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**Proximities and Innovation:
Evidence from the Indian
IT Industry in Bangalore**

by

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Abstract:

Much has been written on the success of the Indian software industry, enumerating systemic factors like first-class higher education and research institutions, both public and private; low labour costs, stimulating (state) policies etc. However, although most studies analysing the 'Indian' software industry cover essentially the South (and West) Indian clusters, this issue has not been tackled explicitly. This paper supplements the economic geography explanations mentioned above with the additional factor social capital, which is not only important within the region, but also in transnational (ethnic) networks linking Indian software clusters with the Silicon Valley. In other words, spatial proximity is complemented with cultural proximity thereby extending the system of innovation. The main hypothesis is that some Indian regions are more apt to economic development and innovation due to their higher affinity to education and learning as well as their more general openness, which has been a main finding of my interviews. In addition, the transnational networks of Silicon Valley Indians seem to be dominated by South Indians, thus corroborating the regional clustering of the Indian software industry

Key words: Proximities; India; Social Capital; Transnational networks.

JEL Codes: O30, R12, Z13, L86

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1. INTRODUCTION

How can the Indian success in IT, especially software, be explained? Is it an eventual consequence of the liberalization in the 1990s? Why, then, have other sectors not produced such an impressive performance? And why do we find an uneven record of growth and development between Indian states with the South being more successful? Is it rather influenced by other factors, probably released through this liberalization, e.g. a regional culture of entrepreneurship and innovation? And what is the relevance of transnational network connections, with Silicon Valley (SV) in particular?

The novelty of this paper is the incorporation of culture and ethnicity as independent variables in order to explain the regional concentration of the Indian software industry predominantly in the South. There are two central hypotheses of this paper which are tested empirically through secondary data from existing interview-based literature and through own fieldwork. Firstly, some ethnic and cultural groups in India apparently are more apt to socio-economic development in knowledge-intensive industries due to their higher appreciation of learning. There seem to be diverse culturally rooted attitudes towards education and technological or economic change. Secondly, it is argued that geographical distance can, at least partly, be bridged by other forms of proximity – in this case socio-cultural – through transnational networks given the socio-cultural dimensions of the actors in this industry and their network connections. Eventually, these particular groups from South India have developed the strongest transnational network ties between India and SV. On the one hand these networks appear to stimulate the growth of the Indian software industry. But on the other they are also influenced by developments within India. Notably the higher inclination of some groups to migrate abroad, in particular the better educated Indians from the South and West. Partly, this higher propensity stems from the expectation of higher rewards from their education. Hence, a positive feedback mechanism is in place here but, in order to simplify, the two phenomena will be examined separately. Firstly, the background for South India will be assessed, and then the transnational networks are examined. Whereas the second one receives a good deal of support, the first hypothesis is rather rejected by my own field work.

1.1. An overview of the Indian IT industry

The Indian IT industry mainly consists of a broad spectrum of software development enterprises. The figures for software exports show an astonishing annual growth of roughly 50 % for the 1990s. Having started with basic programming India now delivers services *and* products, on a globally competitive level that has not been seen in any other industry since independence. There are several factors contributing to this extraordinary development and there is no doubt about the purely economic ones. Over the last few years there have been many studies on the Indian software

industry analyzing it from different angles ranging from general perspectives (Arora et al. 2001) to others more focused on innovative capabilities (Fromhold-Eisebith 1999; D'Costa 2002) and quality considerations (Banerjee & Duflo 2000) to the involvement of multi-national firms and domestic linkages or spillovers (Basant et al. 2001; Patibandla & Petersen 2002), and an eventual development impact (Arora & Athreye 2002).

Although its involvement is criticized as 'benign neglect' (Arora et al. 2001) rather than active stimulation of business, the Indian Government did recognize the importance of supporting the software sector in general, and exports in particular – as early as 1972 with the establishment of an export processing zone (Evans 1992). Other supportive policies like establishing the prestigious Indian Institutes of Technology (IIT) have been of critical value to the evolution of the software industry. Subsequently, the first Software Technology Parks (STP) were established in 1990 (Bajpai & Shastri 1998). The quality of software-exporting firms is assessed at high levels. India has more than half of ISO 9000 certified companies and the largest number of enterprises assessed at Level 5 of Carnegie Mellon University's Software Engineering Institute Capability Maturity Model worldwide (Arora et al. 2001). Nevertheless, the innovative capabilities of the Indian software industry are viewed rather skeptically as being still rather low in the value chain (Arora et al. 2001; D'Costa 2002). The relatively unimportant domestic market is identified as another major shortcoming (Bajpai & Shastri 1998).

In spite of this, more recently almost all multinational companies (MNCs) increasingly locate not only low-level tasks but also research and development (R & D) centers or laboratories in India; many already have more than one research lab. However, the most advanced research continues to cluster in Bangalore. Generally, one finds an uneven distribution of the software industry locations which is clustered in the South (Bangalore, Hyderabad and Chennai), West (Mumbai and Pune), and around the capital New Delhi in the North. Thus, the question addressed here is why some regions are more successful than others. More recently, there is a growing number of works on the spatial concentration in South Indian centers (Balasubramanyam & Balasubramanyam 2000; D'Costa 2003; Vijayabaskar & Krishnaswamy 2003) and emphasizing the influence of international networks (Dossani 2002; Kapur & McHale 2002; Saxenian et al. 2002).

The rest of this paper is structured as follows. Section II outlines a South Indian regional culture. Section III extends the discussion to the background of Indian immigrants in high-tech industries and section IV discusses the issue of transnational labor mobility through ethnic networks. Section V summarizes the findings from existing interview-based literature. Section VI describes my own fieldwork, and its similarities and contrasts with earlier findings. Section VII concludes.

2. REGIONAL CULTURE OF SOUTH INDIA

This section is a brief outline of the basic economic features of a culture that can be derived from a Brahmin and South Indian background, respectively. The central question is, whether there exists a regional culture of innovation resembling to some extent the one of Silicon Valley (Saxenian 1994). There is a misconception of the 'Hindu' attitude towards modernization and innovation. Economists arrived at the conclusion that it impedes the modernization of the Indian economy (Akerlof 1976; Lal 1988) not acknowledging anthropological fieldwork (Taeube 2004). Recently, there is more than anecdotal evidence that new Indian enterprises are determined even by the formerly priestly Brahmin caste rather than Vaishyas, the traditional merchant caste. It might result from the fact that Brahmins have been involved more generally with activities relating to knowledge. Earlier Brahmins had a much more negative attitude towards business, trade and commerce in general (Evans 1992).

With regard to South India there are a few notable deviations. Primarily, there have always been high-caste non-Brahmins pertaining to the indigenous population who were not only engaged with the learning of their texts but 'who were adept in Sanskrit learning as well' (Stein 1999: 52). Hence, the foundations for a knowledge-based society have existed in South India ever since and, moreover, have been much more diffused throughout the broader society. Secondly, the population of the South is said to be much more homogenous than in the North. Thus, political movements in favor of backward groups started much earlier in South India and led to a more equal pattern compared to the still traditionally dominated, hierarchically oriented North (Jaffrelot 2002). Altogether, the Southern part of India seems to exhibit a more distinct regional culture of learning, not only in the sense of the regional development literature (Gertler 1997) but also literally. Apparently, this attitude is a solid foundation for the absorptive capacity necessary in order to adapt to new technologies (Lateef 1997). Although institutions of higher education have been allocated evenly over the whole country, there is a more than proportionate share of colleges, especially for engineering, and enrolment in the South (see tab. 1).

Table 1: Number of engineering colleges and enrolment compared to population

Region	Engineering colleges ^I		Enrolment ^I		Population ^{II}
	No.	National share	Sanctioned capacity	National share	National share
Central	50	7,54%	9,470	6,05%	-
East	25	3,77%	4,812	3,07%	25,8%
North	140	21,12%	25,449	16,26%	31,3%
West	140	21,12%	34,165	21,83%	19,6%
South	308	46,46%	82,597	52,78%	23,2%
Total	663	100,00%	156,493	100,00%	100,00%

^I Source: Arora & Athreye (2002)

^{II} Source: Dossani (2002)

Some features in South Indian cultures do not only provide a foundation for a more pronounced human capital base, but also increase the intensity of interaction in social networks. Thus ‘cultural proximity’ is presumably more significant in the South, thereby increasing the level of trust that exists in these communities (Taeube 2004). This, in turn, enhances the potential for knowledge-intensive industries by facilitating the required communication, especially without geographical proximity by means of ICTs. This potential seems to be further nurtured by the immigration patterns to be found among Indians in the US, which triggers a positive feedback mechanism mentioned earlier.

3. INDIAN IMMIGRANTS IN HIGH-TECHNOLOGY INDUSTRIES

There is a lot of anecdotal evidence suggesting a particular aptness of certain layers of the Indian society for science related and research-oriented activities (Das 2001). This translates into the dominance of the leading scientific institutions by these particular groups. Given that key actors in the Indian IT industry, both domestic and overseas, are graduates of graduates of the prestigious Indian Institutes of Technology or the Indian Institute of Science (IISc), the process of network building begins already in India. Except for one (Gowahati), all the other institutes (Bombay, Delhi,

Kanpur, Kharagpur, Madras) maintain alumni associations.⁴ Since many of those graduates migrated to the US there are now regular alumni meetings both in India and in the US. The common educational background appears to be a major force uniting NRIs in the US high-tech industry and upholding the link to and identification with their home country (Saxenian 1999; Tschang 2001). The underlying rationale for the establishment of hundreds of first-class educational institutions was the policy goal of self-reliance which meant a great commitment to science and technology. Typically, Indians do their first degree, mostly a Bachelor, in India before they go to the US for higher studies; even scientists with master degrees or PhDs pursue further studies abroad. In 1998/99 Indian students accounted for 8 % of international students in US higher education. Among science and engineering graduates, where India accounts for the biggest portion with more than 30 % of all the international students (Khadria 2001).

Regarding the scope of this paper the most important destination of Indian emigrants is the US, particularly Silicon Valley. Earlier Indian immigrants to California 30-40 % were mostly North Indians (Sikhs) who represent merely 2 % of the Indian population. Today India accounts for over 40 % of all H1-B visas, including more than 25 % of worldwide H1-B visa applications coming from South India (Xiang 2002). Estimates suggest that 25-50 % of Indian software engineers in the US are South Indians. A survey among 10,000 members of Indian and Chinese software professionals' associations in SV finds that 36,5 % of the respondents come from South India while this region accounts for only 23,2 % of the Indian population. The Western part of India is also over represented (Dossani 2002). A possible explanation for the dominance of South Indians is the strategic localization of sensitive national research institutes. The Hindustan Aeronautics Limited or the Indian Space Research Organization in Bangalore, the Defense Electronics Research Laboratory or the Defense Research and Development Laboratory in Hyderabad are critical for national security. Hence, they have been established far away from the borders to both China and Pakistan (Lateef 1997). Moreover, the Indian Institute of Science is deemed India's best research university (Dossani & Kenney 2002).

The other interesting characteristic is that many of the IT professionals, and probably the students too, apparently have a Brahmin background (Xiang 2002). A study on technical and scientific manpower in the four South Indian states indicates that lower castes are represented much below their share in the population (Deshpande 2000). While it seems plausible that there is a high percentage of Brahmins in the industry workforce the industry leadership seems to be dominated by South Indian Brahmins too (Fromhold-Eisebith 1999). This is insofar fascinating as South Indians

as a social group used to be excluded from the entrepreneurial pool of the Indian business houses (Kapur & Ramamurti 2001).

To sum up, in contrast to earlier rather low-skilled Indian migrants those working in knowledge-intensive high-tech sectors generally, and particularly in software, are among the best educated in the host economy. Their Indian background is most often to be found in a South Indian Brahmin family and upbringing.

4. THE RELEVANCE OF ETHNIC NETWORKS AND KNOWLEDGE SPILLOVERS

In a globalising economy, internationally or translocally linked actors steadily increase in importance. This section aims to identify various aspects of such transnational labor mobility through linkages of transnational ethnic networks and the eventual influence on the Indian economy.

There are two lines of research on how knowledge spills over. One looks at the firm as the main driver of spillovers. In particular, MNCs are often perceived as a source of technology or knowledge spillovers through their co-presence with local firms. Theoretically, spillovers can occur through local firms copying MNC technology, enhanced competition leading to more efficient use of existing technology and search for more efficient technologies on the part of local firms, or through backward or forward linkages of MNCs with local firms (e.g. Patibandla & Petersen 2002). Secondly, there is a growing body of literature concerned with individuals and their mobility (Glaeser 1999; Klepper 2001; Storper & Venables 2002). In industries with attrition rates of 20-25% like the Indian software industry (Saxenian 1999) the mechanism of knowledge spillovers seems to be perfectly in place. For example, in Glaeser (1999) people learn randomly through contact with more skilled neighbors. Thus, those living in cities learn faster given the higher probability to meet people they can learn from. Other studies examine more deliberate learning processes like spin-offs. Franco & Filson (2000) and Klepper (2001) examine spin-offs in high-technology industries. The main finding is that entrepreneurs with experience from successful incumbents are more likely to run a start-up successfully.

In most cases knowledge spillovers are seen as a rather localized phenomenon, therefore labor mobility is usually analyzed in a local setting (Saxenian 1994). The reasoning behind this is that a large part of knowledge is not easily codifiable, but tacit. In order to transmit such knowledge – deliberately or unintended – between economic agents proximity is a crucial element. Usually, proximity is conceived of as a geographical construct. However, Lundvall (1992) argues that there

is more than one kind of proximity. He proposes a taxonomy with four dimensions of space, economic, organizational, geographical, and cultural. This paper examines whether cultural proximity can be a substitute for geographical proximity in order to ensure and allow for knowledge spillovers in a setting not geographically bound. A key feature of social or ethnic networks is that they provide a high degree of trust or social capital stemming from a common socio-cultural background and, hence, sharing the same language, customs, norms etc. This kind of trust can substitute for the trust present in face-to-face contacts. There is some evidence for labor mobility beyond geographical boundaries. Agrawal et al. (2003) find patent citations occurring to a large extent in locations where the inventor lived before the issue of the patent. Their interpretation is that there has been investment in social capital in expectation of future mobility. It appears to be the case for high profile knowledge-intensive activities that the professional and social network tend to be more spatially dispersed than in routine tasks (Storper & Venables 2002).

Through the international movement of US-educated individuals with Indian background a spatial extension of the localized SV model comes into existence. The immigrants open up their local networks and merge them with international contacts in order to become central nodes in a global value chain by providing the links for small firms in the US and India. Thus, the framework of analysis could be a 'Spatial Innovation System' (Malecki & Oinas 1999) connecting SV and Bangalore and forming a multi-regional entity with co-connection partly substituting for co-location in a 'Virtual Diamond' (Kapur & Ramamurti 2001). In this context, Appadurai's concept of an 'ethnoscape' is appealing. He defines it as

'the landscape of persons who constitute the shifting world in which we live: tourists, immigrants, refugees, exiles, guest workers, and other moving groups and individuals constitute an essential feature of the world and appear to affect the politics of (and between) nations to a hitherto unprecedented degree' (Appadurai 1996).

Thus, the term ethnoscape can be interpreted as representing translocal communities, i.e., groups of people who are bound not by geographical proximity, but by some form of shared, although mediated culture which resembles Lundvall's (1992) notion of a cultural space. Kotkin (1993) has identified such an ethnoscape for India as being one of the five global 'tribes' in terms of an ethnic group spread throughout the world, and likely to dominate business in the new global economy. The key features of these global tribes are a resurgence of 'age-old ethnic ties' demonstrated through tribal trust as the basis for a global network, and a passion for and belief in science and technological advancement, which bind together this ethnic identity.

4.1. Ethnic Indian Transnational Networks

For developing countries opportunities to participate in a commodity chain based on a global division of labor have existed for a long time. However, such tasks do not leave much of the value added for the developing country, although such a division of labor can be the (necessary) initial step in a process of upgrading developing country firms' capabilities through international cooperation (Lateef 1997). The rise of the SV model with a network of highly specialized companies over the vertically integrated firm of earlier decades gives entrepreneurs the opportunity to venture into niche markets, and outsource a large part of the global value chain to their home country (Saxenian et al. 2002). Moreover, in this case the migration of skilled labor through transnational networks can be beneficial to the developing country. The importance of international networks for the development of the Indian software industry has been examined from various perspectives in more detail (Taeube 2004b, forthcoming). Firstly, MNCs and their Indian executives, secondly NRI venture capitalists and, thirdly, (non-resident) Indian entrepreneurs. In theory, another category would be the international migration of students, but practically Indian students in the US prefer to stay there after having completed their studies.

The contributions highly skilled Indians made to the rise of SV, either as entrepreneurs or managers of high-technology firms is astonishing. According to Saxenian (1999), one fourth of CEOs in SV is Indian or Chinese. While Chinese are more present in engineering professions, Indians venture more into management and entrepreneurship. For example, in an internet-based survey among foreign-born professionals in high-technology industries in the San Francisco Bay Area, 60% of Indian-born respondents have been involved in founding a company in SV, most of them full-time, as compared to 32 % and 51 % among Mainland Chinese and Taiwanese, respectively (Saxenian et al. 2002). However, these numbers tend to overstate the actual participation in startups, since the survey has been conducted among immigrants from ethnic professional associations, who are plausibly the most active immigrants.

The set-up of Indian operations by MNCs has typically been triggered by senior executives of Indian origin (Tschang 2001). This is well documented in the case of Nortel Networks (Basant et al. 2001) as well as Texas Instruments (TI), the first MNC to invest in India after early liberalization efforts in 1985, and Hewlett Packard (Patibandla & Petersen 2002). Spin-offs with experience from successful incumbents tend to have a higher probability to survive than those without such experience. Since many start-ups in the Indian software industry come directly or indirectly from SV firms, there is a lot of industry experience.

In SV strong ethnic networking among Indians is found to be highly concentrated in one association, The IndUS Entrepreneur (TiE) (Dossani 2002). Its main purpose is to foster and support entrepreneurship, particularly in the early steps of a start-up through angel investing. The benefits for minorities like SV Indians of sticking to an ethnic network, and how long they last for members before they eventually leave it for the 'mainstream' are analyzed by Dossani (2002) in order to find out more about the sustainability of ethnic networks. This interpretation suggests an ethnic network being merely a response to difficulties faced by immigrants in the labor market, and not posing entry barriers to individuals outside the ethnic target group. It is highly fascinating to discern the composition of these ethnic Indian networks, because these immigrants cluster not within their ethnic, sub-national group but rather share an 'Indian' identity:

'Bengalis, Punjabis, Tamil, and Gujaratis tend to stick together. But in Silicon Valley it seems that the Indian identity has become more powerful than these regional distinctions. [...]. This feeling of community could override religion and caste.' (Saxenian 1999)

This distinction of the SV immigrant community's behavior is insofar important as it differs from traditional immigrant settings like London, where immigrants showed a higher tendency to stay among their co-ethnic people (Frederking 2002). This might stem from the fact that SV is perceived to have a very flexible structure and open culture which are cited among the organizational advantages of SV in its evolution as the dominant high-tech cluster (Saxenian 1994). But it is also a phenomenon long known to anthropologists (cf. Evans-Pritchard 1940).⁵ Tschang (2001) finds a similar openness in terms of labor market flows in India indicating that the SV business culture is already being transferred, at least partly. This finding is supported through the results from my fieldwork interviews. The overall impression in most of the interviews was that exactly this openness has been one main reasons for many of the IT companies to set up hop in Bangalore. In addition to a generally higher openness of the South Indian states, there has been an increase due to the exposure to international business as the first mover city of the Indian IT industry.

It is particularly important for India that this networking transcends the boundaries of SV and goes back to Asia. TIE has spread to India through the opening of local chapters; the first one was opened in Bangalore in 1999 signaling the importance of Bangalore as a destination for the Indian entrepreneurs in the US.⁶ However, the transnational contacts of this ethnic Indian network display an uneven distribution. Apparently regarding both inward and outward linkages there is a concentration in the South. Interestingly, most NRIs attracted by the opportunities of the software business in India are looking towards Bangalore (28 %), with another 52 % concentrated in four other metropolitan centers in South and West India (Saxenian et al. 2002), thus reinforcing the

agglomerative tendencies. Of particular interest for the present paper is the finding by Saxenian et al. (2002) that 45 % of Indians say that they will probably return home in the near future. Thus, presumably the highest impact is yet to come, for these immigrant entrepreneurs have quickly adapted to SV business culture which they hopefully would carry with them. They mention the 'culture and lifestyle in the country of birth' as the most important factor followed by the desire to contribute to economic development. Unfortunately, it is not specified what they mean by 'culture'.

With the liberalization of the Indian economy in the early 1990s many of the US-trained Indians were more inclined to return to India, which now offered ample opportunities that did not exist before for these highly qualified professionals (Lateef 1997). An example of the firms established by returning Indian migrants is Satyam Computer. Having studied and learned business in the US, the founder brought back home not modern technology but rather western business culture. Many other engineers or managers working in American companies experience a different organization of work, usually much more flexible and open, especially in high-tech companies in SV. A major difference is the less hierarchical structure with more freedom and responsibility.

Another important characteristic of returning NRIs is that they take their personal networks with them. That means, once they are back in India they do not necessarily forego business opportunities with their US-American contacts, on the contrary, these might actually increase. The industry or management experience they gained enables them to become an entrepreneur. The professional network of contacts they make during their stay abroad often supports this. Actually, one ought to know people and the market abroad to be internationally successful (Tschang 2001). A prime example for a very successful continuation of such a network is the case of Infosys whose founders have all worked in the US before starting their own company in India (Lateef 1997). But the entrepreneurs interviewed by me confirmed this kind of experience. Eventually Indian companies set up offices in the US to take advantage of the large (professional) Indian community with know-how on the US market (Tschang 2001). Similarly, what we heard from executives in Frankfurt branches is that Indian firms continuously rotate their labor force in Europe in order to get a larger percentage accustomed to this environment. By working in this climate with European clients, they learn not only project skill but also, more importantly, managing capabilities and dealing with customers culturally different from US-American ones. They are trained through learning-by-doing in an intercultural environment in order to obtain some cultural proximity, beyond the professional and organizational they have while working in a medium to large Indian company, and to avoid misunderstandings based on different cultural contexts (Grote et al. 2002). However, in the Indian

case there are pessimistic appraisals due to little institutionalization efforts by the Indian Government and hence an underutilized network potential (cf. Saxenian et al. 2002).

5. SOCIO-CULTURAL BACKGROUND OF THE INDIAN IT INDUSTRY

The situation depicted for a South Indian economic culture together with the observations made among Indian immigrants to the SV are in part reinforced by the empirical perspective on the software industry in India. This section supports the findings of the previous one that the dominant pattern of socio-cultural background observed in the US seems to apply also to India or, better, has its origins in India. It summarizes an analysis of four interview-based studies on the Indian software industry for spatial and socio-cultural clustering (Taeube 2004).

5.1. Data description and results

The hypothesis is that beyond economic and geographical aspects socio-cultural influences come into play and have a not negligible impact upon the economy. These socio-cultural influences, ethnicity and culture, are approximated through the variables geographical and social origin of the persons interviewed. The approach is qualitative looking at the interview data of previous empirical studies on the Indian software industry. Summarizing, all the interview partners are key entrepreneurs, managers or administrative staff. The information provided in the appendices is not uniform, thus the total number of the sample is not the same for all distributions. However, altogether there are more than 200 entries with nearly 200 mentioning also the name of the interview partner, which is crucial to my findings. Usually, Indian names can be ascribed to a certain caste and region of origin which are taken as approximations for culture and ethnicity. The categorization of these names has been accomplished by the use of anthropological literature. The significance of the numbers differs enormously between the Indian data and that from SV indicating an interesting possible development for future research. The studies analyzed are Arora et al. (2001), Bajpai & Shastri (1998), Saxenian (1999) and Tschang (2001). Their research methodologies differ to a certain degree, but there is also some commonality. Unfortunately, one commonality is that none of the studies provide detailed information about how the people interviewed were chosen. But the impression is that they share the methodology employed by Arora et al. (2001) in being not randomly chosen. Table 2 summarizes the different methodologies.

Table 2. Methodology of Studies on Indian Software Industry

Study	No. of interviews	Research Methodology	Purpose of interviews
Bajpai/Shastri (1998)	30	Industry survey; no explicit interview methodology	Supplement for case study
Saxenian (1999)	167	Interviews in SV and 3 Indian cities to balance other primary data sources	Role of immigrants in SV and linkages to India, China
Tschang (2001)	19	Case studies of 3 firm types	Scenarios for organizational strategies
Arora et al. (2001)	94	5 firm types in 6 Indian cities selected after careful research	Industry overview; international linkages; quality and HR aspects

Almost all studies claim to cover the entire software industry and do not specify a certain regional focus. However, analyzing the interview data of these studies one finds a bias towards South Indian (and, to a lesser extent, West Indian) locations as the major centers of this industry. More than 90% of the interview partners came from firms or authorities in South or West India and more than 50% were from Bangalore and its surrounding state Karnataka. Such a concentration is supported by the number of firms registered with the industry association NASSCOM, which has around 40% of its members coming from South and 25% from West India over the last few years (see tab 3). This is confirmed by the findings of some researchers (Heeks 1998; D’Costa 2003). But there are also others asserting that Bangalore is not the center of the software industry, rather losing its former status as ‘the Silicon Valley of India’ (Arora et al. 2001).

Table 3. Top locations of Indian software companies (Source: Nasscom)

City	No. of Software company headquarters		
	2000	2002	2003
Bangalore	122	160	182
Chennai	55	72	92
Delhi (incl. Noida & Gurgaon)	111	106	182
Hyderabad	64	61	78
Kolkata	25	32	32
Mumbai	131	148	152
Pune	23	48	57
Other	69	73	79
Total	600	700	854

The ethnic background is somewhat less clear with roughly 50% of the people interviewed being from south India and one additional quarter from the otherwise underrepresented Hindi speaking heartland in the Center North. According to Dossani (2002), the share of the South Indian population is only 23,2%, whereas more than 55% come from the North or the East of the country (see table 5). Again the composition of the software industry differs enormously from the usual pattern of the Indian society. These results need to be qualified for the small size of the sample. Also, there might be an ex-post selection bias stemming from the concentration of the most successful software firms in the South, overlooking developments taking place in other regions. However, they indicate worthwhile directions for further research.

Table 5. Distribution of software professionals according to ethnicity/birthplace

Region	Share of software industry ^I	Share of Immigration US ^{II}	Share of national population ^{II}
South India	49	36,5	23,2
West India	7	29,6	19,6
North India	24	24,1	31,3
East India	8	10,3	25,8
Other	12	-	-

^I Own calculations, based on Tschang (2001), Saxenian (1999), Bajpai & Shastri (1998) and Arora et al. (2001)

^{II} Source: Dossani (2002)

However, in the context of SV the result is quite different. A possible explanation might be that it is exactly those people to emigrate who do not find accession to the Bangalore cluster being dominated by other groups.² There is evidence of non-economic factors determining migration decisions in the context of a socio-culturally embedded setting in three regions of rural India (Gidwani & Sivaramakrishnan 2003).

To summarize, the findings are that the majority of the key people of the Indian software industry are located in South India, are Brahmins and come from a South Indian background in terms of ethnicity. These findings are supported by Saxenian et al. (2002) who highlight the importance of the South as a destination for investments and returns to their home country by SV Indians.

5.2. Discussion

Before I would venture into a discussion of the results I should repeat that they need to be interpreted very carefully. The reason is that the data is only covering four samples and sometimes is not entirely consistent. However the strength of the result allows for some provisional interpretations that call for further research into this direction.

The regional distribution seems to be influenced by historical and geographical factors, at least to a certain extent. There are explanations like university-industry linkages with the premier research institutes, the establishment of STPs close to the IITs and the IISc, as well as historical circumstances that led to the initial localizations. The historical factors rest in the early localization of science and technology related research and teaching institutions in Bangalore as an ideal place in terms of climate and infrastructure to conduct scientific research in strategic areas like defense and electronics. Moreover, the five states most prominent in software are those which are considered to be most reform-oriented.

What is more surprising, however, is the distribution of socio-cultural and ethnic background. There have never in Indian history been so many entrepreneurial and managerial Brahmins as are seen in the software industry now, and especially there have been few entrepreneurs from South India (Fromhold-Eisebith 1999; Kapur & Ramamurti 2001).

Generally speaking, Brahmins were rather associated with priestly tasks, government jobs, all sorts of administration and landholding (Adams 2001). On the other hand, Brahmins as members of the priestly caste were always connected to all sorts of scholarly activities being related to knowledge, learning and teaching, like mathematics, but the brahminical education includes other sciences like grammar, geometry and logic (Sen 1997). Hence, there are many disciplines that are very useful for intellectually challenging professions like sciences or research related pharmaceuticals, biotechnology or software. Moreover, the combination of the subjects emphasized by a brahminical syllabus seems to be especially apt for software, which requires not only mathematics but also language or grammar. Being handed down from one generation to the next for decades or even centuries would place descendants in a privileged position regarding such professions and, thus, be an example for an regional culture. Eventually, this has been compounded by land ownership and political power. Deshpande (2000) calls a cumulative advantage that the upper castes today are in such a strong position that in order to retain their privilege they do not need the customary inheritance of status anymore. However, a dominant position in administration could have been used in order to assure a more than proportionate share of Brahmins in high schools and universities (Adams 2001). But even if Brahmins have monopolized learning there might be a positive impact on the Indian economy in the 'knowledge age' (Das 2001).

In addition what is unexpected is the relative under-representation of Vaishyas, the traditional group of entrepreneurs, although recent studies do not show a significant change in this occupation pattern (Deshpande 2000; Adams 2001). They have always been the entrepreneurial castes of the Hindu population providing economic services like trading, money lending (Rutten 2002). One

explanation resides in the attitude of the traditional merchants and trader class towards risk and quick profits. They often prefer the latter and avoid taking risks, thus foregoing higher profits in the longer term (Frederking 2002).

In the same vein, what follows for the ethnic background might simply be an eventual consequence – a path dependent process that resulted in a lock-in in South India. However, as has been argued above, these Southern states exhibit not only a higher appreciation of learning but also a more hospitable climate towards change, both technological and social. Consequently, the higher degree of tertiary education and reform orientation

What remains is the fact that in SV socio-economic factors among Indians do not seem to play a role since a pan-Indian identity overrides sub-national differences. This is a highly interesting direction for further research, since it is the actual transfer of not only technological knowledge but also social and business norms and practices that apparently originates from SV. Thus the question would be if there might occur a change in social relations in India too, at least in the medium to long run?

6. PRIMARY EMPIRICAL EVIDENCE

6.1. Methodology

Between November and December 2003 I visited the Indian Institute of Science, Bangalore and conducted 33 Interviews with a sample of firms, universities and public sector entities. This sample was selected both randomly and through networking, as well as by chance. The random sample is used in order to get a differentiated picture of the Indian IT industry in Bangalore, and has been selected from a Nasscom directory. The diverse nature of both MNCs and Indian companies is reflected through my selection (see appendix 1). Among the Indian companies both big players as well as medium and very small companies are represented. Moreover, there are hardware companies and software companies, both service and product.

A chain of personal contacts through networks are deployed where it is necessary to learn from key decision makers (Bewley 2002). Most interviews have been conducted at the interviewee's office. But some have been more informal, visiting people at their home, or meeting them in a café. Two interviews have been arranged spontaneously meeting people on campus in the Indian Institute of Science or at a private socializing event. The average length of an interview was 45 minutes, ranging from 20 to 150 minutes. Since most of the people interviewed were founders, CEOs or other senior executives, I decided to design the interviews in a semi-structured way, thereby leaving

more space for open answers on part of the industry insiders. I relied on a questionnaire of more than 30 questions as a guideline to the interviews where applicable. The questions were centred around general company information, employee and recruiting, social networks, regional networks and international networks, and policy. But normally, all the questions have been touched through this kind of open discussion.

The qualitative evidence from 16 semi-structured interviews with senior executives of small, medium and large Indian IT companies in Frankfurt conducted in October and November 2002 complements the findings from Bangalore.

6.2. Findings

This is the first and very preliminary interpretation of this fieldwork. Most of the results conform to the literature on the success of Bangalore as the leading Indian IT cluster. Generally, there has been a discussion on the factors contributing to this evolution. These factors can be perfectly subsumed and analysed in more detail under an innovation system approach.

First, there has always been a strong research base, esp. electrical engineering, manufacturing (machine tools), but no chemical industry. With the early location of military, hence defense research and later also space research, i.e. the concentration of research-intensive high-tech industries Bangalore became the prime location for high technology equipment in an economy rather left out of technological developments due to a prohibitive import tariff structure. Many employees of these research institutions later trained the graduates of the many engineering colleges in the city and the state. The number of these graduates has been much higher than in other Indian regions since the late 1970s, when the privatisation of higher education in the state of Karnataka witnessed a first boost. It has been the first state to privatise higher education, many decades back. Many of these privately funded colleges received not only the regular fees, but also a capitation fee for a quota of the student intake. These funds made possible the establishment of computer labs required for teaching students in IT. This co-evolution of research and training institutions perhaps best reflects the systemic character of what led to the initial competitive advantage (cf. Murmann 2003).

Other, more profound, factors include the more stable society described in section 2, and the most favourable climate, that helped to both locate early research labs in the 1950s as well as making Bangalore a city most attractive for future employees. From early on the latter has been a major concern of decision makers, since people are the most valuable asset in IT companies.

But one factor, which came out very clearly in my interviews contradicts my earlier findings and, hence, the first hypothesis. This is with respect to the social composition of the IT industry. Virtually no one found the industry to be really dominated by South Indians, only in some conceded a marginal lead over other communities. However, this can and has been explained with the reasons mentioned in section 2. But, more importantly, most of my interview partners argued in the opposite way. They say, it is very much the cosmopolitan nature of the city and the historical and traditional openness towards foreigners, both Indian and from abroad that had a high impact on the IT industry. Compared to other states in India, the investment climate has eventually been much friendlier for foreign direct investment. This cosmopolitan nature of Bangalore is in large parts a result of the central government’s policy to locate national institutions in the city. These national institutions were staffed with people from the Indian Administrative Service IAS, or researchers taken after nation-wide job announcements and recruitment processes. The following relocation of many Indian from other parts of the country as early as the 1950s enhanced the already established cosmopolitan nature of the city. Bangalore has been cosmopolitan long before, for at least two other reasons. Since colonial times, it has been one of the climatically most pleasant places for the British. Hence, Bangalore became an important cantonment. Secondly, it is a ‘border city’ only 30-40 km from the neighbouring states Tamil Nadu and Andhra Pradesh. This led to a population of the city consisting of people not originally from the city of more than 50%. Therefore, it is not that surprising to find a similar pattern among my respondents (see table 6).

Table 6: Origin of interview partners in own fieldwork

	Bangalore	not Bangalore	n.a.	
total	9	18	6	33
	27,3%	54,5%	18,2%	100,0%
firms	6	10	3	19
	31,6%	52,6%	15,8%	100,0%
univ	1	4		5
	20,0%	80,0%	0,0%	100,0%
govt	2	4	3	9
	22,2%	44,4%	33,3%	100,0%

This cosmopolitan nature has not only been purported by many respondents, but seems to also resemble the diversity argument in Florida (2002a; 2002b). Other proponents of diversity as an engine of growth are Feldman and Audretsch (1996) and Ottaviano and Peri (2003). However, the former's argument is rather based on a differentiated industrial structure in a city. Similarly, Glaeser and Saiz (2004) find evidence of both amenities and a diversified industrial structure as key ingredients for attracting skilled human capital.

Although it does not necessarily reject my first hypothesis entirely, it obviously marks a major shift from this initial proposition. And, with this line of reasoning from diversity to innovation being reflected not only in my interview statistics, but also in the official census figures, it seems to be worthwhile doing some further research into that direction.

The importance of social networks itself has not been estimated highly by many respondents, and even less so for those in product companies. Since they usually spun off from leading MNC, they have accumulated the necessary technological (but less business) know-how in order to access the more advanced Western markets. Therefore, a local networking does not make much sense for these companies, since their major clients are located in other markets. They normally do not interact with captive development centers in India, but rather with headquarters or other research units directly. However, there have been many reports of local networking in the Indian IT industry. Right from the start it was even at the highest levels and quite informal. But with the growing industry it becomes more formalized, and at different levels. Those participating in such networking events report mostly positive experiences. And those who do not have the time regret not being able to spend some time for socializing. However, if this really is to an extent that comes anywhere close to the interfirm relationships so important to Silicon Valley has yet to be confirmed. It seems to be rather the cultural and professional proximity to (Indians in) the leading Western markets than the spatial proximity to other Indian companies, that allows for an innovative environment in the Indian IT industry of Bangalore. More than inter-firm collaboration, university-industry relationships and a regional culture of learning seem to play an important role.

7. CONCLUSIONS

This paper has looked at the Indian success in the global IT industry from a new perspective. The view taken here suggests that beyond economic and geographic factors there is an important role played by socio-cultural aspects, epitomized by the key actors in the industry and their transnational linkages or networks. This has been approximated through a pair of variables: 'caste' as a proxy for

culture and regional origin taken as ethnicity. Two kinds of conclusions follow, one theoretical and one empirical.

Theoretically, the incorporation of Lundvall's cultural space allows for the analysis of knowledge spillovers through labor mobility over geographical distance. The spatial proximity necessary for the exchange of tacit knowledge through face-to-face contact seems to be substitutable through cultural proximity to be found in ethnic networks, even in a transnational setting. However, this study has only been a first step in this direction. Therefore, it requires further analysis in order to substantiate the findings and the mechanisms at work in ethnic networks. In particular, it is necessary to further develop the theoretical argument and distinguish between various channels of transnational networks. Furthermore, other kinds of proximity or spaces could be assessed for similar substitution effects, like organizational proximity through vertical integration can presumably overcome geographical and cultural distance.

Empirically, there are two key findings regarding the socio-cultural background, both from primary and secondary data on the Indian IT industry. First, this industry has an employment structure different from most other Indian industries. However, one has to distinguish between employees and entrepreneurs. While the software industry seems to be dominated by South Indians mostly of Brahmin origin with regard to the labour force, they are less dominant with respect to the entrepreneurial event, especially when regarded as a risk taking endeavour. As far as the entrepreneurs are concerned, one cannot speak of dominance of South Indians, but probably of a South Indian region. This is supported by the many new-Bangaloreans and has considerable explanatory power regarding the spatial concentration of this industry. The emergence of this social capital is apparently to a large extent caused by the establishment of national institutes, both research and teaching. Especially the latter seems to be responsible for the eventual influx of Indians not originally from Bangalore and an identification of these foreigners with the region through a sense as alumni of a common education institution.

One implication for policy makers in India and the developing world would be to make education and technological change better accepted among the population. This is not a new result for development policy, especially when looking at East Asia, but its relevance can probably not be overemphasized. Another important implication is to create an environment hospitable for the return of emigrants and actively encourage entrepreneurship; for instance, by trying to provide an atmosphere that is rich in amenities, which seems to be one key determinant for inward migration (cf. Glaeser & Saiz 2004).

With Indians in the SV trying to integrate into the US business mainstream ethnicity in the narrow sense loses its importance, while at the most identification with an ‘Indian culture’ remains and probably continues to play an important role in transnational networks (cf. Evans-Pritchard 1940). But so far, the geographical origin or ethnicity seems to play a very important role, since most of the flows through the transnational networks are directed towards South India; although it could well be rather the city of departure for migration. However, this positive feedback process increases the regional concentration of the Indian software industry. This process seems to be already well under way providing in particular Bangalore, and to a lesser extent diffusing to Hyderabad and Chennai, with the competitive advantage in knowledge-intensive industries.

Notes

¹ Stein (1999) points out that there is no evidence for such an invasion or migration of substantial dimensions.

² This question is beyond the scope of this paper. Thanks are due to Robin Cowan for introducing this issue.

³ The author would like to thank Sunil Mani and Rajah Rasiah for clarifying his understanding of the importance of codification in the software industry.

⁴ See e.g. the links section of the IIT Alumni Association Canada, <http://www.iitalumnicanada.com/iitlinks.htm>.

⁵ Thanks are due to Burkhardt Schnepel who coined the phrase of “contingent dynamic and relativity of structurally opposing groups” based on Evans-Pritchard’s analysis of the Nuer. That is, people usually feel closer to ever more distant groups the further they are from their home environment.

⁶ The internet address of the Bangalore chapter is www.tieindia.org.

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Appendix 1: List of Interview partners

Organization	Name	Organization		Location	Origin
		Type	Position		
Amatya Consulting	Bibhas Kumar	Firm	Partner	Bangalore	-
			President	Bangalore	-
BSW Soft Pvt. Ltd.	Manoj Soni	Firm	CEO	Bangalore	-
Cerebra Integrated Technologies Ltd	Gururaja K. Upadhya	Firm	Founder and Director	Bangalore	Bangalore
			Founder, Chairman and Managing		
Cerebra Integrated Technologies Ltd	V Ranganathan	Firm	Director	Bangalore	Bangalore
			Founder		
Clarity Technologies	Patrick Taur	Firm	Owner	Bangalore	Mangalore
Cranes Software	Richard Gall	Firm	Director	Bangalore	USA
Department of IT and Biotechnology	Mr. Jawaid Akhtar	Public sector	Secretary	Bangalore	Orissa
Department of Technical Education	Prof. K. Basavaraju	Public sector	Director	Bangalore	-
Department of Technical Education	W.K. Sharma	Public sector	Joint Director	Bangalore	AP
Department of Technical Education	G. Ramalingana Gowd	Public sector	Assistant Director	Bangalore	Bangalore
			Founder		
EasyLib	Ms Vani Mahesh	Firm	CEO	Bangalore	Bangalore
			Founder		
EasySoftech	Dr. Kavi Mahesh	Firm	CEO	Bangalore	Bangalore
Electronics and Computer Software	Mr. P.V. Ravindran	Public sector	Regional Officer	Bangalore	-

Export
Council

Promotion

Encore	Vinay Deshpande	Firm	Founder and CEO	Bangalore AP
GE Medical Systems	Jaydeep Buzruk	Firm	Director Quality, SE Asia	Bangalore Pune
Goldspark	Richard Gall	Firm	Founder & Chairman	Bangalore USA
Indian Institute of Management-Bangalore	Dr. Murali Patibandla	University	Professor	Bangalore AP
Indian Institute of Science IISc	Dr. Vijay Chandru	University	Professor	Bangalore AP
Indian Institute of Science IISc	Dr. M.H. Bala Subrahmanya	University	Professor	Bangalore Bangalore
Indian Space Research Organisation ISRO	Dr. Sheela Ayer	Public sector	Manager - HR	Bangalore Bangalore
Infosys	K Dinesh	Firm	Co-Founder and Director	Bangalore Bangalore
Ittiam Systems Pvt. Ltd.	Mr Srinivasan Rajam	Firm	CEO and Chairman	Bangalore -
Microsoft Corporation (Pvt. Ltd.)	Raj	Firm	Head of HR	Bangalore Orissa
PicoPeta	Dr. Vijay Chandru	Firm	Co-Founder & Chairman	Bangalore AP
Processor Systems (India) Pvt. Ltd.	V.K. Harindran	Firm	Co-Founder and Managing Director	Bangalore Kerala
Siemens ISL	Mr Patangali	Firm	Chief Manager	Bangalore Pune

			- HR	
Srishti School of Art, Design and Technology	Kurien C.K.	University	Chief Operating Officer	Bangalore Kerala
Srishti School of Art, Design and Technology	Uma V. Chandru	University	Department of Communication Design	Bangalore Tamil Nadu
STPI Bangalore	B.V.Naidu	Public sector	Director	Bangalore AP
			Member - Administrative	
STPI Bangalore	P. Raghu Raman	Public sector	Staff	Bangalore Tamil Nadu
Strand Genomics	Dr. Vijay Chandru	Firm	Co-Founder & Chairman	Bangalore AP
Sun Microsystems, India	K P Unnikrishnan	Firm	Country Head	Bangalore -
Telesoft	Jawad Ayaz	Firm	Co-Founder and CEO	Bangalore Bangalore
Telesoft	Manish Kumar	Firm	Director, business development	Bangalore Bihar
Telesoft	Vinod Chandran	Firm	Co-Founder and COO	Bangalore Tamil Nadu
Wipro	Sudip Banerjee	Firm	President - Enterprise Solutions	Bangalore West Bengal