

## SINGAPORE AND THE IT REVOLUTION

*Chia Siow Yue*

### I. Current Status of IT in Singapore

#### 1. Profile of Singapore's IT industry:

In official statistics, the information and communication technology sector (ICT) covers all industries in the production, processing, transmission, and facilitation of information and communication—ranging from manufacture and sale of ICT products to knowledge-based industries of Internet service providers (ISPs), software development, publishing, and IT education services.

In 1996, ICT sector contributed S\$26 billion in value added to Singapore's GDP (20% of total GDP). The sector enjoyed remarkable growth in 1990s, especially in the knowledge-intensive sub-sectors of computer-related services and business information.

- Between 1990-96, the ICT sector more than doubled from S\$12 billion to S\$26 billion with an estimated average annual growth rate of 26%.
  - Manufacturing accounted for the largest share (60%) of ICT output. Within manufacturing, production of computers and electronic equipment and electronic components contributed the highest value added of S\$13 billion. Singapore is an important distribution hub of ICT products.
  - Wholesale and retail accounted for 16% of the ICT sector, with the bulk of ICT trade in telecoms and office machinery and equipment.
  - Although the telecoms sub-sector contributed only 10.5% to the ICT sector, these activities have been growing rapidly—the number of establishments increased from 3 in 1990 to 39 in 1996 and it has grown even faster with market liberalisation.
  - Computer-related services contributed 3.8% to ICT, with the software development and consultancy industry contributing the major share. It is one of the fastest growing industries in Singapore.
  - Business information and technical services sub-sector constituted 6.9% of ICT sector; business and management consultancy services is the largest industry in this sub-sector.
- The electronics industry has grown rapidly, with annual output rising S\$71 billion in 1999, with a substantial proportion of output by FDI firms. The industry has been continually upgrading towards higher value added products and operations—consumer electronics now accounts for only 3% of industry output, while semiconductors account for 20%. The government is encouraging development of advanced IC manufacture, including equity stakes in Chartered Semiconductor Manufacturing. Domestic private firms have also carved out niches in the manufacture of certain related products, such as Creative Technologies in sound cards for PCs.
  - Much of Singapore IT production is exported. Singapore ranks as one of the world's largest traders in office machines and telecoms equipment.

#### 2. IT manpower:

- A National Computer Board survey showed the manpower status at end-1997:
  - Of about 31,000 total IT manpower, 51.7% were involved in software development, 17% in technical support and 5.9% in R&D, 5.4% in IT management, 4.6% in data and communications, and 2.8% in multimedia/Internet development.
  - Under 80% were under 35 years old, 18% were between 35-44 years old.
  - Over 74% had at least a first degree, 17% had at least a polytechnic diploma, under 14% had a masters degree, and under 1% had a Ph.D.

- 69% had an IT-only educational background; the others had either mixed or non-IT backgrounds.
- The survey projected IT manpower rising to 42,000 by the year 2000, which appears conservative.

### 3. Applications of IT in Singapore:

- Singapore aspires to be an "intelligent island" and a critical, strategic node in the global network of commerce, communications, and information. IT will be exploited to enhance the quality of life.
  - Singapore ONE is one of the major national initiatives, creating a platform on which the country can gear itself up for the transition into a KBE (knowledge-based economy). Singapore ONE consists of a two-pronged approach to promote use and adoption of IT by households and businesses:
    - a world class broadband infrastructure of high capacity network and switches to facilitate IT usage; and
    - several advanced applications and services to take advantage of the sophisticated networks.
  - Developments in the IT field are also being harnessed to create synergies with other important sectors:
    - The civil service has invested heavily in computerisation and IT over the past two decades, to improve efficiency and to provide an infrastructure to introducing various new Internet services into the civil service. An intranet system has been established, which permits various government bodies to communicate and exchange information in a secure system that cannot be accessed from the external Internet. The Ministry of Defence established an on-line procurement system in 1998.
    - Various government services, including "e-filing" of tax returns, are also available through the Internet. An e-citizen facility shows the range of public service activities that Singapore citizens can conduct (in whole or in part) with the government on the Internet including applying for a patent, registering for national service, registering a birth or death, selling an HDB flat, and filing a police report. Singapore's year 2000 population census is currently using the Internet, with 40,000 households to complete the census forms on-line.
    - In the financial sector, some degree of Internet banking is now offered by most of the major local banks, including account balance enquiries, funds transfer, fixed deposit placements, bill and shares payment, demand draft application, loan applications, enquiring about IPO results, obtaining updates on banking services, and Internet calculators. Beyond retail banking, the Monetary Authority of Singapore (MAS) has hired consultants to develop an IT strategy for the capital markets, banking, insurance, and payment systems.
  - There is also increasing IT penetration in Singapore households. Home computer ownership and home Internet penetration has increased substantially and reached 59% and 49% respectively in 1999, probably higher than even the US and Japan. However, average time spent accessing Internet less than 5 hours a week, with 40% of household users spending only 1-3 hours and only 5% spending more than 15 hours. Email/chat is the most common usage by the majority of households.
- ### 4. Regional hub services and Internet:
- Singapore is a hub for regional and Internet telecommunications. In 1998, international traffic generation was around 1.5 billion minutes. SingTel (a government-linked company) is the major investor and player. Eight sub-marine cable networks link Singapore with the world, of which 3 are analogue and 5 are digital. Singapore has 3 satellite stations, and the country's first satellite has been launched (jointly with a Taiwan company), with a footprint that covers all of East Asia.

- The Internet was first introduced in 1994, with licensing of two Internet service providers (ISPs) and a third ISP was established in 1996.
  - A broadband network for Internet, Singapore ONE, was launched in 1997, and is a main pillar in the IT 2000 initiative. Singapore ONE is designed to deliver a high level of interactive, multimedia applications and services to homes, business and schools throughout Singapore. It comprises two integrated levels: a broad-band infrastructure of high capacity networks and switches; and advanced applications and services that use the infrastructure's high speed and high capacity capabilities.
  - Sing Tel Magix is a broadband multi-media service that can stream real-time videos and transmit very sizeable mounts of data. It has the potential to provide a broad spectrum of services on demand, to homes, businesses, institutions, and schools and is regarded as an integral part of the Singapore ONE project.
- In October 1998, the limit on the number of ISP operators was lifted, and a fourth ISP commenced operations in 2000. In 1996 there were estimated to be 88,500 Internet accounts in Singapore, with 114,500 home Internet users. Official statistics projected 30% of households in Singapore, or roughly 1.2 million people, will have Internet access by 2000. The number of websites in Singapore is reported to have increased from around 900 in 1996 to over 4,000 in 1998.

#### 5. E-commerce:

- Official statistics estimated the total value of e-commerce transactions at S\$1.9 billion in 1999. Despite strong growth in recent years, such transactions accounted for only 0.1% of total turnover in the economy.
- E-commerce has yet to take up with consumers. Only 8% of Singapore home Internet users have used it. Probably this is because shopping is still regarded as a leisure activity, there is easy access to a large number of retail outlets, and there is concern over the security of Internet payments. The value of Internet transactions is not high. Most purchases are below S\$150, and books and stationery (39.2%) the most popular items, followed by IT-related products (20%), and groceries (18%). On-line government transactions and financial services are used by 14% and 10% of total home Internet users respectively.
- B2B (business-to-business) is the predominant form of e-commerce, accounting for 98% of such transactions. Still, only 4% of firms carry out B2B deals. There is a shift from closed networks (intranets and extranets) to the Internet, with the proportion rising to 24% in 1999. B2C (business to consumer) involved only 2% of firms.
- Growth of e-commerce is unevenly distributed, with large enterprises embracing it more readily than SMEs. Sixty-one percent of large firms have their own websites, compared to 32% of SMEs.
- The National Computer Board released in mid-1999 details of a survey conducted into B2B e-commerce in Singapore, covering over 1,000 companies in 8 industry sectors. The survey found that almost three-fourths have some form of Internet access, and over one-third owned corporate websites. The top 5 motivations cited by companies who were using, or planning to use, Internet-based B2B e-commerce were: image and reputation (62.9%); to increase sales (51.7%); to improve global reach of suppliers (49.1%); to improve global reach of customers (46.8%); to improve productivity (41.6%). In terms of hurdles, companies that were interested in adopting e-commerce cited security (59.4%), initial set up costs (36.9%), and ongoing operational costs (28.2%) as some of the key barriers.

#### 7. Major players in IT in Singapore:

- The role of the Singapore government in IT industry development has been crucial, not only in providing policies for development and regulation, but providing an enabling business environment. This is discussed further under Policies.
- Foreign investment has played a crucial role in the development of electronics industry. Foreign firms are major players in the IT industry phenomenon in Singapore. Recent FDI activity in this

field includes the opening of a US\$70 million manufacturing and operations facility by 3Com in late 1998, its first in Asia. (3Com principally makes modems, network interface cards, and personal organisers.)

## **II. IT POLICIES AND INSTITUTIONAL DEVELOPMENTS**

### **1. Major strengths and weaknesses of Singapore's IT industry:**

#### **• Major strengths:**

- Strong government planning and support, including a coherent policy framework on IT development that dovetails with other areas of economic development and considerable investment in IT infrastructure, (eg national broadband network), commitment of funds for R&D, and a liberal policy for inflow of foreign skilled personnel.
- An existing, established and relatively substantial platform of pertinent industry and service sector activities.
- Strong human capital base from which to source skilled workers and willingness to recruit foreign expertise.
- An open economy that is well integrated into the international business community and is attractive to foreign MNCs seeking FDI and establish business operations.
- Well established legal environment, providing protection of intellectual property and other proprietary knowledge.

#### **• Main weaknesses:**

- Inadequate entrepreneurial zeal and general appetite for risk-taking in business, which could limit the ability of Singapore to generate new domestic start-up businesses in the IT industry.
- An education system that did not place sufficient emphasis, until recently, on innovation and creativity.

### **2. Policy evolution: Singapore has a highly advanced level of policy and institutional development pertaining to ICT development, which can be demarcated by a number of phases:**

#### **• 1981-91:**

- 1981 Civil Service Computerisation Programme, targeted at improving efficiency and service provision and building up a pool of computer professionals.
- 1986 National IT Plan with twin goals of developing an export-oriented IT industry and improving business efficiency. The plan involved upgrading the telecommunications infrastructure, developing IT manpower, promoting an IT culture, building IT applications, fostering a local IT industry, engendering IT creativity and innovation, and encouraging coordination and collaboration in implementation of the plan.

#### **• 1992-2000:**

- 1992 launch of IT-2000 "A Vision of an Intelligent Island", seeking to enhance the working, living, and leisure environments and building on a national information infrastructure of computers interconnecting homes, schools, and workplaces. IT-2000 is part of a broader plan covering Singapore's 11 major economic sectors. There are 5 strategic thrusts: developing a global hub; improving quality of life; boosting the economic engine; linking communities locally and globally; and enhancing the potential of individuals.
- IT-2000 is also compatible with other elements of the government's wider economic and industrial development policy. Under the Economic Development Board's Industry 21 blueprint, Singapore will be "vibrant and robust global hub of knowledge-driven industries". Goals include manufacturing and services sectors to be developed with a strong emphasis on technology, innovation and capabilities; Singapore to be made more

attractive for MNCs so that they locate more of their knowledge-intensive activities in the country; local companies to be encouraged to embrace knowledge-intensive activities; and leverage on other hubs for ideas, talent, resources, capital and markets. In a bid to achieve these goals, EDB has a 5-point strategy: build up world-class capabilities and global coverage; promote innovation; develop local talent and attract foreign talent; and create a conducive business environment and world-class infrastructure necessary to support knowledge-driven activities.

- From its establishment in 1981 to its merger into IDA in 1999, the National Computer Board was the statutory body responsible for IT policy and development. Its mission was "to drive Singapore to excel in the information age by exploiting IT extensively to enhance Singapore's economic competitiveness and quality of life. The main thrusts of NCB activity included promoting use of IT in government; helping develop an IT culture and nurturing the IT industry; overseeing IT-related manpower development; working with other pertinent government bodies to create an appropriate infrastructure for IT development.
- In late 1999 NCB merged with TAS to form Infocomm Development Authority (IDA), with responsibility for all ICT planning and policy. The merger was in recognition of the convergence of IT and communications technologies and businesses, and the need for an integrated perspective to promotion, development and regulation across these technologies and businesses. IDA will be responsible for the growth and development of the IT and telecoms industries in Singapore.
- Recently, Infocomm 21 was released, with a 3pronged strategy to develop the local broadband multimedia industry, promote collaborative innovation in key areas such as e-commerce and mobile Internet services, and foster overseas strategic partnerships.

### 3. Report of the Committee on Singapore's Competitiveness:

- In November 1998 CSC released its report outlining the vision of Singapore as an advanced and globally competitive knowledge economy within the next decade and recommended several key strategies, including on IT services and e-commerce. IT is seen as enabling business and providing more efficient access, processing, and use of information.
- CSC recommended building "an IT 2000 plan to position Singapore as a global IT hub in the Asia Pacific region", and proposed 3 strategies:
  - Focus Singapore as a communications and media hub by attracting creative talents; tightening the enforcement of IPR protection laws; and capitalising on Singapore ONE to jumpstart the local multimedia and broadband industries.
  - Position Singapore as a one-stop, secure, and trusted business centre for processing of e-commerce transactions and payments.
  - Position Singapore as a national test bed where new and innovative products and services are created, customised, and tested before they are exported to the region and beyond. Singapore ONE and IT2000 provide good platforms on which to enact such a policy.

### 4. IT manpower capability:

- State-owned universities and polytechnics provide IT-related education. Domestic facilities are being expanded rapidly to cope with the anticipated sharp growth in demand. An increasing number of students also study at overseas universities and colleges.
- The Critical IT Resource Programme (CITREP) was established in 1989 to accelerate the development of critical and specialised IT skills required by both the IT industry and user organisations in Singapore. Under the scheme, the National Computer Board (NCB) underwrote 50% of course and/or examination fees for all IT training programmes endorsed by CITREP.
- In 1998, the Institute of Systems Science (established in 1981) and the Information Technology Institute (established in 1986) were merged into a single entity, Kent Ridge Digital Labs,

employing over 400 research scientists and engineers.

- As part of the policy of recruiting foreign talents to boost Singapore's skilled manpower base, foreign IT professionals are also being actively recruited.
- In a further effort to meet the shortage of IT professionals, the government recently announced a training subsidy for Singapore citizens and permanent residents with degrees or diplomas who are willing to switch to a career in ICT. The subsidy would train people in fields such as programming, systems analysis, consultancy, networking and database administration.
- By 1994, Singapore's national telephone network was fully digitised. By 1999, all homes were linked by fibre-optic cables, completing the 1995 plan to connect the whole of Singapore within a single broadband network (Singapore ONE).
- Singapore Telecom (SingTel) was incorporated in 1992 to take over the business functions of the Telecommunications Authority of Singapore (TAS). SingTel is listed on the Singapore Stock Exchange, with the government as major shareholder. The company was given an exclusive licence to provide mobile communications services until end-March 1997, and basic telecommunications services until end-March 2000. However, with the liberalisation of the telecommunications sector, SingTel's monopoly and new operators have entered the Singapore market to provide mobile phone, pager, international telephone call and Internet services, resulting in an increasingly competitive domestic market.

#### 6. Electronic Commerce Master Plan:

- Launched in 1998, the master plan has the following aims: to jump start Singapore as an EC hub; to expedite industry's adoption of EC; to build an internationally linked infrastructure to support businesses with global reach; to harmonise cross border law and policy to allow parties to trade confidently; and to promote local usage. The target is S\$4 billion of products and services transacted by e-commerce and 50% of firms using some form of e-commerce by 2003
  - To jump start Singapore as an EC hub: The plan focuses on sectors where Singapore has already established a hub advantage, including finance, transport and logistics, and telecommunications. In particular, the government aims to attract 25 of the world's top logistics, manufacturing and service companies to set up EC operations in Singapore by 2003.
  - To encourage businesses and public to use EC: Education and other supporting programmes are seen as essential to helping businesses exploit EC, including training schemes, promotion and mass education drives, financial incentives, electronic delivery of public services.
  - To develop an internationally linked infrastructure, seen as crucial to developing Singapore as an EC hub. Strategies are: develop and deploy (in partnership with industry) an efficient settlement for Internet transactions, link local infrastructure services to those overseas, and establish international standards.

#### 7. Legislative and regulatory framework for IT:

- Respect for and enforcement of intellectual property rights are regarded by the government as an important element in providing a conducive business environment. The 1997 Copyright Act includes a copyright tribunal process.
- The late 1999 merger of the Telecommunications Authority of Singapore (TAS) with the National Computer Board (NCB) to form the Infocomm Development Authority (IDA) is a reflection of the inter-connectivity of information technology and telecommunications.
- An Electronics Transaction Act was passed in 1998 to address the various legal issues on e-commerce and achieve Singapore's objective of being an international electronic commerce hub. The main features of the Act include a commercial code for e-commerce transactions; public key infrastructure; electronic applications and licences for the public sector; and network providers' liability. The Electronic Transactions (Certification Authority) Regulations 1999

provides for the licensing and regulation of certification authorities. The Singapore Broadcasting Authority (Class Licence) Notification 1996 and an Internet Code of Practice were introduced by the Singapore Broadcasting Authority in 1996. In 1996, formal regulation of the Internet was introduced, and both Internet Service Providers (ISPs) and Internet Content Providers (ICPs) must register with the Singapore Broadcasting Authority, although this is not the case for individuals putting up their own homepages. Guidelines prohibit the use of material which may bring the government into hatred or contempt; jeopardise security or defence; undermine confidence in the administration of defence; or which misleads and alarms the public.

#### 8. External linkages:

- Singapore is actively establishing linkages with the US to spur the development of its own IT industry.
  - Singapore has announced committing US\$100 million, through the Technopreneurship Investment Fund, to the US\$1 billion ePlanet Fund to connect Asia and the United States. The aim is to interest US. venture capitalists in Asia's IT opportunities. Start-up companies from both Asia and the United States would also be able to access the financing and networking strengths of the venture capitalists.
  - Singapore is also setting up a Singapore centre called Connect@sig in the California Bay Area. The centre will be a critical node in the U.S.-Singapore high tech partnership linkage. It will act as a one-stop shop providing business amenities for Singapore start-ups in the US; provide soft and hard networking infrastructure for technopreneurs and create entry points for Singapore start-ups to engage the Silicon Valley and for US start-ups keen on Asia; and be the confluence of different Singapore agencies.
- IDA is also focusing on the regional emerging markets of China and India. Besides the market potential, there are vast synergies to be reaped from co-operation. China and India are big sources of original Asian content and Singapore hopes to leverage on its multilingualism and multiculturalism to translate, digitise, and repackage the content for global consumption.