

# Broadband Potential in Asian Giants: A Comparison of China and India

*Keywords: India, China, broadband, diffusion, leadership*

## Introduction

India and the People's Republic of China (henceforth, China), whose telecommunications networks are among the largest in the world, have a number of areas for broadband use ripe for exploration. For instance, each country is projected to have more Internet users than in the U.S. by 2010 (Nua 1999). China is estimated to produce \$11.7 billion worth of e-transactions by 2003 (Heller 2000). A study conducted by India's National Association of Software and Service Companies (NASSCOM) and McKinsey indicated that India's e-business revenue would reach \$10 billion by 2008. According to the same study, India's e-commerce and Internet related software and services exports amounted to \$1.2 billion in 2000, and are expected to increase to \$3 billion by 2003.

China and India account for 38% of the world's population. The rapid growth in the Internet, e-commerce, and other information and communication technologies (ICT) in these two countries therefore has global significance. A deeper and clearer understanding of the mechanisms by which ICT-related developments influence the growth trajectories of broadband technology in the two Asian giants would provide valuable lessons to academics, technology marketers as well as policymakers. Although some studies have compared and contrasted Internet and some ICT-related indicators in the two economies (e.g., Press et al 1999; Press et al 2002) and factors driving them (e.g., Kshetri 2002), little research exists on the broadband industry of these two economies.

This paper aims to fill the research gap by examining in depth the factors that could shape the patterns of diffusion of broadband telecommunications technologies in India and China. The remainder of the paper has three sections. The section following this introductory section summarizes the major differences in the broadband industries of the two Asian giants. Next, we compare and contrast the factors that are likely to drive the broadband potential in the two countries. Finally, we provide discussion and some conclusions.

## Broadband industry: Major differences in China and India

There are a number of reasons to believe that these two countries may exhibit distinct and varied patterns of broadband diffusion. First, the two economies differ widely in terms of the potential for possible broadband applications such as multimedia and animation, business-to-business (B2B) and business-to-consumer (B2C) e-commerce, and IT enabled services.

Second, they differ widely in terms of the level and composition of base technologies for the development of different varieties of broadband (Table 1). For instance, broadband access in the forms of ISDN/DSL, cable modems and wireless depends on the penetration rates of fixed phones, cable TV and wireless phones respectively. China is ahead of India in terms of the penetration rates of these technologies (Table 1).

Third, existing technologies in the two economies are not equally upgradeable to broadband technologies. For instance, India has based its cellular networks mainly on CDMA and hence has potential to benefit from smoother, less expensive transition to high bandwidth 3G technology in the form of CDMA2000 or W-CDMA (The Economist 2002). On the other hand, out of 110 million mobile phones in use in China in mid-2001, 80 million subscribers used GSM phones (Lawcommerce.com 2001). Transition to high bandwidth 3G mobile technology (a form of broadband) in China could be slowed down by the requirement to build new 3G networks from scratch.

Fourth, China and India differ in terms of the degree and type of liberalization of telecom sectors. The competition for broadband and traditional services is healthier in India than in China (Pyramid Research 2001).

Fifth, other supporting infrastructures required for broadband development are not equally developed in the two economies. For instance, the Chinese initiative to launch its version of national information infrastructure (NII), known as the “Golden Projects” in response to similar initiatives in the developed countries (Tan et al 1997), resulted in more developed telecom infrastructure in China than in India (Pyramid Research 2001).

## **Factors impacting broadband potential**

Following Beise (2001), Lehrer (2003) and Lehrer, Dholakia and Kshetri (2002), we divide the factors influencing the diffusion of broadband in the two economies into three groups (Table 2): *demand and cost conditions* (Linder 1961; Vernon 1966), *industry structure and competitive rivalry* (Porter 1990), and *export and transfer conditions* (Beise 2001; Tilton 1971).

### **Demand and cost conditions**

*Demand and cost conditions* include factors such as consumer preferences, income level, and input costs as well as government regulations, and prior national experience with previous generations of technology. So far, broadband has penetrated only a tiny fraction of the population in both economies. For instance, only 1% of Chinese households were connected to broadband networks by the end of 2001<sup>1</sup> and the proportion is much lower in India. A telecom analyst at Gartner Group suggests that broadband subscription will be beyond the reach of the majority of Chinese and Indians in the near future (see Chotrani 2002). Demand and cost conditions, however, favor China compared to India. For instance, China became the Asia's largest IT market in 2000 and by 2005 it is expected to have about a million broadband subscribers<sup>2</sup>. There are a number of reasons for this. First, China has a higher income level than India and the income is growing more rapidly. For instance, the Chinese economy grew by 7% annually in the 1980s and the material consumption per capita increased by over 100% during 1978-92 (Sklair 1994). Similarly, from 1992 to 1999, per capita GNP rose from US\$396 to US\$780, registering a compound annual growth rate of 4.6%.

Second, “technological innovativeness” or the propensity to adopt modern technologies such as broadband is higher in China than in India. For instance, in the mid-1980s, the penetration rates of consumer durables in China were about the same as South Korea, Japan and the then-USSR (Sklair 1994). Thanks to such “technological innovativeness” of Chinese consumers, in terms of the technology achievement index recently constructed by the UNDP (2001), China's rank of 45 (out of 72 economies considered) puts it in the group of “dynamic adopters” of new technologies and ahead of

other developing countries with higher per capita GDP such as Bolivia, Colombia, Peru, Paraguay, Jamaica and Tunisia. The same study ranked India 63<sup>rd</sup> out of the 72 economies:

Third, China has made much heavier investment in the telecom sector (Table 1). For instance, in the mid-1980s, annual investment in the telecom infrastructure averaged US\$300 million (30% of revenue), which resulted in an annual network growth of 14% (Kelly 2000). In 1988 and 1989, the investment doubled every year and fixed lines grew accordingly. During the inflationary early 1990s, the Chinese government cut off investments in other sectors but not in the telecom sector. During 1992 and 1993, investment was again doubled, resulting in telecom growth rates of 36% and 48% respectively (Kelly 2000). The telecom investment experienced similar rates of growth during and after the late-1990s Asian financial crisis. China's telecom investment in 1999 was about eight times that of India (International Marketing Data and Statistics 2001).

Fourth, a high proportion of the telecom investment in China went to the "most modern" available infrastructure because the government aspired for "nothing but the best". For instance, consider Shanghai, the most populous Chinese city. In the late 1980s and early 1990s, Shanghai Telecom undertook projects to lay under the city's streets one of the world's largest fiber optic cable networks that contained much more bandwidth than needed for simple telephone services (McGill 2001). The huge surplus in bandwidth accelerated the diffusion of broadband technology. The investment in the "most modern" infrastructure is a part of Chinese national initiatives to develop telecom infrastructure and high-speed data networks. China launched its version of national information infrastructure (NII), known as the "Golden Projects" in response to similar initiatives in the developed countries (Tan et al 1997). There are six network organizations that operate international telecommunication circuits and network facilities: China Public Computer Network (CHINANET), China Golden Bridge Network (CHINAGBN), Unicom's UNINET, China Netcom (CNCNET), Chinese Science and Technology Network (CSTNET), and China Education Network (CERNET) (Anderson 2001). China received better marks than India for infrastructure (Pyramid Research 2001).

Fifth, while 72% of China's mobile phones are based on GSM standard (and therefore may require building of high bandwidth 3G networks from scratch), China has 30 times as many mobile phones as in India. Although India's CDMA mobile standard is readily upgradeable to high bandwidth 3G technology in the form of CDMA2000 or W-CDMA, it has far fewer cellular phones than China. Thus, China is likely to have much higher mobile broadband potential than India.

Sixth, although higher percentage of India's televisions is cable ready, the absolute number of TV sets is much higher in China (Table 1). Thus, the potential of cable broadband is also higher in China.

While China fares better than India along several dimensions related to demand and cost conditions, India has some relative advantages as well. India's position as a major supplier of global IT services is likely to trigger the demand for broadband services. An estimate suggests that global IT services could employ 1.1 million Indian white collar workers generating nearly \$19 billion in annual revenues by 2008 (Dhume 1999). Thanks to improved telecommunications and the Internet, multinationals such as GE Capital, British Airways, Swiss Air and American Express are utilizing India's vast pool of English-speaking and computer-literate workers to perform white-collar tasks

remotely from India (Dhume 1999; Ebusinessforum.com 2001). Similarly, to relocate its accounting division from Washington D.C., World Bank evaluated several countries in terms of the availability of IT manpower at reasonable costs, and chose Chennai, India (Goonewardene 2001).

### **Industry structure and competitive rivalry**

*Industry structure and competitive rivalry* include the market openness for competition in broadband and traditional sectors. China and India are taking several measures to increase competition in the telecom market. A study conducted by Pyramid Research (2001) indicated, however, that the competition for broadband and traditional services is better in India than in China.

According to the recommendation provided by a high-powered IT taskforce to liberalize the telecom sector, among other measures, the Indian government privatized the national long-distance market, permitted ISPs to set up their own submarine cable landing stations and share bandwidth with other ISP, and allowed the use of Ku-band in both Indian and foreign satellites. These factors are ushering in a bandwidth boom in India. During the mid-2000 to the mid-2002, an estimated \$5 billion investment is expected in new fiber-optic systems (Erickson 2000). MNCs such as Lucent Technologies and Airtel are laying fiber-optic lines. In October 2000, Singapore Telecom announced an eight-terabit cable connection between Singapore and India (Lynch 2001). Similarly, VSNL, the state-owned Telephone Company listed on the New York Stock exchange in the mid-2000, and has plans to increase its capacity to 13 gigabits by 2004 (Erickson 2000).

The Chinese government also devised a series of programs to accelerate telecom development in the 1990s, including extensive reengineering of and intense competition in this sector. Telecom companies were required to adopt the rigorous disclosure requirements of the NYSE, NASDAQ, and Hong Kong's Growth Enterprise Market (McDaniels and Waterman 2000).

The factors mentioned above resulted in rapid decline in the cost of broadband subscription in both economies. For instance, in Shanghai, the monthly subscriber rate of DSL is about US\$15, and provides a speed of 380 Kbps (Liu 2001). In India, the monthly broadband subscription cost is around \$20<sup>3</sup>.

### **Transfer and export conditions**

*Transfer and export conditions* include trade policy, the export orientation of industry, strategic regulation, and market size. China fares better than India in terms of several dimensions of transfer and export conditions related to broadband technology. First, the ICT market size is higher in China than in India. Because of its higher market size, China is ahead of India in terms of several indicators related to broadband such as the number of hosts, number of users, and total e-commerce transactions (Kshetri 2002). Second, China's high technology exports as a proportion of manufactured exports was 19% in 2002 which is substantially higher than India's 4% in the same year (UNDP 2002).

China's inward internationalization, to some extent, facilitated, the export of high technology products. China's post-Mao reform, together with its billion-plus market, attracted huge inflow of foreign direct investment (FDI) in the technology sector (inward internationalization). The annual FDI inflow in China averaged \$11.7 billion during

1985-95 and \$42 billion during 1996-99. These compare to India \$0.45 billion and \$2.7 billion respectively for the same periods (UNCTAD 2000). FDI in China averaged 13.9% of gross fixed capital formation during 1996-98, which is significantly higher than that of the world (8.1%) and the average for developing countries (10.1%) during that same period (UNCTAD 2000).

Several factors restricted the internationalization of India's ICT industry, particularly the hardware sector, in the 1980s and 1990s. The Indian government protected the hardware industry from external competition. Its distorted tariff structure further hampered the internationalization of the hardware sector (Gopalan 2002). Reduced access to foreign exchange and distorted tariff structures increased the *transaction costs* for exporting hardware, which tends to be more import-intensive (64% of sales volume was imports in the early 1990s) than software (40% import-intensity) (Tandon 1991, p. 65) and encouraged even hardware companies to consider software exports to earn foreign exchange (McDowell 1995). In recent years, liberalization in the Indian economy has resulted in the lowering of such barriers and increases in *merchandise exports* (export of hardware). Moreover, competitive threats from neighboring countries such as China are forcing the Indian government to develop a vibrant hardware industry to support its software and services sectors.

Thanks to the measures taken in recent years, the exports of Information and communications technology (ICT) industry are growing at a phenomenal rate in India. In the fiscal year 2000-1, India's export of hardware, software and information technology (IT) enabled services amounted to \$1 billion (Elcina.com 2002), \$6.2 billion, and \$896 million (NASSCOM 2002), respectively. By 2008, Indian ICT industry is estimated to earn export revenues of \$10 billion from hardware (Elcina.com 2002), \$50 billion from software, and \$17 billion from IT-enabled services (NASSCOM 2002) and provide employment to 7 million people<sup>4</sup>.

## **Discussion and conclusion**

We have examined several factors that are likely to influence the broadband potential in the two Asian giants. Our analysis indicates that factors such as higher income, higher propensity of Chinese consumers to adopt new technologies, higher investment in the telecom sector (and a significant proportion of it going to the most modern technology), and much higher mobile phone and cable penetration favor China in terms of the demand and cost conditions affecting the potential of broadband. On the other hand, India's position in the global IT map as a major provider of IT services is likely to trigger the demand for broadband. The competition levels in the broadband and traditional telecom sectors are comparable in the two economies; with India faring slightly better. As a result, the broadband subscription costs are declining rapidly in both economies, which are likely to further drive the demand for broadband technology. Although China fares better in terms of several dimensions of transfer and export conditions, India is taking several measures in recent years to improve the situation.

The analysis of this paper is expected to help broadband manufacturers and service providers devise appropriate strategies in these two markets and elsewhere. Furthermore, the insights provided by such analysis would help policymakers devise appropriate policies to accelerate the diffusion of broadband technology in developing and developed countries.

**Table 1: Indicators related to broadband development in China and India**

	China	India
<b>Number of fixed telephones ('000), 2000</b>	132634 (100% digital)	32078 (99.9% digital)
<b>Number of cellular phones ('000), 2000</b>	72789 (72% digital in 1998)	2452 (100% digital in 1998)
<b>Total telecom investment, \$billion (2000)</b>	19.9	3.3
<b>Number of ISDN subscribers</b>		
1994	1600	NA
1995	2100	NA
1996	2400	293
1997	4900	1378
1998	102000	5242
1999	186000	14258
2000	294300	20862
<b>Number of Internet users (million), 2000</b>	13.72	4.98
<b>No. of Internet hosts</b>	99780	34127
<b>No. of TV households (TVH) ('000) (2000)</b>	148023	56885
<b>Cable households ('000)</b>	57982 (39.1% of TVH)	24757 (43.5% of TVH)
<b>Number of PCs, million (1999)</b>	15.3 (12.2 per 1000)	9.1 (9.1 per 1000)
<b>Investment in telecommunication infrastructures (billion \$, 1999)</b>	23.5	3.0
<b>High technology exports as percentage of total exports</b>	15	5
<b>High technology exports as percentage of total exports</b>	19	4
<b>GNP per capita \$ (2000)</b>	840	460
<b>Population, million (1999)</b>	1254	998

Sources: International Marketing Data and Statistics (2002), World Bank (2002) and authors' calculations.

**Table 2: Sources of leadership in broadband technology: China vs. India**

<b>Dimension</b>	<b>China</b>	<b>India</b>
<b>Demand and cost conditions</b>	<ul style="list-style-type: none"> <li>▪ Higher income</li> <li>▪ Mobile and fixed line penetration rates higher</li> <li>▪ Better infrastructure than India</li> <li>▪ About 75% of mobile phones based on GSM standard, requirement to build new 3G networks from scratch</li> <li>▪ Higher International bandwidth</li> <li>▪ Produces most IT products domestically</li> </ul>	<ul style="list-style-type: none"> <li>▪ Higher proportion of TV household connected to cable than in China</li> <li>▪ Cellular networks mainly based on CDMA, less expensive transition to one of the rival 3G technologies, CDMA2000 or W-CDMA</li> </ul>
<b>Industry structure and competitive rivalry</b>	<ul style="list-style-type: none"> <li>▪ Reengineered the telecom sector in the late 1990s</li> <li>▪ Opening the telecom market for competition.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Ahead of China in liberalizing telecom sector</li> <li>▪ Some telecom equipment manufacturers have program focused on India only</li> </ul>
<b>Export and transfer conditions</b>	<ul style="list-style-type: none"> <li>▪ Export of hi-tech products as a proportion of total exports much higher than India and other developing countries</li> <li>▪ Heavy inflow of FDI in technology sector facilitated export via inward internationalization</li> <li>▪ Higher market size</li> </ul>	<ul style="list-style-type: none"> <li>▪ Heavy exporter of software</li> <li>▪ Taking several measures in recent years</li> </ul>

Source: Beise (2001), Lehrer (2003), Lehrer, Dholakia and Kshetri (2002), Lawcommerce.com 2001, Pyramid Research (2001), The Economist (2002), and authors' research.

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<sup>1</sup> See <http://www.china.org.cn/english/2001/Dec/24459.htm>

<sup>2</sup> See <http://www.satnewsasia.com/Features/feature-opportunities-asiasat.html>

<sup>3</sup> See *Broadband Service Providers in India* <http://www.pcquest.com/content/broadband/101030301.asp>

<sup>4</sup> See <http://www.commonwealthknowledge.net/documents/Kummar/ Toc500136352>