

Fast growth of Mobile Communications in India: Lessons for emerging markets

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Abstract

In most of the developing countries, mobile penetration is strongly correlated with economic growth and social benefits. India, a developing country in South Asia with a population of over one billion people, has low telephony penetration of just 18 percent of the population, but has now become one of the high volume, high growth telecommunication services market in the world. The annual growth of mobile cellular services recorded in India during the last few years has been nearly 100 percent, but all this expansion of services and networks has so far been mainly in urban areas whereas the vast rural areas, where 70 percent of the population lives, have very low coverage. Similarly the penetration of Internet and broadband services even in urban areas is below the targets set by the Government and the industry. Convergence is on the horizon and modern trend is towards greater mobility with increasing data rates. The launch of new services and to extend the networks in the uncovered rural areas is now being given high priority and this will sustain the present fast growth in the coming years.

Telecommunications sector needs voracious capital investment and developing countries have no means to raise large capital needed in closing the digital divide between urban and rural areas. Government policy and Regulator clarity conducive to open competition and increase in foreign equity to 74 percent from the earlier 49 percent are the measures that have resulted in Indian telecom market attracting unprecedented investor interest. India's success story of fast growth of mobile communications is being watched by a number of developing countries, as these steps could be useful lessons for the emerging markets.

1. Introduction

India has emerged as one of the world's best performing economies during the last five years. This is evident from economy growth rate of 8 percent per year, the size of the middle class has trebled, people below poverty line have decreased by ten percent, population growth has slowed down and the per capita income in terms of purchasing power has increased to nearly three times. The important thing to be noted is that India has not adopted the popular Asian strategy of exporting labor-intensive, low priced manufactured goods to the developed world, but has rather built services sector for exports and the domestic market for consumption. Despite all these positive achievements there a number of bottlenecks like inadequate infrastructure - particularly in rural areas, slow success in public education, stringent labor laws, poor governance and insensitive bureaucracy.

One sector that has emerged winner in the current scenario in India is the telecom sector. The growth of cellular mobile services is leading the telecom revolution in India and the other services are following. But still after over a decade of start of mobile services in the country, only 30 percent of the 500 million addressable market of mobile users in the country of over one billion people has been reached. Coverage-wise, only 60 percent of the population mainly in urban areas has access to mobile communication. But the coverage is likely to be increased to about 75 percent in the next two years.

India is the second largest and one of the fastest growing markets with strong demand of ICT services. Like all over the world, the unprecedented surge is towards mobile communications in India. GSM mobile and CDMA networks for wireless local loop as well as for complete mobility have come in a big way in urban areas. The competition and falling revenues are soon expected to force operators to extend cellular networks to rural areas.

Even after seven years of Internet services started in India, the number of Internet users is just one percent of the population. The Department of IT, Ministry of Communication and IT has set an ambitious target of 100 million Internet connections by the year 2008 and one million Internet enabled IT kiosks/ cyber cafes to be established covering the entire country. Wireless networks capable of handling data and video along with the voice at affordable prices could be the answer in achieving these targets.

2. Mobility scene in India

Telecom is the common success story in Asia. In South Asia region, where all the countries are developing or less developed, tele-density in all these countries remains low. The mobile phone has become a most visible device with people all around in cities. The Indian telecom market was opened to privatization and competition in 1992, but the regulator, Telecom Regulatory Authority of India (TRAI) was set up only in 1997. Subsequently the New Telecom Policy 1999 was promulgated and under this policy, operators could use any technology. The competition has brought sharp drop in call rates and handset subsidies and promotional schemes have fueled the phenomenal growth of subscribers during the last two years. Cellular operators are up-grading their networks to provide services beyond basic voice connectivity. People who had two fixed telephones at home have surrendered one and have started using mobile cellular, resulting in saving and mobility.

India is now the 4th largest market for mobile phones and by the year 2009 end, it is expected to overcome both US and Russia to become the second largest market only after China. The mobile sector in India has grown from around 10 million subscribers in the year 2002 to over 150 million at the end of February 2007, out of which 108 million are GSM based and the remaining 42 million are on CDMA 2000-1x technology. At the present growth rate of nearly 6 million

mobiles per month, India is set to have 250 million mobile phones by end 2007. The next target is 400 million mobile phones by 2010.

Comparison between China and India always generate interest in any forum, when growth of telecom in Asian region is discussed. Challenges in China and India are different. China has a lead of about ten years, as it started opening up its market to international vendors in mid eighties, whereas India opened up its market to privatization and competition in early nineties. In China, mainly the Government drives the market, while in India, private sector companies and the market itself are pushing the telecom growth. But both China and India are offering plenty of growth opportunities. The reforms in China have dynamically promoted the development of telecommunications industry and have successfully combined the government administrative functions with corporate management functions to centralize the development of nation wide telecom network. Currently the scale of the communications network in China is the largest in the world having 400 million mobile telephones and 360 million fixed telephones. In comparison while tele-density in China is 58 percent of the population, the tele-density in India is only 18 percent. Rural communications in both China and India has remained neglected. While in China there are 695,000 villages and about 20,000 (3 percent) villages yet have no access to telephones. In India there are 607,000 villages and about 40,000 (7 percent) villages have no telephony services. The rural penetration in both countries is around 4 percent. China's growth of mobile phones has in recent months slowed down after peaking last year (2006) at 5 million phones added every month. Whereas In India the growth of mobile phones is currently 6 million phones being added every month.

To sustain the present highest growth of adding nearly 6 million subscribers per month in India appears easily achievable with sweeping reforms like unified licensing, lowering of access deficit charge, increased sharing of infrastructure and coverage of more areas by the operators. But the most important factors, which stand out for faster growth are low cost handsets and lowest tariff compared to anywhere in the world. Streamlining of foreign direct investment (FDI) procedures and raising the limit of FDI from the earlier 49 percent to 74 percent has further encouraged faster infrastructure augmentation and up-gradation to 3G services. There is an estimated requirement of US \$ 69 billion investment in telecom sector by 2010. Raising such a huge amount without investment from abroad may not be possible.

3. Wireless and Broadband

The era of mobile broadband has commenced, but for remote and rural areas wireless as access network technology for broadband is the main technology. Fixed wireless access in UHF and higher frequency bands is becoming popular solution for rural communication and as point-to-point corporate access. But no clear standards have emerged in this area. 3G evolving with HSDPA (High Speed Downlink Packet Access) is going to soon become wireless broadband

standard and will find its extensive use in rural areas due to cost advantage as the incremental cost of extending networks to cover more and more villages will work out less.

Broadband is increasingly regarded as a catalyst for economic success in information society. Developing countries are opting for use of wireless broadband technology to leapfrog ahead of the traditional wire-line infrastructure. Wireless Fidelity (Wi-Fi) or the 802.11 family standards have become the most popular standards for wireless LAN solution using 2.4 GHz unlicensed portion of radio spectrum band. Wi-Fi has emerged into the wireless scene in the year 2003. It has put 3G in the back seat, as far as wireless broadband Internet is concerned. Wi-Fi is basically for Wireless Local Area Network or WLAN, and more recently the 802.16 standard has been approved by IEEE, enabling wireless metropolitan area network (WMAN) or WiMAX (Wireless interoperable Mobile Access) network.

The main advantage of Wi-Fi is that it enables multiple users to share the same Internet connection without cables, allowing full portability using laptop PCs or PDAs. Wi-Fi technology is also seen to hold much promise for developing countries who want to achieve universal access to ICTs for the masses in rural areas or regions where telephone or cable infrastructures are not deployed.

4. Regulatory and Policy Issues

The concept of an independent regulator is comparatively new in developing countries, as privatization and competition itself are recent changes from government controlled services. Separate regulators have been created in almost all the countries of this region during the last seven years only.

In India, the Telecom Regulatory Authority of India (TRAI) is functional since January 1997, with a view to provide an effective regulatory framework and adequate safeguards to ensure fair competition and protection to consumer interests. Making the regulator independent is a slow progress in India as in most countries. Presently the main role of TRAI is that of an adjudicator and arbitrator, whereas the Department of Telecommunications (DOT) looks after policy making, licensing and coordination.

A Bill known as 'Communications Convergence Bill' is pending before the Indian Parliament for the last few years but its enactment is likely to be delayed. This is due to experiencing of difficulties in launching of convergence of technologies introduced through law in some of the Asian Pacific countries. One of the aims of this new proposed legislation is to establish a licensing framework for carriage and content information in the scenario of convergence of telecommunication, broadcasting and multimedia and other related technologies and to establish a single regulatory authority as 'Communication Commission of India'. Telecom

Disputes Settlement Appellate Tribunal (TDSAT) will remain in place as an independent entity.

The performance of private service operators for rural area communications has been dismal so far. It is therefore necessary that a fresh approach be made to improve rural telecommunications, which must include high speed Internet. Operators do not find it profitable to extend the service to rural and remote areas due to high capital cost and low revenue. The loss in providing a village telephone is offset through Universal Service Obligation (USO) Fund, which has been specially created for this purpose. The funds needed by such statutory regulator – cum – administrator come from a levy of 5 percent of the revenue of telecom service providers including mobile cellular operators.

Deregulation and competition means more regulation, as the regulator needs to regulate many more players than in the earlier monopoly regime. Cellular mobile scene in India has become very interesting and the benefits gone to consumers to a great extent are due to TRAI's efforts. In fact India has more competition than desired, as in each circle (province) there are four GSM cellular networks and two to three CDMA networks. In a developing country like India it is an expensive way of investment in setting up so many independent networks, though it brings cheers to vendors. The Government of India in consultation with TRAI is now reviewing the clause that allows an unlimited number of players in any licensed areas.

In February 2007, GSM Association has conferred the Government of India with the 'Government leadership award 2007 for exceptional achievement in the field of mobile communication policy, at Barcelona, Spain during 3GSM Congress. The award was given to India because of its success in establishing a framework of policy and regulation, which has enabled and stimulated the growth of mobile communication over the past three years.

5. Technology challenges

Recent worldwide explosion of mobile communication systems can lead to a most effective key technology for solution of telecommunication issues in bridging digital divide in the developing world. The demand for cellular communication services in India can be divided in two segments. In metros and big commercial centres, the demand is for latest 3G cellular mobile services having all the features like video, streaming, high-speed data etc. In due course, the existing CDMA 2000-1x networks are expected to get upgraded with EV-DO service. Soon global positioning technology will also be part of mobile services. However for masses in cities as well as for people in rural and sub-urban areas, the demand will remain mainly for voice along with data services to get information the users need.

The wireless industry is focusing its attention to developing countries as the matured markets of developed countries are reaching saturation. A number of cellular equipment manufacturing companies are developing GSM/CDMA based Wireless local loop products with low-end handsets and low cost cellular infrastructure that are cheaper to deploy as pre-integrated and pre-configured base stations mountable on towers. The incumbent fixed line operators and new entrant private operators have all diversified into cellular mobile services in urban areas.

W-CDMA and CDMA2000-1x family is emerging as IMT-2000 standards for 3G. For 3G high-speed access to business critical applications, laptop and PDAs need to be upgraded to 3G. These services will find enough market amongst 300 million people living in metros and big cities in India. But the success of 3G in India will depend on the pricing of spectrum, launch of cost effective services and availability of 3G handsets. For rural folks and poor people in urban areas, tabletop PCs are more suitable in community information centers, as majority of rural households cannot afford a personal connection.

At the same time Wi-Fi or WLAN hot spots have made inroads before the 3G to offer an alternative form of mobile access. But the two technologies instead of competing with each other can complement each other by offering seamless access. A consumer need not bother to know whether the access is to a fixed or mobile connection and it should be transparent. Similarly a consumer should be able to access to his e-mail and the web on a handset or a laptop or a low-cost PC in a simple and user friendly manner.

At present neither technology yet offers ubiquitous access to the net and hence is not a true mass-market service. When we talk of beyond 3G, we should actually develop heterogeneous wireless network architecture using 3G and WLAN technologies. The connectivity should be transparent to mobile handsets, laptop PCs, PDAs as well as to table top PCs. In village community info centres, it should be possible to connect PCs with its full size monitors and printers to 3G wireless socket connection.

The single biggest phenomenon that is transforming the global telecom industry is convergence. Internet users are now exposed to different modes of communication as against the basic voice telephony. Communication now includes pictures, videos and is not limited to person-to-person communication, but communities and user groups are being created and information exchange is not limited to and from people known to each other. Content is driving the service subscription and identifying the right content, in the right format at right cost and delivering it in secure manner to any kind of business model for communication industry are the main issues. Convergence is visible on the horizon for the last couple of years, but has yet to arrive in developing countries in a major way. Unless convergence reduces the cost of communication for the common masses

and provides content in local languages, convergence will remain restricted to enterprise segment for another two to three years.

While all these new ways to communicate and the exploding tele-density is good for the country at large, the same communication infrastructure makes it easier for terrorists and other criminals to communicate without fear of detection. Criminals are in fact early adopters and innovative users / abusers of technology and gap in mobile security. They are normally well funded and can afford to get the latest means to misuse the communication. 3G systems are more secure than either GPRS or 2.5G systems. GPRS networks are vulnerable to hackers, who can get into your data and financial transactions. On the other hand hacking is extremely difficult in CDMA wireless system due to extremely complicated CDMA interfaces. WLAN security is also weak at present. Securing telecom networks against illegal interception is important, but equally important is enabling facility for lawful interception and monitoring of the networks. Current regulatory requirements are there for making available, LIS – requirement of switching system for lawful interception; and LIN – Lawful interception and monitoring requirement. But unfortunately these guidelines are not adequate and compliance is not always enforced. Introduction of new technologies, services or capabilities put citizens at risk. The need is that the Regulator, the service providers and the security agencies to take a collective look at the existing scenario and build the requirement for having monitoring capability before launching a service.

6. Spectrum policy in India

Mobile communication is one of the most important developments in the recent times. The current technological developments promise high speed data services based on Internet Protocol (IP) as well as greater capacity and efficiency. The 3G platform provides converged voice, data, Internet and multimedia services supported by high data rate. The single global standard for third generation wireless technology and network, based on ITU initiative is International Mobile Telecommunications – 2000 (IMT-2000). In India CDMA-2000 1X EVDO and Wideband Code Division Multiple Access (WCDMA) are accepted as Universal Mobile Telecommunication System (UTMS) for 3G services.

For the spread and growth of mobile services, spectrum is most vital and scarce resource. Spectrum below 3 GHz is most suitable for mobile applications presently. But shortly mobile technologies using 3 -6 GHz band are expected to be available. India with its highest growth rate in mobile services, lowest tariff and huge market potential is in a leading position for this development effort. A sound spectrum policy and efficient utilization of available spectrum are the key points while dealing with spectrum issues. At the same time, spectrum policy has to be technology neutral, till the availability of equipment in particular frequency band affects the technology neutral approach. Technology developments like software defined radio, different frequency radio transmitter- receiver (Tx-Rx) on a single

chip and demand in the market will very soon remove the restriction of availability of equipment in specific frequency bands. Ultimately equipment using various technologies would be available in all frequency bands where demand exists. These developments would also help in achieving seamless connectivity among various networks.

According to the National Frequency Allocation Plan of India, the requirement of IMT – 2000 (3G) applications in the frequency bands 1885 -2025 paired with 2110 – 2200 MHz is to be coordinated with the existing users initially for 1920 – 1980 MHz paired with 2110 -2170 MHz (FDD mode) and 2010 -2170 MHz (TDD mode) depending on the market needs and availability, as far as possible.

So far the spectrum is being allotted to mobile operators as per the subscriber base criterion. In the existing licensing framework in India, the licensee is required to pay one time entry fee for the license which also includes fee for usage of spectrum. The licensee also pays annual spectrum charges and annual license fee, which are on revenue share basis as a percentage of AGR.

The Government of India is going to call for bids soon for 3G networks and expects an amount of US \$ 1.8 billion from the auction. In addition, operators will be required to pay Annual Spectrum Charges at one percent of Aggregate Gross Revenue. The Government of India has finalized financial compensation package (US \$ one billion approximately) for Armed Forces to vacate the spectrum required for wireless services and to migrate to alternate frequencies.

For efficient use of radio spectrum, Software Defined Radio (SDR) technology will play an important role in this requirement and will be an essential tool for dynamic spectrum allocation resulting in spectrum resource sharing. A part of UHF frequencies bands, which as per the present international standards are universally used for mobile communications services are with defense, police and space organizations in India. These frequency bands are expected to be vacated by these organizations as per the Government of India plan by end 2007 and will be available for commercial mobile services.

Recently the Government has de-licensed the 2.4 – 2.48 GHz band and allowed the indoor as well as outdoor or in campus use of Wi-Fi technology 802.11b and g within the band. 5 GHz frequency band is already exempted for the indoor use of low power wireless equipment from licensing requirements.

7. New application and Services

Airtime rates have already hit the bottom and now the focus has shifted to value-added services (VAS) to increase revenues. The handset has become an entertainer, an informer, a secretary and an undeniable part of users' lives. The world over, voice revenues are reducing and this is forcing operators to focus on non-voice revenues. The initial change is towards SMS and then progressing to

other data services like ring-tones, sports updates, film gossip and astrology. While browser and voice-based services are expensive and require expensive handsets, operators need to reach out to the masses through SMS with compelling India-specific content in local language. Service providers are targeting as much as 20 percent of their revenue from data services this year. Mobile operators have to learn that content cannot be free and revenue sharing with content providers should be comparable as in developed markets. Broadcasters and mobile operators can join up for mutual profit to provide content to mobile users.

Playing games on cellular mobile handsets by students and young persons is a common sight in developed countries and is an inevitable progression in developing countries like India. The biggest factor in mobile games is perhaps Java, which enables animation and downloads. But mobile games would also have issues like out of bound content, digital rights management and ease-of-use for games.

Multimedia Messaging Service (MMS) and other 3G services will become common by the year 2010 and Indian market share is expected to be 7 percent of the world market. The predictions are that due to MMS experience in Japan and South Korea, Asian countries will become leaders in 3G MMS.

Availability of low cost handsets is an important factor for the fast growth of mobile communications in India. Entry level cheap handsets are now available at a price of US \$ 30 and soon a handset with basic features is expected to be in the market for US \$ 15.

8. Improving profitability

The importance of voice for healthy ARPU would always remain. But data drives voice usage and vice versa. Despite falling tariff, profitability can be improved by segmenting the users depending on their needs, like corporate people on move, students, housewives etc. Within the prepaid market, identify profitable segment for growth.

Mobile entertainment industry is another area where potential is huge and with recent introduction of Java color handsets in the Indian market there is an immense scope to improve revenues by mobile operators. For mobile gaming to become popular and enjoyable, quality of content and gaming concepts that users can relate to are the drivers. Java games will increase GPRS and WAP usage on GSM as well as on CDMA 2001-1x networks.

Other important issues that need to be addressed are promoting emerging technologies quickly and aim at lowering ARPU further. Operating expenses in India are still higher at \$ 4 per subscriber as compared to \$2.41 in China. Infrastructure sharing and flexible tariff rates are other areas that need special

innovative approach to meet the affordability of vast Indian population. As an example for rural areas the taxes must be lowered.

An important aspect is customer care. Developing countries, till very recently who have for long been serviced by government controlled monopoly operators, have a poor record of customer services. Even after privatization and competition, it lacks fast response to customer complaints, unlike in developed countries, where effective mechanism for consumer redress exists. Long recorded auto audio reply on dialing a customer care telephone number, very often irritates a complainant, when he or she is unable to reach the desired person or data for the needed response.

Major part of mobile subscriber growth now comes from the emerging markets and understanding this has enabled the operators to prepare business models according to needs of this segment. Low tariffs, low cost handsets, new content, sharing of infrastructure are leading to developing of new business models as below:

- Life time connection by one time payment of US \$ 30. No further rentals.
- Advance payment of rental for three years with as low as US \$ 20.
- Handsets are provided with new connection at nominal per month rental for handset.
- Handset insurance to build loyalty and cut churn.
- Killer applications like GIS and mobile TV, expected to become popular.

Competition is the key driver of explosive growth of wireless cellular communication. Mobile cellular competition has brought innovative pricing and service offering. Prepaid rechargeable cards have made the common man user of mobile service without elaborate identification and credit histories. Users who are not familiar with computers can send short messages as SMS instead of e-mail.

Cellular all over the world has become very price competitive. Wire-line operators are fighting back by matching the downward trend in tariff and introducing fixed line SMS and convergence services offering unlimited voice minutes. Operators who own both wire-line and wireless cellular networks are introducing bundled offers like CDMA handset automatically becoming a cordless phone at home. Similarly wireless handsets will be able to hook on to the enterprise PBX using Bluetooth. In developing world mobile growth is surging high whereas fixed line growth is flat.

An innovation with the ability to lift ARPU and retain customers is push to talk over cellular known as P2T or POC that is expected to be introduced soon. The service does not require extra bandwidth due to being half-duplex connection, gives thrill to the users and meets the needs of both consumers and operators. CDMA POC handsets are likely to be available in the market soon with features

like store and forward voice, multimedia messaging and location based applications

9. Factors for sustaining development and responsible growth

In the next five years, more people in India who do not have any phone will be getting mobile phones. The mobile communication has contributed more than any other technology to bridge the digital divide. The prominence of mobile handsets in the daily lives of people of all age groups and all cross sections of society has created some aspects that are worrying the sociologists and drawing the attention of users, government and regulators. Health issues due to almost round the clock exposure to electromagnetic radiation and impact on environment with the rollout of 3G networks can affect the growth of mobile industry. Introduction of handsets with cameras has tempted some people to indulge in illegal or highly unethical activities even by school children.

Millions of mobile handsets become outdated or beyond economical repair in almost all the countries of the world. There is still no clear methodology for the reuse of the material or recycling of such handsets. It is the corporate social responsibility to ensure that such schemes are developed and implemented for environmental friendly disposal / reuse.

Communication for disaster warning and management is usually based on satellite system. But its integration to local public networks is needed to make communication available to as many affected locations as possible. Tsunami warning system in Indian Ocean planned by United Nations and Indian Ocean countries is expected to be operational by 2007. Unfortunately mobile cellular or cable networks are not built to meet such emergencies and operators do not take any responsibility to come up with innovative solutions to meet the emergencies. Next generation mobile networks must incorporate the requirement to provide interconnectivity at short notice with satellite based emergency communications system for instantaneous communication in rural and isolated areas at the time of emergencies.

10. Some lessons for other emerging markets

Priorities, pattern of governance and needs of different countries are different, but lack of infrastructure is the common handicap in all developing countries. Some of the lessons that could be helpful in formulating policies, regulatory issues and implementation of plans for providing telecommunication services to the masses at affordable prices are as given below:

- (a) A sound competitive environment by providing a fair playing field is necessary for the market to develop. Emphasis on better quality of service gives better customer loyalty and increase in revenue due to maturing of more calls.

- (b) To achieve faster growth, target first time users of telephony services and in developing countries such people are in large numbers. The first time users like farmers and fishermen find greater access to markets and information about prices very exciting and useful for improving their earnings.
- (c) Cellular phone growth is driven by the young. More than half of Indian population is less than 25 years of age. As most of the first time users are students and low income group people, call rates and rentals should be kept lowest possible. Low ARPU promotes faster growth
- (d) It is seen that lower taxes and duties not only benefit users due to cheaper call rates, and operators because of more usage and lower costs, but the government also gets higher share as service tax. Current annual service tax contribution of telecom sector in India to the exchequer is US \$ 2 billion.
- (e) One of the factors responsible for faster growth in developing countries is the availability of low cost handsets through large volumes. Companies like Motorola, Nokia, Sony Ericsson and Samsung have set up their handset manufacturing plants in India and China that supply low cost hand sets to neighboring countries in the region as well.
- (f) For doing business in developing countries, foreign companies' partnership with local telecom operators/ service providers is helpful to both partners. This helps in bagging big projects. The foreign companies should establish necessary infrastructure in the country with very long term market perspective to support the operator proactively.

11. Conclusion

The mobile communications technology is evolving rapidly in the world as more and more people demand mobile services with larger bandwidth and new innovative services like connectivity anywhere, anytime for features like TV, multimedia, interoperability and seamless connectivity with all types of protocols and standards. While the 3G services are yet to fully come up, serious discussion on 4G has started. WLAN hot spots have made inroads along with 3G to offer an alternative form of mobile access.

Broadband connectivity from urban homes and small / medium businesses is extending to villages for e-services to improve the quality of living of vast majority of Indians living in rural areas. Trials for WiMAX technology are going on in number of Indian states to develop a low cost business model for rural applications.

China and India combined have a population of nearly 2.5 billion people and both the economies are doing exceedingly well by recording the highest all-round growth in the world. India has an added advantage of a large number of technically qualified manpower available at low cost and this has attracted a number of multinational telecom companies like Motorola, Ericsson, Nokia,

Microsoft and Intel to set up its telecommunications research and development centers in India. India like China offers a huge opportunity for mobile vendors evolving the global telecom markets and reshaping the technology landscape.

Using wireless to provide voice and data communication to many outlying remote areas will help bring the people into 21st century faster. Mobile communication is not simply about replacing wires or upgrading existing 2/2.5 G mobile services, but in developing countries it means connecting the people through voice and data, where there were none before.

Emerging markets of developing countries should share their experiences in achieving faster mobile growth. International organizations like ITU, UNDP and the World Bank can sponsor development of such initiatives for specific suitability for the rural areas of developing countries. At the same time a coordinated approach by the government, telecom industry, education and health sectors is needed to develop specific applications in local languages to provide cost effective and useful ICT services to the masses.

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