

Taiwan

Ching-Yi Liu

Overview

Taiwan is located in the Western Pacific, between Japan and the Philippines, off the southeast coast of China and separated from China by the Taiwan Strait. The island has a total area of about 36,000 square kilometres and is 394 kilometres long and 144 kilometres at its widest point. Its GNP in 2001 was US\$286.8 billion, with per-capita GNP reaching US\$12,876. The lack of natural resources and a relatively small domestic market make Taiwan dependent on foreign trade, which constitutes about 80 percent of GNP. They have also made Taiwan the third largest holder of foreign exchange reserves, with over US\$140 billion. In 2001, Taiwan's foreign trade totalled US\$230.1 billion. Although exports for the year were down by 17.2 percent to US\$122.9 billion, owing to the global economic recession, Taiwan still ranked 14th among the world's leading exporters. In the same year, Taiwan was ranked the world's 16th largest economy and the 16th largest importer.¹

Agriculture's contribution to the economy continues to shrink, accounting for only 1.95 percent of GDP. The GDP share of the manufacturing sector dropped from 32.40 percent in 2000 to 31.09 percent in 2001. At the same time, the GDP share of the service sector rose to 66.96 percent. Employment in the service sector (finance, commerce, transportation, etc.) also constitutes the largest share of the workforce at 56.5 percent.²

Taiwan's diligent labour force created an economic miracle in the 1980s. Over the past two decades, Taiwan has gradually transformed its industries. Today, it has the world's fourth largest ICT hardware industry and the fourth largest semiconductor industry. Innovative and high-quality "Made in Taiwan" products are sold around the world. With its accession to WTO in January 2002, Taiwan is positioned to make significant contributions to the global trading system and its economic prosperity.³

The USA, Hong Kong and Japan are the top buyers of Taiwanese exports, accounting for 54.8 percent of the total in 2001. Major export products include electrical machinery, mechanical appliances, plastics, textiles, iron and steel. In 2001, exports to the USA totalled US\$27.7 billion and the trade surplus with the USA was US\$9.4 billion. Reliance on the USA has decreased in recent years as a result of Taiwan's economic liberalisation and inter-nationalisation. Over a

decade ago, nearly 40 percent of exports from Taiwan went to the USA; in 2001, the figure was 22.5 percent. Taiwan's exports to Hong Kong totalled US\$27.0 billion in 2001, down 13.9 percent from the preceding year but registering a US\$25.1 billion surplus primarily due to indirect trade with China. In 2001, Hong Kong imported 21.9 percent of Taiwan's exports.⁴

At the same time, Southeast Asia has recently emerged as a new market for Taiwan, becoming the favourite place for Taiwanese foreign investment after China. In 2001, exports to Southeast Asian countries accounted for 12.0 percent of Taiwan's total exports. Another target of Taiwan's recent market diversification policy is Europe. In 2001, exports to Europe totalled US\$19.8 billion, accounting for 16.1 percent of the total. In previous years, Taiwan usually registered a trade deficit with Europe; however, the situation has reversed since 1999. In 2001, Taiwan enjoyed a trade surplus of US\$4.8 billion with Europe.⁵

The aggregate value of Taiwan's imports in 2001 was US\$107.2 billion, down 23.4 percent from the preceding year. Major imports include electrical machinery, mechanical appliances, mineral fuels and precision instruments. The leading source of imports is Japan, which in 2001 accounted for 24.1 percent or US\$25.9 billion of the total. Many Taiwanese industries rely heavily on parts and manufacturing technology from Japan, particularly the information and automotive industries. With the exception of 1996, 1998 and 2001, imports from Japan have grown continuously, leading to a serious trade deficit. Nowadays, imports from Japan are eight times larger than they were 20 years ago, rising from US\$3.2 billion to US\$25.9 billion in 2001.⁶

The second largest supplier of imports is the USA, accounting for 17.1 percent or US\$18.2 billion in 2001. Collectively, ASEAN countries provided 14.9 percent of imports in 2001, while imports from Europe accounted for 14.0 percent in the same year. South Korea has become the third largest supplier of products to Taiwan in recent years. Although South Korea's export value still lags far behind that of Japan and the USA, imports from South Korea have allowed the two sides to balance their bilateral trade.⁷

To comply with WTO requirements, Taiwan has increasingly liberalised its telecommunications sector,

established a mechanism for fair competition and accelerated the development of broadband network infrastructure. In compliance with the government's liberalisation policy, local and long-distance cable leased-circuit services are open to public utility corporations employing cable transmission networks in order to increase competition, lower operating costs and facilitate faster network establishment by related service providers. The Ministry of Transportation and Communications (MOTC) in June 1999 began accepting applications for electric power, mass transportation, petroleum, and cable radio and television systems and 12 licences and 39 establishment permits had been issued by mid-2001.⁸

Mobile phone, radio paging and mobile data services were open to the private sector in 1997. They were followed by satellite communications in 1998, cable leasing and 1,900 MHz digital low-power cordless phone services in 1999, fixed networking and international submarine cable leased-circuit services in 2000, and international simple resale and third-generation mobile telecommunications services in 2001.⁹

Local telephone services have long been available via fixed networks throughout Taiwan. Chunghwa Telecom dominated Taiwan's telecommunications market until 2001 when competition was introduced by licensing three private competitors in fixed networking. These networks are connected, facilitating dial-up connections to selected local telephone service providers and a choice of other long-distance and international telephone service providers. Local and "0800" toll-free telephone subscribers are also allowed to retain their telephone numbers when they switch to new service providers. As of June 2001, local telephone subscribers totalled 12.75 million, which pushed the penetration rate to 57 percent.¹⁰

Since their liberalisation at the end of 1997, mobile phone services have become more diverse and the number of subscribers has increased. Four national and two regional operators provided services to 19.96 million subscribers at a penetration rate of 89.4 percent as of May 2001. MOTC auctioned off five licences for broadband wireless telecommunications service providers in February 2002.¹¹

The development of broadband in Taiwan has been surprisingly rapid. For example, Chunghwa Telecom currently employs fibre-in-the-loop technique to provide telecommunications services to some residential and commercial buildings, communities and schools in remote areas, which together account for only 1 percent of its subscribers. Plans are also underway to extend the use of this technique to serve government organisations, educational and medical institutions, commercial buildings and industrial parks.¹²

In 2001, Taiwan's Internet penetration rate was 35 percent. The steady increase in this figure is attributed to

Taiwan facts

Total population: 22.41 million (2001)^a

Key economic sectors: Services, manufacturing.^b

Computer ownership per 100 inhabitants: 25.27 (2001)^a

Telephone lines per 100 inhabitants: 57.34 (2001)^a

Internet hosts per 10,000 inhabitants: 764.34 (2001)^a

Internet users per 10,000 inhabitants: 3,490.20 (2001)^a

Cell phone subscribers per 100 inhabitants: 89.4 (2001)^c

Sources:

- (a) ITU (2002). *Asia-Pacific Telecommunication Indicators 2002*. Geneva.
- (b) Government Information Office <<http://www.gio.gov.tw/taiwan-website>>.
- (c) Directorate-General of Telecommunications (2001). *Annual Report 2001*.

the availability of broadband services. According to the Directorate-General of Telecommunications of MOTC, 15 percent of the users of Internet services in Taiwan obtain broadband access to the Internet through ADSL or cable modems. These broadband users enjoy higher data communication speed at a price below US\$30 a month per user. As Taiwan's Internet penetration rate rises, e-commerce develops, and demand for broadband networking expands. Establishment permits were issued to three companies for international submarine cable leasing operations, expanding the international submarine cable traffic capacity while lowering related costs and enhancing Taiwan's competitive edge in the global telecommunications market. According to the Institute for Information Industry, there were 7.55 million users of Internet services in Taiwan by the end of September 2001, representing a 25 percent growth from December 2000 and accounting for 34 percent of the population.¹³

Full penetration of broadband among universities and schools was achieved in 2000. As of December 2001, ADSL and cable modem subscribers totalled 920,000 and 210,000, respectively, an increase of 700 percent and 89 percent from 2000. In contrast, users of narrowband and other comparably "traditional" Internet services showed a decline; dial-up, ISDN and direct PC subscribers decreased by 0.6 percent, 20 percent and 28 percent, respectively. Leased-line subscribers, however, increased by 6 percent.¹⁴

Content

The rapid development of the Internet has dramatically changed the media markets in Taiwan. Print media has gone online. Several newspapers publish online not only their daily editions but also breaking news, while magazines lure readers with free online access to selected articles in their printed issues. Book publishers and bookstores have established online bookstores to reduce overhead and to offer round-the-clock service. Radio and television stations are also reaching out to the growing population of surfers with streaming audio and video broadcasts of news, music and drama.¹⁵

In recent years, Taiwan's private sector has gained in strength, and community development has gradually taken place, again displaying the tremendous vitality of Taiwanese society and the growing power of private groups and individuals. Responding to the information needs of community development, the Research, Development and Evaluation Commission (RDEC) consistently strives to take government information and services to the grassroots level. RDEC has joined forces with private parties in implementing the "Computers in Every Village, the Internet in Every Neighbourhood" plan. Under this plan, implemented on a trial basis, online public service points are established throughout villages and communities, community information kiosks are installed, and "village websites" are developed. More than 6,500 villages and neighbourhoods have completed webpage construction to date. The establishment of community websites on RDEC's Internet platform allows the public to find and share information on community affairs and activities, giving people more opportunities to participate in community affairs. For their part, community leaders can use the websites to communicate community development plans and concepts. This framework will strengthen the public's understanding of, concern for and desire to participate in community affairs, fostering community consciousness and a sense of interdependence.¹⁶ For example, the establishment of a "921" earthquake (which occurred on 21 September 1999 and exacted a heavy toll on lives and property) reconstruction information system and website¹⁷ has aided the implementation of reconstruction works by fostering public consciousness in stricken areas and inspiring individuals to plan and execute reconstruction works.

Important local sources of content

Chinese is the major language used in online content in Taiwan. News and current affairs are carried by almost all types of media, including the Internet. At the same time, online information related to business, government, education, banking and finance, health, NGOs, culture, arts, entertainment, tourism, etc., are more than abundant. Most of the important sources of content listed below are published in traditional Chinese characters and English.

Yam Digital Technology <<http://www.yam.com>>

The first search engine and portal site in Taiwan's Internet community, Yam Digital Technology started as a non-profit organisation named Frontier Foundation. It was commercialised in 1998. Yam.com is still one of the most popular portals in Taiwan.

Yam Annual Survey of Internet Use

<<http://survey.yam.com>>

This website provides all the annual surveys on the use of the Internet conducted by Yam since 1996.

Yahoo <<http://www.yahoo.com.tw>>

The Taiwanese branch of Yahoo, Yahoo-Kimo, is one of the most popular portals in Taiwan and attracts primarily younger users.

Google <<http://www.google.com>>

Google has become one of the most popular search engines. In Taiwan, Google partners with Yam.com to provide services to Chinese users.

Market Intelligence Centre of the Institute for Information Industry <<http://mic.iii.org.tw>>

The Market Intelligence Centre has been Taiwan's leading IT industry analysis and consulting service provider since 1984. As a strategic policy think tank, it serves senior decision makers in the industry, government, academic sectors and investment communities. More information is available at this website of the Computing Information Service Centre of the Institute for Information Industry <<http://www.cisc.iii.org.tw>>.

The E-Government Entry <<http://www.gov.tw>> **ENGLISH**

Launched in early 2002, this website is a unified gateway to the government's public services and a high-speed communication link between the government and the people. It allows users to query a wide range of government information and make online applications.

National Digital Archives Programme

<<http://www.ndap.org.tw>>

Currently supported by government funding, the National Digital Archives Programme has constructed this gateway to all the historical, cultural and artistic digital archives in Taiwan. The programme aims to digitise the major items in the collections of nine national cultural and historical agencies, including the National Palace Museum, Academia Historica, the National Central Library and Academia Sinica. The National Science Council's "digital collections" project officially began in January 2002, whose mission is to preserve cultural assets and to create a public information system to enable businesses to access and use the data, thereby enriching the productions of the digital content industry.

Software Liberty Association of Taiwan

<<http://www.softwareliberty.org>>

This is the website of the largest software engineers and users association. It aims to promote the adoption of open source software. News and the projects and activities of Taiwan's open source community are available at this website.

Challenge 2008 <<http://www.cepd.gov.tw/2008/index.htm>>

The government's Challenge 2008 project is closely related to the development of the Internet and IT industries.

Online services

E-government

The government made the decision to use the open high-speed online environment to provide the public with convenient information and services when the popularity of the Internet spread rapidly in the 1990s. This was seen as an inevitable trend in the informatisation of the government. In November 1997, the government assigned RDEC the task of drafting the Mid-Term E-Government Implementation Plan (1997–2000). This plan called for the full-scale deployment of a government backbone network, the development of convenient online public services and administrative applications, the acceleration of government information interchange and the establishment of electronic certification and network security mechanisms. To further broaden the scope of e-government applications, RDEC issued the E-Government Action Programme (2001–2004) in April 2001 and expects to enhance the depth and breadth of government online applications during the four-year period of this plan. The ultimate goal of the action programme is to raise national competitiveness by promoting Internet applications throughout society and industry.¹⁸

RDEC established a dedicated government Internet backbone system – the Government Service Network (GSN) – in 1997 to help accelerate the application of the Internet in government agencies, improve online service standards, promote sharing of government information, strengthen government network management and lower network installation and maintenance costs of the various agencies. The GSN system provides government agencies at all levels with a common platform for the development of public service systems. GSN offers fast, convenient and economical network services. Through efficient allocation and utilisation of network resources, government agencies have been able to dramatically lower their Internet usage threshold, speed up the linkage of agency networks via the Internet and lay a solid foundation for e-government.¹⁹

RDEC established a Government Certificate Authority (GCA) in February 1998 to establish a secure and reliable network transaction environment. This facility provides online identity authentication services to government

agencies and the public. As of November 2001, GCA had issued 210,000 digital certificates and begun providing certification services in connection with online tax reporting, motor vehicle registration, electronic disbursement, electronic procurement and electronic official document exchange. RDEC also began implementing an online data transmission and official document exchange system in July 2000 to enable the government to communicate more effectively. As of December 2001, 8,000 central and local government agencies and schools had been hooked up to the electronic document exchange.²⁰

Online public services are being established to include tax reporting, motor vehicle registration, disbursement, industrial information, health insurance and utilities services. The government is gearing up to provide even more innovative 24-hour services in the near future. To further enhance the usefulness of online public services and provide the public with one-stop online government services, RDEC formally inaugurated the “My E-Government – E-Government Portal of Taiwan” in March 2002. This portal site will offer the public 1,500 online application services within three years. An “electronic gateway” mechanism will be used to promote information interchange and circulation among various agencies. This mechanism will be extended to inter-agency online queries and searches, reducing paperwork and eliminating the need for transcripts and certificates.²¹

Furthermore, the government has committed to make public large quantities of information on the Internet. This will enable individuals to better understand government policies and regulations, allow them to conveniently and effortlessly express their policy positions, opinions, values and needs to their elected representatives and government decision makers, as well as give them the means to follow up on issues. This will be a complete break with the situation in the past when citizens depended entirely upon the professional knowledge of their representatives and civil servants in the drafting of public policies, determination of social needs and distribution of public resources.

The e-government portal website was established by RDEC to help fully implement the policy of providing citizens with free access to government information and to further meet the public's right to know by enriching content and improving service quality. This portal aims to make all public service information, laws, and application documents and forms available online for free public queries and downloads within three years. At the same time, RDEC will respond to the public's demand for high-quality information by continuing to promote the establishment of government websites and enrichment of website content. RDEC conducted a government website evaluation activity in May 2001. Fifty-three outstanding government agencies were chosen and their websites exhibited and recommended to the public. RDEC will continue to regularly evaluate government websites and will include website service quality among its public service assessment criteria.²²

The establishment of fair, equitable and open markets promoting free competition is a basic precondition for the creation of a just society. Since the government's annual procurement budget in Taiwan is usually huge, it is essential that transparent procurement procedures are instituted. Transparent procedures will raise procurement efficiency and quality, lessen improper intervention and interference, promote a free market and encourage fair competition.

In recent years, the Public Construction Commission (PCC) has installed the Government Procurement Information Posting System and established the online Government Procurement Information Centre to provide contractors with tender information of the various government agencies. Besides tender announcements, this system also offers a database of unacceptable contractors. It also openly posts requests for contractors' reference data and solicits for proposals and written price quotations. As of November 2001, government agencies had posted more than 720,000 public tender requests via the system, while an average of 300,000 queries were made every month and a cumulative total of 8.4 million queries had been made altogether. Apart from this procurement information system, PCC has also established an online bidding system and an online vendor catalogue and price inquiry/quotation system. These systems help significantly in the promotion of fair competition and establish the procurement market on sound foundations.²³

Distance education and e-learning

Since mid-1990, many colleges and universities in Taiwan have developed distance education programmes. Some government agencies also provide educational programmes to the private sector. Distance education and e-learning have become one of the major missions in Taiwan's e-society effort. For instance, the National Science Council will invest US\$119 million in e-learning over the next five years. The programme, which will include the creation of "e-schoolbags" for children and e-learning for all citizens, is also meant to allow the unemployed, those in military service, housewives and retired people to become familiar with the Internet. The programme also aims to raise Taiwan's competitiveness through e-learning and to increase productivity via the Internet.²⁴

E-commerce and e-business

E-commerce is becoming increasingly popular in Taiwan. The government has realised since 1999 the importance of creating an effective electronic transaction environment so as to improve industry competitiveness in a digital economy. Therefore, as early as in June 1999 the Executive Yuan had approved two main policies of promoting e-business with innovative business application and establishing electronic transactions to prepare the

government, businesses and people for "electronisation" so that they can take full advantage of IT to enhance industry competitiveness through Internet linkages with the world.²⁵

Telemedicine

The government has endeavoured to develop a comprehensive telemedicine infrastructure.²⁶ An IC-card-based national health information system was officially introduced in 2002. Hospitals and clinics should become fully connected by the end of 2003. However, many NGOs are still very concerned about potential security risks and privacy violation associated with the information system and strongly opposes its implementation.

E-conference

An e-conference infrastructure and related equipment have been introduced and manufactured in Taiwan since the early 1990s. However, the approach towards e-conferencing has been transformed with the introduction of the Internet and the World Wide Web.

E-forum and e-community

Taiwanese e-forums have a long and popular tradition, beginning with the introduction of BBSs in the late 1980s. They cover current affairs, news, economy, sports, entertainment and various other topics. Current affairs and news forums are very influential and help to shape public opinion.

The stable technical support provided by the Taiwan Academic Network²⁷ to online forum discussions and BBSs helped to build an active online community composed of students from hundreds of Taiwanese universities and colleges. Portal sites such as Yam,²⁸ Yahoo-Kimo,²⁹ Hinet³⁰ and PC-home³¹ have implemented e-community services covering news, politics, health, sports, entertainment, fashion, women, etc.

ICT industries and services

In 2001, industrial production accounted for 31.09 percent of GDP. Goods that once dominated Taiwan's exports, such as processed food, textiles and garments, as well as agricultural products like wood, bamboo and leather, have all declined over the years. These labour-intensive industries have gradually been replaced by capital and technology-intensive industries, such as chemicals, petrochemicals, ICT, electrical equipment and electronics.³²

For the past two decades, the government has been promoting emerging industries such as computer hardware and software, telecommunications, precision machinery, aerospace, energy, environmental industries, advanced materials and chemicals, life sciences, and biomedical

industries. Manufacturing has dominated Taiwan's industrial sector since the mid-1960s. In 2000, the computer hardware industry's domestic and overseas production was US\$47 billion, up 17.9 percent from the previous year's US\$39.9 billion, making it Taiwan's most important foreign exchange earner. Taiwan was the world's third largest computer hardware supplier from 1995 to 1999 and ranked fourth in 2000, trailing only the USA, Japan and China. The 1,000-plus computer hardware manufacturers provide jobs for approximately 130,000 employees. In 2000, laptop computers, monitors, PCs and motherboards accounted for about 80 percent of the production value of the IT industry. Taiwan manufacturers have a large share of the world market because of their competitive prices and the high quality of their products.³³

According to reports released by the Institute for Information Industry, Taiwan had already replaced Singapore by 2000 as Japan's second largest supplier of information products, second only to the USA. In 2001, manufacturing output constituted around 82 percent of total industrial production and employed over one-fourth of Taiwan's workforce. That same year, manufacturing accounted for 25.57 percent of GDP. The IT and electronics sectors continue to outperform all other manufacturing sectors.³⁴

Taiwan's accession to WTO in early 2002 may have affected certain industrial sectors, such as automobile, heavy electrical machinery, home electrical appliances and a few other less competitive traditional industries which rely mainly on the domestic market. However, overall, WTO membership is expected to bring new business opportunities, facilitate industrial modernisation, boost Taiwan's international profile, and help resolve unfair trade practices through an institutionalised mechanism.³⁵

Examples of innovative and key initiatives

The government has launched several important projects to promote the development of the national economy and the construction of the information infrastructure. The following are some of the initiatives.

E-Taiwan

Digital technology is transforming economies and societies throughout the world, and it has the potential to transform governments as well. Policy makers in Taiwan have a vision of a future where citizens, businesses and governments all save time and resources. To achieve that vision, they are implementing projects that build environments conducive to advanced information applications, which in turn can help create commercial opportunities and raise competitiveness. Taiwan is well positioned to build that future given its good Internet environment.

According to the Center for International Development at Harvard University, Taiwan has excellent Internet preparedness.³⁶ Brown University³⁷ and the World Markets Research Center³⁸ confirmed this conclusion. Taiwan's government institutions, they observed, provide top online services, exceeding even those of the USA. Now, promoters of E-Taiwan³⁹ hope to shape the island as the most "e-oriented" in Asia as part of the Challenge 2008 six-year national development plan. The project has been evolving for quite some time. The plans that preceded it include the national information infrastructure (NII) development programme in 1994, the intermediate range NII programme in 1997, the e-government programme in 1998 and the National Information and Communication Initiative in 2001. The E-Taiwan project is now a priority of the government. Challenge 2008 targets the development of broadband communications facilities, an e-government environment, information application services, digital competitiveness and a reengineered government.⁴⁰

With a budget of over US\$1 billion and more than US\$3 billion in business opportunities, some 20,000 jobs will be created through this project. Furthermore, e-commerce will constitute 15 percent of GDP upon completion of the plan in 2008. The plan is aiming for six million households with broadband access by 2008 in order to provide an "ez-life" rich in cultural information. It also aims to raise the quality of e-learning and eliminate the digital divide. The plan also envisions developing e-businesses and transforming Taiwan into one of the top five e-governments in the world.⁴¹

The government regards the construction of high-density broadband facilities as necessary for transforming Taiwan into a "Green Silicon Island". It is developing new high-tech industries that are environmentally friendly. An estimated 70 percent of Taiwan's wired population will have broadband access to the Internet by 2007. It is also estimated that by the end of 2007 the island's main north-south broadband infrastructure will reach 1,150 Gbps and the international undersea cable, 1,000 Gbps. Over the next five years, the efficiency of official document delivery is expected to improve 200-fold.⁴²

In terms of application, the government envisions creating a "wireless island". It plans to give assistance to small and medium businesses in using the Internet to develop commercial opportunities. According to a survey conducted by the Institute for Information Industry in 2001, the Internet usage rate of Taiwan companies was only 26.4 percent, low compared with 98.7 percent in Singapore, 82.1 percent in Japan, 78 percent in Canada and 63 percent in the UK.⁴³

The plan also aims to preserve and disseminate art and culture by making digital archives accessible to the public. E-learning programmes will integrate digital resources. Specific strategies include developing "e-schoolbags" to spur the use of ICTs and using Internet cafés to help people find new employment.⁴⁴

A digital entertainment plan for wireless and cable television, radio and movies is also being mapped out. It will aim to improve quality and spur development in this sector. A cultural network will include a national cultural bank, digital library, digital museum, instant online arts and cultural information, and online teaching.⁴⁵

For the disabled and residents in remote areas, websites “without obstacles” will be built. E-learning, information sharing and online meetings will be conducted to raise the competitiveness of the workforce. Certificates will be issued to farmers and fishermen for lifelong e-learning about agriculture. Furthermore, a real estate data centre will provide information to construction companies, banks, consumers and government policy makers to make the property market more transparent and reduce uninformed investments in real estate.⁴⁶

Industrial automation and e-business

This programme was concluded in 2001. The programme helped e-business and e-commerce to develop quickly and comprehensively. It impressed upon the government that promoting the integration of business activities with infrastructure development could significantly raise domestic competitiveness and contribute towards the economy. As a result, the 2,728th Executive Yuan meeting in April 2001 approved the National Information Infrastructure Programme, the E-Government Promotion Committee and the Industrial Automation and Electronic Business Programme of the Executive Yuan to be brought together under the National Information and Communication Initiative. The meeting also approved the continuation of the former industrial automation and “electronisation” project as the e-business subgroup of the initiative.⁴⁷

There are three specific strategies as far as e-business is concerned in the E-Taiwan project. Integrating e-markets and e-standardisation are necessary if Taiwan is to join the international supply chains. Multinational customer service models are also crucial if Taiwan is to become a product design centre. Assistance will be given to industries like electronics, semiconductors, telecommunications, textiles and precision instruments to establish a system to coordinate design.

In future, the experience gained from promoting the e-industry programme of the above industries can be extended and expanded to other domestic industries. This will help Taiwan to attain the goal of becoming a global e-industry order-receiving, production and sales-operation centre. According to the E-Taiwan Office, the task of improving the future global logistics service ability of industries includes the following: (1) to assist specific industries (e.g. information industry) or businesses in deploying electronic logistics systems to link domestic and foreign customers, distributors and suppliers for the purposes of acquiring raw materials, manufacturing,

distribution, delivery, and provision of after-sale service, etc.; (2) to assist export-oriented industries and manufacturers to effectively coordinate with major international third-party logistics service providers and track logistics information services; (3) to assist the domestic financial service industry in deploying domestic and foreign electronic cash-flow services and to provide e-industry with integrated applications and enhanced transaction effectiveness.⁴⁸

In order to enhance the R&D and innovation abilities of Taiwan’s industries, the government has adopted the following steps: (1) to establish a multinational online collaborative design and R&D knowledge community, to increase local manufacturers’ added value and ability in R&D and technical services, to accumulate the R&D knowledge of the domestic industry, and to enhance the image of Taiwan in sustaining innovation. (2) to plan actively and promote the accreditation and barrier-removal mechanisms between buyers and sellers, to establish secure information transaction systems and effective dispute resolution systems, and to remove foreign customers’ doubt about online ordering. (3) to plan and promote research on products and processes, as well as on classification and documentation standards to help domestic industries establish products and services e-catalogues in accordance with international standards.⁴⁹

Practical measures for enhancing the international marketing ability of Taiwan’s industries include these: (1) encouraging and assisting industries in establishing databases on foreign customers, saleable products and manufacturers’ information so as to raise the effectiveness of companies in carrying out global marketing with the help of ICTs. (2) encouraging and assisting enterprises in putting catalogues and related information on outstanding products from Taiwan on the Internet, and in establishing a common brand to attract international online purchasing. (3) promoting technology and design information of related components and products from Taiwan via the Internet, attracting more international researchers to make enquiries online and facilitating their follow-up on these enquiries. (4) encouraging firms to actively promote domestic products via an e-marketplace.⁵⁰

E-government

According to the vision offered by the e-government programme, one-stop integrated services will be provided for the processing and/or payment of taxes, motor vehicle and business licences, health insurance and copyright. This vision will be achieved by making a reality electronic transmission of official documents, videoconferencing, and the opening of government digital information systems, including the National Archives. This integrated system will aid in disaster prevention and relief, management of state-owned land and public construction, and the integration of emergency communication systems. The single-window

service will have a user interface that is user-focused. It will have a common operating platform which will provide cross-system and cross-organisation services to the public, businesses and civil servants as well as process documentation in a central place.⁵¹

In addition, the Intelligent Transportation System – which comprises integrated transportation information of bus, taxi, air and train services; IC cards; and assistance to county governments to build intelligent urban transportation control systems – will help solve traffic problems by offering the public real-time transportation information. IC cards will be used on buses, trains and mass rapid transit systems as well as in parking lots.⁵²

The e-government system is expected to save US\$3 billion in administrative costs. About 600 types of online services will be offered at its website <<http://www.taiwan.gov.tw>>, which went online in March 2002. So far, there are 13 common gateway services divided into two categories. The first gateway covers residential, land and taxation administration as well as motor vehicle management and inspection. The second includes public security, construction, social administration, environmental protection, sanitation, civil administration, transportation and land administration.⁵³

Enabling policies

Despite the generally lacklustre performance of the domestic economy in recent years, Taiwan's ICT hardware industry still has managed to register significant growth. This achievement has been attributed to many factors: the rapid growth of the Internet, the increased popularity of multimedia computers, and the expansion of production by local PC manufacturers. Taiwan's IT industry has grown from a minor player to a major contributor to the island's export-based economy. This is partly a result of governmental inducements and partly because of the extreme flexibility of domestic small and medium enterprises (SMEs), which were able to quickly adapt to the latest market trends and adjust their production accordingly. Nevertheless, the industry still faces problems that are common to all manufacturing industries.

The structure of Taiwan's IT industry is best described as a pyramid. A handful of companies at the top of the pyramid commit themselves to product innovation through costly and time-consuming R&D, while SMEs at the base of the pyramid account for almost 85 percent of the actual output. The latter represents a weak and unstable downstream foundation. As in other manufacturing sectors, SMEs generally produce goods on an OEM (original equipment manufacturer) and ODM (original design manufacturer) basis, and they therefore spend a negligible percentage of their revenue on R&D. This has resulted in the inability of these companies to make in-depth assessments for investment, production and marketing of new and innovative products. Moreover, heavy reliance on the importation of

key parts and advanced technology from the USA and Japan has tied Taiwan's IT sector to the economic strength of these two countries, thereby offsetting a substantial portion of Taiwan's trade surplus each year.

Promoting the digital content industry

The government considers the digital content industry as the catalyst for the development of a knowledge-based economy. It will help to transform traditional industries into high value-added industries to improve the competitiveness of the entire industry in Taiwan. The government has included this industry in the Development Plan of the New Century Twin Trillion, Twin Star Industries. The Executive Yuan also approved a promotion programme for the digital content industry, to be implemented by the Industrial Development Bureau of the Ministry of Economic Affairs via the Digital Content Industry Promotion Office, which will act as the focal point for industry promotion and guidance.⁵⁴

Challenge 2008, which was finalised in early 2003, identifies two trillion-dollar industries (semiconductors and displays) and two rising stars (biotechnology and digital content). According to the action plan of Challenge 2008, massive investments will be made in the digital content industry over the next five years by the government. Investments will be targeted at four areas – digital learning, video and multimedia, digital animation, and computer games – in the hope of increasing the industry's value from its current NT\$130 billion to NT\$370 billion by 2005.⁵⁵

National development

As noted earlier, the government has formulated the comprehensive six-year national development plan Challenge 2008 in its latest effort to foster the creativity and talent Taiwan needs to transform itself into a Green Silicon Island. President Chen Shui-bian proposed developing Taiwan into a Green Silicon Island during his inauguration speech to ensure a balance between environmental conservation and economic development. On 7 May 2001, the Executive Yuan passed the Green Silicon Island Plan, which is based on three major concepts: a knowledge-based economy, a sustainable environment and a just society.

Developing Taiwan into a Green Silicon Island has become the main national development policy and is being implemented over a ten-year period through the National Development Plan for the New Century and other related projects by all ministries. The development projects proposed on 8 May 2002 cover wide-ranging areas while focusing on economic growth and environmental protection. Taiwan is facing technological challenges as well as loss of investment and skilled workers to China, thus the Executive Yuan has formulated three major reforms and four major investments in the national development plan.

The three major reforms focus on the sectors of government, banking and finance. The four major investments cover personnel training; research, development and innovation; international logistics; and a good living environment. The six-year national development plan will cost an estimated NT\$2.6 trillion (US\$75 billion) and has the following goals: (1) expanding the number of products and technologies that meet the world's highest standards to 15; (2) doubling the number of foreign visitors; (3) increasing R&D expenditure to 3 percent of GDP; (4) reducing the average unemployment rate of the next six years to less than 4 percent; (5) raising the average economic growth rate in the next six years to over 5 percent; (6) boosting the number of broadband Internet users to over six million; and (7) creating 700,000 jobs.⁵⁶

Bridging the digital divide

As the government strives to promote Internet use and establish a fair and equitable society, it is also looking at the issue of digital divide in terms of gender and age differences, rural and urban accessibility, ethnicity, as well as income and educational levels. To avoid leaving out certain groups in the move to an information society, the government has launched programmes to make sure all communities possess the knowledge and skills required to enjoy the benefits that IT brings to their lives.

RDEC has recently begun coordinating and overseeing programmes implemented by various agencies to tackle the digital divide. For example, it plans to use special development funds to implement the Plan to Strengthen Information Education in Elementary and Middle Schools in Remote Areas, Labour Information Education Plan, Farmers' Lifelong Education Plan, and the Aborigine Information Education and Training Plan.⁵⁷

The government believes that it is possible to enhance people's ability to make use of ICTs and information via a multifaceted approach. This includes the following strategies: tapping into private resources and strengthening the information education infrastructure; establishing channels for lifelong learning; increasing online government services; making the Internet relevant to everyday life; encouraging industry to develop a barrier-free, user-friendly digital environment (e.g. by introducing computers for the blind); installing public information kiosks; increasing the number of people going online; and assisting low-income households to go online. The government believes that by doing so it will be possible to transform the digital divide into digital opportunities.⁵⁸ A widely shared belief is that if the government succeeds in transforming Taiwan into a Green Silicon Island in tandem with the elimination of the digital divide, Taiwan's core competitiveness will be enhanced and the ideal of a just society will be realised at the same time.

Policy-making and research institutions

The following are the key institutions:

- National Information and Communication Initiative (NICI), Executive Yuan <<http://www.nici.nat.gov.tw/intro.html>>
- Ministry of Economic Affairs <<http://www.moea.gov.tw>>
- Ministry of Transportation and Communications <<http://www.motc.gov.tw>>
- Ministry of Finance <<http://www.mof.gov.tw>>
- National Science Council <<http://www.nsc.gov.tw>>
- Institute for Information Industry <<http://www.iii.org.tw>>
- Academia Sinica <<http://www.sinica.edu.tw>>
- Taiwan Internet Network Information Centre <<http://www.twnic.net>>

Research into ICT

Developing an e-Taiwan

Challenge 2008 is referred to as "a key task that will lead Taiwan's transition and upgrading" over the next 20 years. One of its most significant projects is E-Taiwan which was launched at the end of 2001 and is now incorporated into the master plan. It is aimed at promoting the national information infrastructure and knowledge-based economic development. It promotes the development of applications for next-generation broadband networks, such as IPv6 and wireless LAN. Efforts will also be made to deploy broadband networks ubiquitously and to promote broadband Internet usage in order to realise the goals of e-government, e-industry, e-society and e-infrastructure.⁵⁹

In the area of e-government, ministries and commissions are formulating three to five core plans with the goal of putting all government agencies and government employees online, placing 1,500 application services online and eliminating all household and land registration certificates.⁶⁰

With regard to e-industry, companies will be assisted in setting up global logistics systems. An industrial automation and e-industry application environment will be promoted while a high-efficiency supply chain management network will be built. The Ministry of Economic Affairs has announced the investment of NT\$1.6 billion by 2005 in an E-Industry CDE Plan. The investment is expected to stimulate private investment of at least NT\$1 billion in the same endeavour. The aim of this plan is to bring about an overall reinforcement of Taiwan's international logistics competitiveness by integrating factors that are crucial to global logistics operations, including cash flow, delivery, and engineering collaboration (CDE).⁶¹

In the area of e-society, the target is to create a digital learning environment that will facilitate online learning

and to provide individualised health-care and medical information services.⁶²

The goal of e-infrastructure is to boost the ratio of Taiwan's online population from the present 35 percent to 50 percent within five years, with broadband users accounting for 70 percent of the total online population. It also aims to establish a network security mechanism and to popularise national information education.⁶³

Development of the cultural and creative industries

The goals of this initiative are to develop the creative industries, and to combine culture and economics to develop the cultural industries. Several strategies will be employed over the next few years: (1) establishment of a promotion organisation for the cultural and creative industries; (2) nurturing of creative human resources for art and design; (3) preparation of an environment for the development of the creative industries; and (4) development of creative design and creative culture industries.⁶⁴

Nurturing innovation and R&D

Challenge 2008 also aims to encourage private investments in R&D. It has set out to increase R&D expenditure to 3 percent of GDP, the same level as in advanced countries, within six years. The strategies for accomplishing this are: (1) attracting international R&D personnel and introducing R&D resources from around the world; (2) provision of NT\$50 billion in R&D loans to support and seed innovation and R&D activities; (3) establishment of key industrial colleges, such as for IC design and digital content, and encouraging cooperation among industry, academe and research institutes in the cultivation of human resources for industry; (4) establishment of innovation and R&D centres for the creation of R&D niches; and (5) promotion of key industrial technology research and establishment of core industrial technologies.⁶⁵

Raising industrial value

The government has drafted the following strategies to increase the industrial value of Taiwan and transform it into a global production and supply centre for high value-added products: (1) mobilising NT\$100 billion in venture capital funds from the government and private sectors for funding emerging industries; (2) provision of assistance for the development of core industrial technologies, including in electronics and information, communications, machinery, textiles, and biotechnology; (3) promotion of key industries, including adding value for traditional industries, semiconductors and three other core industries, information application services and three other new service industries, and green industries; (4) incentives for investment in international channels and brands; (5) upgrading human

resources; and (6) construction of industrial parks as bases for industrial development.⁶⁶

Regulatory environment

The Directorate-General of Telecommunications (DGT) is the primary regulatory agency for the telecommunications industry in Taiwan. It has aggressively planned and implemented the liberalisation of the domestic telecommunications market since the early 1990s. The first *Cable TV (CATV) Act of Taiwan* was passed in the mid-1990s. The *Press Law*, a long-time obstacle to the freedom of speech, was abolished in the late 1990s.⁶⁷

The liberalisation of the telecommunications market and the reconstruction of media regulatory regimes have, as predicted, brought about dramatic changes in Taiwan.⁶⁸ The lifting of limitations on content has not only removed legalised censorship but also helped build a truly robust marketplace of ideas. At the same time, the deregulation of the telecommunications and cable markets launched the construction of the national information infrastructure.

The liberalisation of the domestic telecommunications market was also one of the steps taken to clear the path for Taiwan's accession to WTO. The newly introduced regulatory mechanisms, such as universal telecommunication services, telecommunications accounting system, price control regulations and telephone number portability, in the *Telecommunications Act of 1999* are all the results of DGT's efforts to align Taiwan's telecommunications regulatory framework with WTO's regulatory principles.⁶⁹ The policy offered the extra advantage of creating an Internet-friendly infrastructure for Taiwan.

The convergence brought about by ICTs and the Internet poses new problems for countries that adopt a multiple regulatory model. The regulatory regime of Taiwan is premised on distinct telecommunications and broadcasting sectors being governed by different sets of regulations. However, this distinction is gradually blurring, if not being removed altogether, in this era of convergence.

The regulator for the telecommunications sector is DGT, while the regulator for the broadcasting sector is the Government Information Office. Under the multiple regulatory model, the media regulators develop their own regulatory principles and practices. However, new media services created in the Internet era may straddle various traditional sectors and may end up being licensed and regulated by multiple regulators. Under these circumstances, instead of fostering the development of new media services, the existence of multiple regulators may lead to "over-regulation" and retard the development of these new services. Furthermore, the licensing of new media services by different regulators may result in discriminatory treatment of new media services and thereby distort the media markets.

As a result, it seems fair to believe that the gradual blurring of distinction among the media sectors will

inevitably lead to the convergence of multiple regulatory regimes into a single regulator. The obvious advantage of having a single regulator is that both policy and law are formulated and applied by the same regulator and therefore the regulatory standards applied to different media sectors can be harmonised. This is exactly why the government has been planning to establish a new regulatory agency similar to the US Federal Communications Commission to take full charge of all regulatory matters in the telecommunications, information and broadcasting industries. It has been emphasized that such a regulator will have to be more competent and accountable than the current regulatory agencies. As convergence intensifies, harmonisation of the regulations for the various media sectors becomes more urgent.

Although regulators have endeavoured to create a national network with sufficient bandwidth and supported by a sound regulatory mechanism, many cases illustrate the dilemma Taiwan's policy makers face in considering whether existing laws can be applied or new laws need to be adopted to address legal issues arising from online activities. For instance, it has never been fully resolved as to how the information stream flowing on the Internet should be treated and whether a content provider should be regulated as a broadcaster or a telecommunications operator. These questions remain no matter whether online services are offered over the existing telecommunications network or via emerging wireless technologies. To date, regulators have responded to these challenges in a "hands-off" approach, which might seem rather relaxed when viewed from the traditional perspective of "big-government" in Asian countries. However, the regulators' refusal to fit new Internet services into an old regulatory model has provided the ISPs and their users with the necessary freedom and flexibility to develop their own rules of the game. Consequently, it has helped foster the development of new online business models and in turn increased public participation in all kinds of forums on the Internet.

Moreover, the rules of the game for IT industries will inevitably change in this new era of technological convergence; the question is to what extent and how fast. It is also certain that technological convergence will continue to shape future policy and exert new pressures on policy makers and regulators alike. Technological convergence, made more real by the Internet, has also brought to the front broader regulatory issues of competition policy and law. Taiwan's effort in fine-tuning the role of competition law and policy also shows that regulators do not take a minimalist approach for the regulation of cyberspace. The Fair Trade Commission (FTC), the competition law enforcement agency of Taiwan, has apparently realised that, as convergence continues to evolve, cross-media acquisitions will increase and will lead to both growing horizontal integration among the bigger players and intensified concentration in the market. This trend seems to make FTC

believe that even greater concentration of market power will appear in the media industries and something has to be done to prevent market manipulation and ensure competition. FTC has therefore launched several in-depth studies on the competition law and policy issues brought about by the Internet and released several guidelines for the media industries. In other words, it is clear that the emergence of cross-media mega-mergers has forced Taiwan's regulators to consider the appropriate levels of concentration of media in regional and/or global markets and to formulate new competition policies.⁷⁰

Finally, in addition to the *Act for the Protection of Computerised Individual Data* and various laws regulating the use of the Internet, the Legislative Yuan has passed the *Digital Signature Act* to deal with problems brought about by the paperless e-society.

It is extremely difficult to determine, in the face of any new technology, whether new legislation is needed. It is no less complicated a challenge to adopt a sensible and reasonably proportionate regulation to address new legal issues. On balance, the government is correct in concluding that some new legislative cures are needed to fix the dysfunctions resulting from the advent of the Internet. The time and energy spent on the introduction of new regulations has been tremendous, but the pace of regulatory reform is still not satisfactory in adapting to the rapidly changing technological and business environments.

Open source movement

Most computers in offices and schools in Taiwan run software supplied by a few foreign companies. Government agencies and schools spend large sums of money on software purchases every year. Linux has a relatively small number of users in Taiwan for the moment. However, the number of companies and manufacturers of Linux has been increasing since mid-1990. The government has recently offered policy support and R&D funding to encourage and promote the use of open source software in response to a push from the open source software community within the private sector. Government departments have also begun to make use of open source software.

NICI and RDEC have both clearly announced their support for open source software. They have also released a development strategy for the software industry that will benefit open source software development. In fact, several commercial entities have succeeded in developing open source products during the past few years. These companies include Shinewave International <<http://www.shinewave.com>>, Wahoo International Inc. <<http://www.wahoo.com.tw>> and OurInet <<http://www.ourinet.com>>.

An association of user groups named the Software Liberty Association of Taiwan (described earlier) was established in the late 1990s.

According to public officials, the government will announce a National Open Source Plan in 2003 to facilitate the development of free software. The plan will be spread out over at least two years and its results will benefit government agencies and NGOs. It is estimated that it will save the government US\$59 million and the society at large US\$294 million on software expenditures.⁷¹

The National Supercomputer Centre is drafting and implementing the National Open Source Plan. The goal is to establish Taiwan's basic software development infrastructure. It is also hoped that more reliable software will result from the "common sharing" of open (free) source code, enabling a greater pool of computing talent to maintain and improve on the source code. Free software development will create a diverse software eco-environment and lay a solid foundation for Taiwan's software industry. The plan includes the completion of a Chinese open source software environment for the needs of Taiwanese users. Also included in the plan is international cooperation on free application software development. The results will be shared freely around the world, thus raising Taiwan's profile in the high-tech field globally.

In addition to software development, this plan includes training and education. The government will cooperate with community colleges and NGOs to establish six training centres, which will train 120,000 users in the basic skills required for working in open source software environments. Advanced courses will train 9,600 "seed" people, who will help adapt free software environments to the community's needs.⁷²

Finally, the national education system will switch to open source software in order to provide a diverse IT education environment and ensure people's rights to the freedom of information.⁷³

Future trends

According to DGT, the level of broadband connections to the Internet in Taiwan is expected to gradually increase from the current 15 percent to 70 percent by the end of 2006.⁷⁴

In order to raise the domestic density of broadband Internet users, DGT will upgrade the fibre optic backbone telecommunications network around Taiwan. Total bandwidth will be increased from 120 Gbps (as of end 2002) to 1,150 Gbps by the end of 2005. Meanwhile, the bandwidth of Taiwan's international telecommunications links via submarine cable, which stood at 210 Gbps by the end of 2002, will also be augmented.⁷⁵

DGT hopes that Taiwan's four operators of fixed telecommunications networks, namely state-run Chunghwa Telecom and private companies Eastern Broadband Telecommunications, New Century InfoCom and Taiwan Fixed Network, can speedup the establishment of their broadband infrastructures in line with DGT's efforts described above. Through these measures, DGT predicts that

the number of broadband Internet users in Taiwan will reach 70 percent of the total, at a one-way speed of 6 Mbps, by the end of 2006.⁷⁶

During 2001–2005, the local telecommunications and Internet services industry is projected to invest US\$4 billion in infrastructure, generate an average annual production value of US\$10 billion or GDP contribution of US\$2 billion, and generate 77,000 jobs.⁷⁷

Where e-government is concerned, online services will be expanded to encompass all public services. Customised digital services will be offered very soon. Furthermore, the successful development of the core plans discussed earlier is expected to have a positive impact on the export of IT products.

Finally, it is anticipated that the Taiwanese people will be able to enjoy the benefits of the information society in a just and equitable way through the efforts of the government to build a truly E-Taiwan.

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