

## Research Report

# ICT Development in North Korea: Changes and Challenges

### **Abstract**

*Conditions of ICT development in North Korea are among the least known in the world. This paper relies on interviews, documentary material, and other sources to analyze the potentials of and constraints on North Korea's ICT development. We find substantial interest in ICT diffusion at high levels in the government, which has consistently promoted economically focused ICT programs and projects, while severely constraining political uses of ICT. While North Korea can gain substantial benefits from its proximity to South Korea, nonetheless the future of ICT development in North Korea depends on geopolitical circumstances surrounding the Korean Peninsula.*

### **Introduction**

Information and communication technology (ICT) is considered by many developing countries as a leverage for socio-economic development. This view is encouraged for example by India's success in the software industry (Nidumolu and Goodman, 1993). Many other developing and transitional countries are also pursuing strategies to promote ICT as a means of advancing their development (Carmel, 2003a). Yet while a great deal is known about India and other ICT leaders like China, other Asian countries are less familiar to students of ICT and development. North Korea is one such country. Perhaps, surprisingly, key elements of the national leadership are aggressively pursuing their own version of the information revolution. Yet like its neighbor China, North Korea wants to restrict the political dimensions of diffusion, while benefiting from its possible economic impacts to modernize selective elements of the national economy.

However, the outside world has not fully understood North Korea's attempts to reach out substantially to South Korea, and to engage with other nations to help it modernize its economy. This information has been overshadowed by the media coverage of North Korea's degenerate economy and its confrontation with the United States over its nuclear weapons program.

This paper aims to break through the shadow covering knowledge about ICT conditions in North Korea. We draw on a variety of sources, using interviews, reports published in South Korea, and other materials. We ask: Why has the country embarked on its particular ICT policy? What are the potentials of, and constraints on, this policy? What needs to be done to realize the potentials and overcome the constraints? This paper addresses these questions.

In contrast to many other countries, there is very little research on ICT in North Korea in related discipline. Although there is one paper on

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development studies in North Korea (Collins & Nixon, 1993) that briefly touches on ICT projects supported by the UN Development Program (UNDP), there is virtually no study of North Korea's ICT. Some work has been done in South Korea, but it is largely written in Korean and in the form of policy papers. These studies remain surveys of basic facts, rough projections of the future, and resulting policy recommendations (Beal, 2002; IMRI, 2001; Choi, 2001; Yoo, 2001; KIPA, 2000; Institute of Far Eastern Studies, 2000).

Another stream of research relevant to North Korea's ICT comes from studies of the political impact of the Internet on authoritarian countries. The Internet inherently enables increased and enhanced exchanges of information among citizens, including information of political import. Governments in authoritarian countries therefore face a dilemma: while the Internet is a desirable tool for the economic development they are desperately seeking, it may threaten their regimes by exposing citizens to information from outside, thereby arousing political awareness and providing platforms for organizing activities (Kalathil & Boas, 2003; Hachigian, 2002; Boas, 2000). A commonly held view among politicians, policy makers, and journalists, influenced by technological determinism, is that the Internet will automatically bring democratization to authoritarian regimes. This view is anecdotally supported by selectively chosen examples, of which the most frequently quoted is the Soviet Union's inability to control the flow of electronic information during the collapse of the Communist Bloc in Eastern Europe (Kalathil & Boas, 2003). In response to this potential threat to their political stability, it is assumed that authoritarian states will take measures to restrict Internet use among the population.

This popular view has been challenged by recent studies examining various strategies taken by authoritarian countries both to retain political control and to gain economic benefits. Having studied eight case countries, including China and Cuba, Kalathil & Boas (2003) argue that the Internet is not necessarily a threat to authoritarian regimes. While some uses of the Internet pose political challenges to authoritarian governments, other uses may reinforce authoritarian rule. Some authoritarian governments are proactively using the Internet in selected areas where it can benefit them. In Cuba, for example, the Internet is used to counter international criticism

and improve its image, and is helpful to Cuba's growing tourist trade (Boas, 2000). Hachigian (2002) identifies four types of Internet restriction strategies taken by one-party East Asian states, including North Korea, in their efforts to balance the Internet's political and economic impacts.

Although the political impact of the Internet is not the focus of this paper, we have learned that we cannot overlook the issue, because North Korea's policy on citizens' access to the Internet will ultimately impact its ICT development. The access policy is linked to economic gains sought by North Korea, in that restrictive (or free) access to the Internet by ordinary people in such an authoritarian country sends a significant signal to those able and potentially willing to invest in the country.

As is typical in North Korean studies (Noland, Robinson, & Wang, 2000), we find that there is lack of primary sources of reliable information. We hear of and read only secondary sources; that is, work that has already been interpreted or screened by those who may have their own purposes and vested interests. Despite the difficulties in accessing reliable sources, the authors believe that this research can be a small step toward future in-depth research in North Korea's ICT development. Data were collected mainly by two methods: document review and interviews. We collected materials published and available in South Korea and interviewed three businessmen who had been involved in North Korea ICT business projects. One of the authors visited a South Korean ICT firm in Dandong, China, which is close to the North Korean border.

This paper consists of seven sections. The following section presents a brief background of North Korea's economy. Section three examines its motivations for ICT development, and section four describes the current status of ICT in North Korea. Section five presents North Korea's ICT cooperation with South Korea. In section six, we present constraints on ICT development in North Korea. The concluding section summarizes the paper, and addresses the feasibility and sustainability of North Korea's ICT development strategy.

### North Korea's Economy

The Democratic People's Republic of Korea (DPRK) is located in the far-eastern part of Northeast Asia. It is a small country, similar in size to England, with a

Table 1. Basic Facts About North Korea

Population & Geography	
Population	22,224,195 (July 2002 est.)
Size	120,540 sq. km. (water: 130; land: 120,410)
National Accounts	
GDP	Purchasing power parity: \$21.8 billion (2001 est.)
GDP growth (average 1997–2001)	–3% (2001 est.)
GDP per head	Purchasing power parity: \$1,000 (2001 est.)
GDP composition by sector	Agriculture: 30%; industry; 42%; services, 28% (1999 est.)

Source: CIA. The World Factbook 2002 ([www.cia.gov/publications/factbook/kn.html](http://www.cia.gov/publications/factbook/kn.html))

population of 22 million. North Korea is ruled by Kim Jong-Il, who has been in power since his father Kim Il-Sung died in 1994. It emphasizes *juche*, meaning national self-reliance, as the organizing ideology of the polity and economy, which results in the world's most autarkic economy (Noland et al., 2000). The country is characterized by the extremely centralized state planning economy.

North Korea heavily relied on the USSR for economic support until the collapse of the Soviet bloc in the late 1980s. After the break-up of the Soviet Union, Russia stopped its supply of subsidized oil to North Korea: A series of natural disasters compounded the economic difficulties facing North Korea: the country suffered catastrophic floods in the summer of 1995, followed by more floods in 1996 and a drought in 1997. These disasters exacerbated the already-problematic food deficit. These factors, in addition to inefficiencies and systemic distortions of resource allocation originating from the ineffective central planning, caused the North Korean economy to shrink from the mid-1990s onward (Noland et al., 2000).

These crises led to the attempts at reform, including opening the economy to increase international trade and investment. For example, a Constitutional revision in 1998 mentions market concepts, such as private property, material incentives, and profit (Noland et al., 2000). The Rajin-

Sonbong Free Economic Zone was created in 1991 (although it was not successful) and special economic zones are being developed in Sinuiju, Kaesung, and Mt. Kumkang. These special economic zones highlight the government's recent enthusiasm for reviving its economy.

Questions have been raised about whether the newly included market concepts in the Constitutional revision and the recently created special economic zones signal any serious move toward reform. However, recent visitors to North Korea report the burgeoning of a grassroots market economy (Quietly, 2003). It is worth noting that North Korea is getting economically closer to South Korea despite the diplomatic tug of war with the United States surrounding its nuclear weapons program (O'Hanlon & Mochizuki, 2003). The first regular sightseeing tour to the North's capital, Pyongyang, started in November 2003. South Korea's trade with North Korea increased by 40% in the first 10 months of 2003, and during the first half of 2003, 427 South Korean companies participated in 557 projects producing \$340 million in bilateral trade (Quietly, 2003).

## North Korea's ICT: Growing Interests and Motivations

North Korea's interests in the ICT industry developed in two phases. Awareness of ICT was awakened and formed in phase I (1984–mid-1990s) following Kim Il-Sung's 1984 trip to Europe where he was impressed by the advanced microelectronics industry. Kim recognized the importance of ICT and set up government plans to develop science and technology. North Korea signed technology cooperation agreements with European countries and sent North Korean trainees to Europe (Bae, 2001:63–64). In this period, North Korea founded several computer science research and education institutes: the Kim Chek Engineering College in 1983, the Chosun Calculator College and Pyongyang University of Computer Technology in 1985, the Pyongyang Programming Center in 1986, and the Chosun Computer Center in 1990. In 1995, Eunjung District in Pyongyang was designated as "Scientist Center" since major universities are located in the district. In addition, an ICT industrial district called Daedong River Valley was created (Bae, 2001:64).

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Phase II began in the mid-1990s in the global wave of ICT fever. From then, North Korea made concerted efforts to boost the ICT industry. Kim Jong-Il adopted a policy emphasizing science as a development strategy in 1998, and the year 1999 was designated as “the year of science.” In the 2000 joint New Year editorial of major newspapers like *Rodong Sinmun* (a newspaper from the Workers’ Party of Chosun), *Chosun Inmingun* (the army), and *Chongnyon Jonwi* (Kim Il-Sung Socialist Youth League), science was designated as one of the three major pillars for the construction of *Kangsung Taeguk* (“strong and big nation”), along with ideology and arms (Bae, 2001:61). Kim Jong-Il emphasized the need to develop information technology, saying, “The current age is the age of science, technology and computers” (*Chongnyon Chonwi*, April 11, 2001: quoted from Kim, 2002:44).

This policy direction appears in a variety of areas. In November 1999, North Korea established the Ministry of Electronic Industries to be responsible for ICT. The budget for science increased by 6.3% in 1999 and by 5.4% in 2000. One of the two deputy prime ministers is responsible for science and technology (Ministry of Unification, 2002:31). The Minister of Foreign Affairs revealed in his visit to Europe in March 2002 that North Korea wanted to send at least 500 students to study in Europe (*Joongang Ilbo*, March 18, 2002). At a special session of the UN General Assembly in June 2002, North Korea asked for more assistance in the ICT sector for developing countries (North calls, 2002). The government is stressing the need for public education in ICT to develop the information industry, and encouraging people to participate in computer studies. In its efforts to nurture an ICT workforce, new computer science colleges were opened in the Kim Il-Sung University and the Kim Chaek Industrial University in 1999. A national computer programming contest for university students is held to stimulate interest and to find talented students (Bae, 2001:65).

Why is North Korea so keen to embark on ICT? We infer one reason from internal factors and two motivations from external ones. As stated in the previous section, North Korea is in a dire economic situation. Through ICT, North Korea hopes to overcome current economic difficulties (Kim, 2002:44). North Korea recognizes that its traditional industries lack efficiency and competitiveness, and that it needs to

correct the inefficiencies pervading existing industries. North Korea has found in ICT a possibility for improvement, and has made a strategic choice to lay the groundwork for self-renewal through the high-value-added ICT industry (Bae, 2001:60, 63). As one writer rightly describes, “If isolation from the rest of the world and its economic difficulties throughout the 1990s can be labeled as an ‘analog’ challenge, the challenge of the future will stem from failure to move forward in IT. Moreover, the ‘digital’ challenge will prove impossible to overcome with any ‘analog’ approach” (Kang, 2001:93). The North’s strategy attempts to jump straight to the high-tech industry and bypass the traditional industrial development stage that focuses on light industries. While preserving the socialist system, they want to leapfrog (they call it “single leap”) to an industrial stage with ICT at its center (Bae, 2001:63, 68; Seo, 2001:184–187).

This strategy has an external origin. North Korea recently sent three economic fact-finding missions to Vietnam (Quietly, 2003). Since the mid-1980s Vietnam has been shifting from a centrally planned economy to an open market while keeping the Communist Party in power. In Vietnam, ICT is also emphasized and promoted for the country’s industrialization and modernization (ITU, 2002). It was reported that after his secret visit to *Zhongguancun*, the “Silicon Valley” of China in May 2000, Kim Jong-Il ordered his government to promote ICT. Considering North Korea’s close relationship with China and its interests in Vietnam, we can anticipate that in the short term North Korea will take a similar approach, which is a controlled economic transition to open markets with the ruling communist regime in political power.

Another external factor comes from the south of the Peninsula. It is well-known that South Korea overcame the financial crisis of 1997 by using ICT. During the crisis, South Korea suffered unprecedented rates of unemployment and bankruptcies, forcing the restructuring of the Korean economy. At that point, ICT was viewed by the government and industrial leaders as an engine for growth that would serve the recovery of the overall economy, and was promoted as such. As a result, ICT industries—equipment, telecommunication services, and software—played a central role in the rebound of the economy. Now South Korea has become a leading ICT country, driven by its advances in ICT (Lee,

2003). When North Korea's current prime minister, then chemical industry minister, led a fact-finding mission to South Korean industries in 2002, one of the focal points was semiconductor plants. This illustrates the North's interest in ICT industries and the South's success story through ICT. This interest is shared by South Korean companies that see North Korea as a short-term source of low-cost, talented workers, and as a potential market for their electronic and ICT-related goods and services in the long term. This perspective is described in detail in section five.

Kim Jong-Il's personal interest in ICT has been a further factor influencing North Korea's focus on ICT development. In countries such as North Korea where leaders have absolute power, leaders' personal interests may influence issues of strategic importance such as industrial policies (Shih, 1990). It is reported that when new computer models are imported, Kim inspects them in person and decides how they will be allocated to research institutes and universities. He often visits the Chosun Computer Center and the Pyongyang Information Center, which are at the forefront of the North's ICT research, and encourages their researchers (NK's Fledgling, 2001). Kim is reported to have said that he frequently visits South Korea's governmental Web sites, such as the home pages of the Ministry of Unification and the Blue House (the Korean equivalent of the White House) (Chairman Kim, 2002). Another episode illustrates how he shows off his interest: when the then U.S. Secretary of State Madeleine Albright visited Pyongyang in October 2000, Kim asked for her e-mail address (China Report, 2001).

## The Current State of ICT in North Korea

It is hard to find reliable information on ICT in North Korea. There is little information about communication infrastructure and hardware development in North Korea because of the secretive nature of the country. The information that is available is not necessarily accurate. Based on some policy reports (IFES and Hanaro, 2000; KIPA, 2000) and newspaper articles, we trace the efforts made by North Korea to develop its ICT sectors.

In 1994, a fiber-optic cable factory was built in Pyongyang and cable network was completed between Pyongyang and Hamheung. In 1998, a fiber-

optic cable network was laid out from Pyongyang to Sinuiju (400 km) with aid from the UNDP (North growing, 2002). As for connection to the outside world, particularly between South and North Korea, there are two links available. One comprises eight lines linking Korea-Japan KDD-Intelsat-Pyongyang-Shinpo, which was established in August 1999 and used for the Korean Peninsula Energy Development Organization (KEDO) that is responsible for the light water reactor project. The other comprises eight lines linking Korea-Japan IDC-Intelsat-Pyongyang-Wonsan-Onjung-Changjun. This was set up in November 1998 for Hyundai Group's Mt. Kumgang tourism project (Kang, 2001:95-96). The capacity of these links is very limited.

North Korea appears to have tried to follow technological trends in the early years of computer manufacturing. The first generation digital computer, called "Junjin-5500," was developed in the 1960s, the second-generation computer "Yongnamsan 1" in the 1970s, and the 8-bit "Bonghwa 4-1" in 1982. According to a report by the Korea IT Industry Promotion Agency (KIPA, 2000), as of 2000, North Korea was producing old models of 32-bit computers on current production lines. It is estimated that there is demand for one million PCs; however, the Chosun Computer Center has the production capacity of 30,000, and only 10% of it is operational due to the poor supply of electricity (KIPA, 2000:4).

North Korea has serious limitations in ICT infrastructure and manufacturing. Therefore, North Korea is focusing on software, which does not require a great deal of investment and can be developed by a quality workforce. Some of the software developed in North Korea has received positive evaluation (Table 2). As an attempt to publicize and sell its software, North Korea held the first software exhibition at the China World Hotel in Beijing in April 2002 (Pyongyang hosts, 2002).

Having set up a local area network (LAN) in early 1990 and a wide area network (WAN) in June 1997, the country is now capable of providing scientific technology-related information using a search engine called *Kwangmyong*. Kim Il-Sung University and Chosun Computer Center set up a B2B (business-to-business) intranet site (Nkelicks, 2000). Networking is also progressing within banks, food factories, and local administrations. The North's Korean Central Bank, which established a central computer system in its headquarters in 2001, is reported to have linked all its branches, thus modernizing the

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*Table 2. Representative Software*

Sindong	2002	5 languages text scanner (Korean, Japanese, Chinese, English, Russian)
Korean DOS 3.30	1989	OS
Changduk	1990	Korean Version of MS-Word
Dan-gun	1996	Korean-language Windows 95 Lookalike

Source: *North Korea catches IT fever. (2000, June 19). Joongang Ilbo, English Edition. Retrieved December 4, 2002, from <http://www.joongang.co.kr>*

*Table 3. North Korea’s Web Sites*

Name	Web Address	Year Started	Contents
<i>Korean Central News Agency</i>	<a href="http://www.kcna.co.jp/">www.kcna.co.jp/</a>	January 1997	The official news agency of the DPRK
<i>Chosun Sinbo</i>	<a href="http://www.Korea-np.co.jp/korea">www.Korea-np.co.jp/korea</a>		The official paper of Chongryon, the pro-North Korea group of Korean residents in Japan
<i>People’s Korea</i>	<a href="http://www.korea-np.co.jp/pk">www.korea-np.co.jp/pk</a>		A fortnightly publication of Chongryon
<i>Chosunl NFOBANK</i>	<a href="http://www.dprkorea.com/">http://www.dprkorea.com/</a>	July 2000	Pyongyang’s official English Web site, providing information and news on North Korea
<i>Sili Bank</i>	<a href="http://www.silibank.com/">http://www.silibank.com/</a>		The site providing a chance for the outside world to access the Internet service in North Korea
<i>Kumgansan International Group</i>	<a href="http://210.118.120.201/kor/">http://210.118.120.201/kor/</a>	Not working at the time of writing this paper	
<i>Tangun Homepage</i>	<a href="http://www.tangun.co.jp/moviekr/">www.tangun.co.jp/moviekr/</a>	Not working at the time of writing this paper	
<i>International Institute of the Juche Idea</i>	<a href="http://www.cnetta.ne.jp/juche/defaulte.htm">http://www.cnetta.ne.jp/juche/defaulte.htm</a>	Not working at the time of writing this paper	

Source: *IMRI, 2001:20–22.*

whole operating process (North growing, 2002). North Korea is reported to have seven Web sites, but its servers are located outside the country, either in Japan or China.

**South-North ICT Cooperation**

North Korea has realized that economic cooperation with foreign countries is essential to the building of its ICT infrastructure. In May 1999, the Pearl Oriental Cyberforce of Hong Kong signed a contract with the Ministry of Post and Telecommunication for a long-distance and mobile telephone 30-year agreement. The Roxley Group of Thailand also se-

cured 27 years of telecommunication copyrights from 1995, and planned a project to upgrade communication infrastructure in the Rajin-Sonbong area with US\$500 million. However, the Roxley project was not successful: it built only 5,000 telephone lines and 500 mobile lines, and 80 public phone booths (*Hankyure Shinmun*, November 17, 2000).

North Korea is seeking ICT cooperation with South Korea, and Seoul and Pyongyang have discovered that there are mutual benefits for their ICT sectors. Since the June 15, 2002 Joint Declaration—the outcome of the landmark Pyongyang summit between the leaders of the two Koreas—circumstances for economic cooperation have grown much

more favorable. The North expects to learn advanced ICT from the South and to earn much-needed foreign currency. The South can boost its international competitiveness by using North Korea's highly trained manpower at low cost (Bae, 2001:68), thereby relieving its ICT labor shortage. According to South Korea's Ministry of Information and Communications, there are shortages of programmers, systems analysts, and Web designers, and the number of unfilled places will be 142,000 by 2005. On the other hand, of the 100,000 ICT workforce in North Korea, only 5,000 are employed. Experts believe some of the remaining can be readily deployed in South Korean companies (Increasing labor shortage, 2001; Ministry of Unification, 2002:45). In addition, South Korean companies will have an opportunity to enter North Korea's market, and will be able to secure an advantage over competitors from abroad (Bae, 2001:68).

Big South Korean companies like Samsung and SK Telecom have been interested in the ICT sector in the North. In March 2000, Samsung Electronics, in cooperation with Chosun Computer Center, launched a joint software development center in Beijing. They developed a word processor called *Tong-il* (unification) Word. Two large telecommunication firms, KT and SK Telecom, will lead a consortium to carry out telecom projects in North Korea (Telecom group, 2002).

Small- and medium-sized companies are also active. Onse Telecom, selected to build a telecommunication network in the Mt. Kumgang region, plans to construct a direct inter-Korean network using a satellite to link networks in the Kaesong industrial complex and the Mt. Kumgang region. It plans to build a network linking Pyongyang, Wonsan, Haeju, and Shinuiju by constructing and providing services with digital hybrid wired/wireless equipment that encompasses wireless telephone functions of 4,000 circuits (IT firms hustle, 2001). The IMRI established a production line for finished monitors in 2000, and is producing circuit boards for computer monitors. The company also jointly established UNIKOTECH ([www.unikotech.com](http://www.unikotech.com)) with a North Korean software development organization and the Chongnyon Company in Tokyo in July 2000. UNIKOTECH was formed to provide various communication solutions and focuses on sales in Japan (personal communication with the CEO of IMRI, November 25, 2002).

In July 2000, the second largest South Korean

telecommunication firm, Hanaro, invested in the construction of a factory to make high-speed Internet signal distributors on a contract basis. The plant produced 171,000 filters and 10,000 high-speed Internet signal distributors and telephones. The company also produced a three-dimensional cartoon animation titled *Dinga, the Lazy Cat* (personal communication with an executive director of Hanaro, November 18, 2002). South Korea's Hanabiz Co. and Pyongyang Informatics Center (PIC) jointly established the Hana Program Center at Dandong, China in August 2000. The center allows North and South Korean companies to cooperate in a profit-making venture by filling orders for software development from South Korea and China using the quality North Korean workforce (personal communication with a manager of Hana Program Center, January 8, 2003).

## Constraints on North Korea's ICT Development

Despite North Korea's enthusiasm, there are both internal and external factors that constrain North Korea's ICT development. First, telecommunication and telephone networks remain undeveloped. In 1998 the North had only 1.1 million telephone lines, which is 1/18th of those of the South. Among them, the number of private subscribers is estimated at fewer than 70,000. Only 4.82 North Koreans per 100 have a line compared with 43.27 in South Korea (ITU, World Telecommunication Development Report, 1999, quoted in Ministry of Unification, 2002:33).

Another constraint is the short supply of basic equipment. Hardware, such as computers and modems, is in short supply. According to a South Korean businessman who visited North Korea's Chosun Computer Center, while the center had about 500 research staff, it had only 80 Pentium computers, which comprised 10% of the total Pentium computers in the country. The center lacked books on program languages and applications. Only a few computers had a LAN installed (NK's fledgling, 2001; NK hot, 2001).

Third, information and communication technology, especially the Internet, inherently pose a dilemma to politically oppressive countries. While the Internet can bring economic gains to a country, it can cause political destabilization by enabling eco-

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conomic and political information to flow freely, beyond the government's control. China's response to the Internet is worth noting here. Some argue that ICT, currently represented by the Internet, are "technologies of freedom," and that by modernizing its communications, China will lose the balance between economic liberalization and political control. The Chinese government has a different view, which is that "IT can give them *both* modernization and enhanced powers of central control and stability" (Mueller and Tan, 1997:12 authors' italics). China's Internet policy reflects this belief: promoting economic development and simultaneously maintaining the state's political and economic control are the governing principles of its Internet strategy. The key to this strategy is to restrict the number of organizations that can provide interconnection to the global Internet. There are four interconnecting networks and these are tied closely to, and coordinated and managed by, government agencies (Tan, Foster, & Goodman, 1999). At the user level, all Internet users must register with the local police and sign an agreement not to do anything that may harm the country (Chismar, 1996).

The North Korean government's intention to support ICT appears strong, and the Internet is often mentioned as essential for learning the world's ICT trends. Despite its rhetoric, however, it is not likely that the government will allow ordinary North Koreans to access the Internet freely, even when they have the physical infrastructure, which is currently available only to a privileged few. Although North Korea reportedly has the world's most restrictive policy on Internet access (Hachigian, 2002), there is actually no need for explicit regulations because North Korea's ICT infrastructure is so poor that the general public has virtually no Internet access anyway. While the Internet country code *kp* has been assigned to North Korea, no *kp* Web addresses have yet been registered. Most offices of the central government are connected via Intranet, e-mails are used, and the network is being extended to regional and local offices (North growing, 2002). However, international connections are limited, sites outside North Korea are not accessible, and content is mostly limited to science and technology.

As infrastructure improves and more people have access to the Internet, the North Korean government will reach the point where it will have to make an explicit policy decision. This decision will be

significant, not only for its political impact, but also for its economic implications because it will be interpreted by potential foreign investors as an initial signal of North Korea's sincerity in observing international economic norms. If North Korea approaches the most open medium in the most closed manner, this approach may help maintain political control, but it will not be helpful in bringing the economic gains that are the initial motivation of North Korea's ICT pursuit.

Fourth, advanced technology industries such as ICT require a large amount of capital, which North Korea does not have. It must come from foreign investors, but there is no sufficient incentive offered by North Korea to attract them. The domestic market does not exist at all. Jean-Jacques Grauhar, secretary general of the European Union Chamber of Commerce in Korea said, "One factor that hinders development of the nation is the low purchasing power of the people and lack of foreign currency that limits the scale of the domestic market" (EU still examining, 2002). It is hard for foreign companies to justify their entry into the country with high political risks.

Constraints exist not only internally, but also come from outside. Related to the fourth point, perhaps the investment needs to come from South Korea. Many ICT companies are interested in North Korea for its allegedly cheap and good quality ICT workforce. However, large companies are still cautious about investing in North Korea due to political risks. Even when they invest, they do so not because they expect a profit, but because they want to maintain links for future opportunities. For small ICT ventures, complicated regulations and procedures imposed by the South Korean government discourage them from seeking cooperation with North Korean partners. For example, the Law on Inter-Korean Exchanges and Cooperation stipulates that those who wish to contact or communicate with North Koreans must obtain an approval from the Ministry of Unification by completing a form 15 days prior to the intended communication. After the meeting, a written report is required. More complicated procedures are applied to telecommunication companies wishing to engage in inter-Korean cooperative projects. These complex procedures are full of pitfalls and deter many companies from entering North Korea (Bae, 2001:71). The South Korean government may consider easing the procedures. However, rela-

tions with North Korea is still the thorniest issue in the internal politics of Seoul,<sup>1</sup> and consensus on the approach is necessary before further development is possible.

Sixth, any policies on North Korea are inevitably influenced by international factors. The Wassenaar Arrangement bars ICT-related exports to North Korea. It was established in 1996 to promote transparency and greater responsibility in transfers of conventional arms and dual-use goods and technologies (that is, those that can be used for military purposes). It replaced the COCOM (Coordinating Committee for Export Control to Communist Areas) because COCOM's East-West Cold War focus was no longer the appropriate basis for export controls ([www.wassenaar.org](http://www.wassenaar.org)), and South Korea is one of the founding member countries. The Wassenaar Arrangement prohibits the export of dual-use goods and technologies to North Korea, which is classified as a terrorism-sponsoring nation. Even low-level computers like 486 PCs cannot be exported to North Korea, according to the Arrangement<sup>2</sup> (Bae, 2001:72).

The Wassenaar Arrangement has contributed to the failures of some inter-Korean economic cooperation projects. In 1999, Hyundai Electronics signed a \$1.5 million contract for the transfer of computer assembly facilities, and submitted the application for shipment to the Ministry of Unification. However, the Ministry could not approve the shipment because of the Wassenaar Arrangement (Bae, 2001:73–74). South Korea's telecom carriers, KT and SK Telecom, are leading a consortium of Korean firms to provide CDMA (code division multiple access) mobile communication services in Pyongyang and Nampo. They faced difficulties because of the

Wassenaar Arrangement, under which South Korea is prohibited from shipping CDMA equipment to North Korea. The United States is reported to oppose to CDMA exports to the North (Alleged inter-Korean accord, 2002; Consortium to introduce, 2002).

In brief, North Korea's ICT development is heavily influenced by external political circumstances. For example, an inter-Korean telecommunications meeting for the wireless communications network mentioned above was cancelled in the wake of the naval clash in the Yellow Sea in July 2002. The United States under the Clinton administration did ease economic sanctions on North Korea in June 2000, but since the beginning of the Bush administration, international political circumstances have become unfavorable to North Korea's ICT development. In particular, North Korea's current nuclear crisis will have a huge impact on the destiny of its economic plan, which may in turn have a great influence on ICT projects.<sup>3</sup>

## Concluding Remarks

ICT development in North Korea faces many obstacles, and its success depends on how North Korea overcomes each of them. This concluding section suggests measures that could be taken to improve North Korea's ICT environment. The authors are aware that "it is easier said than done," particularly when the *realpolitik* of international relations is involved.

To build information infrastructure, government investment in human resources and telecommunications networks is required. This includes broad-based investment in general education and widespread provision of basic telecommunication services

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1. The previous administration saw economic collaboration with (or aid to) North Korea as essential to its unification policy which was named the "Sunshine Policy" because the sun of economic benefits will continue to shine even on cloudy days despite various disputes within the Peninsula. This policy will help ease economic difficulties of North Korea and improve the internal relationship between South and North. Although there are some variations, the current administration maintains the basics of the Sunshine Policy. Conservative opposition parties, especially hardliners, oppose the Sunshine Policy, arguing that the economic aid only helps the regime survive its economic hardships and aid is even used for military purposes.

2. North Korea recently established a joint computer assembly and production company. It will manufacture Pentium IV PCs in the first half of 2003. In this way, North Korea can bypass the Wassenaar Arrangement which forbids North Korea from importing complete computers (Worth to get Pentium IV, 2002).

3. North Korea is losing a series of huge infrastructure projects due to the renewed nuclear program (Quietly, 2003). In November 2003, it was announced that a natural gas pipeline worth \$17 billion would bypass North Korea by being laid on the floor of the Yellow Sea to avoid the political and financial risks of North Korea. KEDO announced the suspension of a \$4.6 billion project to build two nuclear power plants in North Korea. The power plants were compensation for the North's abandonment of its nuclear bomb program.

(Kraemer & Dedrick, 1993:15). As North Korea does not have enough capital to make such investments, the country should seek external assistance. Exchanges at various levels are being tried and will be helpful. For example, two computer professors from South Korea gave lectures to postgraduate students of Kim Chaek Engineering College in summer 2002 (First Inter Korean, 2002). It is a practical step. In addition, the importance of governmental overseas development assistance and private-sector investment should be highlighted. Given the political circumstances surrounding North Korea and restrictions of the Wassenaar Arrangement, large-scale investments will be limited, but small-scale investments will be useful. However, all the efforts depend on international political circumstances surrounding the Korean Peninsula.

We close the paper by posing, and trying to answer, the question: Is North Korea's ICT development strategy feasible and sustainable? As noted at the outset, this strategy, particularly with its focus on the software industry, is popular among many developing countries (Carmel, 2003b). However, the only reported successes have been India, Ireland, and Israel, the so-called 3R countries (Tessler, Barr, & Hanna, 2003). As a latecomer, North Korea will face fierce competition, casting further doubt on the feasibility of the strategy.

We suggest that attention be paid to the factors that make North Korea unique. North Korea has a capable and willing brethren neighbor, South Korea, which has recently emerged as a leading ICT country in the world. Despite the separation of a half-century, there are still homogenous factors in the two Koreas, including the Korean language. In addition, South Korea has technologies that can be transferred to North Korea, and an internal market large enough to consume goods and services produced in North Korea. North Korea could also attempt to create an export market using South Korea's reputation in, and access to, the world market. This scenario becomes more plausible if we recall that one of India's success factors has been patriotism toward the mother country felt by Indian expatriates in the United States.

South Korea has its own economic and political needs. Its economic needs, as mentioned earlier, include low-cost labor in the short term; this may be available in the North. In addition, South Korean

businesses are looking for future markets for their goods, and North Korea is an obvious target. Regarding political needs, it is increasingly recognized that South Korea needs to assist and grow North Korea's economy before possible unification. Otherwise, drawing on the experience of Germany, all costs related to the unification are likely to be placed on the shoulders of the South Korean economy. However, regardless of its needs and intentions, South Korea is not fully free from international politics. Its options are restricted by the climate of the international relations surrounding the Korean Peninsula. Both Koreas are aware of this. Therefore, to make North Korea's ICT strategy feasible and sustainable, a progressive approach is required to improve the international climate. ■

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