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Coming back home after the sun rises: Returnee entrepreneurs and growth of high tech industries

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ABSTRACT

Recently, the role of returnees in the economic development of various East Asian nations has received much attention. The early literature on the relocation of the most highly trained individuals from a developing nation to a developed nation viewed the phenomena as a "brain drain." Since the 1990s, a new strand of thinking has suggested that for developing nations this was actually a positive phenomenon; as these expatriates studied and then worked abroad, they absorbed technical expertise, managerial, and entrepreneurial skills. These theories stipulated that these expatriates then returned home, and ignited a virtuous circle of technological entrepreneurship leading to rapid economic development. Much of this literature gives returnees a critical role in the home country's take-off period of the local information and communications technology (ICT) industry. This interpretative essay examines the evidence for three of the most prominent East Asian economic success stories – Taiwan, China and India – to determine the actual role played by returnees in their ICT industries' growth. The key question is whether returnees were critical for the initial development period, or whether they played an important role only in the later, expansionary phase of the industry. We find, contrary to the current literature that returnees were not critical, in the initial formation of these countries' ICT industries, but did play an active role in the secondary developmental phase after indigenous entrepreneurs and policy makers had laid the groundwork for the industry.

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1. Introduction

The significant contributions to the U.S. economy brought by highly skilled or, at least, bright and motivated, immigrants have long been known. The same dynamic, however, for a long time was seen as a negative "brain drain," from the point of view of the less developed economies from whence these bright and motivated immigrants came. Brain drain was seen as a process by which the U.S., and, to a lesser degree, other advanced economies, attracted the best talent away from already poor developing nations (Adams, 1968; Bhagwati and Hamada, 1974). In recent years, the perception of brain drain has changed as an increasing number of scholars have noted that some immigrants are returning to their countries of origin to establish new businesses, and hence, becoming returnee entrepreneurs.[1] This is argued to be a "brain gain," whereby former emigrants return with their experiences in the metropole nation and transfer knowledge, practices, and their international networks to their home nation. This brain gain is claimed to have been critical in the formation of powerful export-based ICT industries and their supporting clusters in Taiwan, China, and India (Dai and Liu, 2009; Filatotchev et al., 2011; Saxenian, 2006). For this article, we define a returnee as a foreign national who left their home country to be educated abroad, usually in the United States, and then worked abroad for a period of time, absorbing technological, managerial and entrepreneurial know-how before returning to his or her country to start a business.[2]

This paper does not question the fact that returnees are and have been the carriers of important technical and organizational knowledge absorbed while in the U.S. back to their home nations. Rather, by deploying a sequential historical perspective, it questions the

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[1] In the sociological literature, these individuals have been termed "transnationals" (Guarnizo and Smith, 1998; Ong, 1999; Pries, 1999; Sassen, 1988).

[2] Some scholars have paid particular attention to the importance of Silicon Valley education or work experience, particularly in the Taiwanese and Indian cases. However, we bias our sample by allowing for any U.S. education or training, thus increasing the difficulty of proving that returnees did not play a critical role in the initial formative stages of industrial development in these countries.

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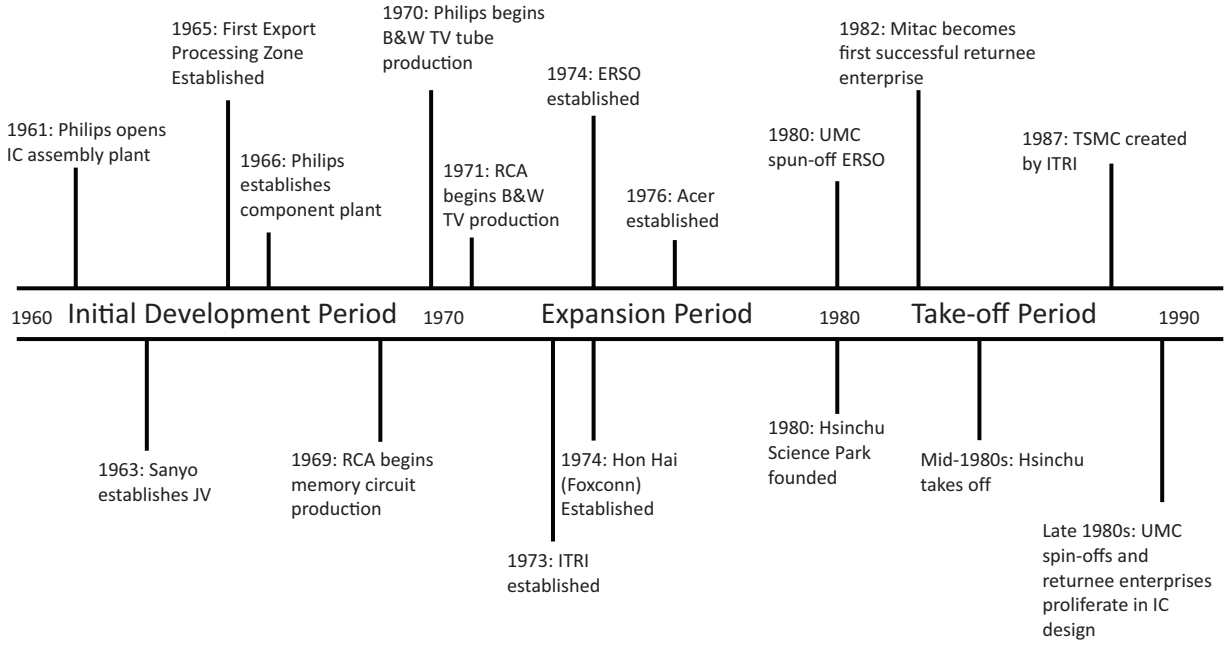

Fig. 1. Taiwan ICT industry development timeline: 1960–1990.

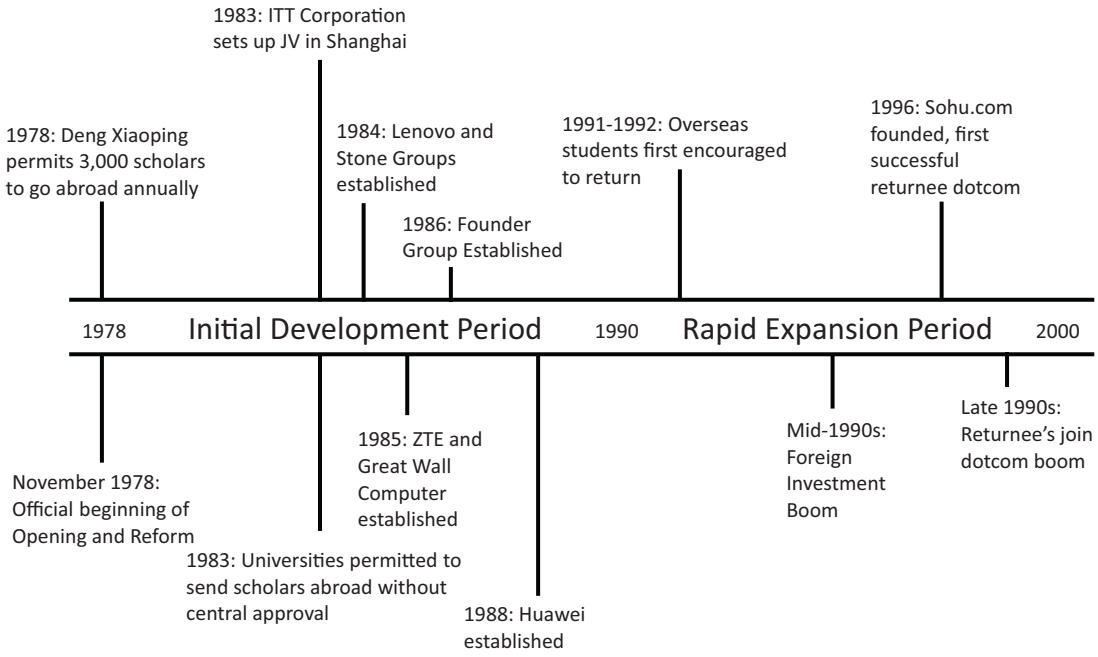

Fig. 2. China ICT industry development timeline: 1978–2000.

importance of returnees for *igniting* the initial self-reinforcing cycle of ICT entrepreneurship in India, China, and Taiwan. We argue that returnee entrepreneurs were not determinative of the seminal emergence and early development of the ICT industry in any of these cases. Most returnee entrepreneurs returned only *after* the domestic industry had already achieved international success, re-joining their home country and contributing to the subsequent rapid expansion phase of the domestic industry. For the three cases, their ICT industries' development can be roughly divided into two or three periods. For Taiwan, the initial development took place from 1961 to 1970; more rapid expansion and deepening including a more activist state role in the 1970s; take-off occurred in the 1980s and only then – and more so in the 1990s, did returnee entrepreneurs begin to play a role. For China, initial development took place in the 1980s followed by more rapid expansion in the 1990s with early returnee entrepreneurs starting businesses in the late 1990s. For India, the 1970s and 1980s were the incipient formative period, followed by more rapid expansion and the beginnings of returnee entrepreneurship in the 1990s (see Figs. 1–3).

In all three cases, as the self-reinforcing development of the ICT industry began *before* the arrival of returnee entrepreneurs, the broader implication is that the efforts of local entrepreneurs and investment and technology transfer/learning from MNCs and public policy hold the key to the emergence and early success of high technology industries in emerging economies. *Returnee entrepreneurs begin playing an influential role only after the industry*

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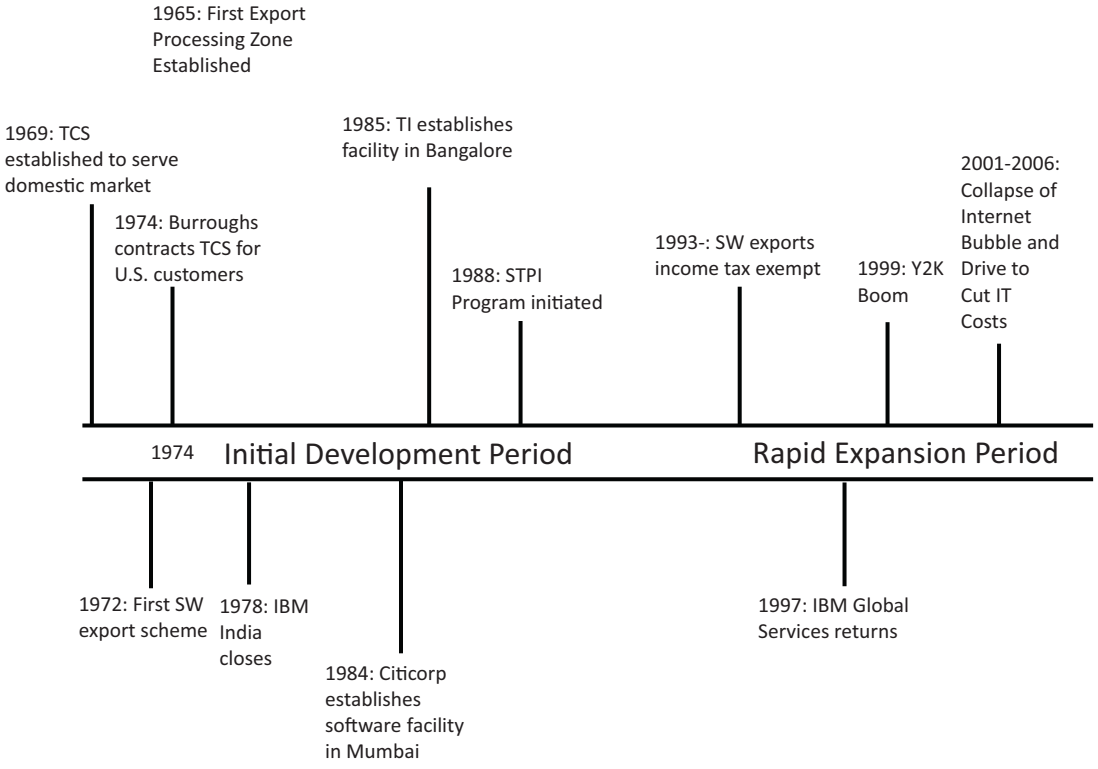

Fig. 3. Indian ICT industry development timeline: 1974–2000.

is already in its expansion and growth phases. Accordingly, both theory and policy prescriptions following the ahistorical views of the transformative impact of returnees should be significantly revised.

Understanding the role of returnees is academically significant not only for the development of theories and our understanding of Rapid-Innovation-Based economic growth, but is of great relevance because an increasing number of nations are developing policies to encourage overseas engineers and scientists to return (Kuznetsov, 2006; Meyer, 2001; Meyer and Wattiaux, 2006). For example, both the central and regional governments in China operate costly programs aimed at luring returnees (known locally as Sea Turtles) in the hope that they will bring about a great wave of entrepreneurial growth and transform the local dynamic to a higher growth curve (Breznitz and Murphree, 2011; Fuller, 2005, 2010).[3] Kuznetsov (2006) notes that the governments of Mexico, Armenia and South Africa are also actively pursuing means of tapping expatriate and migrant networks as sources of domestic industrial development capital and expertise. Some governments have come to believe that returnees are the key to the formation of Silicon Valley-like electronics clusters (Breshahan and Gambardella, 2004). Employing an explicitly historical analysis, this article evaluates the role of returnee entrepreneurship in formation of early firms and critical policy measures in Taiwan, China, and India.

The goal of this paper is to identify at what phase, where, and how important returnees were for the emergence of high technology entrepreneurship in the three nations. While drawing upon the "brain gain" literature, our historical perspective leads to a critique of some of its attribution of significant causal or catalytic influence to returnees.

Returnee studies have appropriately concentrated upon the ICT industry because it offers relatively low-technology, low-skill, and low-capital intensity entry points, as well as multiple paths for upgrading. ICT was also the first high technology industry to fragment and globalize, and indeed was the upgrading vehicle of choice in the most successful emerging economies. Furthermore, ICT was also the industry through which Taiwan, China, and India came to be recognized as emerging technological powers. As Rodrik (2006) and Breznitz (2007b) observed, ICT product export growth differentiates the successful East Asian developing nations from nearly all other developing nations.[4] India differs from the other two nations since it essentially exports no ICT hardware products; rather, its miracle has been most famously based on exporting ICT-enabled services and software. Breznitz and other scholars have observed that the cross-national production networks within which the ICT industry of each of these nations is enmeshed, have multiple pathways for upgrading to higher valued productive activities whether in hardware products or software and services (Breznitz, 2005b, 2007a,b; Breznitz and Murphree, 2011; Borrus et al., 2000; Sturgeon, 2002).

In its strongest, and most parsimonious, version, the returnee literature claims that immigrants from these three nations came to the U.S. for educational opportunities, usually at the graduate level. Upon completion of their terminal degrees, they learned entrepreneurship and the American way of business through work experience in the United States. Armed with this knowledge and their set of connections in high technology hubs including Silicon Valley, Boston, San Diego and elsewhere, they returned to their home countries and became the catalytic factor for the successful

[3] Returnee entrepreneurs enjoy incentives not available to local entrepreneurs including specialized facilities, assistance with administrative procedures such as incorporation and licensing, tax breaks for the enterprise, and personal tax breaks on consumption such as purchasing homes or cars.

[4] We omit Israel from our analysis because it was a new state that was by definition based on immigration from around the world. Indeed, until Itzhak Rabin, all Israeli Prime ministers had been born and raised in Europe or North America. Ireland is omitted because it has not usually been considered a developing nation.

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growth of the ICT industries in their home countries. Accordingly, the literature implies that returnees were the pioneering entrepreneurs who seeded the local industry with their knowledge, organizational practices, business models and market connections, and established new firms while maintaining close, often physical, ties to the United States.

There is a subtle but significant distinction in this argument; the "brain gain" refers not to those who merely studied abroad, but specifically to those who studied and then embarked on a career abroad, returning only after having both these experiences. The implication is that the source nations benefit by sending their best and brightest young talents to the U.S. to be educated and gain work experience. The policy recommendations which follow from such an argument are: (1) developing nations wishing to successfully develop ICT industries should dispatch their best and brightest to the U.S. as these will become knowledge carriers who can return and "jump start" their home nation's industries, and (2) developing nations should implement policies to attract these emigrants home after they have acquired both academic and business experience.

To explain the actual role of returnee entrepreneurs in the success of Taiwan, China and India's ICT industries it is necessary to understand the historical process and the key agents in each country's industry's evolution. Explicit in our appreciative model is the simple observation: for the three nations we study, emigrants left their homelands for better opportunities elsewhere.[5] In each case, as they are free to choose whether or not to return home, they undertake a rational calculation as to the probability of success. Hence, we argue that absent opportunities in their home country, where existing businesses will not value the skills developed abroad, and where establishing new businesses is difficult, the flow of returnees will be commensurately low.[6]

As a corollary, if the home country environment changes and attractive opportunities become available, then the flow of returnees is likely to increase. Indeed, Saravia and Miranda (2004), argue that only once the home country environment is conducive to investment and development can tax incentives and prestige awards successfully entice emigrants to return and invest. This leads to the question of whether returnees could be responsible for the initial emergence of the ICT industries, or whether their importance, although clear and well publicized, has been mostly in the *later expansionary phase* of the industries' growth.

Our historical analysis leads us to conclude that, in each of these nations, domestic entrepreneurs first created the absorptive capacity needed for technological entrepreneurship to flourish (Cohen and Levinthal, 1990). Hence indigenous risk-takers from both the private and public sectors developed the ecosystem within which returnees could successfully return and become entrepreneurs. We define the ICT ecosystem as the underlying structure of institutions and industries which create the demand and capability for higher value added service-based businesses to be viable. Institutions include liberalization of labor and trade markets and allowing foreign direct investment. Ecosystem-building industries include electronics and ICT hardware – especially in the Taiwanese and Chinese cases. In each of these cases, it is only after this ecosystem has been formed that returnee entrepreneurs have a market and opportunity. Only then, in the rapid expansion or take-off phase do they return. It is likely much of the confusion about the role of returnees comes down to an understanding which only considers small start-ups producing cutting-edge software or design products to be high technology. This ignores the underlying ecosystem of the electronics and ICT hardware industry, which in the case of Taiwan and China, provided the initial impetus for returnee entrepreneurship in these areas.

The paper begins by examining the previous research on the role of returnees and a brief section on our methodology. This is followed by case studies of Taiwan, China, and India. We conclude by arguing that our results suggest that governments should focus first on encouraging domestic entrepreneurship and initiating policies that build absorptive capacity, and only later, if at all, develop policies specifically for attracting high-skilled returnees.

2. An appreciative model for understanding returnees

In order to understand the relative importance of returnees in the rapid growth of the three nations' ICT industries, it is necessary to employ historical analysis to situate the role of key individuals and posit their contribution within the overall development of each industry. In the period following World War II, the U.S. was extremely attractive to foreign students. This attraction was further reinforced by the 1965 Immigration Act that removed national quotas, favored immigrants with tertiary education, and encouraged familial reunion. In response there was a rapid increase in the immigration of engineering and scientific personnel particularly from the Philippines, India, and Taiwan (Kanjanapan, 1995; Keely, 1975; Liu, 1996). Undoubtedly, this created the reservoir of experienced personnel in the U.S., but since the Philippines and India were the greatest contributors in terms of numbers from the inception, it cannot explain the timing of the various take-offs or the lack of take-off in the Philippines.[7]

In the U.S. these educated immigrants were offered professional positions or financial support to be educated in the best universities in the world, after which they could either return home or, more commonly, especially after the 1965 Immigration Act, remain in the U.S. where there was great demand for technically trained personnel. Those who stayed in the U.S. received far higher salaries than in their homelands, could undertake more challenging work, and live in a developed country environment. It is neither remarkable nor surprising that many of these individuals remained in the U.S. Indeed, over time in high-technology-based regions such as Silicon Valley, Boston, and San Diego, non-U.S. citizens came to constitute a substantial portion of the technical work force.[8]

In the 1990s, scholars began noticing that some erstwhile high-skilled immigrants were returning to their home countries to establish firms (Kapur, 2001; Kapur and McHale, 2005; Luo and Wang, 2002; Saxenian, 2006). Saxenian (2006) argued that this was particularly important for the formation of the ICT industry in Taiwan, China, and India. Based on this evidence, some scholars concluded that a "brain circulation" or, for the most positive, a "brain gain" dynamic for the donor nations had emerged as highly skilled emigrants returned home.[9]

[5] Other scholars, including Saravia and Miranda (2004) and Zweig (2006) have found similar forces at work, noting that only once opportunity becomes available after internal policies are made coherent and investments in science and technology begin to bear fruit will overseas nationals consider returnee entrepreneurship.

[6] Kuznetsov (2006) finds that many developing countries with large and comparatively wealthy overseas resident ethnic and migrant communities find it difficult to tap into these resources because of the obstacles to establishing businesses in the metropole nation. Only once the domestic environment has improved, or the perception of difficulty has been corrected, can these large overseas networks be expected to invest directly in domestic economic growth.

[7] Philippino immigration included medical, engineering, and scientific personnel and evolved over time to be more oriented toward medical service personnel, in particular, nurses and doctors (Kanjanapan, 1995).

[8] The Silicon Valley work force is multinational, but the East and South Asian immigrants are most noticeable and receive the greatest attention because of their physical differences while European immigrants simply "blend in." Immigrants of all types made up 32% of Silicon Valley's technological workforce in 1990, two-thirds of whom were Asian..

[9] This positive evaluation has been challenged; see, for example, Schiff (2005).

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Returnee entrepreneurs, of course, are not the only exogenous source of knowledge transfer. However, returnee studies consistently downplay multinational corporations (MNCs) as another mechanism for transfer of managerial techniques and technical capabilities.[10] The returnee literature has no provision for this mechanism of return due to its emphasis on the decisions of individual free agents, not the transfer of emigrants back to their homelands as expatriate managers and research directors. In contrast, in evaluating the role of returnees, this paper makes an important distinction between the role of MNCs as a vehicle for knowledge and skill transfer – especially in the early period of ICT industry development in these countries, and the, later, role of individuals who independently return specifically to become entrepreneurs.[11]

There is little doubt that returnees can be particularly skilled interlocutors or carriers of technology (on carriers, see Edquist and Jacobsson, 1987). The efficacy of relocating knowledgeable people to transfer knowledge has long been recognized which partly accounts for the importance of transferring expatriate managers and directors to new investment locations (Davenport and Prusak, 1998; Kogut and Zander, 1993). This is true, in part, due to the difficulty of transferring tacit knowledge without face-to-face communication (Szulanski, 1996). Yet it is difficult or impossible, even with face-to-face interaction, to transmit either tacit or even some types of explicit knowledge, if the receiver does not have the capacity to absorb and use the knowledge (Cohen and Levinthal, 1990). The development of this absorptive capacity is, therefore, the first and necessary step prior to returnees being able to use their skills at home.

The returnee literature recognizes the importance of the state, but almost entirely through the prism of whether the state is actively encouraging emigrants to return (Kuznetsov, 2006; Meyer, 2001; Meyer and Wattiaux, 2006). The reality is, however, that in these nations, the state's role, though different in each case, in creating the preconditions for the successful growth of the ICT industries was both expansive and critical (Amsden and Chu, 2003; Breznitz, 2007b; Gold, 1986; Hwang, 1991; Levi-Faur, 1998; Naughton, 1995; Noble, 1998; Wade, 1990). Thus, while one paper cannot fully analyze all these streams of literature, in our historical analysis we do inquire whether returnees played important role in the development and implementation of key industrial development policies.

3. Defining "returnees"

The broadest definition of a returnee is anyone who attended a university or graduate program abroad and then returned home. However, as noted above, this is not the definition used in the "brain gain" literature. The more normal definition of "returnee" is an individual who finished their studies abroad, then worked in a foreign ICT firm prior to independently returning to be involved in domestically owned, or self-started, ventures. With their foreign work experience, these individuals could be expected to bring practical managerial and technological skills, as opposed to purely academic knowledge. Based on this definition of a returnee, this paper examines the role of the returnees in three domains: (i) the formation of key early companies; (ii) the formation and implantation of policy; and (iii) as carriers of specific new business models, especially given the supposed advantage or uniqueness of Silicon Valley experience.

This paper finds that contrary to the stronger arguments in the returnee literature, returnees were not the critical factor in the *early* formation and development of the ICT industry, since they played a significant role only *after* the local ICT industry already had a, sometimes substantial, degree of domestic and international success. This alters the standard formulation. Our analysis sees returnees as beneficiaries of home nation changes rather than being the initiators of this change. If this is the case, then claims about returnees' inceptional role and their centrality must be revised. The importance of the returnees is more likely in providing what sociologists term "bridging social capital" (Putnam, 2000) or as filling "structural holes" (Burt, 2004) by further deepening home country industrial development and connections to the U.S. economy. Such an interpretation allows a more realistic and nuanced understanding of the networks that led to the growth of ICT industry entrepreneurship and clusters in these three nations. In this formulation, the bonds of school, family, military and ethnicity form the basis of social ties through which much, but not all, cross-national business is conducted (Breznitz, 2005a; Peng and Zhou, 2005), but does not require the returnees to initiate the first stage of home-country ICT entrepreneurship. In this more modest formulation, there can be an explicit recognition of the role of MNCs in increasing the absorptive capacity of their host nations (Kogut and Zander, 1993), building supplier–purchasing relationships, many of which are based on economic interests and not ethnic bonds, as well as creating an effective channel through which immigrants can return as managers and then be woven into the local industry.

4. Methodology

The discussion of the three national ICT industries is drawn from the voluminous secondary sources on the subject, as well as an original dataset tracking the career patterns of the founders of the major ICT firms in the three locales. The firms selected as examples are the largest entrepreneurial or most famous ICT firms still in operation. The firms chosen for inclusion were also those established in the early history of the industry in those nations, in order to show the role, or lack thereof, of returnee entrepreneurs in creation of critical early enterprises. Latecomers such as the now very important Taiwanese cell phone firm, HTC, which was established in 1997, are not included because they were not established early in the development of the industry and thus did not play a role in *creation* of the industry. In the case of China, reorganized or restructured state-owned enterprises including Haier, TCL, Inspur, Putian and Julong are not included as they were not entrepreneurial startups. We also omit later firms such as Datang, Shinco, and Aigo which were established in the 1990s once the consumer electronics market and export sector had begun to take off. We must caveat our research noting it is also possible that certain key firms were omitted due to their early market exit, however, of the universe of successful and transformative firms, our sample is complete and thus sheds light on the role and timing of returnee entrepreneurs.

For each firm, the year of establishment, the headquarters' city, and each of the founders was identified. Where possible it was established whether the founders had attended a U.S. university and the university from which they received their highest degree. For all of those who had studied in the U.S., it was established whether immediately upon graduation they returned home or gained work experience in the U.S. For each founder, it was established whether either the firm that employed them or the university

[10] For key contributions on MNCs and technology transfer, see Prahalad and Doz (1987) and Vernon (1971); for a review of the economic evidence, see Blomström and Kokko (1998).

[11] In the Taiwanese and Chinese cases, MNCs from Japan, Taiwan and Hong Kong were particularly important in transferring capabilities and knowledge in the early years of their ICT industries' development (1960s in Taiwan, 1980s in China). American and European MNCs mostly came later (1970s in Taiwan, 1990s in China), once the host country's institutions and industry were more established. Returnee entrepreneurs came even later. MNCs not only directly transferred skills and experience, they also offered training and management expertise to local employees, some of whom went on to start their own entrepreneurial ventures.

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from which they graduated was within Silicon Valley. With this data, it is possible to ascertain the importance of returnees, or Silicon Valley, for the formation of home nation firms.

5. Taiwan

Taiwan[12] is not only the quintessential case for the argument that returnees are a critical component for a nation's development of an entrepreneurial electronics sector and a Silicon Valley-like cluster – it has served as the template for generalizations to other nations (Saxenian and Hsu, 2001; Saxenian, 2006; for a different perspective, see also So, 2006). However, we shall show that the true roots of Taiwanese ICT success were actually from indigenous entrepreneurship and MNC investment, not returnees. Further, the actions of embedded state actors were critical in creating an ecosystem capable of providing suitable opportunities for returnees (Breznitz, 2007b). When this history is recovered, the actual role of the returnees in building the entrepreneurial ecosystem can be understood.

In the 1960s, Taiwan was recognized as one of the leading brain-drain nations especially in engineering and the sciences (Kindleberger, 1968). Top Taiwanese students typically completed their undergraduate degrees in Taiwan before continuing their studies in the U.S. and not returning (Kao, 1971; Ruth, 1970). As late as 1970, of those that did return, 65% held advanced degrees in the social sciences and humanities (Kao, 1971, p. 25). Surveys of Taiwanese receiving advanced training in the U.S. conducted in the late 1960s indicated that many chose to remain in the U.S. for better facilities, higher salaries, and the intellectual atmosphere.

The roots of the Taiwanese ICT industry can be traced to the investments of foreign MNCs in the consumer electronics industry (Amsden and Chu, 2003; Hobday, 1995b; Wade, 1990). Indeed, the historical evidence suggests that the learning process and initial growth of the industry were the direct result of MNCs' activities. In the 1960s, Japanese and American consumer electronics firms and labor-intensive components suppliers established operations in Taiwan (Simon, 1988; Wade, 1990). With government support and prodding, such as local content requirements and restrictions on the degree of foreign ownership, smaller Japanese firms established joint ventures with Taiwanese parts suppliers (Gold, 1988, p. 166; Hobday, 1995a). Co-location of foreign and domestic firms in Taiwan's free trade zones and enrollment in the same trade associations fostered information exchange and learning for domestic companies, without the input or experiences of returnee entrepreneurs (Hobday, 1995a; Kuo, 1995; Zenger, 1977). Such learning enabled local firms to expand the level of locally produced content in Taiwanese electronics exports from 10% in 1972 to over 30% by 1979 (Breznitz, 2007b). Taiwan was thus integrated into the U.S. and Japanese electronics supply chains, although few managers were returnees (Borrus et al., 2000; Van Der Putten, 2004).

The investments made by Royal Philips Electronics deserve special attention because of their importance in upgrading Taiwanese capabilities. Philips actions are a clear example of the critical role played by MNCs in developing the early ICT industry in Taiwan. In 1970, Philips built the first picture tube manufacturing factory in Taiwan (Van Der Putten, 2004). Philips dispatched engineers and managers to train the Taiwanese thereby initiating a powerful learning dynamic. In 1976 Philips built its first color TV tube factory in Taiwan igniting yet another round of investment and technology upgrading. Philips became an integral part of the Taiwanese high-technology industry and later would provide 27.5% of the initial capital for TSMC (Fuller et al., 2003).

A similar technology transfer dynamic from Japanese firms was underway as they sponsored training seminars and dispatched Japanese engineers to work at local supplier facilities (Hayashida, 1994). Taiwan's electronics industry benefited greatly from the heterogeneity of foreign investors and customers as this created a solid foundation for Taiwan's indigenous electronics industry and initiated the trajectory resulting in Taiwan's developing a globally competitive ICT manufacturing industry. The growing capabilities and size of the domestic ICT manufacturing industry changed the landscape for ICT business in Taiwan. Acer's President Stan Shih (1996, p. 4) reflected upon the importance of this development saying that after the MNCs entered, for "the first time, graduate students did not have to go abroad and had the opportunity to work at home." In Shih's case, this led to his becoming a domestic entrepreneur. The roots of Taiwan's ICT industry thus do not lie with returnee entrepreneurs but rather foreign MNCs' investments and the responses of their increasingly numerous local suppliers.

The role of the state in the development of Taiwan's electronics industry, which is elaborated on below, was not *sui generis*, but resulted from aggressive government interaction with local firms and MNCs. As Breznitz (2007a,b) shows, the Taiwanese government, in close communication with industry, actively developed policies to encourage Taiwanese firms to become enmeshed in global supply chains.[13] In contrast to strong developmental state arguments, the first of the local-multinational corporation alliances actually occurred *prior* to implementation of proactive product- or market-specific policy targeting. It was only after these relationships were established that the state became a strong advocate for indigenous electronics firms and shifted legislation from attracting foreign investment to encouraging and protecting local firms by restricting foreign participation in certain markets and technologies (see Lam, 1992; Kuo, 1995). Ties to foreign firms provided local manufacturers with the know-how and legitimacy necessary for the state to leverage a more targeted industrial policy in the 1970s. Experience supplying components for consumer electronics MNCs prepared Taiwan for making parts for and assembling personal computers (Chen and Ku, 2002; Wang, 1995). In the early 1980s, the government made another fateful decision: it opened the consumer electronics industry to global competition, thereby forcing Taiwanese firms to search for new business opportunities. Contemporaneously, for social policy reasons, new government regulations restricted the ability to produce computer gaming equipment (Tinn, 2011). These opportunities turned out to be in the personal computer and computer peripheral industries, which were just taking off in the U.S. This is illustrated in Table 1 which shows that most of the early assembly oriented firms that gave birth to Taiwan's ICT industry were established by local Taiwanese entrepreneurs without overseas experience.

Despite its successes in producing an array of electronic components and providing assembly services for foreign companies in a wide variety of electronics areas including semiconductor packaging and testing, by the mid-1970s, it was clear that developing competencies in integrated circuits was critical for Taiwan's continuing success in electronics. However, mastering this technology was also very expensive. Following the Japanese lead, mastering semiconductor technology became the goal of the Taiwanese government. The initial effort was to establish semiconductor fabrication operations that would produce semiconductors under contract for firms that designed chips (these firms are included in Table 1). Returnees would have greater importance as investors and entrepreneurs in the design sector, an industry that has come

[12] Much of this history section is drawn from Lowe and Kenney (1999) and Breznitz (2005b, 2007b).

[13] The role of K.T. Li and Y.S. Sun in encouraging such relationships cannot be underestimated, as they appeared, as an intermediary/policy maker cum negotiator in many of these relationships.

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Table 1
Taiwanese ICT assembly and integrated circuit fabrication firms, founders, and information on returnee status. Plain indicates domestic, ***italics bold indicates MNCs/Government/University spin-offs and returnees,*** *italics indicates returnees*, **bold indicates Silicon Valley**.

Firm	Founding Date	Founders	U.S. Education*	U.S. Work Experience*	SV Experience*
Hon Hai (Foxconn)	1974	Terry Guo	None	None	None
Acer	1976	Stan Shih	None	None	None
		George Huang	None	None	None
		Fred Lin	None	None	None
		Kenneth Tai	None	None	None
		Carolyn Yeh	None	None	None
United Microelectronics Corporation (ITRI Spin-off)	1980	Robert H.C. Tsao	None	None	None
First International Computer (ITRI Spin-off)	*1980*	*Chien Ming J. Charlene Wang*	*BS, Ph.D., UC Berkeley Statistics, UC Berkeley*	*Bell Laboratories Rockwell International*	*University-only University-only*
Mitac	**1982**	**Matthew Miau**	**BS EE/CS, UC Berkeley, MBA Santa Clara**	**Yes**	**Intel**
Episil	1985	Archie Hwang	None	None	None
*Winbond (ITRI Spin-off)#### *	*1987*	*Yang Ding-Yuan*	*Ph.D. EE Princeton*	*Harris Semiconductor*	*None*
*TSMC (ITRI Spin-off)### *	*1987*	*Morris Chang*	*BS, MS in ME, MIT, Ph.D. EE Stanford*	*Texas Instruments, Pres., General Instrument Corp*	*University-only*
Quanta	1988	Barry Lam#	None	None	None
Computer		Leung C.C.#	None	None	None
**Macronix## **	**1989**	**Miin Wu**	**MS, Materials Science, Stanford**	**Rockwell International**	**Intel**
ASUSTek	1990	Tung T.H.	None	None	None
		Ted Hsu	None	None	None
		Wayne Hsieh	None	None	None
		Liao M.T.	None	None	None

Source: Author's compilation from various sources.
* Prior to establishing the firm.
# Co-founded Kinpo in 1973, then left to form Quanta.
Macronix started with 100 persons many of whom were returnees.
Morris Chang was recruited by the Taiwanese government to head ITRI and when TSMC was spun-off he became the founding chairman.
In 1987, after the launch of TSMC, ITRI was still in possession of its first pilot fabrication plant and its personnel. The plant manager, Dr. Ding-Yuan Yang, who was educated in Princeton before being hired by ITRI hired to come back to Taiwan and lead its research group, engineered an MBO, launching the ITRI fab as Winbond.

to be considered the quintessential Taiwanese returnee industrial sector. And yet, even in this case the role of returnees was neither catalytic nor formative as the first enterprises were created through a public industrial research institution – the Industrial Technology Research Institute (ITRI); especially through one of its early laboratories – the Electronic Research and Service Organization (ERSO). At that time Taiwan was one of the policy pioneers of creating private high technology companies by government-blessed spin-offs of complete research groups and projects from ITRI's ERSO.

Remarkably, despite ITRI's and the Taiwanese state's critical role in laying the groundwork for, and creating the market demand for, returnee entrepreneurs and enterprises, the entire historical trajectory that built the competencies allowing Taiwanese firms to transition to the PC era has been largely ignored in the returnee literature. It was this industrial ecosystem of electronics and PC manufacturing that created the domestic demand for chips and created the impetus for state action to help build the industry and later create demand and opportunity for returnees.

5.1. Taiwanese government policy

Taiwan's government played an active role in fostering the development of the semiconductor and electronics industries. In the 1970s, officials recognized that to achieve continuing success, Taiwan would have to import and integrate more sophisticated technology from abroad. This prompted the government to form ITRI in 1973 in Hsinchu City.[14] ITRI's role in the development of the semiconductor fabrication industry is considered the great Taiwanese success story, and is often held up as a model, if not the model, of effective state-led public research institute-based economic and technological upgrading (Mathews, 1997). The importance of the educated and experienced Taiwanese community abroad during this period was not as a source of returnees, but rather providing advisors to the government on the kinds of policies that could drive industrial upgrading.[15] Overseas scientists, especially at RCA, played an important role in the formation of ITRI's ERSO and the later development of the IC industry in Taiwan.

The key to making Taiwanese firms into global leaders in producing an array of ICT hardware was learning and upgrading (Breznitz, 2007b). To accomplish this goal, ITRI formed specific research groups to develop technology and products that were then spun-off, a globally novel policy approach at the time. This is the main model in which ITRI first created and then seeded the Taiwanese semiconductor industry. Also, ITRI formed successive consortia focused on importing, developing, and transferring technology from the U.S., Japan, and Europe to Taiwan's myriad assemblers. These consortia were crucial in the creation of the Taiwanese desktop, laptop, and mobile phone industries (Mathews, 2002; Mathews and Cho, 2000). ITRI provided Taiwanese firms with a mechanism for upgrading, thereby facilitating their entry into markets dominated by foreign firms and then assisting upgrading through learning-by-doing. ITRI was not a bleeding-edge scientific research institute but rather a technology importation, absorption, and diffusion institution whose goal was to transfer technologies to private industry (see, for example, Breznitz, 2007a,b).

By the mid-1980s, U.S. firms were leaving the semiconductor memory business, while ITRI and the Taiwanese government

[14] There is some confusion regarding the year that ITRI was officially established. Some ITRI publications cite 1973 and others 1974.

[15] However, several of the most important foreign advisers were not Taiwanese. For example, one of the central overseas advisors was Robert O. Evans, a former vice president for semiconductor development at IBM who was not Taiwanese (Partee, 2004, pp. 107, 109 and 110). Evans also was involved in recruiting Morris Chang for TSMC and was a joint chairman of UMC (Breznitz, 2007a,b; Partee, 2004).

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resolved to enter this sector (Mathews and Cho, 2000, pp. 169–170). Roughly paralleling the investments by Korean and Japanese firms in Silicon Valley semiconductor firms during this period, ITRI's ESRO entered into agreements with three Silicon Valley firms: Quasel, Mosel (MOS Electronics Taiwan, Inc.), and Vitelic for technology development.[16] Quasel was established in Silicon Valley in 1984 but, after raising large sums of capital to build a memory fabrication facility in Taiwan, collapsed five years later (Mathews and Cho, 2000, pp. 169–170; Uerkvitz, 1984). Mosel was established by two Taiwanese veterans of Fairchild Semiconductor (Saxenian, 2006), who formed a memory firm in Silicon Valley with investments from a Taiwanese multinational. In 1983,Vitelic was formed in Silicon Valley by Alex Au who also had had experience in Fairchild with the intent of using U.S. design skills and Taiwanese production capacity. Vitelic became a research contractor for ITRI in Taiwan's VLSI project, with a view to developing VLSI technology for 1M-DRAM production (Partee, 2004, p. 288).[17] The Taiwanese operation apparently began operation in 1985. According to Mathews (2006, p. 100), these firms had difficulties because the absorptive capacity for advanced memory production was not present in Taiwan at that time. For these three semiconductor memory design firms, Taiwanese engineers in Silicon Valley were founders, however, very importantly, in each case the firm was established first in Silicon Valley and, for all intents and purposes, recruited back to Taiwan by ITRI.

Of ITRI's successes, the creation of the semiconductor foundry business through its establishing of UMC and TSMC has received the greatest attention. As an initial source of technology, the U.S. – though not Silicon Valley firms but rather RCA, AT&T, and later Texas Instruments – was of crucial importance (Mathews and Cho, 2000). The fledging firms took advantage of the fact that the cost of building a semiconductor production facility had made it impossible for venture capitalists to fund a de novo semiconductor firm (Leachman and Leachman, 2003). Silicon Valley entrepreneurs instead established small firms developing unique designs that could be very profitable, but they required a factory to produce them. Initially, the only production facilities available were on existing semiconductor firm's production lines creating significant conflict.[18] The need for a secure means of producing chips provided an opening for Taiwan. Leveraging low-cost capital available in Taiwan, ITRI and the Taiwanese government established TSMC with the intention of creating a pure-play foundry which would only produce chips for others. The initial launch was a major gamble. Only with massive state support either directly or through the investment arm of the then ruling KMT party, a significant investment from Royal Philips Electronics, and capital advanced by wealthy Taiwanese, sufficient funds were pooled to launch TSMC. Together with UMC, which converted to the pure play model in the 1990s, the two Taiwanese companies changed the organization of the semiconductor value chain, and in the process became the globally dominant companies in this new market niche. As a result, this allowed the rapid expansion of a new type of firm – the fabless semiconductor firm.

The skills developed by Taiwanese engineers designing semiconductors in U.S. firms and close contacts with electronics firms willing to buy semiconductors encouraged Taiwanese engineers to establish their own fabless semiconductor design firms, most often designing chips for products produced by Taiwanese ICT assemblers, thereby replacing imported integrated circuits. The symbiosis between pure-play foundries and high local demand for mid-range consumer and computing integrated circuits created an expanding market opportunity for semiconductor design firms. As a result, Taiwan is now home to a greater number of global top 25 semiconductor design firms than any other nation except the U.S. Further, with its conversion to the contract manufacturing model, UMC spun off several companies including MediaTek, RealTek, Novatek and Faraday Technology, which became leading design firms in their own right. Nonetheless, it is very important to notice two facts, first many of these companies (such as the giant MediaTek) are direct spin-offs of state-led initiatives, and the market for these companies is concentrated in Sino-phone Asia.

As the ultimate source of so many of these ventures, ITRI has been at the core of the semiconductor industry's success. Connections with Taiwanese engineers in the U.S. were important for providing ITRI with experienced leaders such as Morris Chang,[19] some of whom, after serving as ITRI employees for an extended period, later transferred to the private industry, either as leaders of official spin-offs, such as in the case of Morris Chang and TSMC, or in more truly entrepreneurial endeavors. However, these later entrepreneurs had all first returned as state employees working in ITRI or ITRI-established firms, not as independent returnee entrepreneurs. As can be seen in Table 2, Taiwan's semiconductor design industry has been a fruitful area for returnee entrepreneurs, but they certainly have not been the dominant force. Of Taiwan's top 10 IC design firms, seven are spin-offs from either UMC or ICT manufacturers like Acer. Of the remaining firms, only one firm, Via, traces itself, at least partly, to Silicon Valley. Interestingly, Via was initially established in Fremont, California. It became successful only after Cher Wang, relocated it to Taiwan.[20] Her elder sister was a co-founder of First International Computer (FIC) in 1980, one of Taiwanese most successful electronics assemblers. FIC, in turn, became an early investor in Via.

While returnees were important to Taiwan's ICT industry after it was already beginning to achieve international success, they built upon the ecosystem and skills that had already emerged prior to their return. Some did establish or were part of many critical firms, but they were not the dominant actors in the emergence of Taiwan's ICT industry.

5.2. Taiwanese firms

Today, the two most important sectors in the Taiwanese ICT manufacturing industry are, in terms of sales and employment, the larger, older, and more important electronics sector with both leading assembly firms and myriad suppliers, and the more celebrated semiconductor industry led by pure-play foundries, as well as

[16] On Korean firms investing in Silicon Valley and buying semiconductor technology and firms; some of which had Korean engineers or founders, see Mathews and Cho (2000, p. 124).

[17] Vitelic eventually sold its DRAM designs to Hyundai, citing inability to produce them in Taiwan (Meany, 1994). This proved to be a political motivator for approving further VLSI fabrication projects in ITRI by the government (Hong, 1997).

[18] Using the production lines of established semiconductor firms like Intel or Texas Instruments provided a means for design startups to produce their chips without having to invest the massive capital necessary to build their own foundries. However, this arrangement meant potential competitors were given intimate perspectives on the startup's technology and during the peak production periods, exactly when the greatest profits could be made, the startups found that their jobs received lower priority.

[19] Interestingly, Morris Chang is not exactly a returnee, according to (2010: 246–247), a former President of ITRI who observed in an interview that Chang grew up in China, went to MIT for his college education, then worked for Texas Instruments, and later became president of General Instruments. For Morris deciding to move to Taiwan to become president of ITRI was "a difficult decision because he [had] never really lived in Taiwan."

[20] Cher Wang is the daughter of Wang Yung-ching (YC Wang) Taiwan's most successful domestic entrepreneur, who made his fortune as founder of Formosa Plastics. She received her master's degree in economics at UC-Berkeley in 1981 before returning to Taiwan to work at FIC in 1982. As she had no work experience in the U.S. and did not study science or engineering, Wang would not qualify as a returnee entrepreneur in the most commonly understood sense. Wang is also the co-founder of HTC.

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Table 2
Key Taiwanese integrated circuit design firms, founders, and information on returnee status. Plain indicates domestic, ***italics bold indicates MNCs/Government/University spin-offs and returnees,*** *italics indicates returnees*, **bold indicates Silicon Valley**.

Name	Founding Date	Founder(s)	U.S. Education*	U.S. Work Experience*	SV Experience*	Main Products	Spinoff
ALi Corp. (Spin-off Acer)	*1987*	*Ronald Chwang*	*PhD - EE, USC*	*Intel - Oregon, Bell Northern Research - Ottawa*	*None*	*PC chipsets, DVD Player IC*	*Acer*
		Wu Chin	*MS - Materials Science, Tennessee Technology University, PhD - USC*	*Quasel Electronics (USA), Inc., Rockwell International, Jet Propulsion Laboratories*	*None*		
		Lee S.J.	Unknown	Unknown	Unknown		
Faraday Technology (Spin-off UMC)	*1993*	*ShrKe-Jiang*	*EE, MIT*	*National Semiconductor*	*Yes*	*Consumer*	*UMC*
MediaTek Inc. (Spin-off UMC)	1997	*Tsai Ming-Kai*	*Masters EE, University of Cincinnati*	*None*	*None*	Optical storage	UMC
		Cho Jyh-Jer	None	None	None		
		Liu Ding-Jen	None	None	None		
Novatek Microelectronics Corp. (Spin-off UMC)	1997	Ho T.S.	Unknown	Unknown	Unknown	Consumer	UMC
Himax (Spin-off Chi Mei Optics)	2001	Wu Biing-Seng	None	None	None	LCD Drivers	Chi Mei Optics
Silicon Integrated Systems	*1987*	*Du Jiun-Yuan*	*PhD in EE, Stanford*	*IBM Watson, Yorktown Heights, NY*	*University-only*	*Multimedia/Chipsets*	
VIA	**1987 (Founded in Fremont, CA, moved to Taiwan in 1992)**	**Chen Wen-Chi**	**MS CS, Cal Tech**	**Intel and Symphony Technologies**	**Intel and Symphony Technologies**	**PC Chipsets**	
		Cher Wang	**UC Berkeley**	**Yes**	**University-only**		
		Lin Tzu-Mu	**MSCS and PhD in CS, Cal Tech**	**Yes**	**Yes**		
Sunplus Technology (formed by a group of former ITRI ERSO engineers)	1990	*Chen Yang-Cheng*	*MS UC Santa Barbara*	*Unknown*	*Unknown*	Consumer	
		Shr Bing-Huang	None	Unknown	Unknown		
		Wang Tai-Cheng	None	Unknown	Unknown		
		Gung Jr-Hau	None	Unknown	Unknown		
		Yang Huei-Ming	None	Unknown	Unknown		
		Li Wen-Chin	None	Unknown	Unknown		
		Liou De-Jung	None	Unknown	Unknown		
		Huang Jou-Jie	None	None	None		
Etron Technology	**1991**	**Nicky Lu (and four others)**	**PhD - EE, StanfordUniversity**	**IBM Research, IBM**	**University-only**	**Memory**	
Elite Semiconductor	*1998*	*Hu Chao*	*PhD - Princeton*	*IBM*	*Unknown*	*Memory*	
		Mao Shu	*Unknown*	*IBM*	*Unknown*		
RealTek (Spin-off UMC)	1987	7 founders	Unknown	Unknown	Unknown	Networking	
Holtek (Spin-off UMC)	1983 (1998)	Wu Chi-Yung	None	None	None	Various	

* Prior to establishing the firm.

fabless IC design firms. Examining the different semiconductor sectors provides a basis for evaluating returnee timing and importance. As has been shown, in the electronics industry, returnee entrepreneurs played a tertiary role to MNCs and domestic firms in the formative and expansion years of the 1960s and 1970s. Contrary to what some have argued, this is also the case in semiconductors.

The semiconductor industry is often seen as closer to the conceptual model of returnees playing a critical role in Taiwan's development. Many of the key technologies were imported from and individuals were educated and gained work experience across the U.S. (RCA – New York; Texas Instruments – Texas; Harris Semiconductor – Florida; and Rockwell International – Los Angeles). Although returnees were important in later semiconductor design firms, the most important semiconductor foundry firms, UMC, TSMC, Vanguard, and Winbond were all products of ITRI policy initiatives. In examining the IC design sector, the importance of UMC and the older electronics assembly companies such as Acer is apparent. Returnees established only three of the top ten firms, and only one of the firms' founders had a direct Silicon Valley work experience connection while another two had founders with Silicon Valley educations.

The returnee-centric version of Taiwan's development does not recognize the importance of MNCs, indigenous entrepreneurship, and ITRI's spin-off policy for creating the environment that would be attractive to returnees. Scholars have underestimated the significance of the ecosystem that had been built prior to the appearance of returnee entrepreneurs, mostly in the 1990s. It had taken nearly 20 years of growth and indigenous development to begin convincing would-be entrepreneurs that it would pay to return to Taiwan. The ecosystem was critical to attracting returnees home. It created the conditions within which the returnees could utilize the education and skills learned abroad and provided the Taiwanese node of the structural hole they would fill and later expand.

6. China[21]

From garments and toys to steel and wind turbines, China has grown rapidly in nearly every industry it has entered. As Breznitz

[21] Previous evaluations of the role of returnees in the Chinese electronics sector include (Chen, 2008; Nakagawa, 2010).

and Murphree (2011) and Rodrik (2006) point out, however, the ICT industries and their exports have, as in Taiwan, been major drivers for the nation's development and are the vanguard for high technology industry and innovation. As was the case for Taiwan in the 1960s, Rodrik identifies consumer electronics, which increasingly consist of ICT components and embedded software, as critical for China's export success. Not surprisingly, electronics producers and exporters, as in Taiwan, increasingly morphed into producers of ICT products. ICT products, whether technically electronics or ICT hardware depending on the definition, constitute the vast majority – over 90% – of China's high technology exports.[22] The Chinese ICT industry is mostly concentrated in three regions: Beijing, Shanghai, and the Pearl River Delta in Guangdong province; each with a unique ecosystem (Breznitz and Murphree, 2011; Segal, 2003; Thun, 2006; Segal and Thun, 2001).

Because of the legacy of the planned economy and the comparatively late entry of China into the global ICT industry, analyzing the evolution of the industry and the role of returnees is clearer than in the Taiwanese case. When China opened its economy and began encouraging entrepreneurship after 1978, there were initially no Chinese nationals educated abroad who could return, so the initial wave of startups was, by default, initiated by domestic entrepreneurs. As in Taiwan, only once the ICT industry was established and demand for new services and businesses created did Chinese educated and working abroad begin returning as entrepreneurs.

China has a long history of sending students abroad for study. The first such missions took place in the 1860s. During the Nationalist era (1911–1949), students from both the Nationalist and Communist Parties studied overseas (in the U.S., Europe, and Japan or Russia respectively). After 1949, China sent students to the Soviet Union and Eastern Europe – including future president Jiang Zemin. However, during the Cultural Revolution (1966–1976), any foreign contacts – including education abroad – were suspect and China virtually closed itself off entirely. In 1978, Deng Xiaoping decided to begin sending 3000 students abroad annually, particularly to the United States. Overseas education began expanding rapidly. By 1988, some 60,000 Chinese students and scholars had gone abroad (Zhao and Xie, 1992). However, less than 10% returned (Zweig, 2006). By 1997, only 32% (94,000) of the 293,000 Chinese who had gone abroad since 1978 had returned. Of those who returned, 37,500 were short term scholars. 96.1% of self-funded students remained abroad after finishing their studies (Zweig and Rosen, 2003). Overseas scholars, now with work experience, did not begin returning until the late 1990s once economic reforms and growth – as well as political stability – had taken root. By 2007, the overall rate of return had increased to 30% and was accelerating as China's economy offered more and better opportunities for emigrants with overseas education and experience (Watts, 2007). In total, of the 1.9 million Chinese who had studied overseas between 1978 and 2010, 33% had returned to China (Xinhua, 2011).

Given the lack of domestic experience with international business and the backwardness of many Chinese production technologies, a major goal of economic reform and opening was to encourage foreign MNCs to establish factories in China and absorb their technological, managerial, marketing and production know-how. With China's comparative advantage in low-cost labor and the lack of absorptive capacity, initial operations were necessarily low-technology export-processing assembly operations.

The main overseas investment thrust came from Hong Kong and, to a lesser degree, Taiwanese firms establishing assembly facilities in China. Only after China firmly committed itself to developing a "socialist market economy" in 1992, did MNCs from around the world aggressively establish facilities in China making it into the world's shop floor.[23] Simultaneously, China would become one of the world's most important markets for ICT products, which is quite different than was the case of Taiwan (OECD, 2006, 2007).

As in Taiwan, the Chinese government has been anxious to ensure, encourage, and facilitate technology transfer from MNCs. In the 1980s and 1990s, nearly all foreign investment came as joint ventures with Chinese firms. Through these joint ventures, Chinese state-owned enterprises (the most common partners) hoped to upgrade their capabilities and learn from foreign best practice. Some, such as the ITT Corporation joint venture with Shanghai Posts and Telecommunications Industrial Corporation (the predecessor of Alcatel Shanghai Bell) have been very successful and influential. Over time, however, except in strategic industries such as automobiles and telecommunications, foreign companies have increasingly opted for wholly foreign-owned investments. Whatever the nature of ownership, even in 2011 many of the ICT products manufactured in China by Chinese and foreign firms alike are standardized and commoditized.

The highest value-added technologies are in a few of the parts, such as the memory chips, the microprocessors, LCD flat panel displays, and technologically sophisticated components for which foreign firms have generally resisted establishing production facilities in China. Chinese firms and foreign subsidiaries often labor at the lower end of the value chain, producing general ICT or electronics components or providing assembly services. To make up for foreign reticence, Chinese firms and the state are investing in developing these technologies indigenously. Returnees with experience abroad can play an important role in the transfer of these technologies and capabilities. However, as in Taiwan, any role returnees play in this area will be building upon the foundation already established by MNCs and indigenous investors who have created an industrial ecosystem which now demands the types of products and skills returnees can provide.

6.1. Chinese government policy

From technology transfer to taxation and ICT standards setting, Chinese government actions to achieve policy goals have broadly shaped industrial development. Indeed, although there were many indigenous entrepreneurs in the first decade of reform, many of the early – and today leading – ICT enterprises were begun by enterprising local governments and government units. In the early 1990s, China's growth and further government policy liberalization attracted foreign MNCs, many of who established themselves in Beijing's Zhongguancun (ZGC) to be close to the government and the elite universities. In general, the earliest "returnees" were not entrepreneurs, but employees recruited by MNCs for their Chinese operations. With regards to ICT, an overarching government goal has been to encourage indigenous technology development. There has been little incentive for MNCs to transfer their most advanced technologies to their Chinese operations, and the Chinese government instead has sought to strengthen local "champions." By the late 1990s and 2000s, it had become increasingly clear that relying on MNCs as a source of technology was an unsustainable strategy for economic upgrading.

[22] In many cases local and regional statistics merge or blur the concepts of electronics and ICT hardware as both are very similar in their industrial structure, components, and performance.

[23] Early movers such as Belgium's ITT Corporation (1983), GE (1984), and Motorola (1987 – representative office) had to create joint ventures or limited themselves to representative or sales offices during the uncertain 1980s. At the time, government surcharges, levies and requirements made offices in Beijing some of the most expensive in the world.

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Table 3
Key Chinese Internet Firms, Founders, and Information on Returnee Status. Plain indicates domestic, ***italics bold indicates MNCs/Government/University spin-offs and returnees,*** *italics indicates returnees*, **bold indicates Silicon Valley**.

Firm Name	Founding Date	Founder(s)	U.S. Education*	U.S. Work Experience*	SV Experience*
Sohu.com	*1996*	*Charles Zhang*	*Ph.D. MIT*	*Yes*	*No*
		Ed Roberts#	MIT Prof.	N/A	N/A
Tencent	1998	Ma Huateng	No	No	No
		Zhang Zhidong	No	No	No
		Xu Chenye	No	No	No
		Chen Yidan	No	No	No
		Zeng Liqing	No	No	No
Sina.com	1999	Wang Zhidong	No	No	No
Alibaba	1999	Jack Ma##	No	No	No
Shanda	1999	Tan Qunzhao	No	No	No
		Chen Danian	No	No	No
		Chen Tianqiao	No	No	No
CTrip	*1999*	*Liang Jianzhang*	*MS Georgia Tech*	*Yes*	*Yes*
		Min Fan	No	No	No
		Neil Shen	*MBA Yale*	*Yes*	*No*
Baidu.com	**1999**	**Robin Li**	**MS SUNY Buffalo**	**Yes**	**Infoseek**
		Eric Xu	**Texas A&M University**	**Yes**	**Yes**
Netease	2001	Ding Lei	No	No	No

Source: Author's compilation from various sources.
* Prior to establishing the firm.
# MIT professor co-founder.
Eighteen co-founders.

The perceived unwillingness of MNCs to transfer technology, and the purported benefits achieved in Taiwan, were significant motivators for the government policy of encouraging the return of experienced Chinese from abroad (Zweig et al., 2004). As Table 4 shows, this policy yielded some successes such as Baidu; however, even in this later stage, much of the entrepreneurship has still been homegrown. Furthermore, these entrepreneurs are building on the base established by domestic entrepreneurs (both private and government) and MNCs since the early 1980s.

The relative unimportance of returnee entrepreneurs does not mean they are not helping China significantly. There have been more subtle benefits from returnees. A growing body of quantitative research has studied the impact of firms established by returnees. Through surveying science park firms in Beijing, these studies found, that in terms of patenting, returnee firms were much more innovative and performed better than non-returnee firms (Liu et al., 2009; Dai and Liu, 2009). The results also indicated that indigenous firms with linkages to returnee firms were more likely to patent and export than firms without such links. However, although they patent and export more, the technology they bring to China is still not the latest. In Zweig et al.'s (2006) study, of the 55% of the returnees in their Zhongguancun sample who brought technology to China, it usually was not the latest but rather merely a new technology for China.

Nonetheless, these findings suggest that returnee firms can impact nearby firms' innovation performance and thus serve as an indirect channel for technological knowledge spillovers. In contrast, a study of the population of Shanghai semiconductor design firms by Obukhova (2009, p. 4) found that, "firms with high skilled [returnees] are not more likely to survive than firms without high-skilled migrants. However, firms with foreign investors do enjoy a survival advantage. In turn, high-skilled migrants are more likely to join firms with a foreign investor." Most important, Obukhova found that "when skills and resources from one environment are not appropriate in another environment, individuals do not benefit from being in a position of potential brokerage" (Obukhova, 2009, p. 5). These results confirm, as in the Taiwanese semiconductor industry case, that returnees are significant when the home-nation environment has the absorptive capacity to allow the skills the returnees developed overseas to be exercised.

6.2. Chinese firms

China's pioneering ICT firms in the initial phase were Lenovo (Legend), ZTE, Huawei, Stone, Great Wall, and Founder (Lu, 2000; Mu and Lee, 2005; Segal, 2003).[24] A number of these firms have become significant competitors in portions of the global ICT industry, but as Table 3 indicates, not one of these firms had a founder with overseas education or work experience. Most, including Lenovo, were founded by large teams which included all future CEOs, CTOs, and CIOs, none of who had overseas educational or work experience before establishing their ventures. Somewhat complicating the picture, three were not truly entrepreneurial ventures: ZTE was established directly by government units, and Lenovo and Founder were quasi-spin-offs in which the government retained a strong or controlling stake. All of these firms were established in the mid-1980s in response to the opportunities created by economic opening and market reform at a time when there were no returnees with overseas education and work experience available to return and found or even staff these firms.

Returnee entrepreneurship only began during the Internet boom of the late 1990s. Although more important in Internet start-ups, as Table 4 shows, even in this sector only three firms were established by returnees and only one, Baidu, had a founder with Silicon Valley experience. Intriguingly, given the lack of direct connections, each of the leading Chinese Internet firms is, in some measure, a China-specific adaptation of a Silicon Valley business model.

Given the success in rapidly mimicking cutting-edge new Internet firms pioneered abroad by Chinese entrepreneurs with no direct Silicon Valley connection, it is possible that presence or training abroad is not necessary for forming such firms.[25] If this is the case,

[24] This firm list does not include restructured state-owned enterprises which entered or continued producing for the ICT industry in the 1980s. Local governments and former state industries played a role in creating some of the first consumer electronics firms (Bachman, 2001).

[25] To illustrate, China's analog of Facebook, Xiaonei, was started by a group of Tsinghua University students in December 2005, while Facebook was initiated in February 2004 by a group of Harvard students. It is far easier to "translate" a website concept to the Chinese market than to copy an industrial process or reverse engineer a complex software program. While these Chinese translations have little appeal outside of China, the Chinese market is sufficiently large to offer a significant opportunity, room for growth and profits.

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Table 4
Key Pioneering Chinese ICT Firms, Founders, and Information on Returnee Status.

Firm Name	Founding Date	Original Location	Founders(s)	U.S. Education*	U.S. Work Experience*	SV Experience*
Lenovo/Legend#	1984	Beijing	Liu Chuanzhi and 10 others	None	None	None
Stone##	1984	Beijing	Liu Haipin	None	None	None
			Wan Runnan	None	None	None
			Shen Guojun	None	None	None
ZTE###	1985	Shenzhen	State-Owned Enterprise	None	None	None
China Great Wall Computer Co.	1985	Beijing	Wang Zhi	None	None	None
Founder/Beida New Tech	1986	Beijing	University Enterprise	None	None	None
Huawei	1988	Shenzhen	Ren Zhengfei	None	None	None

Source: Author's compilation from various sources.
* Prior to establishing the firm.
# Lenovo had 11 founders (Liu Chuanzhi, Wang Shuhe, Zhang Zuxiang, Jia Xifu, Zhou Xiaolan, Jia Wanzhen, Ma Wenbao, Li Tianfu, Xie Songlin, Wang Shiying, and Pang Dawei), all researchers in the Chinese Academy of Science's Institute of Computing Technology. None had overseas education or experience (Ling and Zhijun., 2005).
Kennedy and Scott (1997) describes it as a "collective enterprise.
ZTE was created with investment from the Ministry of Aerospace and the Shenzhen City Government. It remains partially state-owned.

then returnees may no longer be as important as some believe – at least in creating Internet-enabled services. Returnees played no role in the creation of the early pioneering and now globally competitive Chinese electronics and ICT hardware firms. Although returnees' role was more significant in the Internet Boom of the late 1990s and 2000s, the online sector itself required the earlier success of the electronics and PC industries in China to create a critical mass of consumers able to access and willing to pay for online content. Thus the domestic success of the industry had to occur in order to create the market space in which returnee entrepreneurs could compete.

In China, returnees had no significant economic impact on the initial formation or early growth of the ICT industry. In the 1980s, China did not have the absorptive capacity or even long-time overseas residents and experienced former students ready to return and catalyze growth. Rather their significance in terms of entrepreneurship begins only in the late 1990s with the Internet Boom. While important in helping develop this new sector, the ICT industry already existed before this wave of entrepreneurship began. Since the 2008 global financial crisis, there have been many and increasing opportunities for overseas returnees in China so it is likely there will be more returnee entrepreneurship in the future. However, in many parts of the ICT industry, they will experience significant competition from domestic entrepreneurs who are constantly searching for opportunities to independently transfer, adopt and adapt new concepts from the U.S.

7. India

India's emergence as a location for high-technology industry began in the 1980s, but only came into the public consciousness during the 1990s as ICT services offshoring became more visible. More interesting, while Taiwan and China specialized in ICT hardware products, India is unique as it inserted itself into the global economy as an exporter of software and information and communication technology-enabled services (ICTS) (Dossani and Kenney, 2007, 2008). There is, and has been, an Indian electronics and ICT hardware industry, which historically has been heavily protected and as of 2012 is of no global significance and returnees play very little role in it (see, for example, Athreye, 2005; Heeks, 1996). Exporting ICTS, producing, managing, and supplying services embodied in software code, is a unique entry strategy for a developing economy. In the ICTS industry India's exports are entirely digital; there are almost no physical products involved. As in Taiwan and China, not only have MNCs played an important inceptional role, but significant indigenous firms emerged in the formative years as well. Some researchers have hailed the importance of returnees for building the Indian ICTS industry (Saxenian, 2006). The case for returnees being important in India is buttressed by the fact that Indian immigrants are one of the most highly educated, and wealthiest, nationalities in the U.S. and the relationship between U.S. higher education and India is long and deep.[26] The significance of Indians in Silicon Valley entrepreneurship has also been widely recognized as they have been active since the early 1980s and particularly active more recently.

The Indian government has long been a highly interventionist state. Prior to the 1980s, Indian government policy was "statist, protectionist and regulatory" (Rubin, 1985). In essence, India attempted to adopt a form of centralized economic planning in the context of a democratic polity. An industrial licensing regime and state-owned banks curtailed private–sector activity and generally discouraged entrepreneurship. Since independence in 1947, the government itself was the main producer of ICT hardware and had a strategy to create "national champion" state-owned enterprises, which were granted monopolies for computer and telecommunication equipment production (Sridharan, 2004). The state remained hostile or, at best, indifferent to the ICTS industry throughout the 1970s (Heeks, 1996). Import tariffs were high (135% on computer hardware and 100% on software) to protect local industry. Furthermore, software was not considered an "industry," and exporters were thus ineligible for bank financing. India, like China before 1978, was hardly a promising environment for the emergence of a globally competitive industry. Most of the early software and ICTS firms were established by venerable private conglomerates, as small firms found it difficult to overcome government policies including the crippling lack of access to capital.[27] Because only large firms could secure financing, they predictably became the dominant private sector players (Heeks, 1996).

In the 1980s under Rajiv Gandhi's administration, new policies were introduced to encourage MNCs to establish operations in India, particularly in ICT, and to encourage existing indigenous Indian ICTS firms to expand. In India a few returnees had an early *policy* role. The most influential returnee in formulating Indian IT policy was Satyanarayan Gangaram (Sam) Pitroda. In 1974 after

[26] This relationship was particularly strong with MIT, both in terms of graduates and the establishment of the Indian Institutes of Technology (Bassett, 2009; Leslie and Kargon, 2006).
[27] These private family-run conglomerates often had foreign-educated executives but these were not returnees in the meaning of the term as used in this paper.

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receiving a Master's Degree in Electrical Engineering from the Illinois Institute of Technology, he formed a communications firm that was later purchased by Rockwell. In 1984, Pitroda returned to India and established the Center for Development of Telematics and advised Gandhi on the liberalization of India's telecommunications policies. However, with this one major exception, during this early period there were few other returnees who played a significant role in government policy-making. Nonetheless, the formative ventures in the ICTS industry would not be initiated by returnee entrepreneurs.

The entrance of MNCs, such as Texas Instruments and Hewlett Packard to begin semiconductor (which was becoming increasingly software-intensive) and software development in India, had a catalytic effect on the ICT industry environment. As an incentive to establish an operation in Bangalore, in 1987 the government, through the Bangalore Software and Technology Parks of India (STPI), provided Texas Instruments the first 64K bit computer foreign communications link in India (Heeks, 1996, p. 291). This access proved to be a trigger for other MNCs to establish ICTS operations in Bangalore and then other cities. During the 1980s, other firms such as ANZ Bank and Citigroup established facilities to write custom software for in-house use. These early entrants persuaded the Indian government to improve the physical and regulatory infrastructure. However, MNCs, like their domestic counterparts, still faced daunting communications costs and intrusive regulation throughout this period (Parthasarathy, 2004).

Domestic ICTS firms initially specialized in training and sending inexpensive engineers abroad to work on temporary projects. This practice was often referred to pejoratively as "body shopping," whereby the Indian firms simply provided programmers (known in the industry as "bodies") to work at their customers' facilities outside of India. In the late 1980s and 1990s, although continuing dispatching software professionals overseas, a few domestic firms also began supplying software coded in India, while relying on foreign co-vendors for program design and specification (D'Costa, 2002; Dossani and Kenney, 2007; Heeks, 1996). These domestic firms formed the basis of the modern Indian ICTS industry. Indian firms gradually shifted from exporting contract programmers to exporting outsourced custom software programmed in India. The shift, though gradual, induced more domestic firms to enter the market. The number of Indian software firms increased from 35 in 1984 to 700 in 1990, and the share of smaller firms rose (Dossani and Kenney, 2007). There have been no studies of the entrepreneurs that formed these new entrants or their background. What is certain is that during this period the activities at these firms was almost entirely mundane coding, which did not require a sophisticated computer science background – a set of skills that were not present in India prior to mid-1990s (Arora et al., 2001).

7.1. India's government policy

The role of the Indian government in the development of the ICTS industry was complex. In the earliest days, software attracted interest and skilled personnel chiefly because it was outside the other highly regulated and stultified sectors of the economy. Certainly, Rajiv Gandhi's efforts to deregulate the economy and loosen import tariffs and restrictions contributed to further growth. However, for the growth of ICTS, it is likely that the most important single measure was the establishment of the STPI organization. STPI was so important because it was established as a separate state-run firm with enormous powers and, very importantly, could directly provide the various permits necessary to establish firms and MNC subsidiaries without forcing applicants to interact with other government bureaucracies. STPI was able to build offices to be leased to MNCs or indigenous firms, communication base stations, and other facilities without going through normal governmental channels. It could import all necessary equipment and materials duty-free, though in-bond. Thus the offices it provided could be state-of-the-art and thereby attractive to MNCs and, as a side benefit, to ambitious Indian firms. By creating and empowering STPI, the government circumvented its inability to provide infrastructure (Dossani and Kenney, 2007).

Another important area of government activity were waves of liberalization of regulations that affected the software industry, in particular, but also the economy, more generally. These made imported hardware and software less expensive, eased access to foreign exchange, allowed access satellite-based communication linkages, created the STPI scheme, and exempted software exports from income tax (Athreye, 2005). These actions increased competition, reduced costs for international communication, and contributed to improvements in quality and efficiency. While much of the deregulation was not solely meant to assist the ICTS industry, taken together, this process proved critical for success. Once deregulated, falling prices made India an increasingly popular location for ICTS as its excellent telecommunications infrastructure and English-speaking workforce made it ideal for offshored ICTS.

In contrast to China and Taiwan, India's government has no specific policies to encourage the return of expatriates, though recently returnees have been viewed more favorably than in the past. Returning to India for business or other purposes is treated as an individual choice.

7.2. India's key companies

The inception of the Indian ICTS industry can be traced to 1974, when Burroughs, a U.S. mainframe manufacturer, asked its Indian sales agent, Tata Consultancy Services (TCS), to supply programmers for installing system software at a U.S. client (Dossani and Kenney, 2008). Indian firms were not content to simply subcontract for established U.S. firms and soon began prospecting for contracts themselves. Fledgling Indian firms established partnerships by providing subcontracted software-related services to yet other U.S. customers. During this earliest period, the role of the U.S. MNCs such as Burroughs, Control Data, and others in introducing Indian programmers into the operations of their overseas clients cannot be overestimated. Their efforts validated the quality of the Indian programmers, and firms not only learned by doing, but also earned a reputation for their capabilities and competencies. Interestingly most of the pioneering foreign firms were not Silicon Valley companies, but rather were mainframe computer manufacturers that were competing with IBM and needed to install and customize software for their final clients.

The most important pioneering Indian firms were formed in the 1970s and 1980s (Table 5). Of these, only one had a founder who had work experience in the U.S., and even that experience was not in Silicon Valley. As can be seen, four of the seven firms had founders that attended a U.S. university, but only one of these, Azim Premji, attended a Silicon Valley university.

As of 2011, there are a large number of IT services firms in India, but three were crucial to building the indigenous industry: Tata Consultancy Services (TCS), Infosys, and Wipro. TCS is a subsidiary of the giant Tata Group.[28] The first TCS president, F. C. Kohli, graduated from Punjab University, received a B.Sc. in Electrical Engineering from Queens University in Canada and then completed an MS in Electrical Engineering at MIT. Upon graduation, Kohli returned to India and joined the Tata Electric Company. He was later dispatched to the fledgling TCS in 1974 as CEO (Queen's University, 2010). Neither he nor the higher-level executives in the

[28] The Tata Group traces its origins to a Mumbai-based cotton trading firm established in 1868.

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Table 5
Key early Indian ICTS outsourcing firms, founders, and information on returnee status. Plain indicates domestic, ***italics bold indicates MNCs/Government/University spin-offs and returnees,*** *italics indicates returnees*, **bold indicates Silicon Valley**.

Firm	Original Location (Current)	Founding Date	Founders	U.S. Education*	U.S. Work Experience*	SV Work Experience*
TCS (Tata spin-off)	*Mumbai*	*1968*	*F. C. Kohli*	*MS, EE, MIT*	*None*	*None*
Hinditron	*Mumbai*	*1972*	*Pravin Gandhi*	*BS, IE, Cornell*	*None*	*None*
HCL	Noida	1976	Shiv Nadar	None	None	None
			Arjun Malhotra	None	None	None
			Subhash Arora	Unknown	Unknown	Unknown
			Ajai Chowdhry	None	None	None
			DS Puri	None	None	None
			Yogesh Vaidya	None	None	None
Patni Computer	Mumbai	1978	*Narendra K Patni*	*MS, EE, MIT*	*President, Forrester Consulting Group*	*None*
			Gajendra K Patni	None	None	None
			Ashok K Patni	None	None	None
Wipro	**Bangalore**	**1979**	**Azim Premji**	**EE, Stanford**	**None**	**University only**
Infosys	Pune (Bangalore)	1981	N. R. Narayana Murthy	None	None	None
			Kris Gopalakrishnan	None	None	None
			Nandan Nilekani	None	None	None
			N. S. Raghavan	None	None	None
			S. D. Shibulal	*MS, CS Boston University*	*None*	*None*
			Ashok Arora	Unknown	Unknown	Unknown
			K. Dinesh	None	None	None
Satyam	*Hyderabad*	*1987*	*Ramalinga Raju*	*MBA, Ohio University*	*None*	*None*

Source: Author's compilation from various sources.
* Prior to establishing the firm.

Tata Group were entrepreneurial returnees. TCS, with the backing of the Tata Group, soon became the Indian ITCS outsourcing leader.

Infosys is the second largest Indian IT services firm. Interestingly, Infosys was an entrepreneurial startup founded in 1981 by seven entrepreneurs who spun out of Patni Computer Systems, which was formed in the U.S. Patni's founder graduated from MIT, and later joined Forrester Research. Only one of the Infosys's original team had a U.S. education and none of them had work experience in either an MNC operating in India or in the U.S. The third largest Indian IT services firm is Wipro. Wipro's founder, Azim Premji, was the son of the owner of a significant vegetable oil firm in Mumbai. Premji began but, due to his father's death, did not complete his bachelor's degree in electrical engineering at Stanford University. He returned to take over his father's business, where he expanded the firm to become a conglomerate involved in a wide variety of activities. Over time, the electronics services portion of Wipro became ever more significant with the ICT services subsidiary being formally established in 1980. Even for Wipro, the returnee narrative is dubious as Premji was not a classical Silicon Valley entrepreneur. He did not finish his education abroad, nor did he have work experience in the U.S. Furthermore, his company was not a startup but rather built from an existing conglomerate in the Indian tradition of family business groups (Kedia et al., 2006).

The point of this discussion is not to be exhaustive, but merely to demonstrate that none of the most important firms were built in the way that the returnee literature would suggest. Moreover, even in the three cases where the founders did return from the U.S., the firms were not typical Silicon Valley-type entrepreneurial firms but rather expansions of existing Indian business groups or, in the case of Patni, begun in the U.S. In fact, the two clearest cases of entrepreneurial firms, Infosys is an entirely home-grown enterprise, while Patni was established in the U.S. and then moved to the India afterwards. For the Indian IT services firms the returnee narrative is inadequate and misunderstands the dynamic of the growth of the industry.

As mentioned earlier, a number of the U.S. mainframe computer manufacturers were significant early contributors to the Indian ICTS export economy.[29] Other pioneering firms established for exporting software and services from India were a diverse group including Accenture, British Airways, Citicorp, General Electric, HSBC, Hewlett Packard, and Texas Instruments. In contrast to China, these firms began Indian operations quite early in the development of the Indian ICTS industry and became important examples for U.S. customers considering hiring an Indian firm. Further, the success of these pioneers motivated other MNCs, especially those for which software was important, to establish their own facilities. Interestingly, with the exception of Hewlett Packard, Silicon Valley firms such as Oracle (1994), Cisco (1995), Adobe (1998) and, Intel (1998) were relatively late in establishing Indian operations.

It has been speculated, and there are many anecdotes claiming, that it was the success of Indian engineers within U.S. firms that convinced top management that India was a good offshore location (Nanda and Khanna, 2007). The validity of this conjecture has not been conclusively established. An alternative conjecture is that the cost-effective success of the body-shopped engineers provided initially by U.S. firms such as Burroughs, and then later the Indian software services firms, motivated U.S. firm managers to locate facilities in India for operations that they were unwilling to outsource. Regardless of how the Indian ICTS industry emerged, it was not as a result of returnee entrepreneurship.

8. Closing discussion

Recognition of the role of returnees was an important advance in understanding cross-border technology and business model diffusion. It focused attention upon the role of entrepreneurship in the growth of a number of the most dynamic economies in the world. It also recognized the significant role that Taiwanese, Chinese and

[29] IBM was an important contributor to the growth of Indian IT services industry in another respect, because when it abandoned in the Indian market because it did not want to join a joint venture, it released many trained personnel into the local labor market (Heeks, 1996).

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Indian nationals played in the U.S. ICT industries and their significance in the recent success of Silicon Valley and other ICT industrial clusters. And yet, exaggerating the role of returnees in the development of the ICT industries in their home nations is neither plausible nor justified by the historical record.

Not surprisingly, there are major differences between Taiwan, India, and China. Given the recent hype, the low number of early entrepreneurs having overseas experience in each of these countries is quite remarkable. Indeed, it is the number of founders of the earliest firms without overseas experience that is most noteworthy. This was even the case in Taiwan, which had the greatest number of returnee founders, especially in the semiconductor industry.

Drawing from the Taiwanese case, the returnee model also sees skilled returnees as having significant advisory influence on the political system. Though the true influence of expatriate Taiwanese on government policy is not clearly understood, there is little doubt that returnees had little influence in the case China. In the case of India, with the exception of Sam Pitroda who returned to India and acted as an advisor, the non-resident Indians were not particularly influential. The argument that Chinese expatriates in Silicon Valley or elsewhere in the U.S. drove China's policies or success is not credible. In economic and technology policies, the Chinese government has exhibited extreme independence. While returnees came to be seen as a vehicle for technology transfer, there is no evidence that they influenced early government policy. This is almost in complete opposition to Taiwan, where expatriates played an important role in policy formulation. The most important motivation for Chinese government leaders was to encourage economic growth and technological advancement; quite early in this process, the Chinese government recognized the importance of ICT and domestic entrepreneurs and reforming state enterprises grasped the opportunity even as students heading overseas overwhelmingly chose not to return.

Understanding how entrepreneurship can transform environments is critical for policy making in developing nations. The suggestion that returnees are central to successful development of the electronics industries could, if their actual role is not examined in its historical context, lead to policy-making that is excessively focused on attracting emigrants instead of focusing upon the essential transformation of national institutions to encourage entrepreneurship and investment by locals, MNCs and returnees. Also, the emphasis on returnees unfortunately, especially in the case of Taiwan and India, underestimates the role which MNC operations can play in technology, skill transfer, environment creation, and in the Indian case in particular, legitimating India and Indian personnel as capable.

For policy makers, the primary lesson of our research is that indigenous entrepreneurship and MNC investments develop absorptive capacity; this is the starting point for any long-term strategy for developing an innovation-based ICT industry. In the case of Taiwan and India, in particular, the educational system was producing engineers and scientists in excess of what local industry could employ, as a result engineers emigrated in search of higher education and superior employment opportunities. Each of these three nations initially had limited internal human capital as much of their skilled human capital had emigrated or, and in the case of China, large pools of highly educated global-class engineers had not yet been created. Thus the early entrepreneurs entered the global economy by selling low-cost labor; however they also actively set about learning both through direct engagement with the global economy and local partnerships and business relationships with MNCs and their subsidiaries. In Taiwan and China, MNCs were welcomed, but governments actively encouraged partnerships with and sourcing from local firms to ensure technology transfer and learning. India was more of a mixed case, but Indian firms clearly understood the necessity of learning from their foreign customers. In the cases of Taiwan and China, only after local industries experienced success did the governments initiate campaigns to attract returnees. These campaigns experienced increasing successes as the home country ecosystems became richer and deeper, and thereby able to offer the resources and opportunities returnees could draw upon to build their new firms. During the ICT industries' initial development period, as a whole, returnees were of minimal significance to either economic growth or policy formation. The returnees arrived only after the difficult process of building the initial ecosystem had been ignited by indigenous entrepreneurs and MNCs. Although in Taiwan, unlike China, returnees were important in helping Taiwanese companies to achieve early international success.

The true story of Taiwan, China, and India's success in developing indigenous ICT industries illustrates the fact that rather than looking abroad and expending resources to attract returnees to an environment unprepared to absorb and utilize their capabilities, governments should invest in incentives for locals to build the ecosystem. Attracting MNCs can be part of this ecosystem construction process, but without local entrepreneurs learning from supplying and interacting with them, the result is likely to be more like the export platform maquiladoras in Mexico that never ignited a self-reinforcing spiral of improvement and also have attracted few successful Mexican technologists to return from abroad. Only once this ecosystem is operational can and will returnee entrepreneurs make the effort to return and launch new ventures.

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