International Telecommunication Union

Broadband Korea: Internet Case Study

March 2003

International Telecommunication Union

This report was prepared by Tim Kelly, Vanessa Gray and Michael Minges. It is based on research carried out from 23 to 30 May 2002 as well as articles and reports noted in the document. The assistance of *the Ministry of Information and Communication*, particularly Sang-Hak Lee, was indispensable and highly appreciated. The assistance of colleagues within ITU is also noted particularly Nathalie Delmas, who formatted the report and created the cover. Both Jin-Kyu Jeong and Chinyong Chong provided detailed comments.

The report would not have been possible without the cooperation of the many Korean organizations who offered their time to the report's authors. The report is one of a series examining the Internet in developing nations. Additional information is available on ITU's Internet Case Study web page at http://www.itu.int/ITU-D/ict/cs/.

The report may not necessarily reflect the opinions of ITU, its members or the Government of the Republic of Korea.

The title refers to Korea's top ranking in broadband Internet penetration.

NOTE: UNLESS STATED OTHERWISE, ALL REFERENCES TO KOREA IN THE REPORT REFER TO THE REPUBLIC OF KOREA ALSO COMMONLY KNOWN AS SOUTH KOREA.

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1. From rags to riches in ICT

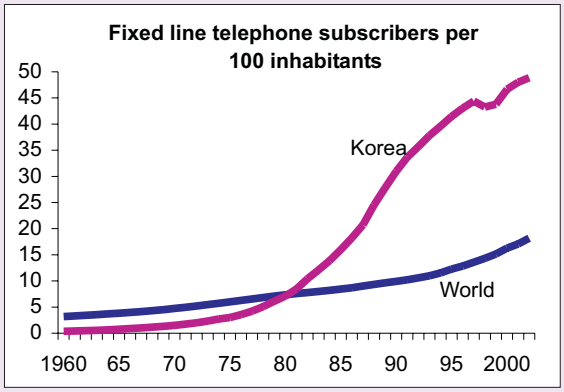
1.1 The Korea miracle

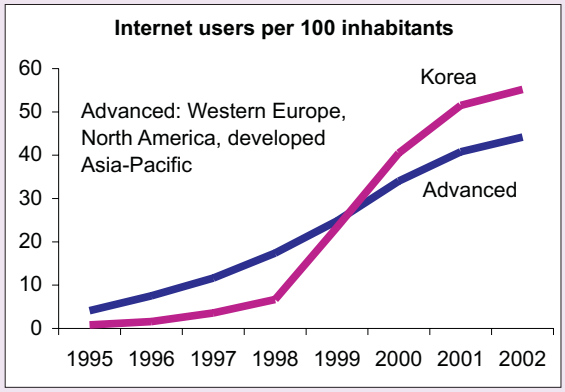
The Republic of Korea (Korea) has made major strides in Information and Communication Technology (ICT) over the last four decades:

- In 1960, Korea had a telephone penetration of 0.36 per 100 inhabitants, barely one tenth of the then world average. By 1981, Korea caught up with the world average and at the end of 2002, its teledensity was 48.8, or almost three times more than the world average (see Figure 1.1, top left). Today 92 per cent of Korean households have a fixed telephone and 79 per cent have a mobile one.
- In 1995, Korea had less than one Internet user per 100 inhabitants. In 1999, it surpassed the developed nation average (see Figure 1.1, top right) and by the end of 2002 was the world's fifth largest Internet market, with 26 million users. Korea has the third highest Internet penetration in the world and ranks top in Asia (see Figure 1.1, bottom left).
- Korea leads the world in broadband Internet access penetration. At December 2002, Korea's penetration of Digital Subscriber Line (DSL) and cable modem Internet access was first in the world (see Figure 1.1, bottom right).

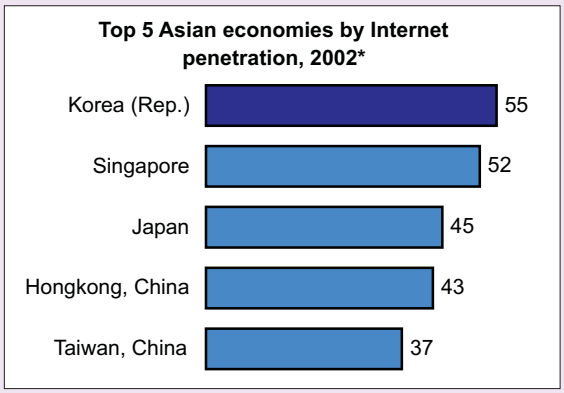
Korea is the leading example of a country rising from a low level of ICT access to one of the highest in the world. Is Korea a miraculous exception or are there lessons to be learned for other countries? This case study examines the factors that have accelerated ICT development. This chapter looks at the extent to which ICT has permeated Korea in its efforts to transform towards a knowledge-based society.

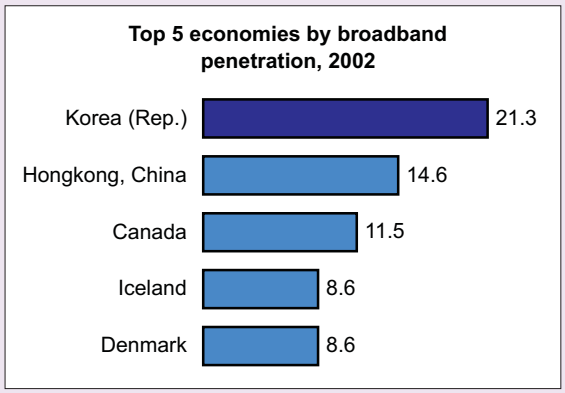
Figure 1.1: Korea catches up ...





... and starts to take the lead





Note: *PC-based users.
Source: ITU World Telecommunication Indicators database.

1.2 What explains Korea's success?

Korea is not demographically suited to have the highest Internet penetration in Asia. It is the largest of the so-called *Four Tigers* (the others being Hong Kong, China; Singapore and Taiwan, China) both in terms of land area and population. The Republic of Korea's population stood at 47.7 million in 2001, twice as large as Taiwan, China, seven times bigger than Hong Kong, China and more than 11 times larger than Singapore.

Korea is also not economically suited to have the highest Internet penetration in Asia. All the other Tigers have a higher per capita income than Korea's US$ 9'400 in 2001 as do 50 other economies. The World Bank classifies Korea as an upper-middle-income country, one category down from the high-income classification. Therefore, though Korea is not poor, it is not among the world's wealthiest nations. Hence, Korea's high level of Internet penetration is not strongly correlated to its income level.

Another factor seemingly weighing against Korea's ICT development is language. Koreans have their own language. Therefore, the country cannot easily leverage the vast amount of content developed in more widely spoken languages. The Korean alphabet, known as Han-gul, uses a pictographic font that is not ideally suited to computerization.

On the other hand, Han-gul is phonetic with one character representing a sound, making it easy to learn: *"Han-gul is a simple, scientific language. Learning how to read it is easy, which is probably one of the reasons why Korea has one of the highest literacy rates in the world."*[1] This is where the tide starts turning in Korea's favour. Its literacy rate of 97.6 is the highest among the Asian Tigers.

Korea also excels in education. Its overall school enrolment rate (primary, secondary and tertiary) of 90 per cent is the highest among the Asian Tigers. Primary school is compulsory (and free) and soon secondary will be. Korea's tertiary school enrolment is quite high at 68 per cent. Korea has the highest level of secondary school graduates among all high-income Asia-Pacific economies.

Table 1.1: Socio-demographic indicators

Selected socio-economic indicators for Asia-Pacific economies

	Gross National Income per capita, US$, 2001	Land area (km², 000s)	Population			Literacy	School enrol--ment	Tertiary students per 100 inhab-itants d)	Second -ary+ c)
			Total (000s) 2001	Density Per km²	% Urban				
Korea (Rep.)	**9'400**	**99**	**47'676**	**482**	**82**	**97.6**	**90**	**5.0**	**71.8**
New Zealand	12'380	268	3'912	15	87	99.0	99	4.6	72.4
Taiwan, China a)	14'188	36	22'406	619	84	95.6	83	3.3	58.2
Australia	19'770	7'682	19'604	3	85	99.0	116	5.4	67.3
Singapore	24'740	0.682	4'131 b)	6'055	100	92.5	75	2.5	55.0
Hong Kong, China	25'920	1.099	6'760	6'151	100	93.3	63	1.6	52.1
Japan	35'990	365	127'370	340	79	99.0	82	3.1	66.2

Note: a) Data for Taiwan, China from Bureau of Statistics. b) Mid-year. c) Per cent of adult population with at least a secondary education. d) 1995 or latest year available.
Source: National statistics (Population, Secondary+), World Bank (GNI, land area, urban population), UNDP (literacy, school enrolment), UNESCO (Tertiary students).

Korea's high rate of literacy and school enrolment are essential prerequisites for the widespread adoption of ICTs. These factors have helped contribute to the growing impact of ICT in Korean economy and society.

1.3 ICT in the Korean economy

Korea's economic growth is often described as a *miracle*. Starting with a per capita income of less than US$ 100 in 1960, Korea averaged an annual economic growth rate of eight per cent a year for the next four decades. By 2000, per capita income was US$ 8'910 and Korea's economy ranked 13th in the world. The focus of growth has been manufacturing and exports. As Korea's economy has matured, its manufacturing base has shifted from textiles, to chemicals, then machinery and later electronics. Today knowledge and information products and services play an important and increasing role in the Korean economy.

Korea divides its ICT sector into three segments: Telecommunication Services, Information Communication Equipment and Software. The ICT market accounted for US$ 103 billion in 2001 (see Table 1.2). The share of the ICT industry in the Korean economy was 13 per cent in 2000, up from 8.6 per cent in 1997 and the highest among the Organization of Economic Cooperation and Development (OECD) countries.[2]

ICT is also adding value to the economy at a rate higher than other sectors. ICT contributed 50 per cent of the growth in overall GDP in 2000. Apart from the direct benefits to people and companies, ICT has the indirect benefit of contributing to overall economic wealth and employment. The ICT sector in Korea employed 1.3 million people at the end of 2000 and is forecast to grow around five per cent through 2005, compared to only two per cent for overall employment.

Manufacturing has underpinned Korea's economic growth. The manufacturing sector has traditionally been dominated by large *chaebols* that today are known around the world (e.g., Samsung, LG, Hyundai, etc.).[3] They produce everything from television sets to semiconductors to mobile phones. Within the Korean ICT sector, equipment forms the biggest market segment, accounting for 74 per cent. Exports make up 41 per cent of ICT

Table 1.2: Korea's ICT Sector

Production value of Korea's Information and Communication industry, US$ billion

	1997	1998	1999	2000	2001
Information communication services	13	14	16	22	26
Information communication equipment	35	37	54	67	68
Communication equipment	10	9	12	14	13
Information equipment	5	5	8	12	10
Broadcasting equipment	0	1	0	1	1
Electronic components	19	23	33	40	43
Software	3	4	5	9	10
Total	51	54	75	97	103
Rate of increase	37%	6%	40%	29%	7%

Note: Converted to US$ at rate of 31 December 2001.
Source: KISDI.

equipment production. Furthermore, ICT products account for a third of Korea's total exports. The large equipment industry and its export orientation have a strategic impact on Korea's ICT sector. It helps explain why Korea has been quick to exploit new ICT technologies. First, they create new domestic markets driving demand for telecommunication equipment to be produced by local manufacturers. Second, they can give Korea a strategic edge in high technology exports. Instead of being reliant on other nations, if Korea can be among the first to develop and use a new technology, its manufacturers will gain experience that can then be translated to higher exports. Korean companies are already benefiting from supplying the domestic broadband market by winning export orders.[4]

One area where Korea does not have an apparent advantage is software. Unlike other nations such as India that are heavily promoting their offshore software industry, Korea is more focused on hardware. Korea only accounted for 1.3 per cent of the global software market in 2000 and runs a large trade deficit in that category. One disadvantage is language. Unlike India, which has a strategic advantage by using English in higher education, Korean is not a global language. Nonetheless, Korea's software industry and exports have been growing. Indeed software showed the highest rate of growth among ICT market segments in 2000. Furthermore, there are certain niche markets, such as online games, where Korea is taking a lead. The Korean company, NCSoft, is already the largest independent online gaming company in the world. Its popular Lineage game has some two million users in Korea and is sold in four other countries.

[1] Korean Educational Development Institute. *Let's Learn about Korea*. Seoul, 2002.

[2] The OECD rankings are based on older data but it is unlikely that Korea's position would have changed much. See OECD. *Measuring the ICT Sector*. http://www.oecd.org/pdf/M00002000/M00002651.pdf.

[3] Samsung had the world's fastest growing brand image in 2001. See "The Best Global Brands." *BusinessWeek*. 5 August 2002. www.businessweek.com/magazine/content/02_31/b3794032.htm.

[4] Samsung is the fourth largest ADSL manufacturer in the world. See Samsung. "Samsung is one of the world-leading ADSL vendors." *Press Release*. 9 February 2001.

2. ICT market

2.1 The end of circuit switching?

Korea's telecommunication history began in August 1885 when a telegraph line was installed between Seoul and Inchon. The first telephones were installed in 1902 and the first automatic exchange introduced in 1935. Korea joined the International Telecommunication Union in 1952. By the end of the 1980s, Korea had achieved a high level of universal service (see Box 2.1). It signed the World Trade Organization (WTO) agreement on basic telecommunication services that became effective in November 1997, committing the country to liberalization of its telecommunication sector.

The nation's historical operator is **Korea Telecom** Corporation (KT). It began as the government-owned Korea Telecom Authority in January 1982. Its statute was changed in 1989 allowing it to be privatized and in November 1993 the government began selling its shares in the company. Ten additional share sales ensued over the next decade with the final one in May 2002 when the government fully divested itself of the company.

Korea progressively liberalized its telecommunication sector during the 1990s. The first market segment to be opened was international long distance with the entry of **Dacom** in December 1991. **Onse Telecom** entered the market in October 1997. National long distance services were opened to competition in January 1996 when Dacom extended its services to this sector of the market (followed by Onse in December 1999). Finally, local telephone services were opened in April 1999 with the entry of **Hanaro**. This was notable as it would prove to have a major impact on Korea's broadband development. Though KT is still dominant, its market share has dropped, particularly in international long distance (see Table 2.1).

The **Ministry of Information and Communications** (MIC) is responsible for telecommunication and broadcasting policy and regulation. This mandate also extends to certain areas of information technology. The MIC is active in promoting and developing the

Table 2.1: Telephone service competition in Korea

Service	Year competition was introduced	Korea Telecom market share 2001
Local (1)	1999	96.9%
Domestic long distance (2)	1996	85.5%
International long distance (2)	1991	67.1%

Note: (1) in terms of subscribers. (2) in terms of revenue.
Source: KT.

Box 2.1: The Republic of Korea's path to universal service

There are around a dozen *developing* economies that have graduated to the ranks of the *universally served*: 90 per cent or greater of households with a telephone. How did they succeed in achieving universal service? The composition of the group tends to reinforce the importance of wealth as well as highlight the advantage that small countries have. All are high-income economies with GNP per capita in the range of US$ 11'450 to US$ 23'790. Hong Kong, China, for example, has a higher GNP per capita than the United Kingdom. Several are oil-rich states (Brunei, Kuwait, Qatar, United Arab Emirates) and most are relatively small (Bahrain; Cyprus; Hong Kong, China; Macao, China; Malta, and Singapore).

Of these developing countries, the Republic of Korea stands out. It has the largest land area of any country in the group and has developed its economy without the benefit of natural resources such as oil. Until the 1960s, telephone services were mainly used for political and military purposes. The country's rapid economic growth and consequent rise in living standards led to a surge in demand for telephone service in the 1970s. Waiting lists grew and the backlog emerged as a social problem.

As a result, upgrading the telecommunication network became a priority and a *one-phone, one-family* policy was pursued. Korea Telecom was separated from the Ministry of Communications in 1982 to give it more flexibility to eradicate the waiting list. Investment was directed to rural areas to minimize disparities with urban regions. Rural areas were also targeted for the latest digital technology because of the investment already made in analogue telephone switches in cities. The government also pushed the development of a locally produced telephone exchange—the TDX—to reduce dependency on foreign imports and alleviate capacity limitations.

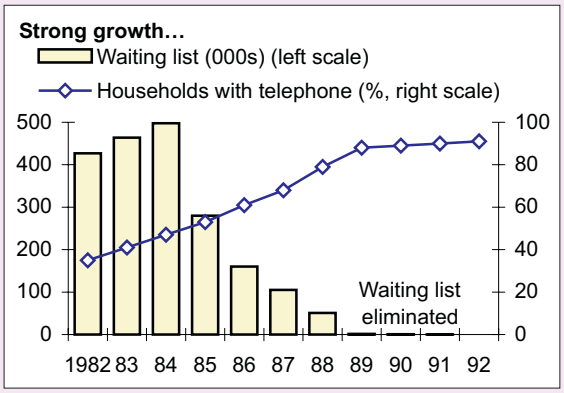
Tariffs were modified to enhance accessibility. The number of local call areas was reduced from about 1'600 to about 150 and a national flat-rate usage tariff became a policy goal. Installation charges were standardized and used to reduce the gap within the country by raising urban installation charges and lowering rural ones.

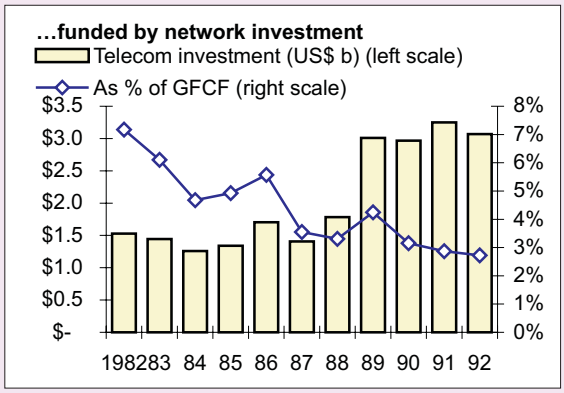
Money for telecommunication investment was raised from several sources. Various laws were established to raise funds from bonds. Tariffs were structured to maximize investment funding. Telecommunications was given priority in the Fifth Five-Year Socio-Economic Development Program (1982–86), rising from less than three per cent of total national investment in the 1970s up to seven per cent in the 1980s.

Because of these policies, the country achieved rapid telecommunication growth through the 1980s. Household telephone penetration increased from 21 per cent in 1980 to 90 per cent by 1990. Domestic and international pressure to open the telecommunication market began to grow in the 1990s. As in many developed countries, a high level of universal service has allowed the Republic of Korea to progressively liberalize its telecommunication market.

Box Figure 2.1: The way to universal service in the Republic of Korea

Waiting list, percentage of households with telephone and telecom investment, US$ billion, Republic of Korea





Note: In the right chart, GFCF refers to Gross Fixed Capital Formation.
Source: ITU World Telecommunication Indicators Database.

communication industry in Korea. One tool it has had at its disposal is requiring telecommunication operators to contribute to government programmes for industry development. Unlike other countries, this money is reinvested in the telecommunication sector instead of being transferred to other areas of the government.

Korea's telecommunication market is arguably as open as any in the Asia-Pacific region. Market entry is contingent upon government approval and essentially depends on the nature of the service provider. Three different classifications exist: (1) Network Service Provider (NSP) who build their own facilities and which requires a license; (2) Specific Service Provider (SSP), such as resellers, who use the facilities of others and which requires registration; and (3) Value-added Service Providers (VSP), such as Internet Service Provider (ISP), which requires a simple notification.

Though Korea's telecom market is probably as liberal as any in the Asia-Pacific region, most companies would have little incentive for entering infrastructure-based segments. First, the market is already well served with high penetration levels. Second, revenues and profits are declining for traditional circuit-switched voice services (see Figure 2.1, left chart). Except for KT and one of the mobile operators, none of Korea's facilities-based telecommunication providers made a profit in 2001. Third, Korea is inadvertently transitioning to a next-generation network whose eventual structure is uncertain.

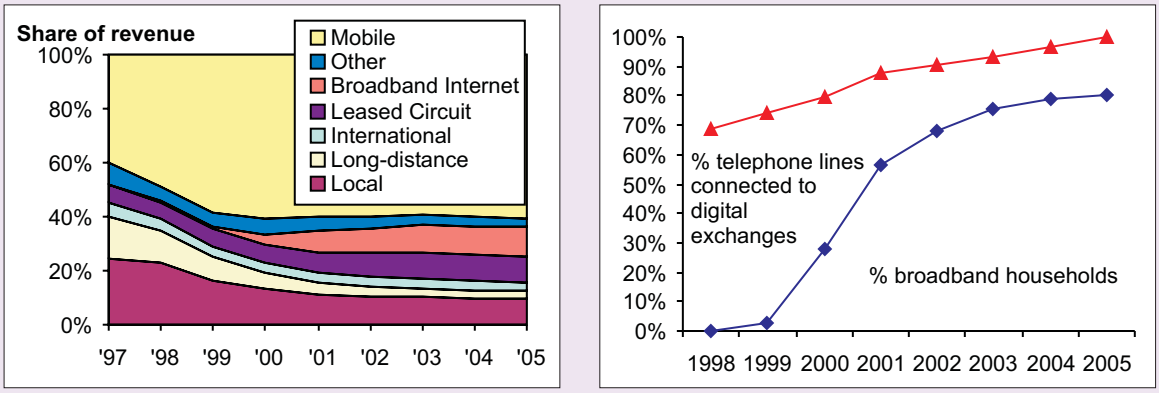
The rapid take-up of broadband has radically altered conventional network thinking and evolution. By June 2002, there were some 10 million subscribers with a broadband connection. There is now a need to offer subscribers increasingly higher bandwidth by locating fiber optic cable closer to the end user. KT plans to offer Very high bit rate Digital Subscriber Line (VDSL) services (at up to 26 Mbps) over the next few years and move aggressively into fiber-to-the-home by 2005 (i.e., replace copper lines with fiber) (see Figure 2.2). It forecasts some 5.6 million broadband subscribers of its own by 2003 (out of a nationwide total of 11.9 million).

Faced with intense competition from new broadband providers, KT abandoned Integrated Services Digital Networks (ISDN) as its strategy for data communications over circuit switched telephone networks. This was a significant move since in other countries, operators have been unwilling to rapidly introduce high-speed Asymmetric Digital Subscriber Line (ADSL) technologies or price it competitively for fear of cannibalizing their lucrative ISDN and leased line offerings. The attraction of ADSL for KT was that it could leverage its already installed copper lines. Furthermore the economics were compelling. Average Revenue Per User (ARPU) is seven times higher with ADSL than for local and long distance voice telephone calls. The pay back period for the ADSL investment is also fairly quick at a little over a year. At the end of 2001, revenues from broadband connection services accounted for eight per cent of total telecommunication revenues, a higher share than long distance. Furthermore, local circuit-switched telephone services have seen their share of telecommunication revenue decline from one quarter in 1997 to 11 per cent by 2001. By 2005, broadband access revenues are forecast to surpass those of local telephone service.

ADSL traffic is separated from circuit-switched traffic and routed over Internet Protocol (IP) networks. At the same time, Voice over Internet Protocol (VoIP) is increasingly being used in Korea and bundled into broadband offerings by operators. The Korean VoIP market is expected to grow around 50 per cent between 2000 and 2005 while conventional circuit-switch telephone conversations will show no growth. Thus an increasing portion of Korea's communication traffic is traversing IP networks and not the circuit- switched

Figure 2.1: Network transition

Distribution of telecommunication market revenue by segment and percentage of telephone lines connected to digital exchanges and percentage of households with broadband access



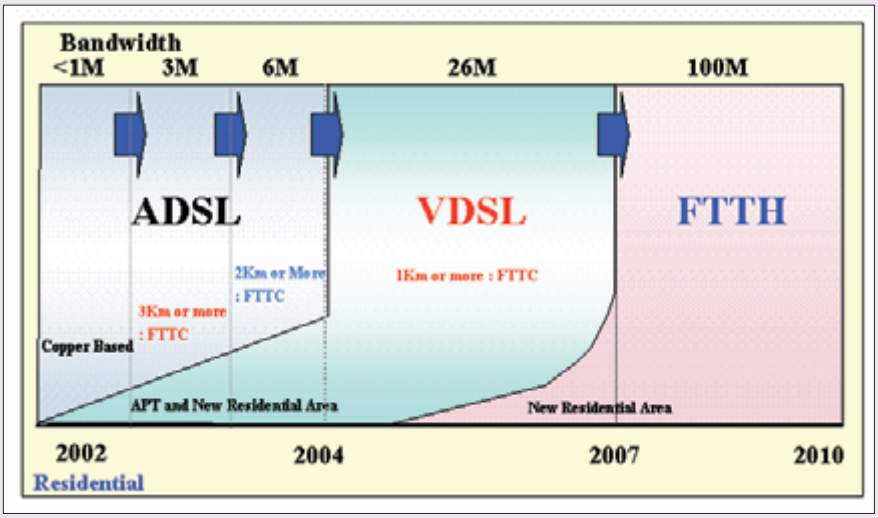
Source: KISDI, ETRI.

network. It is only a matter of time before the packet-switched network will replace the conventional telephone network.

Broadband Internet access and growth of IP-related services is having a great impact on the technical evolution of the Korean fixed telephone network. Ironically, though Korea has one of the lowest levels of local telephone line digitization—only 87.5 per cent in December 2001, one of the lowest in the world[1]—it is at the same time moving towards a next generation communication network. Indeed by the time it would have probably connected all its local

Figure 2.2: More and more bandwidth

Evolution of KT's access network



Source: KT.

telephone lines to digital exchanges, they may not be around any more.

2.2 Another broadband path to the home

Cable television has been available in Korea since the 1960s. However, these so called *cable-relay* networks simply provided retransmission of terrestrial stations in order to improve reception. *True* cable television, that is the provision of additional programming not available on terrestrial-based stations, started relatively late, in March 1995.

Korea's cable industry has a fragmented structure with exclusive licenses awarded on a regional basis. 77 regional system operators provide service and deal with customers. The electricity company—KEPCO—and KT were charged with building fibre backbones, which the system operators in turn lease to connect their networks to the source of programming. Pay cable television has not proven highly popular in Korea despite the limited number of terrestrial-based channels and the lack of satellite television. Only 20 per cent of homes subscribed at the end of 2001. One reason is that relatively inexpensive alternatives such as videotapes and Digital Video Discs are widely available.

The development of cable television infrastructure has provided Korea with another method for high speed Internet access. Some 8.3 million Korean homes—57 per cent of the total—are passed by cable television.[2] Internet access via cable television was launched by Thrunet in July 1998. At December 2002, there was 3.7 million subscribers to broadband cable modem services. The market leader is Thrunet; in addition, there are five other cable modem providers. Unlike most other countries, cable ISPs are not system operators. They either build out a Hybrid Fibre Coaxial (HFC) cable network or lease it from system operators. Thrunet for example collaborates with 74 of 77 system operators to provide its cable

Table 2.2: Korean mass media indicators

Indicator	Value	Year	Note
Newspaper circulation	40.6%	1996	Population aged 15+ who read newspaper every day. Source: National Statistical Office.
Radio sets	47.5 million	1997	Source: UNESCO.
-Per 100 inhabitants	103.9		
% of households with a television	94.3%	2000	Colour TV less than 30 inches. Source: National Statistical Office.
Households passed by cable television	8.3 million	2001	Source: Thrunet.
-As % of total households	57%		
Subscribers to "relay" cable television	7.0 million	2001	Source: Korean Broadcasting Comission.
-As % of total households	43%		
Subscribers to "pay" cable television	3.3 million	2001	Source: MIC.
-As % of total households	20%		
Cable modem subscribers	3.7 million	2002	Source: MIC.

Source: ITU adapted from sources shown under "Note."

modem service. It reimburses them a portion of the fees it receives from cable modem service. Pricing is competitive with ADSL service. Thrunet charges a monthly fee of Won 38'000 (US$ 28.93), which includes unlimited access, an e-mail account, 50 Mbps of storage and speeds of up to 10 Mbps.

2.3 Broadening Internet

2.3.1 Market

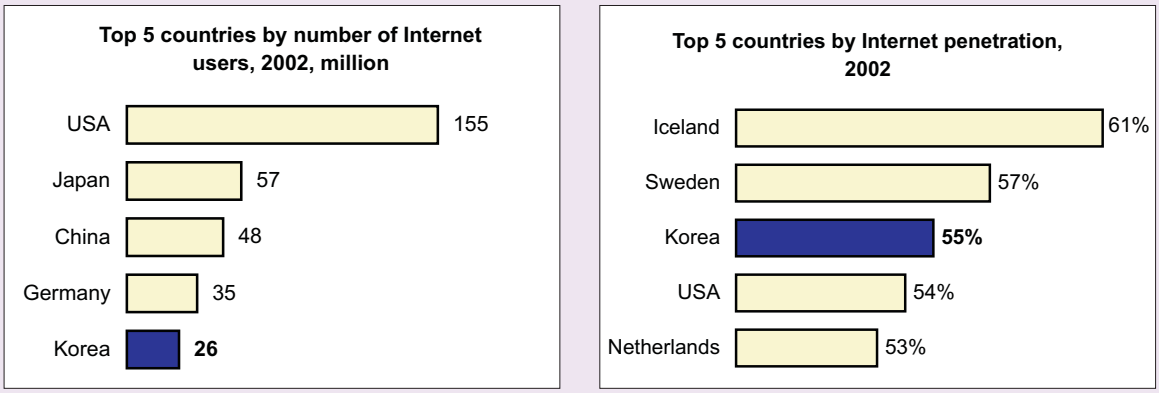
With 26.3 million users at the end of 2002, Korea represents the world's fifth largest Internet market (Figure 2.3, left). Its Internet penetration rate, 55.2 per cent at end of 2002, makes it the third highest in the world (Figure 2.3, right). These are astounding statistics considering that five years previously, it had less than a million Internet users for a penetration rate of 1.6 per cent. Furthermore, the growth came at a time of a severe economic downturn. What explains this dramatic turnaround?

First, the statistics are a bit misleading. While Korea's Internet user population has grown dramatically, it has had a high level of subscribers to non-Internet online services for sometime. For example in 1996, it had 1.7 million subscribers to so-called *PC-based* services compared to just 0.7 million Internet users. This anomaly is explained by demand for Korean content. Internet content in Korean was lacking so users utilized the services of proprietary online services that provided a plethora of services in a language they understood. Koreans were wary of venturing into the Internet world, where most content was in English and there was a lack of structure to finding information. As the volume of Korean Internet content expanded—reflected by a six-fold rise in Korean Internet hosts between 1996 and 2001—users moved over to the Internet (Figure 2.4, left). Most online providers have now converted to web-based services.

A second factor driving Internet use was the growth in broadband access. When broadband launched, it came with Internet access. Since the launch of broadband Internet access in July 1998, the number of subscribers has risen to ten million by the end of 2002. Most services that needed broadband access such as audio and video streaming, gaming and e-commerce were only available on the Internet so this created many new Internet users. Today 78 per cent of Internet users log in via a broadband connection (Figure 2.4, right).

Figure 2.3: Top Internet countries

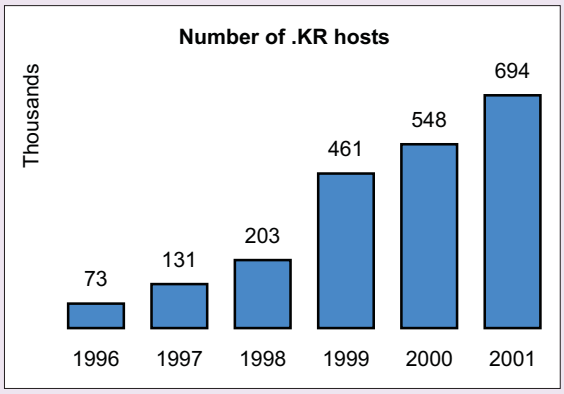
Top five countries by number of Internet users, 2002 and top five countries by Internet users per 100 persons, 2002

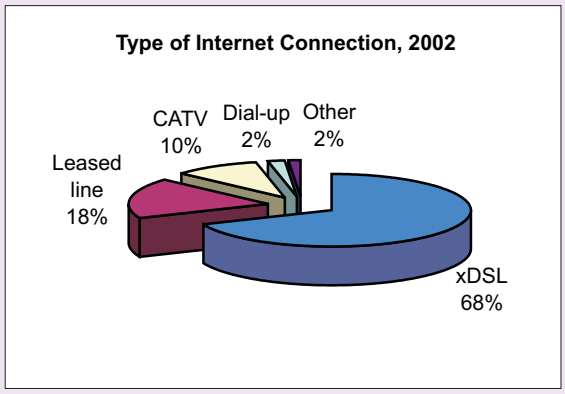


Source: ITU World Telecommunication Indicators database.

Figure 2.4: Internet drivers: Content and Broadband

Number of .KR hosts and type of access





Source: KRNIC.

Box 2.2: One big Intranet?

Korea is an exception to the argument that limited English fluency or non-Latin character alphabets are barriers to Internet access. The development of Korean content has been astounding and today the nation has one of the highest usage ratios of home grown content. The top 10 web sites accessed by Korean users are all in Korean. The number of domains registered using .KR—almost exclusively in the Korean language—ranks the nation fifth in the world.[6] Not only has this driven use, but it has also reduced the need for expensive international circuits. It also suggests that in many ways the Internet in Korea is actually one big Intranet with most users preferring to access local sites.

Korea's top web site is *Daum*, a start-up company founded in 1995. In 1997, it began operating a web-based email service filling a void created by the slowness of Korea's proprietary online services to provide Internet-based content. In 1999, this budding dot-com went public with an offering on the Korean venture capital stock exchange (KOSDAQ). The number of its users grew from 5.7 million at the end of 1999 to 19.6 million at the end of 2002. Some 90 per cent of all Korean Internet users log onto Daum, ranking it first. Around 450 million pages of Daum's content is viewed on an average day. Daum ranks tops in pages per user and session time in the world. Daum is really not much different than other portals except that its business model works. It offers familiar portal content: e-mail, instant messaging, news, information, shopping, music, videos, etc and makes money from advertising, e-commerce transactions and members-only portions of its site. But what allows it to earn money is that it is Korean. Few Koreans surf abroad because of the lack of Korean content and lack of ease with English. So Daum has just been better than other Korean portals in attracting customers.

2.3.2 Connectivity

Korea's local, national and international Internet connectivity is both qualitatively and quantitatively substantial. Its Internet network today is very different from its initial connectivity to the global network by way of a 56 kbps link to the United States in 1991. Today, the majority of Korean users access the Internet via broadband and it leads the world in this category. The country is criss-crossed by several nationwide, gigabit fibre-optic backbones operated by telecommunication operators, Internet providers and the electric company. International connectivity has been growing rapidly over the last several years.

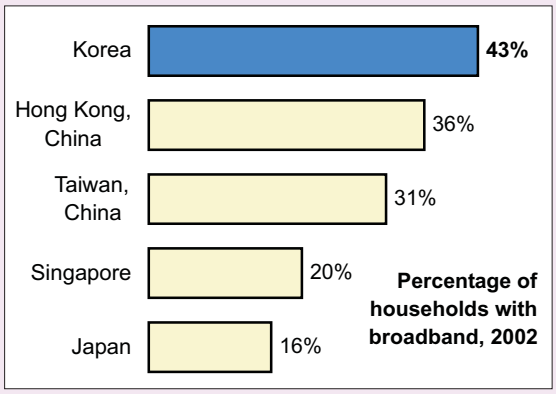
Until the mid-1990s, there was no national Internet exchange in Korea

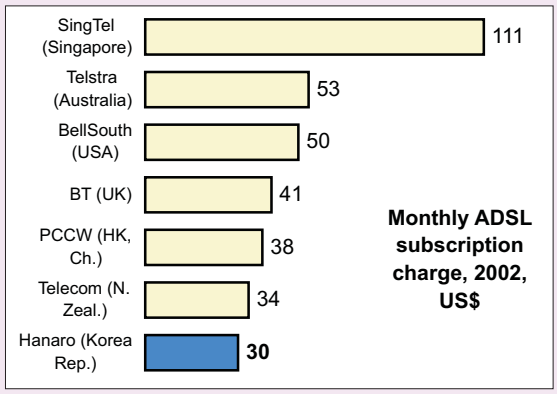
Box 2.3: Broadband drivers

43 per cent of the Republic of Korea's households had a broadband Internet connection at March 2002, the highest ratio in the world. Korea's high broadband penetration can be attributed to the following factors:

Geography. 80 per cent of Korea's population lives in urban areas. Though this figure is not as high as island economies such as Hong Kong, China or Singapore, Korea's urban geography is dense, simplifying broadband access.[3] Apartments account for 48 per cent of Korea's housing stock and provide dwelling for 40 per cent of its population. Another factor is the proximity of telephone exchanges. The average distance of a customer from a telephone exchange is 2.2 kilometres, with 95 per cent of customers within four kilometres, the target range of ADSL.

Competition. Consumer broadband access in Korea began in July 1998 with the launch of cable modem service by Thrunet. The introduction of local loop competition with the entry of Hanaro Telecom in April 1999 further fuelled the broadband market. With most Koreans already subscribing to incumbent Korea Telecom, the market was saturated for traditional telephone service. In addition, local loop unbundling was not implemented. Hanaro also faced barriers that discouraged KT customers from switching network providers. This included no number portability and users having to pay a higher connection and subscription charge if they switched to Hanaro and later reconnected to Korea Telecom. One way for Hanaro to break into the market was to offer a broadband Internet access service. This exploited KT's unwillingness to enter the ADSL market due to its large investment in ISDN. Faced with a declining market share, KT entered the ADSL market in June 1999. At October 2001, there were seven companies providing broadband Internet access service. Competition among broadband technologies has also grown the market through greater choice and lower pricing. ADSL is readily available to the 90 per cent of Korean households with a fixed telephone line. Some 57 per cent of Korean homes are passed by cable television, providing them with another broadband option through cable modem. In addition, there are other broadband options such as Local Area Networks (LAN), broadband Wireless Local Loop (WLL) and satellite-delivered solutions. As a result of both market and technological competition, prices are among the lowest in the world (see right chart below).





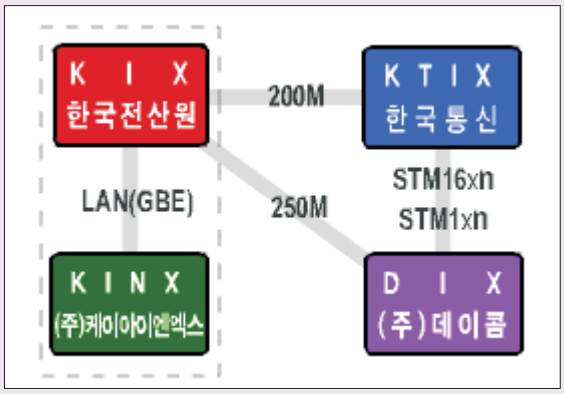
Government support. The government has facilitated broadband development through an early commitment to high-speed infrastructure with specific programs. This has included a positive and supportive relationship with the private sector, low interest loans and a certification program for apartment complexes with high-speed access (for more detail on the government's support see Box 3.1).

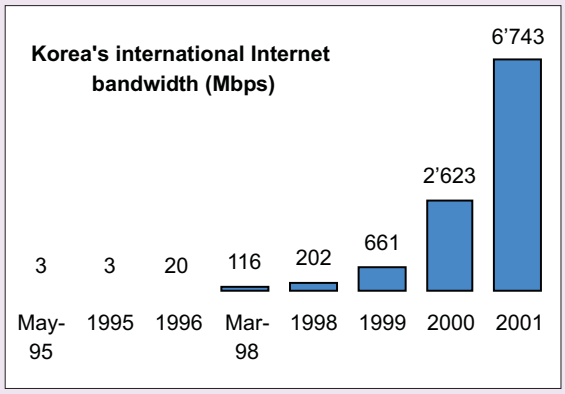
Equipment. Korea's manufacturing industry has been an advantage with local suppliers eager to get into the ADSL market.[4] This has minimized shortages and helped keep equipment prices low. A growing number of subscribers created economies of scale, which also reduced equipment prices. KT's ADSL equipment purchase cost per line dropped from US$ 574 in 1999 to US$ 132 in 2001.[5]

Mentality. Though more difficult to measure, it is widely agreed that Korean "mentality" is also a key factor. Many Korean Internet users first got a taste of high-speed access at Internet cafés (so-called "PC bangs") and subsequently wanted the same rapidity at home. There is also a "copy-cat" syndrome; once one person gets something everyone else wants it, too.

Figure 2.5: Internet exchanges and international bandwidth

Korea's national Internet exchanges and international Internet bandwidth (Mbps)





Note: In the right chart, data is for three facilities-based operators.
Source: ITU adapted from KRNIC, NCA.

and domestic traffic between different ISPs was routed abroad. The National Computerization Agency led the drive to establish a public exchange, the Korean Internet Exchange (KIX) in 1995.[6] However, traffic soon exceeded capacity. This led to the Korean Internet Neutral Exchange (KINX) in June 1999. In addition, Korea Telecom and Dacom have established exchanges, KTIX and DIX respectively. All four exchanges are inter-connected (see Figure 2.5, left) and most ISPs connect with each other through the exchanges rather than private peering arrangements.

Korea's international Internet connectivity has expanded tremendously and stood at 5.2 Gbps at December 2001 (Figure 2.5, right). It has benefited from its proximity to the sea and hence fibre-optic submarine cables (it is connected to around ten different systems).

2.3.3 Pricing

The most relevant data to use for comparing Korea's Internet pricing are rates for broadband access (e.g., DSL and cable modem) since the majority of Koreans connect to the Internet in this way. In that regard, Korea has among the lowest broadband Internet prices in the world. Broadband pricing is flat rate and compared to other countries, the bandwidth on offer is above average. Broadband pricing is uniform across providers in Korea. Most packages are around US$ 30 per month. The variations depend on the amount of bandwidth. One plan offered by Thrunet proposes users a lower price (US$ 26 per month) in exchange for receiving e-mail advertisements.

Dial-up Internet prices are not so relevant considering that most subscribers now use broadband. One important motive for switching to flat-rate broadband is to avoid the local telephone charge imminent with dial-up subscriptions. A dial-up Internet subscriber must pay local telephone charges of 39 Won (3 US cents) per unit (three minutes during peak times and 4.3 minutes in off-peak periods). By contrast, an entry plan ADSL subscription costs 30'000 Won (US$ 22.84). After 30 hours of monthly use, it is cheaper to switch from dial-up to broadband access in Korea. With the average Korean Internet user logging on for some 40 hours a month, it is no surprise that so many have switched to broadband access.[7]

Leased lines also are being impacted by consumer broadband technologies. Former users of ISDN or other low bandwidth leased line services are switching to ADSL and cable modem. Only users with very high bandwidth requirements (above eight Mbps) are continuing to lease lines in the conventional sense.

2.3.4 Domain

The Korea Network Information Center (KRNIC) is responsible for administering Korea's .KR domain name. Korea uses second level domain names based on five common identifiers depending on the type of organization. In addition, users can select the PE or personnel second level domain name. There are also 16 regional domains used by different regions in Korea (see Figure 2.6). Charges are KRW 11'000 (US$ 8.36) per year for personal users and 22'000 for organizations. A person or organization must have an address in Korea to register a domain name. Furthermore, businesses require a certification.

KRNIC's domain name registration is just one small part of its activities. It is also involved in research and development, industry promotion as well as compiling information about the Internet in Korea.

2.3.5 Regulation

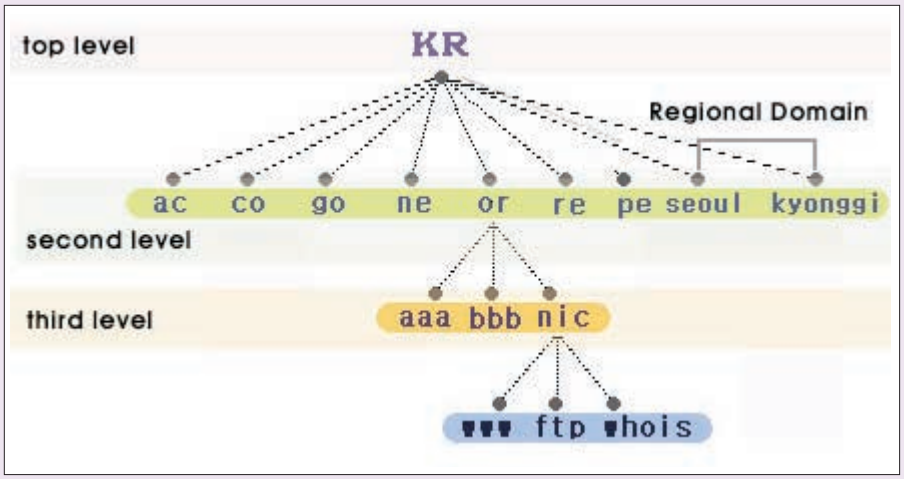
Korean government involvement in the Internet is oriented towards consumer protection and reducing the Digital Divide. Entry into the ISP market is straightforward. As value-added service providers, ISPs must simply notify the government that they want to go into business. An ISP must lease facilities from licensed infrastructure providers or obtain their own facilities-based license.

2.4 Mobile Communications

2.4.1 Mobile market players

Although Korea's success in broadband networks and services has stolen the headlines, mobile communications development has proved almost as successful. Korea was relatively slow to introduce digital services, and when it did so it opted for the CDMA standard rather than the more widely used GSM.[8] Nevertheless, Korea now has one of the highest levels of mobile penetration in the world. Korea was one of the first countries in the Asia-Pacific region where mobile phone users overtook fixed-line subscribers, an event that happened in October 1999. Subsequently, mobile

Figure 2.6: Korea's domain name structure



Source: KRNIC.

penetration has continued to grow. Korea overtook Australia, Japan and New Zealand in terms of mobile penetration during the late 1990s and is today ranked fourth in the region (Figure 2.7, left chart). As of the end of 2002, there were some 32.3 million mobile subscribers compared with just 23.3 million fixed-line users.[9]

The evolution of mobile in Korea has gone through three distinct phases (see Figure 2.8):

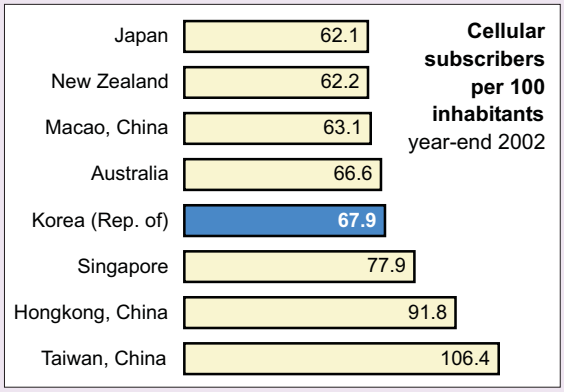
- **1984-1994:** between the launch of Korea Mobile Telecommunication Service's (KMTS) analogue cellular service in 1984, as a subsidiary of Korea Telecom, and the sale of the company to SK Group in 1994.[10] During this period KMTS, which now trades as SK Telecom, enjoyed a monopoly in the provision of cellular services. By 1995, cellular penetration rates had reached only two subscribers for every 100 inhabitants, one of the lowest levels among the advanced Asia-Pacific economies.

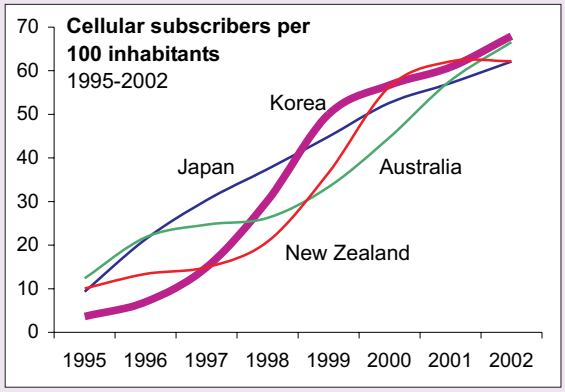
- **1995-2000:** between the launch of CDMA digital voice services (IS-95A) in January 1996 and the launch of CDMA2000 1x, in October 2000 (although commercial services only arrived a few months later). During this period, penetration grew rapidly to cross the symbolic 50 lines per 100 inhabitants. Few countries have transformed their mobile communication sectors so rapidly. This period saw the introduction of four new operators all using CDMA: Shinsegi Telecom (800 MHz) and three Personal Communication Services (PCS) operators at 1.8 GHz: Korea Telecom Freetel (now KTF); LG Telecom and Hansol (later M.Com).

- **2001 to date:** corresponds with somewhat slower growth in the number of mobile voice subscribers, as the market approaches saturation. Instead the focus has shifted to the development of mobile data applications. CDMA2000 1x mobile data services were launched in October 2000, CDMA2000 1x EV-DO in May 2002 and services in the IMT-2000 2.1 GHz band (for an explanation of the different terms, see Box 2.4) were licensed in December 2000 for launch in 2003. This period also has seen a consolidation in the

Figure 2.7: Catching up and overtaking

Cellular mobile penetration in Korea, compared with other Asia-Pacific economies, 2002 and with Australia, Japan and New Zealand, 1995-2002

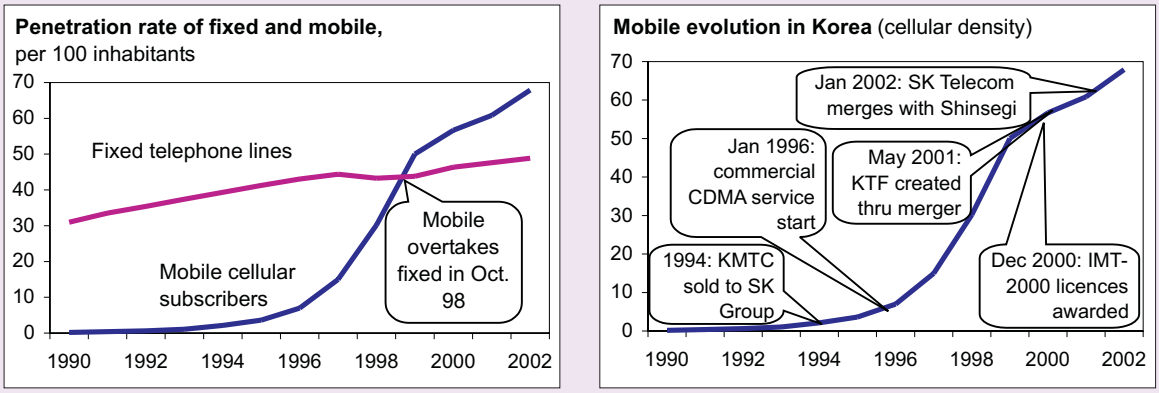




Source: ITU World Telecommunication Indicators Database.

Figure 2.8: Mobile evolution in Korea

Cellular subscribers per 100 inhabitants, compared with fixed-line teledensity and tracked against major landmarks in the development of the sector



Source: ITU World Telecommunication Indicators Database and case study research.

number of operators, with SK Telecom acquiring Shinsegi and KT Freetel acquiring Hansol to become KTF.

Although the IMT-2000 licenses in the 2.1 GHz band introduces some new investors, it effectively locks in this three-company market structure. There are linkages between the three different operators both at a horizontal level and through vertical integration with the activities of different chaebol and equipment manufacturers. The recent acquisition by SK Telecom of an 11 per cent stake (the biggest single shareholding) in KT further complicates competition policy issues that are raised by the market structure. Figure 2.9 attempts to summarise the status as of May 2002 with regard to cross-ownership, but the situation remains a dynamic one, subject to change.

2.4.1.1 SK Telecom

SK Telecom <www.sktelecom.com> is currently the major player in the Korean mobile market with a 53 per cent market share, as of December 2002 and net income in 2001 of Won 1.1 billion Won (US$ 868 million) on a turnover of Won 6.2 trillion (US$ 5 billion). SK Telecom was the first company in Korea to offer analogue mobile services (in 1984, as Korean Mobile Telecommunication Services) and also the first to offer digital CDMA services (in 1996, after its acquisition by the SK Group).

SK Telecom is considered by the Ministry of Information and Communication (MIC) to be the dominant mobile operator, and for this reason its prices are regulated. In January 2002, it completed the takeover of Shinsegi Telecom, its leading competitor in the CDMA 800 MHz field. In order to satisfy MIC requirements for allowing the acquisition, SK Telecom had to reduce its combined market share to below 50 per cent. This they did for one month (June 2001) by a process they called *demarketing* (getting rid of their least profitable subscribers and not advertising for new ones). Subsequently, market share has started to grow again.

SK has investments in several Asian economies, including Mongolia (SkyTel) and Uzbekistan and most recently they have gained a CDMA license to operate in Viet Nam (S Telecom) and in Cambodia. SK Telecom also has technology sharing agreements with China Unicom and Pelephone (Israel) related to CDMA technology.

SK Telecom was the first in the world to offer mobile data services over its standard CDMA network (IS-95). In October 2000, it launched its CDMA2000 1x service, under the brand name *Nate*, and in January 2002 it commercialized its CDMA2000 1x EV-DO (1x Evolution, data optimized) service. As of December 2002, it had 14.8 million wireless Internet-enabled handsets in use and 8.4 million regular *Nate* users (defined as using the service at least once a month).

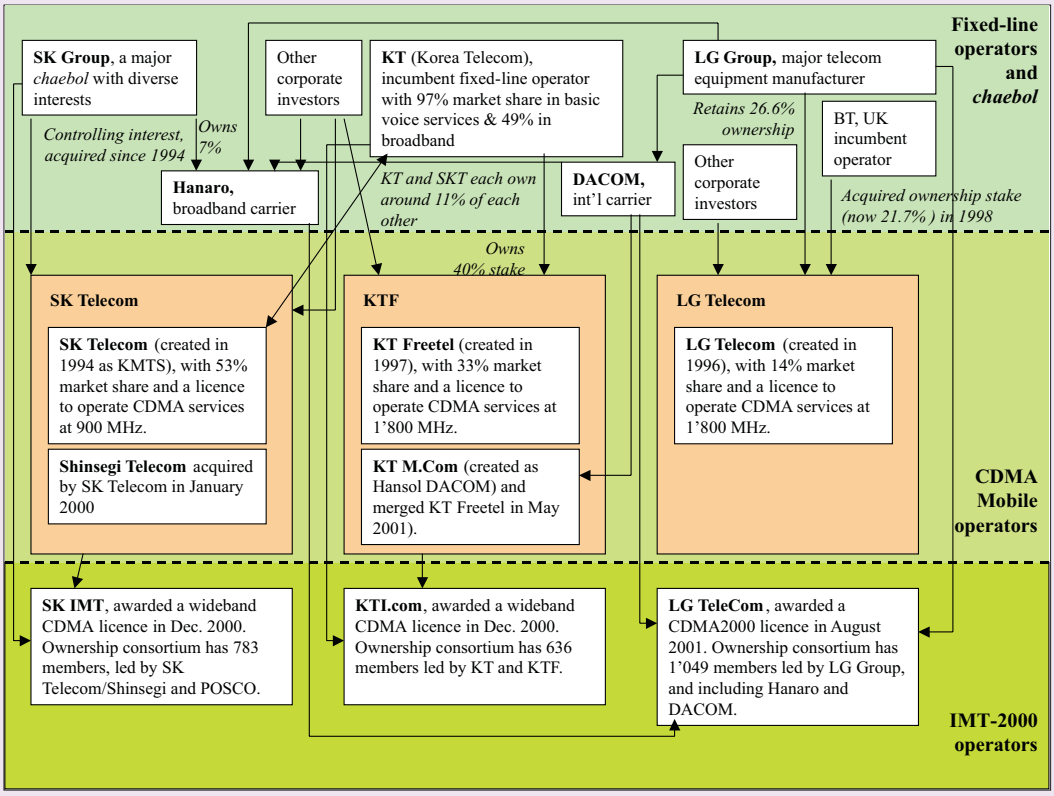
2.4.1.2 KTF

KTF <www.ktf.co.kr> is the second largest mobile network operator with a 32 per cent market share in December 2002 and a turnover of Won 4.49 trillion (US$ 3.7 billion). Like its rival, SK Telecom, KTF has its roots in Korea Telecom, which owns a 40 per cent stake. This came about through KT FreeTel, which merged with M.Com (now KTM.Com) in May 2001. KTF has a CDMA licence to operate in the 1'800 MHz band.

KTF claims that it was the first to introduce segmented marketing to the Korean market. Among the different segments it identifies and targets are: up to age 13 (Kid's market); 13-18 year-olds (Bigi); 18-25 year-olds (Na); 25-35 year olds (Main); older age groups (silver market); women (Drama) and corporate sector (Viz). Average Revenue Per User (ARPU) is highest in the "Main" group, but mobile Internet usage is highest among the Na and Bigi groups.

Figure 2.9: How are they related?

Selected links between fixed-line, mobile and IMT-2000 operators in the Korean market, May 2002



Note: Only selected ownership links are shown and these are subject to change.
Source: ITU Korea case study research.

Like SK Telecom, KTF records wireless Internet users as all those that have suitably equipped handsets. This amounts to 10.2 million in December 2002, of which 4.9 million are CDMA2000 1x users.

2.4.1.3 LG Telecom

LG Telecom <www.lg019.co.kr/english> is the third mobile operator, with a market share of 15 per cent in December 2002. As its name suggests, it is part of the LG Corporation with LG holding a 36 per cent share and BT of the UK a further 17 per cent (though it is reportedly looking to sell this stake). LG missed out on the consolidation that has taken place in the mobile market since the year 2000; being neither acquired not acquiring. It also missed out on the W-CDMA licences for IMT-2000, but has a CDMA-2000 licence in the 2.1 GHz band.

LG relies heavily on its sister companies for distribution. These include, for instance, gas stations and supermarkets. It has a 1'800 MHz PCS licence, which it markets under the brand name "PCS 019". As of December 2002, LG Telecom had 3.5 million wireless Internet users and 1.7 million CDMA2000 1x users.

2.4.1.4 IMT-2000 players

There are three IMT-2000 licensees in Korea. As shown in Figure 2.9, they are each aligned with one of the existing mobile operators and also with fixed-line operators*, chaebol* and other investors. Indeed, each IMT licensee is really a consortium rather that a single company and the consortia have 783 (SK IMT), 636 (Kti.Com) and 1'049 (LG Telecom) members respectively.

The licensing of IMT-2000 proceeded in two stages. Consortia led by the two major mobile operators were initially awarded two W-CDMA licences, in December 2000, at a cost of around US$ 1 billion each, through a hybrid beauty contest/auction. The unsuccessful bidders in this round included LG Telecom (the third mobile operator) and Hanaro Telecom (a broadband network operator). A consortium including these two companies was later awarded a CDMA2000 licence in August 2001, for which it paid around US$ 900 million.

In terms of commercial services, it is not expected that IMT-2000 services in the 2.1 GHz band will be available until the second half of 2003. By then, it is likely that the commercially available alternative CDMA2000 1x EV-DO service will have stolen a march on the market and it may be difficult for W-CDMA to make up the lost ground.

2.4.2 Mobile data

2.4.2.1 What makes Korea different?

In some ways, Korea is ahead of the rest of the world in mobile data. Korea probably has a higher penetration of users of high-speed mobile Internet service than any other country in the world. But, on the other hand, until recently Korean mobile operators generated a lower percentage of their revenue from non-voice services than other operators, for instance in Europe or Japan (see Figure 2.10). How can this apparent contradiction be explained?

One reason is because of the particular Korean way of counting mobile data users. As no subscription payments are required, the number of subscribers recorded are those that have suitably-equipped handsets. So, as most Korean subscribers like to have the most up-to-date terminals, the recorded number of mobile data users is high. On the other hand, short message service, which provides the bulk of non-voice revenue for mobile operators in the GSM world, is relatively modest in Korea. For instance, SK Telecom reports that on basic second generation (2G) SMS-enabled handsets, average revenue per user (ARPU) from mobile data is only 1'756 Won (around US$ 1.40) per month. In Europe, SMS generates many times this level of revenue.

But the signs are that the situation is changing. Mobile data ARPU from CDMA2000 1x subscribers is more than twice the level of that from basic 2G users, and for CDMA2000 1x

Box 2.4: 1x, 1x EV-DO, IMT-2000: What's the difference?

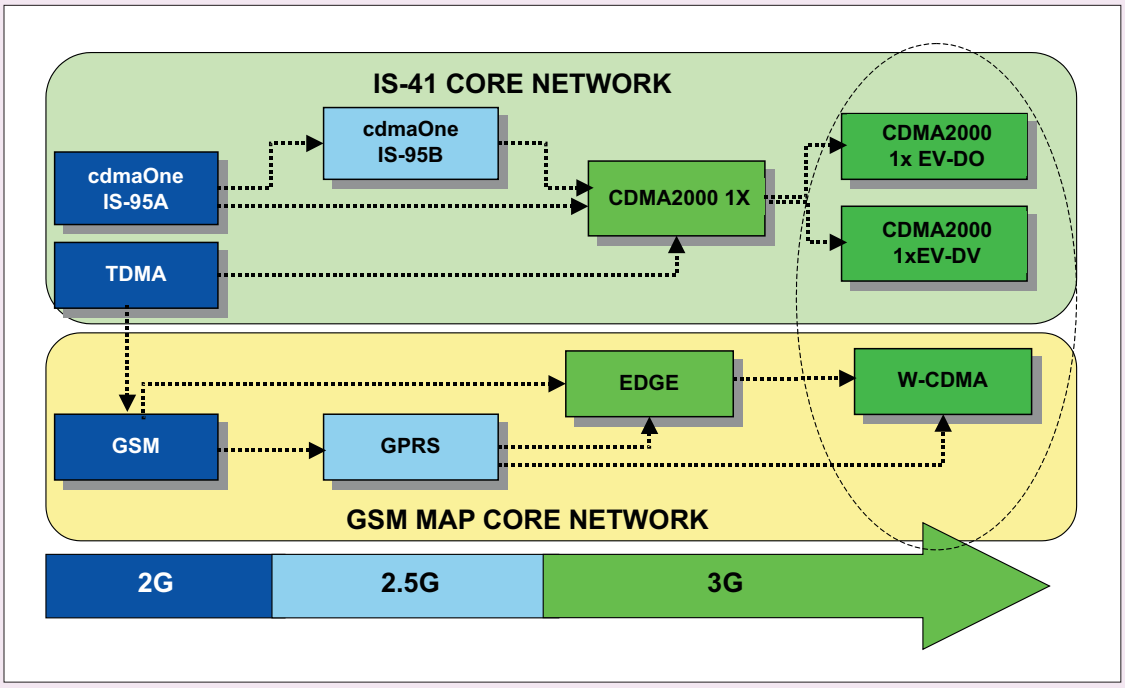
The mobile world is currently moving from second generation (2G) standards to a *2.5G* world —with many competing standards— to a third generation (3G) world in which the IMT-2000 family of standards will provide for higher data speeds.

For CDMA technologies, the 2G is known as cdmaOne (or IS-95A) and *2.5G* is known as IS-95B. Third generation or IMT-2000 is known as CDMA2000 1x (as shown below) with its evolved technologies EV-DO and EV-DV.[11] Different brands of CDMA2000 1x use different browsers and, in practice, are able to offer more than WAP/GPRS, both in terms of speed and functionality. CDMA2000 1x offers a top speed of some 144 kbit/s whereas GPRS only goes as high as 115 kbit/s (in practice, neither technology has achieved the full capacity under operational conditions). Also, there are many colour handsets already available for CDMA2000 1x whereas colour handsets for GPRS are still a rarity.

A second difficulty is to interpret where CDMA2000 1x EV-DO (1x evolution, data optimised) fits in. On the basis of speed (up to 2.4 Mbit/s), it is comparable with other 3G IMT-2000 standards, such as W-CDMA. However, 1x EV-DO still uses essentially the same circuit-switched technology as ordinary CDMA subscribers (SK Telecom estimates that only an extra US$ 20 per subscriber is needed to move from CDMA2000 1x to 1x EV-DO) whereas a separate 3G network would need to be constructed at substantial additional cost.

The main advantage of 1x EV-DO is that it is available now and is a logical evolution from products already available on the market. However, the initial signs are that take-up has been slow, compared to 1x.[12]

Box Figure 2.4: One view of mobile data evolution



Source: ITU Internet Reports 2002: Internet for a Mobile Generation.

subscribers with a colour handset, the level is higher still, at around Won 7'000 (US$ 5.40) per month. Furthermore, whereas only around one third of ordinary 2G handsets are used for SMS, some four-fifths of those with colour capability use data facilities (see Figure 2.10). It appears that the introduction of colour handsets, which occurred after September 2001, has been a major factor in increasing the level of mobile

Table 2.3: Implementations of mobile data services

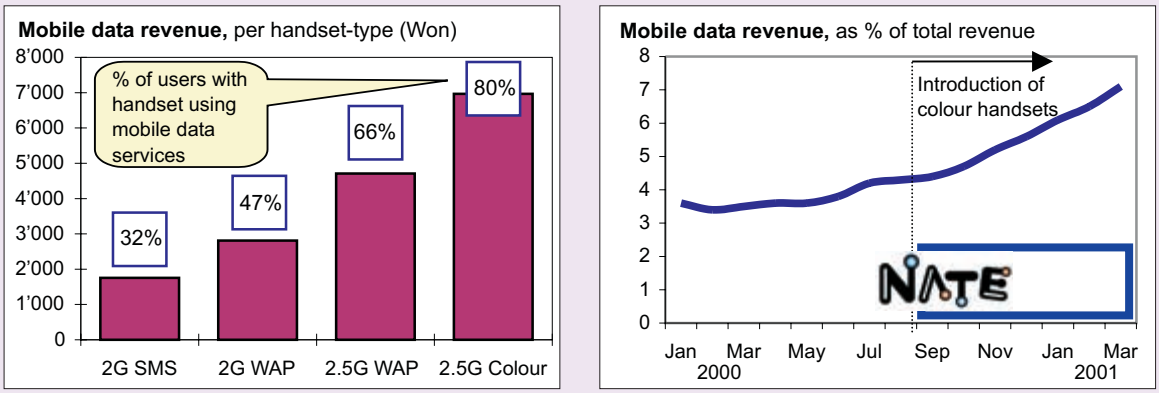
Using examples from Korea, Japan and Europe (Switzerland)

Country	Korea			Japan	Switzerland
Company	SK Telecom	KTF	LG Telecom	NTT DoCoMo	Orange
Standard	CDMA 1x	CDMA 1x	CDMA 1x	i-mode	GPRS
Speed	Up to 144 kbit/s	Up to 144 kbit/s	Up to 144 kbit/s	9.6 kbit/s plus	Up to 115 kbit/s
Brand name	Nate	MultiPack/Magic (n)	EZWeb	i-mode	Orangeworld
Browser	WAP	BREW/Microsoft ME	Microsoft ME	i-mode	WAP
Language	WML	C++/HDML	M-HTML	c-HTML	WML

Source: ITU research.

Figure 2.10 Growing the mobile data market

SK Telecom's revenue from mobile data, as a percentage of total data (Jan 2001 - March 2002) and by type of handset, March 2002 (in Won)



Source: ITU adapted from SK Telecom.

data ARPU. In September 2001, mobile data ARPU contributed around 4.3 per cent of total ARPU for SK Telecom, but this had grown to 7.1 per cent by March 2002. Terms like 2.5G or CDMA2000 1x may seem like algebra to consumers; but colour makes a very visible difference (see Box 2.5: Handset wars). Although colour does not necessarily enhance the functionality, and may actually reduce battery performance, nevertheless the psychological impact of colour of the user's perception of the mobile terminal seems to be extremely positive.

Korea's experience provides valuable insights into the demographics of the mobile Internet marketplace (see Figure 2.11).

- The first key message is that it is the residential market, not the business market, which is driving usage. Although service providers like SK Telecom recognise business users as a specific market segment, only half of them use mobile data and their contribution provides just two per cent of total revenue.

Box 2.5: Handset wars

The Korean mobile market is different from that of Europe in several ways. For instance, there are few prepaid users, operators use a CDMA platform but with calling party pays rather than receiving party pays, and ring tones are positively symphonic in comparison to those tinny jingles heard in Europe. Another way in which Korea is different is that the revenue the country derives from equipment sales is far higher than that from services sales. In 2000, for instance, info-communication equipment production in Korea amounted to US$ 67 billion compared with services sales of just US$ 22 billion. A high proportion of this comes from production, sales and exports of mobile terminals (see 2.4.4). This puts the equipment manufacturers, like LG, Samsung, Daewoo or Hyundai, in a very strong position.

Between 1996 and mid 1999, mobile handsets were subsidised by some 4.9 trillion Won (US$ 4 billion) by service providers. However, since June 2000, handset subsidies have been officially banned in Korea. During that month, handset sales fell to a quarter of their former level, though they have subsequently picked up again. Most other countries either allow subsidies, or the problem does not arise because competition in the services market is insufficient to warrant subsidies. The fact that subsidies are explicitly banned gives Korea's mobile industry a convenient excuse of explaining high handset prices to consumers (i.e., blaming MIC).

The current market prices range:

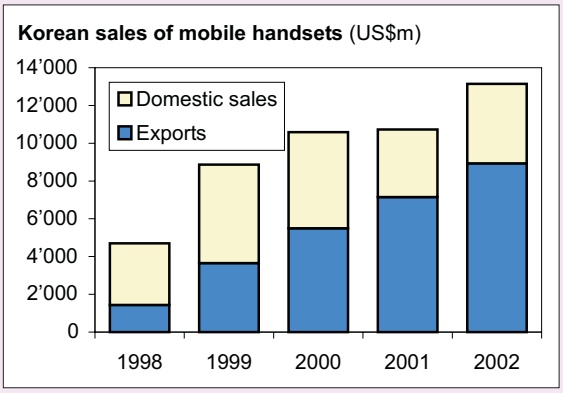
- between US$ 250 - 500 for full-colour CDMA2000 1x handsets;
- between US$ 200 – 250 for black & white CDMA2000 1x handsets;
- between US$ 500 – 650 for EV-DO handsets.

Despite these relatively high prices, technophile Koreans trade-up their handsets quite often with colour driving the market. The price of a colour screen, with high-speed Internet access, is shorter battery life. It is common, in Korea, to see mobile battery re-charging stations in supermarkets, garages and other public places because of the heavy usage of voice and data applications. As the rest of the world catches up with Korea, this is one area where Korean manufacturers already have a head start.

Since the ban on handset subsidies, the major manufacturers and the shift towards CDMA2000 1x, the combined market share of the leading companies, Samsung and LG, has risen from around two thirds to three-quarters of all sales in the domestic market. Exports have also become more important, reaching an expected US$ eight billion in 2002, which compensates for the fall in domestic market sales. Imports remain minimal with sales of just US$ 54 million expected in 2002.

Box Figure 2.5: Trends in sales

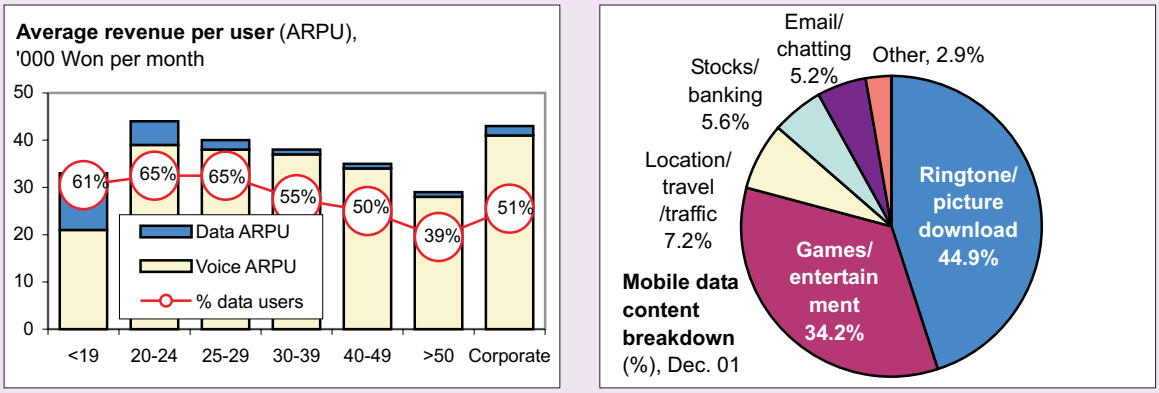
by Korean manufacturers of mobile handsets, 1998-2002, in US$ m, and a sample Samsung mobile phone with colour screen



Source: Left chart: KISDI IT Outlook for Korea, 2002. Right photo: Michael Minges.

Figure 2.11: Mobile data usage patterns

Data from SK Telecom on average revenue per user (ARPU) by age group and breakdown of content use



Note: "Other" content, in right chart, includes news/sports (2.0%), e-books/education (0.6%) and e-lottery/shopping (0.3%).
Source: SK Telecom.

- By contrast, teenagers are the main market drivers. Although teenagers have the second lowest (after users aged over 50) total ARPU, at just 33'000 Won (US$ 27) per month, more than a third of this is spent on data applications. Data ARPU diminishes sharply with age, with 20-24 year-olds spending less than half as much as teenagers, despite their greater spending power, and by the age of thirty, users are spending less than US$ one per month on average on data applications.

- The breakdown of content shows that applications designed to appeal to the teenage market, such as download of ring tones or cartoon animations, together with games and entertainment, form more than three-quarters of the total.[13] By contrast, information services aimed at older age groups, such as traffic information or stock prices, occupy relatively little space. Of course, viewing the market by value, rather than by volume may produce a different picture, but most mobile content is available elsewhere (for instance, over the Internet).

- The usage breakdown contrasts markedly with that of other countries. Compare with China, for instance. There, the main mobile data application is email (41 per cent) followed by stock transactions (16 per cent) and news (12 per cent). These three categories account for two-thirds of the market demand in China but only 13 per cent in Korea. Of course, it could be that, once China acquires mobile data networks that run as fast as those in Korea, then the two usage patterns will converge, but the suspicion is that China is more representative of mobile data usage in the wider, low-speed market, and that it is Korea, with its high-speed mobile networks, which is currently unique but may signal the future trend for the high-speed mobile market.

2.4.2.2 Pricing mobile data

One of the most difficult-to-manage aspects of the shift from voice to data for mobile revenue is to get the pricing right. A recent survey of 3'000 mobile

Internet users carried out by KRNIC showed a relatively low level of satisfaction with the price of the service.[14] Some 17 per cent of non-mobile Internet users quoted high prices as the reason they were not using the service.[15] There are four main elements to pricing data on a mobile platform:

- The cost of subscription. Unlike NTT DoCoMo's service in Japan, Korean operators do not charge a subscription price for mobile data.

- The cost for the volume of data downloaded, normally measured by packets of 512 bytes each.

- The cost of the content, which is related to its perceived value and timeliness.

In an era where technology transition, from low to high-speed services, is significant, service providers must walk a fine line between pricing new services too cheaply (and risk undercutting older, better established low speed data services) and pricing them too expensively (and stifling the market). Operators have thus tried to differentiate their service offerings by platform and by message type:

- **Platform:** SK Telecom, for instance, recognizes five main platforms for its *NATE* mobile data service: mobile handsets, PCs, PDAs (personal digital assistants), vehicle-mounted terminals and interactive televisions. For each platform, the philosophy is based on traffic causation, so that PC service is designed for sending and receiving messages from mobile phones while the vehicle-mounted service (Nate drive) is intended as an online service, getting data updates constantly from the network, rather than as a standalone service using a CD-ROM, for instance.

- **Message type:** Currently, Korean operators recognize three different message types for purposes of pricing: Text messages, charged at 6.5 Won per packet (97 kb for US$ one); Multimedia messages, charged at 2.5 Won per packet (250 kb per US$ one); and audio/video on demand, charged at 1.25 Won per packet (0.5 Mb per US$ one), a price reduction of 50 per cent that was approved by the MIC on May 29 2002.

The current signs are that the price is not yet quite right and continue to be adjusted. The most popular mobile data applications are those that can be downloaded (e.g., ring tones and games) and played offline rather than those that require the user to be online or the handset to be "always-on".

Korean mobile operators are using a business model which is very similar to that used by NTT DoCoMo in Japan, but without the subscription price for data services. They are mainly offering a "walled garden" type content model with revenues split between content provider and services provider in the ration 90:10. KTF has more than 130 content providers and SK Telecom more than 250. In theory, the content providers should get 90 per cent of any revenue raised from the sale of content (a lower figure is applied for streaming TV content). But in practice, the majority of revenues (around 70 per cent) come from airtime (per minute prices paid for using the mobile phone). The operator retains all of this revenue.

2.4.3 Applications

The major applications in use for mobile data are those shown in Figure 2.11, right chart and in Figure 2.12. To a large extent this usage pattern reflects the legacy of slow-speed mobile Internet access rather than any true 3G mobile Internet usage. Carriers interviewed during the research programme admitted they were finding it hard to persuade users to start paying for content. This is especially a problem in Korea, where the vast majority of actual and potential mobile data users probably already have an "always-on" broadband connection at home, for which they play a flat-fee for usage.

So the challenge is to create applications that are specific to mobile phones, that are viable within the bandwidth constraints of current technology and that users are willing to pay for. Here are some of the applications that are currently being tried.

- **Video on demand**. As Figure 2.12 suggests, the main difference in the most popular services on 2G and 1x handsets is video-on-demand. This is a highly data intensive application, and even with the newly reduced rates for this service, download of a music video clip could easily cost US$ 2-3. The secret to driving this market therefore lies in offering compelling and exclusive content. An example is "mobile drama", or one-minute daily soap operas. One way of reducing costs is through Java-based software "wavelets" that offer multimedia content (e.g., cartoon animations) at a lower level of quality than high-resolution MPEG-4 handsets. Because this is software-driven, rather than requiring a special chip, "wavelet" handsets are much cheaper than MPEG-4 ones. SK Telecom reports that wavelet downloads rose by 165 per cent between January and March 2002 with almost all the growth accounted for by colour handsets.

- **Music on demand**. Closely related to video-on-demand is the supply of MP3 music files. This service is particularly popular on mobile phone that are specially adapted to this use (e.g., MPEG-4 compatible handsets with better speakers, headphones etc). SK Telecom reports that music download accounts for 34 per cent of data usage on MPEG-4 handsets. Again, price sensitivity is a barrier so the obvious route forwards would seem to be to encourage file-sharing (**peer-to-peer, P2P**) applications that would allow users to download music files without paying royalty fees to copyright owners. The most popular P2P service in Korea is called "Soribada" (www.soribada.com literally "sea of sound"), which is sometimes referred to as the Korean Napster, though unlike Napster it does not require a central server. The legality of this type of service is still doubtful and the service providers are awaiting guidance from MIC. Soribada itself has only recently reopened (in August 2002) after having been shut down following a dispute with the Korean record music industry.

- **Streaming TV**. A variation on video-on-demand is to offer television channels, such as CNN, delivered to a mobile handset. A future variation on this theme is to offer an interactive TV service where by an ADSL subscriber would be able to access mobile data type-interfaces (e.g. SK Telecom's Nate) from an ordinary TV screen, allowing for product tie-ins (e.g. direct ordering of products advertised on television), or purchase of pay-per-view events.

- **In-car navigation systems**. Both SK Telecom (Nate Drive) and KTF (Telematics, in conjunction with Daewoo and Hyundai) offer vehicle-mounted terminals that combine GPS functionality with mobile data. The KTF system, launched in March 2002, is offered on a subscription-based or a usage-based tariff. It offers traffic news, entertainment/content and location information that can be delivered directly to an in-car dashboard or viewed from a PC. The Nate Drive service, launched in February 2002, offers a specially adapted handset, with GPS-built-in, that fits into a cradle in the car that acts as a display unit. There is a hot-button that links to an Internet navigation portal. This portal can then be voice activated and can give voice signals on direction. The driver's position is updated every 50 metres and this is matched with GIS (Geographic

Figure 2.12: The top five most popular mobile data services on KTF's 2G and 1x services

May 2002

Source: KTF.

Information System) data. Users pay a monthly subscription of 20'000 Won (US$ 16), plus call fees. The cheapest package would cost around 390'000 Won or US$ 350 to install. SK Telecom argue that having the service online (rather than pre-recorded) will make it more accurate for things like traffic jams, but it will obviously generate more user fees. Because of the current limitations with 1x EV/DO, it is not possible to use the terminal for incoming voice calls while it is being used for receiving navigation information, but this problem should be addressed with 1x EV/DV.

- **Services to PDAs**. Limitations on the size of screens on mobile handsets may limit their usefulness. Some users may instead choose to use 1x EV/DO service with a Personal Digital Assistant (PDA). In May 2002, there were two main wireless PDAs available, Compaq's iPAQ and a locally manufactured JTEL, but others are coming on to the market. PDAs are particularly suitable for downloading content from the Web that can be later read, for instance while commuting on the metro. PDAs are also more suitable than handsets to operate as an email client.

- **Multimedia messaging service (MMS)**. In Japan, where KDDI using CDMA 1x technology has reached over a million subscribers within a few months of launch, sending and receiving still photos is proving to be the killer application for mobile data, especially among teenage users. The service is catching on in Korea too. KTF's Magic (n) "multimessage" service offers phone-to-phone, phone-to-email and web-to-phone messaging. However, Koreans seem to prefer to send character animations of themselves with accompanying text, rather than real photos. In the streets of Seoul, there are

lots of boutiques offering to develop a character animation of clients, based on a photo, but made to look more like a cartoon, which can then be sent to a mobile phone or to an email client.

- **Fixed/wireless integration**. Wireless LANs are becoming big business in Korea. There are many coffee shops that already offer wireless LANs as well as airports, universities etc. The telecommunication service providers are getting into the game with subscription-based services, such as KT's Nespot service, launched in May 2002. Although this service is usually accessed from PCs, there is scope for offering a service, say to PDAs, that would offer high-speed access, via wireless LAN, at hotspots, combined with slower-speed access, via 1x or 1x EV/DO, when roaming. All of the operators are developing service offerings. KT has been working with McDonalds, while SK Telecom has been working with Starbucks and Sheraton to develop pilot services. KTF's N-Zone service additionally offers Voice over IP (VoIP) service for cut-price calls to mobiles.

- **Mobile/Internet numbering integration**. One specific application, currently unique to Korea, is to provide integration of the mobile numbering system (e.g., 079 1234 5678) with the Internet Domain Name System (e.g., john@itu.int). The current approach at the global level is based around the ENUM standard.[16] But progress on this has been slowed by politics, in particular on whether or not there should be a "golden tree" structure to the numbering plan and, if so, who should control it. Korea's domain name administration authority (KRNIC: www.nic.or.kr) has come up with an innovative solution that it calls WINC (Wireless Internet Numbers for Content). This enables a mobile phone to use numbers to access Internet sites. Testing began on 15 April 2002 and was made available commercially on 1 June 2002. For instance, typing 642 would give access to a limited set of URLs from which the user could choose from the screen (e.g., nic.or.kr or mic.or.kr). Typing 642#123 (confirm) would take the user directly to www.nic.or.kr).

- **Mobile Commerce**. As elsewhere in the world, it is hoped that mobile commerce will be a driver of mobile Internet take-up in Korea. KTF is offering a platform called "K-merce", which offers personal finance services (stock trading, banking, money transfers from a mobile phone), shopping transactions (including participation in auctions) and payments, made from an IC chip embedded in the phone. One of the most popular mobile commerce services thus far has been the **e-lottery** service, which enables lottery tickets to be purchased from a mobile phone. Recently, someone won a jackpot from an e-lottery ticket, which generated a lot of favourable publicity. However, a major constraint to the development of mobile commerce in Korea is the limit of 30'000 Won per month (around US$ 25), which was imposed by regulators, under pressure from credit card companies worried that mobile phone companies would steal their business. Virtually all billing in Korea is post-paid rather than prepaid, so this acts as a limit on credit. The mobile phone companies are negotiating for the limit to be raised.

These are still early days in the development of the mobile Internet, and it is not clear which of these applications, or others not yet developed, will turn out to be major demand drivers and which will flop. Korea, along with Japan, is a pioneer in this field, as shown by the fact that these two countries have much higher levels of mobile data usage than other

countries (see Figure 2.7).[17] There is intense rivalry between the two countries as to who will prove top dog in the mobile Internet. Although Japan has a greater percentage of mobile users that use the Internet (mainly thanks to the i-mode phenomenon), Korea has the bigger number of high-speed mobile data users (thanks to CDMA 1x). Their experiences will be closely observed as 3G services are implemented elsewhere in the world.

2.4.4 Korea as a mobile pioneer

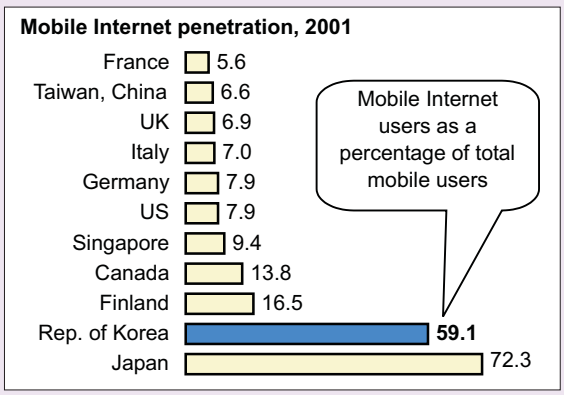
The approach that Korea has taken in mobile technology has been quite bold. Although Korean manufacturers of mobile handsets, like Samsung or LG, compete actively in the market for GSM equipment, the domestic market is purely CDMA. When the Football World Cup was hosted in Korea in June 2002, foreign visitors could only roam by having their GSM handsets encased in a CDMA "shell". Korean operators lost out on a potentially huge source of revenue because few visitors bothered to do this and were thus unable to use their mobile terminals.

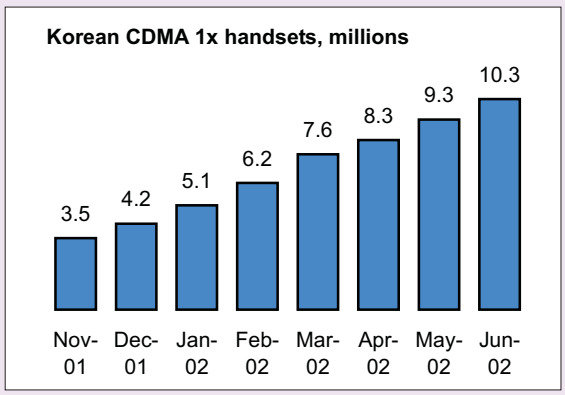
If Korea's decisions on choosing a mobile technology had been based purely on market concerns, then it is unlikely that they would have chosen CDMA. But CDMA represents a technically superior alternative (for instance, it is at least three times more efficient in the use of spectrum) and, above all, championing CDMA technology has been an important part of the Korean government's overall IT strategy. The key question is whether CDMA puts Korea in a better or worse position as the market moves on to the next generation of mobile technology? The early evidence suggests that CDMA 2000 1x is leading the way in 3G. It is outperforming W-CDMA in Japan and it has scored some early successes in North America. But it may never be adopted in Europe and it is unlikely to be adopted anywhere else in the GSM world. Thus, like for the CDMA platform itself, technically superior performance is not enough. It is industrial policy that counts.

Japanese manufacturers are in a similar situation. Their homegrown mobile technology, PDC (Personal Digital Cellular), is not used anywhere outside Japan. They have scored some successes with i-Mode but need now to market that success outside the country. NTT DoCoMo is leading the charge to push i-mode and is doing this through acquisitions (e.g., as a shareholder in AT&T

Figure 2.13: Ahead of the pack

Mobile data usage in Korea, compared with selected other economies (left) and over time (right)





Source: MPHPT Japan (left), MIC Korea (right).

Wireless), through Joint Ventures (e.g., with KPN of the Netherlands) and by bidding for licences. For the moment, Korea's operators have only limited interests outside their home country. The conclusion from this would seem to be that, if Korea really wants CDMA 1x to be successful in potential export markets, this would require Korea's operators to look outside their home territory as well as Korea's manufacturers.

A second question that arises is the extent to which wireless LAN (WLAN) services (such as KT's "Nespot") and 3G services (such as the CDMA 1x service) will be complementary or competitive? Although, in theory, WLAN services should not be substitutable for 3G, because of their limited range (typically below 150 metres), in practice, as the density of WLAN hotspots increase, there will be a degree of substitutability. The primary advantage of WLAN services is their pricing mechanism. They tend to be priced on the basis of a flat-rate subscription, not a per minute basis. This is a critical advantage for access to the Internet, where users are familiar with unlimited usage pricing. The capacity available on WLAN is also much greater than that currently available on mobile networks.

This represents a dilemma for Korea's wireless operators. Should they embrace WLAN, and risk cannibalising their CDMA 1x revenues? Or should they try to ignore WLAN, and risk losing the market to other operators, such as KT? Perhaps the answer lies in a greater degree of terminal integration. It is relatively easy to envisage developing terminals that could use either WLAN, where available, and CDMA 1x, where it is not. Here is a major market opportunity for Korean manufacturers.

[1] Korea's low rate of local lines connected to digital exchanges is partly a result of country's drive to produce its own local telephone exchanges known as TDX. Though a large number of the TDX exchanges were installed during the 1980s, installation has tapered off lately. According to one researcher this is due to the high development costs which make the exchange more expensive than those produced in other countries. See Sung-Bum Hong, "The Patterns and the Directions of Technological Innovation in the Switchboard Industry of Korea."

[2] See Thrunet. "Fact Book." english.thrunet.com/ir/fact_book.asp.

[3] The urbanization of Korea has progressed rapidly since the 1980s and the construction of apartments has boomed since 1995. In the year 2000, apartments emerged as the main housing unit.

[4] Korea's manufacturers are beginning to have an impact on global ADSL markets. For example, Samsung has emerged as the fourth and third largest vendor globally for ADSL exchange and customer equipment respectively. See "Samsung is one of the world-leading ADSL vendors." *Samsung Electronics Press Release*. 9 February 2001. http://www.samsungelectronics.com/network/broadband_network/product_news/news02_09_fed.html. http://www.samsungelectronics.com/news/telecommunications/com_news_1013075527859_001500.html.

[5] MIC. Broadband Internet in Korea. April 2002.

[6] For more on the development of Internet exchanges in Korea see, Young-Ro Lee and Byeong-Nam Yoon. "IXs in Korea." www.apia.org/nl8/IXKorea.html.

[7] "In addition, Internet users in Korea pursuant to traditional dial-up services must pay local per minute telephony charges, whereas ADSL subscribers pay a flat fee. Therefore, we believe that subscribers that average over two hours a day on the Internet realize cost savings through our ADSL services." Hanaro Telecom. *Annual Report on Form 20-F 2001*.

[8] GSM (Global System for Mobile Communications) is widely used throughout Europe, Africa and Asia and was first introduced in July 1991. CDMA (Code Division Multiple Access) is a more recent technology, which is used in some parts of the Americas and in Korea. It is now being introduced in some parts of Asia. For more details on different mobile technologies, see, ITU Internet Reports 2002: Internet for a Mobile Generation, available at: www.itu.int/mobileinternet.

[9] As the level of prepaid subscribers in Korea is very low compared with other countries, it can be assumed that this represents the real number of subscribers rather than an inflated number caused by many unused accounts.

[10] The sale started in 1994 with the purchase of 23 per cent by the Sunkyong Group (SK) and was completed in 1997 when KMTS changed its name to SK Telecom. As of May 2002, KT still retained 11 per cent of the shares of SK Telecom, but a sale of shares was imminent.

[11] CDMA2000 1x, available in Korea since October 2000, was faster than existing networks but did not initially meet ITU's requirements for IMT-2000. However, together with the latest evolution of this standard (1xEV-DO), CMDA2000 1x has now been approved by the ITU as an IMT-2000 standard, retroactively making Korea the first country to commercially deploy 3G services. For more information, see the *ITU Internet Reports 2002: Internet for a Mobile Generation* at: www.itu.int/mobileinternet. For more information on IMT-2000 standards, see: http://www.itu.int/home/imt.html.

[12] See, for instance, "Korea's EV-DO 3G service struggling with slow penetration." *Korea Herald*. 9 September 2002. http://www.koreaherald.co.kr/SITE/data/html_dir/2002/09/09/200209090018.asp.

[13] Interestingly, Korean's appetite for computer animation is helping to bring North and South Korea closer together. The "mydinga" 3D computer animations (www.mydinga.com), a series of short animated films featuring a lazy cat and a cool dog, have been designed in the South (by a subsidiary of Hanaro Telecom) but subcontracted to the North, where labour is cheaper. They are designed to be downloaded onto different platforms, such as mobile phones or PC screens.

[14] See the report on the Korea Herald website at: http://www.koreaherald.co.kr/SITE/data/html_dir/2002/05/25/200205250026.asp. The report was carried out between March 22 and April 15 2002.

[15] For more information, see the summary on the KRNIC website at: http://www.nic.or.kr/cgi-bin/EnterBoard2/enboard.cgi?ActionID=14&dbname=stat_mon&filename=bW9iaWxlIHN1bW1hcnlfZW5nLnBwdA==.2002.07.1211.57.06&index=77.

[16] For more information on ENUM, see the ITU website at: http://www.itu.int/osg/spu/enum/index.html.

[17] For an extended discussion of this theme, see chapter three (Market Trends) of the ITU Internet Reports 2002: Internet for a Mobile Generation, available for purchase at: http://www.itu.int/osg/spu/publications/mobileinternet/index.html.

3. Sector absorption and ICT applications

3.1 E-government

3.1.1 Where Korea stands...

Korea's growing Internet population is an important step towards the country's e-government efforts. An ICT-literate citizenry is needed if online government services are to reach their full potential. A number of e-government projects have been implemented and the country has the prerequisites to move from e-readiness to e-nation.

A variety of achievements can be highlighted. By January 2000, almost all government ministries and agencies were online and connected to a high-speed backbone network. More than 80 per cent of the central government's documents are computerized and 55 per cent of the government's (both national and local) documents are handled electronically. Various applications have also been implemented including a real estate registration system that has computerized over 200 million pieces of property. Information about the properties can be examined in real time and titles issued on demand. The system is accessible from government offices as well as kiosks. Time spent on registering properties has been reduced from over two hours to less than five minutes. The resident registration system contains birth, death, marriage and divorce information on all Koreans. The system was launched in 1993 and is accessible by all relevant government agencies. Citizens can update their record online with no need to visit government offices, reducing the time spent on registration to between 1-3 minutes from 15-20 minutes.

3.1.2 ... and how Korea got there

The Korean government has played a leading role in ICT development. Korea has combined the benefits of a

Table 3.1: Korean government ICT budget

2001 and 2002, Won billion, (US$ millions)

Category	2001 Budget	2002 Budget	Remarks
E-government	490 ($ 372)	572 ($ 435)	Key items in the e-government agenda
IT Infrastructure & Industrial IT Application	322($ 245)	403($ 306)	Software & digital contents development, standardized electronic catalogues
IT Application in Everyday Life	463($ 352)	511($ 388)	Public library digitalisation, electronic mapping of underground utility networks
Digital Divide & Abuse Prevention	228($ 173)	126($ 96)	Low-income subsidies for internet access, network & equipment protection
Total IT budget	**1'503($ 1'143)**	**1'611($ 1'225)**	**7% increase**

Source: Ministry of Planning and Budget. "Synopsis of the Budget of the Republic of Korea, Fiscal Year 2002." February 2002.

free market economy (e.g., competition and innovation), with the positive effects of a robust government, such as the protection of disadvantaged groups and the promotion of long-term investments (see Box 3.1). There is much to learn from the government's active role as provider, user and promoter of ICT. The emphasis here lies on the word *active* since the Korean government not only provides the necessary regulatory framework and supportive environment but, in an effort to be one step ahead, also encourages companies to invest in and consumers to use ICT.

Korea was one of the first countries to emphasize the importance of ICT as an economic stimulus. It also recognized the role that ICT could play to make its society more productive and its government more democratic. The government's leadership and top leaders' commitment to ICT, combined with adequate funding, have helped Korea to spark and maintain its digital revolution. Between 1998 and 2001, government spending for information technology doubled, from Won 715 billion (US$ 544 million) to Won 1'503 billion (US$ 1.1 billion). ICT spending represents 1.4 per cent of the government's total budget and is one of the top ten expenditures.

The country's successful ICT adaptation is partially the result of its governmental organization structure. Some countries in the world have been overtaken by events, without a clear

Box 3.1: The Korean equilibrium - public and private harmony

It may seem unusual to hear a company manager say, "It is part of our business culture to listen to the government."[1] After all, an adversarial relationship between public and private interests is common in many countries. But in Korea, there seems to be a quiet agreement between government and business. Instead of a zero-sum game, in which one wins what the other loses, there is a culture of mutual and shared interests where both sides can win.

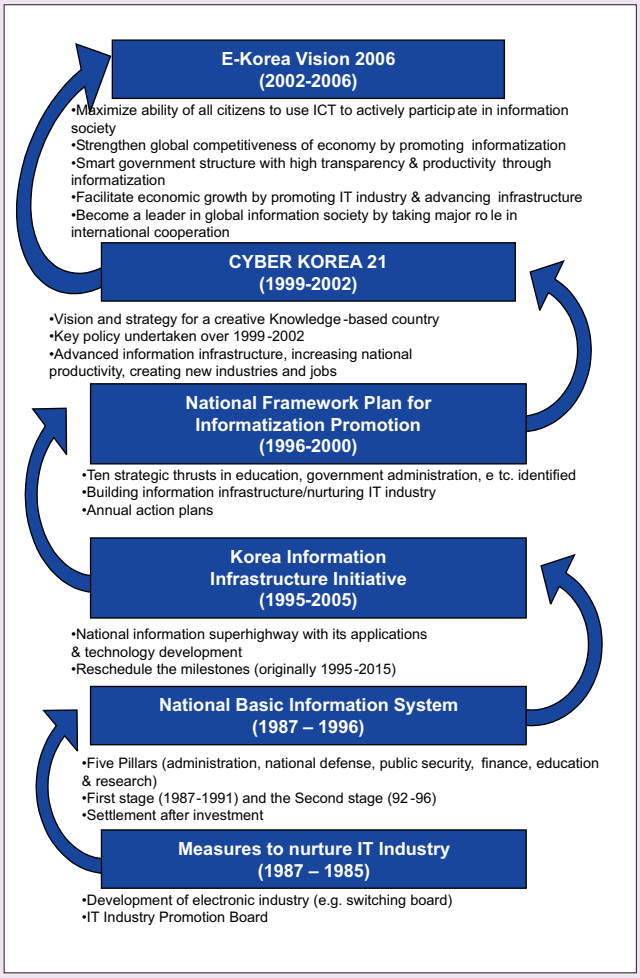
Part of this is uniquely Korean with a tradition of government authority. Nevertheless, it is important to understand the government's way of dealing with the private sector, which contributes to this equilibrium. The Korean government's mission is delicate, in which it influences the market without dominating it. Its active intervention is aimed not only at counteracting market failures but also at inducing the private sector to make long-term investments by providing a certain degree of protection. Part of the strategy is to get government and business officials together. Furthermore, almost all government projects are planned and carried out in cooperation between the two sides.

To achieve long-term ICT investments, the government has come up with different types of funding mechanisms and policies. It has also contributed to the growth of the ICT industry by being one of the private sector's best clients for information technologies. The Informatization Promotion Fund, established by the MIC, is used to support projects selected by a special committee on a competitive basis. In 1999 and 2000, the government provided Facilities-based Service Providers (FSP) with US$ 77 million, at a very low interest rate, to invest in broadband access networks. The 2000 provision included the condition that the companies invest in less densely populated areas. While this reduced the financial burden taken on by the FSPs, the payback of this investment is substantial. It is estimated that the spill over effects of the investment in broadband Internet services amount to over US$ seven billion and had created 5'000-8'000 jobs by 2001.

Similarly, government test beds let private companies experiment with new technologies without the financial risk. The government's Security Net program currently provides companies with support for research on next-generation Internet technologies such as the Ipv6 backbone. Another way of encouraging companies to invest in ICT is the 'Certification Program for Broadband Buildings and Apartments.' This initiative certifies the informatization level of new apartments and buildings. Buildings receive 1st, 2nd or 3rd class certificates, depending on whether they provide over 100 Mbps, 10-100 Mbps or 10 Mbps Internet connections.

A recently announced government plan calls for boosting the country's information technology export industry by helping smaller Korean companies establish an overseas market presence. The initiative, called *e-Silkroad*, will select 50 products that are most likely to be a success and ensures the manufacturer receives financial funding. The government will also investigate the market potential for the product in different countries. Selected projects include CDMA technologies, games software and home networking.[2]

Figure 3.1: Korea's ICT plans



Source: NCA.

ICT strategy. There are often competing projects across different agencies and ministries. Korea has not allowed itself to be taken by surprise. The government is characterized by a clear distribution of responsibilities between different agencies. Recognizing the challenges and opportunities brought about by ICT, the government was quick to reorganize existing structures or introduce new agencies and to revise or launch new laws and regulations. Goal identification and measurement have played a crucial role. The ICT activities of government ministries and agencies are carefully monitored and there is a plethora of statistics and reports.

Finally, the government has also implemented its vision of an information society in a series of plans dating back to 1987 (see Figure 3.1). Six major national projects have structured the direction of government policies:

1. *The National Basic Information System* (1987-1996) was the first national project to call on the mobilization of resources to be used for the use and promotion of computer networks.

2. The *Korea Information Infrastructure* (KII) project, initiated in 1995, included the construction of the national high-speed public backbone, the development of ICT applications, the promotion of R&D and IT-related pilot projects. KII emphasized public-private partnership, established an information promotion fund, which encouraged private companies to make long-term investments and promoted research. A certification program for broadband buildings was launched and the government provided test beds to help companies avoid risks while at the same time encouraging R&D. The KII project has been continuously revised and upgraded in response to market and technical developments.

3. The *National Framework Plan for Informatization Promotion*, initiated in 1996, set up the annual action plan for different sectors, including government and education. It also included a blueprint for an information society (with e-government plans) and set up the Informatization Promotion Committee. This top-level decision-making body, chaired by the Prime Minister, suggests and evaluates projects. It works together with and takes advice from the Informatization Promotion Advisory Committee, made up of 26 representatives from the

business sector, academic sector and private organization.

4. *CYBER KOREA 21* (1999) was a response to the Asian financial crisis and designed to counter the effects of the recession and to overcome the crisis. It laid out the necessary steps to reform the country into a dynamic information society and increase ICT productivity to create new businesses and jobs. It boosted national infrastructure and connectivity was increased from 155 Mbps to 40 Gbps in 144 regions.

5. The *e-Government Initiatives* (January 2001) specified 11 actions to enhance the development and use of government applications, such as the home tax service, the e-procurement system, the financial/education information system and the personnel management system. An e-Government Committee, including experts from the private and the public sector, is responsible for the implementation and evaluation of e-Government projects. The Committee reports directly to the President.

6. Finally, *Global leader, e-Korea* is the slogan for the MIC's latest initiative. It includes the e-Korea project (launched in April 2002), aimed at upgrading the country's information technology infrastructure and tackling fresh challenges stemming from the digital divide. The government plans to invest over 70 trillion won (US$ 53 billion) in ICT over the next five years. Goals include getting more than 90 per cent of all Koreans online, improving e-government and encouraging schools to use more sophisticated ICT applications.

3.1.3 Government as user

The National Computerization Agency (NCA, at <www.nca.or.kr>) has, since 1987, been in charge of developing and deploying information technology in the public sector. It is in charge of computerizing the government and acts as consultant and administrator to the public sector to make sure that ICT are used effectively. Through the Korea Information Infrastructure Initiative (KII), which was launched in 1995, the government allocated 32 trillion won (US$ 24 billion) to build a national broadband backbone network, mainly through optical fibre cables. It provides over 28'000 government ministries, agencies and public institutions with high-speed broadband access. The nation-wide broadband service is continuously improved and updated and provides the basis for the government's commitment to provide the necessary infrastructure for e-government.

All of Korea's 143'000 central government employees have their own PC and e-mail address. To ensure that the government is effectively using ICT, all employees have to adapt to the informatization process. ICT training is made widely available and the government organizes contests to provide incentives for staff to improve their IT skills. In addition, each ministry has a Chief Information Officer in charge of promoting and overseeing the use of ICT.

In January 2001, the government created the *Special Committee for e-Government Korea*. The Committee, made up of experts from the private as well as the public sector, studied the problem of rivalries between ministries that often hinder the successful development of projects. It came up with several initiatives to enhance coordination and minimize conflict between government entities. Eleven key tasks were identified to improve the quality of civil service and the way the administration works (see Table 3.2).

3.1.3.1 Government as provider

Korea has a long history of trying to improve public services to its citizens through the use of IT. Its efforts go back to the 1980s when it began setting up public databases. A strong characteristic of the Korean government is it inclusive approach, that is, the idea that every Korean

Table 3.2: e-Government initiatives

Key Tasks identified in 2001 for e-Government, to be achieved by 2002

Key Task	Description
Innovative and better services Public and Businesses	
Public-oriented service through a Single Window (G4C: Government for Citizen)	Establishing portal site and public information sharing system for five major databases in the areas of resident registration, real estate, vehicles, corporate and tax
Linking four major social insurance information systems	Linking medical, national pension, employment, and accident compensation insurances and activating information sharing
Home Tax Service via the Internet	24 hour online service such as tax declaration and payment, affairs document issuance and tax counselling
G2B: Integrated e-Procurement System	Establishing a single procurement window and making all procurement related processes electronic such as registration, tender, contract and payment
Productivity and efficiency Government	
Integrated National Finance Management System	Establishing a system for information sharing and linkage for finance related institutions
Integrated Administration Information System in local government	Completing information for all administrative affairs such as resident registration and real estate, finance, tax, etc. in 21 cities
Nation-wide Education Administration Information System	Establishing an online logistics system for school affairs and education administration material connecting schools, Office of Education and Ministry of Education and Human Resources Development
Personnel Policy Management System	Developing and diffusing a standardized system for the whole human resources including recruitment, promotion, payment and training of public service personnel
Government e-Document Exchange	E-processing of preparation, approval, distribution and storage of all governmental documents
Building an infrastructure for e-Government	
Government e-signature and e-seal system	Securing reliability for information distribution and e-administration such as private information protection and security
Consolidation of Government Computing Centres	Protecting 24 hour working, professional service, and secure information resources by managing computing environment in an integrated manner

Source: NCA.

should and needs to participate in the global information revolution. At the same time, it is very goal-oriented. Currently, the government's objective is to get 90 per cent of all Korean's online by 2006. Its approach is inclusive in another way. Instead of simply providing the infrastructure and relying on peoples' interest to get connected, the government is also active in raising awareness and providing training, especially to what it calls the information disabled. Between 2000 and 2002 more than 8.1 million people were trained, including the elderly, housewives, and prisoners. Some 20'000 military personnel received computer training and had the possibility of obtaining an Information Specialist certificate - a bonus on the job market. Small-and Medium-sized enterprises (SME) and marginalized sectors of the society are provided with subsidized Internet access. The 'Plan for Promoting ICT Use and Distributing PCs to Children of Low Income Families' was launched in 2001 and provides those who cannot afford to have ICT with a PC and a discount Internet access rate. The government also subsidizes companies to provide computer training for their older personnel.

Until recently, e-government was more focused on the use of ICT to enhance government procedures with citizens benefiting indirectly through more efficient and quicker processing. While it used to take three days and four different forms to process a new passport, it now takes 20 minutes and one form. So while the application is not available online, citizens can get passports in a much shorter period.

The government has set up the civil affairs portal (G4C), which will make it much easier for Koreans to deal with administrative matters. The single portal will provide some 4'200 government services online without citizens having to visit different agencies. A map will help citizens navigate through the different procedures and a search system will help them to find their way. Using the e-government portal, citizens will be able to use online filing, issuing and identifying services such as residence registration transcript and abstract, certificate for the disabled, tax-paid certificate and building registrations. The cost of the transaction will be calculated online and application forms will be available.

Since April 2002 the e-government portal (www.egov.go.kr) has been providing electronic filing and information services and by the end of 2002 some 400 civil affairs services will be processed electronically. The site averages about 11'000 hits a day and the number is increasing rapidly. "*The …project concentrates on the renovation of civil affairs service to minimize peoples' time and efforts, by abolishing unnecessary work, reducing the number of documents to be submitted and simplifying civil affairs processing procedures*."[3]

The government is also developing an integrated database covering five major areas: real estate, citizen's registry, automobile registration, enterprise information, and taxation. Organized on the federal level it will cut across all government agencies, including the 16 provincial and 232 local governments. According to the government, this project will reduce the average number of documents required for a resident from 1.9 to 0.1, and the average number of visits from 4.5 to 1.2.[4]

3.1.4 ICT success factors

The success of Korea's ICT sector is in a large part due to the direction and policies that the government has adopted. The following examples illustrate the government's active role in the promotion of ICT. They also highlight factors that could serve as a motivation and inspiration to policy makers around the world.

- *Project evaluation*. The Korean government meticulously collects data, writes reports, carries out surveys, analyses progress and identifies goals. Reports include the NCA's *Internet White Papers*, KISDI's *IT Industry Outlook,* the Ministry of Education's *White Paper*

on Adapting Education to the Information Age and the MIC's *White Papers.* These reports are an important development tool since they highlight strengths and weaknesses. They also allow the government to put achievements into international perspective and to compare different government strategies to each other.

- The *Evaluation System for National IT projects* was introduced in 1997 to assess the results of different projects. The Informatization Evaluation Committee, composed of government officials as well as experts from academic and research organizations and industry, oversees evaluations. A self-evaluation by the agency involved is followed by an external evaluation by the Committee. In 2001, 62 projects were evaluated. The Informatization Evaluation Committee also assesses the computerization of central and provincial government agencies with regard to infrastructure, utilization and vision and strategies. The results of the evaluation are used to determine new projects and plans.

- *Research and Development*. There are a number of research and development organizations in Korea dealing with ICT, such as the Electronics and Telecommunications Research Institute (ETRI, see Box 3.2). The Korea Information Society Development Institute (KISDI, at www.kisdi.re.kr) is another government sponsored research institute. Its primary aim is to provide the vision and policy direction towards a knowledge-based society in Korea. The Korea Advanced Research Network (KOREN) receives government funding to study the suitability and feasibility of future technologies.

- Universal access. With the launch of Cyber Korea 21 in 1999, the government declared war on the dig-

Box 3.2: ETRI — Korea's innovation driver

Established in 1976, the Electronics and Telecommunications Research Institute (ETRI, at www.etri.re.kr) is a non-profit, government-funded research organization and one of the driving forces behind Korea's ICT success. Some 30 per cent of its almost 2'000 staff hold a Ph.D. degree and another 60 per cent a Master's degree. Its personnel hold over 2'000 international patents and have published some 20'000 articles in Korean and foreign journals.

As the country's premier developer of innovative technologies, ETRI's customers include not only the public sector, such as the MIC, but also the private sector, especially small and medium-sized companies. ETRI's technology transfer mechanism allows it to commercialize new technologies while also helping to support its existence. Once a project has been sufficiently developed and is ready to be commercialised, it is handed over to the private sector. Over 800 technologies have so far been transferred from ETRI to some 1'800 private companies, an arrangement that has provided ETRI with over US$ 200 million in royalties. Through its development of products such as the TDX digital telephone exchange and Code Division Multiple Access (CDMA) technology, and its incubator facility for start-up companies, ETRI has helped make Korea a competitive force in the ICT field. Current research areas at ETRI include fourth generation mobile communications and future security networks.

ETRI's success partly explains Korea's ICT success. In order for a nation to take a lead in ICT, it must play an active role in technology research and development. This helps to nurture local sustainability as well as competitive advantage. A number of ETRI's projects had their roots in uniquely Korean problems such as the need for a local telephone switch to meet overwhelming demand in the 1980s. Another example is automated Korean/Japanese/English language translators that ETRI has developed to generate technical manuals, translate web pages and generate subtitles for television. ETRI has also helped overcome market uncertainty by carrying out R&D in areas where business has been reluctant to invest. The payoff has been big with ETRI estimating that sales of products and services using technologies it developed were some 200 times higher than the initial R&D investment.

ital divide. It has since been actively promoting policies to provide universal access to ICTs. The *2002 Act on Closing the Digital Divide* includes the establishment of the Korea Agency for Digital Opportunity and Promotion (KADO) as well as a Digital Divide Committee and a five-year Master Plan. Goals are to equip every region in the country with broadband access, provide a minimum of one location with free Internet access for each of the country's 3'500 administrative units, offer IT training to every interested person, and help vulnerable groups (e.g., disabled, elderly, etc.) take advantage of online content. There are also digital divide projects for education and small and medium sized enterprises.

- As part of the digital divide project, 500'000 primary and secondary school students from low-income families received extra curriculum computer courses during 2000 and 2001. Apart from these lessons, 50'000 low-income students with good grades received a free PC, together with a free five-year Internet subscription. 4'500 recycled PCs were given to the needy and free Internet access is provided in almost 3'000 public places, such as post offices and community centres. The government also finances research on ICT accessibility for the disabled. The government's war on the digital divide is not restricted to only Korean citizens. Free Internet access along with PCs and other ICT equipment will be installed in locations where foreign workers (of which there are some 300'000) are housed. At the international level, Korea is cooperating with various organizations, including the ITU, OECD and APEC, to reduce the digital divide.

- *Right environment.* Since the enactment of the Framework Act on Informatization Promotion in 1995, the Korean government has put through over 150 laws related to informatization. They cover a range of topics including security, privacy, e-commerce, e-government, intellectual property and reducing the digital divide. The laws establish a legal framework for ICT in Korea and help promote the development of an information society by enhancing confidence in online activities. Recent focus has been on information security. The *Secure-e-Korea* project, initiated by the government in 2002, features an ICT security system that all businesses will have to adopt. The project is the government's response to protecting electronic information due to increasing e-commerce transactions, online medical prescriptions and other sensitive online dealings. The government is expecting to invest some 280 billion won (US$ 213 million) in information protection technologies and standards over the next six years.[5]

- *Learning from and sharing with others*. The Korean government has been increasingly active on the international front to promote ICTs. It not only participates in a number of international and regional organizations dealing with ICT matters but also organizes an increasing number of workshops, seminars and conferences. One example was the July 2002 e-government symposium in Seoul, which was hosted by the MIC and attended by some 200 high-level policy makers. Organized in cooperation with the Asia Pacific Economic Cooperation (APEC), the meeting was aimed at helping countries to exchange information on e-government projects. Korea is seen as one of the e-government forerunners among APEC members and *"keen to publicize the successful implementation of its e-government project….paving the way for the export of digitalisation solutions."*[6]

Despite these successes, there is room for improvement. A recent global ranking of e-government suggests that though Korea is doing well, others have done better. Korea ranks 15th, placing it in the high e-government category but below other Asia-Pacific nations including Australia, New Zealand and Singapore (see Table 3.3).[7] However as these are all nations where English is the official language, there could be some linguistic bias (indeed of the top ten ranked nations, six were English speaking). Japan ranked 27th while Hong Kong, China and Taiwan, China did not appear in the ranking.

Table 3.3: Ranking e-government

Country	Rank	Score
USA	1	3.11
Australia	2	2.60
New Zealand	3	2.59
Singapore	4	2.58
Korea	15	2.30
Japan	27	2.12

Source: UN, Benchmarking E-government: A Global Perspective.

3.2 Education

3.2.1 Where Korea stands...

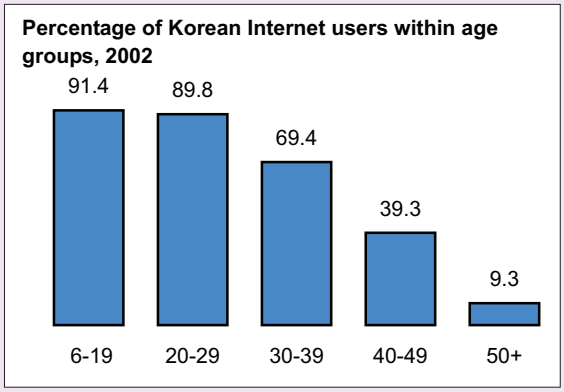
Every primary and secondary school in Korea has access to the Internet. By early 2001, all were equipped with a Local Area Network (LAN), at least one computer lab and access to the government backbone network, PUBNet (www.pubnet.ne.kr). Connection speed up to 256 kbps is provided free of charge and schools get discounted rates for higher speeds. Today over 96 per cent of all schools have their own web pages, every teacher has their own PC and 93 per cent of Koreans between the ages of 7-19 use the Internet.

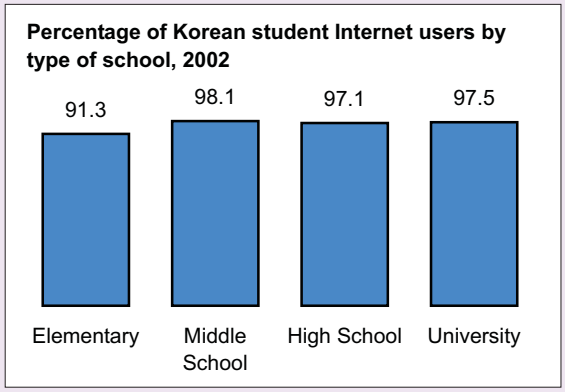
3.2.2 ...and how Korea got there

In 1995, the Korean government made a decision to use Information and Communication Technologies (ICT) to remodel the country's educational system and to create *edutopia*.[8] This term reflects the government's goal of creating an *education welfare state*, in which all citizens are given the possibility to develop their full potential. Special emphasis is placed on the promotion of creativity, individuality and an open educational system for all. The Korean government felt that ICT could play a major role in helping to achieve this goal.

Figure 3.2: Korean youth online

Percentage of Korean Internet users by age and percentage of Korean Internet users by school, 2001





Source: KRNIC.

Many governments have come to realize the importance of ICT and the need to make it available in schools and universities. Korea distinguishes itself from most other countries in its belief in the transforming properties of ICT. According to the Ministry of Education and Human Resources Development, *"As the society changes, new types of people will be needed. The goal of education utilizing ICT should be to graduate students who can meet the requirements of society."*[9] Instead of using new tools to make the existing system work better, Korea uses ICT to help people change their way of thinking and working. In other words, *"Adapting education to the information age does not identify a specific activity, but it implies a total change in content, method, and objectives…"*[10].

3.2.3 The Ministry of Education and Human Resources Development

The Ministry of Education and Human Resources Development (MOE, at www.moe.go.kr) has been online since 1996 and its web site provides a variety of information on the educational system. The different departments of the Ministry can easily share documents and use an electronic bulletin board to exchange information. The computerization of the Ministry's administrative activities, including the educational budget, the management of teacher training institutes, and the issuing of teacher certificates took place in 1998. More than half of all documents within the MOE are today processed electronically.

The Comprehensive School Information Management System, which was set up in 1997 and later replaced by the Nationwide Educational Administration Information System, aims to computerize school records and streamline services. The system facilitates the exchange of information, through e-mail services, bulletin boards and electronic document processing. It also includes a database on students' school life records, such as courses taken and grades. Other services include the computerization of school budgets, personnel, student health care, etc. By 2002, almost 9'000 schools (around 90 per cent) had adopted this system.

3.2.4 Primary and secondary education

Korea's school system is divided into elementary school (1st to 6th grades, when children are between the age of six and 11), middle school (7th to 9th grades, age 12-14) and high school (10th to 12th grades, age 15-17). Elementary school is compulsory and the government is planning to extend this to middle school although almost all Koreans already attend high school and the country has the highest level of secondary school graduates in Asia. Government efforts to improve the

Table 3.4: e-education indicators in Korea

2001

Primary education	
Number of primary schools	5'322
— Percentage with Internet access	100%
— Number with web pages	4'928
Secondary education	
Number of secondary schools	4'955
— age with Internet access	100%
— Number with web pages	4'588
Higher education	
Number of Universities	174
Number of Polytechnics/other technical Institutes	20
Number of Junior Colleges	158
Number of IT graduates (*)	34'970

Note: * IT graduates refers to graduates from the fields of computer science, computer design, and e-business management.
Source: KERIS.

educational system are supported by parents, many of who are eager for their children to go on to college or university. The fact that many parents are willing to spend money on private tutoring reflects how important education is to Koreans.

Korea's schools are well endowed with ICTs. In 2000, the student to PC ratio was 17:1 and over 50 per cent of schools were equipped with multimedia equipment, such as scanners and digital cameras. Currently about half of all schools have a network connection speed of at least two Mbps. The government plans to provide all schools with this speed by 2005. Two schools have been designated "Internet High Schools" providing them with the latest high-tech equipment and teaching methods (see Box 3.3). The Internet high schools allow the government to test new teaching methods and compare them to other schools.

Every student begins computer education from primary school with compulsory ICT courses of one hour per week. Middle schools provide three hours of optional ICT training a week and high schools provide two hours per week. According to a 1999 survey, some 48 per cent of middle school students and over 55 per cent of high school students were taking these courses. Every teacher has to make sure that at least ten per cent of their course makes use of computers. This rule is applied vigorously and forces teachers to learn about ICT. Almost 100'000 teachers (over 30 per cent of all teachers) receive ICT training every year and every primary and secondary school has at least one professional ICT teacher. Korea's 11 national education universities have been equipped with multimedia labs, allowing future teaching staff to improve their ICT skills.

3.2.5 Higher education

As in many other nations, the university community pioneered computer networking in Korea. The first TCP/IP network in the country, the System Development Network (SDN), was introduced in 1982 by Seoul National University and the Korea Advanced Institute of Science and Technology. Dial-up connections to the US were established in 1983 and a permanent 56 kbps link to the Internet was made in 1991. The construction of the Internet remained within the academic and research sector until commercial services started in June 1994.

Korea's universities are linked through the Korean Education Network (KREN), which started as a non-profit network in the early 1990s. KREN connects all public universities, some private ones and other educational institutions, including some secondary schools. All universities have high-speed Internet access and bandwidth is increasing constantly. In mid-2000, the government-owned network was outsourced to Korea Telecom and integrated into its KORNET backbone.

Despite a high level of connectivity, the quality of ICT facilities in universities varies. A number of universities have a limited number of PCs. According to a study undertaken at the Seoul National University, students have access to free public computer facilities although *"the record on the use of these PCs shows that 30.6 students share one public PC. It suggests an achievement rate of 33%, far below the goal of 10 students per public PC."*[11]

The first distance education universities opened in March 2000. Only four months later over 5'000 students were enrolled in one of the nine so–called *cyber* universities. Four of these offer only distance education while the others also provide traditional courses. In 2001 there were 6'220 students enrolled. According to government officials, the success of distance education has been mixed. Many students still prefer to physically attend courses, especially in a country where higher education is easily and widely available.

Box 3.3: From mechanics to web design

Located down a narrow street in a quiet section of central Seoul, the Sunrin Internet High School is identified by a large gray stone marker. The stone harks back to traditional Korea, with its elegant characters written in the country's Hangul alphabet. But what is going on in the school is definitely the future. Although all of Korea's primary and secondary schools have computers and Internet connections (the latter accomplished in December 2000), Sunrin is different in that the high school has been designated as only one of two Internet high schools in the country.

Sunrin has traditionally been noted for the quality of its instruction (as well as its baseball team). It has around 1'000 students and 80 teachers. School hours are 8:30 a.m. – 3:30 pm but some students are so hooked they stay until ten pm. Sunrin is a senior high school, roughly equivalent to grades 10-12 in a western school with students aged 16-18. Like at all Korean schools, the students wear uniforms that vary by age and sex.

It is still too early to tell what kinds of jobs the students will get since the first batch has not yet graduated. There is job training through cooperation with industry and some students are already doing business on the side. It was noted that the Internet allows a student's web site, if well done, to be indistinguishable from those of large companies.

Before learning focused on text but now includes images and sounds. Movement, sound, and design are important at the school since they form part of the new digital content. Sunrin is also big on music and there is a lab with equipment for experimenting with digital sounds. The advantage is that you do not have to have the actual instrument, allowing many more students to participate in learning music. Students make their own music, including adding soundtracks to videos they have created. Content development is also taught. For example students study Japanese Manga cartoons for insight into graphical design.

There are plans to create a cyber library. It is expected that in the future students will not need to bring text books since digital versions will be available on the school web site. Other schools could also download textbooks authored by Sunrin teachers, a pretty prolific lot that have already written 15.

Sunrin, a traditional vocational school, was selected as an Internet school because of the enthusiasm of the principal and teachers. According to the principal, a traditional vocational school is useless in today's increasingly information-driven society. Information Technology (IT) is not entirely new at Sunrin, which introduced an Apple Macintosh in 1979 and incorporated computers into the curriculum in 1982.

Teachers are taught IT skills at a private academy funded by the Ministry of Information and Communication. All teachers have their own PC and Internet access.

Computer training is divided into four departments: Internet Information Communication, Web-Managing, Electronic Commerce and Multi-Media Design. Classes range from Unix to learning Web design. Students also take four hours of English a week. In addition, there are extra non-IT courses to compensate for too much exposure to computers.

An interesting example of the multimedia approach is a math class that uses an electronic chalkboard to teach students how to program Eratosthenes Sieve, an algorithm for identifying prime numbers. Thus students learn math and computer programming as well as some English, killing three birds at once. So, while Sunrin Internet High School teaches the basics just like any other Korean high school, it is moving away from conventional teaching methods and towards a new educational environment focused on training digital generations.

There are over 600 PCs and 16 PC Labs, many with the latest equipment. Most PCs are Samsung brand, manufactured by Korea's largest electronics company. The school has two E1 (2.048 Mbps) lines for Internet access paid by the government; much faster than the normal 256 kbps the government provides to other schools.

3.2.6 Educational content

Korea's educational strategy goes beyond simply providing access to ICT. Value is added to the available infrastructure by the provision of applications and content. The Ministry of Education and Human Resources Development, provincial offices of education, as well as the Korea Education and Research Information Service (KERIS) produce online educational material. The private sector is also encouraged to create educational material (which is then certified by KERIS). Annual exhibitions allow companies to present their latest products. In 2001, 88 companies produced almost 200 software titles for schools, which receive government funding to purchase these products. Teachers are encouraged to come up with content ideas and the Ministry regularly organizes software contests.

A special council has been designated to coordinate and oversee content creation. The goal of the Ministry is to cover every single school subject with a variety of multimedia content and to make sure that at least 20 per cent of classroom activities are related to ICT.

A great amount of content is provided over EDUNET (www.edunet4u.net/top.html), the government funded educational portal launched in 1996 catering to students, teachers and parents. The portal is divided into twelve categories to provide information according to the type of user (student, parent, teacher) and educational level (primary, secondary). It includes multimedia packages, teaching-aid material, information on university entrance exams, guidelines for parents, an online dictionary and a question bank database. EDUNET's average annual growth rate has been 140 per cent and in 2002 it reached a subscriber base of over five million. KERIS keeps an exact record of the type of users, the growth rate and access frequency and hours. This helps the organizers of EDUNET to evaluate its usefulness and determine strengths and weaknesses.

Another government-driven project is to increase the use and quality of libraries by providing them with so-called Digital Data Rooms. These will eventually allow students and teachers to manage their library collections through databases, including searching and borrowing material, such as books as well as CD-ROMs, videos and e-books. Eventually the plan is also to connect all libraries to the Digital Data Support Centres, which will allow extensive information sharing, the setting up of a catalogue database and a search system.

The government driven push for content development provision – again in a private/public partnership – has altered the way Korean kids acquire knowledge. The use of the PC, the Internet and other ICT related tools becomes as easy and natural as riding a bike or switching on the TV and is not something they will have to take time to learn. At the same time studying might actually become more interesting and fun thanks to new and interactive methods that not only allow kids to 'play and learn' but also to find their appropriate level of difficulty. One of the advantages of online or ICT-based teaching methods is that they are individualized and flexible. Finally, Korea's example shows that ICT can increase not only the level of quality but also the quantity of tools. Compared to countries that are restricted to working with printed material, Korea's access to vast amounts of online content and the Internet provides students with a much bigger choice and variety of didactic material and available information.

3.2.7 ICT Workforce

In 1999, the Korean government launched *Brain Korea 21,* a higher education reform project to prepare quality Korean human resources for a knowledge-based society. In 2000, undergraduate and graduate enrolment in the science and technology field stood at 727'000 and 71'000, respectively. To provide Korea with the necessary IT work force, the government is funding several programs to promote basic research, and enhance cooperation between the research community and the private sector. In 2001, the government's R&D budget stood at US$ 4.27 billion (4.3% of the total

budget), with an increased level of spending on IT related higher education.

At the end of 2000, Korea's ICT industry employed some 1.3 million people, equivalent to six per cent of the total number of Korean workers. By 2005, the number of IT workers is expected to increase to some 1.6 million.

3.2.8 Life-long education

Government efforts to help Koreans adapt to the information society are not limited to the young. The goal is to provide lifelong education to everyone using information technology by establishing online learning centres and web sites with information on vocational training. Free Internet training is also provided to groups that might not otherwise learn how to use ICT such as the handicapped, elderly and farmers. The *10 million people Internet Education* project, launched in mid-2000, is a two and a half year programme to provide IT training for at least ten million information-alienated. Some 3.5 million people received training in 2000 including one million homemakers.

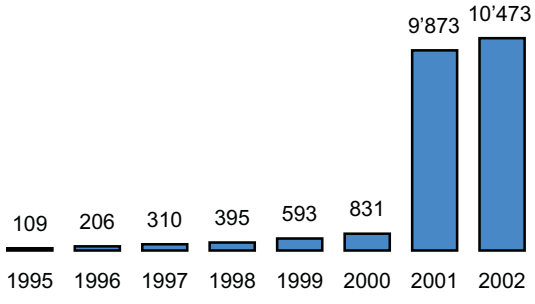
3.2.8.1 Language

Korea defies the assumption that one must be familiar with English to achieve a high level of Internet use. Nonetheless there is a growing sentiment that foreign language skills must be improved to not only utilize the vast amount of information in other languages on the Internet but also to better project Korea's successes and participation in the global information society. Thus, there has been increasing focus on improving English language skills. Every student learns English from primary school on, one hour per week. This is increased to a minimum of three hours per week from secondary school. Some graduate schools even teach their courses in English, the result of a government initiative calling for more English-speaking experts. Studying abroad, especially to learn a foreign language, is encouraged and a growing number of students attend overseas universities for a semester. One motivation for learning English is that the government provides financial assistance for studying IT abroad. Students must have English proficiency since the courses are at universities in

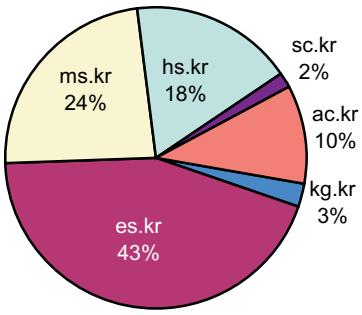
Box 3.4: Dot.school

Until October 2001, educational institutions in Korea used the generic .ac domain name for their web sites. After that date, new second level domain names were created for elementary schools (.es), high schools (.hs), middle schools (.ms), other schools (.sc, such as education and training institutes) and even kindergartens (.kg). This policy allows users to easily identify the nature of a web site. It also expands the number of possible web sites and makes sure that Korea does not run out of domain names.

Second level education domain names in Korea (.ac.kr)



Composition of second level education domain names in Korea, 2002



Note: From October 2001, all school second level domain names are included under academic (.ac). This explains the large jump particularly as that was the period when many schools established web sites.
Source: ITU adapted from KRNIC.

Australia, Canada, India and the United States. Some 900 students participated in this scheme in 2002.

3.3 Health

3.3.1 The health sector

Korea's health sector consists of 1'000 hospitals, 20'000 public health centres, 18'000 pharmacies and 60'000 doctors. The health insurance system has progressively been improved since the 1970s and universal health insurance coverage for all citizens has been in place since the late 1980s. Every citizen, whether employed or self-employed, falls under the health insurance system, financed by contributions made by the insured, employers and by government subsidies. Those who cannot afford to pay for health care (about three per cent) receive assistance.

The Korean Ministry of Health and Welfare (MOHW, at www.mohw.go.kr) is responsible for health policy. Its budget amounted to Won 7.52 trillion (US$ 5.7 billion) in the year 2001, representing 7.5 per cent of the government total.

Despite the rapid advances made in improving the nation's health, there is a feeling that more can be done. There is particular interest in using ICTs to enhance medical service given the rising costs of health care and new developments in medical technology. However, ICT absorption in the health sector has been held back by legal restrictions. There is also a lack of coordination with a number of promising projects but no overall scheme for incorporating the results into a national policy.

3.3.2 ICT in the health care sector

By March 2002, 813 medical institutions were connected to the government's Internet backbone through 953 high-speed links. This includes the MOHW as well as most of the nation's hospitals. The MOHW web site offers information about the health system, policies and links to news regarding health care. One section allows users to ask health related questions that will be answered and posted on the web site. One of the most computerized parts of the health sector is the Health Insurance Review Agency (HIRA, at www.hira.or.kr), an independent agency set up in 2000 to review and process health claims (See Box 3.5).

The first telemedicine project was launched as early as 1994, in conjunction with the Korea Information Infrastructure (KII) initiative. The pilot project delivered medical services using interactive technologies to rural residents.[12] Other pilot projects have followed, by both the government as well as private hospitals. In addition to the rural experiment, government telemedicine projects included a service providing counselling and therapy for people suffering from dementia and a service between homes and hospitals. The experience has been mixed. Most problems are of a non-technical nature and include the reluctance of doctors to be involved (partly because they have not been able to charge for the service) and affordability issues for users who cannot pay the communication charges. Telemedicine is not covered by the national health insurance scheme. Perhaps the biggest barrier has been that telemedicine remains technically illegal due to a fifty-year old law that only allows face-to-face consultations.[13]

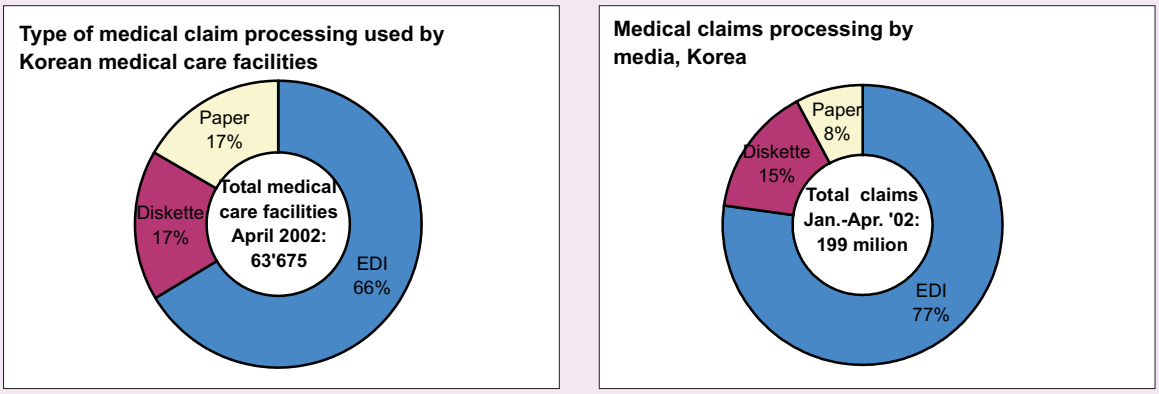
Despite the legal uncertainty regarding online health, some Korean companies offer services to consumers as well as to companies in the health business. Some also sell medical equipment and provide multimedia content, such as live operations and medical seminars. The Dental Network of Korea <www.dentnetkorea.com/index.html> has a database containing information on dental services, clinics, locations, etc. It also provides services to dentists, dental suppliers and laboratories, and functions as a dental market place with data on equipment manufacturers, importers, exporters, etc. CyberHospital <www.HealthKorea.net> was launched in June 1998 and over one million

Box 3.5: Computerizing medical claims

The Health Review Insurance Agency (HIRA) is responsible for processing medical claims in Korea. With close to 600 million claims a year, HIRA has a strong incentive to promote efficient and timely processing through the adoption of information technology. It has been actively encouraging medical care institutions to adopt Electronic Data Interchange (EDI) technology for submitting claims. HIRA has a backbone network connecting its seven regional offices through high-speed ATM links to the headquarters in Seoul. Medical institutions can log into HIRA's site to submit their claims. Although not all health care providers use the EDI system to make their reimbursement claims, most do. Out of a total of 63'675 medical care facilities, 42'280 are connected to the network and HIRA receives 77 per cent of all claims electronically. An additional 15 per cent are submitted by diskette and the remaining claims are sent in paper format. The benefits of electronic processing have been enormous. Errors have been reduced significantly, the number of steps involved reduced dramatically, price checking done instantaneously and there is no more need to maintain rows of paper files.

Besides making the processing of medical claims more efficient, the system also allows patients to check their medical records. Every patient has a personal identification number and, by connecting to the HIRA server, can check information such as their medical expenditures. HIRA has a near term target of having over 90 per cent of medical institutions submitting electronic claims.

Box Figure 3.5: Medical claims processing in Korea



Source: ITU adapted from HIRA.

people have logged into the site. One application features a home unit providing remote monitoring of pulse and blood pressure that is hooked up to CyberHospital via the user's Internet connection.

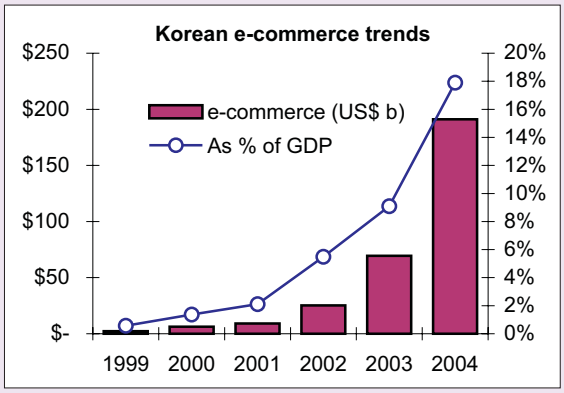
3.4 Electronic commerce in Korea

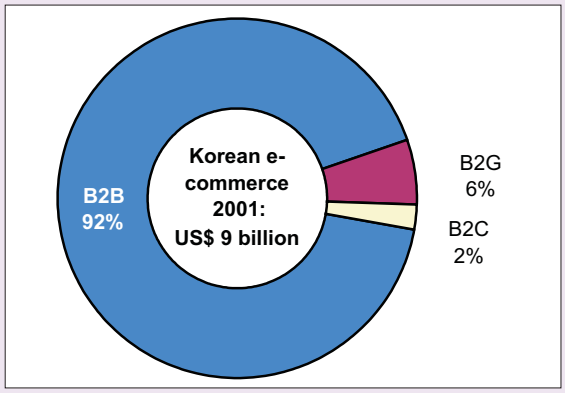
3.4.1 Where Korea stands...

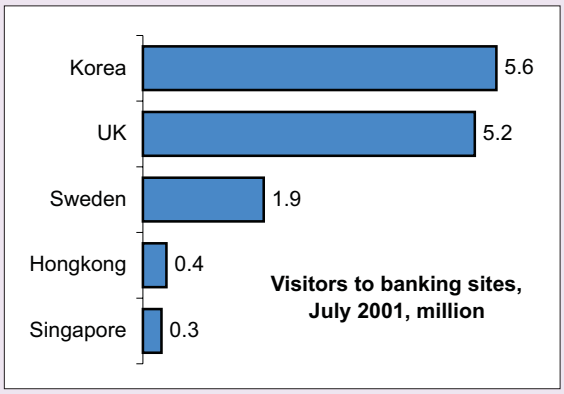
With over 70 million credit cards, there is more plastic than people in Korea. Match those credit cards with the 57 per cent of the Koreans online and the 60 per cent of Korean businesses with an Internet connection, and you have the prerequisites for Korea becoming an electronic commerce paradise.

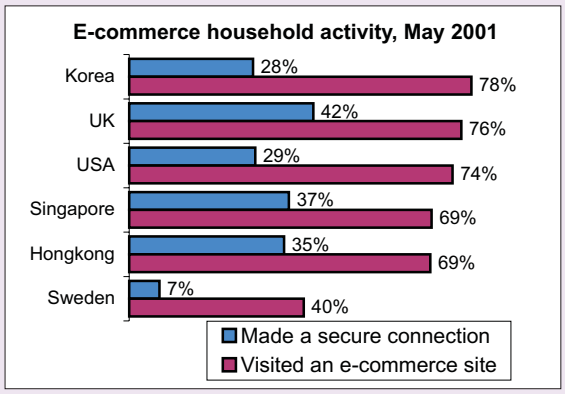
Though official statistics on e-commerce have only been compiled for a short time, they suggest that Korea's e-commerce market is growing rapidly. Estimated at US$ 9 billion in 2001, the Korean e-commerce market represented 2.1 per cent of the economy. E-commerce in Korea is predicted to grow dramatically to almost US$ 200 billion by 2004, and make up almost 18 per cent of the economy.

Figure 3.3: A nation of online shoppers









Note:
Source: ITU adapted from NSO, MIC, NetValue.

Korea leads the world in a number of e-commerce measurements. Over half of Korea's Internet users have visited an e-commerce site, the highest level in the world. With almost 70 per cent of stock market trading done over the Internet, Korea is the number one online stock trader in the world.[14] The country also had 11.3 million online banking users in December 2001, ranking it number one in the world on a per capita basis.

3.4.2 … and how it got there

Factors that have facilitated the growth of e-commerce include the country's high-speed information communication network and large number of Internet users. The government had also established appropriate policies and regulations. Relevant legislation include the Computer Program Protection Act and the Digital Signature Act. The former, enacted in December 1986, extends intellectual property protection to digital goods and services. The latter, enacted in February 1999, guarantees the legitimacy of electronic documents. Four organizations have been certified to verify digital signatures.

While several government entities are involved in the promotion of e-commerce, tasks are clearly divided. The main responsibilities are with the Ministry of Commerce, Industry and Energy (MOCIE, who is responsible for policies and regulations) and the

Ministry of Information and Communication (MIC, who is in charge of the Digital Signature Act, Privacy Protection and infrastructure matters).[15] In February 2000 the government laid out the 'General Plan for promoting e-Commerce' and decided on five main sectors and 40 sub-sectors that would help to turn Korea into an e-commerce nation by 2003 (see Table 3.5).

One of the major barriers to e-commerce is security. Hacking is a major problem in Korea and the number of reported incidents rose from under 600 in 1999 to over 5'000 in the year 2001. The government has taken several steps to combat this trend. It has passed laws against computer crime and support centres have been set up for businesses to find out about viruses and hacking incidents. The Hacking and Virus Consulting Centre in the Korea Information Security Agency (KISA, at www.kisa.or.kr) issued 50 virus warning and prevention notifications in the first half of 2001. It surveys invasion attempts and does research on the latest hacking and virus technologies. The Secure-e-Korea project, initiated by the government in 2002, is a comprehensive security system that all businesses will have to adopt. It is the government's response to protecting e-commerce transactions, personal details and other sensitive online information. The government is expecting to invest some 280 billion won (US$ 213 million) in information protection technologies and standards over the next six years.[16]

Korea's government is also leading by example in order to stimulate e-business. The government has adopted an e-commerce based public procurement service, which, so far, 36'000 firms have replied to. By 2001 over 80 per cent of all procurements in the public sector were carried out online. The adoption of e-commerce

Table 3.5: Summary of Korea's General Plan for Promoting e-Commerce

2000

Main objective	Main Content
Consolidate acts and policies to increase the reliability of cyber market	Obtain e-commerce reliability Strenghten consumer protection Improve e-commerce business conditions Early competion of Information Super Highway
Continuing expansion of e-commerce infrastructure	Promote technology development and standardization Train e-commerce experts
Promote e-commerce acceleration in public sector	National defense sector Construction sector Government-run company Governement
Spread industrial e-commerce	Expand model project Compose e-CEO council
Establish basis for cyber trade	Amend cyber trade support act Establish a unified buyer development system

Source: "General Plan for Activating e-Commerce", February 15, 2000. From 2001 Korea Internet White Paper, NCA, MIC.

in the public sector has a spill over effect on the business community since not only do businesses bid for government contracts, the government also uses B2B sites to procure goods and services. According to the National Statistical Office (NSO) the "public sector plays a leading role for the development of electronic commerce in the sense that it, with its immense purchasing power, is strong enough to encourage and stimulate the private suppliers to introduce e-business in a short period of time".[17] Since the government established the electronic procurement system in the public sector in 2000, the NSO has launched a quarterly "E-commerce Survey on Government." In 2001, Business to Government (B2G) transactions accounted for Won 704 billion (US$ 545 million). The survey covers 57 government organizations carrying out e-commerce.

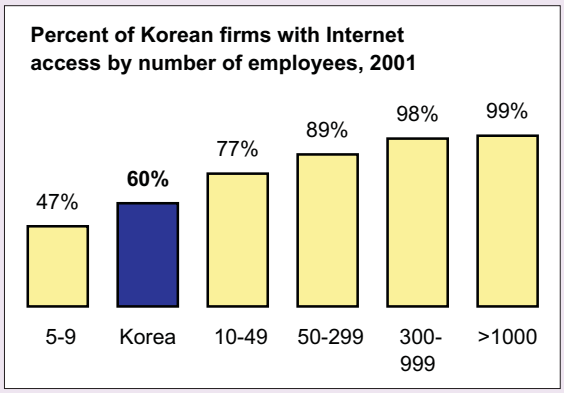
Preparations for next generation e-commerce include the development of mobile e-business (m-commerce). The government has started to develop mobile application servers and to create a stable environment by establishing the necessary authentication system for mobile businesses and billing methods. It has also made it its task to establish fair profit sharing rules among content providers and mobile telecom companies, and to secure an open system of mobile Internet portals that allows mobile Internet users to connect to their favourite Internet sites.

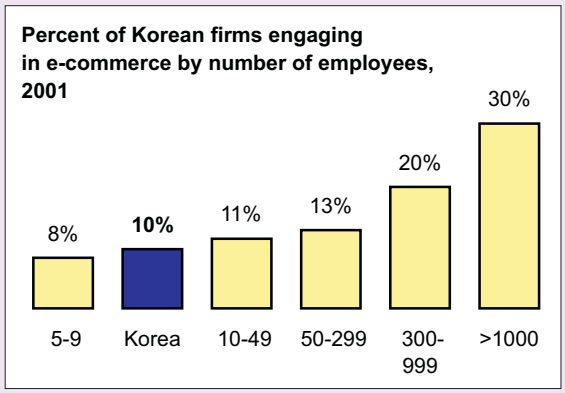
3.4.3 E-Businesses

Out of some 360'000 Korean companies with more than five employees, 60 per cent had access to the Internet in 2001. The rate rises with the size of the firm, ranging from less than 50 per cent among companies with less than five employees (45 per cent of the total number of companies with Internet access) to over 95 per cent among firms with more than 300 employees. Some ten per cent of companies with Internet access engaged in e-commerce. Again, the range varies with larger companies more intensive users of e-commerce (see Figure 3.4, right chart).

Business-to-Business (B2B) e-commerce surveys are carried out by the NSO every three months. Total B2B activity in Korea was Won 11 trillion (US$ 8.4) billion and accounted for 92 per cent of all e-commerce in the country in 2001. The B2B e-commerce survey disaggregates data by buyers, sellers and intermediaries. The former, where transactions are carried out on sites controlled by the buyer, account for more than three-quarters of

Figure 3.4: E-commerce usage in Korean companies





Source: ITU adapted from NCA.

transactions. This reflects the size of large corporations who use their sites to order raw materials and components needed for productions. Intermediary sites such as e-marketplaces account for only a small portion (3.5 per cent) of e-commerce sales in Korea.

The government has made an effort to tackle the business digital divide by assisting small and mid-sized firms. This includes the provision of high-speed Internet access, education, the establishment of a support centre, and aiding firms through information status diagnosis and strategy planning. The government's *Small Enterprises Networking Project* is aimed at helping small companies (with less than 50 employees) to catch up in IT. These companies often cannot afford to have an IT team or to purchase the necessary IT material. They find themselves in a vicious cycle where the lack of demand for IT products for their companies leads to a small market and few innovations. To break this cycle and to help a new market develop, the government, through the National Computerization Agency and the MIC, selects three consortiums to provide companies with the necessary infrastructure and services (e.g., PCs, high-speed Internet access, on-line tax return application and industry specific services), as well as the necessary training. These are provided at minimal costs. *"In a nutshell, the core strategy for this project is to bring two subjects of this project together, which are small enterprises and IT service companies, to move forward with Win-Win strategies."*[18]

3.4.4 Business-to-Consumer (B2C)

B2C statistics are collected through the monthly NSO C*yber Shopping Mall* survey. Cyber shops refer to businesses with web sites selling products online aimed at the consumer market. They include all identifiable online shopping malls in Korea, 2'427 in June 2002 up by 412 from a year earlier. The survey includes information on the number of cyber malls, the value of transactions and the type of products purchased. In 2001, the total value of B2C e-commerce in Korea was Won 258 billion (US$ 200 million), a figure already exceeded in the first six months of 2002. Goods accounted for the largest value of consumer online purchases in 2001. PCs and related accessories accounted for the biggest share (29 per cent), followed by electronic appliances (24 per cent) and then household goods (six per cent). Travel reservations and books made up the next largest categories (each with five per cent). It should be noted that these figures are biased in favour of value rather than volume. When consumers are surveyed, the category they purchase the most of online is books.

According to the NSO's March 2001 Computer Use and Internet Survey, almost half of Korea's Internet users had visited a shopping site while 15 per cent made an online purchase. Of those who did not, trust was the biggest concern. While 32 per cent say they have *'little confidence in the purchase',* another 21 per cent say they are *'concerned about the fraud of e-commerce transactions'* and ten per cent have *'security or privacy concerns'.*[19] Almost ten per cent stated that they had not made an online purchase because they did not have Internet access at home.

Despite concerns about security, credit cards are the number one B2C payment method (54 per cent of transactions). This is not a surprise considering the large number of credit cards in circulation. Electronic fund transfers are used for 44 per cent of transactions. Other payment methods, including "electronic money" only accounted for two per cent.

Box 3.6: Measuring e-commerce

Korea's National Statistical Office (NSO) is a leader in measuring informatization. The NSO has launched a number of projects to track the development of ICT in Korea. In March 2001, the NSO conducted its first Computer and Internet Use Survey (CIUS).[20] The CIUS surveyed 80'000 people and 30'000 households regarding their use and access to ICT. It is arguably one of the most detailed reports ever issued regarding a nation's digital status. The NSO has also been tracking e-commerce since early 2001. It carries out a monthly survey on Business-to-Consumer (B2C) e-commerce, the Cyber Shopping Mall Survey. It also conducts quarterly surveys on Business-to-Business (B2B) and Business-to-Government (B2G) e-commerce. One of the challenges with being an e-commerce measurement pioneer is dealing with various methodological issues:

- The NSO asked businesses to disaggregate purchases by buyer in order to identify the type of B2C consumer. This has proven difficult since many businesses collect data on transaction values, not by purchaser. Another problem with the B2C survey is that it is difficult to identify all companies that offer e-commerce transactions.
- The definitions and concepts used in the surveys are not always consistent with those used by the participating companies. Some companies that use computer communication networks to conduct business consider their transactions to be traditional.
- The B2B survey aims at analysing the effect of e-commerce on business processes and goes into some detail on how companies work. For example, it distinguishes between 'open' and 'closed' transactions. While an open transaction would imply bidding process, a closed transaction would only include predetermined companies. This kind of detail may help to evaluate the benefits of using e-commerce, such as transparency, competitiveness and automation. Some companies are reluctant or unable to provide this kind of detail.
- Companies are sometimes reluctant to give exact e-commerce details and vary in the sophistication of their record keeping. Companies that operate in more than one sector may forget to include information on all sectors. The choice of the proper respondent is important and in some cases it might be better to separate different economic sectors from one another.

To minimize measurement errors, the NSO has several suggestions. Since some companies predominantly sell and others predominantly purchase goods and services (for example, construction companies have more purchasing than selling transactions), the survey should enquire about sales and purchases. This would enhance consistency and error checking since the sum of all purchases should roughly equal the sum of all sales.

[1] Quote by one business manager during ITU interviews. May 2002.

[2] Yang Sung-jin. "Seoul to launch IT export drive 'e-Silkroad'". *The Korea Herald*. 9 June 2002. www.koreaherald.co.kr/SITE/data/html_dir/2002/09/06/200209060017.asp.

[3] Informatization of Korea. National IT Initiatives. National Computerization Agency (NCA). February 2002.

[4] "Major achievements of Korea's e-government program." *The Korea Herald*. 4 July 2002. http://www.koreaherald.co.kr/SITE/data/html_dir/2002/07/04/200207040004.asp.

[5] Kim Deok-hyun. "Secure-e-Korea Campaign Launched". *Korea Times*. 15 July 2002.

[6] Yang Sung-jin. "Top APEC policymakers explore key issues in taking government online." *The Korea Herald*. 4 July 2002. www.koreaherald.co.kr/SITE/data/html_dir/2002/07/04/200207040006.asp.

[7] UN. *Benchmarking E-Government: A Global Perspective*. May 2002. http://www.unpan.org/e-government/Benchmarking%20E-gov%202001.pdf.

[8] The term edutopia was first used by the Presidential Commission on Education Reform in 1995 to describe the establishment of "an education welfare state – a society of open and lifelong education to allow each and every individual equal and easy access to education at any time and place".

[9] 2001 Adapting Education to the Information Age. A White Paper. Ministry of Education & Human Resources Development.

[10] 2001 Adapting Education to the Information Age. A White Paper. Ministry of Education & Human Resources Development.

[11] Keris. *2001 Adapting Education to the Information Age: A White Paper*. December 2001.

[12] Lee, Sung-Ok. "Telemedicine in Korea: Current Status/Prospect." 8 June 1999. www.itu.int/ITU-D/hrd/publications/reports/1999/telemed/pdffr/15-BIS-ARG-KOREA-E.pdf.

[13] For a detailed analysis of telemedicine in Korea see Jim Briggs. *Telemedicine and related technologies in South Korea*. 2001. http://www.tis.bl.uk/korea/Full_report.htm.

[14] "Top APEC policymakers explore key issues in taking government online." *The Korea Herald*. 4 July 2002. www.koreaherald.co.kr/SITE/data/html_dir/2002/07/04/200207040006.asp.

[15] The E-Commerce Policy and E-Commerce Assistance divisions in the Industrial Policy Bureau handle electronic commerce issues within MOCIE. In addition to MOCIE and MIC, other government agencies involved with e-commerce include: Korea Free Trade Commission (consumer protection), Ministry of Culture and Tourism (intellectual property) and the Public Procurement Service (e-commerce in the public sector).

[16] Secure-e-Korea Campaign Launched. Korea Times. 16 July 2002. [I cannot find this article]

[17] E-Commerce Statistics in Korea. Korea National Statistical Office (KNSO). Presentation prepared for ITU representatives in May 2002.

[18] "Small Enterprises Networking Project." Paper presented by the MIC to ITU representatives. April 2002.

[19] KNSO. Report on the Computer and Internet Use Survey. 2001.

[20] English language summaries of NSO ICT subject reports are available on their web site at www.kso.go.kr.

4. The Information Society in Korea

4.1 The Vision of a Creative, Knowledge-Based Society

Korea's emergence as the world leader in information and communication technologies (ICT)—in fields such as broadband Internet, semiconductors and third generation mobile and so on—it is not an accident. The government has specifically targeted this objective. It is no coincidence that the period of most intensive investment in broadband infrastructure corresponded with recovery from the worst effects of the Asian Financial Crisis in the late 1990s (referred to by the Koreans as the "IMF" crisis). Again it was because the Korean government specifically planned this, despite the general level of austerity imposed by the IMF's conditions for their assistance.

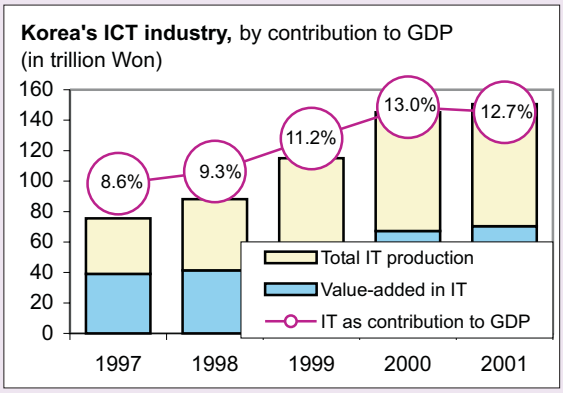
In Korea, the ICT sector is seen as a driver of economic and social development. To quote from the Minister of Information and Communication, Dr. Seung-taik Yang's introduction to the 2001 White Paper:

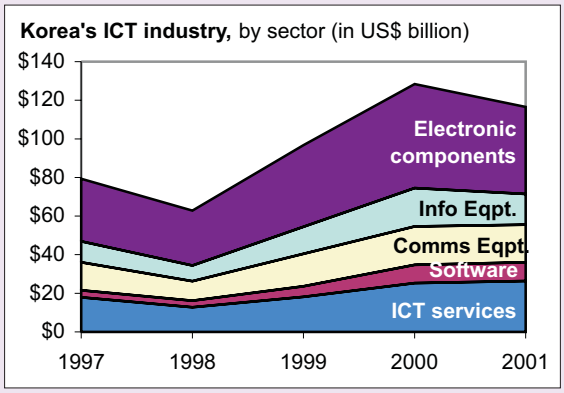
"We … will further strive to become the world's most advanced IT power. To realize this goal, we will push ahead with our e-government initiative, develop the software and content industries, and educate the public to make them the most computer literate citizens in the world. Furthermore, we plan to resolve the digital divide between regions and among different classes of people, and encourage safe and sound use of information."

These are ambitious goals but they are founded on impressive performance. The combined value of the Korean ICT industry in 2001 was Won 150.5 trillion (US$120 billion), and this figure has been growing by an average of 18.8 per cent a year since 1997, more than three times faster than the rest of the economy (although ICT sector growth was slower in 2001 as the market went into recession worldwide). Overall, the ICT sector contributes around 13 per cent to Korea's Gross Domestic Product (see Figure 4.1). Furthermore, the ICT sector provides some 1.3 million jobs (around 5.4 per cent of total

Figure 4.1: Korea's IT industry

In terms of its contribution to Gross Domestic Product, and broken down by sector, in trillions of Won, 1997-2001





Note: "Info equipment" includes also a small contribution from broadcasting equipment.
Source: MIC, "IT Korea 2002: The Vision for Constructing a Creative, Knowledge-Based Society".

employment). This is up by around 300'000 since 1995 and expected to grow by a similar amount by the year 2006.

Government policy has played an important part in this success story. One can recognise successive phases in the development of government policy towards the sector:

- 1980s / early 1990s: Here the emphasis was on market liberalisation and privatisation in the telecommunications sector.
- Mid 1990s: During this period, the first steps were taken towards developing broadband networks and programmes to spread informatization and Internet use. This period also saw further market liberalisation, especially in the mobile sector, and the designation in 1997 of Hanaro Telecom as the second local carrier.
- Late 1990s / early 2000s: This was the period of intense investment and reform of the venture capital market as the Korean economy emerged from the financial crisis. A particular focus of investment has been on the education sector.

The main take-off in the number of broadband subscribers also came during this latter period, especially during 2001. During that year, Korea passed the symbolic mark of 50 per cent of households with broadband. At the other end of the scale, those Korean Internet users still relying upon narrowband telephone dial-up (the dominant access method in the rest of the world) fell below five per cent (see Figure 4.2).

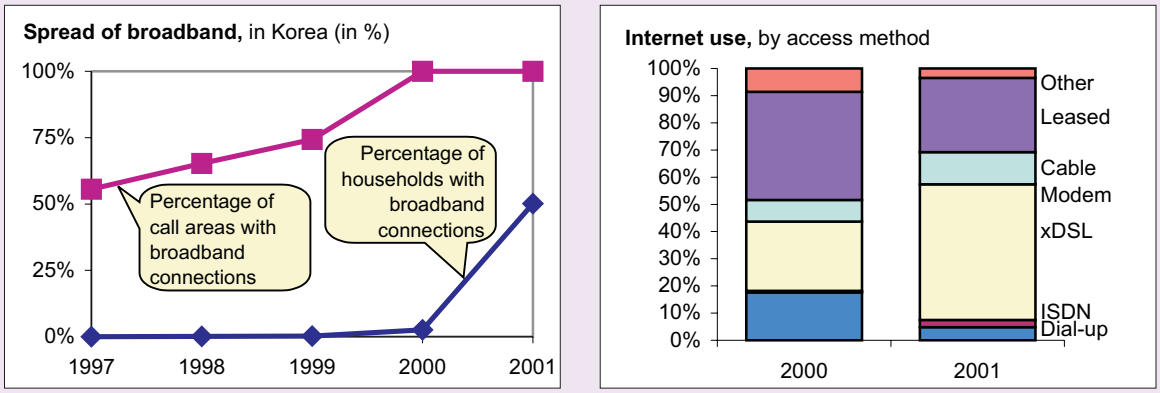
4.2 The Policy Push – creating an information society

Although the private sector has done most of the "heavy lifting" in achieving Korea's current status as a world leader in ICT, the role of government should not be underestimated. As one business manager with a leading Korean company commented "It is part of our business culture to listen to the government" (see Box 3.1). The guidance provided by the Ministry of Information and Communication has been turned into action by the different companies active in the sector. This means that a little government spending can go a lot further in achieving objectives than in other countries where there is a more adversarial relationship between government and the private sector.

However, although the government's main influence has been in promoting

Figure 4.2: Korea's broadband users

Spread of broadband, 1997-2001, and evolution of access methods, 2000-2001



Source: MIC IT Korea 2002 (left chart), NCA Korean Internet White Paper 2002 (right).

the shared vision, the government has also intervened more directly too. As described in section 3.1, there have been at least six major government programmes over the last fifteen years or so, aimed at improving the status of ICT in Korea. Among the more ambitious of these is the National Informatization Framework, established in 1996, which set out the road-map for Korea's future IT development. The Korean government's approach may be characterized as intervention at three levels:

- Creating the right environment, mainly through the pro-market policies of telecommunications liberalisation and privatisation.

- Intervention at the non-market-end of the supply-chain, in particular through the funding of the public Internet backbone, the Korean Information Infrastructure (KII). The Cyber Korea 21 project, for instance, boosted national connectivity at the regional level from 155 Mbit/s to 40 Gbit/s, and all 144 exchange call areas had been provided with broadband connectivity by 2000. This meant that the private sector could push through with the market-end of the supply chain, reaching 50 per cent household connectivity in 2001.

- Intervention at the non-market-end of the demand chain, for instance by providing IT training for some ten million Koreans, in occupations like government, the army, the teaching profession and homemakers.

In common with other countries with a relatively liberal market structure, direct government intervention in close-to-market activities is limited. Korea's distinction between the roles of government and of the private sector is one of the hallmarks of its success. It is equally important to note that the government has actively tried to create an information society. While the construction of an information infrastructure alone does not guarantee that people will actually make use of new ICTs, the provision of training and awareness campaigns helps people to join the information society. Thus, the government has addressed both the supply and the demand side of the equation.

4.2.1 ICT information programmes

Considerable amounts of government money have gone into different ICT promotion activities (see Table 4.1). The trigger for this seems to have been the establishment of the 1996 National Informatization Plan. Government

Table 4.1: Korean Government budget for informatization projects

In US$ millions, 1996 - 2002

Category	1996	1997	1998	1999	2000	2001	2002
Establishing a high-speed Internet Infrastructure	113.0	89.0	57.8	145.9	169.9	211.0	136.4
Support for Informatization Promotion	3.1	33.2	34.1	49.0	99.2	100.7	13.5
Combating digital illiteracy	3.1	4.4	4.5	4.2	8.0	19.9	19.8
ICT industry foundation	12.3	53.9	50.8	46.3	81.9	83.4	139.1
IT labour market programmes	0	0	103.8	227.0	67.3	0	0
Other Programmes	0	0	0	0	23.2	27.2	13.5
Total	**131.5**	**180.5**	**384.4**	**472.5**	**449.2**	**442.2**	**322.2**

Source: Ministry of Information and Communication, Korea.

Box 4.1: Critical infrastructure protection

It would be an understandable mistake to believe that, as a network becomes more sophisticated, it becomes safer. In reality, the opposite is the case, as Korea's experience illustrates. Korea has the world's highest percentage of broadband users (more than half of all households), many of whom have always-on accounts. This means that there are millions of computers with permanent high-speed connections to the global Internet, belonging to users that have had no formal training in network security. It also means that the tools to carry out malicious attacks, or even to unwittingly pass on viruses are widely spread.

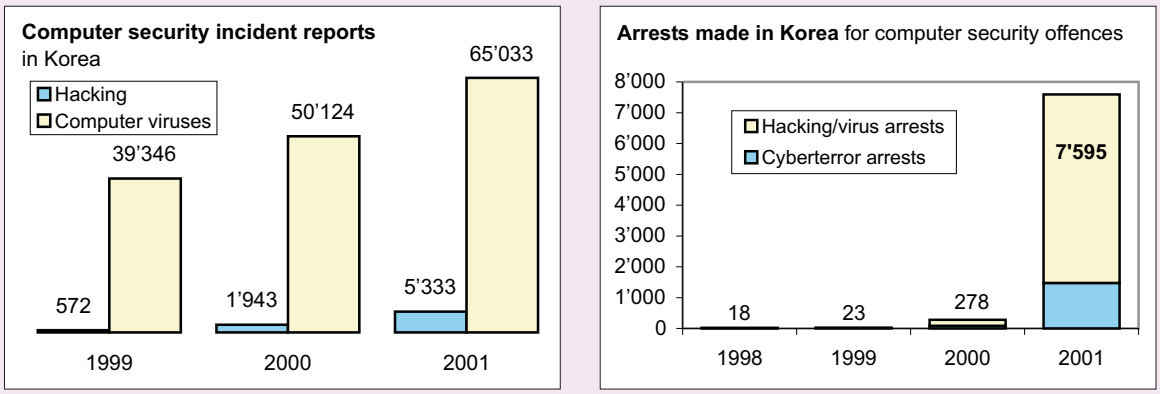
The combination of high-speed networks and lax security makes Korea a hacker's paradise, especially for the routing or hosting of computer viruses for which neither the originators nor the intended victims live in Korea. For instance, a worldwide study of computer security incidents reported between August 2001 and March 2002 found that some 39 per cent of the 11'322 incidents investigated had been routed via Korea. The next country, the United States, accounted for only 12 per cent of incidents.[1]

The charts shown illustrate the scale of the problem and of the Korean government's response. This latter may be characterised as having five main facets:

- Criminalisation. There were more than 7'500 arrests for computer security related incidents in Korea in 2001, up by 25 fold over the previous year. The penal code allows for up to ten years imprisonment (or a fine of 100 million Won, around US$85'000) for offences against designated critical information infrastructures and half of that for offences against ordinary systems. The Korean National Police Agency has some 650 staff dedicated to fighting cybercrime.
- Legislation. Although there is a raft of different measures, the most important is probably the Information Infrastructure Protection Act, in force since July 2001. This provides the general policy framework. It established a Committee on the protection of Information Infrastructure (CII), which is chaired by the Prime Minister with membership of Ministers from the relevant departments. It also sets out criteria for the designation of critical infrastructures and security guidelines to be followed.
- Co-ordination. The policy framework foresees roles for several different agencies. Among the main ones involved in information infrastructure protection are: the CII management body (responsible for vulnerability assessment), technical supporting bodies (Korea Information Security Agency, Electronics and Telecommunications Research Institute, and Information Security Consulting Service Providers), and an Information Sharing and Analysis Centre.
- Incident Prevention and Response. According to the level of threat posed by a particular incident, the response may just involve the CII management body, it may call upon the services of the technical supporting bodies or it may require the establishment of a temporary incident response crisis centre. International co-operation with relevant bodies, notably FIRST (Forum of Incident Response and Security Teams) and APSIRC (Asia-Pacific Security Incident Response Coordination working group), is also carried out.
- Awareness-raising and technical development. For instance, an anti-hacking and virus day is held on the 15th of each month and an early warning and alert system (e-WAS) is being developed. Training programmes are also an important part of the effort.

Box Figure 4.1: Crime and punishment

Number of computer security incident reports and arrests, in Republic of Korea, 1998-2001



Source: MIC Korea (left), Korea National Police Agency (right).

spending on ICT programmes in that year amounted to US$ 132 million, of which the vast majority was spent on upgrading the Internet backbone network. Subsequently, the sums grew to a peak of US$ 473 million in 1999, by which time the focus of spending had shifted from supply to demand, with almost half the available budget being devoted to programmes designed to assist with the ICT labour market (e.g., training, addressing skill shortages, etc).

In line with Korea's commitments to the IMF, other government spending programmes were cut back in the late 1990s.This makes the three-fold increase in ICT spending all the more remarkable. Subsequently, spending on ICT programmes has started to decline, falling to a projected US$ 322 million in 2002. Currently the main areas of commitment are the ongoing support for the backbone Internet infrastructure and the ICT industry foundation. This latter programme is funded from the revenues gained from spectrum auctions (for instance, 3G licences) and is used for activities such as ICT human resource development, narrowing the digital divide, R&D in ICT, and support for small and medium-sized enterprises.

4.2.2 Information security

One area where the Korean government has played a directly interventionist role is in information security and the protection of critical network infrastructures. In May 2002, the Korean government hosted two ITU workshops in Seoul, on standards for information security[2] and on creating trust in critical network infrastructure.[3] These were intended, inter alia, to showcase the progress that Korea had made in this field, as illustrated in Box 4.1.

4.3 Information society lifestyles

Few countries have gone through the transformation from an agrarian to an industrial to an information society as quickly as Korea. Consequently, few societies have had to cope with the changes to lifestyle that the information society entails. Thanks to the prestige associated with education in Korea, and because of the emphasis on promoting Internet use in schools and universities, Korea's youth are in a good position to cope with the changes. Teenagers, in particular, have been driving the market in the adoption of the mobile Internet (see section 2.2) and in Internet applications like peer-to-peer. But for older people, particularly those whose working lives have changed as a result of the growing spread of informatization, adaptation is sometimes hard.

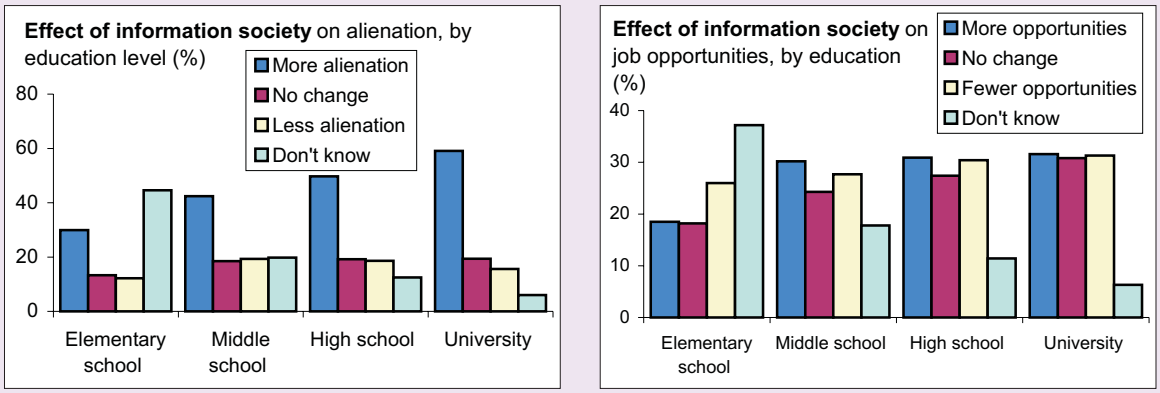
4.3.1 The "convenient" information society

The annual survey of Computer and Internet Use, carried out by the Korean National Statistical Office, provides a unique insight into the opinions of ordinary Koreans. It is based on a survey of 30'000 households and is completed by survey workers who visit each household personally and fill out the questionnaire directly with the respondent. For this reason, the results can be considered highly reliable. The survey methodology allows for cross-tabulation of respondents by various variables including age, education, profession, gender, region and income group.

The results are revealing. There is generally a positive view of the information society's effects on lifestyles with 78 per cent of respondents saying that they expected their lives to become more convenient as a result of the information society, though men (81 per cent) were more confident about this point than women (75 per cent). As might be expected, views on the information society vary with age. Teenagers are the most confident, with around 88 per cent (ten per cent higher than the national average) sure that the information society will have a beneficial effect. This level of confidence tapers off as respondents get older with only just over half of those above the age of 60 feeling that the information society will be beneficial. Interestingly, among older age groups, there is not necessarily any great feeling that the information society will lead to drawbacks, but just a high level of uncertainty, with under a third of over

Figure 4.3: Information society: lost opportunities and job opportunities

Perceived effects of the Information Society on sense of alienation and on job opportunities, by level of education of respondent, as percentage of respondents, in Korea, 2001



Source: Korea National Statistical Office, *Report on Computer and Internet Use Survey*, 2001.

60s responding that they did not know what the effects of the information society would be on their lifestyles, suggesting perhaps that they had not had much exposure to it (see Figure 4.4, left chart).

Views of the information society also vary with level of education (see Figure 4.3), with university graduates being much more confident of the benefits (87 per cent) than those with only primary school education (58 per cent). Similarly, those in professional occupations (87 per cent) are more confident than those in agricultural or fishing occupations (70 per cent). Views of the information society become rosier with wealth. Those on incomes of less than one million Won (US$ 810) per month see twice as many inconveniences as those on incomes above 4.5 million Won (US$ 3'650).

4.3.3 Sense of alienation

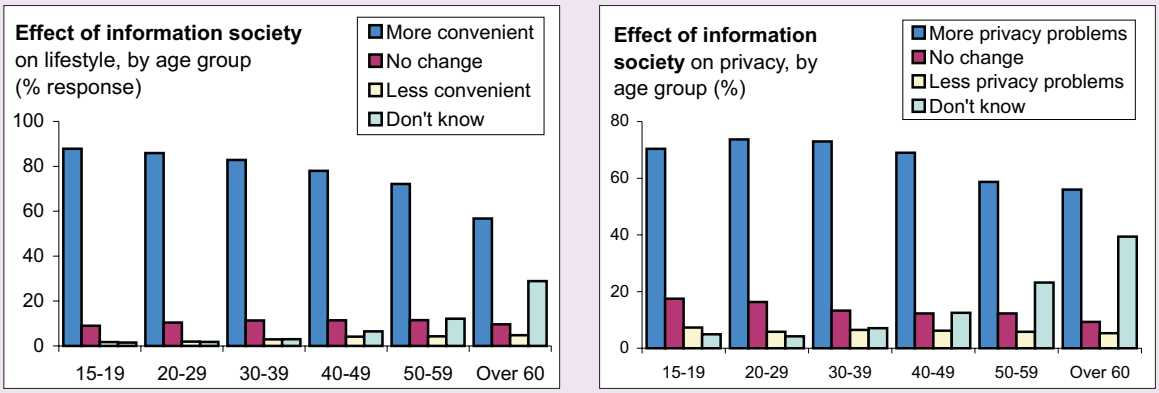
One of the most interesting questions in the survey concerns the effects of the information society on the sense of alienation. Almost three times as many Koreans feel more alienated because of the Information Society than less alienated and the sense of alienation grows as the level of education grows. Therefore, almost 60 per cent of college or university graduates feel that the information society increases the sense of alienation. Perhaps surprisingly, teenagers admit to being more alienated than those over the age of 60, but perhaps again this is the result of much greater use of PCs, and especially video games, amongst the former group. The potential threats of the information society on social development are keenly felt in Korea and the dark side of the information revolution has several facets (see Box 4.2).

4.3.4 So, what are the benefits of the information society?

One might imagine that Koreans' concerns about the intrusive nature of the information society and its contribution to the individual's sense of alienation might be offset by the prospects for new jobs. After all, almost 300'000 new jobs have been created in the sector since the mid 1990s. But in reality, ordinary Koreans are far from convinced. Slightly more Koreans (29 per cent) feel that the information society will generate fewer job opportunities than those (28 per cent) that feel it will create more jobs, and women are more pessimistic than men. Perhaps surprisingly, perceptions do not seem to vary

Figure 4.4: Information Society: hopes and fears

Perceived effects of the Information Society on personal lifestyles and personal privacy, by age group, as percentage of respondents, in Korea, 2001



Source: Korea National Statistical Office, *Report on Computer and Internet Use Survey*, 2001.

according to the occupations of those questioned, and those on high salaries are, if anything, more pessimistic than those on low ones (see Figure 4.4, right chart).

When questioned further, Koreans remained largely pessimistic about the potential benefits of the information society. For instance, 60 per cent of university graduates questioned felt that the information society would tend to increase the income gap between rich and poor, while only eight per cent thought that the gap would be reduced. Similarly, only marginally more Koreans felt that the information society would promote greater regional and cultural development (34 per cent compared with 22 per cent feeling it would have a negative effect).

The irony is that although Koreans are convinced that the information society is good, the only real benefit seems to be on making personal lifestyles easier. Overall, Koreans feel that the information society threatens privacy, increases alienation, has a neutral effect on jobs and increases the income gap. Of course, this negativity may simply reflect the way the questions were posed. However, it does suggest there is a job for government to convince Koreans about the benfits of a creative, knowledge-based society.

Box 4.2: The dark side of the information revolution

While Korea's ICT developments have brought economic and social progress, it is not all a bed of roses. Thorns of different shapes and sizes have surfaced.

One example is online game addiction, which has become a major problem. The excessive use of online games is particularly noticeable among teenagers and people in their early twenties, who play at home or at one of the some 25'000 PC *bangs* (online game rooms). In one case, a Korean computer user died in a PC bang, after three days of continuous games playing. Apparently, he had been so engrossed in the game that he forgot to eat, drink, or sleep. This illustrates that cyber life can sometimes be more gripping than real life, and that one can die of neglect even when surrounded by other people. The Korean Education Research and Information Service (KERIS) has launched a research study into the problem of alienation amongst young people. In addition, the MIC has established the Centre of Internet Addiction Prevention and Counselling to help combat the problem. The Centre is equipped with group and individual counselling rooms and provides free advice to addicts. It also has plans to focus its programme on the prevention of addiction. Parents and teenagers likewise will be addressed and attend lectures on the topic.

While this example may be an extreme one, the cyber café and games culture in Korea has other less flagrant but perhaps harmful consequences for kids. Who knows how healthy it is for young people to spend several hours a day in front of a PC screen. The strain put on the eyes, the brain and ears by constantly changing colours, flying and flashing objects and often loud and aggressive sound effects (PC bang users usually wear headphones) have not yet been fully studied.

PC bangs and online games are also modifying social interaction. As one observer says "[PC bangs are]…rabbit warrens of high-bandwidth connectivity … where young adults gather to play games, video-chat, hang out and hook up."[4] They allow people to pretend to be someone completely different. Avatars, personalized online personas, allow Korean Internauts to assume new personalities. Although it may be just a game, the need to be someone else might make being the real you boring or irritating.

Content-related problems are not uniquely Korean phenomena. Stories about paedophile or racist sites have appeared in many countries. But a country like Korea, with ubiquitous access, is probably even more vulnerable to harmful sites. A Korean children's portal carried out a survey and found that more and more kids were affected by adult content web sites. The survey (which addressed children under 13 years of age) revealed that 28 per cent of the respondents had access to adult web sites. Some 53 per cent accidentally came across these sites and 32 per cent accessed them through spam or unsolicited emails. Some 85 per cent of these kids said that spam was a serious problem.[5] New problems need new solutions and government intervention in this field includes the declaration on 'The Principle of Netizen Ethics' in June 2000. The Korean Government has also organized several campaigns on ethical awareness.

One problem is that Korea has very few countries it can look to for advice. The good news is that it is already grappling with the issue and other countries, that are starting to experiment with broadband access and likely to eventually encounter similar problems, will benefit by monitoring Korea's experiences.

This applies to another area, too. The fact that Korea is not only a bandwidth paradise but also a hacker's paradise, has forced the government to take several steps to combat cybercrime. While Korea has made great efforts to make its cyberspace safer (see Box 4.1), government officials admit, "side effects of digitisation such as hacking, computer virus and privacy infringement and spam mail are yet to be tackled."[6] Not an easy task, especially when hacking has become a real sport. A US$ 100'000 hacking competition (in which a Korean security company challenged hackers to crack their server and leave their registration details in order to receive the prize) ended in turmoil with no winners, when hackers attacked the server with the registration details. The message the hackers left: "One has to keep in mind that no matter how many precautions you take, there will always potentially be a way to hack the system."[7]

[1] See "Present status of cyber-terrorism in Korea and its countermeasures", presentation by Mr. Kun-won Yang at the ITU New Initiatives Workshop on Creating Trust in Critical Network Infrastructures, Seoul, 20-22 May 2002, available at: http://www.itu.int/osg/spu/ni/security/workshop/presentations/cni.22.pdf.

[2] For information, see the ITU website at: http://www.itu.int/ITU-T/worksem/security/index.html.

[3] For more information, see the ITU website at: www.itu.int/cni.

[4] J.C. Herz. "The Bandwidth Capital of the World." *Wired Magazine*. August 2002. www.wired.com/wired/archive/10.08/korea.html

[5] "More children have access to porn sites." *The Korea Herald*. 22 July 2002. http://www.koreaherald.co.kr/SITE/data/html_dir/2002/07/22/200207220033.asp

[6] Yang Sung-jin. "Korea leads Asia in IT infrastructure: 'Global leader, e-Korea project' accelerating IT drive." *The Korea Herald*. 31 May 2002. http://www.koreaherald.co.kr/SITE/data/html_dir/2002/05/31/200205310073.asp

[7] Matt Loney. "$100K hacking contest ends in free-for-all." *ZDNet* (India). 4 June 2002. http://www.zdnetindia.com/techzone/resources/security/stories/58719.html.

5. Conclusion

5.1 State of the Internet

The Mosaic Group <www.agsd.com/gdi97/gdi97.html> has developed a framework for characterizing the state of the Internet in a nation. They consider six dimensions, each of which has five values ranging from zero (non-existent) to four (highly developed). The dimensions are as follow:

- **Pervasiveness:** a measure based on users per capita and the degree to which non-technicians are using the Internet.
- **Geographic dispersion**: a measure of the concentration of the Internet within a nation, from none or a single city to nation-wide availability.
- **Sector absorption**: a measure of the degree of utilization of the Internet in the education, commercial, health care and public sectors.
- **Connectivity infrastructure**: a measure based on international and national backbone bandwidth, exchange points, and last-mile access methods.
- **Organizational infrastructure**: a measure based on the state of the Internet Service Provider (ISP) industry and market conditions.
- **Sophistication of use**: a measure characterizing usage from conventional to highly sophisticated and driving innovation.

Korean values for these dimensions are shown below.

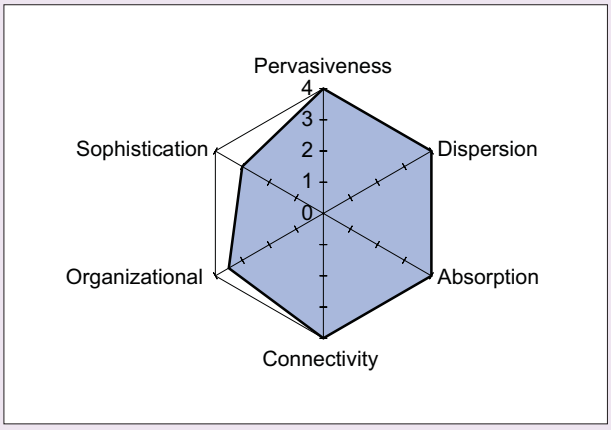
Pervasiveness is rated at level 4, *Pervasive*. At December 2002, there were 26.3 million Internet users in the country or 55.2 per cent of the population.[1]

Geographic Dispersion is rated at level 4, *Nationwide*. Dial-up Internet

Figure 5.1: State of Internet in the Republic of Korea

June 2002

Dimension	Value
Pervasiveness	4.0
Geographic Dispersion	4.0
Sectoral Absorption	4.0
Connectivity Infrastructure	4.0
Organizational Infrastructure	3.5
Sophistication of Use	3.0
TOTAL	**22.5**



Note: The higher the value, the better (0=lowest, 4=highest).
Source: ITU adapted from Mosaic framework (see text).

access is available from any location with a telephone line and PC with a modem and charged at local call rates. In addition, Internet cafés are widespread.

Sector Absorption is rated at level 4 *Widely used*. This ranking is a function of the type of connectivity in education, government, health care and business. All primary, secondary and tertiary schools have Internet access. Practically all government agencies—including both central and local administrations—are online with their own website. The governmental network provides 28'686 government ministries, agencies and public institutions with high-speed broadband access. Around 60 per cent of Korea's 360'000 companies with five or more employees are connected to the Internet (July 2001). The Ministry of Health and Welfare is connected to its different offices, hospitals and the country's health care clinics through a two Mbps leased line.

The **Connectivity Infrastructure** is at level 4, *Immense*. International connectivity in the year 2001 was over 6'500 Mbps. There are a number of nationwide backbone networks operated by ISPs. The major one operates at 5-10 Gbps between major cities and 155-622 Mbps between smaller cities. There are three commercial and one non-profit Internet exchange. Korea leads the world in high-speed local Internet access with options including ADSL, cable modem and apartment and office building Local Area Networks.

The **Organizational Infrastructure** is at level 3.5, between *Competitive and Robust*. Market entry for ISPs is liberalized. There were 82 ISPs registered with the nation's Network Information Center (KRNIC) at December 2002. There are limitations on the direct provision of high-speed access lines. Local loop unbundling, although legal, has not been widely implemented due to commercial barriers.

Sophistication of Use is at level 3, *Transforming*. The most popular consumer application is gaming and the nation leads the world in this category. Educational software is another popular category. E-commerce is well developed as is online banking (some 12 million online banking users) and stock market transactions (online trades account for 67 per cent of stock market transactions).

5.2 Lies, Damned Lies and Statistics[2]

As this report has shown, Korea is well advanced in Information and Communication Technology (ICT). It leads the world in broadband Internet access, is ranked fifth in overall access to the Internet and was one of the first countries to launch a third generation mobile network. It has achieved universal access with practically every household not only having telephone service but more than half with a broadband service. It has one of the worlds leading ICT manufacturing sectors, a remarkable achievement for a nation still officially classified as developing. Koreans are well educated and rank high in literacy and overall educational achievement. Yet, on most international ICT and competitiveness rankings, Korea falls in the middle range (see Table 5.1). Why the inconsistency?

For one thing, the rankings are often based on the same set of variables. The similarity of where Korea shows up, generally in the high 60 percentile, reinforces this assumption. Second, quantity is favoured over quality. The rankings are typically designed to favour a common denominator of widely available indicators, rate high per capita values without adjusting for methodological discrepancies and do not adjust for qualitative differences. For example, many European nations artificially inflate the number of main telephone lines—a common indicator in all of the indexes—by including Integrated Services Digital Network (ISDN) channels. Korea does not. So if the number of physical telephone lines were compared, Korea would rank much higher (see Figure 5.2, top left). A similar situation exists for

mobile cellular subscribers where many nations have a high portion of prepaid cards that are included in the figures but which are not all used. Korea has few mobile prepaid subscribers and consequently has a more realistic figure for mobile penetration (see Figure 5.2, top right).

Another methodological weakness is that many surveys use the number of Internet hosts per capita to rank Internet intensity. This is misleading since host computers can be located anywhere and not necessarily in the country of their domain name. Furthermore, all three letter generic hosts (e.g., .COM) are attributed to the United States even though many other countries use these domain names. On a per capita basis, the number of Internet host computers in Korea—based only on the .KR domain name—is relatively low, affecting its ranking. On the other hand, Korea's high level of Internet and broadband penetration is rarely reflected in the standings (see Figure 5.2, bottom left).

Global rankings also appear to be biased in favour of western theoretical perceptions of competitiveness rather than actual achievement. In general, few Asian nations rank in the top ten. Hypothetical assumptions appear to carry more weight with the rankings more focused on the means rather than the ends. For example, a nation that supposedly allows a greater degree of competition than another would be ranked higher even though the latter might have a far greater level of infrastructure. Another shortcoming is that the rankings tend to weight per capita income highly. In the case of Korea, it is doing exceedingly well in ICT despite a relatively low per capita income. If anything, Korea's ranking should be raised because of this fact. In terms of purchasing power parity, Korea's per capita income is twice that of the conventional measurement (see Figure 5.2, bottom right).

The case of Korea suggests that these scorecards are not very useful in accurately measuring ICT achievement. In any case, in the framework used by the ITU to assess a nation's state of e-readiness, Korea obtains the highest score of any of the fifteen countries studied (for comparison, see: www.itu.int/ict/cs)

5.3 Learning from Korea

Because of its relatively low *e-readiness* rankings, Korea's accomplishments and its way of getting there are often neglected. This is a shame for Korea has much to teach the world. Some of what Korea

Table 5.1: Ranking Korea

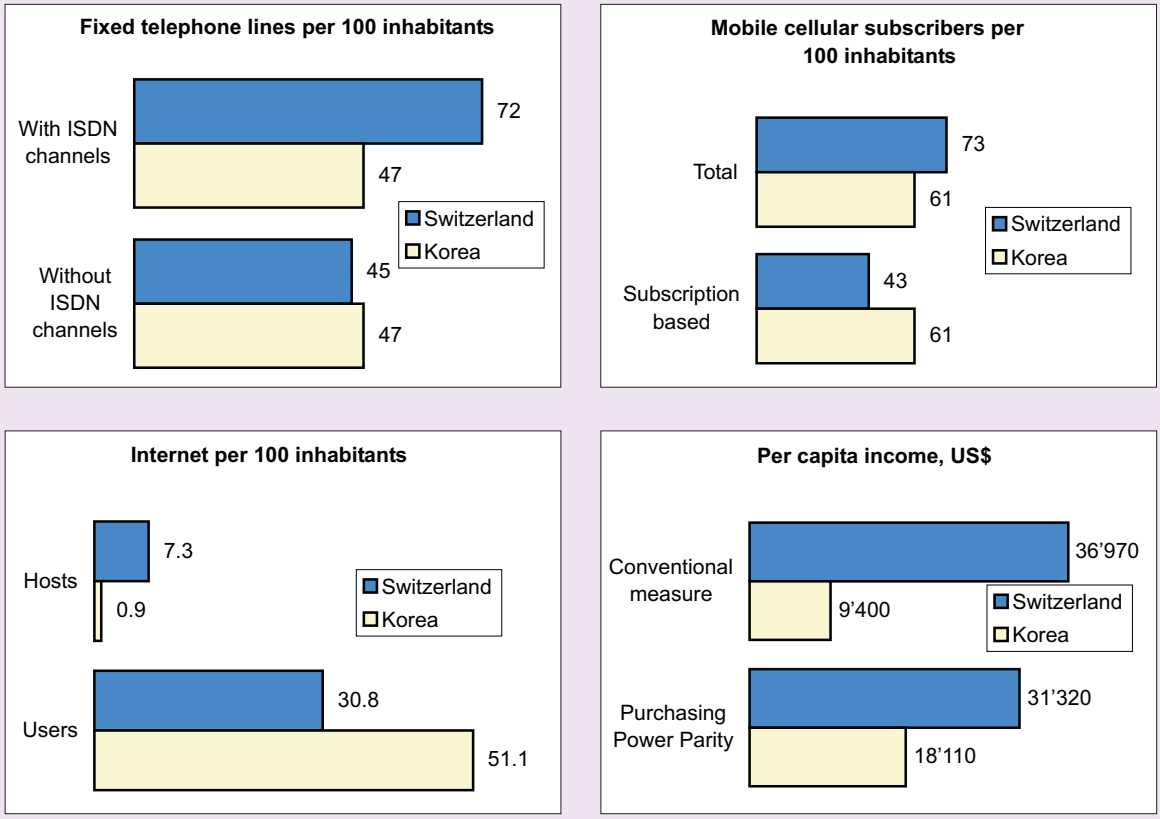
How Korea ranks in various global indexes, 2001

Informatization Index —50 countries		**EIU e-readiness —60 countries**		**World Competitiveness —49 countries**		**Information Society Index —55 countries**	
USA	1	USA	1	USA	1	Sweden	1
Switzerland	6	Switzerland	11	Switzerland	7	Switzerland	7
Korea	17	Korea	21	Korea	27	Korea	18
Last year	(19)		(24)		(28)		(19)
Rank as %	(68%)		(67%)		(47%)		(67%)

Note: Number in parenthesis refers to previous year rank. Percentage in parenthesis refers to rank as a per cent of total countries ranked.
Source: ITU adapted from NCA, EIU, IMD and IDC.

Figure 5.2: Recomparing Korea and Switzerland

2001



Source: ITU World Telecommunication Indicators database.

has done is uniquely Korean and probably not replicable. In some ways, the Internet in Korea is a huge Intranet filled with national content that is unfathomable to non-Korean speakers. But there are plenty of things that Korea has done that provide useful lessons other nations can learn from. One is the fundamental role of the government in promoting ICT infrastructure, applications and usage. Table 5.2 highlights ICT areas where Korea has been successful and the reasons why. It identifies which policies might be relevant for other countries.

There are few recommendations that one can offer a country as advanced in ICT as Korea. Access to basic telecommunication service is nearly universal. The government has in place programs to reduce its digital divide. Access prices are comparatively among the lowest in the world. Broadband penetration is the world's highest. Recommendations also seem futile because Korea is so far ahead and in uncharted territory where insufficient evidence has accumulated to form opinions about best practice.

A US President once said: *"ask not what your country can do for you—ask what you can do for your country."*[3] In the case of Korea, this might rephrased to *"ask not what Korea can do for itself—ask what it can do for other countries."* The Korean government recognizes its advances and has endeavoured to

Table 5.2: Which factors can be exported?

Reasons for Korea's ICT success and whether they are replicable in other nations

Factor	Exportable?
Education. Korea's high level of education—in terms of both school enrolment and educational attainment—has contributed to the Korean population's ability to learn and use ICT.	Korea's success suggests that if countries want to be successful in ICT, they need to commit resources for education. Providing ICTs to educational institutions and enhancing ICT training is essential. This should be the one of the main thrusts of government ICT policies.
Geography. 80 per cent of Korea's population lives in urban areas. Apartments account for 48 per cent of Korea's housing stock and provide dwelling for 40 per cent of its population. This high population density simplifies network development and lowers costs investment.	Countries that have high levels of urbanization can more easily install broadband infrastructure. This includes much of Central and Eastern Europe and Latin America. However, this factor is not relevant for regions such as Africa or South Asia with large rural populations.
Competitiveness. There are a number of broadband service providers creating the competitive environment necessary for lowering prices and speeding network deployment. Although local loop unbundling is possible in Korea, most broadband providers are facilities-based. The availability of a variety of broadband technologies (xDSL, cable modem, wireless, fibre optic LANs) adds to competitiveness and dynamism.	The lesson here is facilities-based competition, one that even developed countries can learn from. Too many nations have focused on local loop unbundling as the way towards creating a competitive broadband market. The results have not generally been very successful. Korea has shown that facilities-based competition, even in a mature network, works. The other lesson is the competitive pressure of alternative broadband technologies. Countries should license cable television and high-speed wireless access providers to offer an alternative to incumbent telephone operator xDSL services. It should be noted that Korea's cable television network is young, just over a dozen years old. Countries without cable television networks might find they could quickly develop them by offering potential investors licenses to provide telephony, entertainment and cable modem services.
Government. Korea's high level of ICT adoption is no accident. It is the result of years of government policies, planning and financial support for targeted areas. A high level of cooperation between government and the private sector has assured success. Furthermore, license fees from the ICT industry remain in the ICT sector and are not transferred to other areas of the government budget. This has provided seed funding for the Ministry of Information and Communication to invest in areas such as low interest loans for network roll out, ICT training and providing access to disadvantaged groups.	A key point is that income from license fees remains in the ICT sector to finance public networks (e.g., government, education) as well as to assist with providing access to disadvantaged groups. Another point is that while infrastructure development is most likely best handled by the private sector, governments nonetheless have a crucial role to play in overall ICT strategy and universal access policies. A third point is the success of Korea's collaborative approach between government and industry. All of these points can be adapted by other nations.
Equipment. Korea has a large ICT equipment industry with well-known names such as Samsung and LG. This has assisted development in that domestic manufacturers have been able to produce ICT products at reasonable costs. Korea's export orientation has put a focus on product development in technologies in which it can play a lead role. This in turn has had a favourable impact on its domestic market by keeping it advanced.	Most developing countries do not have large ICT equipment manufacturers like Korea. Nonetheless, they could try to achieve the same benefits through open, competitive tendering for ICT projects. Local industry could also forge partnerships with overseas equipment vendors to manufacture locally and transfer technology.
Socio-economics. Korea has a much higher level of ICT penetration than its economic level would suggest. The UN classifies it as a developing nation and its per capita income is not in the highest grouping. Korea's relatively large population of some 47 million make for a big market in terms of achieving economies of scale and attracting investment.	The fact that Korea's ICT development is at a significantly higher level in relation to its per capita income is great news for other countries. It means that ICT access does not have to be constrained by income. On the other hand, the relatively large size of Korea is not something all countries can benefit from. However, they can leverage the same benefits by participating in regional grouping particularly for infrastructure projects and bulk equipment purchases.

Source: ITU.

share them with others through participation in international forums and hosting of workshops. In the case of the ITU, Korea made a proposal to the World Telecommunication Development Conference calling for developing nations to explore use of xDSL technologies for broadband access.[4] Korea has also hosted two ITU workshops on network security in 2002. However, it can go further in spreading the secrets of its success by offering firmer support for technical assistance and advice to other nations that want to become information societies.

Box 5.1: And what of the North?

The focus of this report is the Republic of Korea—popularly referred to as South Korea. Yet, it is not the only Korea. The other occupant of the Korean Peninsula is the Democratic People's Republic of Korea—commonly referred to as North Korea. Once one country, cold war tension following the Second World War led to the creation of two separate republics. Despite their cultural, linguistic and ethnic similarity, there are probably few countries as far apart in development. North Korea has pursued a socialist self-sufficient oriented path, guided by state planning. South Korea has a market-oriented economy, and is export oriented. The results are two different countries in terms of economic and ICT development (see table below).

Box Table 5.1: The two Koreas compared

2001

	North	South	Ratio
Population (000s)	22'253	47'343	2
GNI per capita US$	707	8'894	13
Fixed telephone subscribers (000s)	500	22'590	45
Per 100 inhabitants	2.3	47.7	21
Mobile cellular subscribers (000s)	-	29'046	-
Per 100 inhabitants	-	62.0	-
Internet users (000s)	30*	24'380	813
Per 100 inhabitants	0.13	52.1	401

Note: * Refers to "Intranet" users of closed government network. Officially, Internet access is not available although some users may dial-up ISPs in China or Japan.
Source: ITU, Korea (Rep.) Ministry of Unification and Ministry of Information and Communication.

The North has a low level of telecommunication development not only compared to the South but also in relation to other nations. North Korea's fixed telephone density is just over two, about the same level as low-income nations. It does not have a mobile cellular network. The North has 30'000 "Intranet" users, mostly in the government and research centres that can access databases and exchange e-mail through a closed network. North Korea's Internet domain name is .KP but no administrator has been assigned and it is not believed there are any web sites in the country. The national news agency has a site hosted in Japan.

The North Korean government has expressed a desire to upgrade its telecommunication network, to provide more citizens with telephone service and to adopt the latest information and communication technologies. Mobile would have a lot of potential to alleviate telephone shortages in North Korea since a wireless network can be installed relatively quickly. According to one report, if mobile services were introduced, the number of subscribers would climb to 50'000 the first year and to 1.8 million within five years, surpassing forecasts for the fixed network.

It is estimated that it would cost around US$ 500 million over a five-year period to improve the telecommunication network, launch a mobile network and extend telecommunication access in North Korea. The major problem is where the North could obtain the funding. Current services do not generate sufficient income for an investment of that size and vendor financing is problematic. Since the North is not a member of regional or multi-lateral financial institutions such as the Asian Development Bank or the World Bank it cannot obtain financing from those sources. The only feasible alternative seems to be some kind of partnership with foreign companies such as a joint venture or build-transfer arrangement.

The South could help given their higher level of development and ICT success. There appears to be some interest by South Korean firms to invest in the North's ICT sector. Officials of South Korea's largest mobile operator, SK Telecom, have been to the North to discuss the construction of a CDMA mobile network. Hanaro, the South's second largest broadband operator, is working with North Korea to build broadband equipment as well as provide animation services. Despite the dearth of ICT development in the North, there are some bright areas. One field doing relatively well in is software development. Researchers at the Kim Jung Suk Teachers College have developed over 2'000 educational software titles. The Silver Star Computer Technology Institute, created in 1995, has exported software to Japan. The government has been organizing an annual software contest for the last decade and is committed to increasing IT training.

[1] The Korean Network Information Centre (KRNIC) carries out regular surveys to determine the number of Internet users in the country. An Internet user is defined as a person, over the age of six who uses the Internet at least more than once a month. See http://stat.nic.or.kr/iuser/image/survey-dom.gif.

[2] This term was used by the American author Mark Twain to refer to three kinds of lies. Twain incorrectly attributed the quote to a British Prime Minister, Benjamin Disraeli. Subsequent research found that Leonard Henry Courtney, a British Baron, first used the phrase. See University of York (UK). "Lies, Damned Lies and Statistics." www.york.ac.uk/depts/maths/histstat/lies.htm.

[3] John F. Kennedy's inaugural speech. http://www.cs.umb.edu/jfklibrary/j012061.htm.

[4] "Proposal on the xDSL Based Broadband Internet." http://www.itu.int/ITU-D/pdf/2128-086-en.pdf.

Annex 1: List of meetings

No.	Date/ Time	Research Area	Appointment with
1	23/05/02 14:00	Overview of ICT developments in Korea Overview of ICT policies ADSL success factors Telecommunication market policies E-Government E-Commerce	Ministry of Information and Communication (MIC)
2	24/05/02 09:00	E-education	Korea Education & Research Information Service (KERIS)
3	24/05/02 14:00	E-health	Health Insurance Review Agency (HIRA)
4	24/05/02 17:00	Internet domain policies	Korea Network Information Center (KRNIC)
5	27/05/02 09:00	Informatization of statistics Collection of ICT related statistics	Korea National Statistical Office (NSO)
6	27/05/02 14:00	ADSL technology and development The Role of ETRI in Korea	Electronics Telecommunications Research Institute (ETRI)
7	28/05/02 09:00	Cable modem and broadband access	Hanaro Telecom
8	28/05/02 14:00	ADSL Business prospects	KT
9	29/05/02 09:00	Korea informatization and prospects Internet development and prospects	National Computerization Agency (NCA)
10	29/05/02 14:00	Informatization policyies Socio-cultural background on Internet developments Telecommunication market analysis	Korea Information Society Development Institute (KISDI)
11	30/05/02 09:00	IMT-2000 Wireless Internet	SKT
12	30/05/02 14:00	Final session (Review of Interview)	Ministry of Information and Communication (MIC)

Annex 2: Acronyms and abbreviations

2G	Second Generation of mobile communications technology
3G	Third Generation of mobile communications technology
ADSL	Asymmetrical Digital Subscriber Line
APEC	Asia Pacific Economic Cooperation
APSIRC	Asia-Pacific Security Incident Response Coordination working group
ARPU	Average Revenue Per User
ASEAN	Association of South East Asian Nations
B2B	Business-to-Business
B2C	Business-to-Consumer
B2G	Business-to-Government
CDMA	Code-Division Multiple Access
CIUS	Computer and Internet Use Survey
DSL	Digital Subscriber Line
EDI	Electronic Data Interchange
ETRI	Electronics Telecommunications Research Institute
e-WAS	Early warning and alert system
FIFA	Federation Internationale de Football Association
FiMM	First in Mobile Multimedia
FIRST	Forum of Incident Response and Security Teams
FSP	Facilities-based Service Providers
Gbps	Giga bits per second
GDP/GNP/GNI	Gross Domestic Product/Gross National Product/Gross National Income
GFCF	Gross Fixed Capital Formation.
GIS	Geographic Information System
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communication
HFC	Hybrid Fibre Coaxial (cable)
HIRA	Health Insurance Review Agency
HTS	Home Tax Service
ICT	Information and Communication Technology
IMF	International Monetary Fund
IP	Internet Protocol

ISDN	Integrated Services Digital Network
ISP	Internet Service Provider
IT	Information Technology
ITU	International Telecommunication Union
KERIS	Korea Education and Research Information Service
KII	Korea Information Infrastructure project
KISA	Korea Information Security Agency
KISDI	Korea Information Society Development Institute
KIX	Korean Internet Exchange
KNIX	Korean Neutral Internet Exchange
KOREN	Korea Advanced Research Network
KORNET	Korea Telecom's Internet Service Provider
KOSDAQ	Korean venture capital stock exchange (KOSDAQ)
KREN	Korean Education Network
KRNIC	Korea Network Information Center
KRW	Korean Won, Korea's national currency (see Won).
KT	Korea Telecom Corporation
LAN	Local Area Network
LG	Lucky Goldstar
Mbps	Mega bits per second
MHz	Megahertz
MIC	Ministry of Information and Communications
MMS	Multimedia messaging service
MOCIE	Ministry of Commerce, Industry and Energy
MOE	Ministry of Education and Human Resources Development
MOHW	Ministry of Health and Welfare
MPEG	Moving Picture Experts Group
NCA	National Computerization Agency
NSO	Korea National Statistical Office
OECD	Organization of Economic Cooperation and Development
P2P	Peer-to-peer
PC	Personal Computer

PCS	Personal Communication Service
PDA	Personal digital assistant
PDC	Personal Digital Cellular
R&D	Research and Development
SDN	System Development Network
SME	Small- and Medium-sized enterprise
SMS	Short Messaging Service
SSP	Specific Service Provider
TCP/IP	Transmission Control Protocol/ Internet Protocol
TV	Television
UN	United Nations
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
VASP	Value-added Service Provider
VDSL	Very high-bit rate Digital Subscriber Line
VoIP	Voice over Internet Protocol
WAN	Wide Area Network
WAP	Wireless Application Protocol
W-CDMA	Wideband Code-Division Multiple Access.
WINC	Wireless Internet Numbers for Content
WLAN	Wireless Local Area Network
WLL	Wireless Local Loop
WON	The national currency of Korea. Conversions to US dollars in this report have been made at 31 December 2001 exchange rate of 1'315.5 = US$ 1.
WTO	World Trade Organization

Annex 3: Framework dimensions

Table 1: Pervasiveness of the Internet	
Level 0	*Non-existent*: The Internet does not exist in a viable form in this country. No computers with international IP connections are located within the country. There may be some Internet users in the country; however, they obtain a connection via an international telephone call to a foreign ISP.
Level 1	*Embryonic*: The ratio of users per capita is on the order of magnitude of less than one in a thousand (less than 0.1%).
Level 2	*Established*: The ratio of Internet users per capita is on the order of magnitude of at least one in a thousand (0.1% or greater).
Level 3	*Common*: The ratio of Internet users per capita is on the order of magnitude of at least one in a hundred (1% or greater).
Level 4	*Pervasive*: The Internet is pervasive. The ratio of Internet users per capita is on the order of magnitude of at least one in 10 (10% or greater).

Table 2: Geographic Dispersion of the Internet	
Level 0	*Non-existent*. The Internet does not exist in a viable form in this country. No computers with international IP connections are located within the country. A country may be using UUCP connections for email and USEnet.
Level 1	*Single location*: Internet points-of-presence are confined to one major population centre.
Level 2	*Moderately dispersed*: Internet points-of-presence are located in at least half of the first-tier political subdivisions of the country.
Level 3	*Highly dispersed*: Internet points-of-presence are located in at least three-quarters of the first-tier political subdivisions of the country.
Level 4	*Nationwide*: Internet points-of-presence are located in all first-tier political sub-divisions of the country. Rural dial-up access is publicly and commonly available and leased line connectivity is available.

Table 3a: Sectoral Use of the Internet			
Sector	**Rare**	**Moderate**	**Common**
Academic - primary and secondary schools, universities	>0-10% have leased-line Internet connectivity	10-90% have leased-line Internet connectivity	>90% have leased-line Internet connectivity
Commercial-businesses with > 100 employees	>0-10% have Internet servers	10-90% have Internet servers	>90% have Internet servers
Health-hospitals and clinics	>0-10% have leased-line Internet connectivity	10-90% have leased-line Internet connectivity	>90% have leased-line Internet connectivity
Public-top and second tier government entities	>0-10% have Internet servers	10-90% have Internet servers	>90% have Internet servers

Table 3b: The Sectoral Absorption of the Internet		
Sectoral point total	**Absorption dimension rating**	
0	Level 0	*Non-existent*
1-4	Level 1	*Rare*
5-7	Level 2	*Moderate*
8-9	Level 3	*Common*
10-12	Level 4	*Widely used*

Table 4: Connectivity Infrastructure of the Internet					
		Domestic backbone	**International Links**	**Internet Exchanges**	**Access Methods**
Level 0	*Non-existent*	None	None	None	None
Level 1	*Thin*	≤ 2 Mbps	? 128 Kbps	None	Modem
Level 2	*Expanded*	>2 – 200 Mbps	>128 kbps -- 45 Mbps	1	Modem 64 Kbps leased lines
Level 3	*Broad*	>200 Mbps -- 100 Gbps	>45 Mbps -- 10 Gbps	More than 1; Bilateral or Open	Modem > 64 Kbps leased lines
Level 4	*Immense*	> 100 Gbps	> 10 Gbps	Many; Both Bilateral and Open	< 90% modem > 64 Kbps leased lines

Table 5: The Organizational Infrastructure of the Internet	
Level 0	*None*: The Internet is not present in this country.
Level 1	*Single*: A single ISP has a monopoly in the Internet service provision market. This ISP is generally owned or significantly controlled by the government.
Level 2	*Controlled*: There are only a few ISPs because the market is closely controlled through high barriers to entry. All ISPs connect to the international Internet through a monopoly telecommunications service provider. The provision of domestic infrastructure is also a monopoly.
Level 3	*Competitive*: The Internet market is competitive and there are many ISPs due to low barriers to market entry. The provision of international links is a monopoly, but the provision of domestic infrastructure is open to competition, or vice versa.
Level 4	*Robust*: There is a rich service provision infrastructure. There are many ISPs and low barriers to market entry. International links and domestic infrastructure are open to competition. There are collaborative organizations and arrangements such as public exchanges, industry associations, and emergency response teams.

Table 6: The Sophistication of Use of the Internet	
Level 0	*None*: The Internet is not used, except by a very small fraction of the population that logs into foreign services.
Level 1	*Minimal*: The small user community struggles to employ the Internet in conventional, mainstream applications.
Level 2	*Conventional*: The user community changes established practices somewhat in response to or in order to accommodate the technology, but few established processes are changed dramatically. The Internet is used as a substitute or straight-forward enhancement for an existing process (e.g. e-mail vs. post). This is the first level at which we can say that the Internet has "taken hold" in a country.
Level 3	*Transforming*: The user community's use of the Internet results in new applications, or significant changes in existing processes and practices, although these innovations may not necessarily stretch the boundaries of the technology's capabilities. One strong indicator of business process re-engineeering to take advantage of the Internet, is that a significant number (over 5%) of Web sites, both government and business, are interactive.
Level 4	*Innovating*: The user community is discriminating and highly demanding. The user community is regularly applying, or seeking to apply the Internet in innovative ways that push the capabilities of the technology. The user community plays a significant role in driving the state-of-the-art and has a mutually beneficial and synergistic relationship with developers.