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June 2006

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Local Clusters, Ethnic Networks and Diversity in Knowledge-based Industries: evidence from the Indian IT Industry

My dissertation is 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 in a better comprehension of industry evolution, with a special interest in diversity and networks, in particular regarding 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 this industry evolved in a geographically concentrated way and, secondly, what role different types of social networks played in this process? These topics are rooted in economics and management theories such as innovation economics, industrial dynamics 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 parts and so does geography throughout. Therefore, new insight on the phenomenon under study can be gained by shedding light on it from different angles.

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).

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).

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.

Methodologically, I first develop propositions about strategic networks and location of firms in knowledge-intensive industries through grounded fieldwork and secondary data. This step is exploratory and aims at understanding the relevance of local and non-local networks of high-tech firms in geographically concentrated clusters of knowledge-based industries without sophisticated and demanding local buyers.

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 such as software? Secondly, and related to the first, how can a cluster of firms emerge and prosper without sophisticated local demand? The principal aim is to advance the literature by connecting theories of location choice and social networks in knowledge-based industries. My findings include the usefulness of ethnic diversity of clusters that can be relevant for firms in the clusters by increasing the number of structural holes, hence access to a larger pool of knowledge and ideas; ethnic ties combine positive characteristics of networks characterized by both cohesion and structural holes thereby allowing for a trustworthy connection to non-local sources of information and knowledge. 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).

The next step adds to the understanding of agglomerations of high-tech firms in geographically concentrated clusters. Based on existing literature, I analyze the co-location of high-tech industries, human capital and venture capital. In addition, my own fieldwork suggested the relevance of diversity, in terms of ethnicity and gender. The 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.

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

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

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

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

Our variable of interest is the number of member firm foundings as listed in the directory of the National Association of Software and Services, NASSCOM (as of September 2003) in metropolitan areas (IT). 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, in particular 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: ethnic diversity and cultural openness in terms of gender diversity. 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.

My results support the usefulness for firms in a cluster of ethnic (and gender) diversity: 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.