Emergence, geography & networks of the Indian IT industry: evolutionary perspectives

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List of Abbreviations

CEO	Chief Executive Officer
CMM	Capability Maturity Model
COO	Chief Operating Officer
cf.	confer (Latin; English: compare)
DRUID	Danish Research Unit on Industrial Dynamics
EU	European Union
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GEM	Global Entrepreneurship Monitor
GLOBE	Global Leadership and Organizational Behavior Effectiveness
GOI	Government of India
GREMI	Groupe de Recherche Europèen sur les Milieux Innovateurs
HAL	Hindustan Aeronautics Limited
IAS	Indian Administrative Service
IBM	International Business Machines
ICT	Information and Communication Technology
IIIT	Indian Institute of Information Technology
IIM	Indian Institute of Management
IISc	Indian Institute of Science
IIT	Indian Institute of Technology
insb.	insbesondere
ISEN	International Series in Entrepreneurship
ISI	import-substitution led industrialization
ISO	International Organization for Standardization
ISRO	Indian Space Research Organization
IT	Information Technology
M&A	Mergers and Acquisitions
MNC	Multinational Company
MNE	Multinational Enterprise
MNU	Multinationales Unternehmen
NASSCOM	National Association o Software and Services Companies
NCR	National Capital Region
NRI	Non-resident Indian

PCMM	People Capability Maturity Model
R&D	Research and Development
SDC	Securities Data Company
SEBI	Securities and Exchange Board of India
SEI	Software Engineering Institute
SIC	Standard Industrial Classification
SME	Small and Medium Companies
STP	Software Technology Park
STPI	Software Technology Parks of India
SV	Silicon Valley
TEA	Total Entrepreneurial Activity
u.a.	unter anderem
US	United States
USA	United States of America
VC	Venture Capital
vgl.	vergleiche

Kapitel 0

Deutsche Zusammenfassung – Evolution, Cluster und Soziale Netzwerke

0.1 Einleitung

Die vorliegende Dissertation beschäftigt sich mit verschiedenen wirtschafts-wissenschaftlichen Aspekten der Entstehung, räumlichen Verteilung und sozialen Vernetzung einer innovativen, wissensbasierten Technologie-Industrie, sowie Interaktionen zwischen diesen, insbesondere zwischen Geographie und Netzwerken. Aus einer wirtschaftspolitischen Perspektive ist es interessant, das Wachstum von lokalen Agglomerationen innerhalb einer immer globaler werdenden Weltwirtschaft zu verstehen. Das theoretische Interesse liegt auf dem Schwerpunkt der Evolution von Industrien, unter besonderer Beachtung von Netzwerken und sozio-kultureller Diversität, z.B. in Bezug auf Ethnizität. Diese Dissertation leistet einen Beitrag zum besseren Verständnis dieser Zusammenhänge anhand einer Fallstudie der indischen IT-Industrie. Die zentralen Fragen lauten 1) weshalb entwickelt sich eine Industrie in räumlich konzentrierten Gebieten und 2) welche Rolle spielen soziale Netzwerke in solch einer Entwicklung? Diese Fragestellung ist in verschiedenen wirtschaftswissen-schaftlichen Theorien wie Innovationsökonomie, Internationale Wirtschaft oder Wirtschaftsgeographie beheimatet und verwendet einzelne Blöcke aus diesen Gebieten. Ein wichtiger Beitrag dieser Arbeit ist die holistische Auffassung von Wirtschaftswissenschaften als eine Sozialwissenschaft, unter Berücksichtigung verwandter Disziplinen. Als eine Dissertation in Volkswirtschaft ist dies der Fokus der Arbeit, jedoch spielen die benachbarten Sozialwissenschaften Ethnologie oder Soziologie eine wichtige Rolle in einzelnen Kapiteln, und die Geographie durchweg. Durch das Beleuchten des untersuchten Phänomens von verschiedenen Blickwinkeln können somit neue Einsichten gewonnen werden.

Die Arbeit besteht aus fünf Papieren, von denen drei breits in internationalen Fachzeitschriften bzw. als Buchkapitel veröffentlicht worden sind; die restlichen beiden sind bei internationalen Fachzeitschriften eingereicht und z.Zt. unter Begutachtung. Kapitel 2 erschien als “Culture, Innovation, and Economic Development: The Case of the South Indian ICT Clusters” in einem von Sunil Mani und Henny Romijn (2004) herausgegebenen Band, *Innovation, Learning and Technological Dynamism of Developing Countries* (United Nations University Press, New York). Kapitel 5 erschien als “Transnational Networks and

the Evolution of the Indian Software Industry: The Role of Culture and Ethnicity" in der Reihe International Studies in Entrepreneurship, herausgegeben von Dirk Fornahl, Christian Zellner und David B. Audretsch (2005), *The Role of Labour Mobility and Informal Networks for Knowledge Transfer* (Springer, New York). Im Juli 2006 erschien Kapitel 6 als "Offshoring the Financial Services Industry: Implications for the Evolution of Indian IT Clusters"in *Environment and Planning A* in einer "Theme Issue on Global Value Chains", herausgegeben von Henry Wai Chung Yeung und Martin Hess. Die übrigen beiden Kapital basieren auf einem Arbeitspapier, das als *"Proximity and Innovation: Evidence from the Indian IT Industry in Bangalore"* in der DRUID Working Paper-Reihe erschien (04-10). Kapitel 3 wurde bei der Jahrestagung der Academy of Management vorgetragen und ist momentan unter dem Titel „Ethnic Networks and Entrepreneurship in Emerging Markets: an Exploratory Study of Local Clusters without Local Demand" zur Begutachtung für die Zeitschrift *Entrepreneurship Theory and Practice*. Kapitel 4 wurde beim First Annual Max Planck India Workshop on Entrepreneurship, Innovation and Economic Growth, sowie bei der Jahrestagung der Academy of International Business vorgetragen und ist momentan unter dem Titel „The Geography of Technology Entrepreneurship: Evidence from the Indian IT Industry" von der Zeitschrift *Journal of Business Venturing* zur Revision und Wiedereinreichung eingeladen.

Jedes Kapitel bildet eine unabhängige Einheit, aber durch das gemeinsame Oberthema der indischen IT-Industrie sind sie eindeutig miteinander verknüpft. Sie sind soweit miteinander verbunden wie es für unabhängige Kapitel möglich ist und hier in ihrer ursprünglichen Form, d.h. wie in den oben genannten Publikationen, wiedergegeben.

Die Reihenfolge der Kapitel basiert nicht auf der Chronologie des Verfassens, und es gibt gewisse Überschneidungen, die durch die unabhängige Einreichung als Buchkapitel bzw. Zeitschriftenartikel unvermeidbar waren. Diese Einleitung stellt den Kontext für die einzelnen Kapitel her.

Im Folgenden werden zunächst einige grundsätzliche Anmerkungen zu den Kernkonzepten Evolution, Cluster und Netzwerke geboten, bevor der Hintergrund der untersuchten Industrie dargestellt wird, abschließend folgen kurze Beschreibungen der einzelnen Kapitel. Diese Einleitung erhebt keinen Anspruch,

die behandelten Themen ausführlich zu diskutieren, oder gar einen vollständigen Literaturüberblick zu liefern.

0.2 Evolution

Wie im Untertitel angedeutet, bietet diese Dissertation ‚evolutorische' Perspektiven zum behandelten Thema sowohl theoretisch als auch empirisch.

Zum einen ist diese Dissertation evolutorisch, da sie eine Reihe von evolutorischen Konzepten in ihrere Analyse verwendet. Evolutorische Theorien betonen die Bedeutung von Dynamik, Prozessen und Transformation. Lernen und Wissen sind Kernelemente im Wandel eines ökonomischen Systems. „Beschränkt rationale" Individuen agieren, lernen und suchen in einer unsicheren und sich wandelnden Umwelt. Ein zentrales Argument jedes evolutorischen Ansatzes bilden die drei ökonomischen Prozesse, die wirtschaftlichen Wandel vorantreiben: Prozesse, die für eine Vielfalt an Technologie, Produkten, Firmen und Organisationen sorgen, Prozesse der Replikation, die Trägheit und Kontinuität im System verursachen, sowie Selektiosprozesse, die Vielfalt im ökonomischen System verringern. Letzlich entstehen aggregierte Phänomene nach Sicht der Evolutionstheorie als Eigenschaften fern von Interaktionen im Gleichgewicht (Malerba, 2002)

Eines der wichtigsten Konzepte für diese Arbeit ist sicherlich das der *Pfadabhängigkeit* (David, 1985; Arthur, 1989), das Einzug gefunden hat in die Felder Management und Wirtschaftsgeograpie, zwei der in dieser Arbeit verwendeten Ansätze.

Pfadabhängigkeit besagt, dass anfängliche historische Bedingungen und andere ‚historische Zufälle' einen bedeutenden Einfluss auf heute vorherrschende Strukturen haben. Zentral für diese Idee der Pfadabhängigkeit sind Komplementaritäten, oder systemische Faktoren, die in der eher angewandten Literatur der Nationalen Innovationssysteme untersucht werden (Lundvall, 1992; Nelson, 1993), und welche sich später in die Untergebiete der regionalen (Cooke, 2001) und sektoralen (Malerba, 2002) Innovationssysteme aufgespalten haben. Die Literatur der Innovationssysteme untersucht den Prozess des Lernens und des Aufbaus von Kompetenzen anhand der *Koevolution* (Nelson, 1994; Murmann, 2003) des Privatsektors, des öffentlichen Sektors, der unterstützenden (Infra-)

Struktur und Politik auf unterschiedlichen geographischen Ebenen. Koevolution selber ist ein Konzept, das von der Biologie entliehen wurde und responsiven Wandel interdependenter ökologischer Spezies bezeichnet (vgl. van den Bergh and Stagl, 2003).

Ein weiteres wichtiges Konzept, das von der evolutorischen Theorie entliehen wurde ist das der Heterogenität und *Vielfalt* (Nelson and Winter, 1982), oder, in der hier verwendeten Terminologie, *Diversität*. In Verbindung mit Netzwerk-Theorien wird dies als einer der Bausteine angesehen, die das positive Ergebnis bestimmter Konfigurationen von sozialen Netzwerken erklären. Diese Konzepte findet man üblicherweise in verschiedenen Kombinationen, oder alle gemeinsam, in Arbeiten über geographische Agglomerationen (s. nächsten Abschnitt).

Diversität wurde auch von vielen meiner Inteview-Partner genannt, wenngleich eher in Bezug auf die kosmopolitische Natur einer Stadt (Florida 2002a, b). Auch Glaeser and Saiz (2004) finden Belege für die Schlüsselrolle von Annehmlichkeiten, die eine Stadt zu bieten hat, um qualifiziertes Humankapital zu attrahieren. Andererseits bestehen aber auch negative Effekte von einer zu hohen Diversität, insbesondere in Form eines erhöhten Konfliktrisikos (Alesina and La Ferrara, 2004).

Pfadabhängigkeit ist besonders relevant in Vebindung mit Geographie. Evolutorische Theorien, die die Existenz multipler Gleichgewichte zulassen, können nicht *ex ante* ein globales Optimum bestimmen. Daher können historische Zufälle zu sub-optimalen, lokalen Gleichgewichtszuständen führen, z.B. bei der Bestimmung des ‚besten' Standortes für eine Industrie oder ein Unternehmen. Solch ein – *ex post* – sub-optimales Ergebnis wird oft als lock-in beschrieben (s. nächsten Abschnitt).

Zum anderen handelt es sich bei dieser Arbeit um die Analyse einer evolutorischen Entwicklung, daher stellen die einzelnen Kapitel sukzessive, chronologische Schritte der indischen IT-Industrie dar, gewissermassen als historische Abhandlung. Eines der wiederkehrenden Themen ist das der Pfadabhängigkeit der Entwicklung der IT-Industrie. Es gab eine reihe von historischen Ereignissen, die bis heute ihren Einfluss auf die Industrie-Struktur ausüben. Neben einigen Politikmassnahmen auf nationaler Ebene gibt es

mindestens zwei Ereignisse auf regionaler Ebene: zum einen die frühe Ansiedlung von Forschungs- und Bildungsinstitutionen durch die Zentralregierung und zum anderen der Eintritt eines grossen ausländischen Multinationalen Unternehmens (MNU), Texas Instruments, im Jahr 1984 mit eigenen Satelliten und grosser Überkapazität in ihrer Bandbreite, die es kleineren, meist indigenen Unternehmen ermöglichte, von dieser zuverlässigen Datenverbindung zu profitieren und eigene Geschäftsverbindungen in die USA aufzubauen; einige Forscher würden wohl die Verlagerung von Hauptsitzen erfolgreicher *indischer* Unternehmen wie z. B. Infosys im Jahr 1982 hinzufügen.

0.3 Cluster

Die Literatur zu geographischen Agglomerationen hat in der letzten Dekade einen erheblichen Aufschwung erlebt, insbesondere im Zusammenhang mit Innovationen und wissensbasierten Industrien. Diese Arbeit ist allerdings nicht darauf ausgelegt, die verschiedenen Theorierichtungen zu diskutieren oder zu erörtern, welche die beste Erklärung für das Wachstum der indischen IT-Industrie liefert. Daher wird hier die – eher breite – Definition eines *clusters* von Porter (1990) verwendet:

> "A cluster is a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities. The geographic scope of a cluster can range from a single city or state to a country or even a group of neighboring countries. Clusters take varying forms depending on their depth and sophistication, but most include end-product or service companies; suppliers of specialized inputs, components, machinery, and services; financial institutions; and firms in related industries."

Geographische Nähe ist wichtig, wenn sich innovative Aktivitäten gegenseitig beeinflussen, da es Wissen-Spillover gibt, die räumlich begrenzt sind. (Jaffe et al., 1993; Feldman and Audretsch, 1999). Da diese Spillover ausserdem oft impliziter (taziter) Art sind, können sie nicht kostenlos durch den Raum transportiert werden, sondern vielmehr durch direkten und häufigen persönlichen Kontakt (Dosi, 1988). Es gibt empirische Belege für eine generelle Tendenz von Innovation, räumlich konzentriert zu sein, insbesondere für bestimmte einzelne Industrien (Feldman, 1993; Feldman and Audretsch, 1999; Almeida and Kogut, 1997).

Staaten oder Regionen, die eine hohe Kozentration an Inputfaktoren für Innovationen aufweisen, können demnach einen Wettbewerbsvorteil in den entsprechenden Industrien entwickeln. Da wissen kumulativ ist, gestaltet sich solch ein Vorteil als selbstverstärkend und kann auch zu weiteren räumlichen Konzentrationen führen, in anderen Worten, dazu, dass manche Regionen durch ‚historische Ereignisse' oder ‚Zufälle' auf bestimmten technologischen Entwicklungspfaden eingeschlossen werden (‚lock-in'). Gleichermassen können auch Firmen auf bestimmten Produkten und Technologien eingeschlossen werden.

0.4 Soziale Netzwerke

Soziale Netzwerke sind ein allgegenwärtiges Forschungsthema in den Sozialwissenschaften – zu breit für diesen Rahmen, um einen umfassenden Literaturüberblick zu geben. Daher werden hier nur solche Beiträge erwähnt, die besonders relevant für die Theorien geographischer Cluster oder wissensintensiver Industrien sind.

Während die Ökonomie oft einen technologischen Ansatz zu Netzwerken und damit verbundenen steigenden Skalenerträgen wählt (David, 1985; Arthur, 1989), betonen nahestehende Disziplinen eher die oziale Komponente. Granovetter (1973, 1985) kritisiert die Konzeption, dass Transaktionen in einem sozialen Vakuum durchgeführt werden, und bringt stattdessen ein, dass soziale Verbindungen den Grossteil der ökonomischen Aktivität charakterisieren, z.B. formale Abmachungen oder Kommunikation zwischen Firmen. Allerdings ist sein Ansinnen, einen Mittelweg zwischen den beiden Extremen einer ‚untersozialisierten' und ‚übersozialisierten' Perspektive zu betonen. In anderen Worten steht Granovetter für eine Position, bei der der soziale Kontext weder elimiert wird noch deterministisch ist (1985).

In der Folge sind Soziale Netzwerke als Forschungsrichtung in Feldern wie Innovationsökonomie und Wirtschaftsgeographie oder Unternehmensstrategie und Organizationstheorie aufgekommen. Ihre Gemeinsamkeit besteht im Fokus auf organisationellem Lernen, das nicht auf der Firmenebene, sondern auf Netzwerkebene stattfindet, insbesondere in forschungsintensiven Industrien wie Biotechnologie (Powell et al., 1996). Diese Betonung von Lernen ist es, die die Verbindung zur evolutorischen Theorie, zur Erforschung von Innovation und

Agglomeration herstellt. Daraus leitet sich die grundlegende Fragestellung ab: welche Arten von Netzwerken sind am besten geeignet für Firmen in innovativen Industrien?

Grundsätzlich gibt es zwei entgegengesetzte Richtungen der Netzwerktheorie, solche die die Vorzüge von dichten, geschlossenen Netzwerken des ‚Sozialkapital'-Typs propagieren (Coleman, 1988), während andere die Vorteile von Netzwerken mit ‚structural holes' oder nicht-redundanten Verbindungen betonen (Burt, 1992). Eine ähnliche Terminologie spricht auch von ‚starken' und ‚schwachen' Verbindungen. Starke Verbindungen werden normalerweie assoziiert mit starkem Vertrauen zwischen Netzwerkpartnern, sowie effizientem und effektivem Transfer von Informationen und implizitem Wissen. Daher sind starke Verbindungen besser in der Lage, vorhandenes Wissen auszuschöpfen und das Wissen eines Unternehmens in speziellen Fachgebieten zu vertiefen. Andererseits werden schwache Verbindungen mit Erkundung in Verbindung gebracht, d.h. dem Zugang zu *neuem* Wissen. Solch eine Erkundung wird durch eine zu starke Einbettung starker Verbindungen erschwert bis unmöglich gemacht, da sie Experimentieren nicht ermutigen (Uzzi, 1997). Es gibt also einen trade-off zwischen diesen beiden Netzwerktypen, da es selten möglich ist, die Merkmale von beiden zu vereinen.

In der Cluster-Forschung haben Netzwerke einen hohen Stellenwert erlangt. Abgesehen vom ahistorischen Ansatz der Neuen Wirtschaftsgeographie (NEG) betonen alle den positiven Effekt von Netzwerken des Sozialkapitaltyps als kollaboratives Mittel zur Herstellung von Vertrauen und der damit einhergehenden Reduktion von Unsicherheit und Transaktionskosten. Diese Gemeinsamkeit entspringt aus der Betonung von geographischer Nähe, wodurch persönliche Kontakte, und somit die Übertragung von implizitem Wissen, ermöglicht werden. Allerdings gibt es auch kritische Meinungen, z.B. Breschi und Lissoni (2001) oder Boschma (2005), die hervorheben, dass räumliche Nähe lediglich eine Approximation sozialer Nähe sei, und letztere sei schliesslich für die Übertragung von implizitem Wissen verantwortlich. In anderen Worten sind geographische Konzentrationen nur eine Reflexion der Lokalheit von sozialen Netzwerken, nicht von Wissensübertragung *per se*.

In jüngerer Vergangenheit gibt es eine Konvergenz in der geographischen Literatur, die geschlossene, lokale und überbrückende, entfernte Netzwerke verbindet (Rosenkopf and Nerkar, 2001). Diese Entwicklung wird bestärkt durch das Aufkommen von Immigranten-Netzwerken in verschiedenen Kontexten wie z.B. der texanischen Hotelindustrie (Kalnins and Chung, 2006) oder Verbindungen in der Informationstechnologie-Industrie zwischen Silicon Valley und Taiwan oder Indien (Saxenian et al., 2002; Dossani, 2002). Da Immigranten zu einer geographischen Konzentration tendieren, ist die Verbindung zwischen räumlicher und sozialer, in diesem Fall ethnischer, Nähe offenkundig. Darüber hinaus zeigt die Entwicklung von Immigranten-Netzwerken, dass während anfänglich lediglich monetäre Ströme zurückflossen, heutzutage in Ländern wie Taiwan oder Indien Immigranten im Ausland aktiv den Entwicklungsprozess beeinflussen.

In einer ähnlichen Weise kann eine kosmopolitische Natur und Offenheit als ethnische Diversität intepretiert werden. Die Interpretation der Vorteilhaftigkeit einer ethnisch diversifizierten Arbeiterschaft leitet sich aus der Perspektive des sozialen Netzwerks ab, und betrifft die erhöhte Anzahl an Verbindungen. Durch einen gemeinsamen ethnischen Hintergrund besitzen solche Verbindungen eine latente Dichte und Häufigkeit an Kontakten, was einerseits positiv mit Sozialkapital assoziiert wird und gleichzeitig die Wissensbasis erweitert, indem die Anzahl der potentiellen Kontakte zur Generierung von Ideen in einem Netzwerk von Innovatoren erweitert wird (Agrawal et al., 2003; Kotkin, 1993).

0.5 Hintergrund: die indische IT Industrie

Bangalore ist weltbekannt für seine Errungenschaften in der Hochtechnologie. Fast jedes MNU hat einen Teil seiner globalen Aktivitäten in einen der Technologieparks der Stadt verlagert, und somit Bangalore in seine globale Wertschöpfungskette integriert. Darüber hinaus haben viele einheimische Unternehmen, die während dieses Prozesses im letzten Jahrzehnt gegründet worden sind, Kompetenzen und eine Reputation entwickelt, die von indischen Unternehmen vorher nicht bekannt war.

Die indische IT-Industrie besteht in erster Linie aus einem breiten Spektrum an Software-Entwicklungsfirmen. Die Exporte von Software wiesen in den 1990er

Jahren eine Wachstumsrate von erstaunlichen 50% p.a. auf. Indien begann mit einfachen Programmierarbeiten und liefert heute Dienstleistungen und Produkte auf einem weltweit wettbewerbsfähigen Niveau, das seit der Unabhängigkeit keine andere Industrie hervorgebracht hat. Zu dieser aussergewöhnlichen Entwicklung haben verschiedene Faktoren beigetragen und es gibt wenig Zweifel bezüglich rein ökonomischer Aspekte.

Obwohl die indische Zentralregierung dafür kritisiert wurde, dass sie keine aktive Wirtschaftsförderung betrieben hat, so hat sie doch die Bedeutung des Softwaresektors, und insbesondere von Softwareexporten erkannt – und zwar schon im Jahr 1972 mit der Errichtung einer Exportförderzone (Evans 1992). Andere – indirekte – unterstützende Massnahmen wie die Gründung der Indian Institutes of Technology (IIT) waren von grosser Bedeutung für die Entwicklung der Software-Industrie. In der Folge wurden im Jahr 1990 die ersten Software-Technologieparks gegründet (Bajpai & Shastri 1998).

Und obwohl die Innovationsfähigkeit der indischen Software-Industrie eher skeptisch bewertet (Arora et al. 2001; D'Costa 2002) und der einheimische Markt als einer der Schwachpunkte angesehen wird (Bajpai and Shastri 1998), siedeln fast alle wichtigen MNU nicht nur einfache Tätigkeiten, sondern verstärkt Forschungs- und Entwicklungs- (F&E) Zentren in Indien an. Die fortschrittlichste Forschung findet jedoch weiterhin in Bangalore statt. Insgesamt kann man eine ungleiche Verteilung der Software-Industrie feststellen, die im Süden (Bangalore, Hyderabad and Chennai), Westen (Mumbai and Pune), und in der Region um die Haupstadt New Delhi im Norden (s. Abb. 1) konzentriert ist. Trotzdem geben die meisten Arbeiten an, die ganze Software-Industrie zu untersuchen, ohne dabei die geographische Konzentration auch nur zu erwähnen. Die Frage, die in dieser Dissertation untersucht wird, lautet also, wieso sind manche Regionen erfolgreicher als andere?

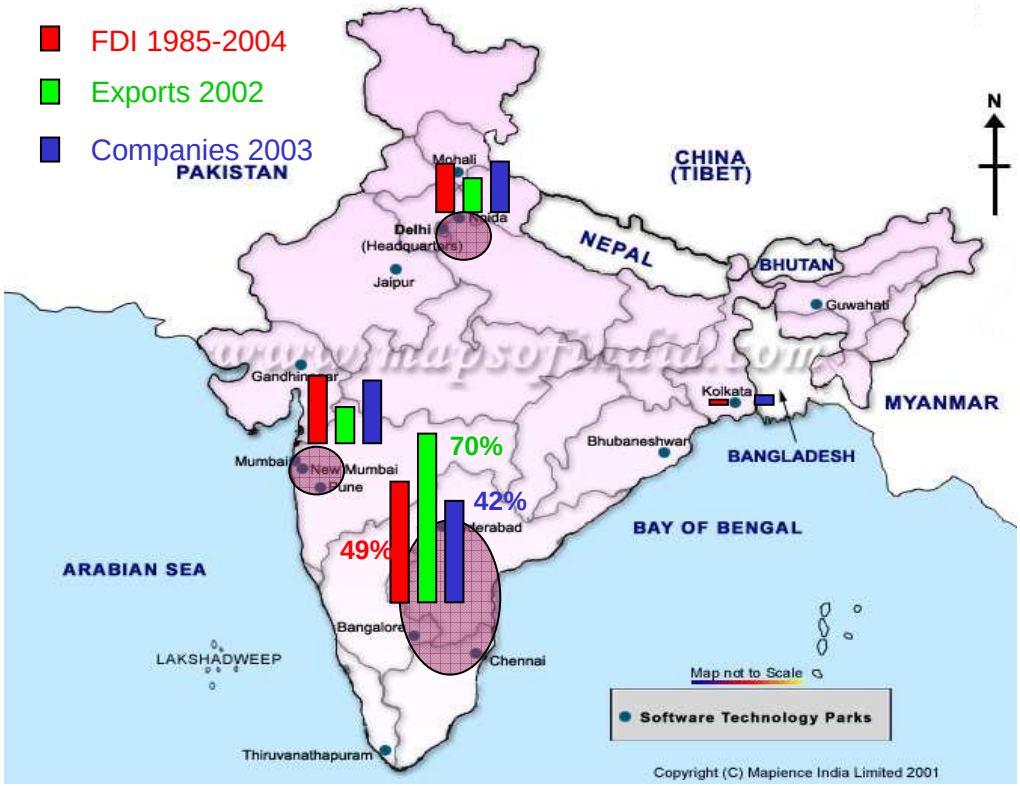

Abbildung 1: Karte der räumlichen Verteilung der indischen IT-Industrie (eigene Darstellung, Quellen: Thomson Financial; Software Technology Parks of India, STPI und National Association of Software and Services Companies, NASSCOM)

Die historische Evolution der indischen IT-Industrie kann wie folgt stilisiert dargestellt werden (Abb. 2). Die Abwesenheit einer spezifischen Ordinate ist beabsichtigt, da verschiedene Variablen wie die Anzahl der IT-Firmen oder Software-Exporte ein ähnliches Bild darstellen würden. Ausserdem ist Phase 3 nicht mit dem Beginn von Phase 4 beendet, da MNU weiterhin Tochterfirmen in Indien eröffnen.

Wegen der Bedeutung Bangalores (s. Abb. 1) untersucht die vorliegende Arbeit die obigen Zusammenhänge insbesondere in diesem Kontext, und folglich werden nun die wichtigsten historischen Ereignisse dargestellt, die zur Dominanz Bangalores geführt haben (s. Tab. 1). Hierbei können vier Kernpunkte identifiziert werden: 1) die traditionelle Kultur des Lernens und Wissens in der Region, 2) die Offenheit der Region, 3) die Politk der wohlwollenden Vernachlässigung (‚benign neglect'), sowie 4) die transnationalen Netzwerke.

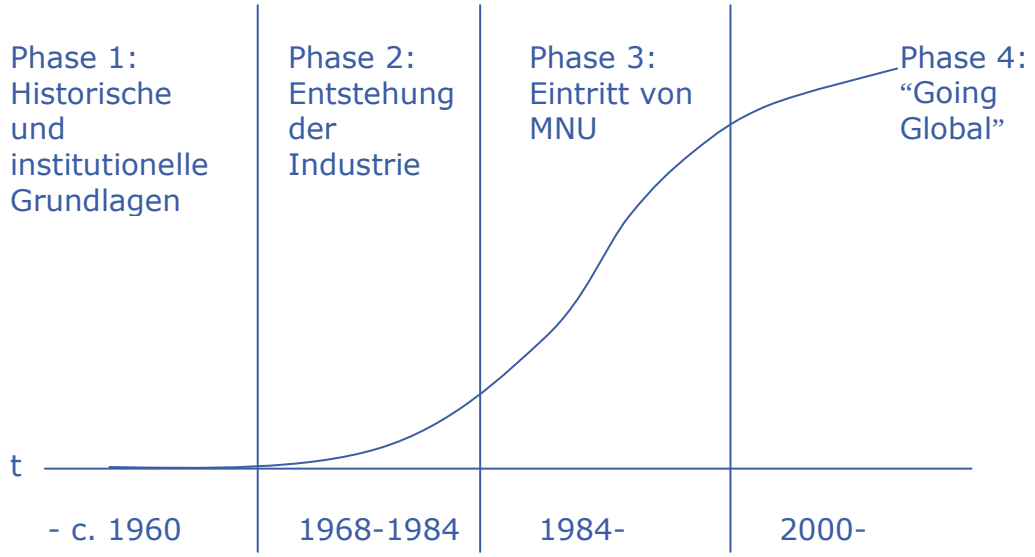

Abbildung 2: Historische Entwicklung der Indischen IT Industrie

Periode	**Teil des Innovationssystems**	**Hauptereignis**
Kolonialzeit	**Bildungs**institutionen	1909–Indian Institute of Science, IISc 1917–Visweswaraiah College of Engineering
Unabhängigkeit	**Forschungs**institute	1940–Hindustan Aeronautics, HAL
Ende 1960er – Anfang 1980er	Erste **einheimische** IT-Firmen im Privatsektor	1973–Process Systems India (Bangalore)
Mitte-1980er – Anfang 1990er	**Politik**wechsel/ Erste **MNU**	*1984–Rajiv Gandhi: Neue Software Politik* 1984–Texas Instruments
Seit 1990	Welle an **MNU**	*1991–Liberalisierung*

Tabelle 1: Wichtige Meilensteine im Entwicklungspfad des IT-Clusters in Bangalore; Ereignisse auf nationaler Ebene sind kursiv (Quelle: eigene Darstellung)

0.5.1 Frühe Grundlagen: eine Kultur des Lernen und Wissens

Die anfänglichen historischen Bedingungen, die zu der später aufkommenden Pfadabhängigkeit geführt haben, können mindesten bis zur Kolonialzeit

zurückverfolgt werden. Eine umfassende Untersuchung der ethnologischen Literatur ergab grundlegende Unterschiede zwischen Nord- und Südindien. Dies führte unter anderem zur Gründung von vielen Universitäten, wie z.B. des Indian Institute of Science (1909), durch Sir M. Visweswaraiah, einen sehr bekannten südindischen Ingenieur und Staatsmann, der dadurch seine Vision einer breiten Bildung, insb. im Staate Mysore (das heutige Karnataka), verfolgte.

Ausserdem gab es in Bangalore eine ausgeprägte Forschungslandschaft, insb. im Elektroingenieurswesen und Maschinenbau, und zwar bereits vor der Unabhängigkeit. Diese Kombination von Lern- und Forschungskultur führte dann zur Ansiedlung von nationalen Forschungsinstituten direkt nach der Unabhängigkeit. Erwähnenswert sind hier Organisationen der militärischen Forschung wie Hindustan Aeronautics, HAL (1940). Durch diese frühe Ansiedlung wurde Bangalore zum bevorzugten Standort von Hochtechnologie-Industrien in einer ansonsten technologisch eher rückständigen Wirtschaft. Im Prinzip war es eine Koevolution von Forschungs- und Trainingsinstitutionen, die den systemischen Charakter dieses ursprünglichen Wettbewerbsvorteils ausmachte (vgl. Murmann 2003).

Viele Angestellte dieser Forschungseinrichtungen bildeten später die Absolventen der zahlreichen technischen Hochschulen in der Stadt und der Region aus. Die Zahl dieser Absolventen war hier die höchste des ganzen Landes, insbes. seit den späten 1970er Jahren, als die privatisierte Bildung in diesem Staat, die erste in ganz Indien, einen grossen Schub erhielt. Die privaten Studiengebühren erlaubten es vielen Hochschulen, Computerlabore einzurichten, die für die Ausbildung von Softwareingenieuren unabdinglich waren.

0.5.2 Offenheit

Ein weiterer interessanter Faktor, der auch während meiner Datenerhebung sehr deutlich hervortrat, ist die gesellschaftliche Zusammensetzung der Industrie. Viele meiner Interviewpartner sagten, dass die kosmopolitische Natur der Stadt Bangalore sowie die historische, traditionelle Offenheit gegenüber Fremden, sowohl Indern als auch Ausländern, einen starken Einfluss auf die IT-Industrie hatte (vgl. das theoretische Netzwerk-Argument in 1.3). Daraus ergibt sich auch das offenere Investitionsklima im Vergleich mit anderen indischen Staaten. Im

Zuge der Ansiedlung von nationalen Forschungseinrichtungen durch die Zentralregierung (s. 1.4.1) kamen auch viele Inder aus anderen Landesteilen in die Stadt. Nicht überraschend ist daher die Tatsache, dass in meiner Erhebung ein Anteil von über 50% Ortsfremden vorzufinden ist.

0.5.3 Der politische Einfluss: wohlwollende Vernachlässigung?

Interessanterweise waren die ersten Jahre und Dekaden der indischen IT-Industrie durch eine vollständige Abwesenheit der Politik gekennzeichnet. Aber entgegen der Behauptung einiger Wissenschaftler hatte die indische Zentralregierung die IT-Industrie nicht vernachlässigt, nicht einmal wohlwollend, sondern vielmehr einige – theoretisch – fördernde Massnahmen eingeleitet. Bereits 1971 richtete Indiens Regierung ein ‚Department of Electronics' ein, das allerdings eher mit der Produktion von Elektronik denn Software zu tun hatte. Insgesamt war die indische Politik bis 1984 bzw. 1991 sehr stark von der vorherrschenden Importsubstitution geprägt, die 1978 mit dem Rückzug von Coca-Cola und IBM aus Indien gipfelte. Zu diesem Zeitpunkt gab es keine Software-*Industrie* in Indien.

Nach Rajiv Gandhis Wahlsieg 1984 war eine seiner ersten Massnahmen eine aktive Förderung der Software-Industrie, die durch seine ‚Computer-Politik' gleichzeitig offiziell als ‚Industrie' anerkannt wurde. Konkrete Massnahmen beinhalteten Erleichterungen von Importen und Exporten durch Zollsenkungen, sowie andere Anreizen für eine explizite Förderung von Software-Exporten. Somit konnten bspw. Investitionen wie die von Texas Instruments angezogen werden. Im Jahr 1988 dann taten sich einige Unternehmen der Software-Industrie zu einem Branchenverband zusammen, um ihre Interessen besser vertreten zu können. Kurz darauf wurden die ersten Software-Technologieparks (STP) eingerichtet, die u.a. als Exportförderzonen mit eigenen Satellitenverbindungen ausgestattet wurden. In Bangalore wurde 1990 einer der ersten drei STPs eingerichtet, wodurch die Stadt einen weiteren Standortvorteil erhielt.

0.5.4 Die Rolle transnationaler Verbindungen

Nach der makroökonomischen Krise 1991 führte eine verstärkte Liberalisierungspolitk zum weiteren Zuzug von MNU, die sich v.a. in Bangalore ansiedelten, das bereits eine internationale Reputation erworben hatte. In der Literatur gibt es keine einheitliche Meinung zum internationalen bzw.

ausländischen Einfluss auf die Entwicklung Bangalores. Während einerseits argumentiert wird, dass MNU direkt zur Entwicklung beitrugen, indem sie einen kumulativen Prozess der Humankapitalbildung auslösten (Patibandla and Petersen, 2002), so gibt es andererseits die Auffassung, dass Wettbewerb durch MNU zu einem Anstieg der Löhne geführt hat. Auf jeden Fall wäre eine rein lokale Struktur suboptimal für die weitere Entwicklung eines Clusters, da sie zu einem Lock-in führen kann (March, 1991). Daher müssen Cluster früher oder später externe Verbindungen aufbauen, um einen kontinuierlichen Wissenszufluss zu ermöglichen (Chiarvesio et al., 2004; Wolfe and Gertler, 2004; Yeung et al., 2006).

In diesem Zusammenhang ist v.a. die wachsende Bedeutung der transnationalen Netzwerke erwähnenswert, insb. zwischen dem US-amerikanischen Silicon Valley und Bangalore. Während der kulturelle oder regionale Hintergrund in Silicon Valley selbst nur eine geringe Bedeutung hat (Saxenian, 1999), so spielt er eine gewichtige Rolle, wenn es um die transnationalen Netzwerke geht, die in erster Linie nach Südindien führen. Dieser postive Rückkopplungseffekt verstärkt somit die regionale Konzentration der indischen Software-Industrie, und stattet insb. Bangalore, sowie, in geringerem Ausmass, Hyderabad und Chennai, mit Wettbewerbsvorteilen aus.

Die Bedeutung lokaler sozialer Netzwerke ist dagegen laut meinen Interviewpartnern nicht so gross, wie man es anhand der Cluster-Literatur erwarten könnte. Das mag v.a. daran liegen, dass viele indische IT-Firmen zwar über technisches Wissen verfügen, da ein Grossteil ihrer Mitarbeiter in MNU gearbeitet haben, oder sogar die Gründung durch einen Spin-off erfolgte, es ihnen aber oft am nötigen Wissen fehlt, um die westlichen Märkte zu durchdringen. Da die Kunden in diesen Märkten ihre Hauptsitze in Übersee haben, macht lokales Netzwerken für diese Unternehmen wenig Sinn. Interessanterweise findet kaum Kontakt mit den lokalen Niederlassungen von MNU statt. Im Gegensatz zu dieser heutigen Situation gab es in den Anfangsjahren ein starkes informales, lokales Netzwerken, und zwar auf höchster Ebene, da sich die ersten Gründer noch persönlich kannten. Aber im Zuge des Industriewachstums wurden diese Kontakte formalisiert und sickerten auf niedrigere Ebenen durch. Trotzdem wünschten sich viele meiner Interviewpartner mehr Zeit für die Pflege lokaler sozialer Netzwerke.

Abschliessend kann man sagen, dass die Bedeutung der lokalen Netzwerke, zumindest im Ausmass wie in Silicon Valley, in Frage gestellt werden kann. Die Nähe zu Forschung- und Bildungsinstitutionen sowie die lokale Kultur des Lernens scheinen eine viel grössere Rolle zu spielen. Einige Interviewpartner meinten sogar, dass das Wachstum der indischen IT-Industrie gänzlich ohne Zutun indischer Emigranten stattfand.

0.6 Abschliessende Bemerkungen und Kurzabriss der einzelnen Kapitel

Lehren für andere Regionen oder Staaten ist u.a. die Bedeutung der Koevolution von Forschung und Industrie, die den systemischen Charakter des Wettbewerbsvorteils kennzeichnet (Murmann, 2003). Aber neben den bekannten Komponenten eines Innovationssystems (e.g. Nelson, 1993), haben sich Offenheit und Diversität als entscheidend herausgestellt. Dieses Argument, das sowohl im Interviewmaterial als auch in offiziellen Zahlen zu finden ist, lässt eine weitere Vertiefung dieser Forschungsrichtung vielversprechend erscheinen. Eine konkrete Empfehlung für Politiker wäre, für bessere Akzeptanz von Bildung und technologischer Entwicklung bei der Bevölkerung zu sorgen. Dies ist keine neue Erkenntnis, insb. wenn man nach Ostasien blickt, ihre Bedeutung kann aber scheinbar nicht überbetont werden. Eine weitere Schlussfolgerung, die man ziehen kann, betrifft das Umfeld, das möglichst attraktiv gestaltet werden sollte, um Emigranten zur Rückkehr zu bewegen und zu selbständigem Unternehmertum zu ermutigen (cf. Glaeser & Saiz 2004).

Die fünf folgenden Kapitel betonen bestimmte Aspekte der Entstehung, der Geographie und der Netzwerke der indischen IT-Industrie. Wie oben erwähnt ist die Geographie ein wiederkehrendes Thema in allen Kapiteln. Das erste Kapitel beschäftigt sich mit Faktoren, die zur Entstehung der IT-Industrie in Südindien, beigetragen haben und analysiert dazu die Zeitspanne um die Erlangung der Unabhängigkeit von Grossbritannien mit Schwerpunkt auf der Bedeutung der Kultur und der Ethnizität für die Herausbildung von Humankapital. Danach folgen drei Beiträge zu sozialen Netzwerken: zuerst ein induktives, Theorie bildendes Kapitel, das aus der Feldforschung Propositionen über Netzwerke und Diversität herleitet und dabei die Vorteile von Diversität im allgemeinen, und ethnischer Diversität im speziellen hervorhebt; zweitens, ein empirisches Kapitel über den Einfluss von transnationalen Netzwerken auf die Evolution der indischen IT-

Industrie, und wiederum über die Rolle von Kultur und Ethnizität, drittens, als eine Synthese der vorherigen Kapitel, werden die zuvor entwickelten Propositionen in einem einfachen Regressionsmodell über die Geographie der indischen Hochtechnologie empirisch getestet. Als letztes folgt eine Erweiterung der Analyse der IT-Agglomerationen mit dem Artikel über ein ‚Upgrading' der indischen IT-Cluster (mit Michael Grote), in dem wir theoretisch und empirisch untersuchen, wie die indische IT-Industrie nicht nur in der Wertschöpfungskette aufsteigt, sondern wie die IT-Cluster auch in der Lage sind, ein 'Upgrading' in andere Sektoren, wie z.B. Finanzdienstleistungen zu erreichen.

Chapter 1

Evolution, Clusters and Social Networks

1.1 Introduction

The essays in this dissertation thesis are concerned with economic issues associated with the emergence, spatial distribution and social networks of an innovative, knowledge-based technology industry, and interaction effects between them. In particular, they are focused on the interaction between geography and networks. From a policy perspective the motivation of this thesis is to further understanding of localized growth of industry clusters in an ever globalizing economy. From a theoretical perspective the interest lies is a better comprehension of industry evolution, with a special focus on networks and socio-cultural diversity, e.g. with regard to ethnicity. This thesis adds to the understanding of these interconnected issues through the case study of the Indian IT industry. The main questions are, firstly, why does an industry evolve in a geographically concentrated way, and, secondly, what role do different types of social networks play in this process? These topics are rooted in economics and management theories such as innovation economics, international business and economic geography, and different theoretical building blocks are taken from these fields. One of the main contributions of this dissertation is the holistic approach to economics as a social science, taking into account related disciplines as well. Being a dissertation in economics this is the focus of the entire analysis, but neighboring social sciences such as anthropology and sociology play prominent roles in some chapters and so does geography throughout. Therefore, new insight on the phenomenon under study can be gained by shedding light on it form different angles.

This dissertation consists of five papers, three of which have already been published in refereed publications. Chapter two appeared as “Culture, Innovation, and Economic Development: The Case of the South Indian ICT Clusters” in a volume edited by Sunil Mani and Henny Romijn (2004), *Innovation, Learning and Technological Dynamism of Developing Countries* published by the United Nations University Press, New York. Chapter five appeared as “Transnational Networks and the Evolution of the Indian Software Industry: The Role of Culture and Ethnicity” in a volume of the International Studies in Entrepreneurship (ISEN) Series edited by Dirk Fornahl, Christian Zellner and David B. Audretsch

(2005), *The Role of Labour Mobility and Informal Networks for Knowledge Transfer*, published by Springer, New York. Lastly, chapter six has been published in July 2006 by *Environment and Planning A* in a Special Issue on Global Value Chains, edited by Henry Wai Chung Yeung and Martin Hess, as "Offshoring the Financial Services Industry: Implications for the Evolution of Indian IT Clusters". The remaining two chapters are based on a modified version of a paper that appeared in the refereed DRUID working paper series as *"Proximity and Innovation: Evidence from the Indian IT Industry in Bangalore"* (working paper 04-10). Chapter three has been presented at the 2006 Annual Meeting of the Academy of Management on Knowledge, Action and the Public Concern and is under review at *Entrepreneurship Theory and Practice*. Chapter four has been presented at The First Annual Max Planck India Workshop on Entrepreneurship, Innovation and Economic Growth, the annual Meeting of the Academy of International Business, and has been invited for a revision and resubmission to the *Journal of Business Venturing*.

Each chapter is meant to stand on its own, but they are interconnected in obvious manner through the unifying core theme of the evolution of the Indian IT industry. The single chapters are as closely linked as possible being in effect independent chapters and, except for one modification, still in their original form based on published research articles. The order of the chapters in this dissertation is not based on the chronological order of writing; and there is some inevitable overlap stemming from independent submission of papers to conferences and for publication. This introduction is intended to put the chapters into their respective context.

In the following a few basic remarks on the key concepts evolution, clusters, and networks will be made, then some background on the context of the industry under study is provided, and finally a brief account of each of the following chapters is given. There is no pretense at extensively surveying the topics discussed, or even providing a broad literature survey in this introduction.

1.2 Evolution

As indicated in the subtitle this dissertation offers 'evolutionary' perspectives on the topic, which is meant in two ways, one theoretical, and one rather empirical.

Firstly, this dissertation is evolutionary insofar as it applies a couple of evolutionary concepts in the analysis. Evolutionary theory places a key emphasis on dynamics, process and transformation. Learning and knowledge are key elements in the change of the economic system. "Boundedly rational" agents act, learn and search in uncertain and changing environments. A central place in an evolutionary approach is occupied by three economic processes driving economic change: processes of variety creation in technologies, products, firms and organizations, processes of replication, that generate inertia and continuity in the system and processes of selection, that reduce variety in the economic system. Finally, in evolutionary theory aggregate phenomena are emergent properties far from equilibrium interactions (Malerba, 2002).

One of the most relevant concepts for this study is certainly that of *path-dependence* (David, 1985; Arthur, 1989) which has found its way into the fields of management and economic geography, two of the approaches used in this study. According to the path dependence perspective, initial historical conditions and other 'historical accidents' matter in determining the structures that are prevalent today. Central to the idea of path dependence are complementarities, or systemic factors, subject to the more applied literature of national innovation systems (Lundvall, 1992; Nelson, 1993) which subsequently has developed into the subfields of regional (Cooke, 2001) and sectoral (Malerba, 2002) innovation systems, among others. The innovation system literature examines the process of learning and competence building by way of *co-evolution* (Nelson, 1994; Murmann, 2003) within the business sector, the public sector, the supporting structure and policy at different geographical units of analysis. Co-evolution is a concept itself borrowed from biology denoting responsive changes of interdependent ecological species (cf. van den Bergh and Stagl, 2003).

Another related key concept borrowed from evolutionary theory is that of heterogeneity and *variety* (Nelson and Winter, 1982), or, in the terminology used here, *diversity*. In conjunction with network theories this is seen as a building block explaining the beneficial outcome of certain configurations of social networks. These concepts are commonly found in various combinations, or all together, in treatises of geographical agglomerations (see next section below).

Diversity has also been reported by many respondents during primary data collection, albeit rather in terms of the cosmopolitan nature of the city (Florida 2002a, b). Similarly, Glaeser and Saiz (2004) find evidence of amenities as a key ingredient for attracting skilled human capital. However, there are also drawbacks from too high a diversity level, most prominently an increased risk of conflicts (Alesina and La Ferrara, 2005).

Path dependence is particularly relevant in combination with geography. Evolutionary theories, which allow for multiple equilibria, cannot determine a global optimum *ex-ante*. Consequently, historical accidents can lead to sub-optimal local equilibrium outcomes, for example, when determining the 'best' location of an industry or firm. Such an – *ex-post* – sub-optimal outcome is often described as a lock-in (see next section below).

Secondly, the entire story told is an evolutionary story; thus the individual chapters are an account of successive, chronological steps in the evolution of the Indian IT industry – in some ways a historical account. One of the recurring themes is the path-dependence of the development of the IT industry in Bangalore. There are a couple of historical accidents which exert their influence on the industry structure of the Indian IT until today. Apart from some national economic policy measures, there are at least two crucial 'accidents' at the regional level: on the one hand, an early location of research and teaching institutions by the national government; and, on the other, the entry of one large foreign Multinational Company (Texas Instruments) in 1984 with their own satellite and large bandwidth overcapacity thereby enabling other, mostly indigenous companies to benefit from this reliable data connection and establish their own business ties to the US; some scholars might add the relocation of headquarters of successful *Indian* companies such as Infosys in 1982 to this list.

1.3 Clusters

Literatures on geographical agglomerations have experienced an upsurge for more than a decade in particular with reference to innovation and knowledge-based industries; these literatures can be subdivided into various different strands of research (cf. Benneworth and Henry, 2004). For example, there are 1) the cluster approach (Porter), 2) the innovative milieu (GREMI), 3) the industrial district

(Beccatini, Brusco), 4) the Regional Innovation System (Cooke), or 5) the New Economic Geography (Krugman, Fujita, Venables), to mention but a few.

However, the scope of this study is not to theoretically discuss the different concepts or to assess which of them is most appropriate to reflect the context of the Indian IT agglomerations. Therefore, the rather broad definition of clusters by Porter (2000) is used:

> "A cluster is a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities. The geographic scope of a cluster can range from a single city or state to a country or even a group of neighboring countries. Clusters take varying forms depending on their depth and sophistication, but most include end-product or service companies; suppliers of specialized inputs, components, machinery, and services; financial institutions; and firms in related industries."

Geographical proximity is important to the extent to which different lines of innovative activity influence one another, because of the existence of knowledge spillovers that are geographically bounded (Jaffe et al., 1993; Feldman and Audretsch, 1999). Given the often uncodified, tacit nature of knowledge, such spillovers are not transmitted costlessly over geographical space, but rather through direct, frequent and face-to-face contact (Dosi, 1988). Innovation is expected to concentrate geographically in areas that provide agglomeration economies—or a high local density of specialized resources—that enhance and facilitate the innovation process. There is empirical evidence for a general tendency for innovations to cluster geographically, this being still more pronounced when considering individual industries (Feldman, 1993; Feldman and Audretsch, 1999; Almeida and Kogut, 1997).

States, or regions, that contain concentrations of innovative inputs in some field of production will develop a competitive advantage in the industries in question. Since knowledge is cumulative, this advantage is self-reinforcing and may lead to further geographical agglomeration. In spatial terms, this would mean the emergence of geographical areas locked in by 'historical events' or 'chance' to a particular pattern of technological specialization, and encourage the technology gaps between countries differing in their fields of activity to remain and even

widen. Similarly, firms may be locked in to certain types of production and technologies.

1.4 Social Networks

Research on networks is ubiquitous in the social sciences. Yet again, this introduction cannot provide an exhaustive overview of this broad topic. Consequently only those contributions of social network theories that are most prominent in theories on geographical clusters and in knowledge-based technology sectors shall be explored here.

Whereas economics often adopted a technological approach to network technologies and increasing returns associated with them (David, 1985; Arthur, 1989) related disciplines rather focus on the social dimensions. Granovetter (1973, 1985) challenged the idea that transactions are carried out in a social vacuum, he proposed that social ties characterize most economic activity, such as formal agreements among firms (subcontracting) or communication across firms. Yet, his purpose is to articulate a middle ground between two extreme views of economic activity – the undersocialized view and the oversocialized view. Granovetter advocates for a position in between the two extremes that neither eliminates social context nor makes it deterministic (1985).

Subsequently, social networks have emerged as lines of research in innovation economics, industrial dynamics, and economic geography; as well as in more firm-oriented management fields of corporate strategy and organization theory that focus on topics such as the competitive positions of firms vis-à-vis rivals and firm founding and survival. All these lines of research share in common the emphasis on organizational learning taking place beyond the level of an individual firm, in particular with reference to research-intensive industries such as biotechnology (Powell et al., 1996). This stress on learning links up with evolutionary theories, and with studies on innovation and agglomeration thereof. So the basic question is what kinds of networks are best suited for firms in innovative industries?

Basically, there are two opposing strands of networks theories, those that propagate beneficial effects of dense, close networks of the “social capital” type (Coleman, 1988) versus others which emphasize the benefits of networks that are

characterized by structural holes or non-redundant ties (Burt, 1992). In network terminology, these are strong ties versus weak ties. Strong ties are usually associated with high trust among partners and efficient and effective transfer of information and tacit knowledge. In this sense, strong ties are better able to exploit extant knowledge, and to deepen the existing knowledge base of the firm in specific areas. On the other hand, weak ties are associated with exploration, that is, access to new areas of knowledge. Such an exploration might not be feasible with strong ties when they become overembedded, for they discourage experimentation (Uzzi, 1997).

Therefore, there is a theoretical trade-off between these two types of network forms, since it is rather difficult, if at all possible, to simultaneously achieve the characteristics of both forms in the same network. However, in an evolutionary context, subsets of networks can well display such different features, for example, by linking up previously unrelated strong tie communities.

In research on clusters networks have gained prominence in many ways. Basically, all of the approaches mentioned above include social networks as an important component for an agglomeration to exist and thrive – except for the New Economic Geography which is rather an ahistorical modeling exercise that cannot take into account contextual factors such as socio-institutional ones. Despite their differences in nuances, most theories on geographic agglomerations share in common their emphasis on the positive impact of social networks of the social capital type as a collaborative means that generates trust, hence reduces uncertainty and transaction costs. This commonality stems from the emphasis of geographic proximity as an enabler of face-to-face contacts as an important device for the transmission of tacit knowledge. However, Breschi and Lissoni (2001) and Boschma (2005) provide critical accounts of this view by maintaining that spatial proximity is merely an approximation of social proximity, which ultimately is responsible for transmission of tacit knowledge. In their view, geographical concentrations are a reflection of the localness of social networks, not of knowledge transmission per se.

More recently, there seems to be a convergence in the geographical literatures combining both cohesive, local networks and boundary-spanning distant ones (e.g. Rosenkopf and Nerkar, 2001). This development has been supported by the

rise of immigrant networks in different contextual settings such as Texas hotel industry (Kalnins and Chung, 2006) or information technology linkages between Silicon Valley and Taiwan or India (Saxenian et al., 2002; Dossani, 2002) among many others (for instance, there is a huge body of literature on *guanxi* – Chinese business networks in South East Asia). Since immigrants themselves tend to cluster geographically, the linkage between spatial and social, in this case ethnic, proximity is again evident. Moreover, an evolutionary view sheds new light on the direction international immigrant networks function; while initially the only thing that flew back were monetary remittances, nowadays in many cases such as Taiwan and India an active involvement of expatriate immigrant communities in the development process of the country of origin can be witnessed.

In a similar vein, cosmopolitan nature and openness can be interpreted as ethnic diversity. The interpretation of the advantage an ethnically diversified labor force possesses that is provided here stems from a social network perspective and concerns the increased number of linkages. Through common ethnic background such linkages would possess a latent density and frequency of contacts positively associated with social capital while simultaneously enlarging the knowledge base by merely expanding the number of potential contacts generating ideas in a network of innovators (cf. Agrawal et al., 2003; Kotkin, 1993).

1.5 The setting: the Indian IT industry

Bangalore is known worldwide for its achievements in the high technology domain. Almost every multinational company has located some of its global activities in one of the technology parks around the city thereby integrating Bangalore in their global value chains. Moreover, many indigenous software firms that sprouted during this process over the last decade or so have themselves developed capabilities and reached reputation levels rather uncommon to Indian companies before.

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 % p.a. 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 hardly any uncertainty pertaining to the purely economic aspects. Over the last few years a number of studies have analyzed the Indian software industry ranging from perspectives focused on innovative capabilities (D'Costa 2002; Tschang 2001) and quality considerations (Banerjee and Duflo 2000), emphasizing the involvement of multi-national firms (Patibandla and Petersen 2002) as well as an eventual development impact (Arora and Athreye 2002).

Although the Government of India (GOI) has been criticized for its 'benign neglect' (Arora et al. 2001) rather than an active stimulation of business, it 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 – indirect – 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. In 2001, for example, India had 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 generally identified as another major shortcoming (Bajpai and Shastri 1998).

In spite of this, 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. Overall, 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 (see map 1). Yet, almost all studies claim to cover the entire software industry and there is no *explicit* treatment of the geographical concentration in South Indian centers, most of all Bangalore. Thus,

the question addressed in this dissertation is why some regions are more successful than others?

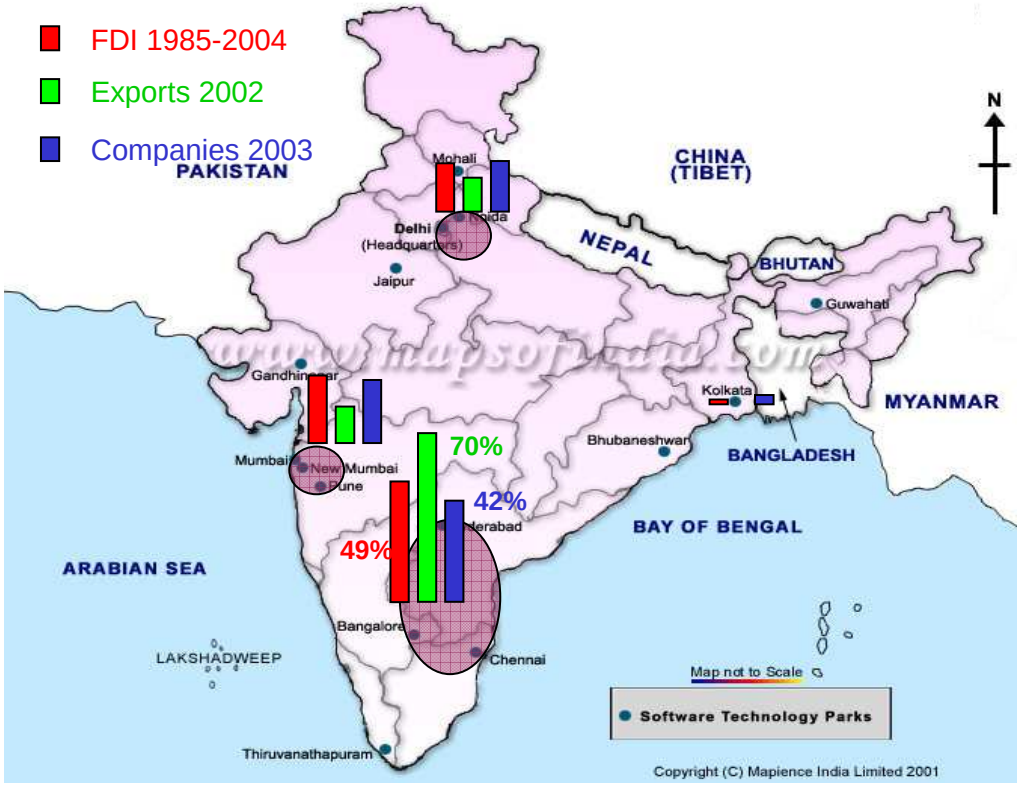

Figure 1.1: Map of spatial distribution of the Indian IT industry (own representation; sources: Thomson Financial; Software Technology Parks of India, STPI and National Association of Software and Services Companies, NASSCOM)

The historical evolution of the Indian IT can be visualized in the following stylized way (figure 2). Note that the absence of an explicit ordinate is intentional; possible measures would include variables such as the number of IT firms or software exports which result in a highly similar shape for the Bangalore context, or IT employment for which, unfortunately, no data are available. Moreover, phase 3 is not terminated with the start of phase 4, because foreign MNCs continue to flock to India opening up Indian subsidiaries. Lastly, 'going global' refers to corporate strategies, mainly cross-border acquisitions (which are not part of this study, but rather of future research). On an operational level this industry has been highly global since its inception with its basic business model based on the so-called body-shopping – the physical sending of software programmers to clients' premises mainly in the US.

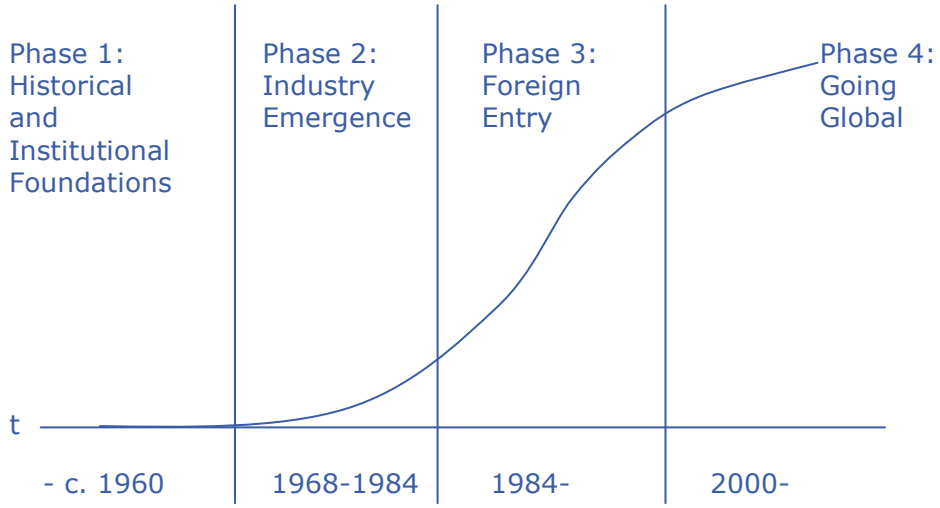

Figure 1.2: Historical evolution of the Indian IT industry

Since this thesis is mainly concerned with analyzing the above development in the case of Bangalore, in the following this case will be exemplified by enumerating the developments that took place there; the main events are summarized in table 1 below.

Period	**Innovation System factor**	**Main Event (italics denote national level)**
Colonial time	Educational Institutions	1909–Indian Institute of Science, IISc 1917–Viswesvaraya College of Engineering
Independence	Research Institutes	1940–Hindustan Aeronautics, HAL
Late 1960s-early 1980s	Indigenous private sector IT firms	1973–Process Systems India (Bangalore)
Mid-1980s – early 1990s	Policy shift/ First MNCs	*1984–Rajiv Gandhi: New Software Policy* 1984–Texas Instruments
Since 1990s	MNC wave	*1991–Liberalization*

Table 1.1: Important milestones in the development path of the Bangalore IT cluster Source: Own representation

1.5.1 Early foundations: a culture of learning and knowledge

Initial historical conditions leading to path-dependencies that evolved later on can be traced back at least to colonial times, and even before the arrival of foreign (political) powers. An extensive study of anthropological literature revealed considerable differences between North and South India in terms of appraisal of education. This led to a number of college formations under Sir M. Visweswaraiah, a famous South Indian engineer. After an early retirement he became the Divan (first Minister) of the Kingdom of Mysore, an important autonomous Princely State under the British Empire and pursued his vision of broad-based education witnessed by the early founding of the Indian Institute of Science (1909), University of Mysore (1916), the sixth-oldest in India and modeled after Chicago, Oxford and Cambridge, and the important Regional Engineering College of Bangalore (1917).

There has been a strong research base, in particular in electrical engineering and manufacturing of machine tools even before independence. With the early location of military, hence defense research Hindustan Aeronautics, HAL (1940) and later also space research (1972), i.e. the concentration of research-intensive technology industries Bangalore became the prime location for high-tech equipment in an economy rather left behind in terms of technological development due to a prohibitive import tariff structure. Co-evolution of these research and training institutions perhaps best reflects the systemic character of what led to the initial competitive advantage (cf. Murmann 2003).

Many employees of these research institutions later trained the graduates of the numerous 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 privatization of higher education in the state of Karnataka witnessed a first boost. It has been the first state to privatize higher education, several 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 enabled the establishment of computer labs required for teaching students in IT.

1.5.2 Openness

Interestingly, one factor which came out very clearly during fieldwork interviews concerns the social composition of the IT industry. Virtually no one found the industry to be really dominated by South Indians. On the contrary, most interview partners even argued in the opposite way. They claimed, it is very much the cosmopolitan nature of the city and the historical and traditional openness towards foreigners, both Indian and from abroad which had a high impact on the IT industry. Compared to other states in India, the investment climate has eventually been much more hospitable to foreign direct investment. The city has grown even more cosmopolitan due to the central government's policy to locate national institutions there. These national institutions were staffed with people from the Indian Administrative Service (IAS), or researchers employed after nation-wide job announcements and recruitment processes. The following relocation of many Indians from other parts of the country after independence and a realignment of state boundaries in 1956 enhanced the already established cosmopolitan nature of the city. More recently, due to the prospects of a booming economy and job market there is a continuous inflow of foreigners (for non-economic factors motivating migration in India see Gidwani and Sivaramakrishnan, 2003). Therefore, it was no surprise to find a similar pattern in the primary data collection with a total of 54,5% among the randomly sampled respondents not being from Bangalore. Apparently Bangalore has reached a level of diversity that allowed benefiting more from the positive effects thereof than suffering from its negative impact.

1.5.3 The impact of policy: benign neglect?

Interestingly the initial decades of the Indian IT industry were characterized by a complete absence of targeted policy measures. But despite many scholars arguing for a benign neglect GOI did introduce a couple of – theoretically – stimulating policies. As early as 1971 India established a Department of Electronics particularly addressing electronics production, which was larger than Korea's at that time. But the overall philosophy of Indian polity until at least 1984, or rather even through to 1991, was one of import-substitution led industrialization (ISI) that culminated in 1978 with the expulsion of MNC that did not want to conform to minority ownership regulations for their Indian operations such as Coca-Cola

and, more importantly, IBM. At that time, no effective Indian software *industry* existed.

In 1984, after Rajiv Gandhi's victory in federal elections, first measures were introduced to stimulate the growth of the software industry, which was also formally recognized as an industry through the "Computer Policy". These measures included an easing of imports and exports by lowering tariffs and other incentives explicitly encouraging software exports as a priority. This helped attracting investment such as the one by Texas Instruments in Bangalore mentioned above. In 1988, software firms themselves formed an industry association to further their interests. This quickly resulted in the establishment of the Software Technology Parks of India, as export-processing zones with dedicated satellite links, other service provisions and incentives. Bangalore was one of the first three STPI units that have been set up in 1990 – again resulting in a first-mover advantage of Bangalore over comparable locations in other cities.

1.5.4 The role of transnational linkages

Following a macroeconomic crisis in 1991 further liberalization policies led to the inflow of MNCs that located primarily in Bangalore which had already gained an international reputation. There is no agreement in the literature about the role of international, or foreign, influences on the development of the Bangalore cluster. Whereas some argue that Multinational Corporations MNCs (directly) contributed in favorable ways to later-stage development through triggering a cumulative process of human capital formation (Patibandla and Petersen, 2002) others argue that rising wages caused by competition through MNCs induced firms to upgrade their capabilities. However, even in the latter case there is an indirect positive influence of MNC entry. Moreover, for a successful subsequent development of clusters an entirely localized structure of networks seems not sufficient, for it might lead to a lock-in or suboptimal equilibrium (March, 1991). Hence, clusters need some form of external linkages in order to provide a continuous inflow of knowledge (Chiarvesio et al., 2004; Wolfe and Gertler, 2004; Yeung et al., 2006).

An important related characteristic is the increasing significance of transnational networks, primarily between the US-American high-tech cluster of Silicon Valley and Bangalore, although in the context of Silicon Valley the influence of culture

seems to be negligible. Saxenian (1999) found that Indians in Silicon Valley share a common Indian identity that transcends the boundaries of caste or ethnicity. While in the context of Silicon Valley, where Indians are trying to integrate into the US business mainstream ethnicity in the narrow sense loses its importance, the geographical origin or ethnicity seems to play a very important role as regards the flows through transnational networks that are directed towards South India. 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.

The importance of local social networks itself has not been estimated by many respondents as highly as one would have expected from cluster and network literatures. Since they often spun off from leading MNCs, they have accumulated the necessary technological (but less business) know-how in order to access the more advanced Western markets. Since their major clients are located in overseas markets, a local networking does not make much sense for these companies. They normally do not interact with captive development centers in India, but rather with headquarters or other research units directly. However, there have been a couple of 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 it diffuses to different, lower 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, whether this local networking takes place to an extent that comes anywhere close to the inter-firm relationships so important to Silicon Valley is questionable. 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. Some of the interview partners, on the contrary, suggested that indigenous firms were responsible for the growth of the Indian IT industry without much involvement of overseas Indians at all.

1.6 Concluding remarks and outline of this dissertation

Lessons for other states or countries include that co-evolution of research and industry perhaps best reflects the systemic character of what led to the initial competitive advantage (Murmann, 2003). But, apart from these well known components of an innovation system (e.g. Nelson, 1993), the openness and diversity seems to have played a substantial role. With this line of reasoning from diversity to innovation being reflected not only in interview data, but also in official figures, it seems to be worthwhile doing further research in this direction.

One specific implication for policy makers 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).

The five chapters that follow focus on certain aspects of the *Emergence, geography & networks of the Indian IT industry.* As mentioned above geography is a recurring theme throughout the papers. The first paper deals with factors pertaining to the *emergence* of the IT industry initially in South India examining time periods before and around independence from British Colonialism, here the focus is on the relevance of culture and ethnicity for building a pool of well-educated human capital. Then, three papers concerned with social networks follow: firstly, an inductive theory-building paper developing propositions on networks and diversity based on original fieldwork, emphasizing the advantages of diversity in general, and of ethnic diversity in particular; secondly, an empirical paper on the impact of *Transnational Networks* on the evolution of the Indian IT industry, and, again, the role of culture and ethnicity thereby linking up with the first paper; thirdly, as a kind of a synthesis of the previous papers, I empirically test the propositions developed earlier in a simple regression model of the *Geography of Indian High-Tech Entrepreneurship*. Lastly, an extension of the analysis of IT clusters is the paper on *Upgrading Indian IT Clusters* (with Michael Grote), where we analyzed theoretically and empirically how the Indian IT

industry not only moves up the value chain, but also IT clusters seem to be well-prepared for an intersectoral upgrading into areas such as financial services.

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Chapter 2

Culture, Innovation and Economic Development:

The Case of the South Indian ICT Clusters

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2.1 Introduction

How can the Indian success in Information and Communication Technologies (ICT) be explained? Is it an eventual result from the liberalization in the 1990s? Then why have other sectors not produced such an impressive performance? Is it rather influenced by other factors, which have been released – or rediscovered – through this liberalization, e.g. a culture of entrepreneurship and innovation? Or may there even be a predisposition towards the so-called knowledge economy?

This chapter is concerned with the successful development of the software industry as the major component of ICT in India. It is inspired by two noteworthy phenomena concerning this industry. First, most of the studies analysing the 'Indian software industry' cover basically the major centres in Bangalore, Hyderabad and Chennai, all South Indian. Secondly, while there has always been a tradition of entrepreneurship by a particular social group, the merchant and trader caste of the Vaishyas, the software industry witnesses more than a proportionate presence of Brahmins, traditionally the priestly and knowledgeable caste group.

Thus the central questions are why Brahmins experienced such an increase in the new industries and, subsequently, why it is concentrated mainly in the South of the subcontinent. Consequently, culture will be approximated through the variables caste and ethnicity. It is important to emphasize that these variables cannot be more than complementary to other explanations of the success of the Indian IT industry. Basically, other contributing factors like R & D or technology policy are left out of the analysis, for there already exists a large body of research on these systemic factors.

Therefore, this chapter employs a mixed methodology. First, the notion 'culture' shall be tried to make workable in terms of a useful definition. This is done by synthesizing the relevant literature. Later this definition shall be applied to the Indian context through identification of characteristic features of the Indian society and economy. Secondly, this application bridges to the empirical part in which I have tried to analyse the societal composition of the Indian entrepreneurial 'class' of the so-called knowledge economy. This preliminary

analysis is based on a small set of existing interview-based studies of which the interviewees' names are taken as an approximation of the cultural background in terms of societal affiliation or, more precisely, social and regional origin. While the use of interview data has its limitations, especially when there is only limited amount of data available, it opens new directions for further research, and should, therefore, be seen as a basis for more empirical work.

The chapter is structured as follows. Section II synthesizes the large field of anthropological and social science work towards a definition of culture which is useful in the economic context. Section III takes a closer look at the Indian and South-Indian situation, in particular. Section IV then applies the resulting hypothesis to the Indian software industry. Section V concludes.

2.2 Economic culture and development

There is a renewal of interest in the relationship between culture and (economic) development. This is manifested in the debate on 'Asian values' as an explanation for the success of the so-called tiger economies. Having started their catch-up from a similar level like other developing countries, their much more successful results are often imputed to their favourable culture. Another recent example is the collective volume edited by Harrison & Huntington (2000) which brings together scholars from different social sciences.

Why can it make sense to include culture into an economic analysis? How can this variable be integrated? Where are the shortcomings of such an approach?

A simple but somewhat naïve answer to the first question is to single out which characteristics different cultures possess are most likely to result in socio-economic progress in order to replicate these positive attributes in other cultural settings. The challenge of approaches which stress the importance of culture and other social factors that are non-economic in nature but influence the economy and are influenced by the latter is not merely to impute differences in economic performance to the cultural factors as earlier scholars often did, but to integrate culture as a variable into theoretical models (Klump 1996). An interesting approach has recently been taken by Frederking (2002) who tries to carve out the

substance of the relationship between culture and development in order to achieve a basis for cross-cultural comparisons.

For this purpose, a quite generic approximation of culture has to be found and applied. Later in this chapter, I will use the variables caste and ethnicity. This is an adaptation to the object of study, but could reasonably be part of a broader aggregate of cultural factors. And, although it is not primarily an economic one, focusing on the economic implications of these proxies narrow the scope of this chapter.

At the outset, one has to emphasize how difficult it is to consistently integrate the mutual interdependences that exist with regard to culture (Klump 1996). Basically, there are two dimensions in this relationship. First, culture can be seen as an end in itself, that is a good which is desirable to be preserved as part of a larger spectrum of goals that should be reached in the course of development. Secondly, it is also a means to development, both directly through cultural investments and, more importantly, indirectly through values and norms working in a society (Sen 2001). Since the majority of development theorists see culture rather as a means than as an immediate goal, at least in the near future, I will concentrate on this. Then the question is how culture exerts its influence on the economic realm (Ruttan 1988). First, there are the often-cited values, beliefs, traditions and norms. However, they are rarely observable, hence difficult to measure. Therefore the more visible manifestation of culture are actions, behaviour or actual social practices which are usually influenced through norms and values.

Focusing on the relationship between culture and the economy and recognizing the fact that there are manifold problems with the definition of culture (Gupta 1994),1 in order to make it operational in the context of economic development the analysis should be narrowed to economic culture. What, then, is economic culture? Certainly, it is part of the larger cultural setting of a society. The methodological problem integrating culture with economics poses to the economist is that it is difficult do define and quantify separately from other

[1] He mentions a taxonomy collected as early as 1952 which gives 164 definitions of culture, presumably there is a multiple of this number today (Gupta 1994, p. 2).

factors, e.g. institutional ones. Economic sociologist DiMaggio (1993: 27) says 'aspects of culture shape economic institutions and affairs [...] economic processes have an irreducible cultural component'. In the same vein is North's (1990: 37) statement that Culture underpins the 'rules of the game' in any society, and provides 'the informal constraints on human interaction'.

Instances of the economic culture approach are the concept of social capital (for a review see Fukuyama 2000) or social capability (Abramovitz 1986). The first approach stresses the informal values and norms shared by a small community allowing for trust and cooperation. The latter is more macro oriented and focuses on the ability of a country to innovate and adapt to changing external factors in order 'to exploit emerging technological opportunities' (Abramovitz 1986: 406). It stresses the interplay of different factors ranging from education, institution and openness in enabling a country to adopt new technologies and is related to the literature on systems of innovation (Lundvall (ed.) 1992, Nelson (ed.) 1993), which vary, however, in terms of geographical focus, i.e. their perspective stretches from national to regional and local. The focus of the innovation systems literature is certainly not on culture, but it can be a complementing factor.

The literature dealing with the culture of economic development demonstrates predominantly one line of argument. Most of the authors working on economic culture try to single out those cultural factors that can be positively correlated with development in the sense of modernization and growth (Lal 1998b). Usually mentioned are for example trust, rationality, the value of work and religion (Grondona 2000).2 This reasoning can be traced back at least to Max Weber's ideal types and has its latest revival in the 'Asian values' debate which has been dubbed a 'neat reversal of Max Weber's famous thesis' (Lal 1998a: 2). These values characterizing the highly hierarchical societies of East Asia, however, do not really match the South Asian context. As Amartya Sen (1999) points out, there are ancient Indian traditions and values contrasting those of the sinic societies to the east. An analysis of the principles of the ancient Indian thinker Kautilya show that they are more egalitarian and condemn such authoritarian approaches as of East Asia (Sarkar 2000; Sen 1999).

[2] She has a typology of 21 factors.

However interesting the value debate, culture is manifested and observable only though action or social practices. In synthesis, culture can be defined as 'socially transmitted heritage', which opens the door for analysis of actual behaviour. The problem with interpreting cultural influences through literature study, or the 'book view' is that people often act differently from what they prefer to behave like. An instance of such a 'preference falsification', it is argued, might be at work in the caste system (Kuran 1987). This leads me to the Indian situation.

2.3 South Indian Economic Culture

This section is a brief theoretical attempt to outline the basic features of an economic culture that can be derived from a Brahmin and South Indian background, respectively. The question is, whether there exists a regional culture of innovation resembling the one of Silicon Valley (Saxenian 1994, Gertler 1997). Therefore, Indian culture has to be analysed in a disaggregate perspective.

Broadly speaking, for the Indian society the cultural framework can be interpreted as 'Hinduism', which provides rather an all-encompassing philosophy than 'merely' a religion (Dehejia & Dehejia 1993). But what is commonly known as belonging to 'Hinduism' is only part of the more complex Hindu civilization – it is embedded in an all-encompassing worldview (e.g. Rothermund 1995; Stietencron 1995). Albeit the differences within that composite of religious beliefs are too subtle to be explored here, the broader cultural view allows for the observation of several regularities.

According to the distinction made in the section before, I will first deal with the issue of values and, then, proceed to the one of observable behaviour. The section ends with an analysis of South India.

2.3.1 Values and caste

Is there anything that makes the Indian economy a peculiar object of analysis, something that precludes a conventional economic study? Presumably it is, some would argue, given the unique phenomenon of caste as the characteristic feature of the Indian society. On the other hand there are those who downplay the influence of caste and, moreover, the institution as such as an invention of 'orientalist' scholars. The most compelling argument is that some social structure

similar to the caste system existed long before the arrival of the Britons, but only their desire for rationally understanding the Indian society with the support of Indian elites they hierarchically institutionalised the rather informal norms (Bayly 1999). While the issue whether there is a system of caste is heavily disputed in the anthropological literature, it is quite safe to assume a certain influence of caste. That is why it is taken as one of the proxies for culture in this analysis.

However, the term caste is used in two different contexts. First, it is used to describe the jati, hierarchically ranked endogamous kinship groups with a regional base centring around the performance of traditional occupations (such as leatherworkers, priests, merchants, or tailors) in an interdependent relationship with other jatis. Secondly, it depicts the more aggregate societal structure of a class-like division, the varnas (Bayly 1999).

Describing the caste system as consisting of a fourfold hierarchy of varnas plus the so-called untouchables, mistakenly referred to as outcastes (Dumont 1980)3, is a gross oversimplification (cf. Chapham 1993)4, that does not do justice to the complexity of this perhaps most refined institution extant today. Except for the highest varna of the Brahmins the remaining ones consist of numerous jatis. But it is useful in the sense that the categories so derived allow for a pan-Indian examination of issues related to caste. It can be seen as the conceptual framework for the actual practice of the society stratified by jati (Sau 1999).

Although very prominent, and studied both intensively and extensively by anthropologists, predominantly in field studies, but also on a theoretical level, its meaning for development has not been scrutinized thoroughly by economists. It is predominantly both the alleged stability of this unique institution and in connection with that fatalism, the presumed tendency of the poor to ascribe everything to their karma, which led many economists to the conclusion that the caste system impedes modernization of the Indian economy (see e.g. Myrdal 1968; Weber 1972; Marx 1971; Akerlof 1976; Olson 1982; Kuran 1987; Lal

[3] Dumont (1980) regards as the most outstanding feature of the caste system that nobody is excluded from the societal structure, contrary to (medieval) Western class conceptions.
[4] M.N. Srinivas (1978) mentions an earlier ‘calculation’ by Ghurye ‘that there are 2000 sub-castes (*jatis*) in every linguistic area. Chapham (1993) speaks of even 3000 sub-castes for the major groups, and of 90.000 endogamous marriage groups.

1988; Scoville, 1996; and a comparative survey of economic, historical and anthropological literature in Subrahmanyam 1996). They blurred both concepts with the resulting lack of an adequate picture of Indian reality as known through anthropological fieldwork. In order to establish through economic theory the rigidity and drawback of the caste system they overlook that it has always been much more open, flexible and adaptable.

The actual meaning of karma is action or deed, and that it also influences current and future lives, but is often (mis-) interpreted simply as fate, which defies the ability of the individual to influence his present life, which is inconsistent with the actual Hindu philosophy as understood, for instance, by Thapar (1990).

Parry (1996), firmly rejecting Weber's thesis of the 'spirit of capitalism' being absent in India, states that the ethical preconditions for the emergence of capitalism have been much more hospitable in India than they actually were in Europe. This might be seen as implicitly subscribed to by Lal (1988) who argued that the caste system initially was a highly efficient institution and very much in favour of economic development, embodied quite early in a high level equilibrium which then was maintained at stable conditions over millennia by still encrusted hierarchies or distributional coalitions in the terms of Olson (1982). The recognition of commerce, trade and other sources of accumulating wealth being in conformity with the religious doctrines, which are definitely culturally determining, on whichever element the emphasis is placed, allows to identify a climate in traditional India, be it in ancient times or in remote areas today, which was unmistakably favourable to generate a capitalist spirit.

There is a prolific misconception of the Indian or better 'Hindu' attitude towards secular affairs, at least if one tries to locate the source of fatalism and 'accommodation', to use Galbraith's (1979) notion, in the roots of the cultural and religious traits as manifested in the ancient scripts. This inference has been initially proposed by Weber5 and is known also as the karmic view on the Indian society. This picture erroneously propagates the pursuit of religious duties and the

[5] 'Ever since Max Weber's analysis of Indian society, many Western (and Indian) social scientists have interpreted social institutions such as caste and the extended family as oppressive, in the sense of hindering the growth of such personality traits as "independence", "initiative", "persistence" and "achievement motivation" in the individual' (Kakar 1981: 10).

outright rejection of material wealth as the basic components of the 'Hindu' belief. There from, according to this perspective, supposedly originates the ignorance of the, indeed, very religious Indian population of (technical) change and innovations that could otherwise bring progress to and enhance the welfare or well-being of the deprived population. The presumption underlying this image is a traditional society with a well-balanced power structure in which innovations of whatever nature are deemed as a threat to the existing equilibrium.6 These scholars ascribed the stagnation in what Lal calls a "high level equilibrium trap" (1998a: 34) mono-causally to the extant ideologies of 'Hinduism'.

After a hopefully convincing debunking of the perception of (Western) economists of values of the Indian society as allegedly impeding development, I will turn to the investigation of actual behaviour. Such an analysis is much more anthropological than economic.

2.3.2 Behaviour

The single most important fact to state with reference to the translation of values and beliefs into action and behaviour is that there are usually large deviations. The motivation for such deviations have been analysed with game-theoretic approaches as 'preference falsification' (Kuran 1987).

One reason for the dissonance between ideological beliefs and actual behaviour is to be found in the philosophical conceptualisation of Hinduism. Whereas many scholars are intrigued by the picture of an overriding principle of Hindu religion like karma, often translated as fate, there does not exist such an idea. Rather karma has to be complemented, if not substituted by dharma, perhaps best

[6] Warner (1970) defends Weber's ideas against critics like Morris (1964) who argue in favour of a secularly oriented mentality that is also responsive to many forms of incentives as offered, for instance, by the market mechanism. The latter is based partly on studies of industrial entrepreneurs in Western India. See the discussion in Subrahmanyam (1996) and the chapter by Singh (1989) on 'the relevance of Max Weber for understanding the Indian reality'. The conclusion is that, in spite of many interpretations that have mistaken Indian reality, in terms of sociological methodology, Weber's approach can still be regarded as extremely useful. Accordingly, especially Weber's idea of 'interpretative understanding' as part of his methodology that is valuable for Indian sociologists, despite his misplaced emphasis on the meaningfulness of cultural factors.

translated as 'sacred duty',7 as the most important principle in determining and understanding the behaviour of Hindus.

The expression 'sacred duty', corresponds to the concept of svadharma or jati-dharma that Dharma, in some sense representing the social order, substituted the idea of a state. Heesterman restates the view of merited sociologists like Louis Dumont that dharma is the ever-present moral order which guides the people rather than commands them ('[L]e dharma règne de haut sans avoir, ce qui lui serait fatal, à gouverner', cited in Heesterman 1984: 77; see also Srinivas 1978). This aspect of dharma can be seen as the abstract, all-encompassing philosophy of Hinduism.

But dharma is not a monolithic concept; it has to be seen as contingent on the person and the group he belongs to (Morris 1967). This is another implication of dharma which is much more practical, it is one's duty obligated to a certain caste (svadharma, i.e. one's own dharma) in order to maintain the cosmic harmony. Parry speaks of the seemingly very similar notion of jati-dharma as 'the code of conduct which is an aspect of his nature.' (Parry 1996: 78) Again we have an ambivalent meaning of the proper word, for e.g. Gelblum (1993: 38) interprets it as the 'concept of the individual's duty' which is implicitly reciprocal of the concept of rights.8 It is in any case of relevance to the individual insofar as it conveys the moral or right actions conforming to the caste one belongs to.

It is quite interesting to note the parallels between dharma, jati-dharma and svadharma on the one hand and 'conventions, norms of behaviour and self-imposed codes of conduct' on the other hand (North 1990: 23). In this sense the social system of the Hindu civilization could be plausibly subsumed under a general categorization with regard to informal institutions.

[7] Thanks are due to Prof. Burkhard Schnepel, now Institute for Social Anthropology, Martin Luther-University, Halle, for this commenting remark of an observation made during several field studies in India.

[8] This aspect was emphasized by Mahatma Gandhi who considered *varnadharma* as the most important and attached to it the importance of the group as opposed to the individual and the primacy of duties over rights (cf. Béteille 1996: 160).

Upper-caste groups, such as Brahmins and merchant and ruling groups, have traditionally discriminated against lower-caste groups, but the ranking of upper- and lower-caste groups has varied by region and through time.

> "If the stability of the caste order could not hinder property differentiation, it could at least block technological change and occupational mobility, [E]ven today, the very fact that new skills and techniques actually lead to the formation of new castes or subcastes strongly handicaps innovation. It sustains tradition no matter how often the all-powerful development of imported capitalism overrides it." (Weber 1958: 104)

Although there has always been upward (and downward) mobility, one could say that the principal varna providing economic services like merchants or entrepreneurs was that of the Vaishyas (Rutten 2002), complemented, of course, by the minority communities of Parsis, Jains and Sikkhs (see e.g. Tripathi 1992).

Brahmins, on the other hand, were traditionally seen as priest, teachers or in related professions. These related professions comprise all the tasks necessary to perform the various religious rituals. This consists mainly of studying, reciting and handing down the sacred texts, but includes auxiliary sciences like grammar or astronomy, as well as mathematics and geometry (in order to construct optimally the altar for sacrifices) (Stietencron 1995). Moreover, the Hindu-Brahminical education system envisaged medicine, literature, philosophy and logics (Gosalia 2000; Das 2000). Hence, there are many disciplines that are very useful for intellectually challenging professions in the so-called knowledge economy like sciences or research related pharmaceuticals, biotechnology or software. 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 (economic) culture as summarised in the previous section. Therefore, even if Brahmins have monopolized learning, as some argue, there might be a positive impact on the Indian economy in the 'knowledge age' (Das 2000: 153).

Especially with regard to traditional professions like artisans this division of labour seems to be still perfectly in place. There is evidence from various field studies, both economic as well as sociological or anthropological that this holds

true.9 Moreover, such a network of interdependent producers and traders adhering to their customary occupation can be described as a cluster. In the traditional footwear cluster of Agra a major factor for the successful mastering of crises is the extent of vertical relationships (Knorringa 1999).

However, with regard to the urban, and more so in the metropolitan, areas of India, this traditional aspect of the culture derived from religion is being undermined by various factors, most notably industrialization and occupational diversification in general (Srinivas 1978). In particular caste is being superseded by issues of class (and ethnicity), more among the upper castes than among the lower ones (Béteille 1996).

Whatever might be the importance of these moral values today, it is noteworthy how they are supposed to have spread during the past millennia in a process described as 'Sanskritisation' of the lower castes, i.e. the imitation of customs and rites as followed by the Brahmins, to an extent possible in terms of ability to perform these rites (Srinivas 1978).

As already said, the most widespread inference made is the one which does not take into account the internal dynamics of caste and its adaptability and tolerant attitude towards external institutional changes, be they political or legislative or anything else (Osborne 2001). Nevertheless, this stance is usually taken by economists who ignore the insights from history and anthropology evidently showing the opposite. They do neither account for the upward mobility of previously lower castes through economic success or the process of Sanskritisation as inherent to caste. Instead it is seen as inseparably interrelated with the Hindu religion, despite the fact that it is hosting other religions and sects, too, albeit as subdivisions, jatis, being ranked according to the prevailing circumstances like, for instance, economic success.

Closely related to the flexibility of the system with regard to the mobility of castes, or better jatis, almost as a precondition, is the emergence of new occupational activities. The jati-dharma has been almost fixed for ancient castes

[9] See Nafziger (1977, 1986, 1994) for economic studies conducted in the southern state of Andhra Pradesh; Rutten (1999, 2000) for a sociological perspective on the western state of Gujarat; and Reiniche (1996) for an anthropological field study of a merchant caste in south Indian Tamil Nadu.

and jatis through scriptural tradition. But there cannot be prescriptions for all the newly evolving sub-castes like there cannot be explicit contracts specifying every contingency. Thus, in the modern Indian society there is some indeterminateness concerning the future adherence and obedience to dharma, because there is no (religious) authority legitimated to declare such a social code of conduct. Furthermore, the developments observed reveal a certain tendency to reversethe process Max Weber has described as 'the transformation from ethnicity to caste' (Fuller 1996: 22), which Dumont labelled 'substantialisation of caste' (quoted in Béteille 1996: 172; Fuller 1996) and anthropologists more broadly have named ethnicisation. It might be particularly meaningful in India as it dissociates class from caste (Platteau 1995; Béteille 1996; Fuller 1996).

Recently, there is some more than anecdotal evidence that the structure of new Indian enterprises is determined by Brahmins rather than Vaishyas, the traditional merchant caste; this evidence is analysed in the next section. It might result from the fact that Brahmins have been involved not only with the profession of priesthood but more generally with activities relating to knowledge and wisdom. In earlier times Brahmins had a much more negative attitude towards business, trade and commercial castes in general. Lal (1995) called this attitude atavistic and described the Brahmins as primarily protecting their status.

An interesting comparison between values and practices is the GLOBE project, which identifies cultural clusters worldwide. India, as part of the South Asia cluster is distinguished as highly group oriented, humane and male dominated. Regarding business strategies the study finds that South Asian managers focus on the combination of knowledge, action and devotion (Gupta et al. 2002; Chhokar 2002).

2.3.3 South India

With regard to South India there are a few notable, somehow contradictory deviations. Firstly, caste has been perceived to be imported by the (Brahmin) Indo-Aryan-speaking migrants from the North.10 Therefore the position of the Brahmins as representatives of this hierarchical order seemed to be more exposed

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

in the Southern states, particularly in Tamil Nadu, but also in the neighbouring Karnataka and Andhra Pradesh. However, there has also been an indigenous Dravidian culture with its own languages, symbols and sacred texts as well. These South Indian cultural elements had to be balanced against their own Sanskritic ones by the Brahmins. On the other hand, there have always been high-caste non-Brahmins pertaining to the indigenous Dravidian population who were not only engaged with the learning of the Dravidian texts but 'who were adept in Sanskrit learning as well' (Stein 1999: 52). Hence, Brahmins are to be seen as mediators who provided for the diffusion of Sanskritic knowledge rather than monopolists. Thus, apparently the foundations for a knowledge-based society have always existed in South India ever since and, moreover, have been much more diffused throughout the whole society. Moreover, political movements in favour of the backward groups of Indian society started much earlier in the South and led to a more equal pattern there as opposed to the more traditionally dominated Northern states (Jaffrelot 2002).

Secondly, the indigenous population of the South is said to be much more homogenous and not displaying the two middle caste groups of Ksatriyas and Vaishyas to the same extent as in the North (Dirks 1996; Stein 1999). On the other hand, there was a further distinction between so-called 'right hand' and 'left hand' divisions in at least three of the four Southern states, adding to the complexity of a hierarchy (Srinivas 2003). Both Brahmins and high-caste non-Brahmins have been excluded from the occupations of these two caste groups, which included different kinds of traders and merchants, both agricultural and non-agricultural occupations. The absence of the warrior castes of the Ksatriyas in particular resulted in a generally more peaceful and contemplative society, one reason often cited for the higher political stability of South Indian states (Stein 1999).

This greater emphasis for learning is reflected by the higher than proportionate share of all the South Indian states in institutions of tertiary education and a higher proliferation of higher education (D'Costa 2003). This is particular revealing when taking into account the lower economic status of these states compared to the North Indian ones (Chalam 2000). Generally, mathematics and other pure

sciences are said to confer a high status to people proficient in them, since they are intellectually the most demanding (Krishna et al. 1998).

What is particularly striking is the large number of technical or engineering colleges in the four southern states (D'Costa 2003). Although there are varying numbers according to the definition of a college used by different sources, the shares remain relatively stable. Dossani (1999), for example, identifies one of the strengths of the South Indian states in its technical capacity with four hundred out of six hundred technical colleges located here. Similarly, Arora and Athreye (2002) report as percentages for South India roughly 50% of all Indian engineering colleges and enrolment as well as 79% for privately financed colleges as against the national average of 69% (table 1).

They find in particular the latter startling and hypothesise that it might relate to cultural and political factors. Chalam (2000) more explicitly links this fact to social and cultural movements (see previous section) that tried to break away from the traditional and superstitious customs in order to arrive at more humanitarian values.

Table 2.1: Number of engineering colleges and enrolment (Source: Arora & Athreye 2002)

Region	No. of engineering colleges	National share in engineering colleges	Enrolment (sanctioned capacity)	National share in enrolment	Percent share of national population	Share of self-financed colleges
Central	50	7,54%	9,470	6,05%	-	52%
East	25	3,77%	4,812	3,07%	25,8%	26%
North (incl north-west)	140	21,12%	25,449	16,26%	31,3%	42%
West	140	21,12%	34,165	21,83%	19,6%	74%
South (incl. South-west)	308	46,46%	82,597	52,78%	23,2%	79%
Total	663	100,00%	156,493	100,00%	100,00%	69%

Taken together, the Southern part of India seems to exhibit a more intensive regional culture not only of learning, quite literally rather than in the sense of the regional development literature, but also of innovation (see Vijayabaskar & Krishnaswamy, this volume). Apparently, this attitude is a solid foundation for the absorptive capacity necessary in order to adapt to new technologies (Lateef 1997).

2.4 The Indian ICT industry

This section provides a overview of the Indian software industry. It is basically a survey of the literature in economics and geography during the last couple of years dealing with IT in India. This review could also be described as a summary of the usual analysis of the success of Bangalore which will be supplemented by a cultural explanation later on. This cultural argument is supported by the findings of previous interview-based studies which are discussed in this section. It should be highlighted that this argument is being added to the conventional analysis of the software agglomerations.

2.4.1 Overview

The Indian ICT industry mainly consists of a broad spectrum of software development enterprises. It contains the most successful branches of the services industry in the Indian economy. The growth rates, particularly of software exports are at an astonishingly high compounded annual growth rate of 46 % for the last decade (1990-91 to 1999-00) (Parthasarathi & Joseph 2002). It is quite respectable with respect to the same industry in other (developing) countries. It is for this reason that the 'Indian model' is tried to be replicated by other emerging economies similar to the orientation towards Silicon Valley by industrialized countries (Arora et al. 2001b). There is a high demand for Indian support in establishing Software Technology Parks (STP) in the way India did, most of the demand coming from the Asia-pacific region like Hong Kong, Singapore, Korea or China. This stems from the fact that although some scholars describe the involvement of the Government of India (GOI) as 'benign neglect' (Arora et al. 2001b: 25) rather than actively stimulating business it did in fact recognize the importance of supporting the software sector in general, and for exports in particular, as early as 1972 (Parthasarathi & Joseph 2002) with the initiation of an

export processing zone near Bombay (Bajpai & Shastri 1998). Other supportive policies like establishing the prestigious Indian Institutes of Technology have been of critical value to the evolution of the software industry (ibid.). Subsequently, the first STPs were established in 1990 (Parthasarathi & Joseph 2002). But there could be more policy initiatives, for example to encourage investment by non-resident Indians (NRIs). For example, India received as foreign direct investment for the years from 1991 to 1998 only about one fourth of what China received in 1998 alone (Klein & Palanivel 2000).

There are some authors who are rather critical about the innovative capabilities of the Indian software industry (ibid.). The argument is that the major activity consists of data-entry, on-site project work (i.e. mostly in the US), or others placed rather low in the value chain (Arora et al. 2001b). India could excel with these activities as long as there exists a cost advantage. But these activities are becoming increasingly substituted by automatic processes. The relatively unimportant domestic market is usually identified as the major shortcoming (Bajpai & Shastri 1998).

On the other hand the quality of the software exporting firms is certified at high levels. Indian firms provided the largest number of ISO 9000 certified companies worldwide in 1998 (ibid.), and more than half of them today (Arora et al. 2001a: 1283). Moreover, they have the largest number worldwide of enterprises being certified by Level 5 of Carnegie Mellon University's Software Engineering Institute (SEI) Capability Maturity Model (CMM) (Bajpai & Shastri 1998) and recently Wipro Technologies has become the first company to obtain both Level 5 of the People Capability Maturity Model (PCMM) and CMM-SEI (Yue et al. 2001).

Even if the export performance is overstated, as some argue (Parthasarathi & Joseph 2002), and individually disappointing results lead to falling share prices, this is in sharp contrast with the rest of the economy. Since independence more than 50 years ago the Indian economy was growing at merely 3,5% the so-called 'Hindu Rate of Growth' that implies 'deep cultural factors' (Bhagwati 2001).

2.4.2 Results of interview data

Certainly, there is no doubt about the purely economic factors that have contributed to the successful evolution of the Indian software industry. It seems quite obvious, for example, that the liberalization initiated in the 1980s and accelerated to a certain extent in the first half of the 1990s has made its contribution. However, regarding the software industry which reached a critical size only in the 1990s, one finds a relatively uneven distribution of its locations. Basically it is clustered in three south Indian regions, i.e. Bangalore, Hyderabad and Chennai (formerly Madras), as well as the west Indian cities of Mumbai (formerly Bombay), Pune and Ahmedabad, and around the capital New-Delhi.

Thus the question that is addressed here is why some regions, largely in the southern (and western) parts of India, are more successful than their counterparts in the rest of the country. The hypothesis is that beyond economic and geographical aspects cultural influences come into play and have not a negligible impact upon the economy. These cultural influences are approximated through the variables geographical and social origin of the persons interviewed.

The approach is a very simple, qualitative one looking at the interview data of previous studies of the Indian software industry. The studies analysed are Tschang (2001), Saxenian (1999), Bajpai & Shastri (1998) and Arora et al. (2001b). There are no econometrics employed, but this should be done in future research. Not even correlations were tested for the number and clarity of the data was not entirely satisfactory. All that happened was calculating frequencies based on the variables location, social and regional background or origin. What follows are the first preliminary results.

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.

Almost all studies claim to cover the entire software industry and do not specify a certain regional focus. However, analysing the interview data of these studies one

finds a bias towards South Indian (and, to a lesser extent, West Indian) locations as the major centres of this industry. More than 90% of the interview partners came from firms or authorities in Southern or Western India (fig. 2.1). Of those more than 50% was from Bangalore and its surrounding state Karnataka (fig. 2.2). This finds support by a study from Richard Heeks (1998), but is in contrast with some of the studies asserting that Bangalore is not the centre of the software industry, but rather losing its former status as 'the Silicon Valley of India' (Arora et al. 2001a: 1272). Presumably, the industry is still in an early stage at which the distributional number of companies varies highly. Therefore the merit of being the number one location might change between Bangalore, Bombay and probably Hyderabad. Of course, there are the usual explanations of university-industry linkages with the Indian Institutes of Technology (IIT), the establishment of software technology parks close to the IITs, as well as historical circumstances which led to the initial localizations.

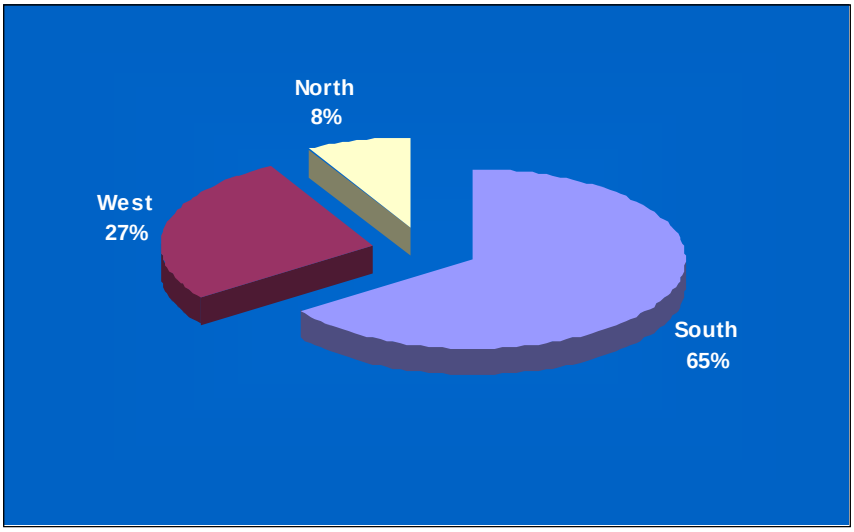

Figure 2.1: Regional distribution of interview partners in India
Sources: Bajpai & Shastri 1998, Saxenian 1999, Tschang 2001, Arora *et al.* 2001b

But, if one takes a closer look at the names of the interview partner there is another remarkable finding. As shown in the previous section there is still adherence to customary values and traditions in India, especially in the South. This phenomenon finds expression in the fact that one can ascribe the ethnic and social, but not necessarily the economic background of many Indians to their name (Deshpande 2002). This is done by the use of anthropological literature and

an Oxford dictionary with a supplement of Indian terms. Although the results seem to be very clear I must state that one has to be very careful with interpretation of these results.

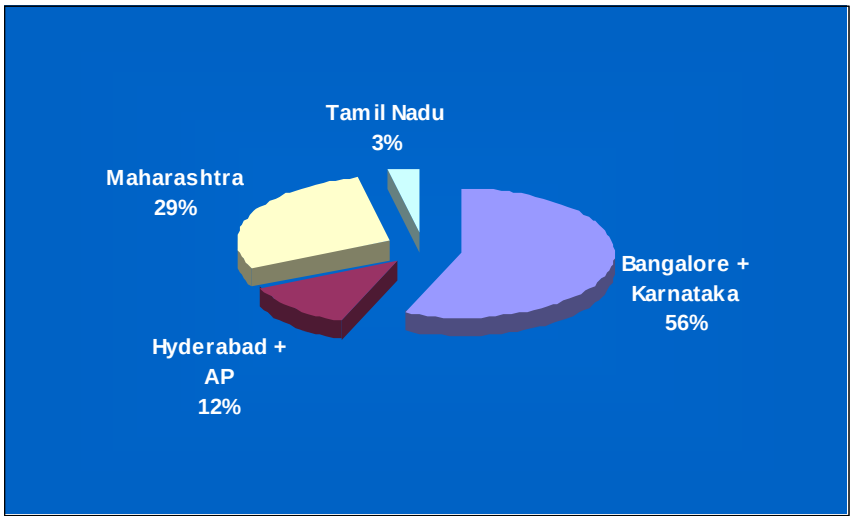

Figure 2.2: State-wise distribution of interview partners in South and West India

The findings for the interviews show that almost 70% of the interview partners are Brahmins, irrespective of the location within India (fig. 2.3). The ethnic background is somewhat less unambiguous with roughly 50% of the people interviewed being from South India and one additional quarter from the otherwise underrepresented Hindi heartland in the Centre North (fig. 2.4). However, there is again an overrepresentation compared to the share in the national population (table 2.2).

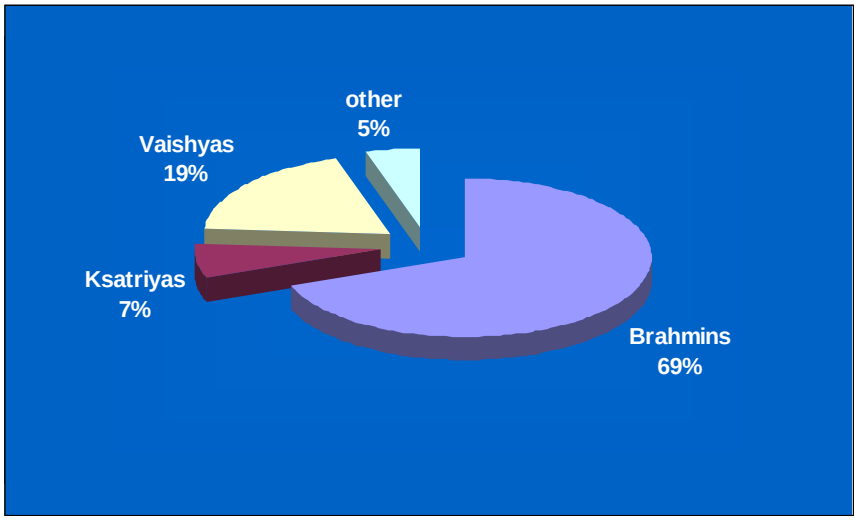

Figure 2.3: Social background of interview partners in India

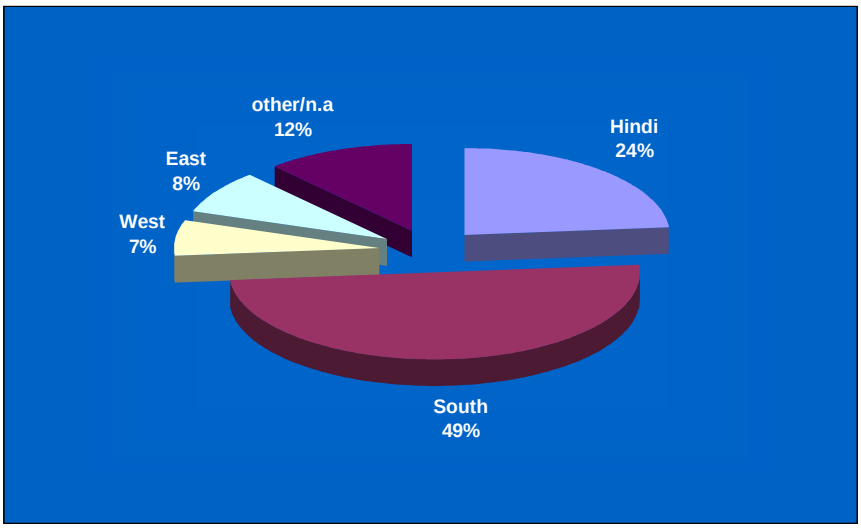

Figure 2.4: Ethnicity of interview partners in India

Table 2.2: Ethnicity of interview partners in Indian software industry and share in national population

Region of Birth	Proportion in the software industry[1]	Percent share of national population[2]	Percentage of "Over-/ Under representation"
South India	49	23,2	+111%
West India	7	19,6	-64%
North India	24	31,3	-23%
East India	8	25,8	-69%
Other	12	-	-

[1] Own calculations, based on Tschang (2001), Saxenian (1999), Bajpai & Shastri (1998) and Arora *et al.* (2001b)

[2] Source: Dossani (2002)

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 or family affiliation. These findings are enforced by the recent study by Saxenian et al. (2002) which highlights the importance of South India as a destination for determinedly planned investments and returns to their home country by Silicon Valley Indians.

Before I venture into a discussion, I should state once again that there needs to be much attention paid to it. The reasons are that the data is not complete and sometimes 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. To the same extent what follows for the ethnic background might simply be an eventual consequence. The historical factors reside 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 sensitive areas like defence and electronics. To qualify what has been said earlier, the southern centres are not the only, they seem to be the dominant ones. That is, there are STPs in North India, too, together with successful local firms and regional offices of south Indian companies.

What is more surprising, however, is the distribution of socio-cultural and ethnic descent. There have never in Indian history been so many entrepreneurial and managerial Brahmins as are seen in the software industry now. Generally speaking, Brahmins were rather associated with priestly tasks, government jobs, all sorts of administration and landholding. On the other hand, Brahmins as members of the priestly caste were always connected to all sorts of activities that are related to knowledge, learning and teaching. That might explain that they could be better suited to knowledge intensive industries like that of software (Das 2000; Zingel 2000). Moreover, the combination of the subjects emphasised by a brahminical syllabus seems to be especially apt for software programming, which requires not only mathematics but also language or grammar. In addition, even though few Indian software companies make software products or packages, the issue of codification is not negligible.11 Most of the firms are engaged in outsourcing from western or multinational companies. In order to effectively communicate between the two corporations involved, a common language platform is essential. Therefore, at least parts of the work must be done in a codified manner (Grimaldi & Torrisi 2001). Here, not only a particular

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

brahminical tradition of analytical and methodical thinking comes into play, but also the way Indian software experts are trained, i.e. according to the International Standards Organisation methodology (Nicholson & Sahay 2001) implying a high degree of codified knowledge. Vice versa is the software industry particularly suitable for Brahmins, for it is an industry where they do not run the risk of pollution, which has traditionally been a major concern of many Brahmins (Zingel 2000).

Then what is unexpected, too is the relative under representation of Vaishyas. As stated above, they have always been the entrepreneurial castes of the Hindu population (Dorin 2003). Although there have always been other entrepreneurs, too (Tripathi 1992), not even in combination with the Parsis and Jains do they make up for their usual share. While it seems plausible that there is a high percentage of Brahmins in the industry workforce the industry's leadership seems to be dominated by South Indian Brahmins too (Merchant 2002; Fromhold-Eisebith 2000). 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).

This also leaves unexplained why so little north Indian act as entrepreneurs in the relatively young software industry. An assumption could have been that they were lured by high profits into the southern regions. 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). But probably there are those who tried in the North and were just missed by the interviews.

Apart from the association with knowledge and learning there is another, socio-cultural factor that might explain the dominance of Brahmins in the South. As indicated in the previous section this is not an unambiguous one. Not being an indigenously Aryan-speaking population, South Indians were fiercely opposed to the Brahmin domination of the North. It has been argued that the non-Brahmin society was relatively homogenous which might partly explain that in South India there has been an absence of the two middle varnas. This absence in turn could have led to an even more dominant position of the Brahmins in the southern parts

of India, which was then compounded by land ownership and political power (Dirks 1996). The contradiction regarding industries like software is with the South Indian society apparently being more egalitarian in terms of traditionally opening knowledge to broader sections of the people as witnessed by a higher proliferation of education institutions in modern times. But this could eventually have become dominated by the political power of the dominant castes. 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 (see also Nafziger 1975). Such 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. It would be worthwhile undertaking some more research in that direction of analysing the networks of the IT industry that have been built through the educational system.

2.5 Conclusion

This chapter has looked at the success of Indians in the global IT industry from a new perspective. The view taken here suggests that beyond the economic and geographic factors that have been highly discussed elsewhere there is an important role played by cultural aspects. It has been tried to operationalise culture through a pair of variables. These variables are caste in the sense of varna as an aggregation of occupationally inherited jatis; and ethnicity. In spite of the shortcomings such an aggregation inherently possesses, there is some evidence that within India the traditionally assigned occupations are losing their importance. Nevertheless, caste continues to play its part in the society, primarily in politics. To a certain extent, the second variable ethnicity is correlated with the first, although through aggregation much of this connection is lost. This stems from the fact that the regional variations within the system of jatis are not reflected through varna. However, interpreting the two varnas most featured in the interview data, the Brahmins broadly as priestly and knowledgeable and the Vaishyas as those occupied with commerce and business displays a socially powerful result. The once dominant group of entrepreneurs has not retained its customary share in business in the evolving software industry, which is now largely controlled by Brahmins. This statement needs to be qualified for the small sample size and some

incompleteness of data in a few cases. Also, there might be an ex-post selection bias stemming from the concentration on the most successful firms in the industry in the South, overlooking social and cultural changes taking place in other regions. However, the results indicate a worthwhile direction for further research.

Summarizing it can be said the rise of the software industry in South India stems from a combination of a broad human capital base and the geo-physical circumstances, at least in the case of Bangalore, stimulating government policies, which to a certain degree have been unintentional, and the involvement of Non-Resident Indians. But most of all, it appears to be the result of the generally more hospitable attitude towards education and learning in South India and the eventual development of an infrastructure in (higher) education. Also the software industry seems to be clearly dominated by South Indian Brahmins which, in turn, has some additional explanatory power regarding the spatial concentration of this industry. Moreover, geographical origin of migrants seems to play another important role, since most of the flows through the transnational networks are directed towards South India. Thus, it might become a positive feedback process thereby increasing 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 Hyderabad, with the competitive advantage for research-intensive industries in a knowledge economy.

As already mentioned this chapter is the first rather theoretical part of a larger project analysing the influence of socio-cultural influences on the evolution of the Indian software industry. Further research shall be undertaken to assess the impact of social networks among the South Indian communities in the software industry both within India and abroad. We have already interviewed the management of Indian software firms in Frankfurt and found only limited evidence of networks and collaboration, probably due to the primarily marketing functions of these offices. It is planned to conduct semi-structured interviews with company executives as well as university faculty in Bangalore at the end of 2003. The result that is expected would be a process of social networking starting at university or college level thereby supporting the cultural influence argument. These networks are supposed to encourage entrepreneurship by both faculty members and

employees of larger, often multinational companies through mutual support and cooperation. Hence innovation in the IT industry would be located to a large extent at the research level. If this holds true it would be no surprise that South India has such an influence on the concentration of the Indian software industry, since the number of education institutions is much higher here. However, this would implicitly stress that software is primarily a people-centred business and, again, place relatively little emphasis on other 'hard' locational factors.

Notes

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Chapter 3

Local Clusters, Ethnic Networks and Diversity in Global Knowledge-based Industries: an Exploratory Study of the Indian IT Industry

Local Clusters, Ethnic Networks and Diversity in Global Knowledge-based Industries: an Exploratory Study of the Indian IT Industry*

Abstract

Entrepreneurship is often clustered geographically, but emerging market entrepreneurs often lack the demand from sophisticated and demanding *local* buyers common in mature economies. To understand how industries such as Indian IT could excel globally this paper explores the interaction between location and networks to bridge this geographical distance. It is inductive and uses mainly qualitative data from India to develop propositions on local and non-local networks of clustered firms. Its main contribution lies in the inclusion of ethnic networks as a unique type of social networks. Preliminary findings include the usefulness of ethnic networks for clusters and firms in clusters.

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3.1 Introduction

This paper combines three striking features of recent global economic development in one main theoretical question. Firstly, entrepreneurship is a rising phenomenon in emerging markets: India, for instance; according to the Global Entrepreneurship Monitor holds the second place in the Total Entrepreneurial Activity (TEA) index among 37 countries in the world (Manimala et al., 2002). Secondly, the Indian IT industry attracts increasing scholarly interest, with software as a major investment target of venture capital (VC), as well as the most active sector in the Indian economy. This paper explicitly focuses on the analysis of geographical concentrations of IT industry and the co-evolution of supportive socio-institutional conditions. Thirdly, this is interesting because these Indian IT clusters have developed far away from their main demand markets. It is primarily the last issue that makes this a highly relevant and theoretically intriguing case study.

A steadily increasing number of Western firms from various industries enter firm clusters in emerging markets like the Indian city of Bangalore to benefit from the capabilities locally available at a fraction of the cost in their respective home countries. It is doubtful that cost advantages can be sustained after more than a decade of such off-shoring and outsourcing, in particular when one employs a more dynamic perspective; cost differentials alone seem to become eroded rather quickly. In fact, it is less the cost savings than the benefits of locating in a cluster that attracts firms. Therefore, these clusters and firms in these clusters must be able to offer something beyond cost advantages.

The purpose of this study is to uncover the links through which firms in a cluster that is distant from the main market gain access to important interaction with customers and maintain a competitive advantage. From the firm perspective, this is relevant for at least two reasons. Firstly, what kinds of network are important for high-tech firms in industries like software? Secondly, and related to the first, how can a cluster of firms emerge and prosper without sophisticated local demand?

It is well established that industry clusters have a competitive advantage for the firms located there (Porter, 1990; Tallman et al., 2004). Surprisingly, Bangalore is

successful without a high degree of typically local knowledge flows. How can an industry cluster be successful if most of its turnover is exports? Interweaving interview material with archival and quantitative sources, empirically grounded research combines perspectives from business and other social sciences that build on network rationale - exemplified in the Indian IT industry and sub-sectors thereof. My arguments are based on and contribute to different theoretical literatures.

One main component of a cluster – per definition – is close interaction with the customers. In the case of local (or regional) demand, local networks are one of the conduits of knowledge transfer as a major competitive advantage of clusters. Firms located in a cluster away from the main markets do not necessarily compete for the same customers, at least not as fiercely; their main competition is for input factors and resources (Baum and Mezias 1992). Thus, a location not proximate to the market reduces competitive effects, thereby positively enhancing the beneficial agglomeration effects of a cluster.

On the other hand, in a cluster located away from the market there must be some other mechanisms that provide for this interaction. In fact, these networks become more important the further away firms get from the market. Ethnic networks as one form of social networks can play this role. They seem to be particularly suited for non-local networking since the shared experience necessary to breed trust can hardly be higher than through a common origin. In most network studies, the net value of a network structure configured by closure vs. structural holes is usually determined as benefits less cost of creating and maintaining the relevant ties. Here we argue that ethnic networks are latent in the sense there is no upfront investment required in order to ‘create’ a tie. Hence, the value of ethnic networks immediately becomes much larger.

The rest of the paper is structured as follows. The next section describes methods and research design. Then, the main theoretical part reviews literatures on clusters, demand and networks, respectively, and develops propositions on each one. The paper ends with some summarizing conclusions.

3.2 Methods

This paper uses a mixed methodology by combining the grounded theory approach of an exploratory study of firms clustered in one metropolitan region (qualitative interviews and historic accounts) with quantitative data (industry statistics etc.) The former includes semi-structured interviews conducted at the premises of firms, educational institutions and government bodies in Bangalore during the Winter of 2003. The latter consists of content analysis of primary and secondary materials at firm, industry and regional level.

Between November and December 2003, I visited the Indian Institute of Science, Bangalore and conducted 36 interviews – 23 with private firms, 8 with public sector units, and 5 with universities; 3 double counts due to multiple affiliations of one contacts were cancelled out (see table 1). Sample selection was designed to reflect both randomness and networks. (However, an element of chance, spontaneously bumping into people working in the IT industry - which is almost unavoidable, being in Bangalore for one month – helped in understanding the context and constructing the propositions). The random sample is used in order to obtain a differentiated picture of the Indian IT industry in Bangalore, and has been selected from a directory of the National Association of Software and Services Companies (NASSCOM). The diverse nature of predominantly small and medium companies (SMEs) but also multinational corporations (MNCs) of both Indian and foreign ownership is reflected through this selection. Among the Indian companies, some large firms complement the medium and very small companies that are represented. Moreover, there are hardware and software companies, in both service and product sectors of IT. A chain of personal contacts through networks was used where it is necessary to learn from key decision makers (Bewley 2002).

Most interviews were conducted at the interviewee's office. However, some were more informal, visiting people at their homes, or meeting them in a coffee shop. Three interviews were arranged spontaneously, meeting people on the campus of the Indian Institute of Science or at private socializing events. 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 conduct the interviews in a semi-structured way, instead of going through the

set of questions one by one; this left considerably more time and space for open answers on the part of these industry insiders. Bewley finds that "respondents were most informative when they talked freely and the discussion wandered". I used a questionnaire of more than 30 questions as a guideline to the interviews. The questions addressed issues related to general company information, employees and recruiting, local networks, regional networks and international networks, and policy. In general, all topics have been covered in these open discussions.

Table 3.1: Composition of interview partners

		Firms	**Public Sector**	**University**
Indian	SMEs	**15**	**8**	**5**
	MNCs	**2**	**-**	**-**
Foreign	SMEs	**2**	**-**	**-**
	MNCs	**4**	**-**	**-**

The qualitative evidence from 16 semi-structured interviews with senior executives of Indian SMEs and MNCs in Germany conducted in Frankfurt between October and November 2002 complements the findings from Bangalore, and was used to triangulate information gathered on international dimensions of networks.

3.3 Theory and hypotheses

This paper focuses on two key elements of most agglomeration theories, which are related to the knowledge spillover argument – the role of networks and of 'sophisticated and demanding buyers' (Porter, 1990: 89). Agglomeration theories, mainly in economic geography, but also in International Business (Tallman et al., 2004), organization theory (Baum and Mezias, 1992) and, more recently revived in strategy (Folta et al. 2006) do explain cluster evolution, and implications for

firms. Given the multi-faceted approaches to agglomeration phenomena, the diversity of explanations comes as no surprise. Factors contributing to firm clustering include knowledge spillovers, factor market pooling, lowering consumer search costs etc. (Porter 1990).

3.3.1 Entrepreneurship and clusters

Most of the literature on entrepreneurship and clusters is mainly concerned with advanced economies, therefore this review will be mainly confined to these countries as well; differences from emerging markets will be added below focusing on the Indian context. It is not possible to cover all the relevant literature. Nor do I intend to debate the virtues or otherwise of other approaches to the same issue; here the goal is to bring together developments from the related literatures of the economics of location and entrepreneurship. There is no consensus in the literature about what entrepreneurship actually is. Theoretical positions range from risk taking to merely founding a new venture, whereas some agreement has been established about the individual micro-level nature of the entrepreneurial process (Carroll and Khessina, 2005). In this paper, I do not wish to delve into this theoretical discussion, but rather employ the narrowly defined notion of firm founding. There is considerable evidence in extant literature suggesting that such firm founding is regionally concentrated in clusters. This concentration of entrepreneurship is more than proportionate for industries engaged in knowledge-intensive activities (Audretsch and Keilbach, 2004). Sorenson and Audia (2000: 426) maintain that, “dense local concentrations of structurally equivalent organizations increase the pool of entrepreneurs in a region, thereby increasing founding rates”.

Most work on agglomerations, be it in the cluster tradition, or in other related strands, emphasize the role of local networks (formal and informal) and the role of user-producer interaction: in other words, the role of demand in quantitative and qualitative terms as an important positive factor for the innovation potential of the cluster. However, more recent research also stressed the importance of non-local linkages for clusters (Britton 2004) and possible upgrading of clusters (Grote and Taeube 2006).

According to traditional location choice theories – mostly developed in relation to manufacturing industries – firms were expected to locate either close to their customers or their suppliers in order to minimize transport costs; services were so-called 'non-tradables', therefore they had to be 'produced' at the locus of consumption. Nowadays, many services have become 'tradable', i.e. they can be transported, often because it is possible to digitize them, such as in the case of software. Therefore, options for location choices become much wider, theoretically 'production' of services can happen anywhere. One such option seems to be the tapping of resources in clusters in order to benefit from a variety of received cluster benefits.

Clusters are established in the literature as important places for learning, innovation and economic development (Romanelli and Khessina, 2005). Different agglomeration theories such as Porter's (1990) cluster, the industrial district, the innovative milieu or the learning region commonly emphasize a regional concentration of firms, in most cases SMEs, and supporting institutions. Besides the traditional Marshallian externalities, external economies like knowledge spillovers (Almeida and Kogut, 1999) derive from collective efficiency, social capital or some other form of social cohesiveness (Uzzi, 1997).

Hence, one would expect higher value-added activities to be localized in those existing clusters exhibiting features such as labour markets with experience specific to the requirements of foreign firms. In particular, the knowledge residing within a cluster is a target of firms entering that cluster. However, in this case, the goods or services offered – software – is mobile and has very low physical transportation costs. Although one could argue that labour is relatively mobile in the service sector – even more so in high-technology industries like software – capital is still the input factor with the greatest mobility. This localness of human capital is responsible for knowledge spillovers – theoretically the most interesting yet under-researched agglomeration mechanism. Bangalore is home to the highest number of engineering schools and students, both absolute and relative to the population (see table 2). In Bangalore, like in other technology clusters, human capital is the most important factor, in particular engineering talent. An intuitive agglomeration channel is the local concentration of the labour market, since it is easier for both parties to find the matching counterpart, if both are located within

the same geographical boundaries; even with the rise of the internet search costs can never be fully eliminated. Hence, a concentrated labour market serves to reduce uncertainty for supply and demand of labour.

Table 3.2: 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)

Nevertheless, economics of clustering are not sufficient to explain the positive impact on innovation of geographic proximity. Economic geography has broadened the range of concepts of proximity used by including social, organizational and cultural proximity, among others (Boschma 2005). In fact, it is claimed that geographic proximity per se is neither a necessary nor a sufficient condition for collective learning (van Dijk and Sverrison 2003). However, it facilitates other forms of proximity to develop and thereby strengthens interactive learning and innovation.

This paper shares some similarity with recent studies that combine cluster level with firm level processes. But whereas other scholars (e.g. Giuliani, 2005; Tallman et al., 2004) explicitly theorize the knowledge bases of firms as heterogeneous, the focus here is on the diversity of individual employees in firms

and the access of firms to the ensuing heterogeneous knowledge bases. Another difference is this paper's emphasis on non-local network relations compared to others that focus on intra-cluster relations. Giuliani (2005) finds knowledge spillovers to be unevenly distributed among firms in a cluster. In other words, the benefits of clustering differ between firms, depending on relative absorptive capacity of firms in a cluster. Similarly, Alcacer (2003) shows that most advanced firms do not locate in a cluster in order to prevent knowledge leakages. Hence, we expect firms conducting R&D not to co-locate with less sophisticated ones. One foreign firm for instance, engaging in R&D for various sub-units, operates in so secluded a manner that it was not even possible to get in contact with this firm. Oerlemans and Meeus (2005) find geographical proximity, i.e. co-location to improve firm performance in R&D-related networks in the Netherlands relative to firms with little or no ties to buyers and suppliers thereby supporting the knowledge spillover argument. Analyzing Canadian information technology firms, Globerman et al. (2005) obtained strong evidence of locational clustering effects on firm growth, but less on survival.

Two clarifications are important for an understanding of the Indian context. Firstly, since most of the Indian IT industry consists of software services firms, it might be useful to have a broad conceptualization of innovation: in this context, innovation must extend beyond product innovation to include mainly process innovation; but one should also include organizational innovation acknowledging the role Indian IT firms have played in the diffusion of new organizational forms. Secondly, one should know that the 'Indian' software industry can also comprise a host of MNCs located in various Indian technology centres, most importantly Bangalore. Using this definition, the IT industry in India has put forward some innovative products.

The secluded R&D-intensive foreign firm mentioned above is at the top end of knowledge-based firms; and the higher the degree of knowledge used in 'production' the higher the risk of knowledge leakage to the cluster. Based on empirical evidence from fieldwork, I maintain that in sub-sectors of IT that are more knowledge-intensive, i.e. software products or hardware, the degree of local networking is reduced to minimise the risk of leakage. On the other hand, when

the risk of knowledge leakage is relatively low, like in software services, there is a higher degree of local networking. Thus, we develop the following proposition:

Proposition 1 (P1): The more knowledge-intensive an industrial sector, hence the higher the risk of knowledge leakage, the lower the degree of local networking.

3.3.2 IT clusters in India: does the Indian context differ?

There are factors that seem to be idiosyncratic to different institutional contexts of emerging economies; some of them might even be special in the Indian case. One idiosyncrasy of the Indian IT sector is that the starting years domestic markets were not targeted; orientation of IT entrepreneurs was initially almost exclusively towards foreign markets. Moreover, entrepreneurs of these firms are found to be young and, hence, their intrinsic motivation a critical factor to rely on. There is ample evidence of emerging economies with underdeveloped product and factor markets exhibiting parallel or informal economies and scope for large integrated conglomerates (Khanna and Palepu, 2000; Ahlstrom and Bruton, 2006). The motive put forward by Sorensen and Audia (2000) seems to have particular relevance in an economy in which the institutional framework seems different in terms of social safety nets. Here, social networks play an even bigger role. Findings from my fieldwork suggest an important role of socio-institutional factors for the emergence and growth of the IT industry as well as its geographical distribution. Two key factors, as mentioned by my interview partners are openness and diversity of a society:

> "one of the most important location factors is the very cosmopolitan nature of the city" (Co-Founder and COO, Indian SME)

> "cosmopolitan nature has created mentality to connect with foreigners" (Director, Indian SME)

> "innovation happens when there's a high level of diversity" (co-Founder and Director, Indian MNC)

Diversity and openness are among the most crucial location factors for knowledge workers of the creative class (Florida, 2002). Florida, taking a multivariate measure to test for location factors relevant to Bohemians, he calls it the three T's – technology, talent and tolerance. In this work, I will specifically look at the correlation between technology, on the one hand, and some indicators of talent and tolerance on the other. While talent is relatively easy to assess given the data in India are much better than in other emerging economies, it becomes more difficult for tolerance. Openness at the firm level is inasmuch a necessary condition as a constant inflow of new knowledge and ideas is necessary in order to maintain a certain degree of innovativeness (Laursen and Salter, 2006). A cluster with a culture of openness helps each firm in it, because knowledge diffuses once it has entered the cluster through one firm (Tallmann et al., 2004). Openness has been found to impact the overall climate of a location together with other amenities (Florida, 2002). According to my interview partners, Bangalore is

> "a place high tech professionals want to be part of" (CEO, MNC Spin-off, product company), with the
>
> "Quality of life at heart in IT" (Co-Founder and Director, Indian MNC).

3.3.3 Local and global market demand – and openness

Sophisticated and demanding buyers (Porter, 1990: 89-91), similar to 'lead users' (von Hippel, 1986), play a key role in most prominent formulations of cluster theories. They are supposedly an integral component of a successful cluster. Geographical proximity to such lead users is supposed to enhance innovation capability though increased interaction. The argument relates to knowledge spillovers found on the supply side of cluster theories, and can be linked to both market and technological knowledge. From this perspective, it is paradoxical for the Indian IT industry to have almost no local or even national demand – certainly not initially when clusters started to emerge and evolve and only to a negligible extent once clusters matured. This is even more surprising given the fact that the Indian IT industry in the early years consisted basically of customized software

project firms. On the one hand, their so-called 'body-shopping' moderated the effect of a lack of local demand; programmers were simply flown to the sites of a firm's customers (usually in the US). On the other hand, then, it remains startling why so many firms chose the same few locations in distant India, with the majority locating in Bangalore.

In industries where a product or service is easily transportable because it is digitizable, one could expect a decrease in clustering compared with manufacturing sectors. Nevertheless, in spite of the ease of transportability, and the implied dispersion of industries we do still witness a high degree of clustering in high-tech industries (e.g., Stuart & Sorenson, 2003; Tsang, 2005). Yet for Bangalore an important missing component is the absence of producer-user interaction, with users as a relevant source of innovation (von Hippel 1986). Given the absence of the demand side in Bangalore, explanations for a clustering in software must either lie with the supply side or with information channels connecting to the non-local demand. In this paper, I emphasize the latter aspect. Indian IT firms usually have other firms as their customers, but there is no convincing argument for why corporate customers should have less relevance to new product development than end-consumers. In some industries, communication with users is possible over a distance; and, in fact, this was the case in the customized software development business of the early years of the Indian IT industry. Recent evidence shows that geographical proximity and face-to-face communication are not enough to stimulate innovation-generating knowledge exchange; the more relevant knowledge rather comes through relational ties (van Dijk and Sverrison 2003), for instance, face-to-face or email (Ganesan et al., 2005). While initial site visits probably were always necessary, in later stages of many projects the physical distance between firms and their customers might well have been overcome by other forms of proximity.

In an industrial cluster where knowledge is a valuable and scarce resource, access to novel sources of knowledge is a competitive advantage. The focal firm is the primary beneficiary from access to wider networks – and the entire population of firms in this cluster benefits through the circulation of new ideas within the locality. In order to allow for such an inflow of new ideas, clusters are expected to have some degree of openness to be successful on a sustainable basis (Laursen &

Salter, 2006), even more so for clusters which have to bridge the distance to the non-local demand.

Proposition 2 (P2): successful clusters without local demand are expected to have a higher degree of openness towards new ideas.

One such source of openness in a traditional and masculine (Hofstede, 1980) society like India is the attitude towards women (Kantor, 2002). Analyzing female university enrolment rates of 13 large Indian area-states, the mean of female enrolment percentages in South and West India (45.08%) is higher than in North and East India (37.62%); in fact taking only South and North the difference increases to 46.32% compared to 33.89%. In addition, the variance is much lower in the South and West (7.63) compared to North and East (8.80), too. Again, this difference is slightly higher comparing only South (9.45) and North (10.70). In other words, except for one state in the North (Punjab), one finds the highest percentages for female enrolment in the four states of South India – Andhra Pradesh, Karnataka, Kerala, Tamil Nadu – plus the two West Indian states Gujarat and Maharashtra (see table 3), i.e. those states where the lion's share of the IT industry is located.

Nevertheless, in all networks (local and non-local, face-to-face, phone or online) there is one common concern to address in every transfer of knowledge or even information: how trustworthy is the source of this new information? Presumably, trust in online communities where both ends of a communication link are initially unknown to each other, is much more difficult to establish than in 'real' communication. The latter has the advantage of additional means of signalling and monitoring, e.g. body language, voice etc. However, this issue of trust will be dealt with below.

Table 3.3: State –wise female enrolment

Female percentage of state-wise student enrolment (2002-2003)			
South (S) and West (W) India		**North (N) and East (E) India**	
Andhra Pradesh (S)	39,3	Bihar (N)	23,81
Gujarat (W)	44,21	Haryana (N)	41
Karnataka (S)	40,86	Orissa (E)	35,69
Kerala (S)	60	Punjab (N)	52,68
Maharashtra (W)	41	Rajasthan (N)	32,33
Tamil Nadu (S)	45,1	Uttar Pradesh (N)	38,4
		West Bengal (E)	39,4
Mean South & West	45,08	**Mean North & East**	37,56
Mean South	46,32	Mean North	37,57
		Mean North (excl. Punjab)	34,55
Variance	7,63	**Variance**	8,80
Variance South	9,45	Variance North	10,70

Source: Own calculations, based on Kapur and Mehta (2004)

3.3.4 Networks and Diversity

Taking a network perspective on industry clusters, one must consider a host of factors; however this paper is not intended to review the network literature. In principle, the benefits of different network relations or structures have to be distinguished but for the present study, conceptual basic differences and similarities (strong vs. weak ties, dense vs. loose networks etc.) should suffice. Ahuja (2000), for example, identifies three types of social network structures that have differing effects on innovative processes in firms: direct ties, indirect ties,

and structural holes. Dense networks of direct ties give the focal firm access to knowledge and resources and the same applies to firms in a dense network of indirect ties, although to a lesser extent. On the other hand, networks characterized by structural holes, i.e. focal actors in a network with non-redundant ties that bridge previously unconnected actors (Burt, 1992) provide focal firms with the benefit of increased information and knowledge flows (Ahuja, 2000). In the related stream of organizational learning literature, these networks are related to exploration and exploitation of firms (March, 1991). In order to learn, diverse and heterogeneous networks serve firms best.

In this paper, we focus on the knowledge and information spillovers networks can provide rather than the resource-sharing aspects of social networks. Ahuja (2000: 432) finds diametrically opposed conclusions regarding the relevance of structural holes depending on whether emphasis is laid on resource sharing or knowledge spillovers as the main benefit of a network. Moreover, in the context of this paper, networks are seen as relational rather than structural constructs, because the emphasis is on inter-personal networks as knowledge conduits (Grabher & Ibert, 2006). In regional development literature there has been a long debate about whether specialized (Marshall, 1890) or diversified (Jacobs, 1969) industrial structures better promote growth at the regional level. In both cases, a major channel for information and knowledge flows is through formal and informal personal networks (Tallman et al., 2004). At the firm level the corresponding argument is that diversified firms can have access to broader or multiple knowledge bases, thereby increasing innovative performance; on the other hand, diversification can also imply greater bureaucratization, hence a reduction in innovative output (Ahuja, 2000: 445).

Analyzing the geographical nature of knowledge spillovers, it is well established that they are almost always confined locally, or regionally at most (e.g. Audretsch and Feldman, 1996). McEvily & Zaheer (1999) find that firms in geographical clusters with fewer non-redundant ties (structural holes) acquire fewer competitive capabilities. A distinct feature of geographic clusters conferring a competitive advantage to firms within the cluster is the increased flow of information through a higher frequency of both formal and informal meetings. Thus, the questions arise, whether and how firms should try to tap non-local sources of knowledge.

The first is easily answered by deduction: given that a more diverse network is beneficial for learning processes both at firm and cluster level, the number of (outside) ties should increase the knowledge stock within the cluster and hence for all the firms located there. Even more so, when outside knowledge e.g. pertaining to non-local demand is unavailable otherwise. In the context of technological knowledge, this might be acquired by firms through exploration beyond local search. Explicitly including the geographical dimension, alliances and mobility of inventors are useful mechanisms (Rosenkopf and Almeida, 2003).

In addition, the knowledge relevant to these firms ideally comes from lead users. Given the nature of Indian IT, their corresponding networks would be rather non-local. Therefore, trust becomes an issue again. On a local level, trust building can be achieved through assimilation (Marini, 2004) by investing in embedding in localized social networks to benefit from the legitimacy of a population.

Maskell (2001) provides an excellent explanation for why spatial clustering cannot be inferred from a reduction in transaction costs alone. His contribution towards a 'knowledge-based theory of the cluster' asserts that internalization alone would result in single firms benefiting from resources, including knowledge, available in the cluster. But it is the variation in the knowledge bases of a multiplicity of firms that gives the cluster its competitive edge.

Transfer of tacit knowledge needs communication channels that are based on proximity and trust (Dosi, 1988). Potential channels for this kind of knowledge transfer are alliances and the mobile researchers and scientists (Rosenkopf and Almeida, 2003) which are instrumental for firms gaining competitive advantage.

This learning is assumed to happen through spillovers that can take place through "both formal and informal interactions by firms and individuals in networks" Mahmood & Rufin (2005: 342). "People almost always have more, more diverse, and stronger ties to contacts in the geographic region in which they reside. This suggests that the form of social capital most valuable in the resource mobilization process is to a large extent a geographically localized currency." (Stuart and Sorenson, 2003: 249)

Diversity is a broad and ambiguous concept, with at least three aspects to it: variety, separation, and disparity (Harrison and Klein, 2007). Diversity can also be

technical or cognitive, both of which reinforce each other. Whereas diversity in the sense of variety confers benefits to the group analyzed, separation and disparity are rather detrimental to a group's effectiveness and efficiency. The benefits of diversity in terms of a diversified industrial base in a region (Jacobs, 1969), different educational backgrounds or gender in teams is relatively straightforward (Visser and Boschma 2004; Harrison and Klein, 2007).

Evidence grounded in our fieldwork shows that for hardware and software product firms, network relations seem to be more crucial in the knowledge spillover realm, which conforms to the findings of Britton (2004). Regarding the sourcing of knowledge, von Hayek (1945) has established the fact of dispersion of knowledge in society. Thus, access to multiple entry points of the knowledge base is beneficial to firms dependent on a multitude of information and knowledge.

Proposition 3 (P3): For firms in knowledge-intensive industries, having diverse network ties as sources of ideas is more important than specific types of diversity.

3.3.5 Ethnic Networks

The benefits of diversity in terms of ethnicity are less straightforward than in other types of diversity. Moreover, ethnic diversity has not yet played a prominent role in network theory. However, taking the step from knowledge spillovers to idea generation and learning makes this much clearer. Here, the distinction between technical and cognitive comes into play; whereas the former is almost a necessary condition of learning, the sufficient condition for "[…] learning requires an act of will - a conscious decision to deviate from one's preferences, to collect and process new information, and to change one's perceptions of how the world looks" (Visser & Boschma 2004: 794). In a context of mental models, one can distinguish between first-order and second-order learning; whereas the former consists of learning within one's established cognitive context, or mental model, the latter implies changing a mental model due to communication with others. First-order learning is thus described as small error-eliminating learning, while second-order learning generates more radical product or process innovations.

The benefits of ties across different ethnicities, or people from various regional backgrounds, are that people in different regions develop different cognitive structures (Visser & Boschma 2004: 796; Johansson, 2004: 47). Ethnicity and hence ethnic diversity are ambiguous concepts; in social science 'ethnicity' or 'ethnic group' has increasingly been used to identify people according to their cultural instead of biological similarity of race (Tsui-Auch 2005).

Depending on the level of interaction with other people anthropologists have found a 'contingent dynamic and relativity of structurally opposing groups' based on Evans-Pritchard's (1940) analysis of the Nuer; in other words, people usually feel closer to ever more distant groups the further they are from their home environment.[1] In the case of India: when abroad Indians might identify themselves as Indians, but in a place like Silicon Valley with many other Indians, they might resort to regional differences; and when in India they will probably use an even more fine-grained self-identification based on, say, language or dialect. Hence, ethnicity is a multi-layered concept, and assuming intra-ethnic homogeneity can only be justified at more grounded levels but not, for example, at the level of 'being Indian'. Using such a broad construct of ethnicity and co-ethnicity, Agrawal, Kapur & McHale (2004) find evidence for stronger knowledge flows between co-inventors sharing 'Indian' ethnicity.

There are only few studies on ethnic Indian sub-groups (Taeube, 2004), particularly compared to overseas Chinese networks (Tan, 2002); e.g. on ethnic entrepreneurs in Singapore (Tsui-Auch 2005), Punjabi and Gujarati immigrants in London and Chicago (Frederking, 2004; Basu & Goswami, 1999), Gujaratis in Texas (Kalnins & Chung, 2006). Interestingly, kin-based networks simultaneously provide extensive and strong ties (Lin, 2001: 110). Arguably, the strength of such ties is rather latent, particularly in societies like the Chinese, Indian or other Asian ones where the concept of family extends beyond the core family. In these societies, there are no grounds for assuming a generally strong connection between all members of the same kin let alone the same ethnicity. Hence, they combine the positive features of a network characterized by both cohesion and structural holes. Therefore, such kin, and to a lesser extent all ethnic networks,

[1] Thanks are due to anthropologist Prof. Burkhart Schnepel, formerly at the University of Frankfurt, who pointed this out to me.

allow for the inflow of filtered (i.e. trustworthy) information and knowledge into a localized cluster. Ethnic network ties confer at least two advantages to a population of firms in an industry or cluster. Firstly, it provides those in a location distant from important markets with the relevant information and knowledge on consumer needs; secondly, this information and knowledge has already passed social filter and screening mechanisms.

Proposition 4a (P4a): Ethnic network ties are *more reliable conduits of information* than other networks characterized by structural holes.

Proposition 4b (P4b): Ethnic network ties are *able to channel thicker information* than other strong ties.

From these two propositions we can infer an additional advantage that an ethnically diverse labour force has for clusters and firms located in clusters: it guarantees access to a diversity of ideas and knowledge that went through the screening processes of ethnic networks (Alesina and LaFerrara, 2005; Ottaviano and Peri, 2006).

3.4 Conclusions, limitations and further directions

Entrepreneurs in emerging markets often face the problem of little knowledge about the demand side that is located far away. This exploratory paper is a first step towards an understanding of the links between knowledge-intensive industry clusters without sophisticated local demand and social networks. Based on inductive fieldwork, it theoretically establishes propositions about clusters, demand interaction and ethnic networks and diversity. The latter are – by deduction – shown to be a valuable resource for firms in emerging markets located away from the main markets. The principal aim of the paper is to advance the literature by connecting theories of location choice and social networks in knowledge-based industries. Its main contribution lies in the integration of ethnic networks as a specific type of social networks. One preliminary finding is the

usefulness of ethnic ties, because there is a latency of trust to peers of one's own ethnicity as well as a broad reach through the global spread of these networks such as the Indian Diaspora. In other words, there are trustworthy connections to both these contacts and other non-local customers on the demand side. Therefore, ethnic networks combine positive characteristics of networks characterized by both cohesion and structural holes. Thus, ethnic network can support clusters without local demand by bridging structural holes and providing access to a larger pool of knowledge and information. By inference, ethnic diversity can enhance a cluster's knowledge base by increasing the number of beneficial ethnic network ties and allowing for a greater influx of different knowledge and ideas on the supply side. Further research into how such ethnic ties can be fruitfully used by the entrepreneurial firm seems worthwhile. In particular, emerging markets such as India and China seem to be able to benefit from their global Diasporas.

Obviously, this study has some limitations: similar to Stuart and Sorenson (2003) who confine their study to explaining the evolution of an industry in locales once a biotech firm has been founded, not why the first firm has been established there, my aim is not to explain the emergence but the subsequent development of a cluster. Another interesting question which is beyond the scope of this paper concerns the regional distribution of users (and their communities); are they as localized as firms are in many clustered industries – maybe even in the same location? Also, I ignore a host of other mechanisms at work, not because they are not important, but rather to sharpen the focus of the present theorizing, given its exploratory and interpretive nature. Such issues include a more nuanced investigation of export intensity (Britton 2004), the role of the global demand structure, the actual process of (local) knowledge spillovers, or a comparative study of multiple locations.

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Annex: Questionnaire for interviews in Bangalore, Nov.-Dec. 2003

General questions/ Company history:

1. Size, nationality and headquarter of company? Belongs to a particular business group (house) or other kind of subsidiary?
   (If yes, name, size, nationality and activity)
2. Foundation date and name of founder(s).
   Work experience or senior positions (domestic/abroad) of founder(s) in companies in the same/other sector?
3. Is the firm member of Nasscom and/or STPI?
4. What are the areas of the firm? Is there any specialisation? Are there products?
   (If yes, how many and which area?)
5. Are there quality certifications (ISO, CMM, or PCMM)?

Employees:

6. How many people work for the company globally? How many at this site?
7. How do you choose your personnel? There seems to be a preference for engineering graduates vs. private training institutes. Where does this preference stem from?
   What are the major sources of recruitment?
   a) Colleges in Bangalore
   b) Colleges in other Metros
   c) Professional Colleges in Bangalore
   d) Professional colleges in other Metros
   f) (Specify)
8. Is the entrance to an engineering school a quality certification (screening device)? Or are they better qualified for IT-related work?
9. Do you benefit from people having acquired knowledge in other (competitor) companies? Is there an attrition problem of losing staff to other firms (competitors or clients, for example, in the US)?
10. Are your employees often abroad (USA)? How prevalent is the return of US-experienced professionals?
11. Is there any dominance of South Indians? If yes, where might this come from?

Social Networks

12. Who are the persons you are in contact with (same industry, same university etc., same caste, public sector)? If possible, please name the most important.
13. What are the media for these contacts (e-mail, phone, face-to-face)? How intense are these (daily, weekly, monthly..)?
14. In case of personal contact, is there a formal occasion or is it rather informal?
15. Would you say there is more trust among a network of personally known people and with more intense contacts?

Regional Networks

16. Since when in Bangalore? What influenced the decision to locate here (originally from here, research base, technology culture, friends/family...)?
17. Did you consider the attractiveness of the city, e.g. coolness of the city's population diversity or climate for both employees and customers?
18. How would you describe the relationship with other local companies in your industry? Is there any collaboration or is it rather only competitive?
19. What are the effects of the local "pub culture"? Is it more a threat to lose staff or a gain through informal learning?
20. Does the networking within India go across ethnic boundaries as suggested for Silicon Valley by Saxenian (1999)?
21. For software companies: is there interaction with (financial) industry people, i.e. banking, insurance etc.?
22. What are the advantages/disadvantages of the location Bangalore? What is the importance within the group?
23. Do you consider a relocation due to disadvantages, for example, to Hyderabad?

International Networks

24. I would be interested in the relationship to Silicon Valley. Have you worked in the US? If yes, what was the purpose (foreign company, Indian company, own company)?
25. What is the influence of Multinational Companies (MNCs) on your strategic behaviour? Is there a direct relationship, either horizontal or

vertical (buyer-supplier or alliance/joint venture)? Are you part of a broader (global) value chain?

26. What are the main reasons to locate abroad (market access, comparative advantage...)?
27. What are the transmission channels to interact and lobby with Silicon Valley (counseling to MNCs, return entrepreneurship, venture capital)?
28. Do you feel some disadvantages due to the geographical distance to places like Silicon Valley? Is there some thing like a cultural proximity that can substitute for geographical proximity?
29. Without the geographical proximity generally perceived as a crucial input, how does VC work in a transnational setting?

Policy questions:

30. Is there any influence owing to the fact of having a government in opposition to the central government?
31. Might this have led to the formulation of state-level policies?
32. Do you see competitive locations as a threat? Does this spur further efforts by the Karnataka government?
33. Did you try to leverage a greater regional identification given the fact that Bangalore is a “border city”?
34. Do you see interaction and collaboration between Bangalore IT firms?

Chapter 4

Transnational Networks and the Evolution of the Indian Software Industry: *The Role of Culture and Ethnicity*

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Abstract
Despite the ongoing process of globalization, which seems all the more important for knowledge-based industries like software, clustering combined with international networking can be observed. But whereas regional networks have received attention in the study of clusters for many years, the impact of transnational networks has come onto the research agenda more recently. This paper seeks to address this issue, in particular how culture and ethnicity of individual actors influence the outcome of transnational networks through the mobility of these individuals, in the context of the Indian software industry.
The most important channel seems to be the interaction between Indian IT professionals, entrepreneurs and venture capitalists in Silicon Valley (SV) and India. The knowledge these overseas Indians have contributed to the Indian software industry has been dubbed 'brain circulation' or 'brain gain' as opposed to the brain drain bemoaned by developing countries some decades ago. This includes not only the tangible return of emigrants but, much more, the technical assistance provided to national and sub-national governments, as well as venture funding and business outsourcing within the network and the learning on-site software engineers experienced during their sojourns with companies in the US.
Thus, this paper analyses transnational ethnic Indian network connections and the information and knowledge transmitted. An important finding is that the transnational networks of Non-Resident Indians (NRIs) tend to be increasingly dominated by South Indians which corroborates the regional clustering of the Indian software industry in the South through a positive feedback process. Furthermore, the evidence suggests that in principle geographical distance can be overcome by other forms of proximity as regards the transfer of knowledge.

Keywords:
Transnational Networks; Culture; India; Regional Agglomerations; Industry Evolution

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4.1 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 in these industries? Is it rather influenced by other factors, probably generated – or released – through this liberalization, e.g. a regional culture of entrepreneurship and innovation? Or might there even be a predisposition towards the so-called knowledge economy? And what is the relevance of transnational network connections, with Silicon Valley (SV) in particular?

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, less 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 (D'Costa 2003; Balasubramanyam & Balasubramanyam 2000; Vijayabaskar & Krishnaswamy 2003) and emphasizing the influence of international networks (Dossani 2002; Kapur & McHale 2002; Saxenian et al. 2002).

The novelty of this chapter 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. These primarily non-economic variables translate into human capital through social capital and networks, and into foreign investment in India promoted by non-resident Indians (NRIs). Thus, the central hypotheses of this paper are that, firstly, some ethnic and cultural groups in India are more apt to socio-economic development in knowledge-intensive industries due to their higher appreciation of learning. Apparently there are diverse culturally rooted attitudes towards education and technological or economic change. It seems to be fruitful in order to understand the evolution of the Indian software industry, which appears to be dominated by South Indians and

Brahmins. 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. It is important to note that the actors in these transnational networks are mainly individuals, often groups, but usually not firms – even when analyzing multinational companies (MNCs). 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 network channels are examined.

It is one of the first attempts to add socio-cultural factors as explanatory variables for the geographic concentration of the Indian software industry. The roles of culture and ethnicity, reflected through social and human capital, are analyzed because many requirements necessary for a successful economic development like basic physical infrastructure are lacking in India. The rest of this chapter is structured as follows. Section II discusses theoretically the issue of transnational labor mobility through ethnic networks. Section III outlines a South Indian regional culture and section IV extends the discussion to the background of Indian immigrants in high-tech industries. Section V supports the findings with evidence from existing interview-based works. Section VI examines three different channels of transnational ethnic networks, Indian employees of multinational firms, Indian Venture capitalists and Indian entrepreneurs in SV. Section VII concludes.

4.2 THE RELEVANCE OF ETHNIC NETWORKS FOR TRANSNATIONAL LABOUR MOBILITY AND KNOWLEDGE SPILLOVERS

Knowledge spillovers are considered to be one of the most important factors for economic growth (Lucas 1988, Romer 1990). Most research is centered on spillovers transmitted between economic agents in a local or regional setting like cities or metropolitan areas. But in a globalising economy, internationally or translocally linked actors steadily increase in importance. This chapter 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 source 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 spillovers 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. Emphasis of this paper is clearly placed on the influence on spillovers through mobility of individuals, even in the case of multinational companies.

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 and proposes a taxonomy with four dimensions of space, economic, organizational, geographical, and cultural.[1] Moreover, he argues that organizational proximity can be a substitute for geographical and cultural proximity. 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 expectance of future mobility. It appears to be the case for high profile knowledge-intensive activities that professional and social networks 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 (Kotkin 1993; see also Ballard 2001, Das 2001, Lachaier 2003).

4.3 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). Economists arrived at the conclusion that the 'Hindu' attitude towards modernization and innovation impedes the modernization of the Indian economy (Akerlof 1976; Lal 1988), which is a misconception, since they were not acknowledging anthropological fieldwork (for a more detailed review see Taeube 2004). Recently, there is more than anecdotal evidence that new Indian enterprises are dominated 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; Lachaier 2003). 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 table 4.1).

Table 4.1. Number of engineering colleges and enrolment compared to population

Region	*Engineering colleges*[I]		*Enrolment*[I]		*Population*[II]
	No.	*National share*	*Capacity (no. of students)*	*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, in particular with regard to education do not only provide a foundation for a broader and more pronounced human capital base, but also increase the intensity of interaction in social networks. Moreover, the South Indian type of marriage on average leads to family circles becoming more close-knit from one generation to the next (Lachaier 2003). Thus, 'cultural proximity' is presumably more distinct 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 the positive feedback mechanism mentioned earlier.

4.4 INDIAN IMMIGRANTS IN HIGH-TECHNOLOGY INDUSTRIES

There is a lot of anecdotal evidence suggesting certain layers of the Indian society to particularly suit 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.[2] 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, India accounts for the biggest portion with more than 30 % of all the international students (Khadria 2001).

Regarding the focus 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. In a similar vein, a survey among 10,000 members of Indian and Chinese software professionals' associations in SV finds that 36,5 % of the Indian respondents come from the South while this region accounts for only 23,2 % of the Indian population. The Western part of India is also over represented (Dossani 2002). A plausible explanation for the dominance of South Indians is the localization of sensitive national research institutes. Bangalore has been an optimal location for the scientific research institutes established after independence for two reasons. First and most important, following the argument laid out in the previous section, the traditional standing of (higher) education and science. This is exemplified by the Indian Institute of Science, which has been established before independence and is deemed India's best research university (Dossani & Kenney 2002). Second, its mild and dry climate shows the necessary features required for this kind of research. Furthermore, 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 strategically established far away from the borders to both China and Pakistan (Lateef 1997).

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 (U.S. Census 1993; Saxenian 1999). Their Indian background is most often to be found in a South Indian Brahmin family and upbringing.

4.5 SOUTH INDIAN ECONOMIC CULTURE

The situation depicted for a South Indian economic culture together with the observations made among Indian immigrants to the SV are 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 is an analysis of four interview-based studies on the Indian software industry for spatial and socio-cultural clustering.

4.5.1 Data description

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.

Bajpai & Shastri (1998) have conducted 30 interviews with both company and government representatives in India alone. The information given in the appendix covers names and organizations of the persons interviewed. They use the information gathered through the interviews to supplement their case study. The basic intention is the formulation of policy recommendations supported by the industry sentiment.

Saxenian (1999) has conducted 167 interviews with a focus on immigrant entrepreneurs in SV. Therefore 100 interviews with engineers, entrepreneurs, venture capitalists, policy makers and other key actors have taken place in SV, of which 42 with Indians and the rest with Chinese. Moreover, 42 interviews with Indians have been carried out in the three Indian regions of Bangalore, Bombay and Delhi (and 25 in two regions in Taiwan) with local and national policymakers and business representatives. She provides information on name, function, organization and location of the interview partners.

Tschang (2001) uses case studies and secondary data to analyze the state of three types of firms within the Indian software industry: Indian offshore development centers, MNC development centers; and start-ups. The case studies are looking at skills and organizational capabilities of these firms through empirical interviews. He has interviewed 19 people active in the software industry, but the only information regards the function of the interviewees and a distinction between Government and Education, and Firms, but he does neither provide the names nor the location.

The most comprehensive information is found in Arora et al. (2001). After extensive literature research, data collection, a survey with over 100 Indian software firms, and discussions with industry experts, they chose various companies for their interviews. These firms included MNCs, large and small

software exporters, and firms focusing on the domestic market and others innovative software producers. They had 94 interviews with people from over 60 organizations in the Indian software industry, of which 70 in India and 24 in the US, at three points of time, between fall 1997 and summer 1999. They provide not only the names of the people interviewed for this project, but also the designation, firm and location. The interviews took place in Bangalore, Bombay and Hyderabad, each twice, plus Delhi, Pune and Madras. Interestingly, the only interviews regarding quality certification issues were in Bangalore and Bombay. Table 4.2 summarizes the different methodologies.

Table 4.2. 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

4.5.2 Results

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 table 4.3). 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 4.3. 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 and surroundings	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

But if one takes a closer look at the names of the interview partners there is another remarkable finding. The findings for the Indian section of the interviews show that almost 70% of the interview partners are Brahmins, irrespective of the location within India (see table 4.4). Over the last decades the proportion of Brahmins among the population has been ranging between 4%-6%. Thus even taking into account the limitations of the data, and possible flaws, the discrepancy is quite substantial. Apparently, within India the traditionally assigned occupations are losing their importance.

Table 4.4. Distribution of interview partners according to cultural background

Caste affiliation	Share of interviews in India (in %)
Brahmin	69
Vaishya	19
Ksatriya	7
Other	5

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

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 4.5). 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 4.5. Distribution of software professionals according to ethnicity/birthplace

Region	Share of software industry[I]	Share of Immigration to 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), Arora *et al. (*2001)

[II] *Source: Dossani (2002)*

However, in the context of SV the result is quite different. Only a minor fraction, roughly 30 %, of the people interviewed could be ascribed to a particular caste. On the one hand this is not very significant a result, but on the other hand it supports the findings of Saxenian (1999, et al. 2002) that Indians in SV share a common Indian identity that transcends the boundaries of caste or ethnicity. The ethnic background of SV Indians is somewhat clearer, with one third coming from the Northern Hindi-speaking states. Again, this subset does not exhibit many entries, thus is to be handled with even more care. 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.[3] 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.

4.5.3 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 a 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?

4.6 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 is examined from various perspectives. 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 following sections give an account of the following three channels of transnational networks: MNCs and their Indian executives, NRI venture capitalists, and (non-resident) Indian entrepreneurs. Unfortunately, the information on these different types is neither equally available nor uniform. Whereas there is some qualitative and, more limited quantitative, evidence of MNCs' activities in India, there is only little data on NRI Venture Capitalists and almost only anecdotal evidence on returning Indian entrepreneurs. Evidence on MNCs is provided by the National Association of Software and Service Companies (NASSCOM) and Department of IT and Biotechnology, Govt. of Karnataka websites, and previous field studies (Basant et al. 2001; Patibandla & Petersen 2002). Additional information is taken from company and association websites, especially TIE (Bangalore), which lists biographies of invited speakers at their networking events as examples for successful entrepreneurship. Further information has been compiled from various financial dailies and weeklies, both Indian as well as international. Finally, there is some qualitative evidence from 16 semi-structured interviews with senior executives of small, medium and large Indian companies in Frankfurt conducted in October and November 2002.

4.6.1 Multinational Companies

In the case of India as in other developing countries, MNCs are a source of technological know-how since they are usually based in technologically advanced economies. There is evidence that MNCs are a critical source for emerging economy firms to enter the global software market (Giarratana et al. 2003). Knowledge spillovers from MNCs occur in various ways. Firstly, they happen through local linkages, viz. in the developing country itself or rather in a sub-national region thereof. For example, if a MNC localizes an R & D center in Bangalore, there are typically backward linkages with indigenous companies in

the region depending on the sensitivity of the research undertaken often realized through outsourcing less critical work. In order to supply inputs for a MNC, the local firm ought to have some knowledge about the product. Hence, there must a knowledge transfer from the technologically advanced MNC to the relatively backward local supplier to have some professional and technological proximity. A drawback for developing countries is that many MNCs do not disclose their critical knowledge whether accumulated at home or in an expatriate research lab. Therefore, even in the case of co-location of the MNC and a local company, the kind of knowledge transferred is typically codified and not tacit. A case in which the knowledge transferred is more of a tacit type is through spin-offs (Franco & Filson 2000). Even if they do not consider MNCs in an emerging economy setting explicitly, they offer useful insights for the Indian context. As mentioned above, 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.

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). Interestingly, Nortel executives wanted to establish long-term relationships with India and, therefore, asked people they knew in TI and HP, probably also of Indian origin, about their experiences (Basant et al. 2001). Through Nortel's initiative to also enter the Indian market the Indian partner firms benefited a lot, since they were closely interacting on a local level with a global technological leader, producing not only for the global but also for the domestic market. Moreover there are demonstration effects both by Nortel's commitment and the presence of the Indian partners in a strategic alliance. And, although Nortel tried to minimize the interaction amongst their four Indian partner firms, there are also spillover effects through employee mobility, which is about 25 % in the Indian software industry. Altogether the case of Nortel collaborating with domestic firms is different from MNCs who merely want to profit from an abundant, cheap labor reservoir. Especially knowledge of advanced

technologies and business know-how can be best learned in an international firm, since it requires both contact with latest technologies and foreign markets (Tschang 2001). A motivation for such collaboration was the small technology gap between Indian and foreign software firms; also the competency in telecom was crucial which made Bangalore with two important public sector firms suitable (Basant et al. 2001). To summarize, most of the MNCs investments in India have been realized after NRIs were successfully working in the US operations of these companies and reached senior positions. Such positive experience had broad reputation effects, which were then leveraged by the Indian managers many of whom subsequently headed the Indian offices. In Bangalore, for instance, at 71 out of 75 MNCs this was the case (Kapur & McHale 2002).

Another source for spillover originating from MNCs is through international (intra-firm) transfer of personnel. By going to the US or other advanced economies the Indian staff gets exposed to global technological leaders. However, this kind of labor mobility is not only to be found within MNCs but also, maybe much more, at the (in-) famous 'body shops'. These are small to medium intermediary firms specialized in sending qualified software engineers from India to the US on H1-B visas to work on an assigned project at the client's site, quite often hired by Indian companies' US branches (Kapur & McHale 2002). Eventually it has become quite common that programmers returning from the US quit their job and start their own business. In doing so they expose another batch of professionals to the knowledge they obtained abroad, hence initiating a diffusion process (Tschang 2001).

4.6.2 Ethnic Entrepreneurship

In SV strong ethnic networking among Indians is found to be highly concentrated in one association, The IndUS Entrepreneur (TiE) and, to a lower extent in the Silicon Valley Indian Professional Association (SIPA) (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 is cited among the organizational advantages of SV in its evolution as the dominant high-tech cluster (Saxenian 1994). Tschang (2001) finds a similar openness in terms of labor market flows in India indicating that the SV business culture has already been partly transferred.

It is particularly important for India that this networking transcends the boundaries of SV and goes back to Asia. In their recent survey Saxenian et al. (2002) find that 74 % of Indians plan to start their own business, and 76 % out of that even think of locating it in India; the survey by Dossani (2002) reports 76% for locating a business in India. Interestingly, when asked directly, only 45% of the Indian respondents answered they will probably return home in the near future (Saxenian et al. 2002). Obviously, none of these numbers will necessarily materialize, since they usually include some overstating. But there seems to be an indication of a reversed brain drain with the highest impact yet to come. The 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'.

Nevertheless, many SV Indians have already been instrumental in starting a business through counseling or lobbying, or even investing their own money in India (Saxenian et al. 2002), for example through venture capital (Dossani & Kenney 2002). 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.[4] 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), thereby reinforcing the agglomerative tendencies; again (Dossani 2002) reports similar figures with 27% for Bangalore and 54% for other South and West India.

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. Founded as late as 1987, it is number 4 in India in terms of turnover, much of it software exports. After receiving his higher education (MBA) in the US, Ramalinga Raju returned to India. Having studied and learned business in an environment different from the Indian one, he 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. Eventually he established a very untypical modern organizational structure at his company modeled after what he had seen in the US.

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 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). An 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). 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).

4.6.3 Transnational Venture Capital

Another mode for NRIs to contribute to the Indian economy is through capital remittances. In fact this is a common observation for many decades now. However, the novelty regarding the software industry is that much of this investment comes via venture capital (VC). Why is VC different from other forms of capital? And why is it particularly important for IT? Since these questions are related to each other, I will deal with them jointly.

Venture capital is different from other forms of investment in that it is risk capital. It is used for seed financing to get firm start-ups going; hence it is closely connected to entrepreneurship, which has been discouraged in India through most of the period after independence. Usually an important characteristic of VC is the high geographic proximity between entrepreneurs and the VC firm (Zook 2002).

Since it is one of the most risky investments, banks usually refuse to lend to newly established companies or those in the way of setting up. The risk is even higher when new and unknown technologies, or more generally innovations are involved. Typically this kind of start-up requires substantial investments before the first profits can be obtained; the need for upfront investment is lower in the case of software which is more human capital-intensive. The link between VC and high-tech has been evident from the US and Israel. And, without positing any causation, Mani and Bartzokas (2002) find for India the highest correlation between the two among 9 high-technology exporting Asian countries. In the Indian case 48 % of VC has gone towards the high-tech sector, substantially more than in China, though much less than in other East-Asian countries. The two factors are complementary, for sufficient investment opportunities are necessary for a for a successful VC industry to evolve.

The interesting link to the international networks is the geographical breakdown of VC sources in 1999. In India, 60 % of the funds came from non-Asian sources, third after Vietnam and Hong Kong, but about 50 % more than in China, Indonesia, Singapore and Thailand. However, in absolute terms India lags behind many East-Asian countries both regarding VC investments and sourcing from abroad (Mani & Bartzokas 2002). One example of a successful firm founded and funded through VC by (returned) Indian expatriates is Mindtree (Das 2001). Many other examples of NRI entrepreneur-turned-Venture Capitalists are mentioned in Saxenian (1999) or Dossani & Kenney (2002). Actually some of the experienced entrepreneurs from SV assisted the Securities and Exchange Board of India (SEBI) to draft a white paper for the VC industry in India. Later also the privately organized Indian Venture Capital Association was established in Bangalore. This was a historical event that gave way to a path-dependent evolution of a ‘technology-related’ VC cluster resembling the US counterparts in SV or Boston. On the other hand Bombay recently attracts a larger number of VC firms that, however, provide much less capital than do the Bangalore ones. The importance for the development of the software industry stems from the fact that much of the capital flowing through these VC funds has been raised in SV. Thus the know-how of high-tech industries the NRI entrepreneurs obtained in the US regarding the financing of such start-up companies has been transferred to the Indian setting,

both through the active involvement of retired entrepreneurs and those who became venture capitalists and through counseling government agencies like SEBI (Dossani & Kenney 2002).

Without going into detail, an interesting feature regarding this flow of venture capital should be mentioned, that it has been increasing without the spatial proximity typically seen in the VC industry. It is in this context that the issue of cultural proximity (Grote et al. 2002) assumes greater importance. The question is whether cultural proximity can be a substitute for geographical proximity in the VC industry, too, where the latter is particularly important? [5] Apparently that is the case, the ethnoscape of an 'Indian' tribe providing the basis for the degree of trust necessary for a transnational dispersion of VC.

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 a 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. Such networks have been examined in various instances, MNCs, transnational entrepreneurship and venture capital. 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 the 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 overcome geographical and cultural distance.

Empirically, a key finding of the socio-cultural background of the Indian software industry is that the once dominant group of entrepreneurs has not retained its customary share in business. At least for the situation in India the software industry seems to be dominated by South Indians mostly of Brahmin origin, which, in turn, has some additional explanatory power regarding the spatial concentration of this industry. Although the results seem to be very clear I must reiterate that one has to be very careful with interpretation of these results, especially in terms of political interpretations. 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 cannot be overemphasized. Another important implication is to create a milieu hospitable for the return of emigrants and actively encourage entrepreneurship.

That the situation is less clear in SV might be explained by the more open regional culture. It can be hypothesized that with the 'brain circulation' of returning SV Indians or through the transnational networks these features will be transferred to the Indian clusters and might further dissolve customary patterns of occupation. 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 an identification with an 'Indian culture' remains and probably continues to play an important role in transnational networks. 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. Hence, 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 Hyderabad and Madras, with the competitive advantage for research-intensive industries in a knowledge economy.

NOTES

[1] For other forms of proximity see the *Cambridge Journal of Economics*, 23 (2), March 1999 (Special Issue on Learning, Proximity and Industrial Performance) or the *Journal of Economic Geography*, 4 (1), January 2004 (Special Issue on Physical and organizational proximity in territorial innovation systems).

[2] See e.g. the links section of the IIT Alumni Association Canada, http://www.iitalumnicanada.com/iitlinks.htm.

[3] Thanks are due to Robin Cowan for introducing this issue.

[4] The internet address of the *Bangalore* chapter is www.tieindia.org.

[5] This is crucial regarding the operation of transnational VC that will be examined as part of a following research project.

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Chapter 5

The geography of technology entrepreneurship: Evidence from the Indian IT industry

The geography of technology entrepreneurship: Evidence from the Indian IT industry

Abstract

This paper adds to the understanding of agglomerations of high-tech firms in geographically concentrated clusters through a study of the IT cluster in Bangalore, India. The principal aim is to integrate literatures of location choice and social network theories. Based on existing literature, this paper analyzes the co-location of high-tech industries, human capital and venture capital. In addition, own fieldwork suggests the relevance of diversity, in terms of ethnicity and gender. Its main theoretical contribution lies in the integration of ethnic networks as a unique kind of social network, in particular, ethnic ties combine positive characteristics of both cohesion and structural holes thereby enabling a trustworthy connection to external sources of knowledge and ideas. Resulting from these benefits ethnic diversity is desirable. A unique dataset is used to test the influence of diversity on regional differences in entrepreneurship. Preliminary findings support the usefulness for firms in a cluster of ethnic (and gender) diversity.

Keywords: Ethnic Networks; Diversity; Location; High-tech Industry; India

5.1. Introduction

This paper combines two striking features of recent global economic development. Firstly, entrepreneurship is a rising phenomenon in India with a second place in Total Entrepreneurial Activity (TEA) index among 37 countries in the world according to the Global Entrepreneurship Monitor (GEM, 2002). On a global scale, most investment in entrepreneurial start-ups is financed by venture capital (VC). In emerging markets like India with relatively underdeveloped financial markets, traditional sources of finance like family businesses or conglomerates still play a significant role (Khanna and Palepu, 2000); nevertheless VC is growing in importance. Moreover, most investments by VC firms are channeled into knowledge-intensive industries like IT or software (GEM, 2002).

Secondly, Indian IT in herself attracts increasing scholarly interest. Most of the research is centered on presumably generic factors of the Indian economy in the context of offshoring and outsourcing, i.e. a well-educated and English-speaking workforce that is cheaply available. This paper focuses on the analysis of geographical concentrations of IT industry and the co-evolution of supportive institutions. The paper employs a mixed methodology based on primary interview data, in order to generate hypotheses, and various sources of secondary data to test these. The main hypotheses tested below are that education and venture capital and ethnic and gender diversity as socio-cultural factors, respectively, influence the pattern of knowledge-intensive industries like software in the Indian context.

Preliminary findings include education and gender diversity having the expected positive impact on regional firm formation; ethnic diversity has a non-monotonic relationship, again as expected. Surprisingly, venture capital is not found to be significant.

The paper is structured as follows. Section 2 reviews the literature on technology entrepreneurship and geographical clustering. Section 3 adds to this literature hypotheses based on my own fieldwork. Section 4 presents empirical evidence and section 5 concludes.

5.2. Theory and hypotheses: Entrepreneurship and clusters

This section reviews the literature on entrepreneurship and clustering, with particular reference to knowledge-intensive technology-based industries like IT. Since most of the literature is mainly concerned with advanced economies, this review will be mainly confined to these countries as well; differences from emerging markets will be added in the next section focusing on the Indian context. It is not possible to cover all the relevant literature. Nor do I intend to debate the virtues or otherwise of other approaches to the same issue; here the goal is to bring together insights from the related literatures of the economics of location and entrepreneurship. There is no consensus in the literature about what entrepreneurship actually is. Theoretical positions range from risk taking to merely founding a new venture; whereas some agreement has been established over the individual micro-level nature of the entrepreneurial process (Carroll and Khessina, 2005). In this paper, I do not wish to delve into this theoretical discussion, but rather employ the narrowly defined notion of firm founding. There is considerable evidence in extant literature suggesting that such firm founding is regionally concentrated in clusters (Audretsch and Keilbach, 2004, 2005). This concentration of entrepreneurship is more than proportionate for industries engaged in knowledge-intensive activities (Johanisson, 1998; Audretsch and Lehmann, 2005). Sorenson and Audia (2000: 426) maintain that, "dense local concentrations of structurally equivalent organizations increase the pool of entrepreneurs in a region, thereby increasing founding rates".

Clusters are long established in the literature as important places for learning, innovation and economic development at the regional level (Glaeser, 1999; Porter, 1998) as well as increased performance at the firm level (Folta et al, 2006). Evidence from Germany suggests that knowledge-intensive services combine such agglomeration with employment growth, hence turning clustering into a subject of interest for policy makers, too (Sternberg and Litzenberger, 2004; Geppert et al., 2006). The most well-known notion of an agglomeration to business scholars is Porter's (1990) cluster concept; but there is a host of other variants like industrial district or innovative milieu (for an overview see Maskell, 2001). They differ in some respects, but share in common a regional concentration

of firms, in most cases small and medium enterprises (SMEs), and some supporting institutions. Besides the traditional Marshallian localization externalities, external economies like knowledge spillovers (Almeida and Kogut, 1999) derive from collective efficiency, social capital or some other form of social cohesiveness (Uzzi, 1997; Nahapiet and Ghoshal, 1998).

Analyzing the geographical nature of knowledge spillovers, it is well established that they are to a very large extent confined locally, or regionally at most (e.g. Audretsch and Feldman, 1996; Jaffe et al., 1993). McEvily & Zaheer (1999) find firms in geographical clusters with fewer non-redundant ties (structural holes) acquire fewer competitive capabilities. A distinct feature of geographic clusters conferring a competitive advantage to firms located within the cluster is the increased flow of information through a higher frequency of both formal and informal meetings.

In general, most research on geography of entrepreneurship deals with traditional production factors capital and labor; or, in more technology-oriented industries, venture capital and skilled human capital. These two input factors are indeed found to play a significant role in agglomeration literature. Hence, one would expect higher value-added activities to be localized in those existing clusters exhibiting features such as labor markets with experience specific to the requirements of new entrant firms such as start-ups but also MNCs (Cantwell and Mudambi, 2004). In particular, knowledge residing inside a cluster is a target of MNCs entering a cluster (Lorenzen & Mahnke, forthcoming) However, in this case the good or service offered – software – is mobile and has very low physical transportation costs (however, there might be other transaction costs involved). Although one could argue that labor is relatively mobile in the service sector, and even more so in high-technology industries like software, capital is still the input factor with the greatest mobility. It is precisely the localness of human capital that is responsible for knowledge spillovers – the theoretically most interesting yet under-researched agglomeration mechanism; most studies implicitly assume the existence of such spillovers.

In the case of Bangalore, like in other technology clusters, human capital is the most important factor, in particular engineering talent (Tsang, 2005). An intuitive

agglomeration channel is the local concentration of the labor pool. From a information and search cost perspective, it is easier for both parties to find the matching counterpart, if both are located within the same geographical boundaries; even with the rise of the internet search costs cannot be fully eliminated. Hence, a concentrated labor market serves to reduce uncertainty for both supply and demand of labor. This concentrated labor market includes graduates entering the market fresh from university. In fact, Bangalore is home to the highest number of engineering schools and students, both absolute and relative to the population. Saxenian (1994) has found such labor mobility to be important in the growth of Silicon Valley. One of the factors implicit in labor mobility is the knowledge embodied in labor, hence knowledge spillovers. They are –again – implicitly assumed to be one of the positive features of a concentrated labor market, mostly because their measurement includes some methodological problem, So while human capital is principally assumed to be one of the most important location determinants for service firms (Hitt et al., 2001), it is particularly important in knowledge-intensive industries such as software (Tsang, 2005; Gardner, 2005; Colombo and Grilli, 2005).

> ***H1: The probability of IT firm founding at one location is positively related to the local availability of human capital.***

Supportive institutions like venture capital and law firms play an extremely important role for location of start-up firms in electronics related industries (Patton and Kenney, 2005). Given that start-up firms do not have access to formal capital markets, and do not posses the necessary collaterals for traditional bank lending, venture capital provides the appropriate risk capital (Powell et al., 2002). Interestingly, VC is regionally highly concentrated (Zook 2002, 2004). Furthermore, Powell et al. (2002) find a high concentration of both ideas and venture capital in biotechnology; moreover, these two crucial input factors of a knowledge-intensive industry are also correlated and highly connected through networks among VC firms as well (Castilla, 2003). Therefore, I hypothesize that the local availability of venture capital increases the probability of firm foundings at this location.

H2: The probability of IT firm founding at one location is positively related to venture capital locally available.

This paper shares some similarity with recent studies that combine cluster level with firm level processes (Folta et al., 2006). But whereas other scholars (Tallman et al., 2004) explicitly theorize the knowledge bases of firms as heterogeneous, the focus here is on the diversity of individual employees in firms and the firms' access to the resultant heterogeneous knowledge bases. In other words, the benefits of clustering differ between firms, in this case depending on relative cognitive proximity and absorptive capacity of firms in a cluster. This conforms to recent studies with quite distinct approaches like, e.g., Alcacer (2003) who shows that most advanced firms do not locate in a cluster in order to prevent knowledge leakages. Hence, we expect them not to co-locate with less sophisticated ones, like, for instance, one anonymous large foreign MNE engaging in R&D for various sub-units from Bangalore; it operates so secluded that the only way to get in contact with this firm is by fax. Unfortunately, during my fieldwork stay it was not possible to interview employees of this organization; but I was fortunate to speak with the director for quality of an affiliate of the same conglomerate. This isolated operation seems to stem from the fact that they fear knowledge leakage more than they hail potential spillovers from the cluster. Such a more pessimistic outlook on co-location as competition-enhancing (Sorenson and Audia, 2000) is reflected in studies of organizational ecology (see Carroll and Khessina, 2005, for a review). On the other hand, analyzing Canadian information technology firms, Globerman et al. (2005) obtained strong evidence of locational clustering effects on firm growth while less on survival. Bell (2005) studying a different services industry – Canadian mutual funds – disentangles cluster from social network effects, with the latter being further subdivided in interpersonal and institutional ties; except for institutional ties he finds all effects to be of relevance for (innovative) firm performance.

Since one of the most prominent arguments for agglomeration benefits builds on the notion of knowledge spillovers there exists a need to disentangle the associated mechanisms. In fact, Boschma (2005) claims that geographic proximity per se is neither a necessary nor a sufficient condition for collective learning. But

it supports other forms of proximity to develop and thereby strengthens interactive learning and innovation (Maskell, 2001). Economic geography has broadened the range of concepts of proximity used by adding social, organizational and cultural (Lundvall, 1988) or cognitive and institutional (Boschma, 2005) proximity.

Social proximity enables a group to benefit from increased social capital and has been found a major characteristic among founding teams, even overcoming the requirement of some functional diversity (Ruef et al., 2003). Localized social networks are one mechanism to channel different types of resources necessary for nascent entrepreneurs (Johanisson, 1998; Sorenson ad Audia, 2000). A particular kind of social network is based on ethnicity (Ruef et al., 2003; Tsui-Auch, 2005). Kalnins and Chung (2006) in their study on Gujarati hotel owners in Texas find a positive impact on firm performance measured as survival by co-locating with entrepreneurs belonging to the same ethnicity. In a broader interpretation common ethnicity is a form of social capital. I will turn to ethnicity as a location factor in the following section.

5.3. IT clusters in India: the role of diversity

This section develops two additional hypotheses based on collection of original primary data. In order to emphasize the contribution of my own fieldwork, I will first give some basic remarks on the research design. 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. 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 directory of the National Association of Software and Services Companies (NASSCOM). The heterogeneity of the industry is reflected through my selection of SMEs as well as MNCs; furthermore, both foreign and Indian companies are represented. Moreover, there are hardware companies and software companies, the latter are engaged in service and product lines.

A chain of personal contacts through networks are deployed where it is necessary to learn from key decision makers (Bewley 2002). 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 centered on general company information, employee and recruiting, social networks, regional networks and international networks, and policy. In general, all questions have been touched through this kind of open discussion. 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, and was used to triangulate information gathered on international dimensions of networks.

Many of the factors identified as influencing technology geographies in advanced economies seem to apply in principle to an emerging economy like India, too. For instance, the century-old history of education in the four southern states seems to be a leading indicator for the subsequent emergence of an IT industry here. This correlation can be closely mirrored by looking at the distribution of colleges in the four main regions of India which are significantly overrepresented compared to their population (cf. Arora et al., 2004).

On the other hand, there are factors that seem to be idiosyncratic to different institutional contexts of emerging economies; some of them might even be special in the Indian case. There is ample evidence of emerging economies with underdeveloped product and factor markets exhibiting parallel or informal economies and scope for large integrated conglomerates (Khanna and Palepu, 2000). The motive put forward by Sorensen and Audia (2000) seems to have particular relevance in an economy in which the institutional framework seems different in terms of social safety nets. One idiosyncrasy of the Indian IT sector is that the starting years domestic markets were not targeted; orientation of IT entrepreneurs was initially almost exclusively towards foreign markets. Moreover, entrepreneurs of these firms are found to be young and, hence, their intrinsic motivation a critical factor to rely on (Contractor and Kundu, 2004: 817).

Findings from my fieldwork suggest an important role of socio-institutional factors for the emergence and growth of the IT industry as well as its geographical distribution. Two key factors, as mentioned by my interview partners are assumed to be openness and diversity of a society:

> "one of the most important location factors is the very cosmopolitan nature of the city" (Co-Founder and COO, Indian SME)
>
> "cosmopolitan nature has created mentality to connect with foreigners" (Director, Indian SME)
>
> "innovation happens when there's a high level of diversity" (co-Founder and Director, Indian MNC)

Diversity and openness are among the most crucial location factors for knowledge workers of the creative class (Florida, 2002). Florida, taking a multivariate measure to test for location factors relevant to Bohemians, he calls it the three T's – technology, talent and tolerance. In this work, I will specifically look at the correlation between technology, on the one hand, and some indicators of talent and tolerance on the other. While talent is relatively easy to assess given the data in India are much better than in other emerging economies, measuring tolerance becomes a more difficult exercise.

Openness at the firm level is inasmuch a necessary condition as a constant inflow of new knowledge and ideas is necessary in order to maintain a certain degree of innovativeness (Laursen and Salter, 2006). A cluster with a culture of openness helps each firm in it, because knowledge diffuses once it has entered the cluster through one firm (Tallmann et al., 2004). Openness has been found to impact the overall climate of a location together with other amenities (Florida, 2002). According to my interview partners, Bangalore is

> "a place high tech professionals want to be part of" (CEO, MNC Spin-off, product company), with the
>
> "Quality of life at heart in IT" (Co-Founder and Director, Indian MNC).

In evolutionary theorizing, diversity assumes an important role in generating a variation of new ideas (Nelson and Winter, 1982), an important characteristic for innovative sectors like software and IT. Diversity can be seen as a sufficient

condition providing access to the variety of novel ideas. In various literatures, different aspects and form of diversity have been theorized (e.g., Raghuram and Garud, 1996). Diversity has been established in the literature as a double-edged sword, with both beneficial and harmful effects on measure such as innovation and firm performance (van der Vegt et al., 2005). Research on diversity and its impact has been mostly at the micro-level and predominantly for concepts such as gender or racial diversity (e.g. Richard et al., 2004), but also for differences in economic performance of regions (Audretsch and Keilbach, 2004) or cities with respect to cultural diversity (Ottaviano and Peri, 2006).

The main contribution of this paper is the inclusion of ethnic diversity – as inferred from the benefits of ethnic networks. Ethnic networks combine the positive characteristics of trust with diversity and openness thereby enhancing the social capital of a region. The benefits from ties across different ethnicities, or people from various regional backgrounds, are that people in different regions develop different cognitive structures (Johansson, 2004: 47). These are advantageous because ethnicity allows for a latent yet trustful sourcing of information and knowledge; as a latent source the costs of maintaining strong networks ties are relatively low, while the benefits of cohesive network can be fruitfully used. Cohesion stems from the common origin or ethnicity as a basis of high-powered trust (Appadurai, 1996; Kotkin, 1993). Moreover, ethnic ties can be particularly useful if and when they reach beyond the local realm (Rosenkopf and Nerkar, 2001), i.e. ethnicities are spread over distant regions such as from India to Silicon Valley (Taeube, 2004). Extending information flows beyond local or national boundaries greatly enhances opportunities to increase variety in firms' resource base. Stemming from heterogeneities in culture, institutions and other national idiosyncrasies, firms can get access to technological trajectories different from their home location (Ahuja and Katila, 2004).

Then, access to a much bigger pool of ideas can be achieved. In this ideal case, ethnic networks can simultaneously provide cohesion and structural holes. Given these beneficial features of ethnic ties, having a greater variety of such ties is desirable, since it will improve knowledge flows even more. However, there are also drawbacks from too high a diversity level, most prominently an increased risk

of conflicts. Two plausible explanations for the beneficial impact of diversity to be found rather in developed countries are advanced: first, an institutional framework that mitigates conflict situations ethnically diverse societies are more prone to and, secondly, a higher level of economic development in which diverse elements in the socio-economic structure reveal their complementarities (Alesina and La Ferrara, 2004). In other words, the benefits of diversity seem to come into effect only beyond some threshold level. Hence, I hypothesize the following:

> ***H3a (Ethnic Diversity): The probability of firm founding is related to ethnic diversity in a non-monotonic curvilinear way.***

In a similar vein, another case of openness regards diversity of the workforce in terms of gender. India is a country with a high degree of masculinity (Hofstede, 1980) hence traditional role models would rather forbid women to become educated. The higher the share of women in education, the less traditional the respective state is, or in other words, more open and tolerant. Based on the argument made earlier of different cognitive structures one can infer positive effects of gender diversity on the idea pool as a resource. Hence, I maintain the following related hypothesis:

> ***H3b (Gender Diversity): The probability of firm founding is positively related to gender diversity.***

5.4. Empirical corroboration: the Indian IT space

5.4.1 Data description

Dependent variable

Our variable of interest is the number of member firms listed in the directory of the National Association of Software and Services, NASSCOM (as of September 2003) in metropolitan areas (IT). The number of such firms in the full sample is 854 dispersed over 35 locations; however, this sample has to be reduced by a number of firms. For eight firms no exact city location is mentioned; moreover, six locations with only one firm entry are deducted, not for having one firm only, but because they are rather small cities and lack a coherent set of other data. In

one case (the state of Chattisgarh) the state has been recently spun off from another so that no other data are available. Another location (Chandigarh) is simultaneously the capital of two states; hence its seven firms will be removed. The remaining sample of firms to be used includes 838 firms concentrated in 27 locations. Once we account for the actual number of IT firms in these locations a concentration in even fewer cities is evident. (see map 1)

Map 1 about here

Independent variables

There are three groups of independent variables representing the components of a basic production function, i.e. capital, labor and institutions. For technology entrepreneurship a specific form of capital is relevant: venture capital. Similarly, with most technology firms being engaged in some form of knowledge-intensive industry, the most relevant form of labor is well educated human capital. One of the main findings from my fieldwork interviews was that Indian software firms do not only look for well-educated manpower, but they specifically target predominantly engineering graduates.

Regarding production technology or institutional framework the issue of identifying appropriate measures is a rather daunting task. Here, the focus is on two variables that have been identified as potentially influencing location decisions, both in theory and practice; and that belong to the rather heterogeneous (and eclectic) construct of institutions: ethnic diversity and cultural openness in terms of gender diversity.

Financial (Venture) Capital

While India has not (yet) reached the stage of big VC industries like US, Western Europe or East Asia, growth from 1998-2002 sees India with the highest increase of all countries with 82% (IVCA, 2004). Data for venture capital have been taken from various sources. The numbers of VC investments (VCINV) at state level in

1998 is from VCline; the number of firms (VCFIRM) is counted at city level and taken from NASSCOM in 2003. One potential endogeneity problem with venture capital in this context is that in India VC might have been attracted to already existing IT clusters. However, this might be more prevalent to foreign VC investors who, interestingly enough, are almost entirely registered with the relevant Securities and Exchange Board of India (SEBI) under a Mauritian address, even though names like Citigroup Venture Capital International or Intel Capital suggest a different country of origin (SEBI, 2005).

Human Capital- Engineering Education

Probably the best indicator for the availability of human capital, or a pooled labor market would be some kind of employment data (Dohse and Schertler, 2003). Unfortunately, such data are not available – yet; therefore I had to find some approximation for available labor force. As suggested in interviews, human capital is measured as university graduates, more specifically as engineering education, not the more generic literacy or university graduates. This is based upon fieldwork interview findings where in most cases the response on hiring practices was that specialized computer classes are much less valued than a broader technological education in engineering. Here, I deploy statistics from the Ministry of Education and the Census of India 2001. Interestingly, not only is the share of engineering enrolment higher in states that have a larger share of IT and high-tech FDI. More importantly, the difference between the share in engineering enrolment and the share in the national population is revealing (EDURENT). Similar to Arora et al. (2004) but on the more disaggregated state level, I find those states more actively involved in IT exhibiting higher positive 'education rents'.

Institutions – Diversity

It is rather difficult to find suitable variables representing openness, or for that matter, tolerance. Two indirect measures are used as approximations: ethnic diversity and gender diversity. As a proxy for ethnic diversity we take the number of peoples speaking the main language in the state (from The Joshua Project,); India is a multi-ethnic society with more than 15 official languages with their own script, hence extremely multi-linguistic. This multiplicity of languages can be

seen at the state level too. We maintain that the higher the number of different groups speaking the main language (or a dialect thereof) indicates a more diverse society (LANG). In order to allow for the non-monotonic effect, ethnic diversity was modelled as a quadratic function (LANG2).

Furthermore, openness, or tolerance, is approximated by gender diversity – the percentage of female enrolment in higher education; not only in engineering but all university enrolment (ENROLFEM). Again, data come from the Ministry of Education and the Census of India 2001. Moreover, there is some anecdotal evidence for cities such as Bangalore being very cosmopolitan, but no data were available to test these assertions.

Control variables

In order to rule out alternative explanations, I controlled for size of the city population and the regional economy. In concordance with literature on urbanization economies (Jacobs, 1969; Glaeser, 1999) I control for city size measured as population (POP) at the metropolitan level. Data are for 1996 have been taken from United Nations statistics division. Another traditional control variable measures GDP. Although this is not very appropriate in the context of an export-oriented or rather export-dominated sector, I use this control for the size of the regional economy. Numbers for state level GDP are for fiscal year 2002-2003 and are taken from the Government of India's Economic Survey (GSDP). Arguably, replacing GDP with a measure of software exports as a control approximating pull factors attracting new entrepreneurs into this industry might be more appropriate.

Tables 1 and 2, respectively, present descriptive statistics and pairwise correlations for the variables.

Tables 1 and 2 about here

5.4.2 Regression analysis

Since the dependent variable is a non-negative, integer count variable, the simple linear regression model is not appropriate. Hence, for count data the standard approach is to employ a Poisson or a negative binomial model. In order to control for overdispersion, I estimate the maximum likelihood for the negative binomial model using the Stata 8.2 routine.

Our model is specified as follows:

$IT = \alpha VCINV + \beta VCFIRM + \gamma EDURENT + \delta LANG + \varepsilon LANG2 + \zeta ENROLFEM + \eta POP + \theta GSDP + const.,$

where VCINV and VCFIRM measure Venture Capital in the region, EDURENT denotes enrolment in engineering colleges relative to population share, LANG and LANG2 denote ethnic diversity of the region measured by number of languages in the state, ENROLFEM measures gender diversity; POP and GSDP are control variables controlling for state population and state GDP, respectively.

5.4.3 Results

In order to understand the influence of the independent variables on the number of software firms per larger metropolitan area better a stepwise regression analysis is performed. First, model 1, the baseline model employing only the control variables (POP, GSDP) is estimated; secondly, model 2 estimates the 'traditional' variables denoting venture capital (VCINV) and (VCFIRM) and human capital (EDURENT). Model 3 introduces the novelty of this paper adding variables for ethnic diversity (LANG) and (LANG2) and gender diversity (ENROLFEM) to the basic model. Model 4 is an estimation of the full model including all variables. The results are displayed in table 3.

Model 1 presents the baseline model with only control variables; among the controls only POP appears to be positive and significant at the 1%-level – in all of the following models, too; GSDP has an insignificant influence, as expected, and takes on small negative values in later model specifications. Surprisingly, model 2 introducing Venture Capital and Human Capital finds no support for either of the classic determinants – in other words we do not find support for H1 or H2. On the

other hand, measures for both ethnic diversity and gender diversity introduced in model 3 are as expected fining strong and moderate support for H3a and H3b, respectively. Ethnic diversity has the assumed non-monotonic relationship and is significant at the 1%-level; gender diversity is significant at 10%-level. Model 4 combines conventional location factors and my own contribution, thereby furthering the argument, to some extent at least. Here, human capital turns positive and significant almost at the 5%-level. Surprisingly though, venture capital measured by the number of VC investments at state level turns even negative and significant at 10%-level. But, on the other hand, significance for diversity indicators increases, in particular for gender diversity from 10%- to 5%-level. In other words, the full model supports H2 and furthers support for H3a and H3b: as expected, ethnic diversity is significant and so are human capital and gender diversity.

In order to check for robustness of the results, I conducted another series of tests which is not reported here, aggregating all count data for the two locations in the National Capital Region (NCR) together with the capital New Delhi herself. None of the results changes in sign or significance level thereby further supporting the results reported here. Robustness of the data has been checked this way because, arguably, New Delhi exercises more influence on these two cities than their respective states; essentially, they are satellite cities of New Delhi. Hence, viewing NCR as one geographical entity, or rather economic space, seemed appropriate.

5.4.4 Discussion and Limitations

One of the main surprises is certainly the result for venture capital. Insignificance and even moderately significant negative influence is absolutely unexpected from the literature. Possible explanations would argue that either the Indian venture capital industry is not – yet – as relevant as the US counterpart. As mentioned above, there is more than anecdotal evidence from my interviews and in business media of VC lagging behind and following technology industries in countries such as India. Alternatively, the importance of VC might be overstated for the specificities of Indian IT. Some argue that Indian IT firms do not involve actual risk-taking; since they are largely based on scale by amassing relatively cheap

software programmers to write code, hence do not require venture, or risk capital for that matter. I did not discuss this issue in detail, but yet again, there is some anecdotal evidence in support of this argument in my interviews. In a similar vein, one could expect business groups or other traditional sources of capital such as extended family to be more relevant for full-blown start-ups and conglomerate diversification, respectively (Khanna and Palepu, 2000).

An interesting direction for future research in this regards is the actual mechanism of transnational venture capital, two issues in particular: firstly, how does a normally highly localized industry function in a transnational context; and, secondly, how important are ethnic ties between VC firms and entrepreneurs?

It is also surprising to find human capital to be significant only in the full model, and even then only at close to 5%. It is surprising because almost every interview partner mentioned engineering talent as one of the single most important factors of their respective company. Again, explanations point toward a somewhat biased interview finding not representing the entire spectrum of Indian IT which potentially includes less risk-taking and less innovative firms as well.

On the other hand, it is interesting to find ethnic diversity as the single most important and robust explanatory factor. But it was expected, since the cosmopolitan nature of Bangalore was part of the main inductive reasoning stemming from my fieldwork. It is the argument from evolutionary theory that heterogeneity and diversity is positive inasmuch as it enhances variety of ideas (Nelson and Winter, 1982). Finding support for this hypothesis turns out nicely. In this way the paper also contributes to the literature on creating heterogeneous resources (Ahuja and Katila, 2004).

Similarly, gender diversity has the same theoretical foundation. But, both measures could also be explained by a certain regional culture (Romanelli and Khessina, 2005). One could argue that it is precisely a socially more coherent and stable culture that is needed to allow for an influx of new, external ideas which makes some regions more successful than others. In other words, a social capital-based explanation could be employed to argue for a balanced population structure.

One limitation is certainly the theoretical issue of finding the most appropriate variables to be employed in a model. In particular, the variables pertaining to the institutional setting are somewhat arbitrary; but these variables constitute precisely the empirical novelty of my research. I argue that they are reasonably close to other proxies that might have been more appropriate, but, unfortunately could not be gathered, e.g. detailed socio-demographic data on a region's population in order to grasp ethnic diversity of the population in one location; or foreigners or foreign firms to approximate tolerance of a region.

As regards the empirical strategy, a couple of shortcomings concern availability of data. Scholars have found founding rates to depend on prior founding, thus indicating spatial autocorrelation, or path-dependence of a location (e.g. Delacroix and Carroll, 1983). Since the data used in this paper are cross-sectional or pooled, respectively, there is no possibility to control for such autocorrelation. Future steps of this research also aim at expanding the data set in this direction.

Another limitation concerns availability of raw data in my sample; in particular, some observations had unsatisfactory independent and control variables. Hence, some observations had to be excluded from the analysis; this pertains to rather less represented locations in my sample, i.e. those with one or zero IT firms. Although this does not seem to be a problem, a potential bias is caused by the fact that unsuccessful locations are not represented in the sample and, thus, results for success might be distorted. Again, future research also aims at improving data quality.

Furthermore, there is one specific problem regarding the geography of India per se and our empirical strategy, respectively. This problem lies in the geography of India and can be explained by the existence of a so-called National Capital Region (NCR) surrounding the city-state of New Delhi. As such, it consists in the fact that there are two neighboring states in the NCR, both of which exhibiting a notable number of IT firms in the cities of Noida and Gurgaon, respectively. In some studies, this region has been taken as one entity. Arguably, this makes a lot of sense, for both of the smaller locations are far away from other urban agglomerations in their respective states, and can be best described as satellite towns, or even suburbs of the New Delhi Metropolitan Region (although they

officially belong to other districts, see Census of India, 2001). Stemming from this ambiguous geography in a politico-economic sense, there is some discretion in allocating endogenous variables to exogenous variables. Obviously, this could have resulted in a misallocation which might explain the surprising weakness of variables such as Venture Capital, for relatively strong locations of the National Capital Region are allocated to relatively weak states in the North. Further research requires some refined examination of raw data.

5.5. Conclusion

This paper is a first step trying to better understand and measure socio-cultural determinants of geographical concentrations of high-tech industry entrepreneurship in emerging markets exemplified by the Indian software industry. The main contribution of this paper is certainly the introduction of a hitherto neglected topic – the influence on regional development of cultural openness in terms of an ethnically diverse and progressive society. Whereas other types of diversity have been studied before, ethnic diversity has been somewhat neglected.

It has been shown that support factors established in the literature such as human capital play an important role in location decisions of technology firms; unexpectedly financial (venture) capital does not. In addition, hypotheses on other explanatory variables have been developed from interview fieldwork. It has been argued that diversity of a regional culture in terms of ethnicity and gender can contribute to a region's economic development and thus the firms located therein. These theoretical arguments are supported by regression analysis on the location of the Indian IT industry and the supportive institutional environment. Preliminary findings include the usefulness for firms in the clusters of ethnic diversity. Ethnic ties combine positive characteristics of both cohesion and structural holes thereby enabling a trustworthy connection to non-local sources of information, knowledge and ideas. Therefore, a variety of such ties is beneficial for clusters and firms therein.

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Figure 1: Mapping the Indian IT industry

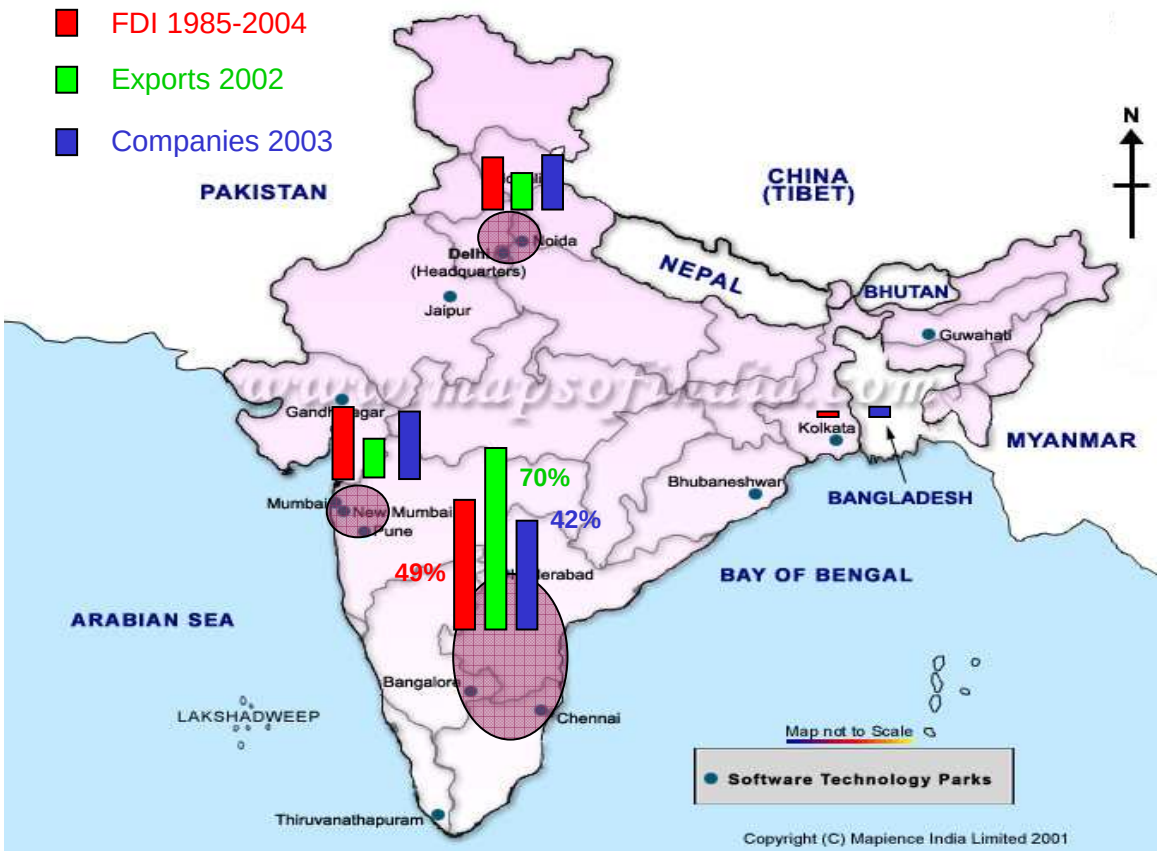

Figure 2: Evolution of the Bangalore IT cluster

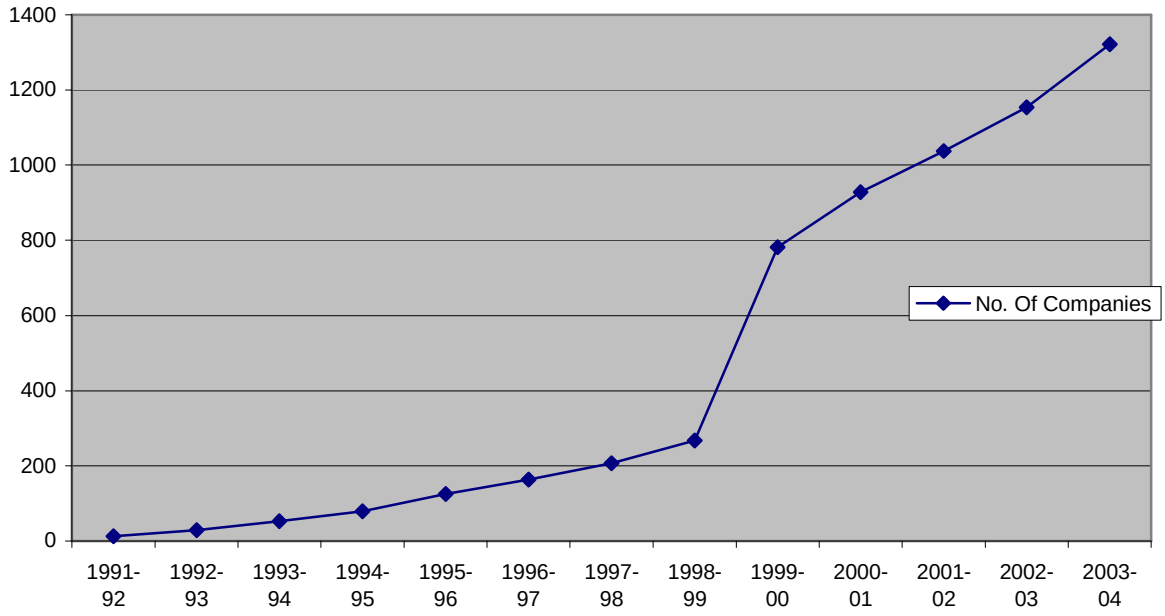

Table 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
it	27	3.103.704	4.957.549	1	182
pop	27	2509453	3289617	123359	1.26e+07
gsdp03	27	134751.9	65214.22	57937	263225
vcfirm	27	5.074.074	7.400.239	0	21
vcinv	27	1.209.002	9.783.184	114.29	2928.12
edurent	27	.0307674	.0809566	-.1046371	.1795477
lang	27	1.022.593	4.446.658	10	175
lang2	27	12361	8.688.408	100	30625
enrolfem	27	284686.4	139927.3	79220	515868

Table 2: Pairwise Correlations

	it	pop	gsdp03	vcfirm	vcinv	edurent	lang	lang2	enrolfem
it	1								
pop	0.688	1							
gsdp03	0.153	0.247	1						
vcfirm	0.393	0.355	0.762	1					
vcinv	0.264	0.213	0.686	0.762	1				
edurent	0.218	0.180	0.566	0.727	0.888	1			
lang	0.001	-0.062	0.105	-0.138	0.114	-0.081	1		
lang2	0.079	-0.033	-0.023	-0.151	0.057	-0.150	0.967	1	
enrolfem	0.097	0.106	0.942	0.631	0.610	0.412	0.203	0.064	1

Table 3: Regression results

Independent variables	Model 1	Model 2	Model 3	Model 4
POP	3.38e-07	3.26e-07	3.36e-07	3.99e-07
	(3.36)***	(2.58)***	(3.44)***	(3.73)***
GSDP03	4.90e-08	-3.50e-06	-.0000111	-.000018
	(0.01)	(-0.53)	(.0000118)	(-1.09)
VCFIRM		.0647959		-.0755868
		(1.09)		(-0.94)
VCINV		.0002388		-.0014081
		(0.27)		(-1.74)*
EDURENT		-6.019009		18.79012
		(0.78)		(1.93)*
LANG			-.06091	-.103496
			(-2.74)***	(-2.84)***
LANG2			.0003032	.0005231
			(2.75)***	(2.88)***
ENROLFEM			9.08e-06	.0000184
			(1.65)*	(2.50)**
CONST			3.281349	4.455597
			(3.69)	(3.73)
Pseudo R-Sq.	0.0610	0.0680	0.0963	0.1120
Obs.	27	27	27	27

Note: ***, **, * denotes significant at the 1, 5 and 10 per cent level; z-values are given under the coefficients.

Chapter 6

Offshoring the Financial Services Industry: Implications for the Evolution of Indian IT Clusters

(with Michael H. Grote)

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Offshoring the Financial Services Industry:

Implications for the Evolution of Indian IT Clusters

Abstract

This paper explores the opportunities for existing Indian IT clusters to upgrade and undertake financial research activities. Wholesale financial activity and the accompanying financial research in banks are still highly concentrated in Western financial centers. Increasing competition in the financial services industry as well as regulatory pressure place the options of outsourcing and offshoring activities, especially research, to low-cost locations high on the agenda of financial institutions. For the first time complex tasks at the core of financial activity are offshored which makes it an interesting case for a lot of other industries and their spatial economic organization in an ever globalizing world. Will there be a World Financial Research Centre in Mumbai? Using qualitative interview data as well as a quantitative analysis, this paper argues that research activities are locally embedded in Western financial centers to an extent that such a development is not likely. Two different research activities, viz. country analysis and institutional equity analysis are examined. This analysis shows, however, that there is a certain potential for some research activities to be relocated to India. So far investments take place in very few existing IT clusters which have already gained reputation in the financial community.

> "National economic prosperity depends not only on the pattern [of success and failure in its economy] at any point in time, however, but even more so on the capacity of a nation's industry to *upgrade itself over time.*"
>
> (Porter, 1990: 277-8, italics in original)

6.1 Introduction

This paper explores the possibilities of upgrading existing Indian IT clusters in order to take over financial research activities. India is so far the prime location for offshoring and outsourcing IT services and financial services firms are among the largest customers with activities like billing and data entry. Although such tasks normally do not yield much of the value-added for the developing country, such a division of labor can be the (necessary) initial step in a process of upgrading the capabilities of firms in these countries through international cooperation (Lateef, 1997). For instance, the rise of the Silicon Valley model with a network of highly specialized companies over the vertically integrated firm of previous decades gave these 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). Previous studies on upgrading in global value chains have usually looked at upgrading trajectories of specific, and rather traditional, industries or sectors, e.g. Asian apparel (Gereffi, 1999). Rabellotti and Pietrobelli (2004) conducted a comparative study on 12 different Latin American clusters. Whereas process and product upgrading are found to be common, intersectoral upgrading is found only in a Chilean salmon cluster that ventured into biotechnology and genetics. Regarding Indian IT clusters, the literature so far also focuses on product and process upgrading (Krishnan and Prabhu, 2002; D'Costa, 2002). Using an enhanced value chain approach, this paper analyzes the possibilities of shifting research activities within the financial sector to existing Indian software clusters, i.e. the possibility of intersectoral upgrading.

At present, wholesale financial activity and the accompanying financial research in banks are highly concentrated in Western financial centers (Clark, 2002). Increasing competition in the financial services industry as well as regulatory pressure place the options of outsourcing and offshoring activities, especially

research, to low-cost locations high on the agenda of financial institutions (Deloitte Consulting, 2003). For the first time complex tasks at the core of financial activity are offshored, which makes it an interesting case for a lot of other industries and their spatial economic organization in an ever globalizing world. Will there be a World Financial Research Centre in Mumbai (formerly called Bombay), the financial center of India? This paper argues that many research activities are locally embedded in Western financial centers to an extent that such a development is not likely. Two different research activities, i.e. country analysis and institutional equity analysis are examined. The analysis shows, however, that there is a certain potential for some research activities to be relocated to India.

The paper is structured as follows: In the two theoretical sections the value chain framework for the analysis of possible business process reorganizations in the financial sector is developed and the potential upgrading channels of Indian software clusters are examined. The subsequent chapter describes the methodology mix that is used in the empirical analysis. The empirical section then presents micro-level results from interviews with financial analysts about their organizational and local 'embeddedness', i.e. an assessment of the relocation possibilities of financial research to India. A quantitative analysis of host region factors determining the location of Brownfield and Greenfield investments by financial institutions in India figures as a complementary meso-level approach. The last section concludes.

6.2 Reorganization in the Financial Industry

Financial activities above the retail level are concentrated to a large extent in financial centers, which form an intricate global production network of interconnected locations between high-end members of the global city hierarchy (Friedmann, 1995; Poon, 2003; Sassen, 1991). Strong agglomerative forces "shape the evolving geographies of domestic and global finance" (Martin, 1999, 15). In the case of financial production, centripetal forces are linked to socio-institutional and cultural factors, labor market externalities, access to intermediate services, and above all informational spillovers (Porteous, 1999; Thrift, 1994; Kindleberger, 1974) – and thus to proximity to other actors. Centrifugal forces, on

the other hand, so far played only a minor role. Intensified competition and re-regulation lead to increasing pressure on the costs of financial services firms (Walter, 2004). Outsourcing and offshoring are regarded as important means of reducing costs in general as well as in financial services. Cost reduction can be achieved via reduction in wages (offshoring), via economies of scale within the service provider delivering the same services to more customers (outsourcing), or both. Information and communication technologies (ICT) in the financial industry now might enable the splitting up of existing production processes: hence, we propose a possibility of integrating new entrants, e.g. from India, into the global financial production network.

Outsourcing is understood here as a process in which certain service providers external to the firm take over business processes formerly conducted within the firm. A relocation of these processes is thus not required for outsourcing. Contrary to that, offshoring means the relocation of activities from one site to another, which is often in low-cost regions, within the same firm or at least the same corporate group. Offshoring can occur in combination with outsourcing, but not necessarily so. The reasons for not outsourcing and offshoring everything to the cheapest location or specialized provider are transaction costs and competencies of the firm that are not easily transferable (see Mahnke, 2001, for a comprehensive overview). It is argued here that the amount and sort of information and communication exchanged in business processes is crucial for the possibilities of outsourcing and offshoring research activities.[1]

An analysis of the spatial consequences of these decisions has to take into account firm and even department levels. The concept of value chains provides a simultaneous and disaggregated analysis of the process and actors, allowing for the appraisal of competitive advantages of firms (looking for the processes that could be outsourced) and comparative advantages of countries or regions (looking for the places to which they could be offshored – see Kogut, 1985). The concept of value chains is mostly used for the analysis of production systems while services are regarded merely as facilitating links between production stages (Dicken, 1998; Rabach and Kim, 1994). We build upon an approach suggested by

[1] The financial sector is heavily regulated and the decision to outsource and offshore activities is often subject to approval of regulatory bodies. However, the regulatory point of view does not consider research activities to be critical for the survival of financial institutions and will not be considered here.

Grote et al. (2002) that allows for analyzing those junctures ('breaking points') where production stages can be separated, either spatially (offshoring) or organizationally (outsourcing). While traditional value chain analyses concentrate on vertical relationships (Leslie and Reimer, 1999), this enhanced approach integrates also horizontal links to co-operating firms, customers, or other sources of information and knowledge. Grote et al. (2002) utilize a combination of vertical analysis with horizontal connections in order to locate the different stages of financial production; these horizontal linkages occur predominantly in geographical agglomerations or clusters. Thus, each stage is regarded as a node which "is in itself a network connected to other nodes concerned with related activities" (Appelbaum et al., 1994, page 188).

Here we are interested in the organizational as well as spatial 'embeddedness' of financial research activities.[2] In this context, embeddedness is understood neither in a pure geographical nor in an exclusively organizational sense. Basically we look at the "structure of the overall network of relations" (Granovetter, 1990, page 98) of analysts and especially the means of information and communication they need to perform their tasks. The ability to slice up the value chain and to outsource certain stages or phases of business processes and to offshore parts of the value chain within their firms to low-wage locations depends crucially on how the processes are 'embedded' in relation to a) the other departments of the bank and b) to the corresponding actors outside the bank. The need for the interchange of information and knowledge between research departments and actors outside as well as inside their banks in other departments, i.e. along the value chain, determines the possibility of relocating activities. We argue that different kinds of proximity are necessary for the communication of complex information or knowledge.

Information (and codified knowledge) is easily transferable between actors via ICT, while tacit knowledge is not. Tacit knowledge is strongly linked to subject and context, and thus difficult to pass on (Nonaka and Takeuchi, 1995). There is, however, no clear-cut distinction between tacit knowledge and information: the "degree of tacitness" (Nelson and Winter, 1982, page 80) is determined by time, complexity, and depth of explanation needed. Whether a specific type of

[2] A large body of literature on (regional and other kinds on) embeddedness exists that will not be covered here.

knowledge could in principle be codified and transferred via ICT is not considered here; when the costs of codifying become too high, the use of ICT becomes de facto impossible. ICT allows for more and more knowledge to become codified and thus transferable in space. However, to interpret this codified knowledge, most often a specific code is needed which has to be learned by actors beforehand – with that learning process itself being based on tacit knowledge (Nelson and Winter, 1982; Cowan and Foray, 1997).

Knowledge with a high degree of tacitness is still passed on only between co-present actors; face-to-face contacts are described as an 'efficient communication technology', where "verbal, physical, contextual, intentional and non-intentional" levels of communication are addressed at the same time (Storper and Venables, 2004, page 355). The higher the need for spontaneous meetings and/or regular informal contacts, the more important spatial proximity becomes. In addition, face-to-face contacts display several other advantages such as the possibility of judging other persons and being judged by others facilitating the detection of lies and thus the building up of trust, and better motivation in co-presence (Storper and Venables, 2004). Trust is an essential aspect in the financial business and especially in communication via ICT (Banerjee and Duflo, 2000); the development of trust requires at least initial spatial proximity (Giddens, 1990).

Other proximities play a role in the spatial organization of the financial research sector as well (Grote et al., 2002; Stein, 2002; cf. Zeller, 2004)[3]: since "nation-states create those institutions which actively define and maintain distinct industrial practices" (Gertler, 1993, page 676) it is a kind of 'cultural' or 'national' proximity that is needed to understand certain business practices, local regulations (or local interpretations of international regulations) and not the least language of the actors. The less transparent an object or transaction, the higher is the relevance of cultural proximity (see Bathelt, 2000). Face-to-face contacts and cultural proximity can be partially compensated through vertical integration or "organizational proximity" (Lundvall, 1988). Organizational proximity exists between actors working in the same company regardless of their geographical location and thus gains a new relevance with the implementation of ICT (Bathelt, 2000). It refers to corporate identity, corporate philosophy, organizational rules,

[3] The following proximities are similar to the different concepts of embeddedness proposed by Hess (2004).

and codes (Blanc and Sierra, 1999). In a similar manner, proximity between actors in the same type of job can bridge spatial and cultural distance to a certain extent. Actors in close 'professional proximity' possess an understanding of each others' methods, practices and aims, share similar interests, and professional language. Both organizational and professional proximity facilitate the building up of trust and furnish a common background for the actors and hence a context for interaction, thereby simplifying knowledge exchange. They are based on shared conventions, thereby providing a common "framework of action [...] with other actors engaged in that activity" (Storper 1997, page 45). Where organizational and professional proximity is strong, trust that enables the disembedding mechanism to operate is supplied; hence ICT can be used to bridge great spatial distances. In contrast, the value provided by spatial and cultural proximity acts predominantly to keep activities within a certain territory. However, parallel to organizational proximity ethnic networks also create a common background and thus help in extending communication from a local, regional or national to a transnational dimension, as exemplified in the case of the Indian software industry and its connections with Silicon Valley (Saxenian et al., 2002, Taeube, 2004b).

In general, outsourcing becomes an option when organizational proximity is not necessary. Moreover, the content of the processes to be outsourced ought not to be of strategic or otherwise critical value to the outsourcing company (Cronin et al., 2004). In this case the increased dependence on specialized suppliers offering specific assets might lead to the classic hold-up problem. Offshoring of complex tasks is possible for parts of the value chain that do not require cultural proximity and face-to-face contacts and where professional and organizational proximity ensures sufficient common background for communicating.

When it is possible to offshore certain tasks, the offshoring location has to be determined. Investment banks' research is a complex task that requires capabilities and training which is not available ubiquitously, contrary to, e.g. call center activities. So, just moving to cheaper locations in the countryside is not an alternative for offshoring: banks have to shift their research activities to places where there is already a pool of adequately trained staff – i.e. to clusters. From a strategic management perspective, Multinational Corporations (MNCs) would locate in clusters that have the highest probabilities of delivering value. Apparently, the local resources need not be idiosyncratic given the nature of ever

more interconnected or networked organizations and business relations (Birkinshaw and Hagström, 2002). Hence, one would expect higher value-added activities to be localized in those existing clusters exhibiting features such as labor markets with experience specific to the requirements of MNCs (Fromhold-Eisebith, 2002; see also Cantwell and Mudambi, 2004). The next section examines the requirements of Indian IT clusters to become hosts for research activities of investment banks and thus lock into the global financial production network.

6.3 Upgrading Channels of Indian IT Clusters

Clusters – and cities with clusters - are long established in the literature as important places for learning, innovation and economic development (Glaeser, 1999; Porter, 1998; Maskell and Malmberg, 1999). Besides the traditional Marshallian externalities, external economies like knowledge spillovers (Almeida and Kogut, 1999) derive from collective efficiency, social capital or some other form of social cohesiveness (Uzzi, 1997; Nahapiet and Ghoshal, 1998). There is evidence from very heterogeneous developing country clusters having faced and mastered economic challenges that the higher the level of local cooperation the higher the success and future performance. Social networks and ties at the local level allow for collective social action and knowledge spillovers that lead to the collective efficiency emphasized by Schmitz (1995) as an important ingredient of cluster upgrading.

A significant role is played by geographical and social proximities: firms and people located in the same region possess some form of a shared culture or collective identity. Geographical proximity enables the creation of common cultural contexts which, in turn, facilitate interactive learning processes crucial for innovation, because regional cultures tend to become institutionalized as rules of conduct which govern the relations and interactions of economic agents within the geographical area (Dosi, 1988; Storper, 1995; Lorenzen & Mahnke, 2004, forthcoming). Other authors stress the importance of learning from competitors in clusters (Malmberg and Maskell, 2002) and the predominance of vertical links (Humphrey and Schmitz, 2000).

According to Humphrey and Schmitz (2000) there are four types of upgrading: 1) process upgrading, which is a more efficient way of production, 2) product upgrading, which means selling similar products in higher market segments, 3) functional upgrading, that is assuming roles with a higher value-added within the production process, and 4) intersectoral upgrading, using competences acquired in one sector for production in other sectors. Typical upgrading channels are all kinds of (knowledge) spillovers, for instance, the mobility of human capital (Franco and Filson, 2000), spin-offs (Klepper, 2001), or knowledge transfer from MNCs (Fromhold-Eisebith, 2002). Schmitz (1995) introduced the concept of collective efficiency, defined as the competitive advantage derived from local external economies and joint action in order to assess the impact on the competitiveness of firms located in clusters. This implies that the capabilities that are required to upgrade are supposedly built up through local processes. It is the concept of absorptive capacity that analyzes the "ability to exploit external knowledge" (Cohen and Levinthal, 1990, 128). Originally developed for analysis at firm level, this concept has been extended to the analysis of countries – developing countries in particular – where education and infrastructure are among the most critical factors (Dahlman and Nelson, 1995) and clusters (Giuliani, 2004, forthcoming).

The success of the Indian software industry is well-researched, with factors like first-class higher education and research institutions, both public and private, low labor costs and stimulating policies commonly accepted as systemic components. Since the late 1990s, an increasing number of studies on its upgrading potential has been published (e.g. Krishnan and Prabhu, 2002; D'Costa, 2002), which usually focus on functional or product upgrading. Nowadays, MNCs increasingly locate not only low-level programming but also research and development (R&D) centers or laboratories in India; many already have more than one research lab (Fromhold-Eisebith, 2002). Generally, the quality of software-exporting firms is assessed at high levels. Nevertheless, the innovative capabilities of the industry are viewed rather skeptically as being still rather low in the value chain (Arora et al., 2001, Tschang, 2001).

India has reached stage 4 of Yourdon's (1992) "stages of development"-model (see figure 1). However, this kind of upgrading is still rather of the product or functional type. Bhatnagar and Madon (1997) argue that reaching a higher stage

necessarily requires certain technological competencies as well as an understanding of international markets. Furthermore, they attribute the maturity the Indian software industry has already achieved to acceptance and reputation in international markets (cf. Banerjee and Duflo, 2000), being endowed with technical competence and capability building among other factors (Fromhold-Eisebith, 2002; Taeube, 2004a).

Stage	Objective	Description
1	Build reputation	Low value-added body shopping
2	Onshore to offshore	Offshore customized software development
3	Improve value addition	Starting up offshore package development
4	Product development	Total offshore product development
5	Innovation	Identify new software-intensive products

Figure 1: Stages of Development (Source: Yourdon, 1992)

A relatively recent tendency in the software industry is to venture into Business Process Outsourcing (BPO) which sometimes even refers to processes at the core of a firm's activities. It started with captive centers founded by MNCs which basically converted data from one kind of medium (paper) to another (digitized) (Aron and Singh, 2003). This involves a high degree of human intervention, since in many cases the documents cannot be reasonably transformed without interpretation. Thus, it also embodies a certain extent of learning (by doing) and capability building in terms of client-specific as well as more generic project-management knowledge (Ethiraj et al., 2004). Financial services already compose the largest part of the business of Indian software companies and are still gaining in its share; in 2003 the financial sector made up for about 39% of the software industry revenues, followed by manufacturing (12%) and telecommunication (9%) (Nasscom, 2003). Having accumulated knowledge and capabilities through supplying intermediate, rather technical, inputs to the financial services industry some of the companies venture into new domains by providing financial services themselves (Economist, 2004, page 9). We assess this potential for upgrading existing IT clusters in India intersectorally in order to undertake financial

research, which would provide another opportunity for some parts of the developing world.

6.4 Methods

The empirical evidence for the analysis presented here draws on qualitative interview data as well as on quantitative data on Foreign Direct Investment (FDI) transactions of financial firms in India. Information pertaining to analysts stems from the findings of interviews carried out during certain former research projects of the authors on the spatial organization of the financial industry (see Grote, 2004; Grote et al., 2002; Lo and Grote, 2002; Taeube, 2004c). Six in-depth interviews with analysts that lasted from one to two and a half hours were conducted between Winter 2003 and Fall 2004 in Frankfurt. The interviews were open ended; notes were taken during the process. The interviewees are research analysts and senior analysts in investment banks based in Frankfurt and London. The interviews focused on the frequency of contacts to any other actors and information sources and the communication method used. We do not claim to provide a representative overview in the statistical sense. However, we asked the interview partners to reflect on other industry practices and former work experiences, which yielded no different results. This part of the survey is not intended to furnish a quantitative analysis of the spatial restructuring of financial research activities, but to reveal the underlying rationales, possibilities and targets for outsourcing and offshoring different research activities in banks.

The interviews with financial analysts are supplemented by background information from 33 semi-structured interviews with senior executives of IT firms, universities and public sector entities conducted in Bangalore and Mumbai in Fall 2003. The questions in these interviews were centered on general business and company information, social, regional and international networks, and policy. 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 (see Täube, 2004c).

In order to test the hypothesis whether Indian software clusters are attractive destinations for offshoring such activities by means of FDI, a multivariate

regression analysis is used. Foreign direct investment can either take place as Brownfield (M&A) or as Greenfield investment; we have compiled data on both. Data on Brownfield investment of financial firms in India are regressed on several characteristics of target locations. The results show that M&A activities of financial institutions are highly concentrated in very few cities with IT clusters in India. Since the data set does not allow for distinguishing between offshoring and other investments, self-collected newspaper articles on Greenfield investments in India by banks corroborate the evidence from the regression analysis.

6.5 Qualitative Evidence: Embeddedness of Research Analysts

'Research' in banks is a heterogeneous field. In our analysis we concentrate for illustrative purposes on two examples of research analysts that are the most and least embedded respectively: institutional equity analysts and country analysts. By asking analysts in open interviews about their daily work, their data gathering, their contacts and frequency thereof, a picture of their embeddedness in local and organizational structures emerges.

Institutional equity analysts work within the wholesale brokerage departments. Clients are big, mostly institutional investors like pension funds or insurance companies investing large sums of money. Analysts get into touch with clients often together with sales persons who maintain relationships with the clients. An analyst's main task is to 'generate trading ideas' for their clients, on which they could (should) trade. These trading ideas have a time horizon that could last from one day to a few months. In general, analysts are paid to know more than 'the market' does – or at least, before the market does. Clients do not pay the banks a set fee for the analysis but route trading volume to that bank in exchange (these are the so-called 'soft dollars', a practice now under interrogation by several regulatory authorities; see, e.g. Financial Services Authority, 2003). Analysts are paid according to the amount of trading volume they generate and their position in the ranking lists, which are compiled by industry observers.

Institutional equity analysts typically cover not more than five big companies in depth and up to about the same number of smaller ones, mostly in related industries. The value of a company depends on its future earnings possibilities; therefore, a large part of what analysts do is project the future. All available data

about the company are taken into account: company sources, analyst meetings, road shows, specialized data providers, newspaper articles, etc., often collected by research assistants (see Wrigley et al., 2003, for similar findings). Almost as important are the consequences for the company ensuing from any other, also seemingly unrelated, events. Analysts interpret a wide range of signals, including price movements of the company's or other stocks, market rumors, and the 'mood', etc. There is a lot of number-crunching involved, but this is used as a tool only. It was stressed that 'understanding' what is going on – and what will be going on – in the company and in the industry is most important (see Agnes, 2000, for analogous results for swap traders).

To get as much information as possible from the current market situation institutional equity analysts are commonly located right within the trading room of banks and communicate with all sorts of traders intensively. Since compliance regulations do not allow even the traders of the own bank to see the recommendations before they are officially published, the analyst's desk is situated on a dais about one and a half meters high above the trader's level with access restricted only to analysts. The interchange and testing of ideas with other equity analysts of the own bank is considered as absolutely necessary; the analysts sit cheek by jowl on the dais in the trading room. Thus, analysts get to know what is going on in the trading room without any trader being able to see what they are doing. Interestingly, contact to the own economists – who make long-term, macroeconomic projections about business cycles and growth, both country- and industry-wise that analysts use as inputs in their studies – is mostly via email and reading and writing reports.

Equity analysts do frequently have contacts with the firms they are covering (cf. Palmer and Sparks, 2004). They use their homepages, telephone contacts with the investor relations department, attend analyst meetings and sometimes visit the sites. A close understanding of local regulations and the interpretation of accounting regulations is viewed as essential. Personal contacts with the heads of investor relations and the chief financial officers (CFOs) are common and regularly renewed at investor conferences. That allows analysts to solve problems with the data and to confirm rumors via telephone more easily. Two analysts stressed that when talking to CFOs, it is crucial how the latter say something and

what they do not say. All interview partners emphasized the high relevance of close and personal contacts to board members of the firms they cover.

Also of interest is the "demand side", viz. investors or potential investors. Analysts frequently speak to the sales persons of the bank. When new studies come out, instead of just mailing them to investors and informing them of trends, most often they are presented face-to-face to investors (sometimes in one-to-one meetings) to brief them about the companies and potential developments relative to the market. This involves traveling to meet clients – who might be located in Europe, the US or Asia – as often as three to four times a year. Asked for the reason, one interviewee answered "They won't take you seriously otherwise. They're getting loads of studies everyday via email. You have to show a commitment." This confirms the findings by Storper and Venables (2004), who conclude: "[…] for complex context-dependent information, the medium is the message" (Storper and Venables, 2004, page 356; cf. Sidaway and Bryson, 2002). The embeddedness of institutional research analysts is summarized on the left side of figure 2 below.

Country analysts are to be found on the opposite side of the scale of embeddedness. They assess country risks and prospects for further regional development. Findings are published sometimes in public country reports distributed by banks but mostly in internal information systems, where they are used as inputs in a variety of decisions: in assessing the credit risk of countries and thus the loan terms for lenders in that country, in generating a benchmark world-portfolio of equity investments, or in advising clients before large real or financial investments. These evaluations are updated frequently on the margin but have an average time horizon of half a year to even a few years. Typically, a certain number of countries in one region are covered together, depending on their importance for the bank; e.g. there might be two or three country analysts for South America in a bank and five for the US and Canada alone.

"Clients" of country analysts are almost exclusively other departments of the same bank. Face-to-face contacts almost never occur. Sometimes, a department has a specific question regarding a particular development, but this is solved via telephone in general. Information is gathered from a variety of sources, mostly internet, newspapers and research reports from specialized vendors. New developments are discussed with colleagues via telephone, email and face-to-face

when they are close by. In large banks, the analysts covering a specific area like, e.g. South America are scattered in different financial centers. Analysts visit the countries they cover to confer with government officials about once a year. The findings are summarized in the right part of figure 2 below.

---→ insert figure 2 about here

The offshoring and/or outsourcing potential of analysts depends on their embeddedness in local or organizational structures. The two types of analysts described above are two extreme cases of embeddedness, with many other kinds of economic and financial research in between possessing characteristics of both sorts. As summarized in figure 2 above, institutional equity analysts need cultural proximity to the firms they cover and maintain sporadic face-to-face contact with the firms as well as investors. This requirement confines them to the same nation or at least region as the firms they cover, such as the EU (the smaller the firms get, the more important is cultural proximity, see Hau, 2001). Since a lot of tacit knowledge is frequently exchanged with traders and sales persons, outsourcing as well as offshoring away from these departments seem highly unlikely. Banks trying to reduce costs in their investment banking departments therefore try not to outsource or offshore the – expensive – equity analysts but to relieve them from a lot of non-essential work. Organizational and professional proximity allows for offshoring tasks that is more than just data processing: internet searches, processing of data from publications of firms into proprietary databases, standardized calculations and preliminary firm valuations can be offshored, since very little face-to-face contact is necessary.

Country economists do not have to be close to the countries they cover and face-to-face contacts hardly play a role in their daily business. Incoming and outgoing information is mostly processed electronically. Since they feed mostly proprietary information systems, offshoring seems to be the best option to cut costs. However, there is not much evidence on such a move besides sporadic newspaper reports of single banks and consulting firms that open economic research departments in India. One reason for this missing offshoring activity might be the small size of these departments (even the largest international banks employ not more than

about 30 country analysts) and the fact that they are paid considerably less than their investment bank peers.

Summing up the findings so far, offshoring of wholesale equity research is not a straightforward undertaking due to the strong embeddedness, both local (within the bank) and regional (with the analyzed firms). Country analysts could be moved more easily but are not a big cost factor anyway, so the pressure to offshore is not high. Hence, the main strategy of banks could be to offshore assistant work like gathering and preparing data and certain calculations – tasks for which Indian IT clusters seem to be prepared quite well. Given the rising importance of the Indian domestic capital market there will be a growing presence of financial firms in the Indian financial center of Mumbai (Shah, 2004). Since these offices will prepare wholesale analysis for the domestic market anyway there might be attempts to use the existing manpower and facilities to conduct research on foreign firms, too.

6.6 Quantitative Evidence: Brownfield and Greenfield FDI in India by Financial Institutions

According to our interview partners, pure outsourcing activities of banks' research are rare (in fact, none was able to give an example for that). Most banks still regard research as their core competence and an important source of competitive advantage which cannot be outsourced (cf. Eisebith, 2002, page 2157). Banks do, however, offshore parts of their research activities, but only within their own corporate group. They either pursue Brownfield investments – buying existing Indian companies or parts thereof – or Greenfield investments, i.e. setting up new branches and subsidiaries. There is only anecdotal evidence for Greenfield investments of banks, but there are some data available for M&A transactions of foreign financial institutions in India. Both are analyzed in order to verify the findings of our interviews with analysts and IT firms in India.

We use an OLS regression analysis to explore the factors that might attract Brownfield FDI (i.e. inward M&A transactions) in India by financial institutions. The main hypothesis inferred from the interviews and reasoning above states that the local concentration of IT firms should strongly influence the localization of banks' investments in India. Due to strong agglomeration forces in the financial

sector, however, most investments are expected to take place in locations with an already strong presence of other banks. We control for the number of commercial banks in these areas and also include a dummy for Mumbai as the predominant financial centre in India to take care of the other financial activities (e.g. stock exchange trading and investment banking) that are predominantly located in Mumbai (Derudder et al., 2003; Poon, 2003). The size of the local economy is controlled for (approximated by the population of the larger metropolitan areas) as well as the regional educational level (measured by enrollment in higher education per capita at the state level). These independent variables were selected to represent forces commonly accepted as attracting FDI by multinational banks as identified for US (Nigh et al., 1986), Japanese (Yamori, 1998), and Italian banks (Mutinelli and Piscitello, 2001) as well as inward FDI in the US (Nachum, 2000).

Data taken from the Thomson Financial SDC Platinum database cover all inward M&A transactions in India by financial institutions from 1985 to the first quarter of 2004. M&A data are notoriously scarce and incomplete outside the US and only precious little information on deal value, locations, and other characteristics is available. With regard to the hypothesis, the dataset has two shortcomings: it does not allow distinguishing between pure portfolio investments and real offshoring investments, and it does not record the specific type of activities pursued in the acquired firms after the transaction. Therefore, we use the analysis of Brownfield investments only to test whether there is a general locational trend for banks' investments in India. We complement the findings with newspaper reports on Greenfield investments focusing exclusively on the offshoring of banks' research activities. Between 1985 and end of the first quarter 2004 Thomson Financial has recorded 1,471 inward M&A deals in India of which 399 were done by acquirers with SIC-codes from 6000-6999, i.e. financial institutions and insurances. Excluding target firms that are neither in the IT nor in the financial industry leaves 219 deals, of which 133 have a known target location in India. None of these deals occurred before 1992 and only 11 before 1997. Although the number of transactions has not yet reached the level of the year 2000 again, there has not been a sharp drop either after the burst of the dotcom-bubble.

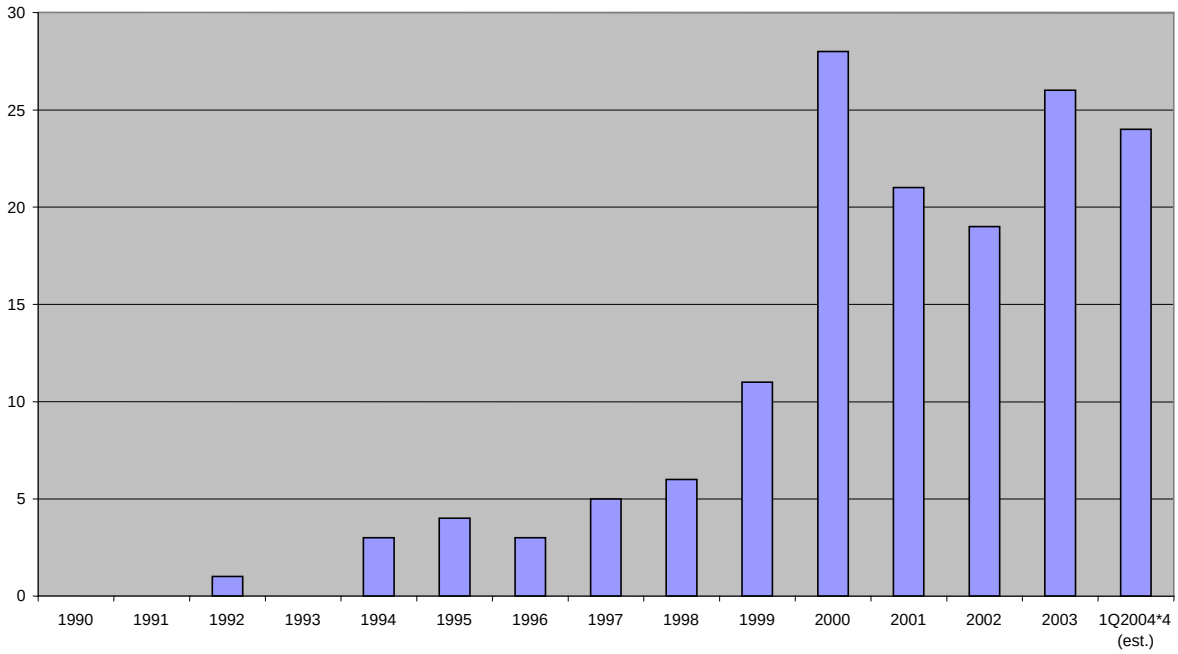

Figure 3: Number of inward M&A transactions by year
Source: Thomson Financial, own calculations

The dependent variable in this analysis is the number of transactions (TRANS) that take place in larger metropolitan areas in India with more than 1 million inhabitants between 1992 and 2004. We use data provided by "The World Gazetteer" for the number of inhabitants (POP) in each larger metropolitan area in 2004. There are 35 of these areas in which 131 of the 133 deals with a known target location occur. The remaining two (target companies in Solan and Trivandrum respectively) are excluded from the analysis. The number of IT companies per larger metropolitan area is taken from the National Association of Software and Service Companies (NASSCOM), the apex body and umbrella organization of IT and IT Enabled Services organizations in India, as on September 2003. In order to avoid problems of multicollinearity, the number of IT firms per million inhabitants in the metropolitan areas have been calculated (ITCAP). The Reserve Bank of India, the Indian central bank, provided data on the number of different commercial banks in the metropolitan areas, a figure commonly used as an approximation for the size of a financial center (BANK) as on 30th September 2003. To test for the influence of education on the location of Brownfield investments, the enrolment in higher education per 1000 capita (EDUCAP) at the state level in 2001 serves as a proxy. Data on education are provided by the Indian Ministry of Education but are only available for the states

of 34 of the 35 larger metropolitan areas, population data is taken from the Census of India 2001. The dummy for the Financial Centre (FIN) is 1 for Mumbai and 0 for all other metropolitan areas. Descriptive statistics for the data are shown below in table 1.

	TRANS	BANK	ITCAP	POP	EDUCAP
Mean	3.74	44.14	3.25	3,409,003	7.04
Median	0.00	42.00	0.71	1,532,000	7.08
Std. Dev.	9.67	16.09	6.30	4,320,171	2.58
Observations	35	35	35	35	34

Table 1: Descriptive statistics

The model adopts the following form:

$$\text{TRANS} = \alpha + \beta_1 \log(\text{POP}) + \beta_2 \text{FIN} + \beta_3 \text{BANK} + \beta_4 \text{ITCAP} + \beta_5 \text{EDUCAP} + \varepsilon$$

In order to understand the influence of the independent variables on the number of inward FDI per larger metropolitan area better and to take care of multicollinearity (a correlation of .76 occurs between the number of banks and the size of the metropolitan area), a stepwise multiple regression analysis is performed. The results are displayed in table 2.

Foreign direct investments by banks are concentrated in very few cities only (the top three are Mumbai with 49 transactions; Bangalore with 24, and Delhi with 21), as could be expected from the literature. The results are highly significant and deliver a high and robust R-squared and adjusted R-squared. In general, Brownfield investments by financial institutions in India can be estimated on the basis of a few variables: not surprisingly, the size of the economy of the larger metropolitan area – the log of the number of inhabitants – explains to a great extent their attractiveness for foreign investments (model 1 in table 2). This is in line with the results of Bajpai and Sachs (2002) and Nachum (2000) that FDI in India is largely determined by the urbanization rate of a state. Moreover, almost all FDI flows into six states out of which Maharashtra, where Mumbai is located, has the most favorable investment climate (Dollar et al., 2002). As expected, the

dummy (FIN) for Mumbai, the financial centre of India is highly significant and adds a large share to the explanatory power of the estimations (model 2).

dependent variable: TRANS							
independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
log(POP)	8.85*** (6.49)	5.74*** (6.43)	4.16** (2.63)	2.67*** (3.58)	3.48*** (4.41)	2.98*** (2.78)	1.47* (1.88)
FIN		34.43*** (7.98)	33.18*** (7.52)	37.63*** (13.15)	37.17*** (11.45)	38.00*** (12.50)	41.27*** (19.06)
BANK			0.10 (1.20)			-0.02 (-0.41)	-0.03 (-0.71)
ITCAP				0.58*** (6.63)		0.60*** (6.30)	0.58*** (7.01)
EDUCAP					0.98*** (4.87)		0.23 (1.43)
constant	-125.68*** (-6,29)	-81.07*** (-6.23)	-62.37*** (-3.09)	-38.17*** (-3.57)	-55.38*** (-5.01)	-41.71*** (-3.01)	-21.61** (-2.06)
no. of observations	35	35	35	35	34	35	34
R^2	0.56	0.85	0.86	0.94	0.92	0.94	0.97
adjusted R^2	0.55	0.84	0.85	0.93	0.91	0.93	0.97
F-value	42.05	92.71	63.16	159.39	115.23	116.37	190.64

t-statistics in parentheses; ***, **, * indicate significance at the 1%, 5%, 10% level respectively

Table 2: Regression findings

The number of banks in the metropolitan areas turns out to be never a statistically significant variable in explaining the attractiveness of a metropolitan region for foreign banks' direct investments (models 3, 6, 7). Since the number of different commercial banks is strongly correlated with the size of the local economy, we conducted a variety of robustness checks - without any qualitative change in the results. Among others, data from the Reserve Bank of India (available only at state level) were taken into account: neither the number or the share of employees in the financial sector, the size of the financial sector relative to the state GDP, nor the state relative to the national GDP in banking explain the attractiveness of metropolitan areas. Whereas banks tend to invest in the predominant financial center, the size of other financial centers does not influence the number of investments in a statistically significant way. This is consistent with the findings by Yamori (1998) and Nachum (2000).

We are mainly interested in the relationship between the number of IT companies and the attractiveness of a metropolitan area for financial institutions: ITCAP, the number of IT firms per capita, is always highly significant – and, as all the variables – has the expected sign. The locations of banks' investments in India are strongly influenced by the local density of IT firms in the metropolitan area (models 4, 6 and 7). This is in line with Gholami et al. (2003) who find that the general level of inward FDI increases with the level of investment in information and communication technologies. Here it is the IT firms themselves that attract investments.

The educational level of the population is significant (model 5) when analyzed in isolation. However, when included in the analysis in combination with IT and banking (model 7) or only with IT (not shown in the table), the significance is lost. Similarly, Self and Grabowski (2004) were able to establish a causal relationship from education to growth for both primary and secondary, but not for the tertiary education.

In general, banks tend to invest in the main financial center Mumbai; further investments are driven by the size of the local economy and the local density of IT firms. The size of the local financial centers, measured by the presence of commercial banks in the areas, does not yield significant results. Foreign investments by financial institutions in India are concentrated in a few – broadly defined – clusters. This is in line with the argument developed in the paper that Indian IT clusters can profit from intersectoral upgrading into the financial sector. However, the data underlying these findings do not allow for distinguishing between banks' investments to shift research activities and other FDI. Newspaper reports on banks that set up research departments in India ("Greenfield investments") are taken into account to substantiate the observed trend.

On top of the Brownfield investments made by foreign banks, more recently there is also some (anecdotal) evidence of investment banks relocating their research activities (e.g. Atal and Niranjan, 2004; Kulkarni, 2004). We have collected data from newspaper articles and the internet on Greenfield investments by foreign financial service firms, in particular investment bank research activities over the last 18 months. The following map 1 provides an overview of FDI of financial services firms in India, both Brownfield and Greenfield.

----→ insert map 1 about here

Most of the Greenfield investments take place in the existing IT centers Bangalore, Hyderabad, and Chennai (Madras) as well as the financial capital Mumbai and the national capital region Delhi. The dataset focuses exclusively on the setting up of research activities of financial firms without the acquisition of an Indian company. These data show a pattern quite similar to the distribution of Brownfield investments and thus substantiate the findings from the regression analysis above.

6.7 Conclusion

The long-run performance of clusters depends on their ability to capture increasing shares of value chains and to adapt to changing environments. In the paper, an enhanced value chain concept is developed that allows for an assessment of the local embeddedness of actors within the value chain. This general concept could be applied to a variety of industries in order to analyze opportunities for spatial reorganization. We have looked particularly at the potential to do financial research in Indian IT clusters. Indian IT firms have built up a reputation and capabilities that would enable an intersectoral upgrading of the IT clusters, especially with regard to banking and financial services. The analysis of research departments in Western financial centers revealed the embeddedness of the highly debated wholesale equity research analysts that makes offshoring unlikely. Other analysts – covered here are country analysts – are embedded only to a very low extent and could therefore be transferred to a low-wage country like India without greater loss of information and knowledge. Most likely is the migration of technical analyses and data gathering assistant work to India. Generally, in terms of the governance structure most financial firms will not outsource their critical and high value-added research activities, but rather keep them offshore in-house or in captive centers. Hence, the potential for upgrading lies in the first place in offshoring of foreign banks' activities to Indian IT clusters, allowing them to tap into the global financial production network.

As the quantitative analysis shows, investments by financial institutions in India are quite concentrated in a few – largely defined – clusters. More than 98% of

Brownfield investments take place in these clusters, with Mumbai leading by a large margin, whereas Greenfield investments are divided between Delhi, Bangalore, Mumbai, and Hyderabad. The density of IT companies (IT companies per capita) contributes significantly to the explanation of the location of investments by financial institutions, as indeed financial firms look for IT clusters to invest in. This confirms the hypothesis that upgrading to financial research might be a viable option for the Indian IT clusters. In order to address the specificities of each cluster and to identify the features that attract financial institutions, research at the micro-level within these clusters is needed to complement the findings of the macro approach presented here.

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figure 2

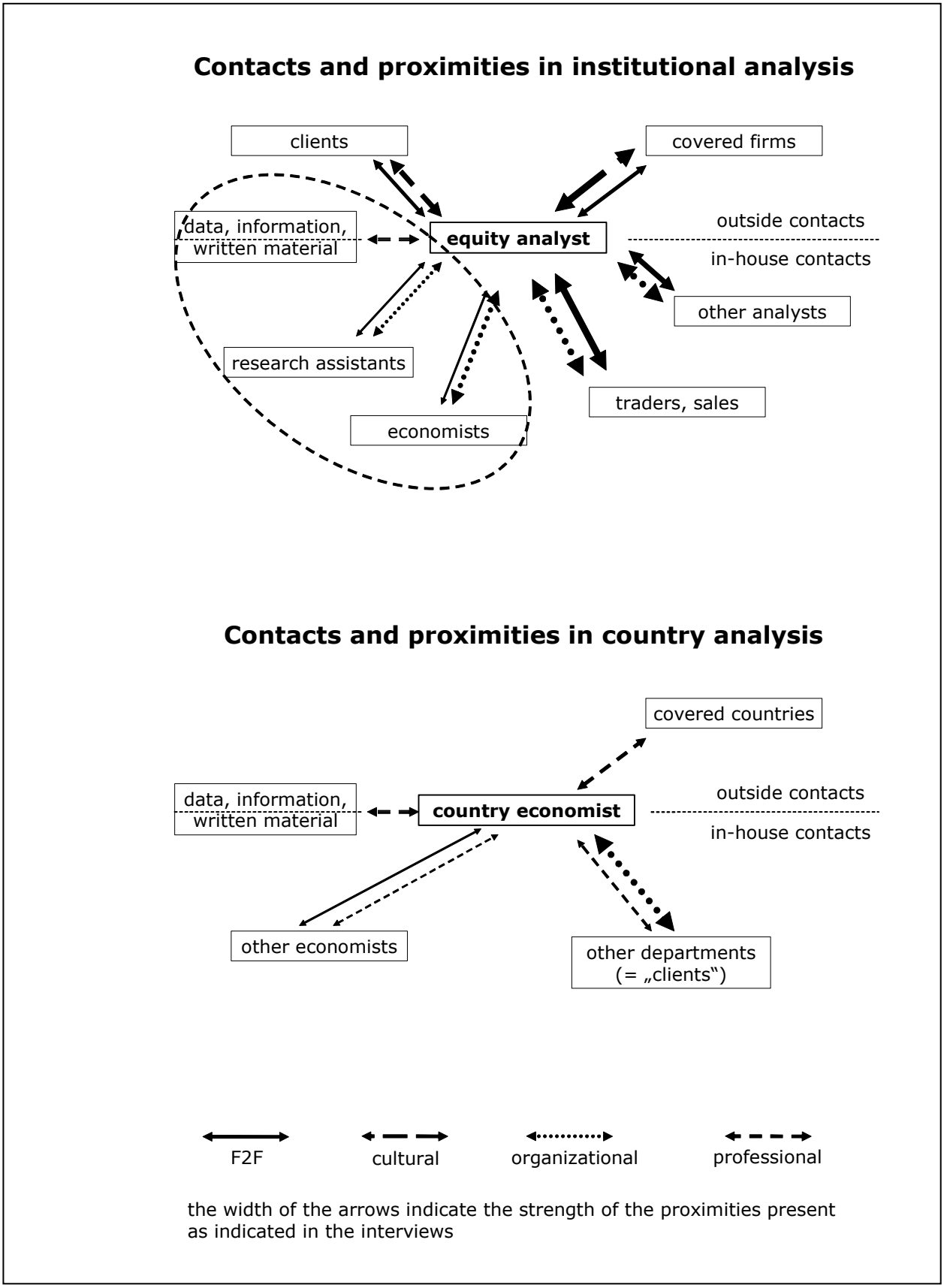
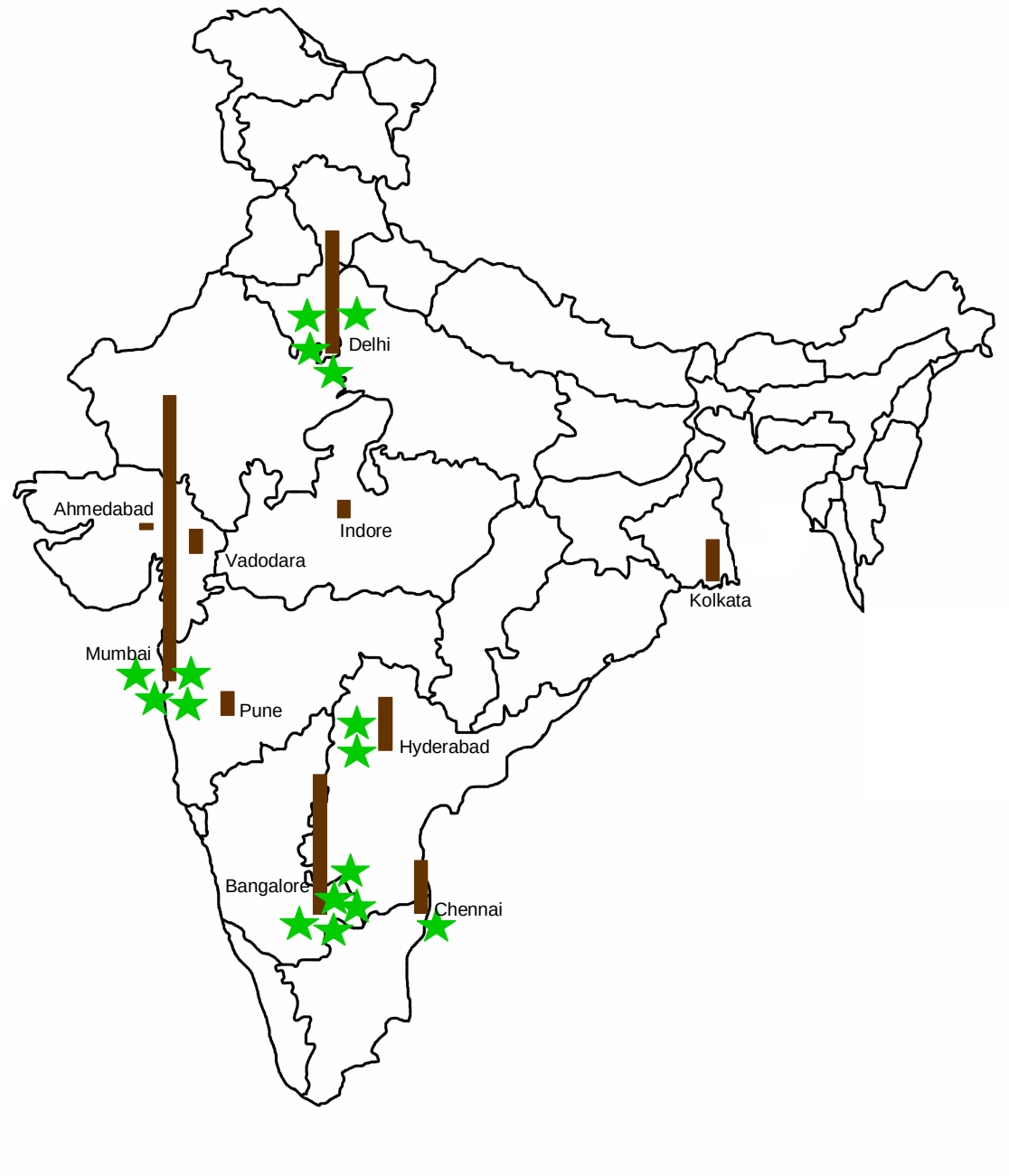


Figure 2: Proximities and embeddedness of analysts



Map 1: FDI by financial institutions in India

Legend: The bars indicate the number of Brownfield investments; the stars denote the number of Greenfield investments.

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Ehrenwörtliche Erklärung

Ich habe die vorgelegte Dissertation selbst verfasst und dabei nur die von mir angegebenen Quellen und Hilfsmittel benutzt. Alle Textstellen, die wörtlich oder sinngemäß aus veröffentlichten oder nicht veröffentlichten Schriften entnommen sind, sowie alle Angaben, die auf mündlichen Auskünften beruhen, sind als solche kenntlich gemacht.

Frankfurt am Main, den 25. Oktober 2006 Florian A. Täube