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The Offshoring Of Innovation

by Dieter Ernst

ASIA'S RISE AS an important location for innovation offshoring signals a profound shift in the center of gravity in the global economy. The main drivers of this change are global—mainly U.S. corporations—who are increasing their overseas investment in research and development, while seeking to integrate geographically dispersed innovation clusters into global networks of production, engineering, development and research. But Asian governments and companies are playing an increasingly active role as promoters and new sources of innovation.

In fact, innovation offshoring owes much to the region's success as the primary "global factory" in industries as diverse as textiles, footwear, agro-industries, electronics, steel, cars, machine tools, software and information technology-enabled business services. Integration into global production networks show the catalytic role that linkages with foreign firms can play for industrial development. Such integration enabled Asian firms to access the world's leading markets, technology, and management techniques, helping to compensate for the initially small size of their domestic markets. This has created new pressures and incentives for Asian suppliers to upgrade their capabilities and the skills of their workers.

Aggressive support policies by Asian governments enabled local firms to take advantage of these opportunities. The result is one of the most impressive success stories of economic development. At the start of the 21st century, the region's rate of growth in GDP, trade and inward foreign direct investment has surpassed even the impressive pace it achieved during the 1980s and 1990s, and Asia also has become an increasingly sophisticated market for

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goods and services.

China is at the center of Asia's accelerated rise in the global economy. The International Monetary Fund (IMF) estimates for 2006 suggest that China will overtake the United Kingdom to become the fourth largest economy at market prices. When differing price levels between countries are taken into account, China is already ranked second, in terms of its GDP at purchasing power parity prices. Based on its swelling trade surplus, China is projected to accumulate more than $1 trillion in foreign exchange, a total that would surpass Japan's projected reserves. Skeptics point out that China's share of global GDP in 2005 stood at 4.9%, while China's exports accounted for 7.3% of global exports. They conclude that "China is still a tiny cog in the global wheel." However, the fallacy of using such aggregate data becomes evident when one looks at specific sectors.

No other industry reflects Asia's rise as well as the electronics industry. Today, Asia's five leading exporting countries (China, South Korea, Taiwan, Singapore and Malaysia) account for more than one-fourth of world electronics manufacturing output. These five countries occupy leading positions in the global market for digital consumer electronics, computers, and mobile devices as well as for high-precision components. In the semiconductor industry, for instance, roughly 70% of output is now based in Asia. India, which has established itself as a global export base for software and IT-enabled business services, is now emerging as the next frontier for offshore manufacturing in sectors as diverse as auto parts and pharmaceuticals.

This process has culminated in China's emergence as the dominant "global factory" location. Since 2004, China is the world's largest exporter of electronic products, surpassing the U.S.—a dramatic increase from its position as number ten in 2000. Particularly noteworthy is China's rapid improvement of its export portfolio—digital consumer electronics and mobile telecommunications equipment have increased relative to appliances and PCs, and electronic components have become its second biggest electronics export item.

Additionally, China's emergence as the second largest electronics importer (up from seventh in 2000), indicates the growing importance of Asia's increasingly sophisticated markets for communications, computing and digital consumer equipment, and for the electronic components (especially semiconductors) required by Asia's global electronics factories.

China is the world's largest market for telecommunications equipment (wired and wireless), as well as a test bed for advanced third generation wireless communication systems. China is also one of the most demanding markets for computing and digital equipment for consumers.

Upgrading Through Technology Diversification

ASIA'S ROLE AS the "global factory" will continue to spur economic growth and capability development. However, both the 1997 Asian financial crisis and the downturn in the global electronics industry in 2000 have brutally exposed the downside of that model: A country becomes more

Asian firms are not focusing on "technology leadership" but on "technology diversification."

vulnerable when it has a high share of electronics in its exports, when it is highly integrated into global production networks, and when the country depends on exports to the U.S. In addition, there are decreasing returns to the "global factory" model. As the capital intensity of such investment increases, it generates less new employment, and spillovers to local suppliers decline as global contract manufacturers—like Flextronics—provide integrated manufacturing services, increasing their share of global factory production.

In addition, much of the "global factory" investment has remained "footloose", leading to plant closures in established locations and relocation to new lower-cost locations. Furthermore, Asian firms heavily rely on U.S., Japanese and European firms as the dominant sources of new technology. This reflects the heavy concentration—much of it centered on the U.S.—of R&D, innovative capabilities and intellectual property rights (IPR). For Asian firms, this has resulted in razor-thin profit margins due to the hefty licensing fees charged by the global brand firms.

Across the region, a broad consensus has emerged that Asia's electronics industry needs to upgrade to higher value-added and technologically more demanding products, services and production stages, and that this requires the development of strong innovative capabilities. To achieve this goal, Asian governments and leading electronics and software companies are seeking to develop the skills, knowledge and management techniques needed to create and commercialize new products, services, and business models.

In their efforts to achieve this edge in innovation, many Asian countries and firms have pragmatically focused not on "technology leadership" but on "technology diversification." Asian firms are not attempting to compete head-on with global technology leaders but rather to expand their technology bases by drawing on other countries' component and process technologies. This enables Asian firms to build on their existing strengths in manufacturing and prototype development. Most importantly, technology diversification allows Asian firms to use their accumulated capabilities to assimilate and improve upon foreign technologies, which arguably has stimulated the region's success in attracting innovation offshoring.

The results of these efforts are impressive. Some Asian governments and leading electronics and software companies have made substantial investments in IT infrastructure (especially for broadband communication), and R&D programs. South Korea, Singapore, Hong Kong and Taiwan lead the world in broadband access and speed. Regions in China and India are attracting innovation offshoring are rapidly catching up. In addition, gross domestic expenditures on R&D have substantially increased in Asia's five leading electronics-exporting countries, with China and Singapore experiencing the fastest rise.

New innovation clusters have emerged

for broadband technology and applications in South Korea and Singapore; for mobile communications and digital consumer devices in Korea, Taiwan and China; and for software engineering and embedded software development in India.

A particularly intriguing example is the efforts by some Asian governments and leading companies to support research programs. In Korean telecommunications, for examples, four leading players (Samsung, SK Telecom, KT, and LG) are all attempting to become major developers of complex technology systems, especially in mobile communications. These efforts build on capabilities accumulated in public research labs (like the Electronics and Telecommunications Research Institute, ETRI), as well as in R&D labs of the chaebol, to develop complex technologies like communication systems that are based on the code-division multiple access, or CDMA, standard developed by U.S telecoms firm Qualcomm.

Another important example is China's attempt to develop an alternative third generation (3G) digital wireless standard, called TD-SCDMA (time-division synchronous code-division multiple access). The TD-SCDMA standard was developed by Datang Telecom, a Chinese state-owned enterprise, and the Research Institute of the Ministry of Information Industry, with technical assistance from Siemens. To accelerate the implementation of this strategy, Datang has formed joint ventures with global industry leaders that are all involve with R&D in China: Nokia, Texas Instruments, LG group, and Philips. It has also formed a licensing agreement with STMicroelectronics that will provide the Chinese company with access to critical design building blocks. Such linkages illustrate the important role that such programs can play in attracting innovation offshoring.

Skills and Capabilities

ASIA'S GREATEST ATTRACTION for innovation offshoring, however, results from impressive improvements in the region's talent pool. Building on existing strengths in volume manufacturing, Asian firms have developed a broad range of specialized skills covering quality control and the management of resources, supply chains and customer relations. Asian firms have moved up into product development and increasingly into system and integrated circuit design.

One reason for this is the success of Asia's leading electronics-exporting countries in expanding their higher educations systems. For instance, China now graduates almost four times as many engineers as the U.S., and South Korea—with a population one-sixth that of the U.S.—graduates nearly the same number of engineers as the U.S. Between 1995 and 2003, first year entrants in science and engineering doctorate programs in China increased six-fold, from 8,139 to 48,740. By 2010, China is expected to produce more doctorates in these fields than the U.S.

Such rapid expansion will undoubtedly come at the cost of a declining quality of graduate education, at least outside a handful of elite universities. A recent McKinsey report shows that, if all negative factors are factored in, only 25 % of India's engineering graduates are suitable

for work at global corporations, while the current share in China is only 10%. But there are signs that the quality problem is being addressed aggressively.

Highly skilled knowledge workers are much cheaper in Asia (outside of Japan) than in the U.S. For instance, the cost of employing a chip design engineer in Asia is typically between 10% and 20% of the cost in Silicon Valley. Given these factors, it is not surprising that the share of Asia in overseas R&D by U.S. firms has almost quadrupled, from 3% of a total of $12 billion in 1994 to close to 12% of $20 billion in 2002. A recent survey (by United Nations Conference on Trade and Development) of the world's largest R&D spenders shows that, by 2004, China has become the third most important offshore R&D location (after the U.S. and the UK), followed by India (sixth place) and Singapore (ninth place). The same survey projects that the pace of R&D internationalization will accelerate as companies expand their reliance on R&D internationalization.

An important new development is that smaller U.S. high-tech companies, and even start-ups, are also now facing considerable pressures to engage early on in innovation offshoring. In fact, venture capitalists in Silicon Valley now require start-ups to present an "offshore outsourcing" plan, as a precondition for receiving the next round of funding. Emblematic for the increasingly fine-grained division of labor in innovation offshoring are "offshoring brokers" who are also influencing start-ups development in Silicon Valley. A typical example is a company based in Santa Clara, California, and Ahmedabad, India. It was founded by an Indian design engineer with a distinguished track record in leading U.S. semiconductor firms. The company was established specifically to work as an offshoring broker to help U.S. semiconductor firms run R&D teams in India.

Three Challenges

INNOVATION OFFSHORING IS driven by profound changes in corporate innovation management as well as the globalization of markets for technology and knowledge workers. It is thus likely to accelerate. U.S. companies are at the forefront of these developments. They are expanding their overseas investment in R&D and seek to integrate Asia's new innovation clusters into global networks of production, engineering, development and research.

To benefit from innovation offshoring, Asian governments now need to address three interrelated challenges. To expand innovation offshoring, Asian governments need to attract R&D investments by global firms. They also need to enable Asian firms to develop their own innovative capabilities. Finally, Asian governments need to reduce the developmental opportunity costs of policies to promote innovation offshoring. For instance, large investments are required to create specialized infrastructure for R&D clusters in Asia's top-tier cities, which will reduce resources available for improving social infrastructure. Most debates have focused on the first policy challenge. But if Asia fails to meet the other two challenges, it is unlikely to reap sustainable benefits from innovation offshoring. ■