The Age of the Agile

Our international mobility, both physically and electronically, is giving a whole new meaning to the concept of a multinational company. What was once the sole preserve of large corporations is increasingly becoming the territory of entrepreneurial start-ups. Based on the Silicon Valley model, the whole world is now California dreaming.

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- *In 2005 the Intel Corporation announced a new US$200 million venture capital fund dedicated to investing in technology start-ups located in China. This was a large, but not unprecedented, commitment. Five years earlier Intel committed a US$100 million fund to India-based start-ups. The firm's venture capital arm, Intel Capital, has invested over US$4 billion in 1,000 entrepreneurial companies since 1991 and a growing proportion of these investments are outside of the United States. Today Intel Capital has investment managers in 25 countries and approximately 40 percent of its investments are overseas.*
- *Walden International Investment Group (WIIG), a venture capital fund founded by a Chinese-American engineer in San Francisco, began investing in technology start-ups in Taiwan in the mid-1980s. The firm achieved the status of a top-tier venture capital firm by financing some of the most successful semiconductor and computer-related ventures in Taiwan. With US$1.5 billion under investment, WIIG is now an active investor in communications, consumer/digital electronics, semiconductor and software/information technology (IT) services start-ups in China, Taiwan, India, Japan, Malaysia, Singapore and the Philippines.*
- *Acer Technology Ventures, the investment arm of Taiwan's Acer Computer, seeks to promote "cross-Pacific start-ups" through investments in companies based in the United States and Asia. Its US$260 million "IP Fund One" is devoted to early-stage start-ups in the Internet protocol (enabling technology and solutions based on Internet platform) and intellectual property (software, integrated circuit (IC) design, etc.) fields. Its limited partners include Acer affiliate companies (32 percent), Acer top management (six percent), and*

institutional investors and the firm has offices in Silicon Valley, Taipei, Shanghai and Singapore.

– *JumpStartUp Venture Fund was established in Bangalore India in 2000 by three veterans of the IT industry with experience in both India and Silicon Valley. The US$45 million fund, targeted at early-stage information technology start-ups, had funding from institutional investors in the US and India as well as successful Indian executives in the United States. In 2002 JumpStartUp moved its headquarters from Bangalore to Santa Clara, California, in order to shift its investment strategy from an India-focused fund toward "US-India cross-border investments." JumpStartUp envisions a role as co-investor with established venture capital firms in order to help portfolio companies set up engineering teams as well as design, deployment, and support functions in India.*

Discussions of foreign direct investment typically evoke images of stand-alone multinational corporations establishing large manufacturing and assembly branch plants or research and development labs in distant locations. However, investments in entrepreneurial technology ventures are an increasingly important component of foreign direct investment and promise to become a critical determinant of long-term developmental outcomes. Whether these investments are made by dedicated venture capital firms like WIIG or by the venture capital arms of established corporations like Intel and Acer, they have already contributed to the creation of dynamic clusters of technological innovation in locations ranging from Israel and Taiwan to India and China. These investments, while small by comparison to total FDI, have contributed to the creation of local business ecosystems that support entrepreneurial experimentation and capability building – and ultimately attract more substantial subsequent rounds of investment.

The globalization of venture capital provides a window into far-reaching changes in global labor markets. The falling cost of transportation and communications has facilitated dramatic increases mobility among highly skilled workers, while digital technologies have accelerated the formalization and exchange of vast amounts of information across long distances. International migration, historically a one-way process, has become a reversible choice, particularly for those with scarce technical skills, and it is now possible to collaborate in real time, even on complex tasks, with counterparts located at great distances. Scientists and engineers from developing countries – once forced to choose between settling abroad and returning home to far less attractive professional opportunities – are contributing to their home economies while maintaining professional and business ties in more technologically advanced economies.

From Brain Drain to Brain Circulation

The migration of talented youth from developing to advanced countries was viewed in the postwar decades as a "brain drain", that exacerbated international inequality by enriching already wealthy economies at the expense of their poor counterparts. In the words of a classic textbook on economic development: "The people who migrate legally from poorer to richer lands are the very ones that Third World countries can least afford to lose, the highly educated and skilled. Since the great majority of these migrants move on a permanent basis, this perverse "brain drain" not only represents a loss of valuable human resources but could also prove to be a serious constraint

on the future economic progress of Third World nations." Data on these trends are hard to find, but the UN has estimated a total of three hundred thousand highly skilled emigrants from all developing countries to the West during the 1960s; the 1990 US Census showed 2.5 million highly skilled immigrants, excluding students.

This "brain drain" from developing to advanced countries during the latter part of the twentieth century involved large-scale migration to the United States. California's Silicon Valley benefited disproportionately from this process. The region's technology producers grew very rapidly from the 1970s through the 1990s, absorbing technical skill voraciously, irrespective of national origin. Tens of thousands of talented immigrants from developing countries, who initially came to the US for graduate engineering education, accepted jobs in Silicon Valley rather than return to their home countries where professional opportunities were limited.

Ethnic Networks

By the end of the 1990s over half of Silicon Valley's 200,000 scientists and engineers were foreign-born, primarily from Asia, and only a small proportion planned to return to their home countries. These immigrants did, however, quickly create ethnic social and professional networks that have supported career advancement and entrepreneurial success in Silicon Valley's open labor markets. The successes of high profile start-ups like Sabeer Bathia's Hotmail, Jerry Yang's Yahoo and Min Zhu's Webex are only the most visible reflections of the extent to which Silicon Valley's immigrant engineers had mastered the region's entrepreneurial business system.

The same individuals who left poor countries like India and China for better professional and economic opportunities abroad are now increasingly reversing the "brain drain", transforming it into "brain circulation", as they return home to establish business relationships or start new companies while maintaining their social and professional ties to the United States. This process is typically led by foreign-educated engineers-turned-venture capitalists who invest in their home countries and transfer first-hand knowledge of new economy financial institutions and business models to peripheral regions. These individuals also often serve as advisers to domestic policymakers who are anxious to promote technology growth. As these experienced engineers and managers return home, either temporarily or permanently, they bring the worldviews and identities that grow out of shared professional and educational experiences. These cross-regional technical communities have the potential to jump-start local entrepreneurship and they succeed over the long-term to the extent that they build alliances with technical professionals, businesses and policymakers in their home countries.

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In the early 1980s foreign-born engineers transferred the Silicon Valley model of early-stage high-risk investing to Taiwan and Israel – locations that US venture capitalists typically had neither interest in nor the ability to serve. Native-born investors provided the cultural and linguistic

know-how needed to operate profitably in these markets. In addition to capital, they brought technical and operating experience, knowledge of new business models and networks of contacts in the United States. Israel and Taiwan today boast the largest venture capital industries outside of North America (US$4 billion is invested annually in Israel and US$1.3 billion in Taiwan.) Both have high rates of new firm formation, innovation, and growth. Israel is now known for software and Internet firms like Mirablis (an instant-messaging program developer) and Checkpoint (security software); Taiwan has become a center of leading edge personal computer (PC) and integrated circuit (IC) manufacturing with firms like Acer (PCs and components) and TSMC (semiconductor foundry).

Immigrants from India and China with experience in Silicon Valley are now starting to influence economic development in their home countries as well, by transferring technology and know-how when they return home to work or start businesses, as well as indirectly, by influencing the formation of policy and other aspects of the institutional environment. By 2004, venture capital and private equity firms were investing more than US$1 billion annually in enterprises located in China and a comparable amount in India. While this is a fraction of the venture capital invested annually in the United States or even the amount of FDI in these economies, it is contributing to the development of local ecosystems that support indigenous entrepreneurship and an alternative, increasingly competitive, trajectory to the development opportunities provided by both the established domestic firms and the multinational corporations in these nations.

Entrepreneurship in the Periphery

Transformations in the world economy have undermined the power of the core-periphery model – the assumption that new products and technologies emerge in industrialized nations that combine sophisticated skill and research capabilities with large, high-income markets and that mass manufacturing is shifted to less costly locations once the product is standardized and the process stabilized. Success in this view builds on success in advanced economies, while peripheral economies remain followers.

However, the increasing mobility of highly skilled workers and information on the one hand and the fragmentation of production in information and communication technology sectors on the other, provide unprecedented opportunities for formerly peripheral economies. Regions that missed the postwar economic boom, in particular, have provided fertile environments for a decentralized growth based on entrepreneurship and experimentation. The key actors in this process are neither policymakers nor multinational corporations in isolation, although both certainly play a role, but rather communities of technically skilled immigrants with work experience and connections to Silicon Valley and related technology centers.

US-educated and trained engineers are increasingly transferring up-to-date technology and market information and helping to jump-start local entrepreneurship, allowing their home economies to participate in the information technology revolution. Because of their experience and professional networks, these cross-regional entrepreneurs can quickly identify promising new market opportunities, raise capital, build management teams, and establish partnerships with other specialist producers – even those located far away. The ease of communication and information exchange within ethnic professional networks accelerates learning about new sources of skill, technology,

and capital as well as about potential collaborators. It also facilitates the timely responses that are essential in a highly competitive environment. This decentralized responsiveness is an advantage that few multinationals can claim.

This is not a one-way process. As recently as the 1970s, only large, established corporations had the resources and capabilities to grow internationally and they did so primarily by establishing marketing offices or manufacturing branch plants overseas. Today, the fragmentation of production and the falling costs of transportation and communication allow even small firms to build partnerships with foreign producers to tap overseas expertise, cost savings, and markets. Start-ups in Silicon Valley today are often global actors from their first day of operations; many raise capital, subcontract manufacturing or software development and market their products or services outside the United States.

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The scarce resource in this environment is the ability to locate foreign partners quickly and to manage complex business relationships and teamwork across cultural and linguistic barriers. This is particularly challenging in high-tech industries in which products, markets, and technologies are continually redefined – and where product cycles are often nine months or less. First-generation immigrants like the Chinese and Indian engineers in Silicon Valley who have the language, cultural and technical skill to function well in the United States as well as in their home markets have a commanding advantage here. They have created institutions and social structures that enable even the smallest producers to locate and maintain mutually beneficial markets.

Remote and Distant

Late-developing economies typically face two major disadvantages: they are remote from the sources of leading-edge technology and they are distant from developed markets and the interactions with users that are crucial for innovation. Firms in peripheral locations use a variety of mechanisms to overcome these disadvantages, from joint ventures and technology licensing to foreign investment and overseas acquisitions. However, a network of technologists with strong ties to global markets and the linguistic and cultural skills to work in their home country is arguably the most efficient and compelling way to overcome these limitations. Cross-regional entrepreneurs and their communities can facilitate the diffusion of technical and institutional know-how, provide access to potential customers and partners and help to overcome reputational as well as informational trade barriers for isolated economies.

The increasing sophistication of information and communication technologies and the liberalization of global markets have accelerated this process. It is now quick, simple, and inexpensive to communicate internationally and to transfer information between distant locations. Information systems that facilitate the formalization of knowledge are dramatically expanding the volume as well as the variety of possible forms of information exchange. However, information technology alone cannot ensure successful coordination or efficient transfers of technical and institutional knowledge. Long-distance collaborations

still depend heavily upon a shared social context and language that ensures mutual intelligibility between partners, particularly as speed and responsiveness are essential in today's technology competition. Efforts to jump-start entrepreneurship by mobilizing researchers, capital and a modern infrastructure cannot replicate the shared language and trust of a technical community that permits open information exchange, collaboration and learning (often by failure).

The new technology centers differ significantly from one another in their technological sophistication as well as the specializations of local producers. Cross-regional entrepreneurs rarely compete head-on with established US producers; instead they build on the skills and the technical and economic resources of their home countries. Israeli entrepreneurs, for example, have successfully applied the findings of the nation's advanced military research to innovations in the Internet security and telecommunications arenas. Indian entrepreneurs, by contrast, recognized the opportunity to mobilize the thousands of underemployed English-speaking Indian engineers to provide software development services for American corporations. Returning entrepreneurs are ideally positioned to identify appropriate market niches, mobilize domestic skill and knowledge, connect to international markets and work with domestic policymakers to identify and devise strategies to overcome obstacles to further growth.

Looking Ahead

The old pattern of one-way flows of technology and capital from the core to the periphery is being replaced by a far more complex and decentralized two-way flow of skill, capital and technology between differently specialized regional economies. Silicon Valley is now at the core of this rapidly diversifying network of economies because it is the largest and most sophisticated market as well as a leading source of new technologies. However, this too could change: the relationships between these emerging technology regions are multiplying and new markets are opening up that promise to further transform the world economy. The fast-growing market for wireless communication in Asia, for example, has created opportunities for firms in China and India to contribute to the direction of the technology and its applications – even if they do not define the leading edge of the technology. Over time, producers in developing regions can build independent capabilities and define entirely new specializations and markets.

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The new regional economies are not replicas of Silicon Valley – although institutions and professional service providers from that region are fast expanding into these new locations. These regions have co-evolved with Silicon Valley. Firms in these regions do not typically seek to compete directly with Silicon Valley producers; they focus instead on developing capabilities in areas that US producers are not pursuing and over time they are transforming activities once regarded as mundane and low-tech into more efficient and dynamic sectors. Taiwan was known in the 1980s for its cheap PC clones and components; today it is recognized for the flexibility and efficiency of its IC and electronic systems producers. China

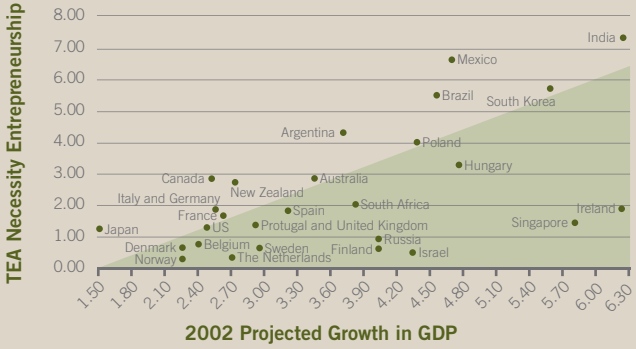
was known in the 1990s for me-too Internet ventures; today Chinese producers are poised to play a lead role in developing wireless technology. In the 1990s India was a provider of labor-intensive software coding and maintenance; today local companies are managing large-scale software services projects for leading global corporations. Israel was a low-cost location for research in the 1980s; since then local entrepreneurs have pioneered sophisticated Internet and security technologies.

A Model for Others?

This is not to suggest that all developing economies are positioned to reap the benefits of brain circulation and peripheral entrepreneurship. This opportunity is benefiting countries that have invested heavily in higher education, typically technical education and are politically and economically stable enough that immigrants will consider returning home. Some of the largest technically skilled immigrant groups in Silicon Valley have not built business or professional connections to their home countries for political reasons. Most of the region's Iranian and Vietnamese immigrants, for example, are political refugees and hence not inclined to return to countries that, in any case, lack the economic stability needed for technology investment or entrepreneurship. This criterion applies in varying degrees to many of the developing economies that have technically skilled communities in the United States and at home, including Russia, parts of Eastern Europe and Latin America. It is possible that urban areas like Saint Petersburg or Buenos Aires will become more attractive to returning entrepreneurs in the future as their economies develop and eventually provide greater professional opportunities for returnees. However, large parts of Africa and Latin America lack the skill base or political openness to become attractive environments for technology entrepreneurship.

In many Asian countries government support for large-scale, capital-intensive investments in the 1970s and 1980s, either by domestic corporations (South Korea) or by multinationals (Singapore), have created inhospitable environments for entrepreneurial experimentation. One indication of this is data on the sources of innovation. South Korea's *chaebol*, or large business groups, accounted for 81 percent of all US patents earned in South Korea in the 1990s compared to only 3.5 percent earned by business groups in Taiwan. Likewise in South Korea the top fifty assignees accounted for 85 percent of all US patents, with Samsung alone accounting for 30 percent, while Taiwan's top 50 assignees accounted for only 26 percent of all US patents. This decentralization of innovative capabilities

Entrepreneurship and Projected Growth in GDP



Source: 2001 Global Entrepreneurship Monitor

was reflected in a substantially higher rate of patenting in the late 1990s, with Taiwan earning 17.7 patents per US$ billion exports compared to 11.6 in South Korea.

Technological Laggards

Another group of developing economies has grown since the 1970s as recipients of manufacturing investments by United States, Japanese, and European technology corporations. These investments, which were targeted at low-wage locations including Singapore, Malaysia, Scotland, and Ireland, have contributed to the development of the supplier infrastructures and skill base needed to master high-volume manufacturing of electronic components. They have also contributed to substantial improvements in standards of living. However, the leading recipients of foreign direct investment remain technological laggards. The rate of patenting, normalized by either population or exports in Singapore, Malaysia, Hong Kong and Ireland since 1970 remains a small fraction of that observed in Taiwan and Israel. Seven of the top ten patent recipients in Singapore, for example, were foreign multinationals or organizations, accounting for 46 percent of all US patents between 1970 and 2000.

Recent policy changes, such as public support of venture capital, have not been sufficient to transform domestic institutions and capital and labor markets. In these nations, skilled workers prefer stable, corporate employment, and start-ups lack access to financial and technical resources as well as markets. The 2001 Global Entrepreneurship Monitor, for example, found that in spite of higher than average GDP growth, Singapore had "one of the lowest rates of entrepreneurial activity" of more than 29 countries *(see Chart, page 52)* it studied. Returning engineers to these nations have not made a significant impact on their home countries.

Cross-regional networks develop only when skilled immigrants are both willing and able to return to their home countries for business in large enough numbers to create close links to the technical community in the home country. The receptiveness of the home country depends upon factors such as political stability, economic openness, and level of economic development. It often builds on multinational investments in research and development that have contributed to a developing local skill base and infrastructure that supports entrepreneurship. The critical variable is the possession of political leaders willing to collaborate with returning entrepreneurs to develop a shared vision and remove institutional and political obstacles to entrepreneurship-led technology growth.

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