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THE ROLE OF INFORMATION AND COMMUNICATION TECHNOLOGIES IN ENHANCING PROCESSES OF ENTREPRENEURSHIP AND GLOBALIZATION IN INDIAN SOFTWARE COMPANIES

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ABSTRACT

Information and Communication Technologies (ICTs) enable hitherto untradable services to be traded internationally, just like commodities, via the internet and the telephone - the recent outsourcing of software programming, airline revenue accounting, insurance claims and call centers to India is a good example. Consequently, ICTs have enabled not only small and medium-sized firms but even start-ups to globalize their operations. For instance, Silicon Valley based technology start-ups owned and managed by foreign-born entrepreneurs have successfully exploited India's software talent - this paper investigates the close relationship between ICTs, globalization and entrepreneurship. A theoretical basis for analysis is developed using innovation theory to study the link between immigrant entrepreneurship and the processes of globalization shaped through the use and proliferation of ICTs in developing countries. The theory is illustrated using seven case studies. This paper adds to the growing body of literature that emphasizes the aforementioned link as compared to the existing studies which have focused exclusively on the behavior of multinational corporations and national markets.

Keywords: Information and Communication Technologies, globalization, entrepreneurship, software, transnational entrepreneurial networks, brain drain, brain circulation, global supply chain.

1. INTRODUCTION

Since the 1960s, many OECD multinational corporations (MNCs) have adopted the "top-down" process of globalization, which has involved the delegation of certain labor-intensive tasks to developing countries and the concomitant leveraging of indigenous assets like relatively cheap labor and access to local markets and raw materials. Although the "top-down" process of globalization consisting, inter-alia, of the construction and operation of a production facility by a local subsidiary continued to be the dominant paradigm (Held et al., 1999), many MNCs also switched to outsourcing specific tasks in the value chain to indigenous suppliers in the NICs. The latter process has led to some sort of reverse leveraging of the MNCs assets by the indigenous supplier from the NICs (Tsai, 2002). Taiwan is a good example of this phenomenon. It benefited from the "top-down" process of globalization referred to above. For instance, by the late 1980s Taiwan's socioeconomic system had entered the post-industrial development stage – per capita GNP increased from US$196 in 1952 to around US$13,500 by the end of 1997 (Iredale and Guo, 2000). A concomitant development was the reversal of the "brain drain" – which had become characteristic of Taiwan from the 1950s to the 1980s – and associated with this was the emergence of reverse

leveraging in the process of globalization by many Taiwanese companies. From Taiwan's point of view, or any other developing (home) country, the emigration of highly skilled scientists and engineers was a "brain drain" since it meant a major economic loss given that the considerable sum of money spent on their education and training turned out to be a sunk cost - conversely, the discussion in the foreign country revolved around the extent to which the immigration of these foreign-born professionals resulted in the displacement of native workers (Saxenian, 2002c).

Recent studies suggest that the rise of science and technology (S&T) diasporas/ transnational entrepreneurial networks (TENs) during the last decade in the developing world has been a direct result of the investment by foreign-born entrepreneurs in their countries of origin (Saxenian, 2002a) as part of the wider process of globalization. Most accounts of globalization focus largely on the transnational activities of MNCs – both from the highly industrialized countries (HICs) and the newly industrialized countries (NICs) – and have consequently ignored the expansion of S&T diasporas/TENs that share access to assets such as information, trust, and contacts (Portes, 1996). This paper suggests that these diasporas/TENs may be an equally important driver - as states and MNCs - of the growth of new technology clusters in their native countries thus leading to a transformation of the "brain drain" process into a process of "brain-circulation". The first half of the paper looks at the process of globalization and demonstrates that ICT has enabled a reduction in the optimal size of the firm, and direct sales in the global market at a lower cost thus leading to the development of a globally competitive software service industry in India. The paper then examines - with the help of case studies of seven firms in the Indian software industry - the link between immigrant entrepreneurship and globalization processes, shaped through the use and proliferation of ICTs, whereby first-generation Indian immigrants study and/or work in the U.S. and then return to start their own businesses or having established business relationships in India commute regularly between India and the U.S. The paper concludes with an outline of the challenges facing the process of globalization and "return entrepreneurship" in the Indian software industry as well as some thoughts about directions for future research.

2. THE PROCESS OF GLOBALIZATION

Traditionally, globalization implied the production and marketing activities of MNCs in multiple national markets with the objective of profit maximization. It involved the use of strategies like FDI and other forms of leveraging of foreign assets and resources to control and manage international subsidiaries (Held et al., 1999). FDI has extended modern skills and technology in the developing world – by introducing global competition within domestic markets it has forced firms to be on the world productivity frontier or go out of business (Cantwell, 1989; Baily and Gersbach, 1995). Further, freer trade has led to the import of new products with the attendant advantage of 'reverse engineering" (The Economist, 2001a). In recent times however, hi-tech global trade has substantially increased the incomes of people in developing countries – this has largely been made possible by the existence of a good communications infrastructure though the growth of hi-tech FDI has been hindered, to some extent, by the failure of certain DCs to protect intellectual property rights (The Economist, 2001a). According to Robertson (1992), the term globalization "refers both to the compression of the world and intensification of consciousness of the world as a whole" (ibid., p. 8) although this has been widely debated over the last decade. The first point is directly associated with time-space compression which involves a significant role of ICTs "through their ability to enable new modes of work, communication, and organization across time and space" (ibid., p. 360). This is illustrated in Castells' influential work (1996; 1997; 1998)

where he points out that information is a prerequisite for the functioning of modern society and is the driver for societal changes in the "information age" – the latter being characterized by increased networking amongst different members of society due to ICTs (Walsham, 2002).

However, do global markets, global supply chains and global financial flows (Giddens, 1999) – aided by the spread of ICTs - imply that the expansion of economic globalization is inevitable? Mirchandani (2004) states that "understanding global processes has traditionally been limited to analyses of cross-border processes such as international trade and investment" (ibid., p. 356) and further that, this "top-down" process of globalization or "transnational centrism" (Grewal and Kaplan, 1994) assumes that the MNC is innately powerful and that global markets will eventually replace local markets. Mirchandani goes on to say that this view has been challenged by many researchers who have stressed the need to focus on the "practices through which what is known as 'globalization' is continually being constituted". She examines these practices - i.e. the "systems, norms and work relations that structure workers' experiences and that constitute globalization" - in the case of India and finds that "transnational corporate practices in globalized call centers" are continually under construction. Robertson (1992) also emphasizes the importance of local cultures in the process of globalization and cites Japan as a good example of the "glocalization" processes. Further, while acknowledging the role of ICTs in helping time-space compression he contends that it leads, inter alia, to a conflict between global, societal and communal attitudes. Appadurai (1997; 2000) also underscores the fact that globalization is characterized by a "world of flows" - of objects, persons, images, and discourses - which are not inter-reliant but are instead in "relations of disjuncture" i.e. the process of globalization is dependant on local institutional structures, geographies, histories and languages etc. Walsham (2001) while discussing, in particular, the role of ICTs builds an associated argument that it is imperative to concentrate on global diversity when evolving and employing such technologies.

There are also some who think that hi-tech trade (employing ICTs) is inherently disadvantageous to developing countries. For instance, economists like Avinash Persaud of State Street Bank fear that by virtue of being first-movers, multinational giants can take advantage of 'network externalities' and drive smaller firms from developing countries out of e-commerce (Woodall, 2000). This claim is not totally unfounded, although it can be argued that non-traditional sectors like ICT, for instance, have enabled developing countries to move into the hi-tech area and leave out intermediate stages such as copper wires and analogue telephones (Woodall, 2000). Further, as mentioned earlier, by reducing the optimal size of a firm in most industries, ICT enables small firms in developing countries to sell directly in the global market at a lower cost. Also, by lowering the costs of communication, ICT helps FDI in developing countries – MNCs are able to take advantage of cheap labor in DCs and simultaneously stay in close touch with their headquarters (Woodall, 2000). ICT also enables hitherto untradable services to be traded, just like commodities, via the internet and the telephone. The outsourcing of software programming, airline revenue accounting, insurance claims and call centers to India is a good example (Woodall, 2000). India has successfully tapped into the global outsourcing market with some help from Indian expatriates in Silicon Valley (SV) who have invested in the hi-tech companies catering to the outsourcing business in their native country. The Business Process Outsourcing (BPO) segment, for instance, accounts for about one-third of the global outsourcing market with the rest being IT-related - this includes accounting services like credit card administration, insurance claims, business payrolls, customer, financial and human resource management and engineering and design services and is likely to be worth about US$500 billion within five years (The Economist, 2005). This has been made possible by public policy that encompasses the establishment of technical colleges with the English language as the medium of instruction and by investing in

communications infrastructure – especially high-speed links and international gateways with sufficient bandwidth (UNDP, Human Development Report, 2001) – thus leading to the *informatization* (Singhal and Rogers, 2001) of certain sectors of Indian society and the emergence of India as a 'world leader in computer software services' (UNDP, Human Development Report, 2005). India is now a major player in the worldwide outsourcing of production by MNCs (with the objective of creating global value chains) based on the new global business models of intermediation, BPO and value chain integration. The Indian outsourcing business owed its success initially to its ability to provide low cost code-writing capability and program fixes to some of the world's leading MNCs plus the very convenient difference in time zones (The Economist, 2003)[1]. Incidentally, exports of India's software services were worth $16 billion in 2003 compared to $500 million in the mid-1990s and - according to the National Association of Software and Service Companies (Nasscom), the Indian IT-industry lobby - by 2008 annual sales of India's IT industry will exceed $50 billion while those of the BPO industry (2003 sales were $3.6 billon) are expected to be $21-$24 billion[2] (Edwards, 2004a). Indian IT-services companies have finally started to venture out of the back office and move up the value chain and this has contributed to the growth of outward stock of foreign direct investment (FDI)[3]. It remains to be seen whether they have the potential to emulate the kind of globalization in software that Taiwanese companies have achieved in IT manufacturing[4].

With the collapse of the technology bubble in the U.S. in 2001, outsourcing revenues of Indian firms also nosedived but they were well-positioned to take advantage – due to a strong marketing drive – of the subsequent cost-cutting efforts by the big MNCs. Obviously, this spectacular growth has been has been achieved at the expense of the giant MNCs (IBM, EDS and Computer Sciences) who have since launched counter-strategies designed to nullify the competitive cost advantage of the Indian firms.

It has been reported that Indian expatriates in SV are the source of many of the investments that have been made in the hi-tech companies catering to the outsourcing business located in the Indian *technopolises* of Hyderabad and Bangalore (Singhal and Rogers, 2001). This reveals the close link between ICT, entrepreneurship and globalization – and, especially, the phenomenon of "brain circulation" - which I will elaborate in the next section.

[1] A quote from Tom Friedman's recent book "The World is Flat" is relevant here. "Outsourcing is just one dimension of a much more fundamental thing happening today in the world", Nilekani (*The CEO of Infosys Technologies Limited, a leading Indian IT company*) explained. "What happened over the last [few] years is that there was a massive investment in technology, especially in the bubble era, when hundreds of millions of dollars were invested in putting broadband connectivity around the world, undersea cables, all those things." At the same time, he added, computers became cheaper and dispersed all over the world, and there was an explosion of software – e-mail, search engines like Google, and proprietary software that can chop up any piece of work and send one part to Boston, one part to Bangalore, and one part to Beijing, making it easy for anyone to do remote development. When all of these things suddenly came together around 2000, added Nilekani, they "created a platform where intellectual work, intellectual capital, could be delivered from anywhere. It could be disaggregated, delivered, distributed, produced, and put back together again – and this gave a whole new degree of freedom to the way we do work, especially work of an intellectual nature…. And what you are seeing in Bangalore today is really the culmination of all these things coming together." (Italics Mine).

[2] Approximately 70% of the BPO industry's revenue comes from call-centers.

[3] For the developing countries as a whole, it has gone up from 3% of GDP in 1980 to 10% today (Narayana Murthy, Globalcorp, 2005; in The Economist's The World in 2005).

[4] It would be appropriate to point out here that the software industry encompasses only a small section of the Indian population.

2.1 Globalization, Entrepreneurship and "Brain Drain": An Overview of the Indian IT Industry

With the increasing use of IT in business, the idea of "reverse leveraging" has gained importance. MNCs like IBM (and DEC subsequently) originated the process of globalization in the IT industry, but in the process unintentionally created potential competitors out of the very local assets they leveraged (Tsai, 2002). Consequently, as outlined above, the focus of the studies on globalization, so far, has been on the behavior of MNCs and national markets to the exclusion of research on the link between entrepreneurship and globalization (Saxenian, 2002). With the phenomenal development of ICTs in the recent past, not only small and medium-sized firms but even start-ups – regardless of where they are located - can globalize their operations.

As a corollary to this, U.S.-educated and trained IT professionals are gradually transferring state-of-the-art technology and market intelligence in addition to promoting entrepreneurship in their native countries thus allowing them to benefit from the IT revolution. Their unique advantage lies in the fact that they can utilize their experience and contacts – stemming from their being part of these professional networks which also facilitate the acquisition of knowledge about potential supplies of talent, state-of-the-art technology and resources – to promptly recognize potential market prospects and respond to them rapidly to stay ahead of the competition. Typically, firms in DCs circumvent the twin problems of a) being distant from both the technology hubs and lucrative markets in advanced countries and b) not being in touch with end users - both of which are critical for innovation (Hobday, 1995) - by resorting to collaborative endeavors, FDI etc. But TENs can assist in the process of diffusion of innovations and afford access to global markets for firms in DCs with the help of ICTs – economic liberalization measures undertaken worldwide as part of the wider process of globalization and ever more complex ICTs have quickened this process. Incidentally, the diffusion of innovations theory's (Rogers, 2003) main emphasis is on communication channels, which is the instrument by which news about an innovation is conveyed to or within the social system - these channels consist of both the mass media and inter-personal communication (IPC). Different social systems have different inclinations with regard to trusting the mass media or IPC – the latter being an important influence in determining the speed and shape of the S-shaped pattern of the diffusion process in a social system - when searching for information about an innovation.

Consequently, ICTs by themselves cannot ensure successful synchronization or cost-effective transfers of technology. TENs, based upon shared ethnicity, can enable transnational ventures to respond promptly to business opportunities with the help of ICTs – especially in the hi-tech sector – and thereby guarantee their success. Likewise, opening up of markets and state sponsored attempts to replicate the SV model alone cannot guarantee the success of firm(s) in the global arena. Further, endeavors aimed at fostering entrepreneurship by marshaling resources, infrastructure etc. are bound to be futile because they cannot substitute for knowledge sharing and learning by doing - in a highly competitive environment like SV's, for instance - that characterize TENs. Actually, it was members of the TENs along with indigenous entrepreneurs who found a market niche in providing highly price-competitive Indian technical talent to service the growing software development needs of several Fortune 500 companies. They thus became a role model for the Indian Government which teamed up with them to develop strategies for accelerating economic growth.

In addition, returning technology entrepreneurs (RTEs) have found ways and means to overcome the obstacles faced in India e.g. the lack of a dependable infrastructure by falling back on telecommunications services and power supplies in the private sector. Further, TENs

and RTEs have realized that they have to focus on moving up the value chain since continuing to be the back office for the world's leading MNCs – by using abundant supplies of low-cost labor for BPO jobs - is not good long term strategy. This is evidenced by the fact that they have invested in hi tech firms and have maintained close ties with Silicon Valley - MosChip Semiconductor Technology Limited, one of the case studies in this paper, is a good example. In fact, hi tech firms in the U.S. are now looking to their opposite numbers in India not simply for a plentiful supply of low cost labor for low cost fixes etc. but more and more as a partner in product development. In addition, local demand like, for instance, the rapidly expanding wireless market in India has produced prospects for domestic firms to play a role - however small - in determining the future path of the technology and its uses. This creates opportunities for RTEs since they cannot rely solely on Governments to guarantee the prerequisites for their return – creation of TENs will be facilitated if and only if RTEs return in sufficient numbers and establish links with the local communities (an increasing number seem to be returning to India now). There is a role for the government though, as stated above, in terms of its contribution to the development of local talent and its efforts in trying to improve the core infrastructure that supports entrepreneurship-led technology growth. The establishment of the Software Technology Park (STP) Scheme by the Government of India in 1991 is a good example – many of the software firms studied later in this paper have been registered under STP, India.

Since much of this technology growth in India has occurred in "regional clusters of entrepreneurship and innovation" similar to SV the microeconomics of growth and trade that have led to the creation of these regional clusters needs to be investigated (Saxenian, 2001). The existing theories of clusters of innovative activity concentrate on two major themes. The first one relates to the ability of companies to retrieve information about the market and new developments in technology more efficiently (Porter, 1998) – this is akin to a direct external effect. There could also be an indirect external effect occurring from efficiency gains in the sourcing of key inputs like highly specialized labor, venture capital and "commercially oriented activities in universities or national laboratories" (Saxenian et al., 2001). These direct and indirect external effects enhance productivity and consequently provide a strong motivation for new firms to locate in an existing cluster. Further, these external effects have two important inferences for economic growth in terms of the role of agglomeration economies. First, given that clusters have an important role to play in enhancing the capability to innovate, they can by raising the rate of return on invention - provided they are significant enough – speed up the "commercialization of valuable technologies faster and closer to markets" and second, given these external effects technology entrepreneurs, venture capitalists and input providers can increase the returns on their investment manifold by being part of these clusters (Saxenian et al., 2001).

The most outstanding example is the hi-tech industry – SV based firms owned and managed by foreign-born entrepreneurs are "poised to exploit both India's software talent and Taiwan's manufacturing capabilities" (Saxenian, 2002c). New Indian immigrants in SV, for instance, have created professional and social networks to marshal information, knowledge, talent and resources for the creation of thousands of technology start-ups leading, in turn, to substantial employment-generation. In addition, quite a few of them have also set up subsidiaries, joint ventures, sub-contracting, or other business operations in their homelands. Further, they have become important links in leveraging low-cost Indian software talent for U.S. businesses. More importantly, these networks have opened up foreign markets for U.S. firms thus strengthening the U.S. economy via exports and speeding up the process of their assimilation into the global economy. This demonstrates that TENs consisting of Indian immigrants in SV have been an important driver of the growth of new technology clusters in

India thus leading to a transformation of the "brain drain" process into a process of "brain-circulation".

A brief historical review of the Indian software industry shows that although India has been a late-comer to computerization, it has been one of the leaders in software exports in the last few years. An examination of the Indian IT industry's recent performance discloses the fact "that the industry has grown at over 45% CAGR (Compound Annual Growth Rate) over the last three years and has been the most value creating sector in the Indian economy"[5]. The findings also reveal that despite the current downturn in economic activity, the growth essentials for the industry in the long run look healthy. Key points of the Nasscom-McKinsey 2002 report on India's IT industry are summarized in Table 1 below:

Table 1. Potential for Indian Software and Service Industry by 2008

Category	**US$ Billion**
IT Services Exports	28-30
ITES Exports	21-24
Product and Technology Services	8-11
Domestic Market	3-15
Total	70-80

Source: NASSCOM-McKinsey Report 2002

- The IT sector is projected to earn revenues of approximately $70 to $80 billion by 2008.
- The projected $77 billion translates into a 7 per cent share of GDP by 2008 (up from 0.3 per cent in 1998-99).
- The long term export potential of the IT-enabled services (ITES) sector is likely to be in the $50 to $54 billion range.
- The IT sector will employ 4 million people by 2008.

The key question that follows is - what has contributed to this growth?

First, a historical analysis reveals that starting in 1980s there was a greater emphasis on computerization and computer literacy. Many projects like, for instance, the computerization of the railroad reservation system were started and there was a mushrooming of new Engineering Colleges, technical schools and institutes imparting computer training – this was in tune with the greater emphasis on Science and Math and served as building blocks for the future.

Second, the opening of markets in the early 1990s coincided with the demand for human capital from the West consequent upon the IT revolution there. Earlier, in the mid-1960s, immigration from India to the US - or brain drain as it was popularly known then - comprised mostly of doctors, engineers, scientists and university teachers. U.S. immigration policy targeted specific categories of professionals and this turned out to be an advantage for an Indian elite that was already poised and ready for such professions by way of the cultural and educational advantages available to them through a post-colonial educational system (as part of the post-independence Nehruvian policy of economic development). This group of Indian immigrants was different from the two other types of post-colonial immigration which

[5] Nasscom-McKinsey. Nasscom-McKinsey: Report - 2002. http://www.nasscom.org/artdisplay.asp?Art_id=1225

consisted of the migration of Anglo-Indians – the progeny of the union between the Indians and the British – to the UK and Australia and the migration of both indigent and highly skilled labor to the Persian Gulf which was solely short-term in nature and was driven principally by the need to make some quick cash to sustain families back in India. However, the migration of Indians to the U.S. in the 1990s consisted primarily of software engineers and was fueled by the tech boom in the U.S. Demand outstripped the supply of computer professionals in the West – especially the US – thus leading to the establishment of a global supply chain with India being an important link in this chain. The availability of low cost skilled manpower – thanks to the large number of university graduates - coupled with a working knowledge of English therefore resulted in an exodus of Indian computer professionals to the US. This exodus was definitely aided by the Indian diaspora (Non Resident Indians or NRIs) who contributed by way of ideas, capital and contacts. But in a large number of cases, it also led to what is commonly referred to in the industry as "body-shopping" – the export of "brainpower" at a price that exceeded the rate in India but fell far short of the going rate in the US. This was undoubtedly possible because of the existence of democratic institutions and a free media in India.

Third, India was already a tiny exporter (as a proportion of total exports) of software solutions, simple code and some integrated software products. The successful export of human capital to the US afforded the opportunity to move up the "value chain" and it goes to the credit of the Indian software industry that they capitalized on this. As is evident from above, the Indian IT industry has made tremendous strides in the last decade but a lot remains to be done.

3. METHODS

The primary purpose of the research is to investigate the close link between ICTs, globalization and entrepreneurship. Indian engineers and scientists are active technological entrepreneurs in SV in addition to being the backbone of the Valley's workforce. They account for around 25 percent of technology ventures in SV in recent years - have founded more than 1000 firms and formed corporations whose collective market capitalization is of the order of $250 billion (Shankar, 2005). Further, they have used their capital and connections to fund start-ups in their native country (Saxenian, 2002c). Subsidiaries (largely for development work) and joint ventures established by U.S. based and/or U.S. educated (or Indians who have gained work experience in the US) Indian technology entrepreneurs in India - apart from leading firms like Wipro Technology (WT) and Infosys - have earned billions of dollars by performing sub-contracting work in the area of software programming for traditional Fortune 500 companies.

After reviewing the backgrounds of the top management of several such firms in India, seven firms were selected which conformed to the research agenda. This sample included global players and prominent software exporters some of whom were competing with the likes of IBM and the case descriptions that follow contain a company profile and also serve as a test site for the theoretical model outlined in Section 2.1 above. Of the seven, three – which were headquartered in Hyderabad – were chosen for a site visit in July/August 2003. Each visit included an extensive interview with the CEO - these visits and interviews were arranged through the Hyderabad Software Exporters Association (HYSEA) and therefore do not constitute a random sample. The interviews (notes were taken during all interviews) focused on the history of the company and, more importantly, on the decision of the CEOs – since in most cases the CEOs were founders or co-founders as well – to use their

entrepreneurial skills to found and manage a successful IT company in India. Needless to add, all the respondents were frank and forthcoming.

4. CASE DESCRIPTIONS

4.1 Tejas Networks

Founded in 2000, Tejas Networks (TN) is a pioneer in the development of software-differentiated, next generation optical networking products for the global market that enable telecom service providers to create converged networks which provide the foundation for both voice and new data services. It is also in the business of providing network design, test and support services for the emerging telecom market in Asia. Incorporated in Bangalore, India, its objective is to create state-of-the art products and solutions for telecom carriers while simultaneously maximizing their revenue and minimizing their network costs. TN also collaborates with major third-party equipment vendors to make intelligent optical networks for its clientele. Among its investors are Sycamore Networks (SN), ASG Omni, LLC, IIML and Intel Capital – a brief outline of whose activities is given below.

4.2 Sycamore Networks

Headquartered in Chelmsford, MA, USA, Sycamore Networks is a publicly owned corporation which is in the business of developing and marketing intelligent optical networking products for the telecommunications industry and is worth 14.5 billion dollars.

4.3 ASG Omni, LLC

Headquartered in Greenwich, Connecticut, USA, ASG Omni, LLC is an investment firm promoting joint Indo-U.S. ventures.

4.4 IL&FS Investment Managers Limited

IIML (http://www.ivcindia.com/) is the Private Equity Investment arm of Infrastructure Leasing & Financial Services Limited (IL&FS), a principal Indian investment bank, and is one of the leading private capital providers in India. Besides IL&FS, the International Finance Corporation, Asian Development Bank, Bank of India, Industrial Credit and Investment Corporation of India, Industrial Development Bank of India, Small Industries Development Bank of India etc. have a stake in IIML. IIML manages a number of venture funds with aggregate commitments of around US$150 million and its portfolio comprises investments in identified growth sectors including Telecom, Information Technology, and Life Sciences etc.

4.5 Intel Capital

Intel Capital, Intel's strategic investment arm, focuses on making equity investments and acquisitions to enable the growth of the worldwide Internet economy, including Internet infrastructure, new content and capabilities in support of Intel's strategic goals.

TN has a highly talented and experienced management team and this is what Hetal Gandhi, a former Managing Director of IIML and leading Indian venture capitalist had to say about TN – “We have seen many successful IT services companies from India who have taken advantage of cost-effective, high-quality engineering talent within India. Tejas (TN) has shown strong early evidence of moving up the value chain and using the same strengths to create a global and profitable product company from India".[6]

Dr. Gururaj "Desh" Deshpande is an outstanding example of TN’s highly talented management team. The co-founder and chairman of SN – he holds a B.S. in Electrical

[6] Gandhi, Hetal. Tejas Networks: Press Releases. January 24, 2002 http://www.tejasnetworks.com/press12.htm

Engineering from the Indian Institute of Technology (IIT), an M.E. in Electrical Engineering from the University of New Brunswick, Canada, and a Ph.D. in data communications from Queens University, Canada. He quit a secure academic job at Queens University in Canada to brave the vagaries of the corporate world. "Desh" co-founded SN in 1998 for creating state-of-the-art optical networking technology that would "transform a once static optical infrastructure into an intelligent and dynamic network foundation for the delivery of new services". Prior to co-founding SN, "Desh" founded Cascade Communications Corporation (CCC), which eventually grew from a one-person start-up to a company with 900 employees and $500 million in revenue. CCC was, ultimately, acquired by Ascend Communications for $3.7 billion.

"Desh" is also the Chairman of TN's board of directors – an example of how a successful hi-tech entrepreneur in the US went global by investing in a company in his native country. "Desh" helped TN in the reverse leveraging process by ensuring that it got its first consulting project from SN in July-September 2000. Building on its original equipment manufacturer (OEM) relationship TN was soon able to win its first international customer order from China thus transforming itself from a local software start-up into a global company. First, this is an example of the SV model of entrepreneurship in practice - a hi-tech sector business model characterized by venture capital financing and high rates of growth which has been successfully adopted by highly skilled immigrants in the US and later transplanted, again successfully, by TENs in India (Saxenian, 2002a). Second, TN was established in Bangalore and hence conforms to the "regional clusters of entrepreneurship and innovation" model outlined in Section 2.1 above. Last, but not the least, "Desh" is an example of the brain-drain process being transformed into a process of brain-circulation.

4.6 Chembiotek Research International

Founded in 2000 by Dr. Purnendu Chatterjee, (head of an investment fund backed by George Soros), Chembiotek Research International (CRI) does contract research in the Pharmaceutical/Biotechnology area for the likes of Bayer and Procter & Gamble and other major pharmaceutical companies in India and abroad. The company complements the R&D efforts of MNCs and assists them in their R&D activities. The major areas of research are synthetic organic chemistry, process chemistry, medicinal chemistry, natural products chemistry, combinatorial synthesis, bioinformatics, bioscreening and Biological assay. In addition, the company also does basic research in the areas of Molecular Biology and Clinical Genomics. CRI started off by doing contract life-sciences research for MNCs to pay its bills but is now moving ahead with its own R&D activities – for example, some of its scientists are investigating gene therapy with the objective of developing a cure for diabetes (The Economist, 2001b). The aim of CRI is to expand and eventually transform itself from a local start-up into a global company.

Dr. Purnendu Chatterjee, the founder of CRI, got a B. Tech from the Indian Institute of Technology in Kharagpur, India in 1971 and a Ph.D in Operations Research from the University of California, Berkeley in 1974. From 1974 to 1976, he was a research associate at the Stanford Research Institute. In 1976 Dr. Chatterjee joined McKinsey & Company and became a principal in 1983. Having honed his hi-tech entrepreneurship skills in the US, Dr. Chatterjee decided to go global by investing in his native country. He founded the Chatterjee Group (TCG) in 1986, an investment fund backed by George Soros, which subsequently sponsored CRI. Apart from TCG, Dr. Chatterjee is on the board of directors of Global Power Investments (a joint venture with GE Capital and the International Finance Corporation) and Computer Associates TCG Software (CATS, a joint venture with Computer Associates, USA). TCG has also set up SkyTECH Solutions, in partnership with United Airlines, to

develop and implement comprehensive software solutions for the transportation industry with special focus on aviation[7]. CRI also is an example of a hi-tech company which has been established in a software park in Kolkata and thus conforms to the "regional clusters of entrepreneurship and innovation" model outlined in Section 2.1 above. Dr. Chatterjee is also part of the transnational entrepreneurial network and exemplifies the reversal of the brain-drain process into a process of brain-circulation.

4.7 e4e

e4e is an American technology company providing remote management technology services including IT and IT-enabled BPO services to the global market. e4e allows firms in the financial services and hi-tech verticals to concentrate on their core competencies by accomplishing non-core but critical business processes in a more efficient way. This enables businesses to increase their profit margins via reduction in operational and overhead costs with the possibility of further cost minimization through process reengineering, e-business conversion and use of off-shore development/transaction centers.

K. B. Chandrasekhar ("Chandra"), co-founder and chairman of the board, is also a co-founder, CEO, and chairman of the board of Jamcracker, Inc., an Applications Services Provider (ASP), which offers a one stop solution for B2B commerce. In 1994, Chandra – realizing the potential of the Internet - founded Exodus Communications, which went public in 1998 and is considered one of the most successful IPOs of 1998. This was followed the next year with Chandra being honored as the Ernst & Young Northern California Entrepreneur of the Year. Chandra was sent to the US in 1990 by Rolta India, Ltd. (RIL) as their country manager - his responsibilities included business development, marketing, and software consulting services for software developers and end users. While at RIL, he brought some key new clients like Ford, DEC, ScanOptics, and Borland on board. Chandra started his career as a customer support engineer for WT and worked his way up through various sales, marketing, and support positions during his seven year stint with the company.

Having successfully tested his entrepreneurial skills in the US, Chandra decided to invest in his native country by providing venture capital to Indian start-ups which had been identified as being potentially helpful to other companies in the corporate group – like, for instance, iseva, iCelerate, Aztec Software and Vinciti AQ – in achieving their strategic objectives. In addition, under his leadership, e4e has set up quite a few subsidiaries – including e4e India (the Indian subsidiary of e4e) - and joint ventures in India and is also serving as an important link in leveraging low-cost Indian software talent. e4e India is also an example of the highly successful SV model of entrepreneurship in practice which has been replicated by TENs in Bangalore, India and hence conforms to the "regional clusters of entrepreneurship and innovation" model outlined in Section 2.1 above. In addition, Chandra epitomizes the process of brain-circulation.

4.8 i2 technologies

i2 is an American company - co-founded by Dr. Sanjiv Sidhu, currently the Chairman of its Board of Directors – which has pioneered next generation SCM technology "designed to dramatically shorten time-to-results for process improvements, reduce software and implementation costs, and minimize implementation risks"[8]. After obtaining his M.S. in chemical engineering from Oklahoma State University in 1982, Dr. Sidhu worked in the world-renowned artificial intelligence laboratory at Texas Instruments (TI), but in 1998 he

[7] SkyTECH has marketing offices in Chicago and New Jersey and offshore development facilities in Kolkata and Mumbai, India.

[8] http://www.i2.com/solutionareas/sixone/synchronize.cfm

quit a promising career to co-found i2, a 5,900-employee company, with the late Ken Sharma. SCM applies technology and best practices to eliminate inefficiencies in business like, for instance, excess inventory with supply chain partners and provides "demand-driven supply chain solutions designed to enable business agility"[9]. Amongst i2's customers are giants like TI, 3M, DaimlerChrysler, IBM, Ford Motor Company, Dell Computer, Caterpillar, Toshiba, Kia etc. i2 earned $389 million in total revenue for the fiscal year 2004 and $98.5 million for the second quarter of 2005 – until 2002 it had been doubling its revenues each year since Sidhu found the company without any external capital. Under the direction of the Ernst & Young High Tech Entrepreneur, the company has built e-marketplaces that have enabled more than $16 billion in revenue growth and cost reductions for around 900 companies in areas like defense, automobiles, drugs, computers, chips, textiles, etc. Sidhu's plans included creating more than $75 billion in value for i2's customers by the end of 2005 from the execution of value chain management solutions. Thanks to Dr. Sidhu, i2 Technologies has a big presence in India - it has two fully owned subsidiaries. The development centers in Mumbai and Bangalore – which conform to the "regional clusters of entrepreneurship and innovation" model outlined in Section 2.1 above - concentrate on developing products that are vital in the areas of supplier relationship management, SCM and demand chain management while i2 India "provides a wide variety of collaborative e-business services for both the early stages and the next generation of e-business adoption, with each service supported by decision optimization, transaction management and content management solutions"[10]. i2 India's e-business solutions are adding value to some of India's leading firms thereby providing evidence for the process of brain-circulation.

4.9 Pramati Technologies

Pramati Technologies Private Limited (PTPL), one of the *Red Herring* 100 Private Companies of Asia, headquartered in Hyderabad, India was incorporated in 1998 with seed capital from the likes of Citigroup and Intel Capital. PTPL is a global provider of Java software development technology (an end-to-end Enterprise Java platform vendor) with offices in New York, San Jose, Hong Kong, Singapore and London. After winning some key customers in India it aggressively marketed its products – the *Pramati Server 4.1* (an application server) and the *Pramati Studio 3.5* (component development lifecycle tools) – to global companies like CitiGroup, Ericsson, and Standard Chartered Bank and ended up winning by being price-competitive and by providing inexpensive support. According to the company, "Pramati Server is the right choice for small-to-medium businesses and independent software vendors, who need fully standards compliant application server platform that provides classic enterprise-class features, scalability and performance demonstrated through industry-standard benchmarks"[11].

Jay Pullur, PTPL's Founder and CEO has a Master's degree in Computer Science from IIT, Kanpur and started his career with WT - one of India's largest software services companies - where he was involved in the execution of projects for several large US corporations such as GE, Hewlett Packard (HP), Xerox and Sequent - before deciding to go on his own. Early in his career, Jay also had a stint with an American company in Ann Arbor, Michigan. Jay's brother Vijay Prasanna Pullur, the co-founder and Chief Technology Officer of the company, is based in San Jose, CA and is the focal point for the company's marketing push in the U.S. – the company's main competitors are the market leaders i.e. IBM, Oracle,

[9] http://www.i2.com/company/news/releases/view.cfm?id=D516613C-508B-D94A-7EA88C075BC721BE
[10] http://www.i2.com/web505/server_navigation/skeletons/i2_01/framework/navigation.cfm?contentid=00109561-A7DE-4BC6-A25A66EBD5481288&navid=26022
[11] http://www.pramati.com/index.jsp?id=corporate

Microsoft and BEA Systems, Inc. While working for Wipro Infotech – the giant consulting arm of WT - Vijay had the opportunity to consult with big players in the IT industry like Sequent, Nortel, Ashton-Tate, Legent, InterVoice and OpenMarket.

PTPL's advantage, according to Jay, lies in its ability to outprice its competitors – its technology is very similar to its competitors thereby narrowing the gap and thus ruling out the possibility of any sacrifice in technology – because its product is developed and supported out of Hyderabad, India where wages are substantially lower than in the U.S. Further, being headquartered in Hyderabad, PTPL also conforms to the "regional clusters of entrepreneurship and innovation" model outlined in Section 2.1 above. PTPL has entered into strategic partnerships with HP, Fujitsu-Siemens and Sun Microsystems. Jay and his brother Vijay have leveraged their work experience in the US to establish a successful IT company in India thus providing further proof of the brain circulation hypothesis.

4.10 HelloSoft

HelloSoft, headquartered in San Jose, CA, is a provider of high-powered communications Internet protocol for VoIP, and wireless devices and gear. It provides customized solutions in the shape of a suite of integrated products "that include DSP software, Networking software, RTL, complete reference designs and design services" to semiconductor companies and Original Device Manufacturers (ODMs) for wireless technologies like Voice-Over-Packet (*HelloVoice)*, Wireless LAN (*HelloWLan)* and wireless data service solutions (*HelloWireless)* for 2/2.5/3G wireless networks. It has been funded by leading venture capital firms such as Venrock Associates, Sofinnova Ventures, Acer Technology Ventures, JumpStartup Venture Fund, Acer Technology Ventures, TD Capital ventures, Entrepia and Mitsui & Co. Venture Partners. Big players like TI, Broadcom, Ericsson, Microsoft, Intel, Sony Ericsson, Sharp and Fujitsu are some of its partners/customers. Personal digital assistants, next-generation mobile phones, IP phones, game consoles etc. are some of the devices that will employ one or more of HelloSoft's solutions. The company employs over 100 experienced digital signal processing engineers at its Research & Development center in Hyderabad.

Rama Rao Sreeramaneni is the co-founder, Vice-President and General Manager, India operations for Hellosoft. Rama has a Master's in Engineering from the University of Missouri and an MBA from Wayne State University. Rama started his career at Vehicle Dynamics International as a Software Engineer and subsequently held a range of positions at Ford Motor Company in the Electronics and Advanced Vehicle Technology divisions and was awarded a US patent for his design of the Climate Control Module. He started ZSP India (the Indian Operations of ZSP Corp.) in 1997, which was later sold to LSI Logic. Rama later joined Hellosoft and worked in the US for several years. He subsequently decided to leverage his US education and work experience in his native country and moved to India to head the company's development center in Hyderabad, thus validating the theoretical model outlined in Section 2.1 above.

4.11 Moschip Semiconductor

MosChip Semiconductor Technology Limited (MosChip), a manufacturer of fabless semiconductors based in Hyderabad, was founded in 1999. The company uses state-of-the-art technology in the design and manufacture of application specific integrated circuits - to service the data connectivity and consumer electronics segment - at its design center in Hyderabad employing more than 80 people (60 of whom are engineers). MosChip manufactures PCI Peripherals, USB 1.1 & USB 2.0, security and interface products. In July 2001, the company acquired NetMos Technology, Inc., now known as MosChip Semiconductor Technology, USA - a fully owned subsidiary of MosChip - focusing on

marketing and providing support services to a developing customer base spread throughout North America, Europe and Southeast Asia from its offices in Silicon valley. In July 2003, Moschip merged with Verasity Technologies - a US-based company which has developed a highly integrated communication chip for last mile Internet equipment - thereby enabling it to enter the Internet Protocol Security space.

Mr. K. Ramachandra Reddy (Ram), the Chairman and CEO of Moschip, has a B.Tech degree in Electronics Engineering from IIT, Madras and an M.S.E.E. from the University of Wisconsin, Madison. During his long SV career – spanning 23 years - in the areas of design, manufacturing and marketing of various integrated circuits, he was responsible for the successful start-up of several semiconductor design companies like Lotus Designs Corp., Silicon Logic and Startech Semiconductor. All these companies were later bought out by larger companies. Before starting his first company in 1982, Ram worked for American Micro Systems in Santa Clara, California where he was responsible for designing the world's first DSP chip. During his long and distinguished career, Ram has also successfully marketed products to companies like Compaq and Nokia. Ram is an outstanding example of how a successful hi-tech entrepreneur in the US decided to invest in his native country by using his entrepreneurial skills to found and manage a successful IT company in Hyderabad, India again confirming the theoretical model outlined in Section 2.1 above.

The firms included in the case studies above are all examples of the new model of the Indian software industry since none of them fit into the major functional areas of the IT Industry in India as per the *old model* i.e. low-cost code writing based on specifications supplied by major clients, remote maintenance of client software, doing only bits and pieces of the whole programming job and price-competition. They have moved up the value chain by shifting the focus of the industry from software services to products, with some moving into areas like Biotechnology. More generally – in terms of moving up the value chain - the Indian IT industry has successfully tapped into the middle layer of services i.e. the routine maintenance and even the installation of popular business-software packages sold by SAP and PeopleSoft (which are becoming de facto standards). Since the top layer of technology services is very customer-specific it is likely that it will continue to be provided close to the IT industry's biggest customers in America, Europe and Japan (Edwards, 2004b).

5. CONCLUSION

In this study I explore the nexus between globalization and technology with reference to India – mobile phones, for instance, have revolutionized communications in the remotest part of the country thereby enabling even rural businessmen to sell in global markets. Also, a relatively better telecommunications infrastructure has made it possible for MNCs to locate in India and take advantage of indigenous assets like relatively cheap labor, and access to local markets and raw materials by enabling constant communication with their corporate headquarters and thus leading to more FDI. Second, and more importantly, it has led to the outsourcing of software services, airline revenue accounting, insurance claims and call centers. The rapid growth of software service exports from India in the recent past has been more the result of a comparative advantage in the software industry as opposed to an absolute advantage in terms of lower wages – this comparative advantage, in turn, is based on the existence of a highly skilled English-speaking labor force coupled with the relative stagnation of the traditional manufacturing sector due to inadequate infrastructure investments in the past (Kambhampati, 2002). However, growth of the software industry has been uneven – it has been limited to only those large urban centers where skilled labor and relatively adequate infrastructure is available. The role of public policy in guaranteeing the more even

distribution of the gains from this growth could be the subject of further research. Further, the outsourcing of software services leads to another interesting issue i.e. the link between globalization and entrepreneurship. New Indian immigrants in SV have created professional and social networks to tap resources for the creation of thousands of technology start-ups and have also set up subsidiaries, joint ventures, sub-contracting, or other business operations in India thus leading to a process of 'brain circulation'. Also, they have become important links in leveraging low-cost Indian software talent for U.S. businesses. These networks have also opened up foreign markets for U.S. firms thus increasing U.S. exports and increasing their exposure to the global economy. The future is bright but there are challenges facing this process of globalization and "return entrepreneurship" (Saxenian, 2002a) in the Indian software industry. Some of the important issues (both from the point of view of the Indian government/domestic private sector and the "returning entrepreneurs") are outlined below.

- Major physical infrastructural (power, roads, airports and telecommunications) upgrades are required.
- The red tape (caused by a huge government bureaucracy and a plethora of regulations) has to be removed.
- In addition to the overseas market, the domestic market needs to be fully tapped by adopting innovative measures like, for instance, the use of local languages in software which will increase penetration in the domestic market. This will go a long way in ensuring a safe return on investment for "returning entrepreneurs".
- "Returning entrepreneurs" have to ensure that the IT firms/subsidiaries that they float emphasize a combination of sound engineering skills and quick and user-friendly implementation.
- More domestic venture capital firms are needed to support the efforts of the "returning entrepreneurs".

The ideas contained in this paper can be used as a starting point for researching the link between globalization and entrepreneurship in the case of other overseas diasporas as well. In addition, there is potential for quantifying the relationship through an empirical study.

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APPENDIX

Table A
Top 20 Indian software and service exporters in the area of IT Services, Products & Technology services

The combined revenue of the top 20 software and service exporters in the area of IT Services, Products & Technology services is US$ 4.3 billion in 2002-03. This is a year-on-year growth of 18% compared to 2001-02. On the macro level, the software and services exports industry (excluding the ITES-BPO sector) recorded revenues of US $ 7.2 billion in 2002-03 registering a growth of 18.4% over 2001-02.

According to Mr. Kiran Karnik, President, NASSCOM, "The top 20 software and service exporters continue to contribute over 60% and the top 5 contribute over 41% of the total IT Services, Products & Technology exports from India in 2002-03 as was witnessed in 2001-02. This shows that the Indian IT software and service companies are truly turning global. We believe that the growth momentum in the industry will aid more Indian IT companies to move to the Rs. 1000 crore ($222 million approx.) mark in FY 2003-04".

THE TOP 20 IT SOFTWARE AND SERVICE EXPORTERS FROM INDIA (2002-2003)*

Ranking	Company	Revenues (Rs. Crore)	Revenues (US$ Million)
1.	Tata Consultancy Services	4545.3	963.0
2.	Infosys Technologies Ltd	3543.5	750.7
3.	Wipro Technologies	2787.4	590.5
4.	Satyam Computer Services Ltd	2003.3	424.4
5.	HCL Technologies Ltd	1530.5	324.3
6.	Patni Computer Systems Ltd	914.0	193.6
7.	Mahindra British Telecom Ltd	634.7	134.5
8.	iFlex Solutions	593.3	125.7
9.	HCL Perot Systems Ltd	449.0	95.1
10.	NIIT Ltd	426.3	90.3
11.	Mascot Systems Ltd (iGATE Global Solutions Limited)	421.0	89.2
12.	Digital Globalsoft Ltd	415.3	88.0
13.	Mastek Ltd	374.4	79.3
14.	Polaris Software	367.2	77.8
15.	Birlasoft Ltd	346.4	73.4
16.	Mphasis BFL Ltd	335.6	71.1
17.	Pentasoft Technologies Ltd	296.5	62.8
18.	Hexaware Technologies Ltd	257.9	54.6
19.	Tata Infotech Ltd	256.0	54.2
20.	Infinite Computer Solutions India Pvt Ltd	249.1	52.8

Source: NASSCOM

Table B
Background Information on case studies

Tejas Networks	Tejas Networks is a pioneer in the development of software-differentiated, next generation optical networking products for the global market that enable telecom service providers to create converged networks which provide the foundation for both voice and new data services. TN is privately owned and funded by a small group of venture capital firms.
Chembiotek Research International	CRI does contract research in the Pharmaceutical/Biotechnology area for the likes of Bayer and Procter & Gamble and other major pharmaceutical companies in India and abroad. The company complements the R&D efforts of MNCs and assists them in their R&D activities. The major areas of research are synthetic organic chemistry, process chemistry, medicinal chemistry, natural products chemistry, combinatorial synthesis, bioinformatics, bioscreening and Biological assay. In addition, the company also does basic research in the areas of Molecular Biology and Clinical Genomics. The company is privately owned.
e4e	e4e is an American technology company providing remote management technology services including IT and IT-enabled BPO services to the global market. e4e allows firms in the financial services and hi-tech verticals to concentrate on their core competencies by accomplishing non-core but critical business processes in a more efficient way. This enables businesses to increase their profit margins via reduction in operational and overhead costs with the possibility of further cost minimization through process reengineering, e-business conversion and use of off-shore development/transaction centers. The company is based in the United States, but has branch offices in Europe and India.
i2 Technologies	i2 is an American company - co-founded by Dr. Sanjiv Sidhu, currently the Chairman of its Board of Directors – which has pioneered next generation SCM technology "designed to dramatically shorten time-to-results for process improvements, reduce software and implementation costs, and minimize implementation risks. SCM applies technology and best practices to eliminate inefficiencies in business like, for instance, excess inventory with supply chain partners and provides "demand-driven supply chain solutions designed to enable business agility"[12]. Amongst i2's customers are giants like TI, 3M, DaimlerChrysler, IBM, Ford Motor Company, Dell Computer, Caterpillar, Toshiba, Kia etc. i2 earned $389 million in total revenue for the fiscal year 2004 and $98.5 million for the second quarter of 2005 – until 2002 it had been doubling its revenues each year since Sidhu found the company without any external capital. Under the direction of the Ernst & Young High Tech Entrepreneur, the company has built e-marketplaces that have enabled more than $16 billion in revenue growth and cost reductions for around 900 companies in areas like defense, automobiles, drugs, computers, chips, textiles, etc.

[12] http://www.i2.com/company/news/releases/view.cfm?id=D516613C-508B-D94A-7EA88C075BC721BE

(Table B continues…)

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HelloSoft	HelloSoft, headquartered in San Jose, CA, is a provider of high-powered communications Internet protocol for VoIP, and wireless devices and gear. It provides customized solutions in the shape of a suite of integrated products "that include DSP software, Networking software, RTL, complete reference designs and design services" to semiconductor companies and Original Device Manufacturers (ODMs) for wireless technologies like Voice-Over-Packet (*HelloVoice)*, Wireless LAN (*HelloWLan)* and wireless data service solutions (*HelloWireless)* for 2/2.5/3G wireless networks. It has been funded by leading venture capital firms such as Venrock Associates, Sofinnova Ventures, Acer Technology Ventures, JumpStartup Venture Fund, Acer Technology Ventures, TD Capital ventures, Entrepia and Mitsui & Co. Venture Partners. Big players like TI, Broadcom, Ericsson, Microsoft, Intel, Sony Ericsson, Sharp and Fujitsu are some of its partners/customers. Personal digital assistants, next-generation mobile phones, IP phones, game consoles etc. are some of the devices that will employ one or more of HelloSoft's solutions.
MosChip Semiconductor	MosChip, a manufacturer of semiconductors based in Hyderabad, was founded in 1999. The company uses state-of-the-art technology in the design and manufacture of application specific integrated circuits - to service the data connectivity and consumer electronics segment - at its design center in Hyderabad employing more than 80 people (60 of whom are engineers). MosChip manufactures PCI Peripherals, USB 1.1 & USB 2.0, security and interface products. In July 2001, the company acquired NetMos Technology, Inc., now known as MosChip Semiconductor Technology, USA - a fully owned subsidiary of MosChip - focusing on marketing and providing support services to a developing customer base spread throughout North America, Europe and Southeast Asia from its offices in Silicon valley. In July 2003, Moschip merged with Verasity Technologies - a US-based company which has developed a highly integrated communication chip for last mile Internet equipment - thereby enabling it to enter the Internet Protocol Security space.