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Technological entrepreneurship in India

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ABSTRACT

Is the rise of the Indian software industry simply another Asian state-dominated industrial growth story or is India distinctive, an economy where small technology entrepreneurs also find niches for development and can be drivers of innovation? Research has predominantly focused on the large integrated Indian and international IT service providers. This study examines the opportunity for growth among smaller innovative technology entrepreneurial firms. Two areas of inquiry are: What factors have been responsible for spurring entrepreneurial growth in the Indian IT industry? What type of work is being carried out at these Indian firms and is this profile changing? Our theoretical proposition is that the emergence of technology entrepreneurs linked to multinational firms reflects a change in global value chains. The paper takes a multi-level approach to understanding development trajectories in the IT sector in India: a global value chain approach to the extent that company processes are seen in their larger networked context across organizations, and an institutional approach in terms of state policies that influence the creation of infrastructure that, in turn, shapes organizational development trajectories. Additionally, we examine the role of the various actors within IT sector organizations—the workers, the managers, and in the case of the small companies in our sample, the owners—on the paths of entrepreneurial growth trajectories in the Indian IT sector. We find that the various levels of change and policy all contribute to the outcome in company trajectories: the dominance of multinational enterprises on the market, the entrepreneurial vision and survival strategies of returned technology expatriates, and the changing policies of the government in promoting indigenous business.

The rapid growth of the Indian economy, particularly in the area of software development and services for just over a decade, has prompted a wide range of research on the roots of its success (Arora and Athreye 2002, Arora and Gambardella 2006, Dossani & Kenney 2006, Athreye 2005, Sharma 2015). This interest is not surprising given the spectacular growth of this industry which has posted continual increases in exports and revenues in all sectors: The original driver of growth in the sector was the low cost, good quality IT-BPM or BPO services (business process management and outsourcing) which reached aggregate revenues crossing the US \$145 billion mark as of 2015 (NASSCOM 2015). Higher value-added sectors also experienced impressive growth rates: IT services exports grew by 19%, amounting to 40 billion US dollars; engineering and R&D services reached exports of over 10 billion US dollars, and the domestic software products segment grew by about 13% from 2011 to 2012 (NASSCOM 2012, 2013, Krishnan 2010, 2011).

Is the rise of the Indian software industry simply another Asian state-dominated industrial growth story or is India distinctive, an economy where small technology entrepreneurs also find niches for development and can be drivers of innovation? Indeed, most research has focused on the large integrated Indian and international service providers. There is no doubt that the offshoring of software services provided a dynamic growth opportunity for a number of well-placed Indian companies such as Infosys and Wipro, who entered the “entrepreneurial space” in the newly emerging IT outsourced services market in the 1980s and 1990s (e.g., see Sharma 2015), but there are few, if any, global IT product firms to have emerged. This raises the question of whether there is also an opportunity for growth among smaller innovative technology entrepreneurial firms, who are interested in product development, either for the Indian economy or for global markets. There are three areas of inquiry that can be pursued to answer these questions: What factors have been responsible for spurring growth in the Indian IT industry? What type of work is being carried out at Indian firms and is this profile changing? And, what role do returnees play in technology transfer and/or financing for entrepreneurial development, as human capital flows have changed course over the past decades? The first question touches upon a complex array of drivers at different levels of analysis. Those most often mentioned include the role of state policy, the role of region, the role of multinational companies and, as related to the third question, the role of the entrepreneur returnee or the “foreign connection” in general—sometimes referred to as Reverse Technology Transfer (e.g., see Chacko 2007, Kale & Little 2010). The second question mainly addresses the type of activities carried out at Indian IT sites and India’s position on global value chains or in global production networks. The latter is, however, inextricably linked to the first in terms of available infrastructure, available talent, and the strategies of multinationals. It is these three dimensions and their interaction that frame this analysis of the development of technology entrepreneurship in India.

The traditional development experience of emerging economies, particularly in the Global South, has been that of supplying low-cost labor for activities “offshored” by industrial countries’ multinational enterprises (MNEs). Indeed, India’s traditional reputation has centered on being a low-cost site with skilled human resources doing relatively low-level work (in call-center support or back-office software services). Typically this would not be the most fertile ground for technological entrepreneurial activity. Moreover, in this sector there was significant out-migration of the most educated and skilled graduates and workers, with over 90 percent of computer science graduates from the most elite universities, emigrating during the 1990s. The “Asian Miracle” experience of the other “Asian tigers” is generally thought to reflect large, sustained, and highly focused state investment, coupled with human capital and business development (e.g., the “capital accumulation” and “productive assimilation” factors as discussed by Nelson and Pack 1999 and Amsden 2001) which was geared to promoting growth in higher value-added activities. Yet the case of India differs from these widely noted Asian cases in that the Indian IT sector grew without large state investment and, arguably, outside of the purview of state policy.¹ Has the lack of state-directed investments (also in infrastructure) led to constraints on Indian innovation that hindered the development of technological entrepreneurship, or did the presence of other factors lead to an alternative path of development for technological entrepreneurship in India, particularly in IT and in smaller niche markets?

It is within the larger context of development strategies and innovation that we examine the Indian case of technology entrepreneurs. Our hypothesis is that, although the absence of a strong state-led development policy (as can be seen in structuring China and other East Asian growth trajectories) limited the types of export industries that could potentially take hold, it also created, by default, the “entrepreneurial space” that left the ground clear for other types of non-state-led development to emerge. It is this distinctive path, a technology entrepreneurial space fostering innovation in small firms, which is the focus of this chapter.² The exploratory case studies presented here examine the nature of a particular type of technology entrepreneurship, which grew mainly in the IT sector and was linked to foreign MNEs. The Indian IT industry and technology entrepreneur development follows a different path than typically described for

¹ There were state enterprise zones that provided favored tax status to exports, but these followed initial IT sector development and did not represent significant state investments in infrastructure or human capital in the early stages. However, it is clear that the foundational work by the Indian government in electronics and computers to support defense, atomic energy, and state enterprises was important (e.g., see Sharma 2015) but it did not have a state-led strategy to develop the new IT sectors as in some other countries.

² See (Salzman & Rosenthal 1994) for discussion of the “action space” within which developers in software firms exercise independent action and the extent to which organizational and external constraints may limit that action, leading to an iterative process in which external constraints are transformed. That firm-level analysis provides the theoretical model for this research, of the opportunities of firms within broader social and market constraints to, interactively and iteratively, transform their environment and development opportunities, what we’re referring to as the “entrepreneurial space” that is dynamic and evolves.

entrepreneurship in which market opportunities are identified and/or a technology is first developed and then pursued in a domestic and/or international market. Instead, the technology entrepreneurship sector in IT, beyond the few large and notable cases of IT services [e.g., Infosys, Wipro, Tata Consultancy Services (TCS)], as characterized by Chandra et al. 2009, 38, can be seen as serendipitous, in which “social networks combined with firm competencies and motivations that drive the discovery of international market opportunities” (also see Ratajczak-Mrozek 2014). In the cases discussed here there is yet another dimension, which is how the atypical entrepreneur pathway, failed product development, brings a set of characteristics (skills, motivation) different from that in the large IT service companies and, we find, leads them ultimately to a different path of “value chain creep” innovation. To the extent that these firms expand, or the number of such firms grows, they may develop one of the important sectors of indigenous growth in high technology and become a sector that is undergoing transformation from a low-cost services industry to an emerging innovation industry in both services and, perhaps, products.

The IT industry, a common focus of Indian technology development, is an extremely diverse sector. Software activities can, for example, be divided into different categories—design and development, analysis and design for clients, and applications for firms using IT for their businesses—all of which involve a wide range of task complexity (Arora 2006). The dominant early models of Indian IT industry growth have been based on the appearance of several large firms in the 1990s that provide software services to client firms (predominantly in the United States) and the establishment and growth of offshore locations of multinationals to provide software services functions within the MNE (either directly for use by the MNE or as part of the MNE’s software consulting services). This is consistent with larger trends of outsourcing and/or offshoring discrete, usually low value-added operations of a firm, described as a lengthening of the value chain (Flecker and Meil, 2010). These simpler processes involved tasks such as rewriting code, customizing user interfaces, maintaining data, or adding functionality to existing software. These are the tasks initially targeted for outsourcing or offshoring to lower cost sites to reduce the overall expenditure for software development projects. Also many of these tasks deal with detailed, time-consuming work. Earlier studies (Krishnan 2010) had found that most Indian firms were not able to move up the value chains of their western MNE customers, but rather remained confined to carrying out low value-added tasks. Among those cases, however, some exceptions were identified that were able to engage in higher value added jobs involving more complex task profiles.

Often these exceptions involve a related, but distinct type of offshoring that allows the integration of small firms into the value chain of larger companies for carrying out development work. It is different from the predominant type of offshoring and outsourcing in that it involves smaller firms, development work that is higher value-added, and is generally a key, non-

commodity component of the MNE's value chain. The shift from back-office services and commodity work to this type of development work is a key transition point in a nation's industrial development (in this case, India) and in changing the nature of offshoring for the MNE home country. This shift in the emerging economies has been discussed as a developing "innovation shift" (Lynn & Salzman 2007), with profound implications for both the MNE home and host countries. It appears that India is beginning to move up the value chain in terms of task complexity and activities such as product development, that were formerly limited to MNE home-country sites. Our findings show that the linkage between multinationals and Indian technology entrepreneur firms is a major driver of this development.

We see the development of technology entrepreneurs in India as stemming from two parallel paths that began to converge in the late 1990s and early 2000s. The first involves factors originating in India, such as the development of the Indian IT industry as a by-product of the national defense industry, atomic energy development and the formation of the Department of Electronics in 1970 (Sharma 2015, 39ff), as well as research labs and the launching of education policies and indigenous infrastructures, accompanied by migration to western institutions of higher education. The latter two played key roles in developing highly skilled human capital in science and technology fields (Khadria 1999, 2006, 2012). The second development was the corporate restructuring of primarily US, but also European firms and their global distribution of work beginning in the 1990s, leading to a unique interaction between multinationals and local Indian firms.

The Pathway From India

Indian Policy and the Public Sector

National research laboratories, which were mostly defense related, were located in the south of India, where (in the 1950s and 60s) they were beyond the reach of missiles that could be sent from hostile northern neighbors. These labs outsourced some of their work which led to the development of a network of small private companies in the regions, in a sense incubated by the national labs. Both were supplied workforces by the regional colleges. It is not clear how successful the small firms were in terms of adopting and developing high technology.

Nonetheless, they did establish a pool of people with significant scientific experience. Sadagopan (2007; see also Seshagiri 2007, Sharma 2015) argues that pioneering efforts in computing took place in the national labs in the 1960s. These, along with the Indian Institutes of Technology (IITs) and the Indian Institute of Science in Bangalore, were important incubators for the IT industry in India. Today, the areas of Bangalore and, followed by Hyderabad and now several other growing areas, are the predominant sources for scientists and technicians in India. These areas have large industrial parks devoted to IT and a number of government policies promoting IT, and the largest numbers of IT graduates come from educational and training institutions in

these two areas. As the history of IT development by Sharma (2015) shows, the Indian government took an active role in developing the computer industry starting in the 1960s and the 1970s, particularly with the formation of the Department of Electronics in 1970 and the Electronics Commission in 1971, though this was focused on providing the electronics needed for defense and atomic energy development. Private sector IT development was not actively state led though the public sector in general played a facilitating role in the growth of the Indian IT industry. Indeed, most of the significant, early IT initiatives were in the public sector such the computerization of the Indian Railways. One of the early top Indian firms, Computer Maintenance Corporation, sprang up to service IBM systems. Computer Maintenance Corporation was staffed by former IBM employees after IBM left the country in 1978 rather than comply with the Foreign Exchange Regulation Act which would have reduced IBM's equity ownership to 26 percent (IBM India Milestones 2011, Sharma 2015). It was a public sector firm and its creation came from the government's domestic development policies that limited foreign ownership with the goal of fostering domestic firms. Thus government policies, both in the form of public sector initiatives as well as education (including regional colleges), contributed to the birth and growth of the IT industry in India. It is the particular path that developed through the government's policy evolution that led to growing technology entrepreneurship.

The Indian government has gone through several different "phases" of policy for foreign direct investment (FDI) (Kumar 2002, Balasubramanyam & Mahambare 2003). Following independence, the Indian government enacted a number of different policies and individual, case-by-case reviews of foreign investment that was selectively restrictive. The period between 1968 through 1979 was a restrictive phase, effectively limiting foreign equity to a maximum of 40 percent in a firm and putting other restrictions on MNE operations and expansion in India which led a number of US companies to divest their Indian operations, most notably Coca-Cola and IBM. After 1980, national regulation of foreign investment was slowly liberalized, with changes in regulation of software and telecommunications companies beginning in the mid-1980s, allowing greater foreign ownership and less restrictive regulation. In 1991 foreign direct investment of up to 51 percent in a joint venture was permitted in specific capital intensive and high technology industries (and up to 75 percent in a small number of other industries on a case-by-case basis). By 1997, complete foreign ownership was allowed, although limited to software companies. In 1994 IBM re-entered India through a joint venture with the Tata Group, and GE formed a joint venture with Wipro. India has continued to liberalize FDI and other industry policies, particularly in certain sectors such as export software services and businesses in special enterprise zones.

Indian policies provided, intentionally or not, an opportunity for Indian firms to grow with some independence from US and other foreign firms. Many of these initial technology entrepreneurial firms in IT services are now well-established multinationals in their own right (e.g., Infosys,

Wipro). Often lost from view is that in the early 1990s, Indian entrepreneurs started product companies to develop indigenous IT innovation. Both as a result of the FDI restrictions that limited foreign firms entry into the Indian market and an IT product market that was not fully dominated by global firms and/or markets in which there were competing products, such as different office software products (e.g., WordPerfect an early market leader in word processing, and a number of different database systems) and even operating systems that were poised to gain dominant market share outside of the United States (e.g., open-source systems were being considered by some governments until Microsoft intervened, exerting pressure on these governments to adopt Microsoft products instead). However, by the late 1990s, it was only the Indian software services industries that prospered globally as primarily US software product companies came to dominate global markets (e.g., Microsoft for the office software market and operating system; Peoplesoft, Oracle, etc. for ERP markets, with SAP, a German-based firm, as one of the few non-US companies to gain global dominance). It was, thus, only in the offshoring software services market that provided growth opportunity for a number of Indian firms to grow from smaller entrepreneurial firms to large multinationals (e.g., Infosys) and for other large firms to move into software services (e.g., TCS, Wipro). As offshore software services began to grow, it was then the integrated multinational as well as foreign (non-Indian) software services companies expanded operations in India (e.g., IBM, Unisys), thereby creating captive Indian services firms.

This history raises the question about whether technology entrepreneurship is still possible in significant numbers, and if so, in what ways? To the extent that technology entrepreneurship is growing, do these firms follow existing models of technology entrepreneur trajectories or do they follow different pathways, representing new models? Does India make use of “brain circulation” in developing technology entrepreneurship? To the extent that returning Indians are involved in technology entrepreneurship, is this due to attracting diaspora Indians who were entrepreneurs in other countries (e.g., the United States), or is it through returning diaspora Indians who launch their entrepreneurship ventures only when returning to India? Does the re-entry of foreign firms into India provide a second opportunity for a new wave of technology entrepreneurial firms? If so, is it through a different set of market dynamics and linkages to foreign MNEs? And does this “second moment” in the Indian IT industry create a new “entrepreneurial space” for innovation?

To the extent that there is research on emerging market global entrepreneurship (e.g., Chandra et al. 2009), most of the arguments surrounding the relationship between western companies and Indian technology development are demand-driven perspectives: What do western companies need and what do they offshore to Indian sites? However, there is little detailed information available about the “pull” side. Where do Indian firms want to go? Where do they see themselves on the value chain? What role do they play in the changing strategies of their customers? For instance, there is evidence that in software development, the acquisition of knowledge and the

enrichment of the provided services were necessary to make offshore locations viable. Relocating or outsourcing only simple coding tasks to India or to central and eastern Europe countries was often not sustainable. Particularly in India, companies faced the problem of high personnel turnover because skilled and ambitious IT workers judged their jobs according to the learning and advancement opportunities they provided. High rates of personnel turnover forced European and US companies to more fully utilize the technical skills of IT workers in India by moving more demanding tasks and thus more stages of the development process to their Indian subsidiaries or outsourcing service providers (Flecker & Kirschenhofer 2002). This then had the effect that dependent units in the value chain were upgraded.

This paper addresses these questions by analyzing and comparing case study data on MNE captives, spin-offs, and independent producers in India. The analysis contained here comes from research conducted as part of a larger project which examines the globalization of technology development work by multinational firms (Lynn & Salzman 2009; Lynn et al. 2012). In the context of this study, interviews were carried out on the issues of overall company strategy, inter-company relations and governance structures with customers, recruitment practices, work organization, and job tasks. Information was collected on the history of the companies, the development of their product profile and portfolio, challenges for obtaining contracts, relations in the value chain with larger MNEs and changes over time, strategies and visions for the future, challenges on the labor market, and related issues as they emerged in the interviews. We used these data to examine whether technological entrepreneurialism is still possible and, if so, what were the defining elements of its success or failure? What role can small niche firms play in the overall Indian landscape of technology players?

The Study: Methods

In order to capture the complexity of a multi-tiered analysis in which institutional context, company and intercompany level strategies and individual level motivations of particular actors all play a role in the evolution of technology entrepreneurship in India, we chose a qualitative case study methodology as the most suitable means of tracking emerging practices, goals, and strategies that are still in the process of development. We created a series of cases using the comparative case study method (Yin 2003 and more broadly Eisenhardt 1989, Glaser and Strauss 1967). Toward this end, we carried out interviews in eight firms in various locations in India. The companies represented a good cross section of local firms embedded in the value chains of large western MNEs, encompassing their first-tier subsidiaries, their captives, and the spin-offs of these first-tier suppliers. It also included independent Indian-owned providers who did work for the MNEs either directly or through their Indian subsidiaries. It is these small Indian-owned firms that are the focus of the more detailed case studies presented below. In all of the companies we interviewed owners (where appropriate), managers, project leaders, and engineering/technologists in India and some at the home country MNE site that was contracting

out to the supplier firm. This linked case study design allows us to examine the dynamics on both sides of the value chain. We also complemented these company cases with interviews from four colleges, which are the recruitment source for the Indian high-technology labor market. This provided a useful overview of recruitment pools, recruitment practices and career trajectories for Indian employees. Altogether this yielded 48 interviews at the 8 technology firms in India. The Indian companies in the study ranged in size from under 100 employees to over 1000. The sectors covered included engineering design solutions and services, IT solutions and services, software product development and services, IT consulting and related service functions. Most of the companies were founded between the mid 1980s and mid 1990s and still exist today. Looking at a diverse range of companies provided a good picture of the workforces, tasks, and role of companies across MNE value chains (Gereffi and Korzeniewicz 1994), as well as the processes of de-integration and re-integration that characterizes movement along these chains (Flecker and Meil 2010; Meil 2012). The strategy of MNEs is still quite dynamic and evolving, the relationships with firms in offshore sites for this type of work are still quite experimental, without established patterns, and the small firms are also in a very dynamic phase, engaging in new types of work different from that of only a few years ago.

We collected detailed accounts from those directly involved in setting strategy, managing operations in the entrepreneurial firm and those in the MNE contracting with the supplier entrepreneur firm. The interview information was supplemented by published and unpublished written accounts. As mentioned above, we focus on three of the eight cases in more detail in this paper. We chose these three companies because they were independent, Indian-owned producers and thus differed from the other cases in being neither an MNE subsidiary nor a captive, who only do work exclusively for one MNE partner. These three companies were engaged in product development and obtained contracts by bidding and negotiating on the open marketplace with various clients, both local and international.

Findings

Technology entrepreneurship in India, in the firms we examined, grew from a combination of factors quite different from the entrepreneurship of the United States or Europe. The factors surrounding changes in government policy, educational policy, the role of the multinational firm, and the role of the foreign-trained returnee have been identified as shaping the particular trajectory of these firms. Small firms, founded by returnees, often began with the intention of being product development companies. The initial growth goals and strategies of most of these firms were, however, not realized. The liberalization of government policy for foreign investment enabled these entrepreneurial firms to meet the demand for services from foreign firms as they changed strategy from product to service companies. The trajectory of these firms

is the more common path of development than that of the Indian domestic giants TCS, Infosys, and Wipro, which appear to follow a path atypical for Indian entrepreneurial firms.³

Below we present findings from three cases which best illustrate the key dimensions in the development and growth of technology entrepreneurial firms in India. For reasons of confidentiality, we have changed the company names. The three cases are: Engineering Development & Design (EDD), NewTec, and TechWare.

EDD – Company History and Growth

EDD's founder followed the now-familiar education and career path of an undergraduate degree from an elite Indian university and then a graduate degree in electrical engineering in the United States in the mid-1980s. However, unlike many of his peers, he returned to India, becoming the managing director of an India-US joint venture, created as a result of India's domestic ownership policy. In the early 1990s he left that company and founded his own IT firm that was partly a joint venture with another US IT company, created primarily as a sales and marketing firm. Using this joint venture as a source of core revenue and investment funds, he expanded the scope of his business. He founded separate operating companies, with a board of expatriates with similar backgrounds: elite Indian undergraduate education, graduate education in the United States, and a range of work experience in the United States and for joint venture companies in India.

Initially the operating companies focused on outsourced IT work, but they also developed products for the Indian domestic finance industry. After the dot-com collapse in the United States, they decided to expand outside of the IT industry. Building on their engineering and development strengths, they developed engineering design and development capabilities in several industrial sectors in a separate operating company, EDD. EDD provided dedicated engineering and design capacity to foreign companies. EDD reserved physical space for each of its clients and a dedicated engineering staff. This model protected the client's intellectual property and served, in essence, as the offshore operation of the MNE. This model was successful in providing a means for MNEs to "try out" higher skilled, higher value-added offshore engineering and development (i.e., for high-level work rather than just lower level, more routine work that was typically offshored at that time). In fact, the success convinced the MNE to expand their offshore operations, but unfortunately for EDD, rather than expanding the business of EDD, they opened their own offshore sites. By agreement, the MNE was able to transfer the entire dedicated engineering group at EDD to its own MNE site. Although this

³ Certainly these large Indian success stories belong in the category of technological entrepreneurs. However, whether emerging from the Indian industrial elite as diversification strategies with vast amounts of available capital or as offshoots of very early and large joint ventures, these firms are quite different from the many small technological niche companies that are the basis of our analysis.

means a loss of business and staff when MNEs in-source their engineering to their own offshore sites, EDD's cooperation with the MNE gives it the opportunity to gain expertise across a broad range of engineering development and design areas and industries. A natural progression would be a move up the technology value chain of other MNEs who want to outsource greater amounts of engineering. Whether this model, as in electronics, will occur across a wide range of industries remains to be seen.

NewTec – Company History and Growth

The second technology entrepreneurial firm, NewTec, was started up in the mid-1990s in India by two men. One was a returning Indian national who had gone to the United States for a graduate education. He had worked for a US firm and then decided to return home because he was, as he said in our interview, “bored with working in a large company” but also because he wanted to be near his family. The other, more on the management than the technical side of the business, remained in the United States in Silicon Valley to engage in sales and marketing work. NewTec was originally conceived as a product company, with a dream of building a “world class product.” However, given the difficulty of selling a platform product in India and competition in the general market with some very high-level players, NewTec decided to leverage capabilities and become a service company as a niche player working only with product companies in order to generate revenue. With this strategy, the company grew to 400 persons by the year 2000.

One of NewTec's central roles in this new constellation began as a sales vendor for a US MNE: PC Products (PCP). This changing orientation for NewTec was at least partially a result of changing Indian government policies which opened up the market for large MNEs. As foreign products were more widely adopted in India, companies like NewTec found greater growth coming from its sales and service for foreign companies than from its own product sales. Accordingly, NewTec shifted its focus to do lower level work for PCP and other US MNEs. However, because it had deep development capacity, NewTec began to do some maintenance, testing, and development work for PCP on subroutines. NewTec's own products also found a market niche, but these did not generate high sales volume. Meanwhile, the demand for service work (testing and localization) by PCP and others was growing so rapidly that NewTec started its own spin-off (All-Tec) to do dedicated work for NewTec. Eventually, this spin-off shifted its focus to work directly for US and European MNEs, concentrating solely on maintenance and testing. NewTec's product development staff, on the other hand, had expertise far beyond the simple maintenance and localization work that PCP was sending to India at that time. So NewTec proposed that PCP undertake more technically challenging and complex product development work. NewTec suggested ways to optimize subroutines and even product modules. Gradually PCP adopted the greater scope of work submitted and proposed by NewTec. Thus, NewTec's expanded role in PCP's product development occurred “bottom up,” but then became part of PCP's offshoring strategy. NewTec is also extremely security conscious regarding

intellectual property and follows stringent guidelines which increase its credibility and attractiveness for MNEs. Nonetheless, NewTec continues to engage in its own design and development work and its founders and many of its high-level technical staff still harbor the goal of becoming a product company.

When asked why MNEs want to work with NewTec the following answers were given:

1. To build up variable capacity.
2. NewTec meets specific technical needs and can develop data management systems. This fits into the philosophy of particularly US MNEs of “why build it yourself when you can get the expertise elsewhere?”
3. Availability of human resources – the company possesses the skills to do development and maintenance work.
4. The company has a good engineering background – it is tuned to the development cycle and will get the job done. It is willing to engage in detailed work – which “may not appeal to the creative side of people,” but is still challenging technical work.
5. Cost advantages – “Indian companies are more efficient than MNE captives.”

TechWare – Company History and Growth

TechWare’s history is somewhat different from the other two Technology Entrepreneur companies, EDD and NewTec. It was initially established as a software division of a large industrial Indian company in the mid-1980s. The restrictive environment for foreign MNEs and emphasis on local development discouraged foreign entry and potentially provided an opportunity for domestic firms to diversify and fill local product niches. TechWare was thus established as a separate software product company in which the Indian industrial firm had equity but was run by an independent management team. Unlike the founding management in the other TechEntre firms, TechWare’s management team came from other Indian firms and nearly all of the team had completed both their undergraduate and graduate education in Indian colleges (primarily colleges in the top two tiers).

TechWare had a large product catalogue for the Indian market, such as financial software for different businesses, and various utilities. Most of the products were not successful and the lax intellectual property laws at that time and the slow-growing computer market led the firm to change strategy. Instead of developing standalone products, it shifted to localization packages for existing US software products. Some of its own products and the localization packages were successful, but did not generate significant growth. In the early 1990s TechWare decided to use its sales channels and software experience to become the Indian distributor of several US software products and to provide support. In the mid-1990s one of its major US customers asked TechWare to do more software development for the Indian market, initially localization projects.

In the late 1990s, TechWare had such a rapid growth opportunity in delivering offshore software services that it established a wholly-owned subsidiary in the United States. It has since expanded throughout the United States and Europe, built multiple Indian sites, and purchased a European technology company.

The common elements in these three Indian companies (and in others that were studied but are not reported here) is that they were established to fill niches created by restrictive Indian FDI policies, either as joint ventures or to develop products that foreign companies were not actively developing or selling in India. EDD and NewTec were true independent entrepreneurial companies established by expatriate Indians, with college degrees from the United States, whereas TechWare was established by a large Indian company and staffed with graduates from Indian colleges. All three companies had a strong product focus and/or high-level engineering design/development focus, although to survive, they all had to initially depend on revenues from providing offshore services to western MNEs.

For Indian-owned niche producers, we can observe a standard development trend in which the offshored site is, “taking over more and more of the process,” in “long term cooperations” with the work being carried out in “dual-country teams” compared to former cooperations in which a piece of the process was outsourced and then delivered. This coincides with Dossani and Kenney’s (2006) description for MNE captives receiving growing shares of domain knowledge in business process outsourcing. The development is not confined to MNE captives, however, but appears to be taking place in the Indian-owned software engineering firms as well.

Recruitment and Work Organization

Getting access to skilled labor is a priority for MNEs as well as small Indian technology firms, and they are in competition with one another to attract and keep employees. The Indian market for engineers works in a very hierarchical fashion. The school one attends and the field of study one pursues determine placement and chances in the labor market. This is because entry into particular schools and fields, such as computer science at a good technical university, is highly competitive. Places at schools and departments are awarded according to test performance. The top places go to computer science students. Other places go to chemical engineering, mechanical engineering, electrical engineering, physics, etc. by how highly valued particular degrees are in the labor market. Many students with technical degrees are interested in obtaining MBAs to complement their competence profiles. The company type (MNE captive, large domestic tier 1 company, niche producer) and area (IT services, IT software development, product engineering software, business process outsourcing - as domain expert or call center operator) a recruitee enters translate into very different opportunities in terms of job content and salary. One interview

partner described the labor market as being divided into four sectors: (1) the lowest sector, Indian small and medium enterprises (SMEs), (2) Indian owned tier 1 companies, (3) MNE owned captives, and (4) IT consumer services for large international investment banking houses and other financial services (such as Goldman Sachs). This last group has a large resource base and pays very high salaries. The sectors also operate as stepping stones, with employees in sector two gaining experience and specialist knowledge in the hope of moving into sector three businesses where the pay is higher and the job content potentially more interesting. Sector three businesses openly recruit sector two employees. Movement from sector one to two or into sector four from any sector is more difficult.

Interviews carried out with students from the IIT in Delhi underscore this picture. In one class of approximately 100 students, we polled them on their career goals. The large majority of the students, independent of field of study (nearly all had an engineering major) planned to work in sector four firms in the foreign MNE financial sector. These were considered the most desirable jobs in terms of money and career opportunities. With the global expansion of financial firms into India, these jobs have replaced IT as the most desirable jobs for many of the elite university graduates.

Most Indian companies build direct relationships with colleges and universities since the competition for recruitment of the top graduates is high, especially in the centers of IT activity such as Bangalore, Pune, and Chennai. The links with educational institutions also operate in a segmented fashion: the firms with high levels of resources and thus higher pay scales, often MNE captives, have connections with the institutions with the best reputations (who have attracted the best students). One model is to offer internships to work in the company while still studying, and to offer a stipend to receive a master's degree in engineering of which, 50 percent is paid by the government and the other 50 percent by the company. Another draw is potentially more interesting job content as captives take over ever-larger pieces of the product's life cycle and more domain knowledge.

Typically small Indian companies such as NewTec attract young engineers and computer scientists from non-elite Indian universities and colleges, very often with master's degrees and potentially previous job experience in very small Indian companies. Although NewTec goes to college campuses to recruit, they also depend on word of mouth and "lateral" movement from other companies. Small companies such as NewTec can be selective in their hiring because they hire in small numbers and offer a good work environment, challenging work, and career opportunities as new employees gain experience because of their expanding portfolio of development and innovation projects. The large companies hire thousands of workers in a cohort and have large back-office IT services projects. They also have extensive training programs (e.g.,

Infosys's training center accommodates over 13,000 and TCS is expanding to train 30,000 at one time (Wadhwa, et al. 2008).

As is usual in these companies, NewTec develops a career ladder within its small company to provide paths for advancement and higher salaries. The initial path at NewTec is team leader, program manager, and then program architect. The ability to move up a hierarchy is an important human resource tool because one of the main challenges for smaller Indian companies is to retain personnel, especially the more highly skilled and experienced employees. Most work on product modules for MNEs involves a range of tasks: back-office coding, the development of high-level software architecture, and front-end client interface. Employees want to be involved in the latter two tasks which are more variable and technically challenging. Also higher level work tasks usually involve a trip abroad to discuss development work with the MNE customer and this is also highly valued. Attrition is one of the largest problems in Indian companies, and the call centers of BPO divisions have the hardest time retaining people because the work is considered the most boring and the least promising for development. In contrast, offering leading edge work is a major recruitment and retention advantage and can even permeate the usual sectoral divisions of the labor market.

Analysis and Discussion

The primary focus of the study is on the emergence of technology entrepreneurial firms in India, their linkages to foreign MNEs, and their emerging role in global technology development and innovation systems. The trajectory of these firms appears significantly different from that of entrepreneurial firm development in other emerging economies and, perhaps, is a part of a broader different developmental trajectory taken by India (though that topic is outside the scope of this paper).

Through the cases and historical analysis we find three salient features that are distinctive to Indian technology entrepreneurial development: (1) the establishment of small, indigenous firms that depend on origin and/or growth of returning émigrés, and the experience, capital, and knowledge they bring; (2) their initial orientation for product development, but growth which is then tightly linked to the strategies of foreign multinationals; and (3) the emerging innovation trajectories that shift the knowledge frontier of these firms from low-end to more challenging work, which leads to changing relationships between Indian firms and foreign MNEs—from service supporters to innovative product developers.

Migration From, and Back to, India

Migration to western institutions of higher education played a key role in developing highly skilled human capital in technological fields and so a significant factor contributing to Indian

technology development actually began with movement out of India. In the 80s and 90s many Indian engineering and science graduates migrated to the west to obtain postgraduate education and to work in the western (mostly US) IT industry. Historically, the Indian education system has been superb at selecting high achieving and highly motivated undergraduate students but very weak at providing strong technical and industry-relevant education at the undergraduate or graduate level. The limited educational capacity (e.g., see Finegold et al. 2011), in combination with limited opportunities for domestic leading-edge technology work, resulted in out-migration for education (see Khadria 1999, 2007, 2012 for historical and contemporary migration patterns). Many graduates then remained overseas to pursue careers not available in Indian industries at the time. The number of non-resident Indians also grew through various guest worker programs such as the H-1B visa program used extensively for technology workers. Initially the H-1B program was used primarily to supply lower cost labor (e.g., through “body shops,” the contract labor supply firms) and to support offshore IT development, sometimes to work for specific projects as a type of exchange worker at the home base of MNEs with sites in India (Salzman 2000).

A more recent trend sees a growing number of these migrant technology specialists returning home as they perceive an improvement in the opportunities in India, both to work in more challenging jobs and to start their own firms. For some expatriates, India offers better career opportunities than those available in the United States. Some began seeing fewer promotion opportunities in the United States and found work there too conventional. Furthermore, as India changed, with more efficient services and less government bureaucracy, it became more attractive (Khadria 2012, Sharma 2015). As one of the Indian managers who had returned said, “It’s exciting to be here. It’s like Silicon Valley in part. Bangalore feels the same way.” Even those who stay abroad make up a pool of “transnational entrepreneurs” (Saxenian 2002) whose cultural know-how and social networks facilitate the link between western and Indian companies.

Pathways from Western MNEs

First Waves of Offshoring

A basic starting point for understanding the offshoring of technology work in the case of India might be the observation that the lengthening of value chains of foreign MNEs has been a major driver for its development. In the 1980s and 1990s company strategies focused increasingly on competitive advantage which involved realizing gains by identifying processes or tasks that can be externalized to be provided more cheaply, without comprising the company’s main business or core competence (Porter 1985). Logically, these processes would entail low levels of skill and be easily subject to being carved up and modularized. In manufacturing, this practice was aggressively pursued in the 1980s and 1990s, leading to a high level of geographical disintegration. The process of decomposing and standardizing tasks (the preparatory steps in outsourcing parts of the value chain to overseas production sites in the manufacturing sector) is

now at a very advanced stage. It has further accelerated by a digitalization of processes, thereby expanding its scope and enabling, for example, the outsourcing of tasks in IT and services (Gereffi 2006, Huws et al. 2009, Author A 2010). In the late 1990s, offshoring by MNEs to India for software and, to a lesser extent, engineering in other industries began to increase, quite dramatically after 1999 (beginning with Y2K remediation and then for back-office and software services (Salzman 2000). As mentioned above, initially so-called lower level tasks were targeted for offshoring; working in call centers and help desks in BPO, rewriting code, and testing in software development were the activities being identified for externalization. Eventually a next step was more offshoring in technology intensive software services. Use of standardized software platforms in corporate information systems developed by western firms is common in a variety of fields, such as finance, human resources, customer relations, and supply chain management. This has contributed to the trend to outsource or offshore to India, moving the emphasis away from a one-dimensional software coding task strategy, to various areas of business process outsourcing (Dossani 2007). The software products typically used by firms to run their business processes cannot be successfully developed and sold without a deep understanding of how these users run their businesses, and without the users having ongoing relationships with the software vendor. Thus the interaction between western MNEs and their Indian offshored sites intensified and the task profile of Indian firms was upgraded. MNEs have been an important driver for Indian technology development. There is evidence that western companies felt pressured to “jump on the bandwagon” and participate in the management fad of offshoring even without a real strategic plan for the use of the remote sites (Flecker & Kirschhofer 2002; Lynn & Salzman 2009, Holtgrewe and Meil 2012).

The concentration on lengthening the MNE value chains as the driver of technological entrepreneurship has been expanded with the recognition that there are different types of Indian companies beyond MNE spin-offs, captives, or outsourcing destinations. Large Indian producers with strong capital bases such as TCS, Wipro, or Infosys have even started to buy up their own subsidiaries and to operate outside of India. Outsourcing, therefore, sometimes ends up contributing to a structural shift in the economy in which large service providers and supplier companies emerge from initially dependent units (Flecker and Meil 2010).

Another type of indigenous firm development led to a number of smaller Indian companies that either found niche product markets or managed to remain service suppliers and IT specialists to a range of customers, thereby maintaining their independent status. These smaller companies, often started by foreign educated returnees, typically begin with the intention of developing an independent software product. However, they found the limits in this strategy because of a still immature Indian market and a lack of expertise and resources in the area of sales and marketing. The investments that would be required in these areas and the unclear outcome often lead to the decision to offer offshore IT services to foreign companies who do not have their own captive

operations in India. Often initiated as an interim strategy to provide IT services as a means of generating operating revenue to support product development, the services business grew rapidly while the product groups floundered. Global standardization in IT and the expanded market push by global companies made it difficult for indigenous companies to compete in more product markets (e.g., before the dominance of Microsoft Office, local products were viable but as Microsoft Office became dominant in the United States and Europe, Indian consumers and businesses wanted to adopt global standard products, as well as not having the resources of global companies such as Microsoft to market their products).

The consequence, as evident in our cases, is that IT services dominated the companies while product development was either largely abandoned or maintained as unprofitable or barely profitable niche units in the company. However, the product development legacy, as in EDD, NewTec, and TechWare meant that developers and managers kept alive both the skills and desire to do product development; despite the source of most revenue, it remained their *raison d'être*. The result was a “bottom up” push by these companies into development work beyond the scope of the service tasks they were contracted to do and overlapping at the edges of development work being done by their MNE clients. Their clients gradually and often without explicit contractual changes, began to transfer more development work to these technology entrepreneur companies (see Lynn & Salzman 2008 for discussion of this phenomenon more broadly and of the impact in the MNEs).

The result of the accretion of these incremental scope changes was a change in the company profile of these subcontracted firms, which strengthened their technology entrepreneurial characteristics. Over time, these firms began to be recognized as different from other IT services companies, and particularly from some of the larger IT services companies, as capable of taking on more development work. As such, they became distinguished as a particular type of technology entrepreneurial firm that could work on product modules or product development for foreign firms, sometimes quite large ones, as well as being especially attractive to medium-size companies that cannot afford to set up their own captives. Another customer group for these Indian technology entrepreneurs is companies with captives who are looking for offshore partners outside of the product range that are allocated to their captives and who want to build variable capacity. Of course, the step to independent production does not always succeed, as a recent study on the survival rates of small IT companies in India demonstrates (Ilavarasan & Parthasarathy 2012).

Dynamic Interaction

MNEs presence is increasingly growing in India. The reasons usually given for offshoring are cost cutting, access to markets, and the use of highly skilled local human resources (Lynn et al., forthcoming). Yet the strategies of MNEs often turn out to be more complex than the original

intention and the reasons for offshoring also change over time. There is evidence that initial cost-cutting motives tend to become mixed with other strategies or move increasingly in the direction of skilled human resources and access to markets. Krishnan (2010, 2011) attributes Indian success in the seamless delivery of high-quality services, to a model in which a limited number of software engineers work at the customer's site, develop a deep understanding of customer needs, and manage the interface to a much larger team of "offshore development centres" who do the actual coding and software development for very customer-specific projects. For the Indian side, certainly the high levels of investment and activity of MNEs create opportunities for small technology entrepreneurs to secure their financial bases and establish themselves for particular tasks and specializations. Moreover, the interaction between workers from the Indian firms and their western colleagues improves the skill and knowledge level of the Indian labor market entrants.

Implications

The case of technology entrepreneurship as it developed in India is a case that, at first, eludes easy conclusions. At first it appears to be the outcome of failure and serendipity: of the failure of state-directed policy to develop indigenous industries and the failure of entrepreneurs to develop globally viable software products, followed by serendipity of opportunity created by MNEs globalizing and outsourcing. On more detailed examination however, we find that, in fact, it is a case that sits between state-directed development and restrictive FDI policy on the one side, and the product entrepreneurship that was born in that period, and on the other side the liberalization of FDI policy and the market dominance of foreign companies that effectively precluded local software product development. That is, in the initial periods of global IT industry development, the exclusion of foreign companies created the "entrepreneurial space" that motivated innovators and product developers to launch their software companies.⁴ The failure of these companies to establish themselves as software product companies seems inevitable in view of the dominance of the major, mostly US, software companies globally. Even the initially promising opportunity for open-source operating systems to take hold during the early 2000s, in the United States, India, and China, were quickly closed by Microsoft through strategic policies and negotiation with governments around the world who were supporting open-source operating systems. Similarly, software product companies in all but a few niche markets had little chance of success in the face of the overwhelming dominance of these global companies and with the increasing need for globally compatible software.

⁴ As noted above, this is a case of an "action space" created in the interstices of structural constraints, in which actors respond to, and push the boundaries of firm strategies and practices and, in so doing, lead to a restructuring of opportunity, of expanding the action space, or entrepreneurial space in this context, from the bottom up (e.g., see Salzman & Rosenthal 1994).

In this context, the failure of India software product companies can be seen as all but inevitable. However, the early protection through restrictive government policies allowed these firms, entrepreneurs, and software developers to emerge, develop networks, and be positioned to exploit the opportunities for software services when MNEs searched for outsourcing companies. As characterized not as a “rational and purposeful planning process in which firms seek to optimize outcomes,” but similarly to Chandra, et al. (2009, 52-53) findings, as “discovered by international opportunities rather than seek them.”

In our findings, notable is not just these firms’ ability to switch from product development into services, but the emergent innovation of “value chain creep” to pursue innovation activities from the bottom up. It is a process in which a firm’s position in networks, in our cases often because of their prior product development, and because of their legacy they had attracted developers and entrepreneurs with the skills and motivations to pursue development rather than just services.

The implications for policy can be characterized as appreciating the value of emergent possibilities, of allowing for change to environmental conditions and eschewing easy and formulaic policy advice (e.g., see Ortmann & Salzman 2002). Although various “development policy” prescriptions flow easily about either protectionism or free markets and focus only on comparative advantage, these cases and the broader history of IT in India suggest otherwise. Namely, unique opportunities are emergent and defy easy policy prescriptions, other than precluding change that does not foreclose emergent possibilities (e.g., such as strong state controlled business development). Although India’s overall policies are typically seen as restrictive and a barrier to new technology and industry development, as Sharma’s (2015) history of the IT industry shows, there was, in fact substantial state-led development that laid the foundation for these later IT service companies to emerge, both the large dominant firms and these smaller technology-entrepreneurial firms. And it was government policies that limited foreign firms in the early technology period that created the opportunity, or “entrepreneurial space,” to attract product innovators to the IT industry and retain some of them in India.

Conclusion

The growth and transformation of commodity firms based on outsourced work is a common trajectory in many emerging countries and a large part of China's initial and continued development. For a number of reasons, including lack of good infrastructure and lack of strong, targeted state investment, India has not been able to pursue this developmental strategy to the same extent as other emerging economies. The focus on hardware and manufacturing is also a defining characteristic of industrial success in most emerging economies. State-led development in sectors which require large initial investments as well as investments in infrastructure, human capital development, and macro-economic policies have fostered industrial growth in the Chinese and east Asian economies (Amsden 2001).

The technology entrepreneurial development in India appears to represent a quite distinctive path in terms of both firm development and broader economic development. It is focused on the IT sector which has been able to develop despite lack of basic infrastructure (roads and reliable electricity) and is in the area of "knowledge work" that is work requiring high levels of education and often high-end tasks, rather than manufacturing or traditional routine engineering. It's similarity to other models is that it, too, initially developed out of low-end, outsourced work that MNEs offshored for labor cost savings. Indeed, there are several large IT firms that grew to capture this work (Infosys, Wipro, TCS). However, there is also a growing sector of small technology entrepreneurial firms that are following a different trajectory. These Indian companies have either found niche markets or have managed to remain service suppliers and IT specialists to a range of customers, thereby maintaining their independent status. Over time, they slowly move to upgrade their portfolios, engaging in MNE product development work, but also on creating their own products.

The "entrepreneurial space" that provides the basis for their emergence and growth comes from a set of historically specific circumstances, some by design and others unintended: the zig-zag course of Indian policy on foreign investment, the regional and industrial geography of India; the Indian educational system; migration paths out of, and back into, India; and the dynamics of MNEs; primarily US MNE globalization (e.g., Lynn & Salzman 2008 on "third generation globalization"). The survival and growth of Indian technology entrepreneurial firms appears much linked to IT outsourcing strategies of MNEs. Their key human capital came from a reverse flow of people who gained their advanced degrees and work experience through medium to long careers in the United States or Europe. It is these Indian returnees who found the "entrepreneurial spaces" to realize their dreams of starting up their own product development firms. Perhaps most importantly, they are beginning to move the innovation frontier in two ways: first, from product to process through innovations in IT services (Lynn & Salzman 2007, 2008); second, from process to product thereby hoping to move higher up in the value chain. These firms are also

better able to enter the knowledge work sectors more easily than firms in other countries because of the English language capabilities of large segments of the population and the foreign experience of these returning émigrés.

The combination of these factors has positioned the technology entrepreneurial firms to pioneer a developmental trajectory that, in many ways, is unique to India. The IT industry has been able to develop without large infrastructure investments and without broader state-led industrial policy beyond some favored tax status. The key human and, to some extent, financial capital base has come through reverse migration. Changes in governmental educational restrictions and increases in education investment are apparently responses to pressure coming from industry (mainly IT) growth that may fuel new opportunities for indigenous innovation. It remains to be seen how extensive and intensive the entrepreneurial product innovation frontier develops in India, but the unique combination of resources and early developments that we observed all point to significant potential. It will not be a surprise to see the “entrepreneurial space” in India expand further.

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