CHAPTER 7

TAIWAN TELECOMMUNICATIONS INDUSTRY

William R. Boulton

INTRODUCTION

Taiwan is putting great effort into developing itself as a service center for the region. Chief among these efforts is the establishment of the Asia-Pacific Regional Operations Center (APROC), the center for six industries of primary importance in the economy. The six industries are telecommunications, manufacturing, finance, air transport, sea transport and the media. In June 2001, The Ministry of Transportation and Communications (MOTC) listed eight transportation-related businesses as emerging, strategically important industries eligible for investment tax credits. Included on this list are integrated Internet services operations, satellite mobile telecommunications, and fixed-line telecommunications. This classification will make it easier to lay new telecommunications lines.

TAIWAN'S NETWORK/COMMUNICATION

Taiwan's Network/Communication sector is changing. The modem market grew 23.3% in 2000, but revenues actually declined by 7.9%. Hubs declined in quantity by 14.1%, and by 20.8% in revenues. However, cable modems grew 100% in quantity, and 69.9% in revenues in 2000. The fastest growing area was switches, which grew 144.9% in quantity, and 102.9% in revenues. While modems and hubs are currently the largest businesses, switches will likely surpass them in revenue in 2002. In data communications, analog modems were the largest segment with $943 million in value for 2000. Taiwan has been strong in local area networks, but is working hard to develop wide area networks. There is also an explosion in the growth of xDSL markets.

In the telecommunications industry, Taiwan’s growth rate is projected to average 63% between 1999 and 2003, growing from under $2 billion in 1999 to over $13.8 billion in 2003. It includes five major sectors: wireless customer premises equipment (CPE), wireless transmission equipment (TE), wired line CPE, wired line TE, and central office (CO) switches. The market for CO switches, which depends on local service providers, remains flat at around $200 million. The largest markets are wireless and wired line CPE with production value of $1.25 billion and $726 million, respectively, in 2000. However, wireless CPE is forecast to reach $9 billion by 2003, doubling annually.

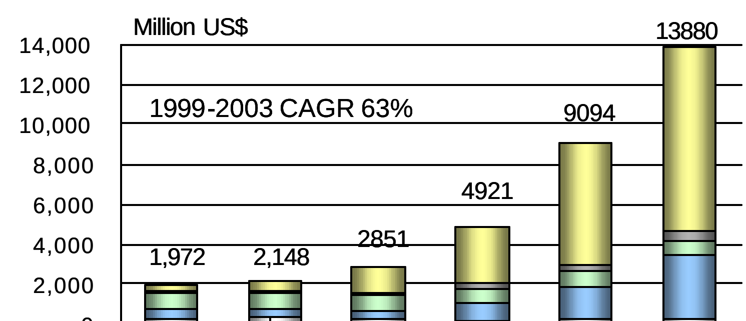
Taiwan Data Communication Industry — Volume = thousand; Value = Million US$

Product	2000		2001F		Growth Rate	
	Volume	Value	Volume	Value	Volume	Value
NIC	39,981	471	47,640	487	19%	3%
Hub	46,430	333	43,855	306	-6%	-8%
Switch	31,069	355	50,304	542	62%	53%
Bridge/Repeater	-	57	-	63	-	11%
Analog Modem	61,101	942	64,508	886	6%	-6%
Cable Modem	4,785	626	6,818	648	43%	6%
xDSL	1,312	139	2,997	327	128%	136%
ISDN	2,179	96	2,380	97	9%	2%
Total		3,018		3,357	-	11%

Source: MIC/III, January 2001

In optical communications, Taiwan has traditionally been strong in passive components with about 40% market share. In the past five years, Taiwan has been able to successfully enter the passive components market and has nearly 60% market share. However, consolidation is taking place in this industry as JDS Uniphase acquired 2 firms.

Taiwan Telecommunication Industry



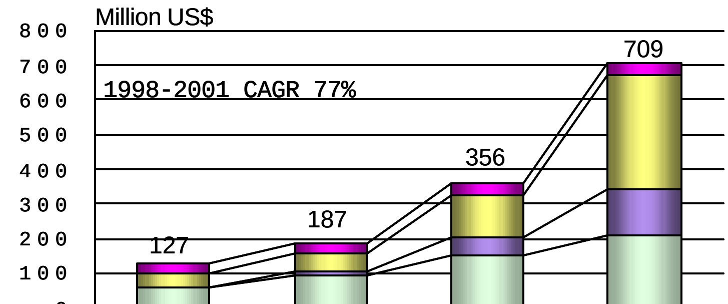
	1998	1999	2000	2001F	2002F	2003F
Wireless CPE	307	470	1,252	2,905	6,147	9,275
Wireless Trans. Equip.	135	140	194	271	328	395
Wired Line CPE	848	763	726	712	699	709
Wired Line T.E.	432	474	481	849	1,718	3,273
C.O. Switch	250	301	199	184	202	227

Source: MIC/III, January 2001

Twenty years ago, Taiwan was producing labor-intensive products. With increasing costs, its companies sought to add more value by moving into design. In the past 10 years, Taiwan has become a dominant player in IC and components. Three of the four leading chip set makers are in Taiwan - all but Intel. Taiwan is now using its experience to move rapidly into the telecommunications industry. Of the 10 mobile phone suppliers now in Taiwan, six are producing leading edge GaAr products. For three years, Taiwan has been developing the supply chain required for producing wireless products as was done previously for PCs and ICs. US technology was first transferred to Taiwan, and is now moving to mainland China. In 3G, Ericsson and Qualcomm are still the leaders, but Taiwan is targeting this area. Taiwan's manufacturers are looking to work with NTT DoCoMo. Companies based in mainland China are viewed as competitors, but often lack the trust that Taiwan-based companies have with major partners. Taiwan is working to strengthen its industry cluster in telecommunications, particularly for wireless.

When Taiwan entered the PC industry, there were not many firms able to conduct R&D. Instead, government labs played a key role. Today, the IT industry in Taiwan is strong and more research is carried out by industry. The government is now supporting industry research directly and putting more effort into international collaborations. For example, Taiwan missed 2G but is planning to be an important player in 3G. Taiwan is playing catch-up in W CDMA and is collaborating with mainland China on TDS CDMA. Taiwan firms are developing chip sets for TDS CDMA with government support.

Taiwan Optical Communication Industry

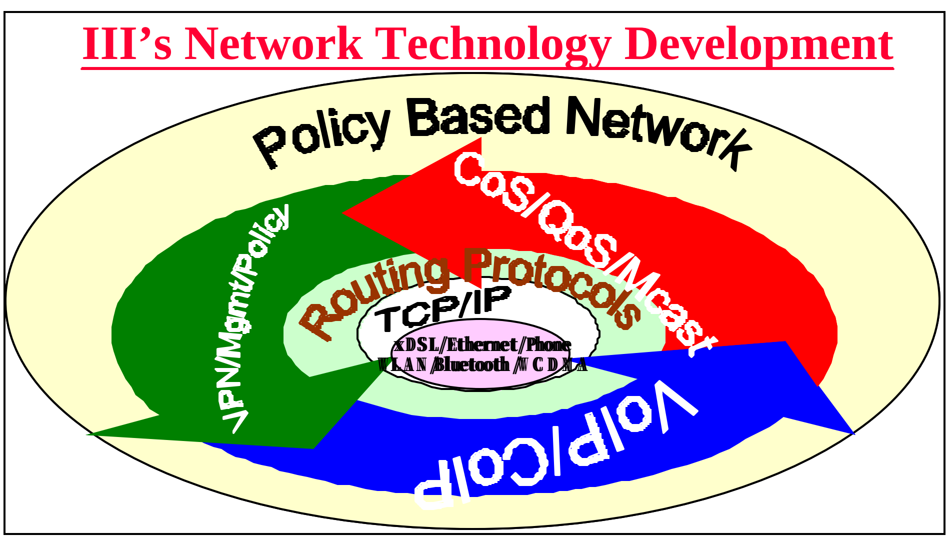


	1998	1999	2000	2001F
Transmission Equipment	25.2	27.2	29.8	37.3
Passive Component	41	53	122.7	331
Active Component	3.9	10.2	47.9	129
Optical Fiber & Cable	57.6	96.7	156	211.8

Source: MIC/III, January 2001

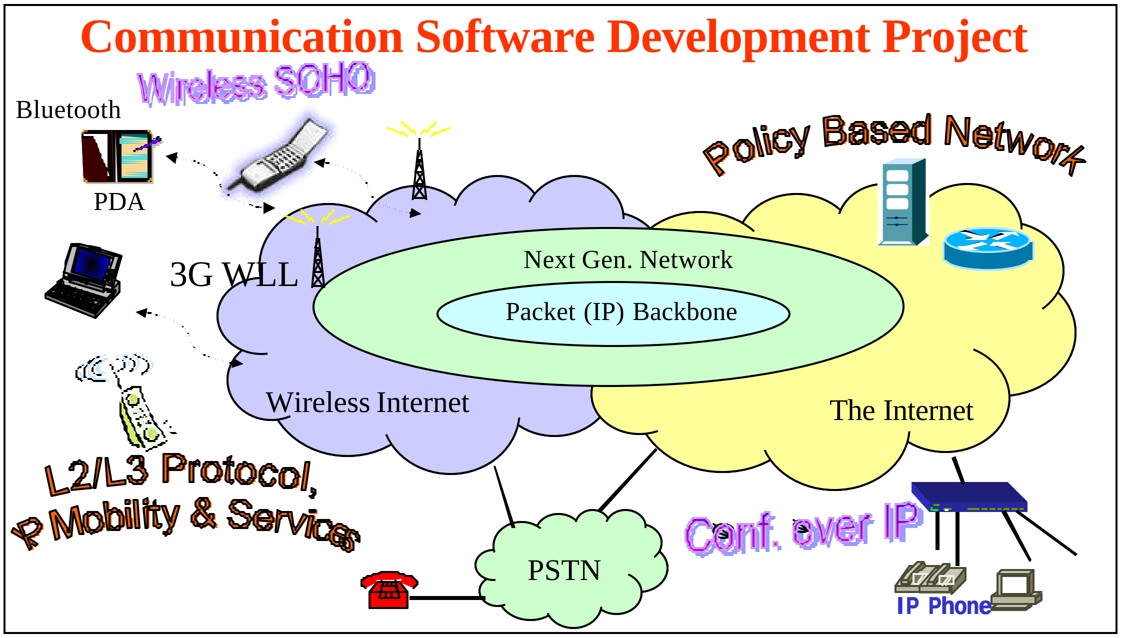
III'S NETWORKING AND COMMUNICATION TECHNOLOGY DEVELOPMENT

The government has set five priorities for wireless. The first is handsets. Second is wireless LANs, including Bluetooth. The third is IC design and chip sets for 3G devices, which is lead by GemTech. The



fourth is mobile commerce. III is also looking at iMode, MP3 downloading, and mobile message exchange. As wireless Internet evolves, III's network development will focus on VoIP/CoIP for communication, QoS/CoS/Mcast for interactive media, and Security/VPN for e-commerce.

III's approach in developing broadband networked multimedia is three pronged: including VoIP/H.323, VPN management policy, and CoS/Qos/multicasting. The underlying requirements for this include developing routing protocols for TCP/IP and providing wireless SOHO. This plan was established by MOEA and is being funded with $5 million per year. It is being implemented by III with support from various vendors.



TECHNOLOGY/PRODUCT ROAD MAP

The ultimate goal is to provide a TCP/IP based QoS/VPN enabled multi-service platform. The development of SOHO routers and Internet appliances will be central.

1. The priority is to develop a broadband access network by improving routing and performance of QoS/CoS/L3/L4. An ADSL router that outperforms Cisco's 677 router is already being produced.

2. It will require development of a VPN server with embedded PPTP (L2TP over Ipsec/IKE).

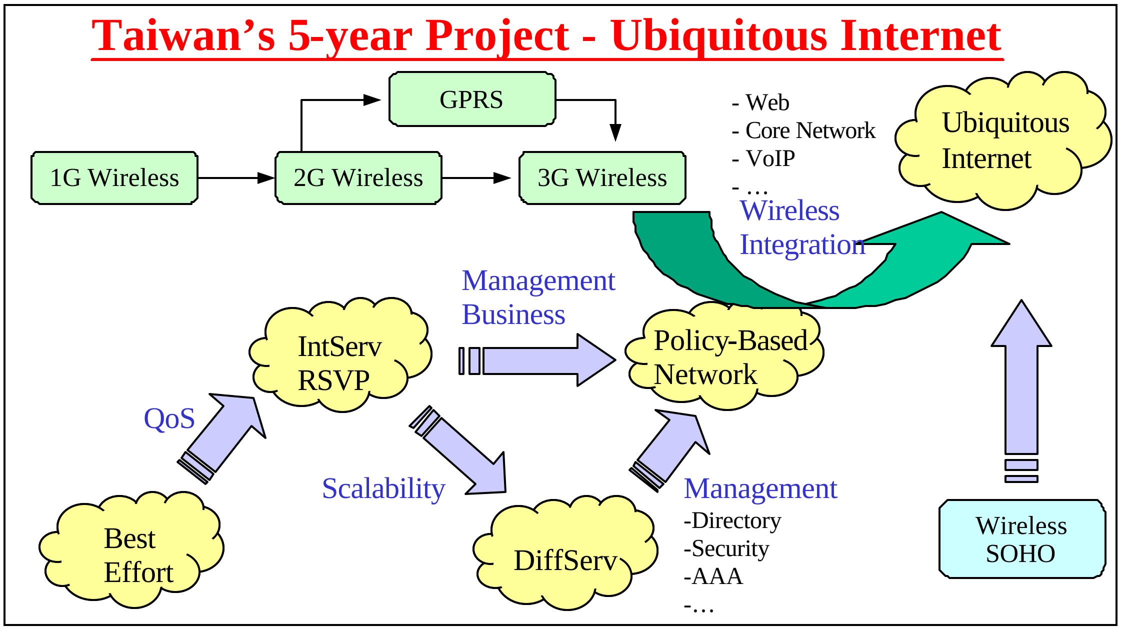
3. It will lead to the develop of a 802.11 wireless LAN that can provide a wireless SOHO, data/voice integration, and enable Bluetooth cordless phones. This will be in cooperation with industry to build chip sets.

4. It will lead to the development of H.323v2 and Iphone (MGCP) devices.

5. It will lead to routing and performance improvement

III has already put together a demonstration lab in four offices to demonstrate its wireless LAN, Bluetooth phones, and Bluetooth Internet access. III has cooperated with Cisco, Analog Devices, Motorola, Texas Instrument and Mitel on these activities.

Over 50 companies in Taiwan have technologies that support this activity. With the converging networks, wireless to IP will be essential. A communication software development project is underway to ensure that packet-based IP backbone and next generation networks will be able to communicate with wireless SOHO and Bluetooth, that L2/L3 mobility and service will be adequate, that conference over IP is available, and that policy based networks management is operational. The goal is to increase value to the network. To do this III is seeking to develop a good wireless application environment, IP mobility enabling technologies, and wireless access protocol technologies.



TAIWAN'S TELECOMMUNICATIONS DEREGULATION

The government's telecommunications policy is under the direction of the Ministry of Transportation and Communication (MOTC) and its department, the Directorate General of Telecommunications (DGT). Taiwan's government planned to completely open the island's telecommunications market to foreign investment in July 2001.

Mobile Competition

Taiwan has surpassed Hong Kong to become the nation with the highest rate of mobile phone usage in Asia. Taiwan's mobile phone penetration rate reached 80.2% in 2000. This percentage has increased rapidly from 4.5% in 1996, 6.9% in 1997, 21.6% in 1998, and 52.2% in 1999. MOTC reported that mobile phone users in Taiwan increased 6.33 million, or 54.9% on the year, from the end of 1999 to a total of 17.87 million at the end of 2000.

To initiate deregulation, the DGT awarded eight new cellular licenses in February 1997. The DGT divided the country into three regions: Northern, Central and Southern. The eight licenses were awarded either nationwide or by region. Two were for a nationwide service, and two for each of the three regions. The new networks began operation either at the end of 1997 or the beginning of 1998. About 20 percent of the investment can come from overseas. As of 2001, the six cellular operators and their area franchise are shown in the table.

Deregulation	**Date**
Local Loop	Jul 2001
Long Distance Services	Jul 2001
International Services	Jul 2001
Mobile Telephone Services	Jan 1997
Mobile Data Services	Mar 1997
CT2	Jun 1995
Paging	Jan 1997
Trunked Radio	May 1997
Leased Lines	Jul 2001
Broadband	Jul 2001
Packet Switching	Jul 2001
Satellite	Dec 1999

Operator	**Type**	*Area*	**Foreign Partner**
FarEastTone	DCS 1800	National	AT&T
	GSM 900	Northern	AT&T
KG Telecom	DCS 1800	Northern	Sprint
Mobitai	GSM 900	Central	De-Te-mobile Sumitomo
Taiwan Cellular	DCS 1800	National	GTE
TransAsia Telecom	GSM 900	Southern	Southwestern Bell
Tuntex	DCS 1800	Central	First Pacific
	DCS 1800	Southern	First Pacific

Chunghwa Telecom operates the only GSM 900/1800 nation-wide cellular system, combining GSM900's outstanding coverage and GSM1800's powerful capacity. Combining Chunghwa Telecom's GSM Network with a dual-band handset enables customers to enjoy the convenience of making calls to and receiving calls from almost any place in Taiwan through the close conjunction of GSM 900 and GSM 1800. Mobile originated national calls are charged per second.

Peak 0.115 NT$/second

Off-peak 0.058 NT$/second

The entry of six mobile network operators has forced Chunghwa Telecom to cede more than two-thirds of the cellular market in the country. After competition, the market share of Chunghwa Telecom fell from 100 percent to about 38 per cent. But the total number of subscribers has gone from 1.4 million up to almost 8 million. However, mobile and data communications revenues grew with respective year-on-year increases of 33.7% and 37.9% in February 2001. Since the six major telecom companies in Taiwan are connected, messages can be sent between different networks.

In December 1997, KG Telecom obtained Taiwan's first private GSM1800 mobile service license. In January 1999, KG Telecom acquired Tuntex Telecom, another major operator in Taiwan's telecommunications market, to provide island-wide GSM1800 service. KG Telecom has more than 1,500 employees with total capital asset at US$ 500 million. According to Taiwan's Directorate General of Telecommunications, KG Telecom has 3.06 million subscribers, giving it a market share of 19 percent.

In March 1999, KG Telecom announced the commitment to incorporate Asia's first GPRS (General Packet Radio Service) technology into its GSM network. In September 2000, KG Telecom launched the region's first nationwide GPRS, offering wireless broadband service to the 23 million people in Taiwan. GPRS provides a packet data transmission rate of over 115kbps in the mobile environment. On November 30, 2000, DoCoMo paid NT $17.1 billion for a 20 percent stake in KG Telecom, the third-largest of Taiwan's six mobile phone service providers. The deal with DoCoMo is seen as boosting KG Telecom's chances of winning a license from Taiwan's government to offer 3G mobile Internet services.

KG Telecom's M-Mode Information Services offer its customers a combination of mobile commerce and mobile Internet, including WAP, A-MoneyMachine financial service, Mobile Banking, Mobile Securities, Mobile Secretary, Mobile Dictionary, Ringtone & Graphic Download and the M-Mode website (http://www.mmode.net).

Message rates in Taiwan vary from company to company. At NT$2 (HK45c) per message, Chunghwa provides the cheapest service, while TransAsia charges the highest rate at NT$3.50 (HK80c) per message. The cheapest way to send short messages is to subscribe to a service provider for delivery over the Internet. The average cost per message is NT$2.50 (HK57c).

Taiwan Cellular Corp. (TCC) bought 97% of regional rival TransAsia Telecommunications Inc. for NT$13.5 billion (US$409 million). Cash-rich Taiwan Cellular had some NT$9 billion in retained profits and another NT$2 billion in earnings each month. Taking TransAsia off the auction block denied rivals an easy way to expand market share in the highly saturated Taiwan market, where a population of 23 million holds 18.6 million mobile phone subscriptions. TCC, which is 13.5 percent owned by Verizon Communications of the United States, had 5.27 million subscribers at the end of February 2001, while TransAsia had 653,319. The acquisition will secure TCC in its leadership position in wireless telecommunication and boost subscriber numbers to over 6m from around 5.5m. Main rival Chunghwa Telecom has 4.78 million subscribers. Its principal stockholders are Pacific Electric Wire & Cable Group, Evergreen Group, Fubon Group, Acer Group, Continental Engineering Co., Ltd., Yageo Corp. and GTE.

Analysts feel that Far EasTone, which is partly owned by AT&T Wireless, is likely to seek a takeover bid for Mobitai Communications. Far EasTone's corporate parent, Far Eastern Textile, took a 4.25 percent stake in

Mobitai last year. Subscribers are 3.66 million for Far EasTone, Compaq Computer Corp. is due to conclude an alliance by the end of June with Far EasTone Telecommunications Ltd. of Taiwan, MTel Ltd. of Hong Kong, and 150 ISPs. Far EasTone will provide the Compaq's new iPAQ pocket PC with system services, while MTel Ltd. will use its compression skills to enhance the GSM transmission speed to 40-50kbps from the current 9.6kbps. This will enable the pocket PC to directly offer data services, according to a Compaq executive. Compaq is counting on its new pocket PC to challenge NTT DoCoMo Inc.'s dominance in the data service market. The iPAQ will also come with a GSM (global systems for mobile communications) module, which provides mobile phones with Internet access once a SIM card is inserted into the phones.

If the experience in Europe is anything to go by, Taiwan's 18 million-plus mobile phone subscribers could be the catalyst for short message service growth rates in excess of 100% over the next few years. On average, each text message can only generate unit profits of NT30c to NT50c (HK07c to HK12c), calculable as a gross profit of NT$150,000 to NT$250,000 for 500,000 messages. After technical and marketing costs, it is likely that the telecommunications companies will make profits.

3G Telecom Market

MOTC plans to auction five third-generation (3G) wireless telecomm licenses by November 2001, and announce the winners in December 2001. The five licences include four new ones and one for the outdated first generation advanced mobile phone system (AMPS), which will be withdrawn from state-controlled Chunghwa Telecom and re-auctioned as a 3G license. The licenses will be for 15 years and cover all of Taiwan.

Taiwan's four major mobile telecommunications service providers, Taiwan Cellular Corp, KG Telecommunications Co, Far EasTone Telecommunications Ltd and Chunghwa Telecom Co are all expected to win licenses. The fifth license could go to Taichung-based Mo Bi Tai Communications Corp and its partner, the Cathay Group. According to the research arm of Nomura Securities, such a license will be worth between $300 million to $1.2 billion. Taiwan Rating Co. estimates the value of each license will be between NT$ 10 billion and NT$ 15 billion.

Information technology giants Acer Group, First International Computer (FIC), Inc. and MiTAC International Corp. of Taiwan have recently entered the third-generation (3G) cellular telephone business. Acer and MiTAC have formed 3G technology teams and FIC has organized a venture to compete for a 3G license. Acer will focus on the 3G modules that integrate 3G technology and PDA solutions. MiTAC is also developing 3G technology and plans to manufacture mobile phones when the market is mature. The company is also developing 3G modules.

FIC is the only one of Taiwan's top three computer manufacturers to announce plans to bid for a 3G license. The company has organized a 3G communications venture, in which Qualcomm Inc. of the United States has acquired a 15% stake. The alliance would include Qualcomm, Shin Kong Group, Prince Motors Co., Ltd., China Development Industrial Bank, Sagatek Co., Ltd., Taiwan Secom, and Systex Corp to compete for a 3G license.

Fixed-line Competition

The number of mobile phone users far exceeds the 5.23 million land-based phone accounts. On March 20, 2000, MOTC issued licenses for fixed-line networks to three domestic companies: Taiwan Fixed Network organized by Pacific Electric Wire & Cable, New Century InfoCom led by Far Eastern Textile, and Eastern Broadband Telecommunications formed by Eastern Multimedia Group. The new fixed-line players are expected to wage price competition in order to gain a foothold in the market. Chunghwa Telecom will experience pressure on prices and market share and will thus see further revenue decline in its fixed-line segment once the new operators start to provide services in April 2001.

By February 2001, Chunghwa Telecom's revenue fell to NT$15.2 billion, representing year-on-year and month-on-month decreases of 3.2% and 4.2%, respectively. Beginning in April, Chunghwa Telecom cut rates 18 percent on local long distance calls and 37 percent worldwide, including a 57 percent price decrease on calls to China and 54 percent on calls to Hong Kong, Canada and the US. Eastern Broadband Telecom Ltd. received official approval for its long distance calling rate cuts, undercutting Chunghwa Telecom Co's lowest rates by as much as 24 percent on calls to anywhere in China. Calls to the US and Canada on Eastern Broadband lines will only be 3.4 percent lower. Sparq (also known as New Century InfoComm Co) and Taiwan Fixed Network Co. pledged to slash prices in a bid to keep up with Chunghwa Telecom's drastic rate cut. Chunghwa Telecom expects its share of the local telephone market will decrease by 20%, and its share of the international telephone market will shrink by 30%. Some analysts say that because Chunghwa controls access to Taiwan's 12.9 million home and business connections -- built with the aid of taxpayer money -- the state-run company is dragging its feet on connecting new competitors.

Chunghwa Telecom is purchasing 1.26 million Asymmetric Digital Subscriber Lines (ADSL) from Alcatel to cover all major cities in Taiwan. It is believed to be the world's largest order of ADSL lines by one telecom operator. ADSL, however, supports two-way transmission rates of from 1.5Mbps to 9Mbps when receiving data and up to 640kbps when sending data. Alcatel commands 53% of the global DSL market. Up to the end of 2000, Alcatel has shipped 7.7 million xDSL lines to operators worldwide. Chunghwa Telecom was considering another 1 million ADSL lines, for a total purchase of 2.8 million ADSL lines purchased in three years. Hoshin GigaMedia and Eastern International Network are the top two providers of cable modem access at present with more than 40,000 existing users each at the end of March 2001.

Foreign companies will be allowed to enter fixed-line network services by July 2001, provided that the three local firms with licenses for operating fixed-line networks are operating by then. Taiwan's telecommunications market will then be totally deregulated in 2004. This represents the first opening of Taiwan's fixed-line business, which is now monopolized by the state-run Chunghwa Telecom. Demand for fibre optic cable in Taiwan is expected to reach over NT$1 billion within the next year. In addition, the minimum paid-in capital required for establishing a fixed-line network carrier will be lowered from the current NT$40 billion. The ceiling of direct foreign investment in a local telecommunications company will be raised to 40 percent from the current 20 percent, while no restrictions will be imposed on indirect foreign investment. In short, combined direct and indirect foreign investment in a local telecommunications firm will be permitted to reach 100 percent of the company's total capital.

The ministry also reports that the number of Internet accounts increased 62% from the end of December 1999 to 4.65 million at the end of December 2000. Chunghwa Telecom's Internet service provider (ISP) HiNet has the highest number of Internet users at 2.1 million. Taiwan's private ISP enterprises have a combined total of 2.53 million Internet users. There are approximately 180,000 ADSL users in Taiwan. HiNet has about 75% of this market with nearly 140,000 customers. The Ministry of Education's ISP Tanet has 14,000 Internet users.

Chunghwa Telecom Co. Ltd

Chunghwa Telecom is the largest telecommunications service company in Taiwan, offering local, long-distance, international calls, mobile cellular phones, and other convenient and versatile services. Chunghwa Telecom is divided by regions and seven fields of business: Northern Taiwan, Central Taiwan, and Southern Taiwan, Long Distance and Mobile, International, Data Communication, and Global Development. Telecommunications Laboratories and Telecommunications Training Institute are the other two subordinates. The company also has District Operating Centers to serve customers.

In 1999, the firm raked in NT$40.8 billion (US$1.2 billion) just from international calls, and one analyst estimated Chunghwa would lose NT$21 billion (US$617 million) over the next three years to the new competitors.

Chunghwa Telecom Labs (TL), founded in 1951 in the name of Radio-wave Research Laboratory and reorganized in 1969, was under the supervision of the Ministry of Transportation and Communications (MOTC) prior to 1996. Its major missions include:

1. Providing Chunghwa Telecom with technical support;

2. Supporting policies of the Executive Yuan and MOTC;

3. Participating in national telecommunications technology R&D projects; and

4. Engaging in technological cooperation with and transfer to local telecommunications companies, and offering them technical support to explore overseas markets.

TL has seven labs concentrating on Wireless Communication, Broadband Transport & Access, Internet & Multimedia Application, Network Operation Support, Customer Service Information, Advanced Tech. Research, and Customer Premises Equipment (CPE). There are also supporting units such as The Planning and Technology Promotion Department, the Product Implementation and Maintenance Department, the Special Projects Department, and the R&D Service Department. TL has some 1,400 employees of which 1200 are engineers, and 80 percent have masters or doctorate degrees.

TL's R&D covers the areas of network technology, wireless communication technology, network access technology, Internet, optical-loop telecommunications, telecommunications operation supporting system technology, new service telecommunications technology, and customer service information technology. Among others, TL's optical amplifier has been widely used in long-distance fiber-optical transmission systems; its DFB laser diode and light-inspector are capable of conducting high-energy physics research projects and searching for DFB laser diode and Photo-Diode Array Receiver Module which are needed in Top Quark Particle accelerators. These results are made in cooperation with Academia Sinica and used by the Fermi Lab of the United States.

The ST-1 satellite was successfully launched from Guyana of South America in cooperation with Singapore Telecom and began operations on December 1, 1998. This joint venture is part of a strategy to make Taiwan an Asia-Pacific telecom center.

Also commissioned by the MOTC, the Electronic Toll Collection system for national freeways has been tested since 1998 and will be implemented in 2001. At that time all freeway users can enjoy an intelligent transportation system.

Concerned about disabled people, TL has designed a dozen of products particularly for them such as the Chinese Automatic Reading Machine for the blind.

As the company's major R&D pillar with its developed technologies, TL provides technical support to a great number of customers and ensures service quality. Their R&D aims at sharpening Chunghwa Telecom's market competitiveness. TL’s strategy is to develop core and forward-looking technologies to consolidate Taiwan's telecommunications development and operation.

Taiwan´s Handset Makers

An informal survey of Taiwan's handset makers suggests the industry grew by almost 500 per cent last year with a total output of about 10 million handsets - just 2.5 per cent of the approximately 410 million mobile phones sold last year. Dbtel had expected to sell eight million handsets last year, but produced only 4.5 million after Motorola cancelled orders. While Arima expects to produce eight million to nine million phones, some analysts have reduced it to as low as four million.

In January, Ericsson signed a deal, expected to be eventually worth $450 million, with Taiwan's GVC Corp. for the design and production of cellphones. Last year, GVC made about 900,000 cellphones and expects to make 2 million this year on the strength of the Ericsson deal. However, some put the figure at 3.5 million to four million.

Acer Communications this year expects to more than double its 2000 shipments of about 4.6 million handsets as orders increase from its main client, Motorola. Like the Ericsson-GVC deal, Acer is hoping that Motorola will also utilize its research and development skills for new cellphone design. Taiwan's mobile phone manufacturers have set annual production targets at 48 million handsets for 2001. Achieving their targets would result in a 300% growth rate compared to their combined output of 12 million handsets in 2000. In fact, output will be lower, given the 10% expected industry growth. Production estimates for 2001 are:

ACM - 8-13 million

Dbtel - 8-15 million

Arima - 8-10 million

Compal - 5 million

Quanta - 3 million

GVC - 4 million

Total: 36-48 million

FIC has stopped production of 2G mobile phones since this competitive segment is no longer profitable. Changing economic conditions in Taiwan, especially increasing salaries, make the rise of the mobile-phone manufacturing business different from the growth of the island's PC industry in the 1990s. Future competitors are expected to design in Taiwan and manufacture in mainland China

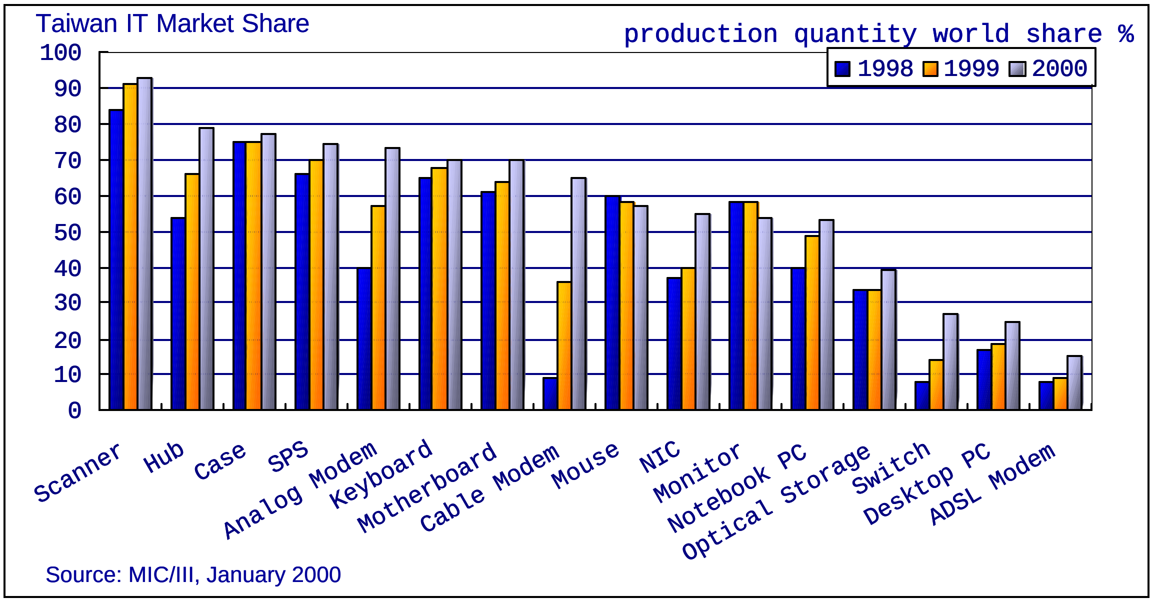
Taiwan's Market Intelligence Centre (NIC) reported telecommunications equipment industry sales of over $3 billion last year. While this is less than 10% of what Taiwan's PC production sales were last year, the projections for growth are impressive.

MIC estimates that in 2003 the industry will produce more than $10 billion worth of products. That is four times the projected growth of the PC industry in Taiwan and twice the projected growth of the world's telecommunications industry.

China Relations

Taiwan and mainland China will cooperate in the drafting of communications standards for third-generation (3G) mobile phones. The first step in cooperation is to set up special interest groups (SIG) to standardize the terms used in the communications and telecommunications industry so that the cooperation can be applied to a wide spectrum of areas. Mainland China would lift the ban on Taiwan-made mobile phones when the mainland is admitted to the World Trade Organization (WTO) officially. China wants Taiwan's design and manufacturing capability.

After the mainland joins the WTO, foreign investment is expected to gradually become concentrated in the telecommunications, finance, insurance, high technology, and product research and development industries.



Economic Uncertainty

Taiwan's IT Industry had a production value of $56.6 billion in 2000, a growth rate of 21%. This number represents output from Taiwanese firms and their international operations. Historically, IT hardware has represented about 85% of the production value of the IT industry. However, the growth rate continues to decline as the industry matures and prices erode, and is projected to grow at only 15% (to $54 billion) in 2001, 9% (to $58.9 billion) in 2002, and 7% (to $62.2 billion) in 2003.

In 2000, IT hardware accounted for over $47 billion in production value, with growth rates of 18% in 1999 and 2000. However, this percentage is falling since growth rates in software, data communication, and telecommunications reached 25% (to $3.7 billion), 47% (to $3 billion) and 45% (to $2.8 billion), respectively, in 2000. Taiwan's worldwide unit market shares for PC and data communication product sectors continues to grow: reaching 80% for hubs, 65% for cable modems, over 25% for switches, and 14% for ADSL modems in 2000.

In IT hardware, the US was first with $88.5 billion, Japan with $45.5 billion, and the PRC with $25.5 billion. In 2000, Taiwan's domestic production value ($23 billion) of IT hardware ranked 4th in the world. About half of Taiwan's production value is located overseas. Taiwan's production grew at only 10%, compared to 38% in mainland China.

However, 73% of mainland China's production value is generated by Taiwanese firms. Due to labor and supply costs, Taiwan's offshore production increased from 47% to 51% of production value between 1999 and 2000. Production in mainland China increased from 29% to 31% of Taiwan's IT production value during that time.

Leading IT Producers Million US$

2000 Ranking	Country	1999	2000	00/99 Growth Rate
1	US	85,085	88,489	4%
2	Japan	44,051	45,468	3%
3	PRC	18,455	25,535	38%
4	Taiwan	21,023	23,081	10%
5	Great Britain	16,007	16,167	1%
6	Germany	10,910	12,001	10%
7	Malaysia	8,865	10,638	20%
8	Mexico	8,568	10,281	20%
9	Ireland	9,271	10,013	8%
10	S. Korea	8,862	9,925	12%

Source: European and US Yearbook; EIAJ, EIAK, NRI, MIC/III, January 2001

Production outside of Asia increased from 5% to 13% between 1999 and 2000 as Taiwanese firms expand global operations. As Taiwan lost competitiveness in labor costs, firms moved offshore to countries like Malaysia and Thailand. Later, operations were moved to lower cost countries like the Philippines and mainland China. For example, 95% of keyboards, mouse, and SPS are produced offshore, of which 85%, 95%, and 90% are produced in mainland China, respectively. All offshore production of scanners, 86%, are produced in mainland China. 45% of motherboards are produced in mainland China. Now, operations are being moved closer to markets like Mexico in North America and Latin America. In Europe, lower cost areas like Scotland or Hungary in Eastern Europe are targets.

Taiwan IT Industry Million US$

	1998	1999	2000	99 Growth	00 Growth
IT Hardware Industry Production Value	33,776	39,881	47,010	18%	18%
IT Software and Service Industry	2,197	2,966	3,722	35%	25%
Data Communication Industry Production Value	1,755	2,052	3,017	17%	47%
Telecommunication Industry Production Value	1,764	1,973	2,851	12%	45%
Total	39,492	46,872	56,660	19%	21%

Source: MIC/III, January 2001

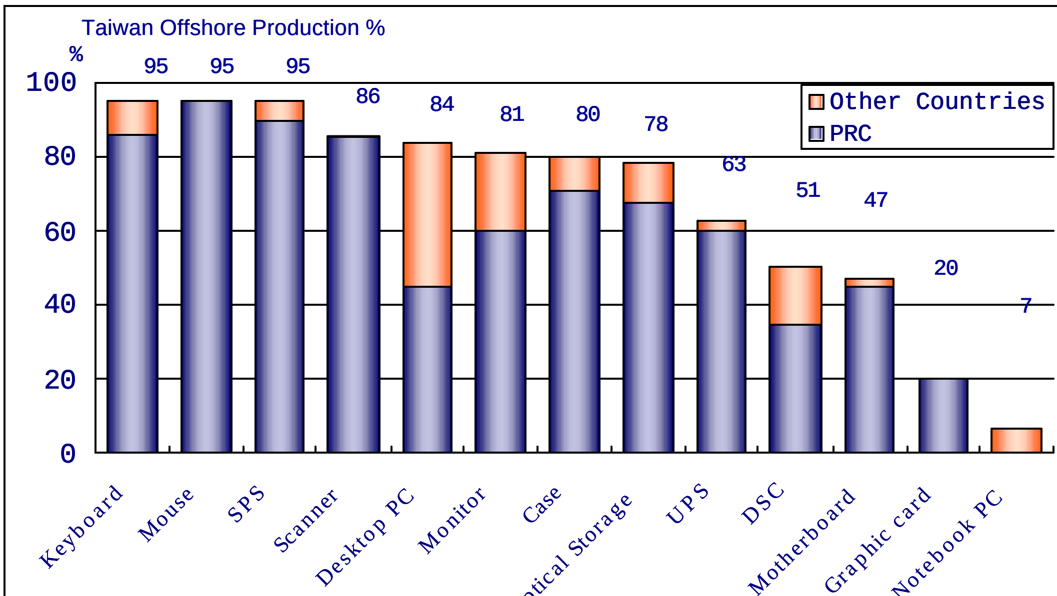
In the 1980s, Taiwan concentrated on consumer products, but as technologies begin to merge, Taiwan is focusing on telecommunications and software development. Software reached $3.7 billion in 2000, and is projected to nearly double by 2003. It is projected to grow at rates of over 20%. While software was initially developed for the domestic market, exports grew 39% in 2000 to over $300 million, primarily to Japan and North America. Of course, the mainland provides a huge potential market.

In 2001, Taiwan's unemployment rate rose over 4 percent, meaning about 400,000 people are out of work, a 40 year high. Shipments fell 23 percent from 2000 to US$10.2 billion, the Ministry of Finance said, the biggest decline since January 1998. Imports dropped 30 percent to US$8.9 billion. That left a US$1.2 billion trade surplus, compared with a US$356.2 million surplus in April. Adding to the bad news was a report from International Data Corp, which said that US sales of PCs are expected to show their first decline this year, sliding 6.3 percent from last year's level. The market research group predicts US PC sales of 45.3 million units this year, compared with 48.4 million last year.

In addition, the Semiconductor Industry Association said it expects worldwide sales of microchips to slip to US$175 billion this year, a drop of 14 percent from the year before. Previously, the group thought sales would rise 10 percent. US purchases of Taiwan-made goods fell 26 percent from a year earlier to US$2.3 billion, or almost a quarter of total exports. Shipments to Japan fell 25 percent to US$1.08 billion, and exports to Europe fell 24 percent to US$1.53 billion. Sales of electronics, the biggest export, fell 27 percent to US$1.89 billion after an 18 percent decline in April. Exports of mobile phones and other telecommunications goods fell 25 percent to US$1.20 billion, compared with an 18 percent drop in April.

Over the past decade, Taiwan's industries have gone through structural adjustment or up-grades, shifting from traditional, labor-intensive industries to capital-intensive, technology-intensive or so-called knowledge-based industries. The new technology-intensive or service-based industries, however, cannot fully absorb the labor force released by traditional industries. Many labor-intensive industries have also left the country. As a result, structural unemployment keeps rising.

The increase in cyclical unemployment is due to deteriorating economic conditions both at home and abroad in the second half of 2000, which led to an economic slowdown. Taiwan is an open island economy, depending heavily on trade. The combined value of exports and imports is higher than the country's GDP. Thus, Taiwan's economy is deeply influenced by the international economic situation, especially by that of the US.



- Local supply and lower production cost drive Taiwan toward global operation
- Offshore production continues to increase from 47% in 1999 to 51% in 2000
- China gains another 2 points from 31% whereas production outside Asia jumped from 5% to 13%

Source: MIC/III, January 2001

In 2000, Taiwan's exports accounted for 54.2 percent of its GDP. The US accounted for 25 percent of Taiwan's exports while Japan accounted for about 8 percent, and mainland China (including Hong Kong) accounted for about 25 percent. In the second half of 2000, the US economy slowed down, and its high-tech industries stagnated and even declined.

Over the past 20 to 30 years, electronic and IT products have been Taiwan's main exports. When US high-tech industries grow slowly or even decline, Taiwan's electronic and IT industries inevitably suffer.

Another reason why cyclical unemployment keeps rising is that the domestic environment for investment and cross-strait relations have not improved. Both the ruling and opposition parties are responsible for the poor investment environment, including the difficulty in acquiring land, high land costs, inefficient administration, rigid regulations and bad financial services. This created a crisis of confidence and has led to a massive capital outflow, especially to China, and a decrease in domestic investment.

The ultimate solution is to improve the domestic investment environment, including eliminating rigid regulations, increasing administrative efficiency, improving services in the financial sector, minimizing political disputes, lowering land costs, etc. In particular, lowering the cost of land is the only way to keep entrepreneurs from leaving the country.

In the past, the establishment of the Hsinchu Science-based Industrial Park provided cheap land to technological industries, creating a boom in Taiwan's electronic and IT industries, and winning the country an important position in the world. Following the model of the Hsinchu Science-based Industrial Park, government land in the industrial and commercial areas should only be available for lease, not for sale. Entrepreneurs could lease the land for 30 to 50 years at low cost, thereby lowering their production costs. This will definitely make entrepreneurs more amenable to staying in Taiwan, and thus create more job opportunities.

Hsinchu Science-based Industrial Park

After reaching a record-high 102,840 employees at the end of December 2000, the Hsinchu Science-based Industrial Park experienced the first decline ever in the size of its workforce in January, with a net loss 73 employees. Park managers expect the workforce to shrink to between 90,000 and 100,000 people in February. Acer Computers recently laid off 800-900 employees in Taiwan and other companies are also expected to announce plans for downsizing. Companies located in the park are feeling the impact of the global economic slowdown and the attraction of the lower costs of manufacturing in mainland China. Companies are laying off workers, freezing workforces, forcing employees to take extra days off and making annual repairs to facilities in order to make it through this economic slump.

The Park at the present has 289 companies, with a combined sales of 30 billion in 2000, a 46% growth over the previous year. There are six major industries in the Park: Integrated Circuits, computer peripherals, telecommunications, optoelectronics, precision machinery, and biotechnology. The following chart (Table I) shows the profiles of these industries for the year of 2000.

While the number of enterprises waiting to set up in the park has not declined, the types of companies wanting to get in has changed a bit. There are about 30 enterprises waiting to get in. Nine biotech companies comprise up the largest category waiting to get into the science park, which is known for its information technology hardware companies. IC design, optical electronics, and telecommunications companies make up the next three largest categories.

Table I: Hsinchu Science-based Industrial Park Clients

Industry	*Companies*	*Employees*	*Sales (usm)*	*Growth (%)*
Integrated Circuits	116	61,288	18,496	67

Computers/Peripherals	49	16,064	6,815	8
Telecommunications	50	7,334	1,628	28
Optoelectronics	44	16,167	2,595	61
Precision Machinery	12	1,351	233	55
Biotechnology	18	636	36	75
Total	***289***	***102,840***	***29,803***	***46***

Source: Hsinchu Science-based Industrial Park Publication [2]