Software exporting: a developing country advantage

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1. Introduction

Software exports have the potential to make a significant contribution to the economies of developing countries and to the global IT industry. Developing countries have demonstrated a comparative advantage in this export sector and the global IT industry can benefit from this developing country advantage. Today, IT is high investment, high risk, and high reward and has graduated from being a critical support function to a key partner, sometimes responsible for directing the strategy of an enterprise. Business and technology managers cannot afford to miss the opportunities provided by the comparative advantage of developing countries in the IT arena.

Worldwide markets for professional IT services will break the $1 trillion mark within the next two years, growing from an estimated $462 billion in 1999 to about $1.08 trillion by 2004 at an 18.6 percent compounded annual growth rate.[1] The North America professional services market is estimated to have been $229 billion in 1999 and will experience an 18.7 percent compounded annual growth rate for the same period, reaching $539 billion by 2004. Management services will grow from $84 billion in 1999 to $192 billion in 2004 on a worldwide basis at an 18 percent compounded annual growth rate. Asia/Pacific is the fastest growing region for

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[1] Caldwell (2001).

IT services market. From 2001 through 2005, it is expected to grow by 65% to reach $ 46.5 billion.[2]

Global IT is now dominated by the United States, which is the single largest source of IT innovation and provider of tools and technologies for the world.[3] The most noticeable change in this marketplace is however, the emergence of India as the major provider of expertise, skills and IT services. The leadership of European nations such as Sweden, and Finland, in the wireless technology market, the possibility of Russia, Ireland, Israel, Philippines, Malaysia and China to follow India's path in the IT services arena also deserve mention.

2. What is the software business? Why is there a need? What is exported and why?

Companies in the information age do not have the luxury of 'information-float', the time between when a business event occurs and when information captured about that event reaches the necessary decision-makers.[4] High performance telecommunication technologies can reduce this time lag to almost zero, and financial transactions can also be instantaneous. This creates a need for real-time operations. Industries are becoming more customer-oriented, and offering a wide range of options and services to customers in order to improve loyalty and market share. Enabling these manufacturing processes with clockwork precision and efficiency are the back-end engines – the superior software solutions that power manufacturing production or services. There is a need for sophisticated high quality products at low prices and also a need for dissemination of product information to customers through company websites (that makes it faster and easier to update and reduce costs). Technological innovation and obsolescence is playing a major role in both the manufacturing and services sector. Hence there is a need for securing intellectually capable manpower with fast learnability. At the same time managers are facing "information overload" – being bombarded with so much potentially

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[2] Heng *et al.* (2002).

[3] Feiman (2002).

[4] Turban and Potter (2001).

useful information they are at risk of "analysis paralysis" and feeling compelled to research vast amounts of data before arriving at the final decision.[5] This has created a need for efficient IT strategists and knowledge management experts. India has risen to this challenge by providing the expertise and knowledge for developing state-of-the-art software developers for American and European clients.

The advent of the PC and the World Wide Web has augmented the technological explosion and created a need for skilled labor for servicing this automation. While the US is the pre-eminent producer and customer of Electronics and Information Technology products and services, amounting to approximately half of the world market estimated at $ 1.2 trillion, India has developed a comparative advantage in IT development and maintenance. Currently India's IT exports to the US are about $6 billion per year; a negligible fraction of the total global IT market. The US is a mix of state-of-the-art technology and marketing skills where as India is a huge reservoir of cost competitive and quality programming, brainpower and software skills. According to a Gartner report, outsourcing IT and business services will be the fastest growing component of the Indian IT services market by 2005.[6]

Europe currently has a shortage of 1.9 million specialists in the ICT (Integrated circuit technology), e-business and call-center sectors and by the year 2003, this figure is expected to jump to 7.5 million.[7] India, with its huge pool of knowledge workers and global expertise in the IT Software and Services, can make a significant contribution towards meeting this supply-demand gap. Most European and American companies are leveraging India's competent outsourcing capabilities and gaining competitive advantage by concentrating their resources in areas of their core competencies. A highlight of 2000-01 was that one out of every four global giants outsourced their mission critical software requirements to India.[8]

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[5] Caldwell (2001).

[6] http://www.nasscom.org/articles/NASSCOM-McKinsey.asp.

[7] NASSCOM-BITKOM (2002).

[8] Chatterjee (2001) and Mehta (2000). The list of these companies consists of illustrious names such as General Motors, Coca Cola, British Airways, Wal-Mart, General Electric, Ford, Sony, Nokia, First Data, Northwest Airlines, Siemens, United Airways, Pepsi, Boeing, Citibank, Chevron, among others.

3. What is India's Competitive advantage? What is India doing right in the software sector?

To become a leader in the software export market, the basic requirements are availability of skilled programmers, proficiency in English, efficient data transfer and well developed network infra-structure, low cost and reliable power, and a stable political system that fosters growth and creates incentives for FDI in the IT and high-tech sector. The key to India's success is the vast availability of technically adept, English speaking manpower.[9] India has taken the lead over Russia and China in the software export sector because of its relative mastery over western languages.

The elements contributing to India's competitive advantage in becoming an ideal destination for IT/S (Information technology software) and ITES (Information technology enabled services) outsourcing are:

– As an average, the United States and India have a 12-hour time zone difference, providing a virtual 24-hour office to a client in the United States. This also facilitates zero-wait responsiveness to IT problems, meeting deadlines for urgent projects and establishing round-the-clock software factories (subcontracting to Indian companies).

– India produces more than double the number of highly skilled, English speaking computer science graduates than any other developed country. The salary range of Indian software professionals is almost five times less than their counterparts in developed countries. Although the low-cost advantage has been somewhat eroded with many software professionals getting remuneration at par with some of their western counterparts, in terms of cost-quality India continues to offer 'value for the money'.

– According to NASSCOM,[10] India has more SEI-CMM[11] and ISO 9000 certified software companies than any other country in the world.

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[9] Second largest English speaking manpower in the world; http://www.easyp. com/locational_advantage.htm.

[10] National Association of Software and Services Companies. For more information look up http://www.nasscom.org/.

– India offers a wide gamut of software services from clerical support, data processing to advanced software development; R&D and IC (Integrated circuit) design. The availability of low cost manpower at all levels of IT services has allowed India to capture a significant percent of the global IT market.

– The forced subcontracting of large Y2K projects to Indian companies, because of time constraints, provided Indian managers with invaluable project management expertise which they are now harnessing to claim even larger projects from foreign clients.

– Indian companies have built expertise on a variety of software platforms ranging from legacy systems to client-server and the latest state-of-the-art e-business technologies. India now has over 1250 companies exporting software.[12]

– India has more than 1200 high-speed communication links of 32-256 kbps connecting Indian software companies with clients abroad.[13] The Software technology parks of India (STPI) provide a majority of these communication links. The availability of high-bandwidth telecom networks is facilitating the off shoring of IT enabled services.

– The existence of significant under penetrated segments in various countries and industries and the competitive pressures for cutting costs have increased the possibilities of India's emergence as a lead player in the global IT market, as global majors are compelled to outsource significant portion of their IT needs to India. The global outsourcing market is worth more than $100 billion and 185 of the fortune 500 companies outsource their software to India alone.[14]

– The Indian software industry has also enjoyed unbridled liberty to conduct business with foreign companies and supported by various tax subsidies and special privileges (see below in the next section).

Thus we can envisage that India has emerged as the leader in the field of software engineering and web based services by harnessing its competitive advantages: cost-effectiveness, world class quality, high reli-

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[11] Software Engineering Institute's Capability Maturity Model. For more information look up http://www.sei.cmu.edu/about/about.html.

[12] Dey (2003).

[13] Khanna (2002).

[14] Dey (2003).

ability, rapid delivery, all powered by state-of-the-art technologies. India is in demand for high quality outsourcing at competitive prices.

4. Role of government

The Government of India has played a unique role in fostering the growth of IT exports by creating the famous STP (Software Techno-logy Parks) initiative. India has become a large software-outsourcing center but an antiquated telecom structure has prevented its smooth development and growth. India has a friendly regulatory environment and is a freer market than the United States as to regulation.[15]

Software Technology Parks of India (STPI[16]) is a society set up by the Ministry of Information Technology, in 1991, with the objective of encouraging, promoting and boosting India's Software Exports. The Software Technology Park (STP) scheme is a 100 percent export-oriented scheme for the development and export of computer software using data communication links or in the form of physical media including the export of professional services. The major attraction of this scheme is single point contact service to STP units.

STPI maintains internal engineering resources to provide consulting, training and implementation services. Services cover network design, system integration, installation, operations and maintenance of application networks and facilities in varied areas ranging from VSATs[17] to ATM based networks. Process development is based on the Quality Management System, which STPI also adheres to in the form of ISO 9001 certification for its own process. The government has liberalized the telecom sector by allowing private players in leased line services. State governments are vying

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[15] Kanakia (2002).

[16] More information on 'Software Technology Parks of India' is available at http://www.stpn.soft.net/.

[17] VSAT stands for "Very Small Aperture Terminal" and refers to receive/transmit terminals installed at dispersed sites connecting to a central hub via satellite using small diameter antenna dishes (0.6 to 3.8 meter). VSAT technology represents a cost effective solution for users seeking an independent communications network connecting a large number of geographically dispersed sites. VSAT networks offer value-added satellite-based services capable of supporting the Internet, data; LAN, voice/fax communications, and can provide powerful, dependable private and public network communications solutions.

with each other to attract ITES investments from multinationals. The government has granted special privileges to ITES players in the form of a 10-year tax holiday, rebates in customs duties, liberal investment policies and by setting up special incubator facilities such as cyber parks by joint venturing with private conglomerates like L&T (Larsen & Toubro).

These facilities are modeled after the Hi-tech city in Hyderabad, – very well constructed, with uninterrupted power supply, high bandwidth connectivity (64 Kbps, 2 Mbps datacom links) and oriented to attract small and medium-sized enterprises. The basic idea behind setting up of such incubation centers is to allow the companies to "Plug and Play"[18] and start their operations in no time since all the basic infrastructure facilities are provided.

Although the current environment appears to be encouraging for the Indian IT industry, the government has still a lot to do in order to make India a global IT superpower. There is a lack of information about other countries' IT infrastructure, IT requirements, culture, laws, regulations and available opportunities for Indian businesses. The supply base of skilled knowledge workers needs to be reinforced by increasing the number of seats in engineering colleges and by increasing the number of IT courses in the curriculum. The domestic IT market requires a fillip by increasing the use of IT in the government agencies and introducing market reforms. Telecom infrastructure has to be radically improved to make the Internet available all over the country. Regulatory bottlenecks need to be removed to ensure consistency of policies and provide a single window clearance for all IT business outsourcing. India ranks 49th in the world as to labour productivity,[19] and this is a major concern for the IT industry. NASSCOM will work actively with the government to institute reforms and publish country specific reports (with strategies and tactics) to ensure India's steady progress towards dominating the global IT market. The government can invest in developing secondary towns and cities into world class software centers (hubs) by improving their IT and telecom infrastructure.[20]

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[18] Software technology parks of India.

[19] In 2001, India ranked 49th in the world (productivity per person employed/hour equals $2.42 and over all productivity valued at $5452, as against Luxembourg which tops the list with $41.9/hour and over all at $73,999 as revealed by a study. India ranks lowest in labour productivity, May28th 2002, www.rediff.com, BS Corporate Bureau, http://www.rediff.com/money/2002/may/28labour.htm.

[20] One initiative could be transforming small cities like Pune, Bhuvaneshwar, Ranchi (capital of the newly formed Jharkhand state), and Bhopal etc. into world class IT centers.

The internet is becoming an integral part of the Indian software business, as evidenced from its use alongside high-speed satellite connectivity for software development and delivery. High-speed connectivity has been an essential element in the globalization of the Indian software industry. To boost the development of IT sector in the country, the government has recently created a new ministry for Information Technology. Last but not the least, another major threat to the Indian IT industry is the increasing geo-political tension with Pakistan and the military build-up on the border.[21] Most businesses are of the opinion that if the present standoff persists, the IT industry will be hard hit.

In spite of short-term concerns, several government initiatives have vindicated the perception that India is the choice destination for IT outsourcing. Prominent among them are FDI incentives, and liberalized regulatory policies. The role of some foreign governments in augmenting India's IT growth deserve special mention. Germany is emerging as a robust market for Indian IT talent. There are currently 440,000 IT jobs available in Germany and the figure is expected to grow to 723,000 by the year 2003,[22] and the German government has introduced new policies to encourage the inflow of Indian knowledge workers to meet their IT demand. Similar to the United States, they have also introduced special 'Green Cards' to IT specialists, which has now encouraged Indian companies to exploit this new opportunity and tap the German market to their advantage. Countries such as the Netherlands, Belgium, Spain, Finland, Denmark and Greece are also sourcing software from India. India's software exports to the EU has increased from $766 million in 1998-9 to $842 million in 1999-2000 (a growth of more than 13%).[23]

5. India's competition

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[21] Indo-Pak crisis threatens India's IT future, June 5th 2002, www.rediff.com, Reuters; War Threat may dent India's software exports, says NASSCOM, June 5th 2002, Reuters, www.rediff.com.

[22] According to the German Association for IT, Telecommunications and New Media (BITKOM). Germany, robust market for Indian IT experts, www.rediff.com June 20, 2002.

[23] *Ibid.*

The application outsourcing market has been dominated by large external service providers (ESP). Recently a strong offshore programming market has emerged, enhanced by increased acceptance of offshore outsourcing. Although Indian vendors dominate today's offshore market, other countries have begun to build their own capabilities (e.g., the Republic of Ireland, Northern Ireland, the Philippines, and others). Many entrepreneurs in other countries (e.g., Russia, Hungary, Egypt and the Ukraine) are planning to compete for western business with or without the active support of their governments. Even China seems poised to participate as enterprises and vendors view the potential of its resource pool (see Figure 1).

China has encouraged software development by investing over $200 million on infrastructural projects for its 10 software industrial parks.[24] Microsoft has launched its first joint venture in China to outsource software services to MNC's and build proprietary software application products for the local market.[25] In contrast to India, where most software is destined for export, Chinese software is targeted towards the domestic market only. This is due to growing local demand, insufficient competence in English and lack of financial resources to market internationally. The government has invested heavily in information and communication technology (ICT) sector, but tremendous economic disparity exists between coastal and interior provinces,

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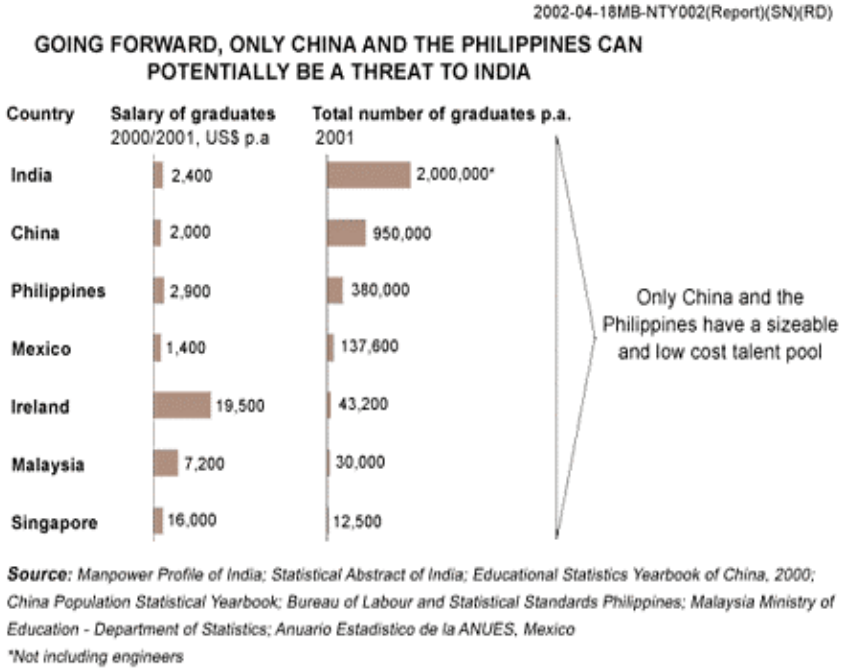
[24] *People's Daily* (2002b).
[25] *Peoples Daily* (2002a).

FIGURE 1

SALARY AND NUMBER OF GRADUATES.



Source: Featured NASSCOM Article, *NASSCOM-McKinsey Report 2002*; http://www.nasscom.org/artdisplay.asp?Art_id=1225 .

which have largely been left out from the benefits of the internet boom in China (China ranks 64th in the Networked Readiness Index[26]). Another factor hampering the unrestricted growth of IT in China is the conflicting policies of the Chinese government towards IT. On one hand it perceives IT as a source of economic development, and on the other it is wary of the potentially disruptive social and political impact of IT especially the Internet. Hence China has a single Internet gateway (China Net), which is closely monitored by the government, and many websites of foreign media and human rights organizations are also blocked.[27]

The Irish economy has seen a rapid transition from low-end manufacturing to high-end software development, supported by government spending on technical and tertiary institutions in the last two decades (Ire-

[26] Kirkman, Osorio and Sachs (2002.)

[27] *Global Information Technology Report 2001-2002* (2002).

land ranks 19th in the Networked Readiness Index[28]). There is a steady supply of skilled workers and friendly tax and trade regulation coupled with small domestic market that has led to a growing export market for Irish software. The Irish government rolled out a national fiber-optic network to more than 120 towns and instituted the e-business Act in 2001 to provide legal support to internet transactions and digital signatures. This is expected to provide impetus to e-commerce and telecommunications. Dublin has become a hub for European call centers that import language workers to take advantage of the city's well-developed network infrastructure.[29]

Philippines' major strength is its highly educated population (literacy rate exceeds 94%), low labor costs and competence in English. The government has adopted the National Information Technology Plan to boost the country's economy and spur national competitiveness. Philippines is a world leader in short messaging service (SMS) and a major hardware exporter. However, major challenges lie in the form of inefficient power supply, low levels of income and PC penetration, huge brain drain of IT skilled labor force and high software piracy rate.[30]

Singapore's advanced information infrastructure is a key factor in its economic development. The Singaporean e-commerce market is one of the best known in Asia, although it is limited to foreign multinationals based in the country and there is lack of local penetration as small & medium-sized enterprises are reluctant to use e-commerce for business. Singapore's e-citizen initiative has received accolades from all over the world for its efficient e-government delivery systems (Singapore ranks first in e-government micro-index). The government has also invested heavily in IT education. One major challenge is the nation's huge dependence on export revenues and foreign investment, which makes it very sensitive to global economic conditions.[31]

Malaysia has taken initiatives to transform its economy into a major IT force. The best-known element of Malaysia's IT strategy is the ultra-high technology business city (Multimedia Super Corridor or MSC) on the outskirts of Kuala Lumpur, home to more than 500 companies. Built with an intention to attract FDI's and skilled IT workers, the MSC included

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[28] Kirkman, Osorio and Sachs (2002).

[29] *Global Information Technology Report 2001-2002* (2002).

[30] *Ibid.*

[31] *Ibid.*

government concessions such as a 10-year tax holiday, duty-free import of IT equipment and fast processing of work Visas for immigrants. The government is taking major steps to improve IT education, e-governance and electronic labor exchange. However, major hurdles remain in the form of limited access to internet and telephony and lack of electricity in schools and rural areas.[32]

Indian IT development is by far the most advanced among the countries discussed, although challenges remain in the form of bureaucracy, political strife and inadequate electric supply throughout the country. Limited telephony and penetration of the Internet has led to high communication costs and poor service. There is also a need to integrate technology in the curriculum of schools. Poverty, illiteracy and linguistic diversity are some other obstacles to IT growth. Individuals and organizations are adept in the use of information technology; however small enterprises, people in rural areas (where 70% of the population lives[33]) are still left behind. The central and state governments are initiating pilot projects to enhance the use of IT education, e-governance and e-commerce throughout the country. Higher education is very well developed (the Indian Institute's of Technology are among the most selective institutes of the world) and churns out thousands of science and engineering graduates every year. There are plenty of technical training institutes that cater to the enthusiastic demand for IT education (Ranking 9th in the world in quality of IT education[34]). The sustained growth of an industry comes through high domestic demand but India falls short in producing and marketing entire software packages. Unlike the US where venture capitalists and entrepreneurs drive the product business, Indian venture finance is hardly available.[35] India also suffers from a lack of market intelligence. The policies and economic incentives for export and lack of adequate computerization has resulted in under development of the domestic IT market. In spite of these challenges, India seems poised to lead the IT market among developing countries because of the availability of vital resources (world's top pool of scientific and IT skilled English speaking manpower).

For economic development to be sustainable, it has to be broad based and made available to the mass, to bridge the digital divide. This is

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[32] *Ibid.*
[33] *Ibid.*
[34] *Ibid.*
[35] Pai and Lal (1998).

where public policy is indispensable – it is essential to have national policies favoring domestic ICT use. ICT is a major instrument for leveraging limited resources to address the problem of illiteracy in developing countries. By providing IT education to the general public and by investing in physical infrastructure (high speed satellite uplinks and international gateways with large band width), countries can ensure long-term benefits for human development and equitable economic growth. While recognizing the importance of education and infrastructure, a nation can benefit from ICT use only if there is political stability, respect for the rule of law and a favorable business climate. Some African countries such as Kenya and Nigeria, in spite of being English speaking, have not benefited as much in the IT economy because of poor business climate and prevalence of corruption.

6. Future trends

India is becoming a strategic point for remote delivery of knowledge services.[36] New opportunities can be identified in alternate medicines like herbal, which is becoming popular across the world.[37] Because of its enormous talent pool, India becomes the ideal destination for setting up call centers and back office operations. The widening IT-skills demand-supply gap in developed nations will continue to ensure a rapid growth of the Indian IT industry. It is estimated that by the year 2008, India will capture $77 billion of the global IT services market. The Indian IT industry is projected to create more than 2 million jobs and will contribute more than 7 percent of India's GDP and 30 percent of its foreign exchange earnings.[38]

Increasingly, most enterprises are demanding global delivery of services to complement local software expertise. Companies like IBM, Global Services, SAP, and Microsoft have opened centers of software excellence and innovation in India. They do not position themselves as foreign multi-

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[36] Prahalad (2001).

[37] http://www.bbc.co.uk/education/medicine/nonint/modern/am/moamfc.shtml; http://www.altmeduniversity.com/altmed/; http://www.jadecampus.com/News/roanoke_times__world_news_111198.htm.

[38] Jafri (2002).

nationals, but as fully engaged citizens of the country where they operate. Infosys Technologies (ITL Infosys) of India is one of the companies that is pursuing this strategy.[39] Demand for IT enabled services will continue to grow steadily through 2005 and the lack of sufficient skilled labor will be a major bottleneck in the developed western countries (USA, Japan, and Western Europe). India needs to develop superior cross border service delivery capabilities in order to exploit this unique growth opportunity and allow businesses based in western nations to leverage its skilled workforce. The Networked Readiness Index[40] ranks India at 54, revealing lack of depth in IT penetration. Although India is renowned for its preeminence in software programming and providing the world with skilled IT workers, the government needs to improve its IT infrastructure.[41] There are many ICT growth zones in India (such as the metro cities in Delhi, Mumbai, Chennai, Calcutta, Bangalore, Pune, Hyderabad) but they need penetration throughout the country instead of remaining localized. India can continue to maintain its dominance in the knowledge based services industry by developing leverageable intellectual asset that transcends national barriers. India needs to develop high-speed digital communications backbone able to deliver uninterrupted connectivity and large bandwidth to internet users. The government should also provide incentives (tax breaks for using IT for business) to private firms and small businesses to adopt IT and enhance their competitiveness in the regional and global markets. The Indian government should adopt an efficient e-governance strategy and provide various government services (passports, drivers licenses, various applications for business licenses etc) through the internet. Software Piracy (estimated at 63% percent[2442]) is a major threat to IT development. Indian government has amended the copyright law to make it one of the most stringent in the world and also lifted import duty on software. The government has removed state monopoly over internet service providers (ISP's) and this has the potential to develop many small start-up web design and hosting businesses. At the same time, India needs to be globally sensitive to the business opportunities, as they arise, by focusing on high performance, talent retention and handling local geo-political tension. Still software exports

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[39] Wiggins (2002).

[40] Kirkman, Osorio and Sachs (2002).

[41] India ranks 29th in e-Commerce, 33rd in e-Government and 63rd in General IT Infrastructure according to the Networked Economy Micro-Index; http://www.cid.harvard.edu/cr/profiles/India.pdf.

[42] *Global Information technology Report 2001-2002* (2002).

are expected to make an increasing contribution to the Indian economy and other developing countries can embark on the same road by examining India's successes and shortfalls. Managers around the globe will increasingly incorporate these opportunities afforded by developing countries as an integral part of their IT strategy.

Internet commerce will make it possible for even small companies in remote locations to market their products and services around the world, hence companies and nations that wish to participate in these production processes will need sophisticated IT skills and good information infrastructures. Those that have made the necessary investments and developed the capabilities will benefit from globalization, while others will be left out.

IT Production benefits only the IT sector, while IT use can benefit all industrial sectors, by increasing productivity.[43] Hence it is politic to promote the use of IT, while promoting IT production as well as developing national capabilities. The governments can themselves become sophisticated IT users by practicing e-governance. This can be achieved by setting up websites where citizens can get information about services, download forms, gather data, and communicate with officials. Governments can encourage use of IT by providing internet access in libraries, schools and other public facilities. They can also mandate companies to transact business with government electronically. There is plenty of opportunity for developing countries to find innovative uses of IT that fit their own situations, e.g. geographical information systems can help nations protect natural resources as well as provide crop information, disseminate farming best practices and plan for growth.

7. Conclusion

The role of ICT is popularly held to be very critical to economic development, however there has to be greater domestic use of ICT as an engine for economic growth, in contrast to the export of products and services. ICT was available to the developing countries at a much earlier stage of their development, as compared to the developed nations and hence their economies were not as well positioned to leverage the benefits

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[43] Pohjola (2001).

of ICT to rapidly help their transition from a subsistence economy to an exchange economy. In order to realize the potential benefits of IT, countries must focus on the value of both IT *production* and *use*, and thereby develop national capabilities. National policies made in coordination with the private sector, academicians coupled with complementary efforts of various government agencies can result in rapid diffusion of IT with broad benefits for the country.

Developing countries can make policy decisions to encourage IT use by small businesses, provide them financial support and encourage partnerships between local firms and multinationals. In order to support both IT use and production, countries need to develop capabilities in the form of human resources, information infrastructure, R&D, and business skills. There is a need to develop a broad base of basic capabilities, such as raising the overall level of education and developing transportation, power and telecommunication infrastructure throughout the country.

In the long run, IT will benefit developing countries to the extent that they can achieve the widest possible diffusion of the technology, and create the broadest base of capabilities to support IT use and production close to use.

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