device
- Subscription/ access

Benefits
- Increased profits for businesses
- Increased income/welfare for households

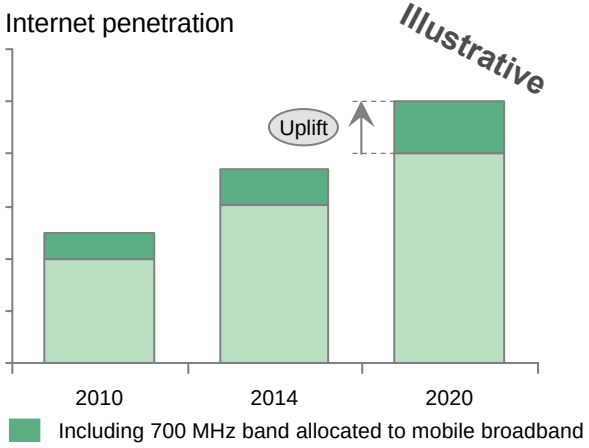
Baseline estimate for Internet penetration





Incremental effect of mobile broadband in 700 MHz band

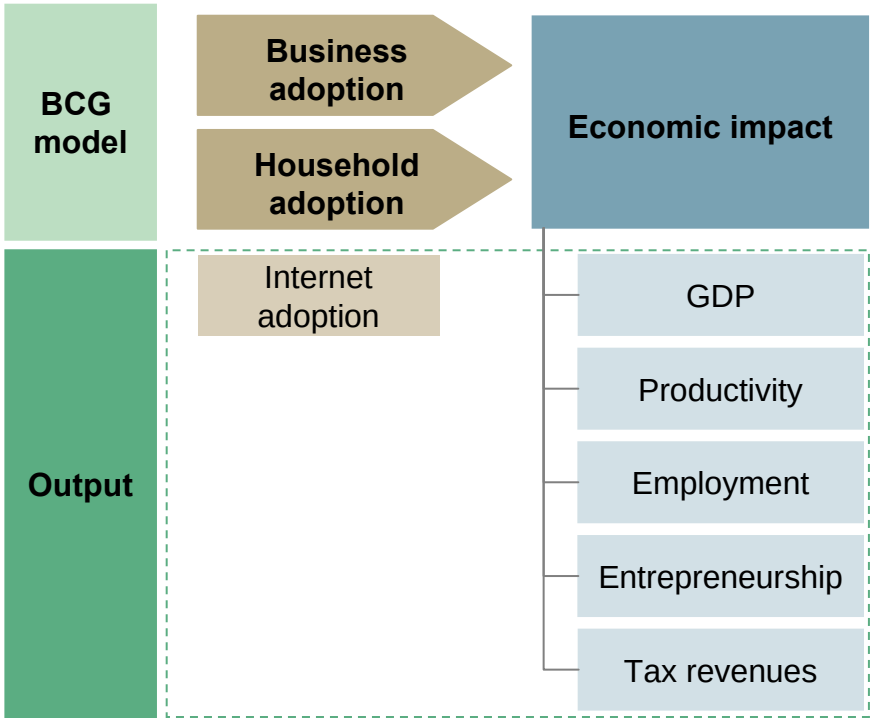
Mobile broadband in 700 MHz band will increase benefits and reduce costs
- Greater coverage and lower service costs will improve accessibility
- Economic benefits from increased productivity and rate of adoption
- Significant social and economic benefits in rural areas



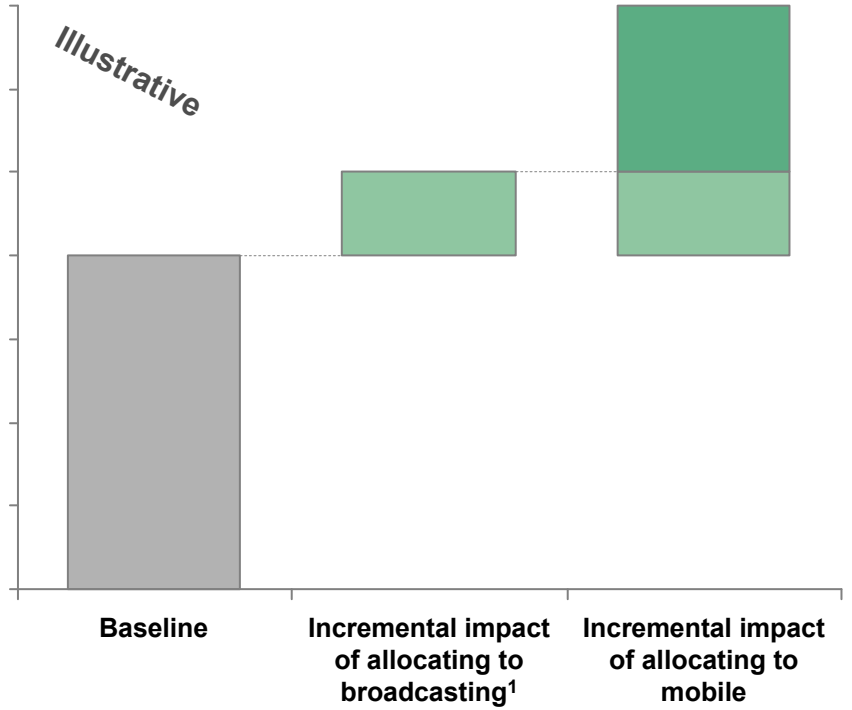
Note: Figures are illustrative

Adoption is translated into five economic factors...

Five economic factors are modeled...



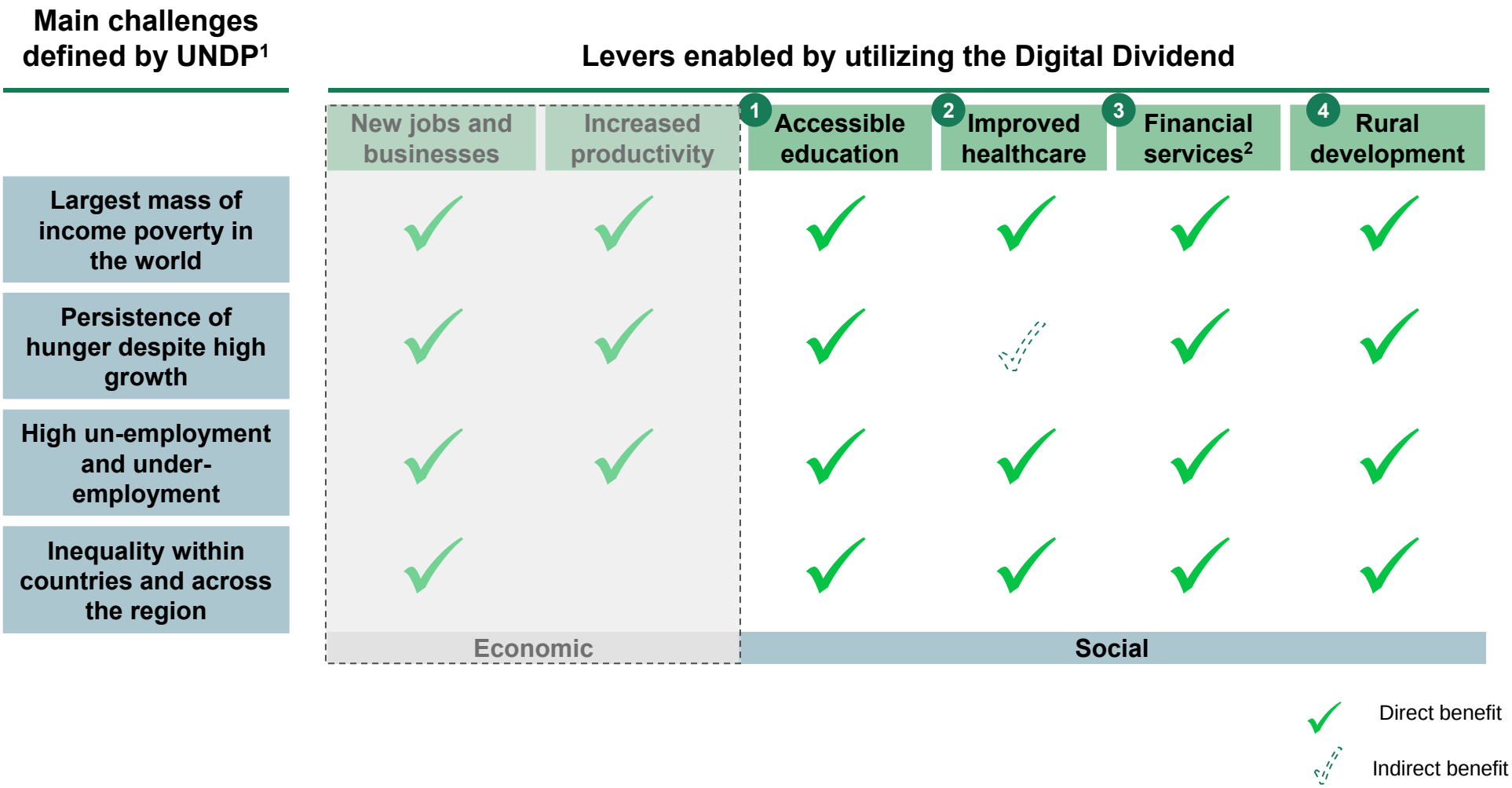
... to assess incremental value of allocating 700 MHz band to mobile



Costs related to digital switchover assumed to be sunk costs, and are not factored in the estimates

1. India currently uses the 700 MHz band for various public and military use, for which it is difficult to estimate socio-economic impact, broadcasting is modeled as an upper bound of alternative use
Source: GSMA; Telecom Regulatory Authority of India

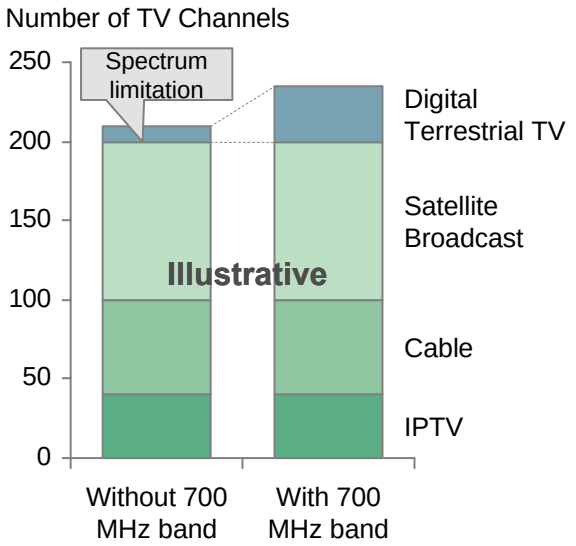
...and four social impact levers to help address the most important challenges across Asia Pacific[1]

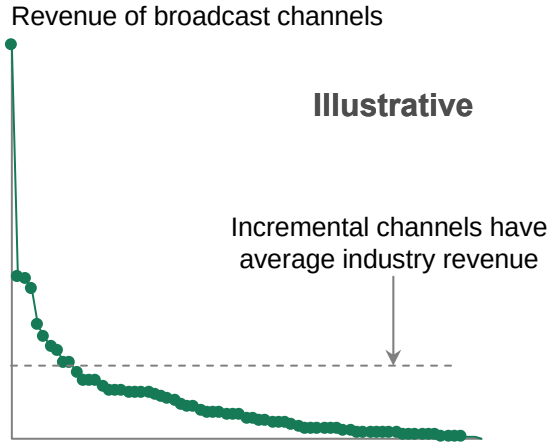


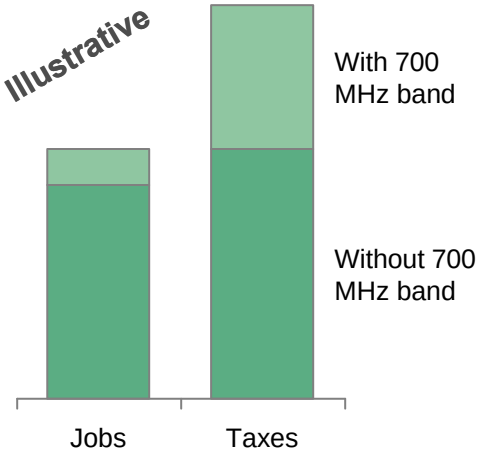
1. As defined by United Nations Development Programme (2009) 2. Including e.g micro-finance, micro-insurance and infrastructure for targeted financial aid from government and NGOs
Source: UNDP

Broadcast impact calculated with best-case assumptions, to ensure conservative estimates of mobile benefit

700 MHz band allows more TV channels... → **Generating revenue across supply chain...** → **As well as broadcast jobs and taxes**







Generous assumptions on additional channels

- 25-35 additional channels are technically possible in most countries
- Possibility that channels may not be commercially viable deliberately excluded

Optimistic revenue assumptions: overall industry effect may be lower

- Additional channels will cannibalize existing offerings
- Marginal channels likely to be niche

Few spinoff effects to general economy

- Existing public service channels already provide wide range of educational content
- Special interest groups well served by cable/satellite

Analysis of two representative study circles extrapolated to estimate impact for India as a whole

Study circles chosen based on HDI[1], urbanization and mobile penetration

Current human development level

- Increased mobile access, particularly in rural areas, has potential to improve education, healthcare, rural employment, etc.
- Current UN Human Development Index (UN HDI) score used as metric of development

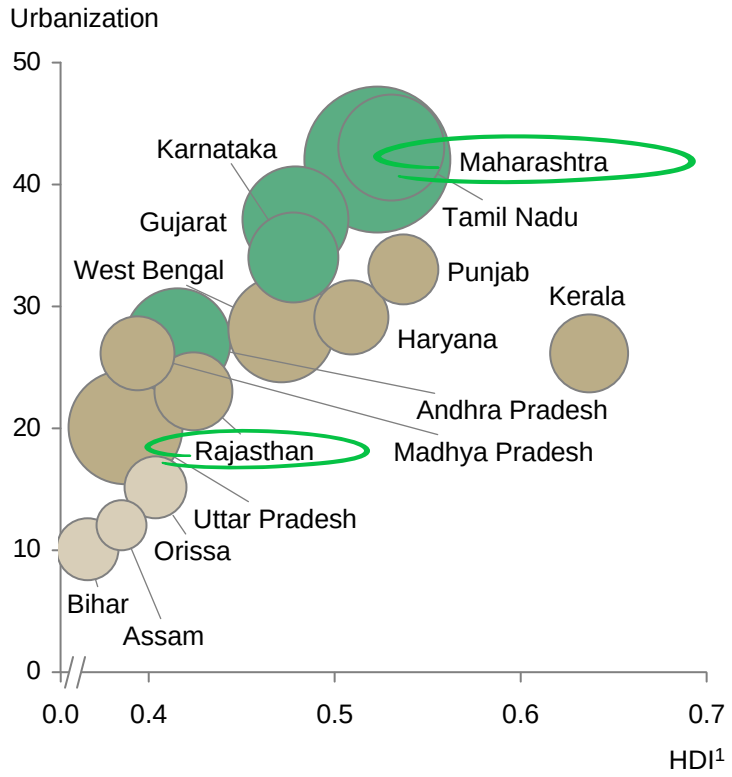
Rural-urban split

- High proportion of rural, low-density population increases incremental value of 700 MHz band

Mobile penetration

- High mobile penetration decreases incremental value of 700 MHz band

Rajasthan and Maharashtra modeled to estimate total impact for India



1. Human development Index
Note: Size of bubble denotes GDP at constant prices (2006) converted at Rs/USD Interbank rate as of 31/12/02006. Metro circles not included
Source: Directorate of Economics & Statistics of respective State Governments, and for All-India, ITU

Extrapolation from study circles based on level of urbanization and current mobile penetration

Urbanization and penetration used to estimate uplift factor...

	Urb. (2) + Penetr. (2) =	Uplift factor
Andhra Pradesh	0.84	0.64	1.35
Assam	0.56	0.54	1.82
Bihar	0.54	0.45	2.02
Delhi	0.42	2.19	0.77
Gujarat	0.86	0.88	1.15
Haryana	1.13	1.24	0.85
Karnataka	0.97	0.80	1.13
Kerala	1.55	1.11	0.75
Madhya Pradesh	0.65	1.14	1.12
Maharashtra[1]	1.00	1.00	1.00
Orissa	0.70	0.64	1.50
Punjab	1.44	1.45	0.69
Rajasthan[1]	1.00	1.00	1.00
Tamil Nadu	1.25	1.04	0.88
Uttar Pradesh	0.68	0.89	1.27
Himachal Pradesh	1.49	0.42	1.05
Jammu & Kashmir	0.93	1.06	1.00

... to estimate socio-economic impact for entire cluster of countries

GDP impact based on impact/GDP ratio

$$\sum_{\text{States}} \frac{\text{GDP uplift study circle}}{\text{GDP of study circle}} * \text{state GDP} * \text{uplift factor}$$

Governmental revenue based on tax/GDP ratio

$$\sum_{\text{States}} \frac{\text{Tax uplift study circle}}{\text{Tax of study circle}} * \text{country tax} * \text{uplift factor}$$

Jobs created based on GDP[2]

$$\sum_{\text{Countries}} \text{Jobs created study circle} * \frac{\text{State GDP}}{\text{Study circle GDP}} * \text{uplift factor}$$

New business creation based on GDP[2]

$$\sum_{\text{Countries}} \text{New biz created study circle} * \frac{\text{State GDP}}{\text{Study circle GDP}} * \text{uplift factor}$$

1. Study circle 2. Used instead of new jobs and business ratios, in lack of accurate data for state-wise number
Source: IMF; UNDP; CIA World Factbook; ITU; BCG Analysis

Agenda

Introduction and methodology

Adoption

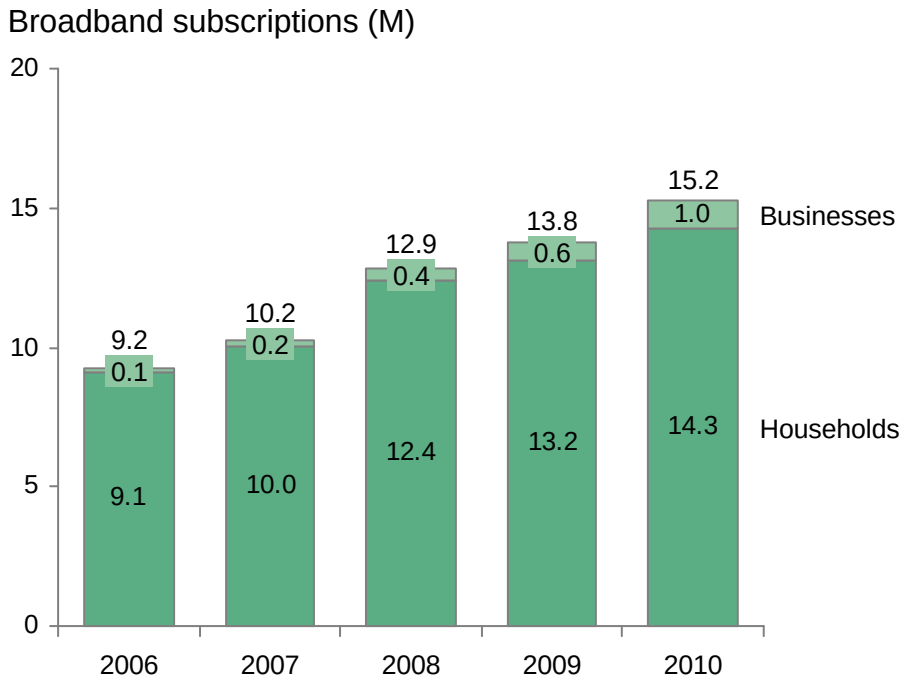
Economic benefits

Social benefits

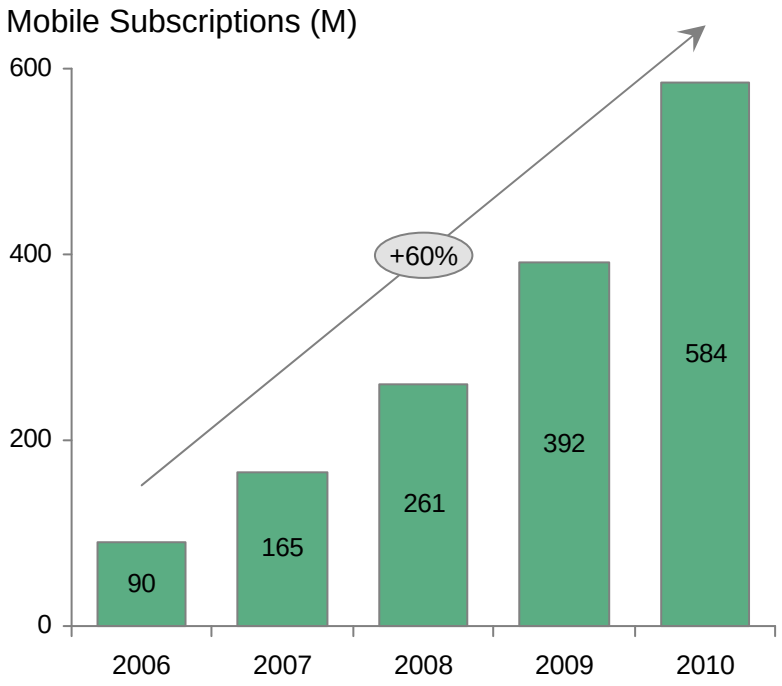
Implications for governments and regulators

Today: Internet access low as compared to mobile penetration

Low penetration and growth rate of internet in India



Mobile penetration rates in excess of 50% and growing rapidly



HDI	Urbanization	Population
0.61	30%	1.17B

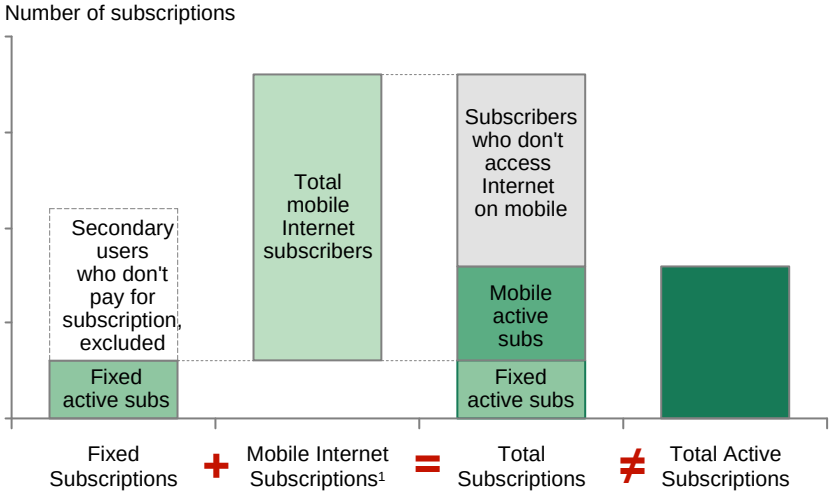
Source: TRAI, Gartner, CIA World Factbook

Baseline Internet penetration calculated as Active Subscriptions, to better predict economic impact

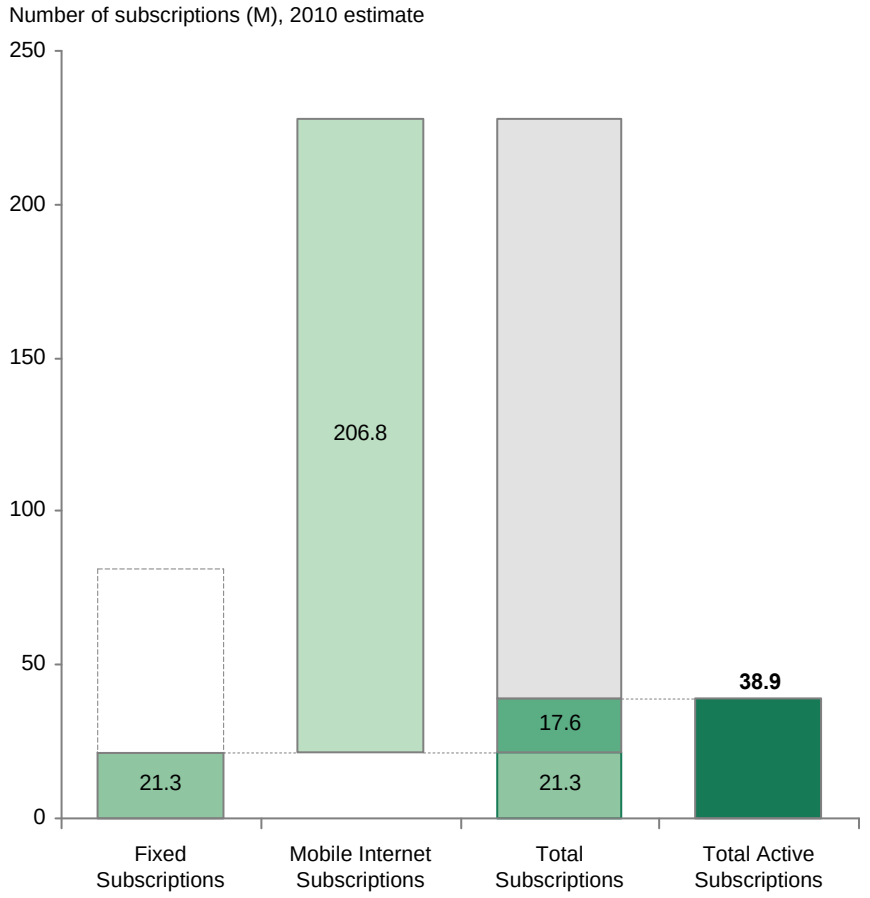
Internet statistics differ according to subscription vs usage

For fixed line internet, generally Users > Subscriptions
- Many people use internet at cafes, or share in household
- Each subscription often shared with secondary users

- **For mobile internet, generally Users < Subscriptions**
- "Subscriptions" counts people with Internet-enabled phones[1] in areas with 2.5G or better coverage
- A subscription could potentially go unused due to unwillingness to pay incremental data charges or lack of awareness of the Internet

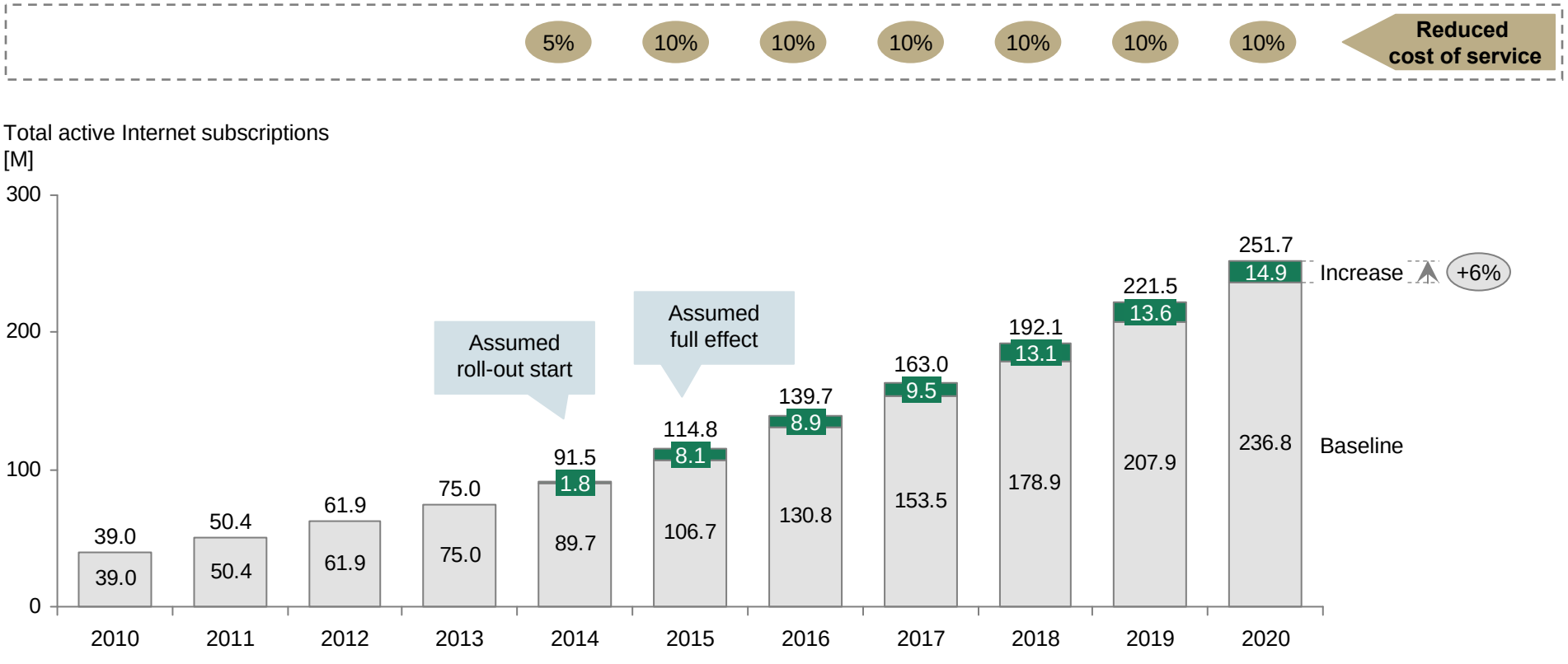


2010 baseline aligned with national and industry statistics



1. Includes dongles and other wireless data devices
Note: subscription numbers not explicitly quoted are estimates for illustrative purposes
Source: TRAI Telecom Subscription Data as of 31st August 2010; IDFC Securities Indian wireless June 2010; Wireless Intelligence; GSMA; TeleGeography; BCG analysis

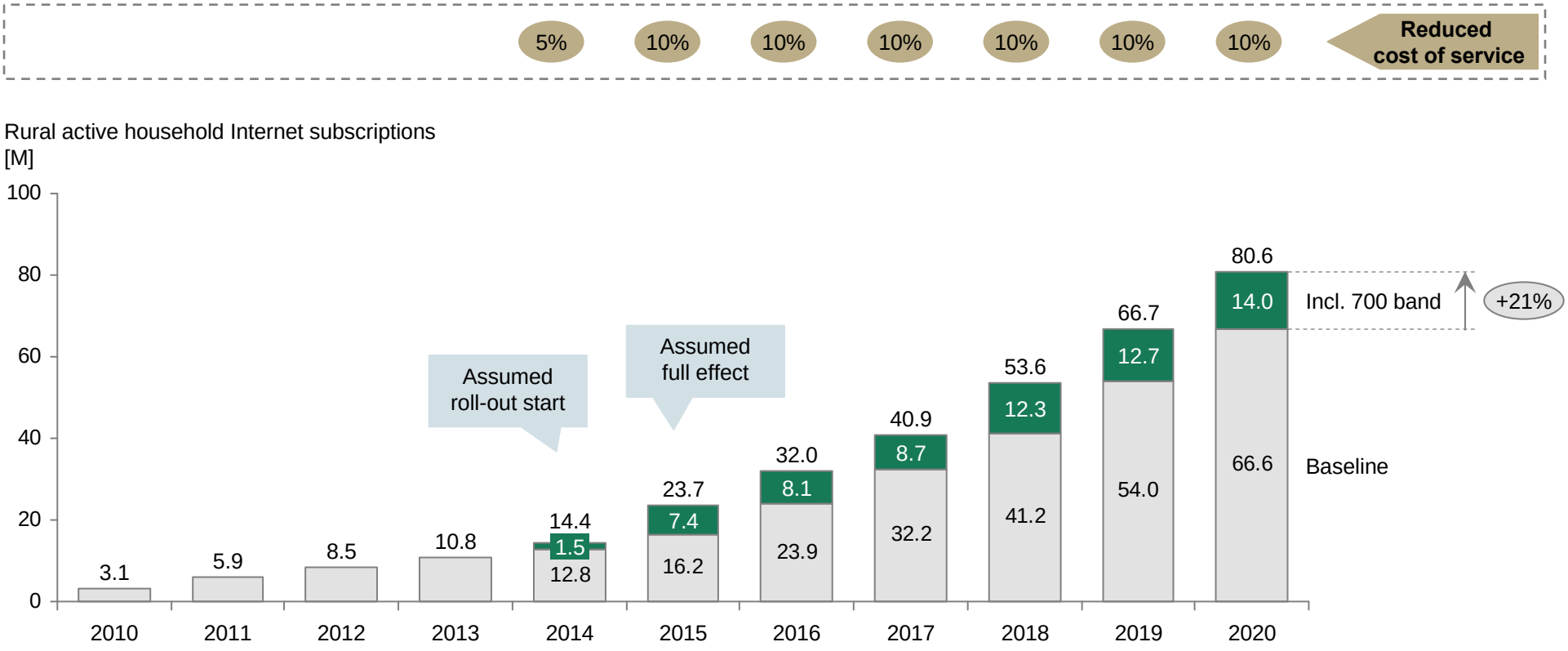
Overall Internet subscriptions expected to increase 6%, representing an additional ~1 subscriber per 100 population



Additional uplift from improved quality of service in urban areas expected, but not included for conservativeness

Source: BCG analysis

Allocating 700 MHz band to mobile broadband can increase rural Internet subscriptions by ~21% by 2020



Source: BCG analysis

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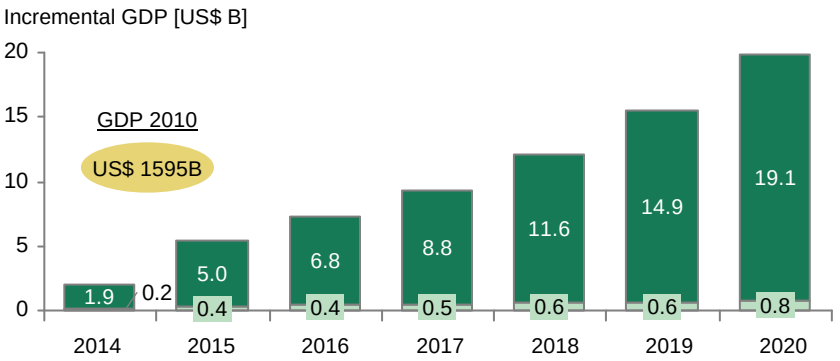
Economic benefits

Social benefits

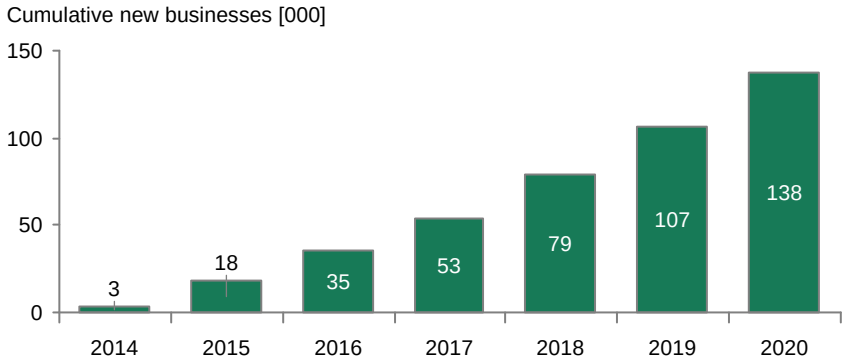
Implications for governments and regulators

Allocation of 698-806 MHz band to mobile will have significant incremental economic benefits over alternative use

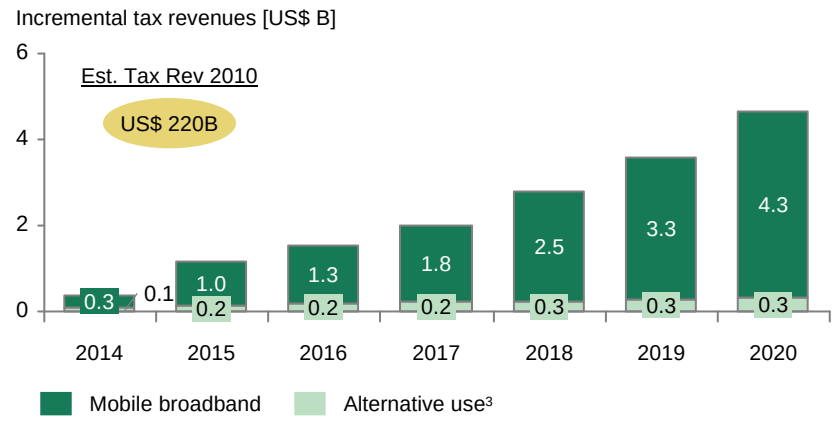
GDP to increase US$ 68.1B 2014-2020 (US$ 43.8 NPV[1])



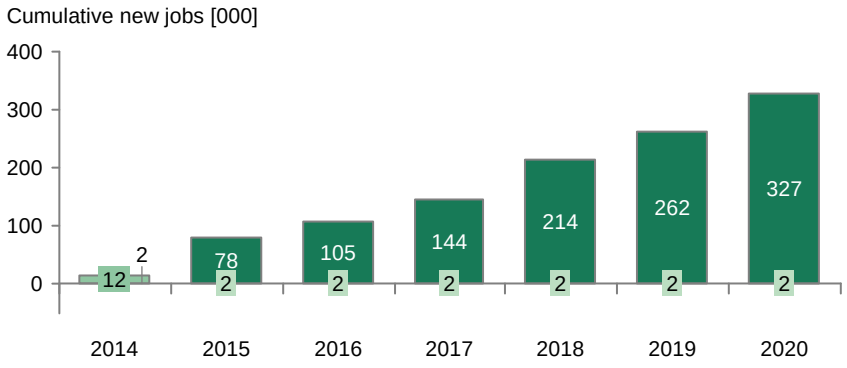
138K new businesses by 2020[2]



Government revenues up US$ 14.6B (US$ 9.3 NPV[1])



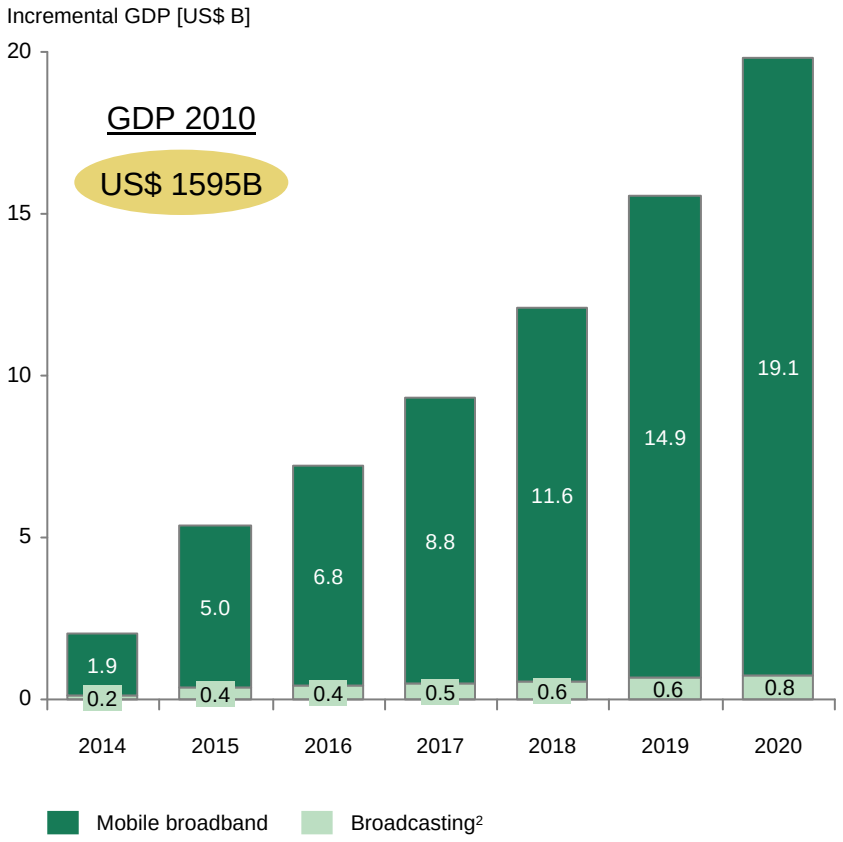
327K new jobs created by 2020



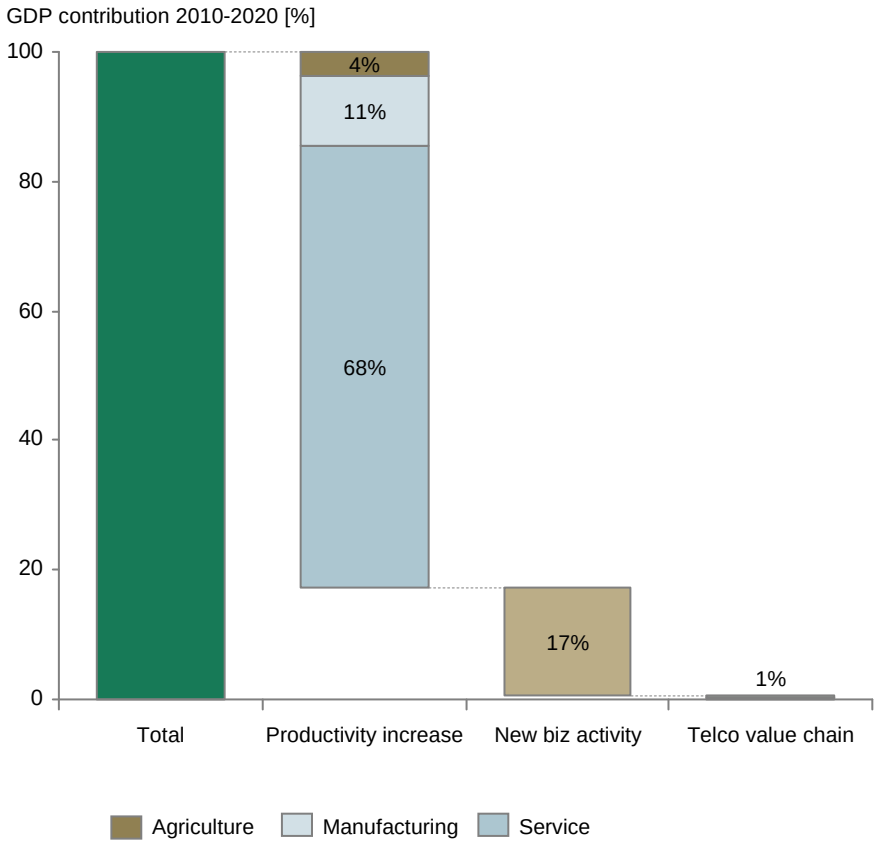
1. Net Present Value 2010-2020 with discount rate of 5%, based on 1y Gov. securities rate 2. Incl. new independent businesses as well as new departments/units/business areas within existing firms
3. India currently uses the 700 MHz band for various public use, for which it is difficult to estimate socio-economic impact, broadcasting is modeled as an upper bound of alternative use
Source: BCG analysis

Total GDP will increase ~US$ 68B for the period 2014-2020

US$ 68.1B increase in GDP for 2014-2020 (US$ 43.8B NPV[1]) ...



... largely driven by increase in business productivity



1. Net Present Value 2010-2020 based on discount rate of 5%, corresponding to 1 year Government securities rate
2. India currently uses the 700 MHz band for various public use, for which it is difficult to estimate socio-economic impact, broadcasting is modeled as an upper bound of alternative use

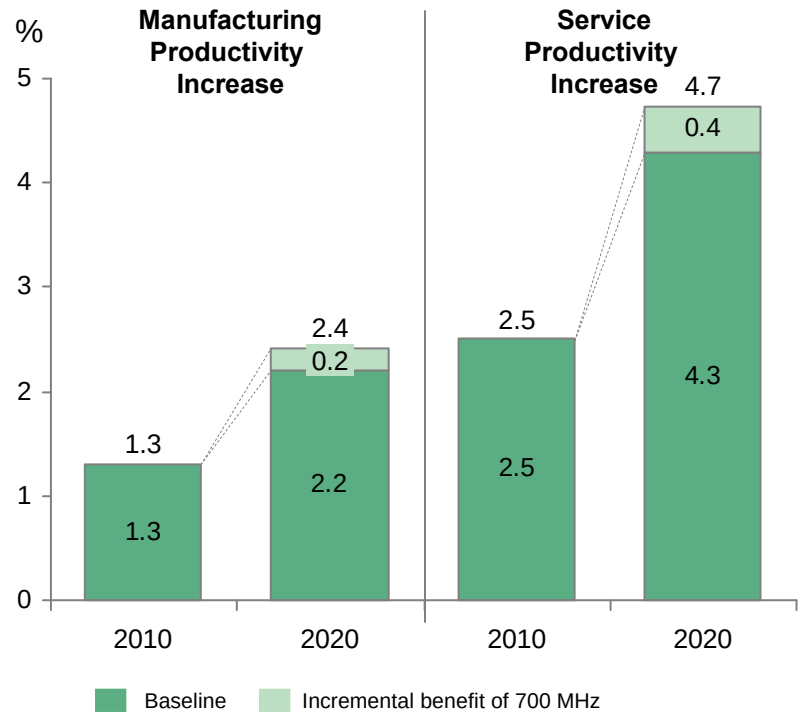
Source: BCG analysis

~0.2% and 0.4% additional uplift in manufacturing and service firms' productivity due to greater rural adoption

Incorporation of Internet into range of business operations ...

Suppliers	• Integrated supply chain reduces lead time & stock levels, as well as optimize logistic and cash management
Customers	• Online services can improve customer satisfaction, reduce costs • E-commerce and online marketing increase selling opportunities
Internal process	• Intranet & email aids knowledge sharing within organization • Streamline process saves time & allows employees to focus on core activities
3rd party transaction	• Electronic transaction with 3rd party such as banks and government saves travel time and improve efficiency for companies

... leads to productivity improvements in manufacturing & service companies



No productivity increase expected from allocating the 700 MHz band to broadcasting

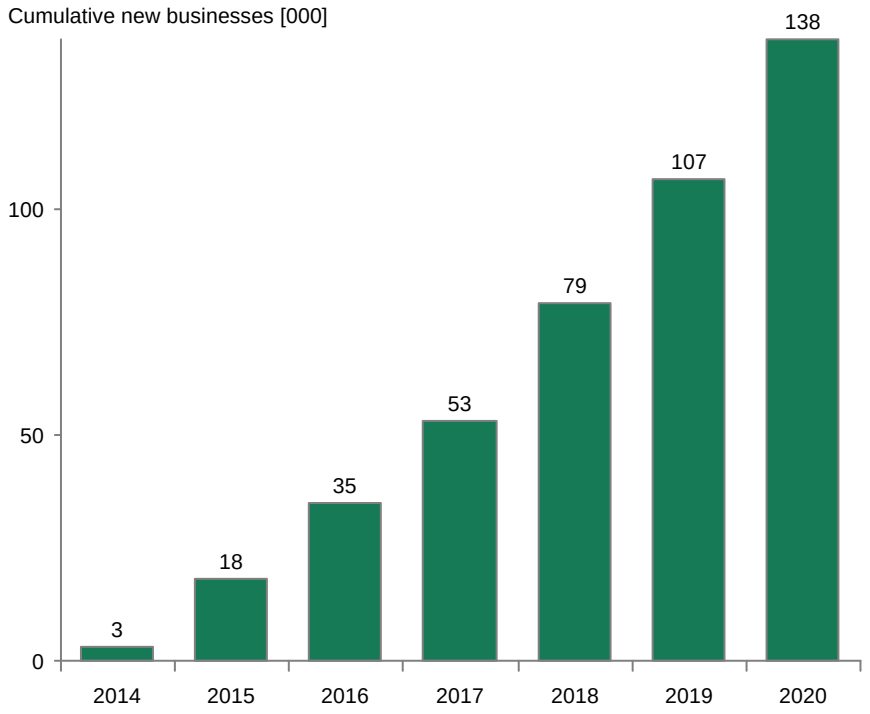
Source: BCG analysis

Allocation of 700 MHz band to mobile could result in ~138K new business activities[1] by 2020...

Increased Internet penetration creates opportunities in new spaces ...

Website design	ICT training	e-commerce for existing businesses
ICT maintenance	e-job services	Online specialty stores
Education application	Agricultural trading	Programming
Online outsourcing	Entertainment content	Hardware / software reseller

… contributing to the generation of new businesses activities



1. New business activities includes establishment of new independent businesses as well as new departments/units/business areas within existing firms
Source: EIU; MIT/CMU; MOSPI; Indiastat; BCG analysis

... and create at least 327K new jobs relative to alternative use

New business activity will drive job creation

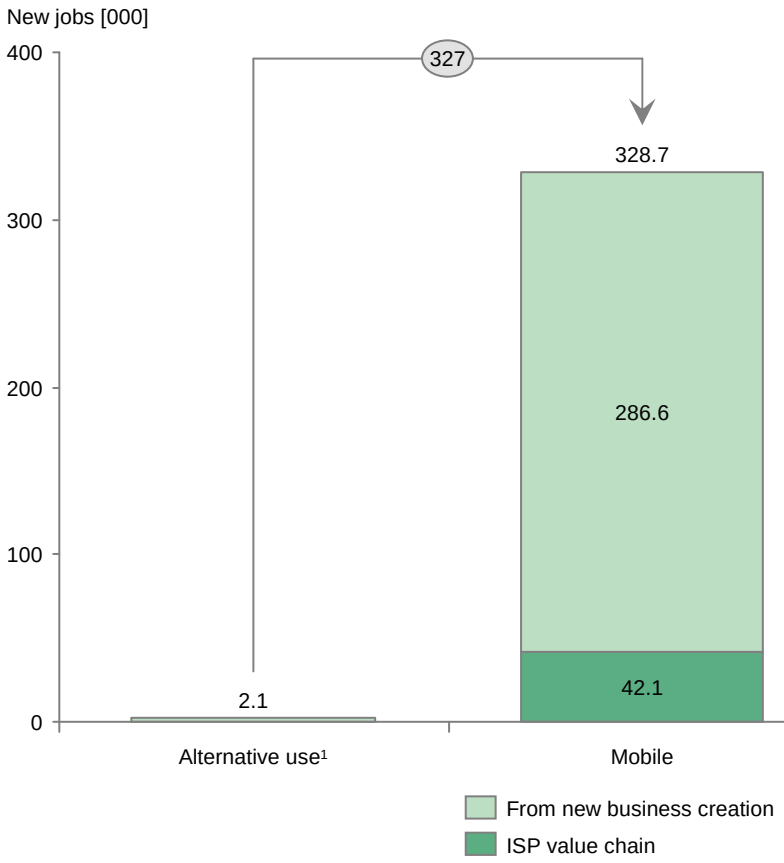
New businesses created as a result of 700 MHz band will create more opportunities for employment

- Diverse range of opportunities, from high-skilled technical roles to basic service functions, e.g.., distribution of goods
- Significant portion should be created in rural areas, as 700 MHz band enables new business models

Although increased productivity in additional firms should spur further job creation, this is excluded from the analysis

- In line with general approach of making conservative assumptions where possible

327K more jobs from mobile than from broadcasting



1. India currently uses the 700 MHz band for various public use, for which it is difficult to estimate socio-economic impact, broadcasting is modeled as an upper bound of alternative use
Note: Rounded to nearest per thousand
Source: EIU; CIA World Factbook; Manobi; OECD; Indiastat; MOSPI; CSO; Capitaline; Press Searches; BCG analysis

In total, allocating 700 MHz band to mobile could contribute additional ~US$ 15B[1] to government revenues 2014-2020

Productivity benefits of mobile drive increased tax revenues for government

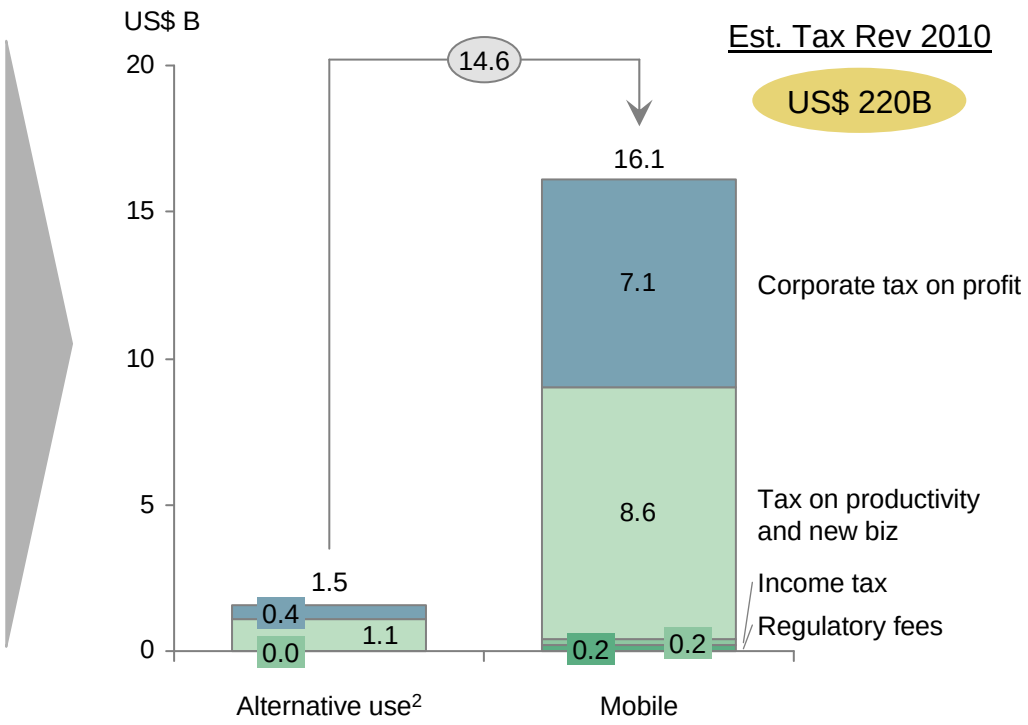
700 MHz band will increase productivity, and hence output, which will in turn increase government revenues

- Increased adoption by rural industries
- Greater adoption of mobile broadband to supplement fixed broadband

Incremental taxes from usage of 700 MHz band expected to be ~US$ 16.1B over 6 years

- ~US$ 14.6B more than broadcasting over the period[1]
- Incremental broadcasting taxes likely to be lower than the estimated US$1.5B, as some of the profits for the new channels will come at the expense of existing channels

Net benefit over broadcasting expected to be US$ 14.6B for by 2020



1. Net Present Value of US$ 9.3B calculated at 1-year GSec rate of 5% (TTM average)
2. India currently uses the 700 MHz band for various public use, for which it is difficult to estimate socio-economic impact, broadcasting is modeled as an upper bound of alternative use

Source: EIU; CIA World Factbook; Manobi; OECD; Indiastat; CSO; Capitaline; Press Searches; BCG analysis

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Implications for governments and regulators

700 MHz band based mobile broadband can significantly improve social benefits from Internet access

While general Internet access already brings advantages to a community...

- Access to information
- Basic IT literacy
- News and current events
- Access to remote markets



... 700 MHz band based mobile broadband will bring greater benefit

Lower cost will increase connections in homes, especially in low income and rural communities

- Enables Internet access for disadvantaged groups (e.g., women and elderly)
- Opens the possibility of home-based micro-entrepreneurship via Internet

Higher potential speed paves the way for high bandwidth applications

- Rich content and visualization engines

700 MHz band for mobile has the potential to create a step change in how people use, and benefit from, the Internet

Source: One Laptop per Child

Mobile broadband can help address key socio-economic goals of India's 11th Five Year Plan to drive inclusive growth

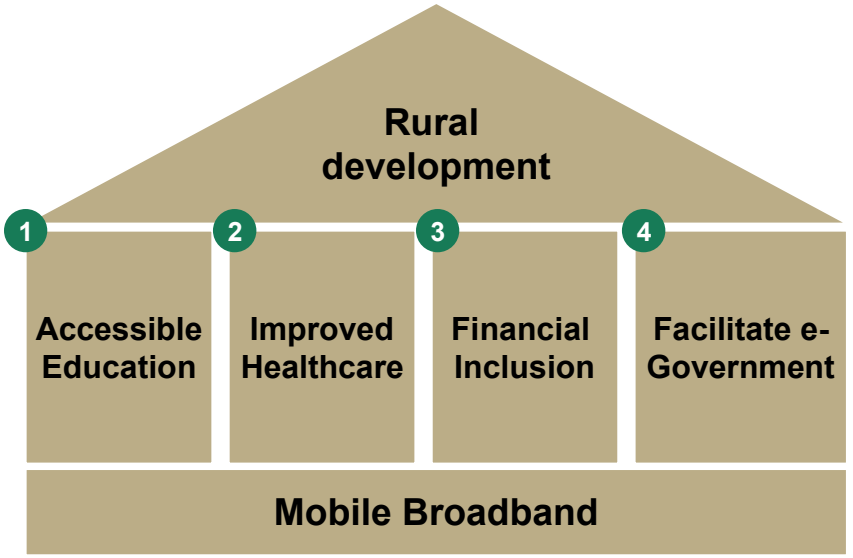
Key socio-economic goals identified by India's Five Year Plan 2007-2012

Education
- Reduce elementary school drop-out rates
- Boost enrollment for higher education
- Increase adult, specifically female, literacy

Healthcare
- Reduce infant and maternal mortality
- Reduce malnutrition and anemia among children and women
- Boost rural healthcare facilities

Income and Poverty
- Boost agricultural GDP
- Drive rural employment

Levers enabled by utilizing the 700 MHz band



Empowering individuals and underprivileged groups is a component of sustained socio-economic improvement

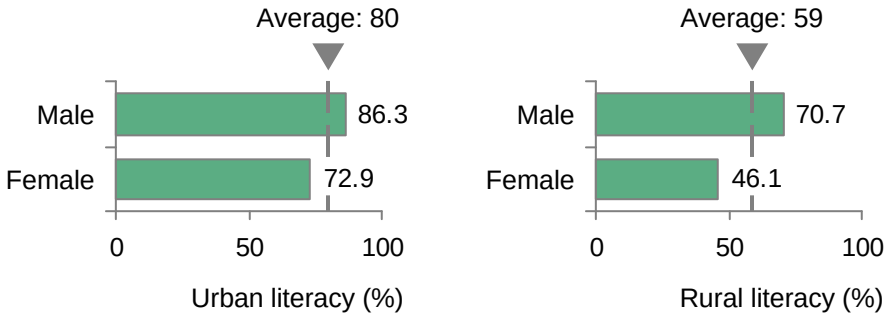
Source: Indian Planning Commission

Indian education plagued by low literacy and poor employability

Low literacy, especially rural, and low employability of skilled workforce...

Low female and rural literacy rate

- Rural female population most disadvantaged



Poor completion of education

- High drop-out rate from schools
- Low enrollment for secondary education

Large unemployability of educated workforce

- Numerical, verbal analytical skills deficient due to poor quality of education
- Vocational skill-set not aligned with industry requirements

... caused by social inequality, poverty and redundancies in curriculum

Resource constraints in rural areas key issue

- Under-qualified teaching staff; high levels of absenteeism among teachers
- Lack of funding and access to resources like libraries and stationery
- Sparse distribution of schools

Deterioration caused by financial crisis; marginalized sections more affected

- Children, especially girls, taken out of school to work as farm labour

Lack of exposure to new avenues

- Disconnect between industry and academia on industry skill requirements
- Delay in delivering new content / curriculum changes down the chain of schools

Source: India Census 2001; BCG Analysis

Mobile broadband can help improve literacy, especially among disadvantaged sections, and increase employability

Access to high quality resources

Virtual platform enables access to quality educational materials at low cost
- Materials developed anywhere can be made available to all

Regular online training for teachers
- Greater awareness through continued learning
- Access to latest teaching aids



More inclusive learning process

Wide, cross-geographic exposure through virtual classrooms
- Free flow of information across learner groups in interactive environment

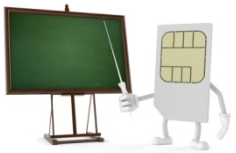
Education accessible to all, especially marginalized groups
- Classroom literally brought to the doorstep
- Lowered social inhibitions through inclusive learning process



Vocational training & adult literacy

Vocational training to ensure greater workforce employability
- Frequent updates to syllabus based on industry feedback
- Accessible even to remote locations covered by internet

Adult literacy through flexi-learning schedules
- Development of individual-specific syllabi in regional languages
- Learning possible without formal enrollment

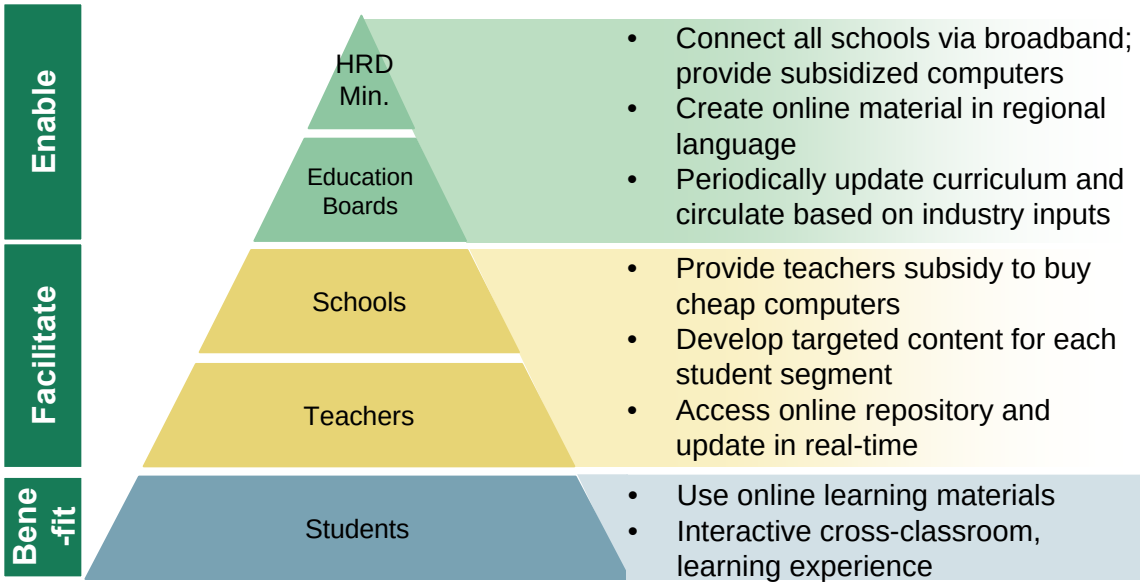


National Skill Development Mission (NSDM) expected to benefit greatly by connecting schools via broadband

NSDM aims to skill / up-skill 500M people in India by 2022 by:

1. **Upgrading skills to international standards through significant industry involvement**
2. **Engaging private sector in identifying and developing the right skill set through Public-Private Partnership (PPP) models**
3. **Focusing on underprivileged sections and backward regions for social uplift**
4. **Enabling viability gap funding, particularly in sectors where market mechanisms are ineffective**

High broadband penetration will significantly boost development of education eco-system



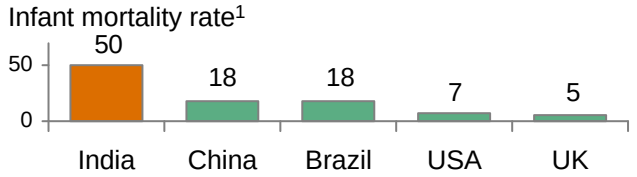
700 MHz band the most cost-efficient method to provide high-speed broadband in rural areas

1. provisional 2005 numbers
Source: Annual Report on Education 2007-08 by HRD Ministry

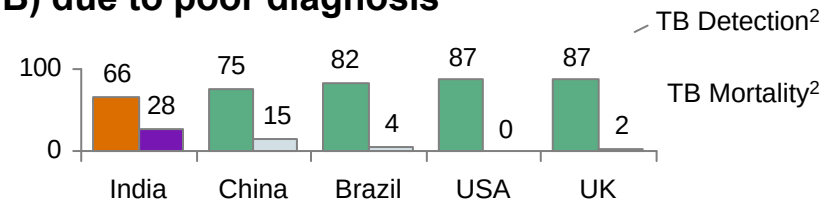
Quality of basic health in India adversely affected by poor healthcare infrastructure

Poor quality of health and lower longevity in India...

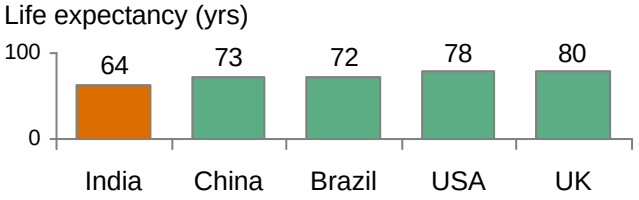
- **High infant and maternal mortality rates**



- **High prevalence of infectious diseases (e.g.. TB) due to poor diagnosis**



- **Lower average life expectancy**



... due to poor quality of healthcare infrastructure, particularly in rural areas

- **Limited access to medical establishments**
  - Sparsely distributed hospital network
  - Shortage of qualified doctors and nursing staff
  - Lack of advanced diagnostic and treatment facilities
- **Quality treatment unaffordable to rural poor**
  - Critical care facilities and treatment for major ailments concentrated in urban areas
  - Need to travel long distances for consultation with specialists
  - Price of drugs prohibitive compared to average rural income
- **Limited government investment in development of healthcare infrastructure**
  - Only ~4% of GDP spent on healthcare

1. Number of deaths of infants (< 5 years old) per 1000 live births
2. Detection is defined as number of cases diagnosed among 100 infected patients. Mortality is defined as number of deaths due to TB per 100,000 people

Source: World Bank, Press searches

Mobile broadband can facilitate service delivery to remote locations and more efficient disease management

Tools for education and awareness

Drive awareness of basic healthcare and hygiene

- Improved access to government and NGO resources
- Dispel common misconceptions about "taboos" like HIV / AIDS and sexual health

Online training for community health workers in latest advances in treatment and disease outbreaks



Streamlined delivery of healthcare

Deliver expert advice to remote locations

- Mobile vans equipped with basic diagnostic facilities
- Real-time update through internet to central repository to enable immediate online diagnosis by specialist
- Multiple opinions for more informed choice of treatment



Improved disease control infrastructure

Easy collection and analysis of health information

- Consolidation of basic health details through online interface
- Dissemination to public health professionals and policy makers

Improved preventive and curative disease management

- Early detection of epidemics through systematic, real-time data collection



Source: BCG Research, Press search, UNAIDS; OneWorld

Some initiatives already underway, but at early stage

Scalability of model constrained by limited rural broadband infrastructure

Real-time monitoring system launched through "SughaVazhvu"

Rural Micro Health Centres (RHMCs) set up across Tamil Nadu

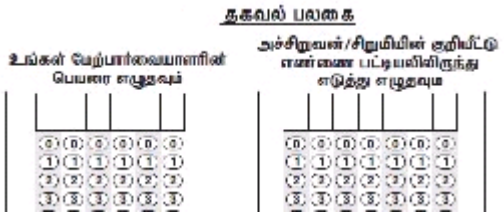
- Run by local community health workers well-versed with basic health concerns in the area

Electronic Health Record (EHR) system established for collation of outpatient details

- Real-time update to central database
- Portal developed in the local language, Tamil, to facilitate use by local health workers

Expert diagnosis conveyed by specialists in leading healthcare institutions

- Prognosis enabled by existence of detailed records



Online diagnostic process piloted through "e-Sanjeevani" in Himachal Pradesh

"Hub-and-spoke" diagnostic model set up

- Remote healthcare centres established in villages with internet and connected to central medical "hub"
- Additionally, GPRS-enabled mobile vans to deliver diagnostic facilities to locations with GSM coverage

Web-based application developed for online collation of basic medical tests

- Mobile vans enabled with basic diagnostic equipment
- Results immediately conveyed to central hub

Tele-consultation by experts in leading urban centres

- Patients can directly interact with specialists via video conferencing



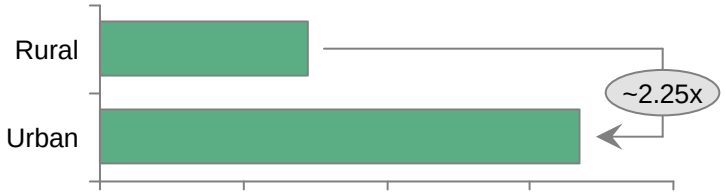
700 MHz band to mobile will drive scalability by increased broadband penetration

Source: Press search; Company website; BCG Research

Low income, fewer employment opportunities in rural India widening rural-urban divide

Low household incomes, poor access to finance, low employment...

Large income gap between urban and rural households (average monthly income, 2009):



Limited access to financial services

- Sparsely distributed bank network
- Large sections of population unbankable
- Low savings and insurance adoption rates

Largely localized businesses

- Lack of awareness and customer outreach due to limited access to wider domestic and global markets

... owing to sluggish growth of rural economy

Rural economy largely driven by agriculture

- ~60% of Indian workforce employed in agriculture, predominantly in rural areas

Low household incomes with high variability

- Limited mechanization of agriculture leading to poor productivity
- Success of crop and financial stability contingent on vagaries of nature

Low profitability of small-scale businesses

- Employ manual labour with low productivity
- Limited economies of scale to leverage
- Limited access to finance owing to poor credit history, resulting from meager and uncertain incomes

Source: NCAER – Great Indian Middle Class Report; Press Research; BCG Previous Case Work; BCG Analysis

Mobile broadband can drive self-sufficiency of rural economy by ensuring business sustainability

Boost productivity and employability of rural businesses

Mobile broadband opens regional and global markets to home-based entrepreneurs
- Increases livelihood potential and opportunities
- Opportunity to sell goods and services to global marketplace

Potential to participate in global labour/service outsourcing
- Broadband enables rural areas to work remotely on outsourced IT work (e.g.., website coding and development, data entry)

Improved productivity of small-scale businesses using ICT
- Opportunity to replace low productivity manual labour, with efficient and reliable processes

Increase access to banking and other financial services

Internet-enabled mobile terminals for wider banking coverage
- Convenient, safe and costless way of saving money; can be as important as financial aid
- Access to micro-loans for entrepreneurship

Micro-insurance can bring much needed protection against frequent financial shocks
- By using mobile accounts, transaction costs and credit risk for insurers can be reduced

ITC's e-choupal has empowered ~4M farmers since 2000

Ensured economic independence of hitherto marginalized farmers

Key highlights of the program

Development of localized content for each user
- Smart card access tracks specific interests of individual farmers

Awareness drives
- Mobile vans to educate farmers
- Development of virtual helpdesks possible through broadband proliferation

Promote online business model
- Immediate payment to farmer upon electronic recording of purchase
- Online transactions rewarded based on volume and value

Helped drive farm revenues and productivity

- **Improved farm productivity through adoption of latest advances in technology**
  - Timely detection and treatment of White Spot virus in shrimp seeds greatly reduced risk faced by farmers
- **Awareness of global and domestic trends in various crops**
  - Real-time updates on demand in different markets
  - Can choose most lucrative market to sell produce in

Greater Internet penetration will extend benefit to deprived sections – 700 MHz band for mobile key to success

Source: ITC Website; press searches

Broadband-enabled services could greatly increase bureaucratic efficiency at national and sub-district level

India has significant scope to implement e-Government services

Reduce costs with traditional paper-based filing
- Large staff required to store/manage documents
- High transportation and postal expenses of documents if stored at different locations
- High cost of paper, printers, cartridges, etc

Improve quality and availability of services
- Free up resources to provide high-quality service
- Reduce red tape and processing times
- Improve national competitiveness

Canada's eGovernment services one of best worldwide, generating high user satisfaction

Created in 2005 to improve the delivery of government programs and services to Canadians
- Faster, easier and more convenient access

Serves over 32 million Canadians from all walks of life, and across the country
- Including rural, remote, and northern locations

Offers single-window access to a wide range of Government of Canada programs and services for citizens

In 2007-2008 alone, following services provided (list not exhaustive)
- Processed 1.4M requests for Social Insurance Numbers
- Received and reviewed 270K passport applications
- Posted more than 1M job ads
- Hosted 26.6M visits to the Service Canada Web site
- Reached 250K Canadians in remote communities
- Investigated over 770K cases of possible fraud

CAD ~300M of efficiency savings annually and 84% user satisfaction ratings

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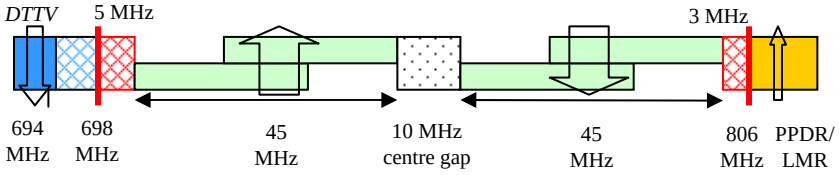
Implications for governments and regulators

Allocation of sufficient and harmonized spectrum has been assumed in the analysis of socio-economic benefits

Sufficient bandwidth needs to be allocated to mobile

2 x 45 MHz needed to provide sufficient bandwidth for effective rollout

- APT harmonized UHF bandplan for IMT within the 698-806 MHz band
- Lower guard-band between 698-703 MHz and an upper guard-band between 803-806 MHz



Adequate bandwidth will facilitate competition between operators, enhancing efficiency and consumer choice and price benefits

Harmonization of spectrum across region necessary to reap full benefits

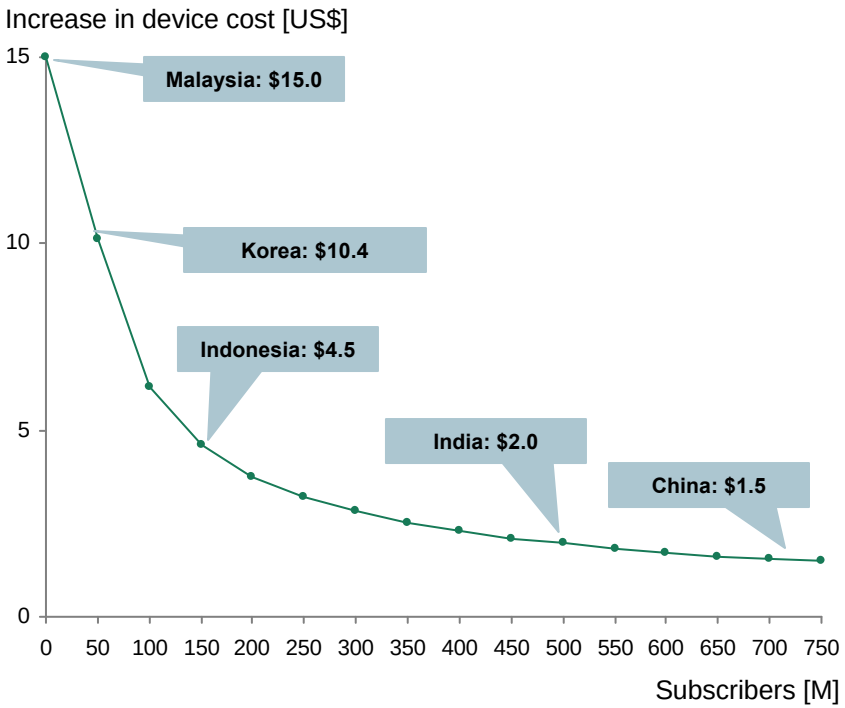
Non-harmonization will drive up cost of hand-sets and make them unaffordable to lower-income consumers

- Lack of frequency harmonization can drive up terminal costs, as providers will not be able to enjoy economies of scale
- Small un-harmonized markets risk being marginalized by equipment manufacturers
- Harmonization will reduce cross-border interference and facilitate improved usage quality

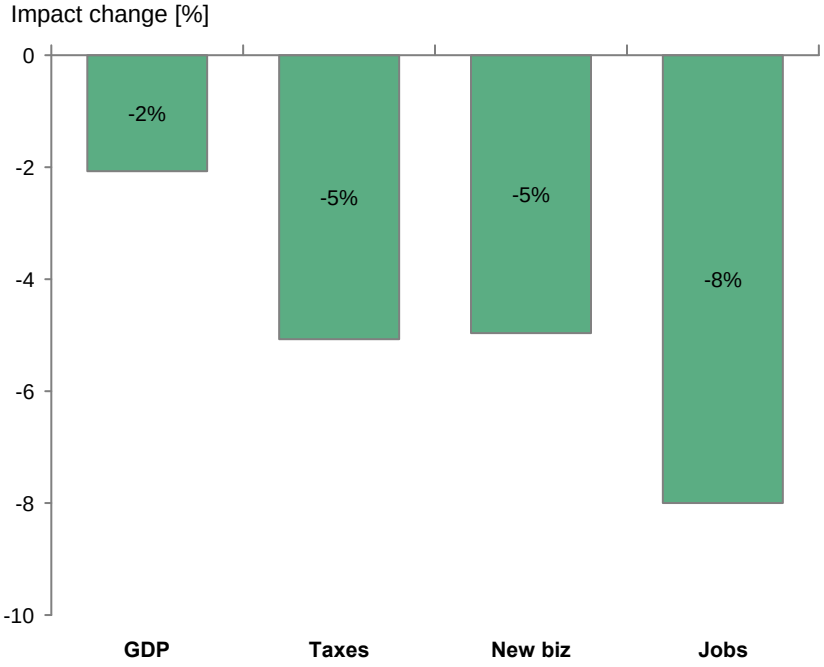
Source: 9th Meeting of the APT Wireless Forum (AWF-9); GSMA

Failure to harmonize spectrum would reduce benefits, especially in government revenues and job creation

Non-harmonized spectrum could increase cost of handset US$2 ...



... reducing government revenues by 5% and job creation by 8%



1. Based on interpolation of analysis results by RTT, which assumes a market like China with 80M handsets sold per year will increase prices US$ 1.5, up to US$ 15 for markets with 8M handsets
Source: RTT; GSMA

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This project was supported by Telenor Group and Telefonaktiebolaget LM Ericsson



