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Internet diffusion in India and China — Who holds the edge

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Study highlights the importance of the Internet access in the context of India and China, which together are home to approx 40% of world's population. It compares the recent trends in the growth of Internet users and Internet connections in the two countries. It explores the problems encountered in its proliferation and examines the factors, which might play crucial role in its future growth. China holds the clear edge over India in terms of number of Internet users and Internet hosts; India is better rated when it comes to e-readiness. Internet is still out of reach of rural population in both the countries and both need to have low cost local language based computing devices for the use of rural population to access Internet.

Keywords: Internet, India, China, E-readiness, Bandwidth

Introduction

Internet has become an important enabling technology. It can improve governance by raising efficiency, transparency and by increasing people's participation in the governing process. It offers huge economic opportunities through development of information and communication technology. It can help in improving environment management through Geographical Information System and early warning systems. Social and human right conditions can be improved by expanding access to better education and healthcare. It can help in knowledge sharing and creating awareness among people. Above all, it can help in reducing poverty by opening new opportunities for woman, the poor and rural population. This is particularly important for India and China, both of which have a large percentage of impoverished people with a large part of the population living in rural areas lacking even basic telephone services. While China has pursued a policy of strong government initiative coupled with encouraging competitions among government owned organizations, India has set policy through publicly visible task forces*. Which policy remains effective in long run remains to be seen[1].

This study compares Internet in India and China with reference to the efforts being carried out in the diffusion of Internet in the national economies, number of users with characteristics and bandwidth availability, relative advantages and disadvantages of Internet in each country, and the future potential of Internet expansion.

Internet Penetration

Internet is diffusing rapidly in India and China. It is estimated that by 2010, each of them will have more Internet users than in US. India was connected to Internet earlier than China when Department of Electronics (DOE) established ERNET (Educational and Research Network) in 1986 with the help of United Nations Development Program (UNDP). ERNET was connected to UUNet** (UNIX to UNIX Network) technologies in the US through IP (Internet Protocol) connection in 1989. It was further connected to the US National Science Foundation (NSFNET) in 1990. In contrast, Internet connectivity in China started in 1993, and by 1994, China had twice the number of Internet hosts and 3.5 times Internet users as compared to India[2] (Tables 1-3).

China has clear edge over India in terms of the number of users and the computers connected to

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*It refers to IT task force which was the high power committee set up by Government of India in 1998 whose task was to recommend immediate steps that the Government needed to take to remove bottlenecks in the path of rapid development of IT in India and give a big boost to Indian IT and software industry.

**First commercial Internet service provider, founded in 1987 in USA.

Table 1—Trends in growth of Internet users

Year	Internet users in India[12]		Internet users in China[13]	
	Million	% Growth	Million	% Growth
1997	0.45		0.62	
1998	0.7	55	1.17	88
1999	1.4	100	4.00	241
2000	2.8	100	16.90	322
2001	6.6	135	26.50	56
2002	9.9	50	45.80	35
2003	12.8	29	59.10	29
2004*	31.23	143	87.00**	47.28
Average growth rate		87.42		116.89

*NASSCOM Surveys: http://www.ascos.com/images_web/Internet_users.gif; **14th Statistical Survey Report on the Internet Development in China (July 2004)

Table 2— Trends in growth of computers connected to Internet in India and China (million)

Year	Computers connected to Internet	
	India[14]	China[13]
1997	0.09	0.04
1998	0.14	0.54
1999	0.28	1.46
2000	0.9	6.50
2001	2.5	10.02
2002	4.5	16.13
2003	10	20.83
2004		36.30*

*14th Statistical Survey Report on the Internet Development in China (July 2004)

Table 3— Fixed line and mobile telephone subscribers in India and China (million)

Year	Fixed line telephone subscribers		Mobile Telephone subscriber	
	India[16]	*China*[17]	India[16]	China[17]
2001	32.7	169.4	3.6	125.77
2002	37.4	198.94	6.4	176.17

Internet (Figs 1 & 2; Tables 1 & 2). The main factor for China's lead over India is that China has given prime importance to the development of telecom sector and hardware-manufacturing sector. China made uninterrupted heavy investment in the telecom sector in 1980s and 1990s. In mid 1980s, annual investments in China in the Telecom infrastructur averaged US$300 million, which resulted in annual network growth rate of 14 percent. In early 1990s,

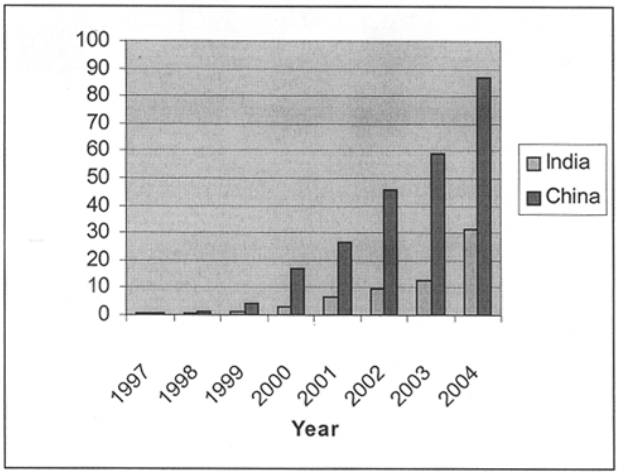

Fig. 1— Number of Internet Users in India and China

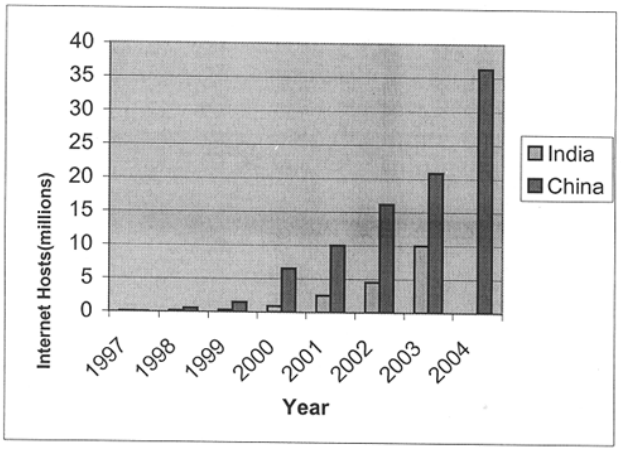

Fig. 2— Computers connected to Internet in India and China

when China placed limits on new investment plans in the other sectors of the economy because of inflation, telecommunications sector remained exempted[2]. The growth in telecom sector went up in 1992 (36%) and in 1993 (48%)[3]. Fixed lines and mobile phones have also grown rapidly (Table 3). Higher fixed line telephone subscribers in China means higher spread of telephone lines. This has made dial up and leased line Internet access more widespread in China than India (Table 4).

In India privatization and competition in the telecom sector was hindered because of the Foreign Contribution (Regulation) Act 1976, which put a limit on foreign investment. Later, although economic reforms were initiated in 1991, no private subscriber was able to access Internet and it was available to only Government departments. Private subscribers were allowed to access Internet only after 1995. Also,

Table 4—Growth in number of Internet users under different categories in India and China (million)

Year	*Dial up users*		Leased line/ISDN users		*Broadband users*	
	India[12]	China[15]	India[12]	China[15]	India[12]	China[15]
2001	6.25	17.93	0.090	4.54	0.125	-
2002	7.70	12	2.00	3.07	0.150	2.00
2003	7.74	14.80	4.00	4.03	1.176	6.60
2004		52.40*		36.90*		42.80*

*15th Statistical Survey Report on Internet Development in China (CNNIC)

Table 5— Total number of PCs in India and China (million)

Year	Total PCs	
	India[12]	China[18]
2001	6.4	21.7
2002	8.2	29.2
2003	11.2	39.4
2004	11.2*	

*http://www.exchange4media.com/izone1_stat.asp?izonestat_id=5

only Government controlled agencies were allowed to provide Internet connections and services before 1998[2].

Along with advances in the telecom sector, vigorous growth of hardware sector in China has been primarily responsible for rapid Internet penetration. In the case of personal computers (PCs) alone, it accounted for Asia Pacific market (36%) with 7.17 million PCs sold in 2000 (45% increase over 1999 sales)[4]. Implementing the policies since 1970s and 1980s, which focused on building up self-sufficiency in hardware production, at present, China is number two PC market in the world and holds third slot in computer hardware production after USA and Japan. Joint ventures with foreign multinational companies (MNCs), export promotion, improvement in IT infrastructure, and lower tariff structure were the highlights of this policy. In late 1990s, China promoted domestic PC manufacturers and improved quality by collaborating with foreign MNCs. China managed to attract global leaders into partnerships with local manufacturers. These resulted in partnerships like, Compaq/Stone, HP/Legend and Toshiba/Tontru. Recently, Dell has setup a wholly owned subsidiary in China. China also initiated *Golden Projects to modernize IT infrastructure. Its entry into WTO in 2001 has further triggered the growth of hardware industry. Taiwanese firms, which have played significant role in Chinese hardware growth, are leading producers of motherboards, scanners, monitors, keyboards, and notebooks. At present, over 50 percent of production is exported by Taiwan, mostly in China[5].

In India, investments in the hardware sector have been very low because of distorted tariff structure, poor infrastructure, and numerous bureaucratic hurdles[6]. Since hardware production is highly capital-intensive, foreign direct investment (FDI) is a crucial factor for the growth of hardware production. India's failure in attracting MNCs resulted in poor growth in hardware manufacturing. India also failed to develop local brands in hardware as compared to Legend and Stone in China, which dominates 28.9 percent of Chinese computer industry[5]. Poor hardware sector resulted in low PC penetration in India as compared to China (Table 5). Thus, a strong telecom sector coupled with strong hardware manufacturing base gave China a definite advantage over India in terms of number of Internet users and Internet hosts.

Internet Bandwidth

Bandwidth availability, which determines the speed of Internet connection, is the key factor in the growth of Internet in any country. Till 2001, India was lagging behind China in term of international bandwidth but with the launch of its first private undersea cable on 09 April 2002, the bandwidth has increased dramatically (Table 6). The 3200 km long cable under seawater links Chennai with Tuas in Singapore. It is a joint venture between India's Bharti Group and Singapore Telecommunications built with an approx cost of US$ 250 million[7].

According to CNNIC (China Internet Network Information Center) study in July 2003, total bandwidth of leased Internet connections in China was 18599 Mbps. However, China also has access to 7680 Gbps link provided by submarine cable system

*Golden projects refer to various initiatives taken up by Chinese government to improve telecommunication and information infrastructure. These started in 1993 and ended up in 2000.

Table 6—Bandwidth growth in India and China

Year	India[19]	China[20]
1999	82 Mbps*	241 Mbps
2000	1000 Mbps	1234 Mbps
2001	2000 Mbps	3257 Mbps
2002	8400Gbps	7 Gbps
2003	8400 Gbps*	18.599 Gbps
2004		74.42Gbps

Table 7—Interconnecting networks in China, March 2002[1]

Networks	Category	International bandwidth (mbps)
China Telecom (ChinaNet)	Incumbent	5,507
China Netcom	Commercial	920
China Unicom (Uninet)	Commercial	443
CERNET	Academic	257.5
China Mobile	Commercial	200
Jitong (ChinaGBN)	Commercial	168
CSTNET	Academic	55
CIETNET	Commercial	2
Total		7,552.5

developed by C2C Pte Ltd, a subsidiary of Singapore Telecommunications. This link is shared by Hong Kong, Japan, Korea, Taiwan and Singapore. How much share of this link China has got is not known. CNNIC has not taken this link into consideration. If this is added to the CNNIC figure, then bandwidth comes out to be 7698.5 Gbps (7680+18.5), which then makes it comparable with India.

Internet Service Provider Industry Scenario

Internet Service Provider (ISP) acts as an interface between the Internet user and Internet. All the Internet access is done through ISP. India and China began with state-controlled telecommunication monopolies, "Videsh Sanchar Nigam Limited" (VSNL) in India and "China Telecom" in China. As a further development, China established Unicom in 1994, and in 1998, created the Ministry of Information Industries (MII) to oversee telecommunications, multimedia, broadcasting, satellites, and the Internet. MII encouraged competition through support of Unicom and by dividing the basic telecom service industry into four government-owned companies specializing in different types of service in 1999, and dividing China Telecom into northern and southern companies in February 2002[8]. China Telecom controls 73 percent of international bandwidth (Table 7), indicating that it remains the dominant ISP.

In case of India, an important recommendation of *IT Task Force appointed in July 1998 was to accelerate the rate of PC penetration in the country and to open Internet access nodes at all district headquarters by the Department of Telecommunication (DoT) and the authorized ISPs. India's DoT has issued Class A (all India) ISP licenses to 79 organizations, and 44 of these had started service in July 2002. In addition to Class A licenses, 357 licenses were granted for access in limited regions or local areas, but only about 90 financially pressed ISPs are in operation[9]. China encouraged competition by creating central control and state-owned enterprises. In spite of India's gains, China still seems to have a more competitive local access market with more than 500 ISPs by the end of 1999. These behave like free market organizations, with many going out of business and attendant layoffs.

India has granted permission to 20 companies to operate 45 international gateways in 16 cities as follows: Delhi, 7; Hyderabad, Chennai & Bangalore, 5 each; Mumbai, Ahmedabad, 4 each; Pune, Kolkata, Chandigarh & Bhopal, 2 each; and Secundrabad, Lucknow, Gurgaon, Cochin & Baruch, 1 each. At least nine government and private organizations currently operate international gateways, and ISPs are free to purchase capacity directly from undersea cable operators. There is freedom to install VSAT connections to the Internet (VSATs** played a major role in India in 1999, as there was little international cable connectivity).

Internet Exchange Points (IXP)

IXP is like telephone exchange where a leased line of high bandwidth capacity is shared among the Internet users. It reduces the cost of Internet access as the total cost is shared among many users[10]. In India, VSNL has established an exchange point. The Internet Service Providers Association of India has announced plans for Indian IXPs, but their implementation seems to be stalled by the dot com bust.

* The task force released an IT action plan for development, manufacture and export of IT hardware in October 1998. It finally released a Long Term National IT Policy in April 1999.

***Very Small Aperture Terminal*, an earthbound station used in satellite communications of data, voice and video signals, excluding broadcast television.

Table 8— Age wise Internet usage (2002)

India[21]		China[22]	
Age group of Internet user	% of users	Age group of user	% of users
15-20	25	Under 18	16.3
21-25	29	18-24	37.2
26-30	14	25-30	16.9
30+	32	30+	29.6

Table 9—Purpose of using Internet in India and China (2002)

Purpose of using Internet	User %	
	India[21]	China[22]
Email	90	92.9
Information	50	40.3
Chat	43	45.5
Education/Academic information	41	8.9
Downloads	38	51
Music/Movies/Entertainment	27	19.7
Jobs	23	22.1

Table 10— Point of access (2002)

Point of access	User %	
	India[21]	China[22]
Home	25	62.1
Cyber café	30	17.3
Work	29	43.3
School	-	21.8
Public library	-	0.7
Mobile access	-	0.9

China is leading in IXP capacity and the capacity to handle domestic traffic domestically. A major IXP is now operating in Beijing, and two others have been constructed in Hanghai and Guangzhou, but pricing and management issues remain to be resolved. There are also several local IXPs, e.g. in Shanghai. IXP and domestic bilateral exchange points have the capacity to handle Chinese traffic (84%), indicating that China has weaned itself from the US and other international communication links used to access Internet.

User Characteristics

Considering user characteristics in terms of age, gender, purpose and point of access of Internet, the number of users in the age group 15-20 (mostly school students) is higher for India than China (Table 8). It means Internet is more popular among school students in India. For next age group (21-25), the percentage is higher for China because of higher penetration of Internet in Chinese institutions of higher education as compared to India. For age groups of 25 and above, users were almost same for the two countries. Gender wise[21,22] Internet users in India and China were found as follows, respectively: Male, 24, 39; and Female, 76, 61.

Internet is mainly used for e-mails in both the countries (Table 9). Most users in India use Internet for educational and entertainment purposes. Chinese use Internet more for chatting and software downloading. Indian users are ahead in seeking information related to music/movies/entertainment from Internet. Internet accessing from home in China is more than double as that of India, mainly due to higher PC and telephone penetration, which can be due to a better-developed hardware-manufacturing sector and Telecom Sector in China (Table 10). Internet penetration in Chinese offices is also higher than India. Internet access through mobile phones in China (0.9%) is higher than India because of higher mobile phone penetration.

Discussion

China, due to higher telephones and PC penetration, is ahead of India in number of Internet users and connections. However, in terms of bandwidth, India has gained edge because of the under seawater cable laid down from Singapore to Chennai. In ISP industry, both countries are trying to encourage competition. In user characteristics, young people (18-25 y) use Internet most in both the countries. More females use Internet in China than India. Internet is used mostly for e-mails in both the countries. While more Chinese use it for software downloading, more Indians use it for academic and educational information. Chinese access Internet mostly from homes while Indians accesses it from cyber cafe. While China is ahead of India in numbers of users and connections, India is ahead in terms of [*]Economic Intelligence Unit (EIU)'s e-readiness ranking, which comprises connectivity, business environment (in next 5 y), e-commerce consumer and business adoption, legal and regulatory environment, supporting E-services and social and cultural situation. India's overall performance is better

*Economist Intelligence Unit (EIU), established in London 50 years ago, acts as an information provider for companies establishing and managing operations across national borders anywhere in the world.

Table 11—Comparison between phone subscribers and Internet subscribers in India[12]

Year	Dial up Internet subscribers Million	Direct exchange lines Million
2000-01	1.1	32.7
2001-02	1.52	37.4
2002-03 (Estimates)	1.89	44.6
2003-04 (Estimates)	30.09	52.3

Table 12—Correlation of Internet access cost and its penetration[23]

Country	Internet access cost % of GDP per capita	Internet users per '000
India	16.82	5
Brazil	5.26	35
South Africa	5.26	34
Mexico	5.17	23
Malaysia	4.85	90
Thailand	4.02	74
Argentina	3.20	53
S. Korea	1.50	349
Singapore	0.84	302
United States	0.65	536
Japan	0.49	174
France	1.03	183
United Kingdom	0.91	554

because of its legal support for virtual transaction and digital signature, well-developed private sector and entrepreneurship, regulatory environment including taxations, and openness to trade and investments. E-readiness ranks of India and China were 50 and 51 out of 60 main economies studied by EIU in 2000. In 2001, India's new rank of 45 puts it in the group of "E-business followers" such as, Greece, Czech Republic, and Hungary. China's new rank of 49 in 2001, on the other hand, puts it in the group of "E-business laggards" such as, Kazakhstan, Vietnam, Azerbaijan, and Pakistan[2].

China has better potential for future expansion of Internet because it has explicit national initiative to develop Internet and hardware manufacturing, while India has adopted market driven piecemeal approach. China has a strong domestic base for manufacturing computer and IT products and lower Internet access charges than India. It is easy to develop local language Internet contents in China than India because it has less number of local dialects. Also, because of market reforms, China has been able to attract more FDI than India in Dotcom and IT sector. Higher density of landline and mobile phones gives China greater potential for Internet expansion. Overall, despite lagging behind China, India has strong network of educational institutions, which makes it a highly desirable destination for outsourcing jobs in software services. Of the top 49 software development facilities in the world rated at level 5, highest level for process maturity scale, 24, are in India. About one-fifth of the fortune 1000 companies have been outsourcing their jobs to India. Indian programmers wrote many popular software applications like Netscape and Microsoft Hotmail fully or in part. Culture, language, and education system make Indian students competent in areas like mathematics and computer code writing. This has reflected on the quality of software developed in India, which has got global recognition. Today India has become one of the most favorable centers of software development.

Internet diffusion in India has not been up to the expectations as was anticipated ever since it was open for private subscribers. India was one of the few countries to enact Information Technology Act-2000, which enabled digital signature in e-commerce transaction. But the number of Internet connections remains below than the total number of landline and mobile phones subscribers (Table 11). This shows that only a small portion of phone users go for Internet connection even if they have a direct telephone line, mainly due to the high cost of computers and related equipments, and high Internet access charges, which are among the highest in the world. Just 20 h of Internet access in India costs around 16.8 percent of its GDP per capita (Table 12). Another reason is landline tariffs, though they are among the lowest in the world, but still not affordable for a large part of the population and need to be brought down for Internet access*. One-way is to open the last mile access for private operators[11]. Internet access through digital subscriber line (DSL) should also be promoted, as it is faster and cheaper way to access Internet.

Indian government has taken certain steps like

* In land line telephone system all communication links emanating from telephone exchange first goes to a box near the users place and from there it goes to the user's place. Second part of the link from this box to user's place is called as last mile access.

allowing ISPs for setting up international gateway. DoT issued licenses to Mahanagar Telephone Nigam Ltd and Dishnet-DSL, subject to some specific conditions. Private ISPs are also allowed to use Ku-band.** Till now, Ku-band was permitted to use frequencies in C-band and extended C-band. Ku-band improves the quality of transmission of data and reduces the capital cost drastically due to a smaller dish size since it operates in the frequency range of 12 to 14 GHz as compared to 4 to 6 GHz in C-band and extended C-band. This reduces the required diam of antenna (1-1.5 m) in a Ku-band gateway, as compared that of a C-band antenna (3.7 –7 m). The cost of ground equipment decreases (50%) and maintenance cost also comes down in Ku-band due to smaller size of the antenna. Communication through Ku-band is very effective tool in the regions where laying down landline cables is difficult. Also, licensed ISPs licensee will have the freedom to lease domestic backbone from DoT, basic service providers, power grid corporation, railways or any other authorized operator. They are also exempted from license fee for first 5 y and nominal fee (Re 1) after that.

Conclusions

China is ahead of India in most of the parameters of Internet diffusion. This is mainly because of the growth, which China has achieved in telecom and hardware manufacturing sectors. Being a favorable destination for outsourced jobs in software, India is likely to trigger Internet growth. India has to increase Internet penetration in order to grab sizable pie in the growing global IT enabled services (ITES) market and to sustain its place in global software and services market. India's main advantage so far has been the availability of skilled manpower at cheaper rates. Coupled with strong Internet base, China can pose a serious threat to India's position in global software and services market. To bring down the overall cost of Internet access, India has to develop its hardware manufacturing sector as well as telecom sector. India has to make flow of Internet traffic as domestic as possible. At present, even if an Internet host is to be contacted in India, the connection is through international telecommunication lines whose lease charges are of international standards. This increases the cost of Internet access drastically. As far as rural population is concerned, Internet is still a distant dream in both the countries. Chinese expertise in hardware and Indian expertise in software can be combined to develop low cost computing devices, which can be used to access Internet in rural areas. Indian software expertise can also be used to develop Internet contents in local languages. At present, eight out ten websites on Internet are in English, a language not understood by almost all the rural population in India and China. One of the options is to use open source software like Linux, which can be used effectively for developing Internet contents in local language.

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