

Chapter 8

Infrastructure Development in Singapore

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Abstract

Just 40 years ago, Singapore faced the problems of overcrowding in the city, poor living conditions and a severe lack of infrastructure. Today, Singapore is a thriving city and international business hub characterized by a high standard of living in a clean and green environment but the success did not come about by chance but through a process of proactive and farsighted planning. From the experience of Singapore, infrastructure is clearly central to socio-economic advancement. An efficient infrastructure facilitates delivery of information, goods and services, supports economic growth and assists in achieving social objectives such as raising the living standards and educational levels. Through a broadly chronological study of various aspects of Singapore's infrastructural development, and the challenges faced, the paper hopes to highlight developmental strategies that could be transferred to other developing Southeast Asian countries. Singapore's Infrastructural Development has been often guided and driven by government agencies set up for that purpose.

1. INTRODUCTION

Just 40 years ago, Singapore faced the problems of overcrowding in the city, poor living conditions and a severe lack of infrastructure. Today, Singapore is a thriving city and international business hub characterized by a high standard of living in a clean and green environment but the success did not come about by chance but through a process of proactive and farsighted planning.¹ From the experience of Singapore, infrastructure is clearly central to socio-economic advancement. An efficient infrastructure facilitates delivery of information, goods and services, supports economic growth and assists in achieving social objectives such as raising the living standards and educational levels.

Through a broadly chronological study of various aspects of Singapore's infrastructural development, and the challenges faced, the paper hopes to highlight developmental strategies that could be transferred to other developing Southeast Asian countries. Singapore's Infrastructural Development has been often guided and driven by government agencies set up for that purpose. The Singapore government's Concept Plan was first developed in 1971 and then fine-tuned. A "Ring Concept" was chosen: high density satellite towns linked to the Central Business District by expressways and a rail system and this was followed by slum clearance and an extensive public housing project.²

¹ Urban Redevelopment Authority, "Our History" in the URA website [downloaded on 1 Dec 2007], available at <http://www.ura.gov.sg/about/ura-history.htm>

² Urban Redevelopment Authority, "Our History" in the URA website [downloaded on 1 Dec 2007], available at <http://www.ura.gov.sg/about/ura-history.htm>

2. HOME OWNERSHIP

Two of the most pressing national concerns following independence were unemployment and lack of public housing and two government agencies were tasked with solving these problems - the Housing and Development Board (HDB) and the Economic Development Board (EDB).³ The HDB tackled the acute housing needs and implemented an urban renewal programme while The EDB was placed in charge of Singapore's industrialization programme.⁴ Housing and housing finance are crucial in a state where land is scarce and thus there is a need for the regulation of HDB Flat prices, and use of CPF for mortgage.

The goal of home ownership for all Singaporeans required a housing finance strategy. Public housing was designed to be high-density and low cost. Along with it, schools, community centres, town centres, health clinics, transportation infrastructure was built. For the Home ownership strategy, three main organisations are involved: the Government, the Housing Development Board and the Central provident fund. CPF acts as a social security system that also assists citizens in paying back mortgage loans. Strategies for home ownership included various approaches. For example, low interest loans payable over 20 years was provide and prices of HDB flats were pegged to

³ Urban Redevelopment Authority, "Our History" in the URA website [downloaded on 1 Dec 2007], available at <http://www.ura.gov.sg/about/ura-history.htm>

⁴ Urban Redevelopment Authority, "Our History" in the URA website [downloaded on 1 Dec 2007], available at <http://www.ura.gov.sg/about/ura-history.htm>

household income levels.⁵

The Ministry in charge of ensuring adequate public housing for everyone is the Ministry of National Development whose policy is to give every Singaporean a stake in the country and through this aspect feel a sense of ownership for the country.⁶ In this sense, there is a nation-building goal tied to the project of public housing. This project has been highly successful because today, 86 per cent of Singaporeans live in public housing flats built by HDB and these homes have also become assets, as 92 per cent of HDB residents own their flats.⁷

Along with the nation-building social goal is the attempt to foster racial harmony by allocating flats in every areas to have a balanced multiracial makeup so that there is a growth of vibrant, thriving multi-racial communities.⁸ Other than ensuring multiracial makeup, HDB also tries to ensure greater social mobility between different income classes by having a multi-pronged programme to help the lower-income group own

⁵ Housing Loan, "News and Events" in the Housing Loans website [downloaded on 1 Dec 2007], available at <http://www.housingloansg.com/news.htm>

⁶ Ministry of National Development (MND), "Building Homes, Shaping Communities" in the MND website [downloaded on 13 Dec 2007], available at http://www.mnd.gov.sg/handbook/build_main.htm

⁷ Ministry of National Development (MND), "Building Homes, Shaping Communities" in the MND website [downloaded on 13 Dec 2007], available at http://www.mnd.gov.sg/handbook/build_main.htm

⁸ Ministry of National Development (MND), "Building Homes, Shaping Communities" in the MND website [downloaded on 13 Dec 2007], available at http://www.mnd.gov.sg/handbook/build_main.htm

HDB flats.⁹ For the small minority who cannot afford their own homes, subsidized rental housing is available.¹⁰

Assistance for Lower-Income Groups is tied closely to economic development. While Singapore's public housing programme has made it a nation of home-owners, there remains a small group of Singaporeans who will need extra help in attaining this dream and this is particularly so as workers without the relevant skills could be marginalized in the New Economy.¹¹ The Special Housing Assistance Programme was developed to consolidate an array of housing assistance schemes designed to give the lower-income group a chance of upward mobility by providing housing subsidies to help lower-income households own their first flat.¹²

To prevent urban decay and the growth of a new underclass, the Estate Renewal Strategy was put in place to rejuvenate older HDB towns and estates and in so doing, it not only transforms the physical environment of these towns, but also enhances the

⁹ Ministry of National Development (MND), "Building Homes, Shaping Communities" in the MND website [downloaded on 13 Dec 2007], available at http://www.mnd.gov.sg/handbook/build_main.htm

¹⁰ Ministry of National Development (MND), "Building Homes, Shaping Communities" in the MND website [downloaded on 13 Dec 2007], available at http://www.mnd.gov.sg/handbook/build_main.htm

¹¹ Ministry of National Development (MND), "Building Homes, Shaping Communities" in the MND website [downloaded on 13 Dec 2007], available at http://www.mnd.gov.sg/handbook/build_main.htm

¹² Ministry of National Development (MND), "Building Homes, Shaping Communities" in the MND website [downloaded on 13 Dec 2007], available at http://www.mnd.gov.sg/handbook/build_main.htm

asset value of the homes.¹³ Lower-skilled workers who have been unable to cope with the demands of the New Economy can enjoy such subsidized housing and divert their limited financial resources to upgrading programs or educational skills training to catch up with the demands of the hi-tech economy.

With the rational allocation of living space for all communities and income classes, there is also a conscious effort to build up a sense of locational and regional identity by building living environments that residents can readily identify with, towns and neighbourhoods incorporate design themes that reflect the heritage or personality of the area.¹⁴ The use of pre-cast technology has given rise to uniquely designed facades, motifs, street and precinct fittings, and other architectural features.¹⁵ Apartment blocks are also grouped in precinct clusters with supporting social and recreational facilities to help heighten residents' sense of belonging.

The introduction of the Home Ownership for the People Scheme in 1964, with its pricing subsidy and attractive mortgage repayment plans, has ensured that prices of new

¹³ Ministry of National Development (MND), "Building Homes, Shaping Communities" in the MND website [downloaded on 13 Dec 2007], available at http://www.mnd.gov.sg/handbook/build_main.htm

¹⁴ Ministry of National Development (MND), "Building Homes, Shaping Communities" in the MND website [downloaded on 13 Dec 2007], available at http://www.mnd.gov.sg/handbook/build_main.htm

¹⁵ Ministry of National Development (MND), "Building Homes, Shaping Communities" in the MND website [downloaded on 13 Dec 2007], available at http://www.mnd.gov.sg/handbook/build_main.htm

HDB flats are kept within the reach of the vast majority of Singaporeans.¹⁶ In addition, allowing the use of Central Provident Fund savings for the purchase of HDB flats has enhanced affordability. Moreover, first-timers can apply for a CPF Housing Grant if they prefer to buy a HDB resale flat.¹⁷

3. GOVERNMENT EXPENDITURE

Singapore's annual average growth rate of gross fixed capital formation between 1966 and 1972 was 30% compared to 9.1% for private consumption and 17.2% for public consumption.¹⁸ This was mainly accounted for by government construction expenditure and urban renewal projects, such as on high-rise office buildings and shopping complexes. But it was also spent to open up the economy by investing in various technologies and industrial machinery, such as petroleum refining, electronic manufacturing, transport equipment, etc. Government infrastructural expenditure is spent on construction expenditure and urban renewal projects, such as on high-rise office buildings and shopping complexes as well as investments in various technologies and industrial machinery, such as petroleum refining, electronic manufacturing, transport equipment, etc.

¹⁶ Ministry of National Development (MND), "Building Homes, Shaping Communities" in the MND website [downloaded on 13 Dec 2007], available at http://www.mnd.gov.sg/handbook/build_main.htm

¹⁷ Ministry of National Development (MND), "Building Homes, Shaping Communities" in the MND website [downloaded on 13 Dec 2007], available at http://www.mnd.gov.sg/handbook/build_main.htm

¹⁸ Lan, Chao-Wei, "Singapore's export promotion strategy and economic growth (1965-84) Working Paper No. 16 [downloaded on 1 Dec 2007], available at www.ucl.ac.uk/dpu/publications/working%20papers%20pdf/wp116.pdf

4. CREATING A TRANSPORTATION HUB: PORT AUTHORITY OF SINGAPORE (PSA)

Strategically located at the southern tip of the island, the deep-water seaport of Singapore was the lifeline of Singapore economy during the colonial days, and its present day contribution has remained substantial. Post-colonial governmental policies continued this strategic asset and expanded the deep-water seaport that had been at the heart of Singapore's economy during colonial times. The port has been expanding since 1960s to cope with increasing demand, as the neighbouring hinterlands grow and Singapore needs to strengthen its trade links with major world economies.

The Port Authority of Singapore (PSA) handles about one-fifth of the world's total container transshipment throughput and in 2006, PSA Singapore Terminals handled 23.98 million twenty-foot equivalent units (TEUS) of containers.¹⁹ PSA operates 4 container terminals and 2 multi-purpose terminals in Singapore, and links shippers to an excellent network of 200 shipping lines with connections to 600 ports in 123 countries.²⁰ Overall, the maritime and logistics industry contributes about 8% to Singapore's GDP. It provides jobs for some 90,000 people, contributing about 1% to our GDP, and employs about 7,000 people.²¹

¹⁹ PSA, "Welcome to PSA Singapore Terminals" in the PSA website [downloaded on 13 Dec 2007], available at <http://www.singaporepsa.com/>

²⁰ PSA, "Welcome to PSA Singapore Terminals" in the PSA website [downloaded on 13 Dec 2007], available at <http://www.singaporepsa.com/>

²¹ Ministry of Transport (MOT), "Speech By Prime Minister Goh Chok Tong At The Port Of Singapore Authority's Gala Dinner To Celebrate 30 Years Of Containerisation In Singapore, Held At The Ritz-Carlton Millenia, On Friday,

The next goal that the Singapore government has in mind for PSA is for the facility to become a global integrated logistics hub, a multi-modal hub, covering and integrating land, sea and air transport.²² For example, transshipment cargo arriving at PSA will be transported by road to, and flown seamlessly out of Changi Airport and special customs treatment will no longer be restricted just to goods moving within a free trade zone around the seaport or the airport²³.

Being an integrated logistics hub, Singapore has a comprehensive range of "soft" services ancillary to the physical handling of cargo, and which cover the entire maritime and logistics value chain, including insurance, brokerage, arbitration and financing.²⁴ In other words, Singapore's ports become a facilitator of global logistics networks, and can add even greater value to shipping lines, airlines, logistics players, manufacturers and

28 June 2002, AT 7.30 PM" in the Ministry of Transport website [downloaded on 13 Dec 2007], available at http://app.mot.gov.sg/data/s_02_06_28.html

²² Ministry of Transport (MOT), "Speech By Prime Minister Goh Chok Tong At The Port Of Singapore Authority's Gala Dinner To Celebrate 30 Years Of Containerisation In Singapore, Held At The Ritz-Carlton Millenia, On Friday, 28 June 2002, AT 7.30 PM" in the Ministry of Transport website [downloaded on 13 Dec 2007], available at http://app.mot.gov.sg/data/s_02_06_28.html

²³ Ministry of Transport (MOT), "Speech By Prime Minister Goh Chok Tong At The Port Of Singapore Authority's Gala Dinner To Celebrate 30 Years Of Containerisation In Singapore, Held At The Ritz-Carlton Millenia, On Friday, 28 JUNE 2002, AT 7.30 PM" in the Ministry of Transport website [downloaded on 13 Dec 2007], available at http://app.mot.gov.sg/data/s_02_06_28.html

²⁴ Ministry of Transport (MOT), "Speech By Prime Minister Goh Chok Tong At The Port Of Singapore Authority's Gala Dinner To Celebrate 30 Years Of Containerisation In Singapore, Held At The Ritz-Carlton Millenia, On Friday, 28 June 2002, AT 7.30 PM" in the Ministry of Transport website [downloaded on 13 Dec 2007], available at http://app.mot.gov.sg/data/s_02_06_28.html

traders.²⁵

The steps that the government took to achieve the goal of being integrated hub included, first, expanding port capacity to play an even bigger transshipment role, preparing land for another 20 berths.²⁶ Secondly introducing competition from an alternative port, Jurong Port, and other international players will spur PSA to offer superior services at competitive prices.²⁷ Thirdly, the port operator has invited business leaders not just onto the PSA Board, but into the Board's Executive Committee to inject a global business and entrepreneurial perspective into the management of the port.

5. CHANGI AIRPORT

The other strategic asset is Singapore's airport facilities. To strengthen trade links with major world economies, the Singapore government's goal is the augmentation and formation of the Future Air Transport Hub. Singapore's first commercial airport had

²⁵ Ministry of Transport (MOT), "Speech By Prime Minister Goh Chok Tong At The Port Of Singapore Authority's Gala Dinner To Celebrate 30 Years Of Containerisation In Singapore, Held At The Ritz-Carlton Millenia, On Friday, 28 June 2002, At 7.30 PM" in the Ministry of Transport website [downloaded on 13 Dec 2007], available at http://app.mot.gov.sg/data/s_02_06_28.html

²⁶ Ministry of Transport (MOT), "Speech By Prime Minister Goh Chok Tong At The Port Of Singapore Authority's Gala Dinner To Celebrate 30 Years Of Containerisation In Singapore, Held At The Ritz-Carlton Millenia, On Friday, 28 June 2002, At 7.30 Pm" In The Ministry Of Transport Website [Downloaded On 13 Dec 2007], available at http://app.mot.gov.sg/data/s_02_06_28.html

²⁷ Ministry of Transport (MOT), "Speech By Prime Minister Goh Chok Tong At The Port Of Singapore Authority's Gala Dinner To Celebrate 30 Years Of Containerisation In Singapore, Held At The Ritz-Carlton Millenia, On Friday, 28 June 2002, At 7.30 Pm" In The Ministry Of Transport Website [downloaded on 13 Dec 2007], available at http://app.mot.gov.sg/data/s_02_06_28.html

been based at Paya Lebar, close to residential areas. If Paya Lebar had continued to host the airport, it would have entailed sterilization of large tracts of economically useful lands because of the height control on buildings near the airport. Landing at Paya Lebar Airport also meant that aircrafts had to fly over congested city areas.

In the 1970s, dramatic rise in demand called for the development of reclaimed land at the eastern tip of the island. Changi was chosen as the new site. Some of the reasons for selecting the Changi site were better airport approach via the sea and there were less residential areas affected by air and noise pollution. Changi Airport was redeveloped and expanded from time to time, and has won international acclaim for its high-level services. Other reasons included better road access and no interruption to air traffic movements at Paya Lebar Airport while Changi was under construction.

To sustain Changi's elite hub status, the government opened a Budget Terminal in Oct 2006 and Terminal 3 in Jan 2008. Construction work on Terminal 3 began only 10 years after Terminals 1 and 2 had been completed in 2000 and the terminal is scheduled to open in 2006/2007 at a cost of S\$1.5 billion.²⁸ Designed to handle 20 million, the new terminal will bring capacity at Changi to 64 million—more than 1 million per week.²⁹

Changi is a good example of the Singapore's efforts in regionalizing its infrastructure

²⁸ Airport technology.com, "Changi Airport (SIN/WSSS), Singapore" in the Airport technology.com website [downloaded 1 Dec 2007], available at <http://www.airport-technology.com/projects/changi/>

²⁹ Airport technology.com, "Changi Airport (SIN/WSSS), Singapore" in the Airport technology.com website [downloaded 1 Dec 2007], available at <http://www.airport-technology.com/projects/changi/>

business. Riding the regional aviation boom, 80 airlines now use Changi to fly to more than 180 cities in 50 countries and accounts for the record number of passengers and tourists who go through the airport yearly and the heavy loads of cargo that Changi handles.³⁰

Singapore's airport management and its associated and related companies and their infrastructure management have impressed many foreign airport operators, inspiring overseas operators to initiate partnerships and investment opportunities with them. Changi Airport International, for instance, clinched an airport management deal with Abu Dhabi International Airport in early 2007.³¹ 10 leading airports in the Middle East are pumping US\$23.5 billion into new airports by 2012, providing capacity for 316 million passengers yearly, expanding total airport capacity to 399 million.³² The Middle East is leading the regions in passenger demand which is growing at 17.8 per cent, outpacing the capacity growth.³³

³⁰ Chuang, Peck Ming, "Riding the regional aviation boom" dated 6 September 2007 in The Business Times [downloaded on 13 December 2007], available at <http://ir.asiaone.com/Investor+Relations/Industry+News/Story/A1Story20070906-24378.html>

³¹ Chuang, Peck Ming, "Riding the regional aviation boom" dated 6 September 2007 in The Business Times [downloaded on 13 December 2007], available at <http://ir.asiaone.com/Investor+Relations/Industry+News/Story/A1Story20070906-24378.html>

³² Chuang, Peck Ming, "Riding the regional aviation boom" dated 6 September 2007 in The Business Times [downloaded on 13 December 2007], available at <http://ir.asiaone.com/Investor+Relations/Industry+News/Story/A1Story20070906-24378.html>

³³ Chuang, Peck Ming, "Riding the regional aviation boom" dated 6 September 2007 in The Business Times [downloaded on 13 December 2007], available at <http://ir.asiaone.com/Investor+Relations/Industry+News/Story/A1Story20070906-24378.html>

This is the same case for even closer regional airport systems in China and India. China is pouring in S\$28 billion over the next five years to build new airports and upgrading existing ones with annual passenger growth in the next 20 years tipped to grow at least at a steady 10.4 per cent yearly.³⁴ In India, where the aviation market is posting growth of up to 10.4 per cent yearly, the government has issued a mandate for seven greenfield airports and 35 non-metro airports.³⁵ The Vietnamese government has also got into the act, launching an extensive campaign to spruce up and expand airports as part of a larger attempt to build the country into Asia's fourth biggest aviation market by 2025.³⁶

6. PUBLIC TRANSPORTATION SYSTEM

In 1958, road network was sparse. The government constructed roads in a radial pattern converging toward the downtown and took the users-pay approach to tackle congestion. Mass-based public transportation system was also instituted. The Mass Rapid Transit (MRT) is a comprehensive rail network is important a high density city like Singapore. Its rapid speed of transportation facilitated CBD as financial hub. 4 years and S\$5 billion

³⁴ Chuang, Peck Ming, "Riding the regional aviation boom" dated 6 September 2007 in The Business Times [downloaded on 13 December 2007], available at <http://ir.asiaone.com/Investor+Relations/Industry+News/Story/A1Story20070906-24378.html>

³⁵ Chuang, Peck Ming, "Riding the regional aviation boom" dated 6 September 2007 in The Business Times [downloaded on 13 December 2007], available at <http://ir.asiaone.com/Investor+Relations/Industry+News/Story/A1Story20070906-24378.html>

³⁶ Chuang, Peck Ming, "Riding the regional aviation boom" dated 6 September 2007 in The Business Times [downloaded on 13 December 2007], available at <http://ir.asiaone.com/Investor+Relations/Industry+News/Story/A1Story20070906-24378.html>

later³⁷, MRT is also popular among public housing dwellers as rail network continues to expand to connect Changi Airport, the North-east of Singapore, Sentosa, Marina area, etc to each other.

7. THE KNOWLEDGE ECONOMY

Physical infrastructure is not sufficient for Singapore to compete in the next lap. Thus, the government has instituted plans for the installation of cutting-edge technologies to utilize, exploit and tap into the next generation of technologies for development. For example, Singapore government's efforts to promote R&D in science and technology included the establishment of the National Science and Technology Board (NSTB). NSTB currently oversees 13 research institutes and centers in Singapore.³⁸

7.1. Information technology (IT) Infrastructure

Singapore moved away from low-value adding manufacturing, and global demands have required it to improve its information access. The World Bank estimates that over half of the GDP in the major high income OECD countries is built on the production and distribution of knowledge. Since the 1980s, however, the information revolution has nullified its geographical advantages, though the strategically located seaport and airport have remained important. The rule of this new global economic game has shifted

³⁷ Phang, Sock-Yong, "Strategic development of airport and rail infrastructure: the case of Singapore" Vol. 10 Issue 1 Jan 2003, in Science Direct [downloaded on 1 Dec 2007], available at linkinghub.elsevier.com/retrieve/pii/S0967070X02000276, pp. 27-33.

³⁸ Adams, Francis Gerard and William E. James, *Public Policies in East Asian Development: Facing New Challenges*, (Praeger/Greenwood), 1999, p. 130.

to the quality of information access, and its support services and skills to support the productivity gains of Singapore’s workforce and to maintain its competitive edge. Use of information technology to stimulate economic growth and achieve national competitiveness then becomes important in Singapore’s IT development.

Table 1: Singapore Government’s IT Infrastructure Plans

1981	The National Computer Board (NCB)
1996	5-year National Science and Technology Plan 2000
1991	Comprehensive information technology plan called “IT 2000” was launched “Singapore ONE” was undertaken to deliver high-speed internet telecommunications
1998	E-commerce master plan was launched along with the Local Enterprise E-Commerce Program

Source: Choo, Chun Wei, "IT2000: Singapore's Vision of an Intelligent Island Chun Wei Choo" adapted from Book chapter in "Intelligent Environments," edited by Peter Droege, published by North-Holland (1997) [downloaded on 1 Dec 2007], available at <http://choo.fis.utoronto.ca/FIS/ResPub/IT2000.html>

In 1981, the National Computer Board (NCB) was created to coordinate computer education and training aimed at supporting industries with appropriate IT manpower. In 1991, the NCB solidified its plan to link up the businesses in Singapore with the world, especially with those developed IT centres in the West including Japan. A comprehensive information technology plan called “IT 2000” was launched in 1991 as a framework to guide Singapore IT development into the 21st century. In line with it was an advanced National Information Infrastructure that was developed to link computers and other information appliances in homes, offices, schools, factories across the country. A nation-wide broadband structure called “Singapore ONE” was undertaken to deliver high-speed internet telecommunications.

In establishing such a globalisation network, the aim was that marketing of high value-added products from Singapore would be designed and manufactured for on time delivery and at minimal costs. In 1996, a 5-year National Science and Technology Plan 2000 costing S\$4.0 billion was initiated to carry out the restructuring and upgrading of Singapore's industry and business clusters.³⁹ The Singapore Government also took on an active role in the establishment of e-commerce infrastructure, which is the use of inter-networked computers to create and transform business relationships. The e-commerce master plan was launched in Sept 1998 to drive the use of electronic commerce. The government launched the Local Enterprise E-Commerce Program (budget \$9 million)⁴⁰ in November 1998 to encourage local companies to implement e-commerce in their business operations.

The characteristics of a regional e-trade hub largely consist of marketplaces (such as the energy exchanges, chemical exchanges, palm oil and rubber exchange, textile market and pulp and paper networks) and business enablers (such as trade documentation, intra-regional and inter-regional integration). The manufacturing and logistics sectors have played a major role in Singapore's industrialisation and economic development. Many of these companies are leveraging on the Internet to effectively manage and

³⁹ Wong, Tai-Chee, "The transition from physical infrastructure to infostructure: infrastructure as a modernizing agent in Singapore" in *GeoJournal* Vol. 49 Number 3/November 1999 [downloaded on 1 Dec 2007], available at <http://www.springerlink.com/content/n20850m77rg53rq8/>

⁴⁰ IDA Singapore, "eBids - Accelerating e-Commerce Development & Growth in Singapore" in IDA Singapore website [downloaded on 1 Dec 2007], available at <http://www.ida.gov.sg/News%20and%20Events/20061213164252.aspx?getPagetype=21>

optimize their supply chain processes and fulfilment needs. These sectors influence other industries as the value chain begins with manufacturing while logistics play a huge supporting role. The repetitive nature of financial transactions, combined with well-established information systems, also allow banks to reap significant cost savings from online delivery of services.

iN2015 is the latest blueprint to navigate Singapore's exhilarating transition into a global city, universally recognised as an enviable synthesis of technology, infrastructure, enterprise and manpower with the aim that, in less than ten years, every single person and business in Singapore will find the world - and everyday life - transformed by technology.⁴¹ Led by the Infocomm Development Authority of Singapore (IDA), iN2015 is a multi-agency effort that is the result of private, public and people sector co-creation.⁴² The vision is to turn the country into an Intelligent Nation and Global City, powered by infocomm.⁴³ The masterplan recommends the way forward for Singapore, into a future where infocomm will bring a sea change and become intrinsic in the way people live, learn, work and play.

The iN2015 masterplan is developed in the past year with inputs from the People, Private and Public sectors with a steering committee chaired by IDA and representatives

⁴¹ IDA Singapore, "About iN2015" [downloaded on 16 Dec 2007], available at <http://www.in2015.sg/>

⁴² IDA Singapore, "About iN2015" [downloaded on 16 Dec 2007], available at <http://www.in2015.sg/>

⁴³ IDA Singapore, "Singapore iN2015 Masterplan Offers a Digital Future for Everyone" dated 20 June 2006 in the IDA website [downloaded on 16 Dec 2007], available at <http://www.ida.gov.sg/News%20and%20Events/20050703161451.aspx?getPagetype=20>

from the infocomm industry, sectors like education, healthcare, manufacturing & logistics, finance, tourism & retail and digital media, as well as the government, guided the development.⁴⁴ The goals are ambitiously to achieve a two-fold increase in value-added¹ of the infocomm industry to S\$26 billion, see a three-fold increase in infocomm export revenue to S\$60 billion, create 80,000 additional jobs, have at least 90 per cent of homes using broadband and ensure 100 per cent computer ownership for all homes with school-going children.⁴⁵

To achieve the targets, the masterplan outlined four key strategies: to spearhead the transformation of key economic sectors, government and society through more sophisticated and innovative use of infocomm; to establish an ultra-high speed, pervasive, intelligent and trusted infocomm infrastructure; to develop a globally competitive infocomm industry; to develop an infocomm-savvy workforce and globally competitive infocomm manpower.⁴⁶

The Next Generation National Infocomm Infrastructure put in place by 2012 is capable

⁴⁴ IDA Singapore, "Singapore iN2015 Masterplan Offers a Digital Future for Everyone" dated 20 June 2006 in the IDA website [downloaded on 16 Dec 2007], available at <http://www.ida.gov.sg/News%20and%20Events/20050703161451.aspx?getPagetype=20>

⁴⁵ IDA Singapore, "Singapore iN2015 Masterplan Offers a Digital Future for Everyone" dated 20 June 2006 in the IDA website [downloaded on 16 Dec 2007], available at <http://www.ida.gov.sg/News%20and%20Events/20050703161451.aspx?getPagetype=20>

⁴⁶ IDA Singapore, "Singapore iN2015 Masterplan Offers a Digital Future for Everyone" dated 20 June 2006 in the IDA website [downloaded on 16 Dec 2007], available at <http://www.ida.gov.sg/News%20and%20Events/20050703161451.aspx?getPagetype=20>

of delivering broadband speeds up to 1 Gbps, and offer pervasive connectivity around the country and the infrastructure will also be IPv6 compliant, enabling an exciting host of new broadband-enabled services and applications, such as immersive learning experiences, telemedicine, high definition TV, immersive video conferencing and grid computing.⁴⁷

To support the growth of the economy and the infocomm industry, the infocomm competencies of the general workforce will be raised with techno-strategists who have both the technical and business expertise groomed to achieve business and organisational goals through the strategic and innovative use of infocomm and to build a pipeline of infocomm professionals, there will be initiatives to attract the best from schools to take up infocomm as a career.⁴⁸

7.2. BioTech

Singapore is attempting to lure major companies like those that conduct research into stem cells with fewer restrictions on embryo cloning compared to the United States.⁴⁹

⁴⁷ IDA Singapore, "Singapore iN2015 Masterplan Offers a Digital Future for Everyone" dated 20 June 2006 in the IDA website [downloaded on 16 Dec 2007], available at <http://www.ida.gov.sg/News%20and%20Events/20050703161451.aspx?getPagetype=20>

⁴⁸ IDA Singapore, "Singapore iN2015 Masterplan Offers a Digital Future for Everyone" dated 20 June 2006 in the IDA website [downloaded on 16 Dec 2007], available at <http://www.ida.gov.sg/News%20and%20Events/20050703161451.aspx?getPagetype=20>

⁴⁹ O Sullivan, Phil, "SINGAPORE'S BIOTECH BET" in CNN website dated 3 December 2003, [downloaded on 1 Dec 2007], available at www.cnn.com/2003/WORLD/asiapcf/12/03/trends.singaporebiotech.reut/index.html

Singapore opened a new complex to house biotech scientists and their companies called the Biopolis, a three hundred million dollar symbol of Singapore's biotech industry. The government is offering tax breaks, grants and other incentives worth up to one-point-three billion dollars aimed at attracting the best and brightest of the biotech world.⁵⁰ The chairman of Singapore's Agency for Science, Technology and Research sums it up: "We cannot compete with America," he says; "We cannot compete with Europe. We must look for areas and the advantage is that we are in Asia, and we must look for diseases that are relevant to our domain and some areas of stem cells where some countries are not very keen in such things. So we must look for those areas to create a niche."⁵¹

The government also instituted the One-North: Biotech project to tap into the booming biotech industry. Conceived as the cornerstone of a much broader vision to build up the biomedical sciences industry in Singapore, the Biopolis is a purpose-built biomedical research hub where researchers from the public and private sectors are co-located and is situated in the south-western part of Singapore, the Biopolis is within walking distance of the Buona Vista MRT Station and is near both the National University of Singapore and the National University Hospital.⁵² The entire Biopolis at one-north, comprising

⁵⁰ O Sullivan, Phil, "Singapore's Biotech Bet" in CNN website dated 3 December 2003, [downloaded on 1 Dec 2007], available at www.cnn.com/2003/WORLD/asiapcf/12/03/trends.singaporebiotech.reut/index.html

⁵¹ O Sullivan, Phil, "Singapore's Biotech Bet" in CNN website dated 3 December 2003, [downloaded on 1 Dec 2007], available at www.cnn.com/2003/WORLD/asiapcf/12/03/trends.singaporebiotech.reut/index.html

⁵² Agency for Science, Technology and Research A Star, "Biopolis" in Astar website [downloaded on 1 Dec 2007], available at <http://www.a-star.edu.sg/astar/biopolis/index.do>

20ha of land is dedicated to cutting-edge biomedical research and development facilities.⁵³

Phase 1 of Biopolis comprises of a seven-building complex linked by skybridges and offers a built-up area of 185,000 sqm and two buildings, Chromos and Helios, are dedicated to biomedical players from the private sector.⁵⁴ The other five buildings (Centros, Genome, Matrix, Nanos and Proteos) house five of the seven biomedical research institutes under the Agency of Science, Technology and Research (A*STAR), Singapore's lead agency for scientific research and development under the aegis of the Ministry of Trade and Industry and they are the BioInformatics Institute (BII), the Bioprocessing Technology Institute (BTI), the Genome Institute of Singapore (GIS), the Institute of Bioengineering & Nanotechnology (IBN) and the Institute of Molecular and Cell Biology (IMCB).⁵⁵

This research community is fully supported by state-of-the-art infrastructure including shared resources and services catering to the full spectrum of R&D activities and

⁵³ One North, "Life Xchange - Biopolis Phase 3 Concept and Fixed Price Tender" [downloaded on 14 Dec 2007], available at http://www.one-north.sg/TendProp_BiopolisP3.aspx

⁵⁴ Agency for Science, Technology and Research A Star, "Biopolis" in Astar website [downloaded on 1 Dec 2007], available at <http://www.a-star.edu.sg/astar/biopolis/index.do>

⁵⁵ Agency for Science, Technology and Research A Star, "Biopolis" in Astar website [downloaded on 1 Dec 2007], available at <http://www.a-star.edu.sg/astar/biopolis/index.do>

graduate training.⁵⁶ Phase 2 of Biopolis, which adds another 37,000 sqm of built-up area, was opened in October 2006 and is expected to achieve occupancy by end 2007 and two new buildings, Neuros and Immunos, will house public research units as well as corporate R&D laboratories. Biopolis is part of a master plan for a much larger 200-hectare development known as one-north and there are provisions for expansion to cater to a growing demand for biomedical R&D space.⁵⁷

Following the completion of Biopolis Phase 1 and 2, the Singapore government is anticipating the demand for more biomedical R&D space beyond 2007 and so the one-north Master Plan identifies the land south of the Biopolis for future development of biomedical facilities.⁵⁸ Targeting mainly private research institutes and incubator research activities, Biopolis 3 is a multi-tenanted research facility which will bridge private and public sector research work by encouraging close collaboration and is intended to extend basic research activities into other segments of translational and clinical research, as well as medical technology (MedTech) research.⁵⁹

⁵⁶ Agency for Science, Technology and Research A Star, "Biopolis" in Astar website [downloaded on 1 Dec 2007], available at <http://www.a-star.edu.sg/astar/biopolis/index.do>

⁵⁷ Agency for Science, Technology and Research A Star, "Biopolis" in Astar website [downloaded on 1 Dec 2007], available at <http://www.a-star.edu.sg/astar/biopolis/index.do>

⁵⁸ One North, "Life Xchange - Biopolis Phase 3 Concept and Fixed Price Tender" [downloaded on 14 Dec 2007], available at http://www.one-north.sg/TendProp_BiopolisP3.aspx

⁵⁹ One North, "Life Xchange - Biopolis Phase 3 Concept and Fixed Price Tender" [downloaded on 14 Dec 2007], available at

http://www.one-north.sg/TendProp_BiopolisP3.aspx

Singapore also adopts a clustering strategies spearheaded by the Singapore Biomedical Sciences (BMS) initiative launched in June 2000 to develop the Biomedical Sciences cluster.⁶⁰ Three key agencies work in close coordination and in an integrated fashion to develop the BMS cluster: the Biomedical Research Council (BMRC) of the Agency for Science, Technology and Research (A*STAR) funds and supports public research initiatives, the Economic Development Board's (EDB) Biomedical Sciences Group (BMSG) promotes private sector manufacturing and R&D activities, and EDB's Bio*One Capital functions as an investment arm.⁶¹

The first phase of development (2000-2005) of the Biomedical Sciences (BMS) initiative was focused on establishing a firm foundation of basic biomedical research in Singapore and, in the second phase (2006-2010), the focus is on deepening our basic research capabilities and strengthening translational and clinical research (TCR) to help realise the full potential of our investments in the BMS initiative with the translation of laboratory discoveries to clinically useful and commercially viable applications.⁶²

⁶⁰ Agency for Science Technology and Research, "The BMS Initiative" in the A-star website [downloaded on 16 Dec 2007], available at

http://www.a-star.gov.sg/astar/biomed/action/biomed_bms.do;jsessionid=FAA37109E8ABB20A66BDF3B973BD835D

⁶¹ Agency for Science Technology and Research, "The BMS Initiative" in the A-star website [downloaded on 16 Dec 2007], available at

http://www.a-star.gov.sg/astar/biomed/action/biomed_bms.do;jsessionid=FAA37109E8ABB20A66BDF3B973BD835D

⁶² Agency for Science Technology and Research, "The BMS Initiative" in the A-star website [downloaded on 16 Dec 2007], available at

BMRC's seven research institutes develop core research capabilities in the areas of bioprocessing, chemical synthesis, genomics and proteomics, molecular and cell biology, bioengineering and nanotechnology and computational biology, as well as bridge the gap between bench and bedside and it has also launched consortial initiatives to focus on developing capabilities in translational research, such as the Singapore Cancer Syndicate, Singapore Bioimaging Consortium, Singapore Stem Cell Consortium, Singapore Consortium of Cohort Studies and Singapore Immunology Network.⁶³

These consortia also optimize Singapore's available resources, allowing for integrated development in strategic areas of biomedical research. In a partnership between BMRC and sister council, the Science and Engineering Research Council, the Institute of Chemical and Engineering Sciences' Chemical Synthesis Laboratory @ Biopolis provides capabilities in chemistry. All these research capabilities support the BMS cluster, comprising the four key sectors: pharmaceuticals, biotechnology, medical technology and healthcare services.⁶⁴

http://www.a-star.gov.sg/astar/biomed/action/biomed_bms.do;jsessionid=FAA37109E8ABB20A66BDF3B973BD835D

⁶³ Agency for Science Technology and Research, "The BMS Initiative" in the A-star website [downloaded on 16 Dec 2007], available at

http://www.a-star.gov.sg/astar/biomed/action/biomed_bms.do;jsessionid=FAA37109E8ABB20A66BDF3B973BD835D

⁶⁴ Agency for Science Technology and Research, "The BMS Initiative" in the A-star website [downloaded on 16 Dec 2007], available at

http://www.a-star.gov.sg/astar/biomed/action/biomed_bms.do;jsessionid=FAA37109E8ABB20A66BDF3B973BD835D

8. THE SERVICE OPTION

In trying to capture revenue from the hitech industry, Singapore is not forgetting its former niche of the service industry, especially tourism and the newly conceptualized strategy of integrated resort.

8.1. Tourist Destination

Over the last few years, Singapore has seen strong double digit growth of Chinese visitors arriving in Singapore. This upward trend is expected to continue in the coming years as China continues to develop, and the people become more well-off and travel more. In order to cater for Chinese visitors who have little or no command of English, and visiting Singapore for their first time, we will need to gear up in terms of introducing multi-lingual tourist sign system to take advantage of the growth in Chinese outbound travel. Another two major groups of visitors who are not conversant in the English language are the Indonesians and Japanese. The Indonesians are our first largest group of tourist arrivals while the Japanese form the second group. Older Chinese and Malay Singaporeans too, have also expressed same difficulty as they do not understand nor read English.

To tap into this growth markets, Singapore Tourism Board sources and facilitates procurement of land to meet tourism businesses' needs. The government facilitates setting up visual communication structure, multi-language signage (for non-English speakers as stated above) and brown signs for tourists. Public facilities include: New

Shopping Districts, New Places of Interest, e.g. Singapore Flyer, Integrated Resorts, Multi-Lingual Tourist Sign System.

8.2. Integrated Resorts

Perhaps the most significant infrastructure complement to the regional tourism boom is the construction of Integrated Resorts in Singapore. The strategic objective of the Integrated Resorts is to broaden our leisure and entertainment options to enhance Singapore's reputation as a premium "must-visit" destination for leisure and business visitors and to tap into the growth of the Asia Pacific tourism market, fuelled by the growing middle class in China, India and ASEAN as well as the emergence of low cost airlines, present significant opportunities.⁶⁵ Singapore wants to capture its fair share of the growing tourism pie because many countries in the region are moving quickly to develop major tourist attractions and new tourism products.⁶⁶

Similar to major resorts in places such as the Bahamas and Las Vegas, the Integrated Resorts in Singapore are envisaged to be distinctive world-class developments with a comprehensive range of amenities such as hotels, convention facilities, entertainment shows, theme attractions, luxury retail, fine dining and casino gaming.⁶⁷ The Integrated

⁶⁵ Ministry of Trade and Industry (MTI) Singapore, "Developing industries Integrated resorts" in the MIT website [downloaded on 1 Dec 2007], available at <http://app.mti.gov.sg/default.asp?id=585>

⁶⁶ Ministry of Trade and Industry (MTI) Singapore, "Developing industries Integrated resorts" in the MIT website [downloaded on 1 Dec 2007], available at <http://app.mti.gov.sg/default.asp?id=585>

⁶⁷ Ministry of Trade and Industry (MTI) Singapore, "Developing industries Integrated resorts" in the MIT website [downloaded on 1 Dec 2007], available at <http://app.mti.gov.sg/default.asp?id=585>

Resorts will be part of a larger spectrum of tourism products we are developing to enhance our destination appeal. It is one of the many strategies that we are pursuing to widen the range of entertainment options in Singapore and ensure that the tourism sector remains a key contributor to the economy.⁶⁸

9. CONCLUDING TRENDS

There is an increasing trend towards privatization of infrastructure construction to the private sector as this may spread risks to a wider range of participants who may be better equipped than governments to deal with the risks. In Singapore, this was enunciated by a high-ranking civil servant on 21 Sep 2006. Mr Lee Chuan Teck, Executive Director, Monetary Authority of Singapore observed: “While a large part of Asia's infrastructure development will be financed from governments' balance sheet, an increasing proportion of private investment is desirable, if not critical.”⁶⁹ In other parts of Southeast Asia, Indonesia, Vietnam and Philippines will also need substantial amounts of infrastructure development, between 50 to 60 billion US dollars per year and to fulfill even half the development outlined in the joint study equates to an expenditure of more than 3% of GDP per year.⁷⁰ In most countries, it would be

⁶⁸ Ministry of Trade and Industry (MTI) Singapore, "Developing industries Integrated resorts" in the MIT website [downloaded on 1 Dec 2007], available at <http://app.mti.gov.sg/default.asp?id=585>

⁶⁹ Monetary Authority of Singapore (MAS), "Speech by Mr Lee Chuan Teck, Executive Director, Monetary Authority of Singapore, at the Public Lender & Insurer Infrastructure Finance Summit 2006 on 21 Sep 2006" in the MAS website [downloaded on 1 Dec 2007], available at http://www.mas.gov.sg/news_room/statements/2006/The_Public_Lender_n_Insurer_Infrastructure_Summit.html

⁷⁰ Monetary Authority of Singapore (MAS), "Speech by Mr Lee Chuan Teck, Executive Director, Monetary Authority of Singapore, at the Public Lender & Insurer Infrastructure Finance Summit 2006 on 21 Sep 2006" in the

prohibitively expensive, if not politically impossible, to do so with pure fiscal funding and may also divert precious resources away from equally pressing priorities such as health care and education.”⁷¹

These investors will demand a broader range of investment products, ranging from conventional instruments like bank deposits, government debentures, publicly listed bonds and stocks to at the other extreme alternative investments like hedge funds and private equity.⁷² In the middle of 2006, Macquarie launched an infrastructure fund in Singapore, the first of its kind in Asia which was very successful and more than S\$800m was raised and the issue was over-subscribed 17.9 times at the institutional level, and 12.7 times at the retail level.⁷³

Other infrastructure strategies in the pipeline would be maintaining high growth via

MAS website [downloaded on 1 Dec 2007], available at

http://www.mas.gov.sg/news_room/statements/2006/The_Public_Lender_n_Insurer_Infrastructure_Summit.html

⁷¹ Monetary Authority of Singapore (MAS), "Speech by Mr Lee Chuan Teck, Executive Director, Monetary Authority of Singapore, at the Public Lender & Insurer Infrastructure Finance Summit 2006 on 21 Sep 2006" in the MAS website [downloaded on 1 Dec 2007], available at

http://www.mas.gov.sg/news_room/statements/2006/The_Public_Lender_n_Insurer_Infrastructure_Summit.html

⁷² Monetary Authority of Singapore (MAS), "Speech by Mr Lee Chuan Teck, Executive Director, Monetary Authority of Singapore, at the Public Lender & Insurer Infrastructure Finance Summit 2006 on 21 Sep 2006" in the MAS website [downloaded on 1 Dec 2007], available at

http://www.mas.gov.sg/news_room/statements/2006/The_Public_Lender_n_Insurer_Infrastructure_Summit.html

⁷³ Monetary Authority of Singapore (MAS), "Speech by Mr Lee Chuan Teck, Executive Director, Monetary Authority of Singapore, at the Public Lender & Insurer Infrastructure Finance Summit 2006 on 21 Sep 2006" in the MAS website [downloaded on 1 Dec 2007], available at

http://www.mas.gov.sg/news_room/statements/2006/The_Public_Lender_n_Insurer_Infrastructure_Summit.html

technology-intensive industries, continually finding niches in global economy and augmenting cluster development plans. Clustering involves grouping industries together e.g. One-North, Jurong Island, Science Park 1 and 2. In terms of finding global niches, Singapore has turned its infrastructure development experience into a successful and profitable business. For example, it has invested in the Suzhou Industrial Park (SIP) in China, International Tech Park Limited Bangalore India and the Batamindo Industrial Park in Indonesia. SIP's GDP grew by 18.8% to reach RMB 68 billion and attracted US\$ 1.6 billion in utilized FDI last year.⁷⁴ During the past decade, SIP has seen quick development and the chief economic indices all grow at a rate of around 50%.⁷⁵ In 2003 alone, the investment in fixed assets in SIP exceeded 20.2 billion yuan.⁷⁶

In South Asia, the International Tech Park Limited in Bangalore India offers total business space solutions which assures guaranteed uninterrupted power supply and telecommunication facilities, immediate occupancy, business incubator space. It is also a one-stop service within a state-of-the-art technology park, attracting tenants, more than half of whom are well-known conglomerates e.g. AT&T, IBM, Motorola, Sony, Texas Instruments, Citicorp. One reason for its success is that it 'cuts through the red

⁷⁴ Ministry of Trade and Industry (MTI), "(SIP) 9TH Joint Steering Council Endorses New Thrusts To Promote The Continued Growth Of SIP" dated 10 July 2007 in the MTI website [downloaded on 1 Dec 2007], available at <http://app.mti.gov.sg/default.asp?id=148&articleID=9081>

⁷⁵ People's Daily, "Vice-Premier Urges Boost for Suzhou Industrial Park" dated 9 June 2001 in People's Daily website [downloaded on 1 Dec 2007], available at http://english.peopledaily.com.cn/200106/09/eng20010609_72197.html

⁷⁶ Business-in-Asia.com, "Industrial Park in Suzhou, China" in the Business in Asia.com website [downloaded on 1 Dec 2007], available at <http://www.business-in-asia.com/suzhou.htm>

tape and bottlenecks that are a part of India's infrastructure and operating environment'.

Nearer to home, for the Batamindo Industrial Park Indonesia, Singapore tapped into the Riau islands' location-specific advantages such as abundant land and cheap labour in contrast to Singapore's land and labour constraints. Another Southeast Asian example is the Vietnam-Singapore Industrial Park which is developed as a 'hassle-free' one-stop service: self-contained, self-sufficient industrial park with prepared land plots, and ready-built factories, bolstered by Singapore-style management expertise and infrastructure support. Training for the Park is provided at the Vietnam-Singapore Technical Training Centre which was established in 1998. The Park has a broad swathe of industries: food, electrical and electronics, pharmaceuticals and healthcare, specialty materials, consumer goods and light industries.

10. POLICY RECOMMENDATIONS

1. Infrastructure development (hardware) combined with public administration development (software) has been the key to Singapore's economic transformation from a Third World to a First World country within 30 years. Singapore's experience has definitely proven that hardware and software development of infrastructure are important and must be undertaken simultaneously;

2. Infrastructure development must be based on long-term planning based on economically viable project and managed on commercial-based practices;

3. At least in the initial stage, efficiency criterion should be the primary guideline, rather than equity objective;

4. The role and involvement of the private sector should be encouraged as the private sector often sets the standard of efficiency and benchmarking of quality and competitiveness;

5. Infrastructure development should be operated on the principle of transparency and accountability with respect to public tender for projects and management operation;

6. Master Plan of infrastructure development should be drafted on a long-term strategic objective based on overall planning, efficiency, competition, clustering and cost and benefit analysis which includes economic and social development objectives;

7. In the past, financing infrastructure development was covered from national development budget and issuance of long-term sovereign bond and external official development assistance (ODA). As East Asian countries have accumulated so much official reserves, estimated around USD 3 trillion, there should be an initiative to put aside part of the accumulated reserves earmarked for regional infrastructure development.

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