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Lessons of Investment  
In Technology Parks and Their Role  
in Bridging the Digital Divide

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## **Lessons of Investment in Technology Parks And Their Role in Bridging the Digital Divide**

### I. INTRODUCTION

What investments are Asia Pacific countries making in information technology parks as part of a national development strategy, and what lessons does this hold for reducing the Global Digital Divide? This paper explores and compares developments in five economies: China, India, Malaysia, Singapore and Taiwan/Chinese Taipei and looks at implications for Hawaii.

The GDD refers to the inequality, throughout the world, in access to information and communication technology and services. The Regional Digital Divide (RDD) refers to inequalities among nations within a region, for example between fast digitization in Singapore and slow access to information in Viet Nam. There is also disparity within nations. In developed countries the divide is marked by the minorities' lack of access to sophisticated telecommunications resources (Leahy and O'Brien *Intermedia*, September 2000 Vol28/5). In less developed countries differences in access often exist between urban and rural areas (Taylor and Jussawalla, 2001).

Addressing inequalities in access to information and communications technology (ICT) in an economy requires substantial investments in infrastructure and human resources. The cost of an economy's not making this investment could be the marginalization of that society in the global economy. The benefit of adopting ICT is that it supports a wide range of human activities and it offers a means of breaking barriers to knowledge, civic participation, and social and economic opportunity (UNDP Human Development Report, 2001).

Developing nations wish to increase economic and political viability through economic development (Khondker, 1999). They are searching for strategies that will promote foreign direct investment (FDI), technology transfer, research and development (R & D), human resource development and employment, entry into the ICT export market, and overall economic growth. Investment in ICT offers the potential for developing countries to expand exports, create good jobs and diversify their economies. The ICT sector requires less initial investment in capital and infrastructure than do more traditional sectors, which may be why high-tech industries are growing faster than medium-tech industries in developing countries (UNDP Human Development Report, 2001).

However, as the Final Report of the Digital Opportunity Initiative points out, there is debate on the effectiveness of using ICT to help achieve development goals. Although ICT has the potential of assisting development efforts, its effectiveness depends on appropriate deployment. An explicit focus on using appropriate ICT for development goals may allow countries to achieve a wide diffusion of benefits and contribute to both broad-based economic growth and specific development goals. The success of national ICT strategies requires the coordination of all actors involved, from local to national to global levels (Digital Opportunity Initiative, 2001).

The Final Report states that nations can use ICT in two basic ways: ICT as a production sector and ICT as a socio-economic development enabler. If they invest in ICT as a production sector, the two most common approaches are to have an export market focus or to have a national capacity/domestic market focus. If they were to develop ICT as an enabler, the two approaches are a global positioning focus or a development goals focus. Technology parks can fall under both the export market focus and the global positioning focus, with parallel strengths and weaknesses.

An export market focused Technology Park strategy can produce economic growth, improve balance of payments and reduce dependence on traditional commodity exports. However it may have only a limited impact on the development of national infrastructure and capacity, and does not automatically translate into broader development gains. The global positioning focus is essential to the long-term economic success of developing countries in the global network economy, but may fail to meet specific development goals (Digital Opportunity Initiative, 2001).

Regardless of these issues, investment in the IT sector has proved a critical element in economic security for these countries. This strategy has been key in reviving the East Asian economies during the Asian financial crisis. Additionally, the development of domestic, in addition to foreign, demand for IT products and services will diversify their markets and provide further stability and growth (Jussawalla, 1999).

Information-based technology parks serve as a vehicle for leapfrogging an economy's technological capacities into the 21st century and bringing it up to par with those of more developed nations. Such a plan has a potentially major impact on both regional and global digital divides.

## II. FIVE COUNTRIES / FIVE MODELS

### A. CHINA

Once Mao liberated China from imperialism and foreign domination, Deng Xiaoping opened China's market economy to pave the way for prosperity. In the ICT arena, the telephone sector has grown at a rate of 41.6% annually since 1993. The government plans to increase teledensity to 8.5% in the first decade of the new millennium. However, this striking growth is confined to the cities and metropolitan areas along the eastern coast. During the Deng Xiaoping era, the state gave priority to telecommunications investments in the coastal regions and allowed industry to focus on major metropolitan areas. This increased the divide between the poorer and richer

regions. China has wrought very little change in rural life, where 80% of its population resides, and this economic gap between the coastal areas and the hinterland is widening. The China Internet Network Information Center reports that only 2% of China's population has computers and Internet penetration remains at less than 1%. (Jussawalla, 2001b).

The drive in technology development continues and is evident in President Jiang Zemin's leadership. During the November 1996 Asia-Pacific Economic Cooperation (APEC) 4th Leader's Informal Conference, Jiang Zemin pointed out, "The most important pioneering work in our century on the industrialization of scientific and technologic achievements is to initiate and develop science and technology industry park. This kind of combination between industry development and science and technology activities, have solved the difficult problem of the separation of science and technology from economy, and made the discovery or invention of mankind transfer smoothly to the industry fields, to realize their economic and social benefit."

The Ministry of Science and Technology initiated and implemented the China Torch Program (CTP). The CTP is aimed at realizing the commercialization, industrialization and internationalization of scientific and technological achievements in China. It embodies China's strategy of "Nation Building through Technology and Education".

A key focus of the CTP is the development of high technology industry development zones. CTP began by building on an existing foundation of industry parks and continued to develop new parks. By 1997 the total number of the new high technology industry development zones at the state level reached 53, which spread over 29 provinces, autonomous regions and municipalities directly under the Central Government.

By the year 2005, the accumulative annual income of China's new high technology industry development zone from technology, industry, and trade is expected to be 1,750 billion yuan. The export earning in foreign exchange is projected to be 35 billion yuan. There may be 50 zones with annual total income over 10 billion yuan and 5 zones with annual income over 100 billion yuan. (<http://www.chinatorch.gov.cn/E-torch/index.htm>, 2001)

## B. INDIA

The development of India's information technology industries has been highly dependent on changing policy attitudes toward the balance between economic self-sufficiency and participation in the global economy. In 1991 India initiated a new fiscal policy encouraging foreign investment by liberalizing trade, devaluing the rupee, and easing foreign exchange transactions. The 1991 reforms and subsequent policies boosted economic growth. The World Bank reports that the economy grew at 7.5% a year in the mid-nineties. Unfortunately, this growth has had little impact on the overall poverty level, which dropped only one point from 35% to 34%. Higher numbers are reported in the rural areas, where most of the population resides. The economy is still heavily dependent on agriculture and industry, which comprise more than half of GDP output.

Much of the recent entrepreneurial energy in India has been directed toward the ICT sector. The growth of the ICT sector is due in large part to the large pool of highly educated, low-cost, English-speaking technology professionals. Indian universities are producing 125,000 engineers a year (Business Week, February 2001) and they are the foundation of software and hardware production in India.

There have been major developments in the areas of basic telecommunications, software engineering, business-support services, television, and space, resulting in an economic growth rate factor of 6% in the information technology sector, among the

fastest rates in the world. India's investment in the development of technology parks has played a critical role in many of these areas. The Indian software industry grew from US\$150 million in 1990-1992 to US\$5.7 billion (including over US\$4 billion worth of software exports in 1999-2000, an annual growth rate of over 50 percent. Teledensity has reached 3.5 percent of the population. The number of Internet accounts is around 1.5 million, growing at 50 percent per annum. The government hopes that the spread of IT will unify a nation divided by cultural, religious, and economic differences.

There are software technology parks and electronics hardware parks, each administered under policy "schemes". The Software Technology Park (STPI) Scheme (under The Ministry of Information Technology, Government of India) is a 100% export-oriented scheme for developing software for export via data communication links. There is also the export of consultancy services.

The Bangalore STP is located in Karnataka State. Karnataka has a state-of-the-art international technology park with 1.5 million sq ft of developed space, 6 new private technology parks with 6 million sq ft, STPs at Mysore, Hubli, Manipal, and Mangalore with high speed data communications, and the best telecommunications infrastructure in country. Karnataka leads India in software exports and the electronics industry, and was the first state in the country to have a software park. The Bangalore Software Park is the first to offer software services, information service provider (ISP) services, training and consultancy, videoconferencing, and is the first park with International Standards Organization (ISO) certification (Naidu, 1999). There is also substantial IT development underway in the area around the City of Hyderabad, which may even exceed that around Bangalore.

### C. SINGAPORE

The Singapore government, from the inception of the state in 1965, realized that political viability and economic survival were two sides of the same coin. Aware of its

small population and lack of natural resources, it looked to new economic activities and new markets to establish itself as a manufacturing base for multi-national corporations and as a service hub for the region. Consequently, Singapore made a key priority of capacity building in science and technology and always played a proactive role towards globalization.

The Government established Singapore Science Park in 1984. It is the cornerstone of Singapore's technology corridor, a 15-kilometer area stretching from the Park to Nanyang Technological University, enclosing the National University of Singapore and several high tech manufacturing facilities (Khondker, 1999).

The Singapore Science Park is the R & D base for many Fortune 500 companies in fields ranging from communications and information technologies to biotechnology. It occupies 300 acres and is being developed over three phases. Phase I is fully developed, with a gross floor area of 240,000 sq. m. and is wholly owned by Ascendas Land Pte Ltd. (formerly Arcasia Land Pte Ltd). Phase II is scheduled to be fully developed by 2001, and Phase III is in planning. The National Science and Technology Board, formed in 1991, is Ascendas' partner in phases II and III. In 1999 there were 123 tenants in Science Park I and 86 tenants in Science Park II, with a total of 7,000 employees. All tenants are required to be at least 50% R & D, and most of the companies are 100% R&D (Khondker, 1999).

In 1999, 51% and 52% of the companies in Phases I and II, respectively, were engaged in information technology and telecommunications activities (Wong 1999). Twelve percent of the employees have PhD, 16% have Masters, and 52% have Degree level education (Wong, 1999). About 50% of the companies are foreign-owned (Wong, 2001) and there are more than 307 multi-national corporations present. (<http://www.sciencepark.com.sg/>, 2001). The TeleTech Park is Southeast Asia's first R & D facility specially designed to meet the needs of telecommunications R&D

companies. Completed in October 1996, it features cutting-edge infrastructure and test-bed (<http://www.sciencepark.com.sg/>, 2001).

#### D. MALAYSIA

The Malaysian government was one of the first to attempt to replicate the Silicon Valley model in a developing country. In its attempt to move to the technology sector to attract domestic and foreign private investment, the government invested in creating what was expected to be a world class physical and information infrastructure. This US\$40 billion initiative, called the Multimedia Super Corridor (MSC), serves as the backbone for the country's information superhighway. The network is supported by a high-speed link (10Gb/s network) which connects the MSC to Japan, ASEAN, the US and Europe. The network is also capable of supporting extensive public, education, and business applications.

Malaysia provides generous tax incentives to attract multi-national corporations (MNCs). It has initiated efforts to raise relevant skill levels within the workforce and instituted policies that ease the entry of foreign knowledge workers. Malaysia has worked to create a strong ICT infrastructure in its major enterprise zones by improving business processes and providing incentives. Its development strategy has stimulated growth in investment and trade.

As a result of these efforts, in 1999 the gross national product (GNP) rose by 5.4%, an increase led by manufacturing and export of ICT-related electronics. The ICT sector's contribution to the GNP was approximately 36.5%, primarily from semiconductor and electronic equipment (Digital Opportunity Initiative, 2001).

However there are still problems. There remains an acute shortage of skilled labor and a lack of ability to generate sufficient numbers of knowledge workers. It is not clear that the goal of entering the knowledge society is best served by a capital intensive focus on multimedia applications, as opposed to a strategy focused on extending

infrastructure, increasing ICT and general literacy, and focusing on small and medium enterprise and government usage of ICT. There is also an emerging gap between the information-rich and information-poor (Digital Opportunity Initiative, 2001).

The Multimedia Super Corridor is located in a site 15 km. wide and 50 km. long, between Kuala Lumpur city and Kuala Lumpur international airport. The MSC has 516 companies and 19 higher education institutions.

Two of the world's first Smart Cities are being developed in the Corridor: Putrajaya, the new seat of government and administrative capital of Malaysia where electronic government will be introduced; and Cyberjaya, an intelligent city with multimedia industries, R & D centres, a multimedia university and operational headquarters for multinationals wishing to direct their worldwide manufacturing and trading activities using multimedia technology.

The Multimedia Development Corporation envisions a 20-year time-frame for the full implementation and execution of the MSC, when Malaysia will have achieved leadership in the Information Age (<http://www.mdc.com.my>, 2001).

#### E. TAIWAN/CHINESE TAIPEI

Taiwan is a highly urbanized and industrialized society. With a US\$101.6 billion foreign reserve that is second only to Japan, Taiwan has had a growth rate of 5% (Wang, 1999). Taiwan's information industry went through several stages of development. Starting as an OEM in monitors and accessories, the industry moved into personal computers and semiconductors. By 1998 the value of Taiwan's information products reached US\$19.2 billion, ranking third after the US and Japan. Taiwan's companies have 50% or more market share in seven different market product types (Wang, 1999).

There are two major parks in Taiwan, Hsinchu Science-based Industrial Park (HSIP) in the north and Tainan in the south. The number of high-tech companies in the

HSIP grew to 272 in 1998 with over 72,000 employees. Of the companies in the park, 222 were domestically owned and 50 were foreign-owned. HSIP companies are classified into six categories: integrated circuits, computers and peripherals, telecommunication, optoelectronics, precision machinery and materials and biotechnology. HSIP firms' combined sales were US\$ 13.7 billion with a negative growth rate of 2.02%. Aggregate investment increased by 23.7% from 1997 to reach US\$15.3 billion. Domestic sources accounted for 90.1% of HSIP investment capital, while foreign sources accounted for 9.9%.

In the area of new investment, 42 new firms entered the park in 1998, with new investments amounting to US\$967.9 million. In 1998, 84 companies increased that amount to US\$4,042 million. 39 companies of the integrated circuits sector alone raised a total of US\$2,781.4 million in new capital.

The activities of the companies in the HSIP are increasingly geared to internationalization. Forty-seven companies have offices abroad, and many well known foreign manufacturers have already signed science and technology cooperation agreements with the park companies.

The Tainan Science-based Industrial Park is located in Tainan County. It covers an area of about 638 hectares and attracts companies producing semiconductors, wireless telecommunications, computer, micro electronic precision machinery, optoelectronics, and agricultural biotechnology products. Until the end of 1998, a total of 28 companies were approved to move into the Park, investing a total amount of US\$4.6 billion. Nine companies have already started with the construction of factory buildings.

As the use of new land inside the HSIP has reached its limits, the fourth expansion plan of the HSIP is now under way in Chunan and Tungluo in Miaoali County to provide a new area for high tech industries. The new area in Chunan covers 117 hectares and 365 hectares will be developed in Tungluo. It is planned that main

companies of the biotechnology, optoelectronics, and telecommunication industries will move into the new Park area (<http://www.sipa.gov.tw/seconde/index1.htm>, 2001).

### III. IMPLICATIONS FOR HAWAII

In recent history Hawaii has been disproportionately dependent upon the tourism sector for its economic growth and security. Due to its geographical isolation and ecological concerns, Hawaii is not strategically suited for a manufacturing economy. High technology development efforts have focused on the telecommunications and software sectors. Hawaii's unique location in the middle of the Pacific Basin, an English-speaking workforce, and a multi-cultural community have provided leverage in these sectors. The state has increased competition in the telecommunications sector and, often in partnership with the federal government, encouraged the development of a high technology sector. The private sector has spawned IT intensive projects and businesses.

One public sector initiative is the Maui High Performance Computing Center. Located on the island of Maui, this project of the Department of Defense houses one of the ten most powerful computers in the world (Bruce, 2001; MHPCC, <http://www.mhpcc.edu/>, 2001). The center encourages state and private sector organizations to participate in the utilization of its computing power. The contribution of this center to human resource development has already been realized through close cooperation with the state's University of Hawaii and a recently executed contract for the university to manage and maintain the center (Gomes, 2001; Ruel, 2001).

The Maui Research and Technology Center (MRTC) is a project of the High Technology Development Center (HTDC). HTDC is an agency of the State of Hawaii which promotes Hawaii as a site for high-technology applications and gives advice on policy and planning. HTDC assists start-up businesses in Hawaii

and is a source of information on high technology activity in the state. The MRTC houses technology oriented start-up companies and is a source of economic diversification through job creation. The MRTC is also a home for the University of Hawaii's Office of Technology Transfer and Economic Development, and the Hawaii Small Business Development Center Network (MRTC, <http://www.mrtc.org/MRTC/about.html>, August 2001).

An example of a private sector initiative is that of the Estate of James Campbell. The estate developed the City of Kapolei, the Kapolei Business Park and the Kapolei Teleport on the island of Oahu. These projects share a high bandwidth high technology infrastructure linked to the continental US, Asia, and the MHPCC and designed to support both government and private business. The 11.5-acre teleport, located adjacent to the City of Kapolei, sits astride a number of the trans-Pacific fiber optic cables. The teleport's earth stations can simultaneously "see" Asian satellites that are invisible to the continental U.S. and North American satellites that are invisible to Asia. The teleport houses earth stations for Verizon and Loral Cyberstar, Sprint USA, Time Warner Communications, and Southern Cross, with other providers presently negotiating with Campbell Estate of locate their facilities there also. Together they have 14 satellite dishes that carry digital voice, data, video, and VSAT traffic to domestic and international destinations. The Teleport will continue expand to provide additional services that will make it an even more important international gateway. This includes interconnectivity between terrestrial and satellite networks, extension of Internet services into the Pacific and Asia, and earth segment connections to numerous new regional satellites needs (Bruce, 2001).

All these projects reflect the strategies of bringing in the latest in high technology, incubating entrepreneurship, and developing human resources.

#### IV. CONCLUSION

Investment in Technology Parks, using different models and different market niches, appears to have helped the nations surveyed to meet their immediate goals of increased FDI, technology transfer, increased exports, technology diffusion, increased employment, and human resource development. In so doing, it has contributed to the goals of overall economic growth, political stability and civic participation. It has supported infrastructure growth and penetration, and increasing access to the Internet. However, it is still subject to regional and global economic trends (e.g., the “dotcom” recession) and the more disruptive tendencies of globalization which can exacerbate gaps in access and affluence.

The contribution of investment in and operation of, technology parks, suggests that such investments can be a significant factor in driving infrastructure improvements, increasing penetration of information technologies, opening up international lines of communications, and increasing use of information technology in countries which have not historically been leaders in this area. They appear to help reduce national and regional digital divides. These concepts may also be of value in their application in other areas of the world, as a significant factor in the long-term effort to reduce the Global Digital Divide.

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