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CHAPTER 5

Information Technology Progress in North Korea and Its Prospects

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North Korea's IT Policy

Since its announcement of the Third Economic Plan (1987-1993), North Korea has focused its resources in enhancing the role of science and technology, especially computer science, in its national economy. The North Korean government declared the 21st century as the IT era. North Korean leaders came to realize that their ultimate objective of building a powerful and prosperous nation could not be achieved without the introduction of information technologies in the people's economy. That is why the Workers' Party of Korea recently announced a new slogan urging everyone to "focus on science and technology in building a powerful and prosperous nation," while emphasizing that the development of the IT sector should pave the way for industrial recovery in the overall economy in the North.

However, North Korea's IT industry is in poor condition due to the collapse of the world socialist economic system in the 1990s, its international isolation, lingering economic difficulties, and technology export controls imposed on the DPRK by the advanced

Western states. Together with Iran and Sudan, North Korea is classified as a rogue state to which exports of advanced computers are prohibited. As a result, North Korea is cut off from the rest of the world and cannot acquire advanced IT products from the West.

Domestically, North Korea actively promotes the IT industry as a key government policy. But it restricts the development of technologies that may lead to information liberalization among its residents, which may threaten the regime itself. In addition, the international society is quite reluctant to support North Korean developmental initiatives. In reality, the world has to come to grips with the fact that North Korea's IT progress may lead to further open-door policy, but at the same time, it may have some adverse national security implications when the technologies are converted for military use.

Current Status of Telecommunication Infrastructure
The level of the DPRK's IT sector is poor, with its conditions being equivalent to that of the ROK in the 1970s. According to " The World Communications Report" prepared by the ITU, given the year of 1997 as a baseline, North Korean telephone communication lines number up to 1.2 million, and telephone distribution rate is five lines per 100 persons. North Korea's telephone communication lines were established first in military and government offices. Telephone lines for individual use are available in limited numbers. Therefore, a majority of North Korean residents still rely on public telephones in their daily lives. Public telephones are available throughout the major cities such as Pyongyang, Hamhung, etc. Telephone lines at local post offices are available for limited public use in regional cities and districts.

The degree of digitization of communication lines for the ROK is 65.1%, whereas the rate for the DPRK is only 4.6%. In collective farms and fishing villages communication relay systems are still manually operated. In major cities, telephone switchboard stations

rely mostly on analogue systems. There are only two digital telephone switchboards in Pyongyang -- long-distance local telephone calls are still limited.

In order to modernize its obsolete telecommunication infrastructure, North Korea is currently undertaking broad measures aimed at automatization and digitization of its nation-wide telephone network. In the past few years, the central government began to install fiber-optic cable networks in various regions in a comprehensive effort to modernize the nation-wide telecommunication system. Communication lines that stretch from Pyongyang to major cities have already been replaced with fiber-optical cables.

Table 5.1. Modernization of the DPRK's Basic Telecommunication Infrastructure in the 1990s

August 1990	· DPRK-UNDP Agreement on Optical Cable Development Project · Optical cable construction in the capital city of Pyongyang, North Hamgyong Province, South Pyongan Province, and Kangwon Province
April 1992	· Pyongyang Optical Cable Factory built with the UNDP assistance
January 1995	· Optical cable construction completed in Pyongyang and Hamgyong Province
February 1998	· Optical cable & automation construction completed in 16 cities and districts in Pyongyang, Shinuiju, and North Pyongan Province

With the support of the UNDP, North Korea's fiber optical cable construction started off by connecting Pyongyang and the regional cities. Now the fiber-optic cable networks expand throughout the nation. To date, optical cable construction has been completed in 16 cities and districts within the areas of Pyongyang - Hamhung, Pyongyang - Shinuiju, and Shinuiju - North Pyongan Province.

However, the total length of the established optical cable that stretches from Pyongyang to the major cities is estimated to be a mere 5,615 kilometers. Most long-distance telecommunication lines are still made of conventional wire.

Fostering IT Talent

It is very difficult to evaluate objectively the qualitative level of North Korea's IT workforce due to the lack of information at hand. Thus, foreign observers have to rely primarily on the information about North Korea's general education system and North Korea's computer-related institutions and schools. Another source is the subjective observations of industry experts from South Korean companies who visited North Korea in the course of implementation their inter-Korean cooperation projects.

At present, they say that the quality of North Korea's labor force is good. The grounds for such assessment lie in the fact that North Korea has a strong education system for basic sciences and that they teach science and technology at middle and high schools. But it is still possible that such assessment is overstated, bearing in mind the fact that most of the information comes from insiders who have on-going interest in North Korea.

The DPRK government strives to increase the number of talented professionals in the fields of science and technology. The 2002 Joint Newspaper Editorial designated "improving science and technology" as one of the main national tasks and called upon the Ministry of Higher Education to fulfill its mission of training more skilled scientists and technicians to facilitate the construction of a "powerful and prosperous nation."

The North Korean interest in training computer experts was first detected when the country commissioned its first computer assembly plant in 1983. At present, many colleges in the North offer electronic engineering courses. A number of research institutes for electronic computation were founded in the past twenty years. In 1985, an electronic computation college was set up under the auspices of the Kim Il Sung National University in Pyongyang. Computer classes are now taught at over 200 middle/high schools and many specialized colleges. The computer education covers basic knowledge about computers and software

development. At the same time, the Ministry of Higher Education sponsors annual Computer Olympiads to discern and select prospective talents. Additionally, relevant governmental organizations publish introductory computer guides, which illustrate the basics of computer utilization and program development, including Microsoft Windows and Visual Basic.

It is generally agreed that North Korean IT professionals do not have the capability to market a product that is competitive and can be sold internationally at any given moment. On January 10, 2002, KISTI announced that they worked with the DPRK's IT experts at the HANA Software Development Center located in Dandong, PRC, and that computer proficiency demonstrated by their North Korean counterparts met a required level. That assessment of performance was meaningful in the sense that it was a related governmental research institution not a private corporation that made it. However, it wouldn't be appropriate to generalize the KISTI's assessment as to the average level of the DPRK's IT industry because the people sent from North Korea to work at the HANA Software Development Center were exclusively selected and extremely talented individuals and their performance was evaluated on the basis of a different IT infrastructure than the one used within North Korea.

Furthermore, one can speculate that North Korea's education in science and technology has little bearing on the actual level of IT development in the North. The primary reason for such a disconnect lies in the fact that 41.2 percent of the educational curriculum focuses on ideological indoctrination. Moreover, there are no private educational institutes to bridge that gap. Besides, North Korea obviously lags behind the industrialized world in terms of training IT personnel and building high-tech facilities. These factors lead us to conclude that the quality of North Korea's IT education isn't really effective.

Not only are we unsure about the level of IT expertise, we are also uninformed about the number of IT experts in North Korea. The general consensus is that there are around 100,000 IT experts in the North. This estimate is based on the assumption that 10,000 experts were added annually up till 1999 from 100 universities and 120 colleges and specialty colleges. However, some people suggest that the more realistic number is actually somewhere in the neighborhood of only 1,000-1,500. Some even argue that out of the 100,000 supposed IT experts, only 1,000 possess the required computer skills; furthermore, only approximately 60 people have proficiency and can compete in terms of their computer skills at an international level. So, it would be impossible at this stage to say that North Korea has established an IT infrastructure with such large differences in estimates of North Korea's IT experts and their skills.

Organization of International Communication Network

It is a widely held assumption that one can reach around 170 nations through IDD telephones from Pyongyang. Existing international communication circuits in North Korea combine the Pyongyang–Beijing–Moscow wireless network and the Sinuiju-Beijing and Ch'ongjin-Vladivostok wired networks. Communication networks to the West include a short-wave wireless network between Pyongyang–Singapore–Hong Kong, and an indirect communication network using the Beijing area station as the relay point.

To be more specific, the U.S.-based telecommunication giant AT&T established a communication link with the United States in 1995. At present, one can make telephone calls from Washington D.C., New York, and Los Angeles to Pyongyang. Between South and North Korea there are 29 direct lines and 14 indirect lines via a third country. Direct lines were established to facilitate contact and support the South-North negotiations while the indirect lines

were established to support the KEDO light-water reactor project in Sinpo and the Mount Kumgang tourism project.

Table 5.2. International Communication Network in the DPRK

Wireless	Pyongyang ~ Beijing ~ Moscow
Wired	Sinuiju ~ Beijing, Ch'ongjin ~ Vladivostok
Wireless Short Wave	Pyongyang ~ Singapore ~ Hong Kong
Indirect Communication Network	Through the Beijing routing station
Service Provided by AT&T	DPRK ~ the United States (between Pyongyang and Washington D.C., New York, and Los Angeles)

The Korean People's Army and the Ministry of Public Security use most of the wireless communication facilities. Limited amounts of public, business-use mobile telephones and wireless pager services are provided in the Rajin-Sonbong area and within the Mount Kumgang tourism zone. According to some sources, interim wireless pager services have recently been deployed in the capital area. Also, by utilizing the international satellite communication station, which was built with the Soviet assistance in the late 1980s, North Korea can communicate with various nations around the world and can receive and broadcast television programs via

satellite. Communication with Japan via satellite became possible with the signing of the bilateral "Agreement on Establishing Satellite Communication Lines." Communication with Japan is also possible by using a dedicated international communication circuit.

North Korean Encounters with the Internet

The use of the Internet in North Korea is strictly limited to certain party organizations, government ministries and agencies, and military users only. One exception is the establishment of the one and only Internet cafe open to the general public in Pyongyang in late 2002. U.N. offices, representatives of foreign NGOs, and foreign embassies in Pyongyang send and receive e-mail by connecting to the Internet using regular international telephone lines.

In the late 1990s, the DPRK Central Science and Technology Communication Security Agency also established Internet links in key agencies and research institutes in North Korea for the purpose of exchanging information with research institutes in Russia and Japan. Since 1999, North Korea is believed to pursue a broader scope of information exchange, especially with respect to international commerce and technology transfers. However, as of today, there are no established sites using the North Korean identification domain ".kp."

To a certain extent, North Korea has succeeded in developing a computer communication network throughout the nation. North Korean officials recognize the importance of the Internet, and the DPRK government is technically capable of utilizing it. However, the common use of the Internet is still actively discouraged due to the government's closed-door policy that blocks off communication with the outside world.

In the long run, many observers believe that North Korea may become willing to gradually open up the Internet in a phased manner after its computer experts complete the construction of required firewalls and network security systems that are capable of safe-guarding the local intranets from attacks by overseas hackers and filtering out capitalistic ideas and "corrupt elements" of the Western culture. In general, North Korea is believed to concentrate its financial and intellectual resources in a number of projects aimed at developing advanced network security technologies. Hence, one can assume that its technology in the network security field is at a rather high level.

Building Capacity - Content, Connectivity, and Computers

The upper echelons of the North Korean government seem to understand very well the importance of the IT industry as the center of economic development. It strives to emphasize the importance of the IT industry in many ways such as sponsoring various science and technology exhibitions, intelligence research seminars, and encouraging IT propaganda in the mass media.

The central government encourages the introduction of IT applications in each industrial sector by financing the development of industry-specific software packages, deploying desktop computers at each enterprise and institution, promoting the establishment of local intranets within each organization, and boosting computer hardware production on a nationwide scale, etc.

The most important yardstick with which one can estimate current IT environment in North Korea is the computer distribution rate. Current PC production is relatively low, as the Pyongyang Computer factory, opened in the late 1990s, produces approximately 30,000, 386-class, 32-bit computers, and assembles on commission a few thousand 486-class computers annually. On May 12, 2001, the Pyongyang Electronics Development Company assembled its first 1,300 new model computers and had them

delivered to the "advanced computer classes" in four public schools, including the Mangyongdae Students' Palace. Generally, computer distribution is limited to 16- and 32-bit desktop computers. The Pentium-class or above desktop computers are used only in a limited number of privileged agencies. Currently, the ROK analysts estimate that about 100,000 desktop personal computers are distributed nationwide in the North.

Externally, North Korea also seeks active cooperation with South Korean companies in the software sector. On May 10, 2001, a government-backed North Korean company agreed to develop a Korean-Chinese language-interpretation software together with a South Korean company, L&I Soft. The North Korean government agreed to build an IT Complex in Pyongyang to host the Coryo Technology Development Factory, a joint venture with the ROK-registered Antrack. On August 2, 2001, the North Korean government entity joined the ROK-based Antrack and Hanabiz Co. to establish the "Hana Software Development Center" in Dandong, China.

In terms of content development, North Korea concentrates its resources on the indigenous development of software for specific industrial sectors. Each sector is being computerized, with the focus on factory-company automation. Some of these software products include overall planning programs for the design stage in light industry, operations control programs for small and medium-size water-powered generators, production line system development programs, and apparel design programs for the Pyongyang children's knitting factory. In addition, software specialists developed multilingual character identification programs, computer typing exercise programs, Chosun language type designs, Chosun cuisine, and Chosun stamps.

Furthermore, governmental agencies and university research institutes developed roughly 10 programs for the Science Council, Ministry of Education, Ministry of Light Industries, and Ministry

of Agriculture, Forestry, and Fisheries, as well as about 10 programs for the Faculty of Mathematics at the Kim Il Sung National University and the Thermo-Engineering Department of Kim Ch'aek University of Technology.

Table 5.3. Major Software R&D Institutes in the DPRK

	National Science Council	Pyongyang Information Center	Chosun Computer Center	Eunbyol Computer Technology Research Institute
Founding Year	October 1952	October 1986 (co-sponsored by UNDP)	October 1990	Currently merged with Chosun Computer Center
Number of Researcher	660	120 (including Kim Ch'aek University & Pyongyang Science University graduates)	800 (Average age 26, Women 20%)	
Main Product	Voice Recognition Plant Control & Automation Research	Word Processor	Medical Systems Fingerprint Recognition General Medical Service Systems	Paduk programs (won the Fost-hosted World Computer Paduk Competition in 1998 and 1999)

In terms of connectivity, many leading governmental institutions and some public organizations are already interconnected via computer networks. For instance, about ten agencies, including the Pyongyang telephone office, Jagangdo library, meteorology water control office, Kim Chaek Iron and Steel Combine, and the Ministry of Metal Machinery Industry are connected through a dedicated computer network of their own. Also, the government developed the "Mangyonggwan Computer Network," a computer network management facility, and began to distribute "an electronic newspaper" for the cadres through local computer intranets.

Such efforts in the development of content, connectivity, and computer hardware are proof that North Korea's technological infrastructure is mature enough to be adapted to each industry sector. North Korea is expected to attempt to break through the current economic difficulties by automating production processes in each industry. In the long run, it is likely to concentrate on IT development so that it becomes the core industry in its strategy of building a "powerful and prosperous nation." North Korea is also expected to pursue two incompatible goals of "opening up" and "closing down" by showing interest in the open IT industry, while standing by the *juch'e* principles of self-reliance and "Our Own Way of Socialism."

IT Environment within the Korean People's Army

Information Hardware Capability

Within the North Korean military, there is one super computer and more than 50 personal computers at the offices of the Ministry of the People's Armed Forces, around thirty PCs at each corps, and a dozen of desktop computers at the division and regiment levels, most of them being the 16- 32-bit, 386-class personal computers. Based on the distribution of these computers the North Korean

military has pursued automation of its command and control systems since 1986.

Fiber optic cables around military installations constitute the backbone of the DPRK's communication-support infrastructure. In 1996-1997, the fiber optic cables were first installed around the military command and control centers. In 1998-1999, additional fiber optic cable lines were laid between military installations and cities and townships. One can assume that the frontline units at the regimental level already have access to fiber optic cables. Currently, secondary cable installation construction is under way, the completion of which should enable access to fiber optic means of communication to the battalion-level military units.

Military Computer Connectivity
There is online intranet connectivity within all regiments, brigades, divisions, army corps, and rear area corps in the KPA. As the KPA introduced command- and communication-automation systems, its computer experts developed various military computer programs applied to specific organizational environments and a specified combat model.

Computer networking within North Korea in general is very limited at present. The Internet use is limited to the military and certain governmental research institutes, and it serves the primary purpose of collecting military, scientific, and technological intelligence. This is not only because of problems in facilities such as the telecommunication networks or limited computer distribution, but also for political reasons, especially because the ruling regime judges online networking as a threat. Therefore, open online Internet or PC telecommunication services for the general public are nonexistent at present.

This notwithstanding, in the early 1990s, LANs were established at the Kim Il Sung National University and the Chosun Computer Center, enabling localized network communication. In June 1997,

inter-organizational computer networks were established, enabling science and technology data exchange and e-mail service.

North Korea relies on overseas pro-North Korean Web sites as means of propaganda. The number of pro-North Korean sites is known to be around 53 including the six websites run by the North Korean government directly.

Cyber Warfare Capabilities

North Korea is believed to be involved in training professional cyber-hackers and developing communication network jamming programs in order to prepare for cyber warfare. In addition, the KPA uses its electronic intelligence warfare assets, including the Internet, to collect military intelligence. Professional computer agents are believed to train at the Command Automation College established in 1986. North Korea seems to have decided to respond to the challenges of the information age by emphasizing the importance of information warfare and greater application of information technologies in the military.

North Korea's hacking expertise and network security technologies are believed to be of very high standard. In particular, North Korea is known to conduct special training for the talented children at the age of 12 to 14 with an IQ over 150 to turn them into professional hackers. The KPA's Electronic Warfare College is believed to be responsible for training professional hackers and network security specialists. Some observers speculate that North Korea hacks into the U.S. Department of Defense computer systems more often than any other country in the world.

Electronic Warfare and Electronic Intelligence Warfare Capabilities

The KPA operates ground monitor and direction-detection posts in forward and rear areas to detect and tap into the strategic

communications of the USFK and ROK armed forces. Concurrently, North Korea operates air and maritime electronic warfare reconnaissance operations using aircrafts and submarines. The KPA also deploys multiple tapping facilities and mobile reconnaissance teams in forward areas to detect and tap into the enemies' tactical communications. The KPA's capability to jam AM and FM frequencies constitutes a threat to the AM and FM communication band used by the ROK armed forces.

To efficiently respond to rapidly improving electronic energy weapons, the KPA relies on electronic warfare as a primary means of reconnaissance and camouflage. To the KPA, electronic warfare is another important way of collecting intelligence. So, radio reconnaissance is integrated into the reconnaissance operations of echelons and each branch. In addition, electronic deception as a camouflage measure is incorporated into its fire-strike plans.

The ministry-level Technical Radio Reconnaissance Agency under the Reconnaissance Bureau and the Electronic Warfare Bureau under the General Staff constitute the core of the military reconnaissance organization in North Korea. Electronic warfare and electronic intelligence warfare operations are centrally controlled and subject to political supervision by the Workers Party of Korea.

North Korea's electronic warfare equipment is mostly portable to enhance mobility. But most of the equipment is believed to be outdated because of the KPA's widespread reliance on the old technologies imported from the former Soviet Union in the 1950s-1970s.

The North Korean Army's capability to collect strategic-communication intelligence is very broad. However, bearing in mind the fact that its communication equipment and technologies lag far behind those of the USFK and ROKA, the KPA has developed its own ways of engagement in electronic warfare. The

KPA concentrates its efforts on electronic interference. For that purpose, they strive to assimilate and develop electronic deception skills, to utilize radio communication networks by detachments in various areas, and to use radio communication equipment. The KPA employs conventional methods in its electronic warfare tactics.

Radio-electronic combat training is part of all communication exercises conducted by the KPA. The objective of the training is to achieve speed and precision in signal detection and communication. The KPA aims to enhance the readiness level of its individual soldiers and units, enabling them to carry out radio communication during electronic warfare and to respond to radio electronic combat.

Inter-Korean Cooperation in the IT Sector

IT-industry cooperation can be broadly categorized into hardware manufacturing, software developing, and joint training. Inter-Korean cooperation in IT hardware manufacturing at the current stage mainly consists of the joint production of Samsung televisions and LG's televisions, phones, and other home appliances at North Korean factories. OEM of computer parts and components is still at its elementary phase. Therefore, inter-Korean IT cooperation today does not require a high level of technology transfer and is not directly related to the IT hardware industry. Large capital investments are required to build manufacturing facilities for the production of IT hardware. They are unlikely to materialize soon because of international embargoes, the DPRK's unstable and murky business environment, and prohibitive domestic regulations.

Concerning the inter-Korean cooperation in the communication sector, Korea Telecom, Hyundai Electronics, and Onse Telecom have a number of joint-venture projects with the North, especially in the Mount Kumgang Special Tourism Zone. They provide

communication lines for people visiting Mt. Kumgang tourist area and coordinate international-calling services between the KEDO construction site in Sinpo and South Korea. It is worth noting that these projects do not directly benefit the North Korean economy. Since the North's communication infrastructure is poor, these joint-venture projects in the communications area mostly simply connect the South Korean telecommunication service providers operating in North Korea directly with the ROK's communication networks.

The software industry seems to be an area of interest where two Koreas can cooperate to mutual benefit. Recently, ROK firms, including Samsung Electronics, Hanabiz.com, and Entrac, have signed a series of agreements to jointly develop and distribute software products with their North Korean counterparts. Joint cooperation in the software sector can either take the form of a true joint development effort or the form of South Korean marketing and representation of North Korean software in the ROK's domestic market. Samsung Electronics is currently involved in a joint project developing software with the North Korean Chosun Computer Center under an agreement made in 1999. Because North Korea does not have an appropriate communication infrastructure adequate for foreign investment, its government prefers to make investments in software development, which is a relatively labor intensive and low capital segment of the IT sector. In the same vein, from the ROK's point of view, the North Korean software industry is attractive because it requires little capital investment, and cheap labor costs in the North allow for the construction of low-cost, advantageous production sites for low technology packages. Thus, an objective evaluation of the software development experts within North Korea could lead to a win-win business opportunity for South and North Korean enterprises.

On the one hand, if one assumes that the IT-related workers in the North total about 100,000 people, then one can consider them to be

a possible source of an alternative solution to the largest drawback the ROK's long-term IT sector development plan, i.e., the lagging supply of qualified manpower. Some analysts estimate that in the next five years, the ROK economy is likely to require up to 94,000 more highly educated professionals with bachelor's degrees or higher. The shortage of qualified labor is critical especially in the software development and communications services. Therefore, ROK companies must consider seriously the possibility of utilizing the North Korean IT professionals as a substitute labor force in the ROK domestic IT sector. On the other hand, one should bear in mind the fact that out of 100,000 people potentially available in the North Korean IT personnel pool, only perhaps 1,000 can be considered as top-notch experts in their respective fields of IT expertise. Professional qualifications of the rest still need to be verified, and their existing skills are unlikely to meet the requirements of the ROK's IT industry. Therefore, it is prudent to conclude that in qualitative terms, North Korean IT personnel may not be able to alleviate the South Korean IT labor shortage.

Currently, a number of the ROK's companies, including Samsung Electronics, Entrac, and Hanabiz.com, are involved in training the North Korean IT workforce in both North Korea and China. For instance, Samsung Electronics established the "Samsung Chosun Computer Joint Development Center" in Beijing and conducts on-site training of the North Korean workers while jointly developing new software programs. Hanabiz.com also set up the "Hanabiz Software Development Center" in Dandong where its personnel trains on-site their North Korean counterparts. Entrac plans to establish the "Koryo Technology Development Factory" in the North.

According to company insiders, the level of the North Korean students receiving the IT education and the workers currently employed roughly equals the level of the people who just graduated from the IT-related educational programs in South Korea. According to the company managers, after two years of

education, the North Korean workers are expected to be on par with the best South Korean professionals. They also believe that the IT-related basic education in the North is somewhat superior to that of the South.

This notwithstanding, the general belief is that except for a few workers, most of the DPRK's IT-related workforce is not qualified to participate in joint software development projects with the South. Instead, the ROK companies can possibly employ them in the areas where relatively low-technology expertise is sufficient and large numbers of operators are required for monotonous data-input and processing jobs.

Obstacles Facing the DPRK's IT-Sector Development
North Korea is a relatively closed society. The isolation policy of the North Korean government is detrimental to the DPRK's socio-economic development in general and IT sector development in particular. For instance, in order to develop computer programs with a competitive edge in world markets, it is essential for software developers to understand the environment of foreign markets and dominant market trends. Otherwise, they will lose in their competition with foreign personnel developing computer games and multimedia content that are more closely related to real life. Isolation hinders both technology imports and application of new technology through exchange with the outside world. The isolated nature of the North Korean economy makes it difficult to gain official access to and compete in foreign markets. If the policy of isolation continues, it will be difficult for North Korean economic actors to obtain marketing experience, let alone R&D capability.

Currently North Korea has a very low level of computer distribution rate --- about 100,000 computers -- a basic requirement for the IT industry. The IT field is an industry in which research, development, and upgrades occur in all sectors simultaneously, requiring continuous R&D investment and equipment upgrades.

But, the DPRK is faced with severe financial constraints. Therefore, its main objective is just to obtain the required hardware from time to time, not continuous investment in R&D and equipment upgrades.

One of the complicating factors in the DPRK's technology development policy is U.S.-sanctioned international embargos banning technology transfers to the DPRK and prohibiting imports from North Korea in the West. The solution to this very real problem is for Pyongyang to improve relations with Washington. If the DPRK-U.S. relations are normalized, the North Korean IT industry will be a main beneficiary of the relaxation of international trade sanctions imposed on North Korea.

Improving relations between South and North Korea is a desperate problem for both Koreas pursuing reunification, from economic as well as other standpoints. Even in the IT sector, South Korea is the only realistic partner North Korea can receive appropriate assistance from and expect mutually beneficial cooperation with. This reflects the importance of South Korea's role in North Korea's IT development.

South-North relations must improve first in order to promote North Korea's IT development and South-North IT cooperation. Even if there may be legitimate grounds for the civilian sector cooperation in the modernization of the decrepit communication networks in the North and for resolving jointly various problems of mutual concern such as standardization in the IT area, as long as the relationship between the two governments is unstable and unpredictable as it is now, one cannot expect either full governmental support in Seoul or a favorable reception of IT-related cooperative initiatives with the North from the ROK general public.

Furthermore, expansion of the South-North cooperation in the IT sector is difficult to expect if North Korea fails to create an open

business environment that allows South Korean companies to freely visit the North and, at the very least, to install direct communication networks connecting the South and the North.

South Korean companies also must do their homework. They propose many blueprints regarding South-North IT cooperation. But they have to invest more money in feasibility studies of proposed IT projects with the North that would be mutually beneficial to both sides. The unsophisticated approach appealing to "nationalist cooperation" as the only reason for investing in the North has very clear limitations for companies, and it will continue to be a burden for future South-North IT cooperation. Developing a mutually beneficial IT project is a matter calling for a lot of preparation and extensive feasibility studies. South Korean companies interested in economic cooperation with the North must request information on achievements and products of their North Korean business partners, which should enable them to make assessments on North Korean technological capabilities, business environment, strengths and shortcomings of their prospective counterparts. If their research bears less than favorable results regarding the North Korean business capabilities or competitive advantages, then they should not carry on unreasonable projects, despite their understandable desire for "national cooperation."

Future Prospects

The North Korean leadership is faced with a serious dilemma: on one hand, it needs to prevent the flow of information in order to assure the regime is survival but, on the other hand, it desires to further enhance the IT sector for general economic development and advanced information communication.

North Korea probably has the worst economic environment for developing a modern IT industry. Its telecommunication infrastructure is grossly obsolete and far underdeveloped. The DPRK may be the only state in the world that is not hooked up to

the global Internet yet.   However, Kim Jong Il is the most proactive supporter for the introduction of advanced technology in North Korea. During former U.S. Secretary of State Albright's visit to North Korea, Kim reportedly even asked her for her e-mail address.

Enhancement in North Korea's IT competitiveness will, as a matter of course, strengthen the KPA forces capabilities. As Kim Jong Il sustains domestic stability and a regime heavily dependent on the military, it is natural that he should strongly push for the advanced IT for the military.

At present, North Korea experiments with a two-track economic development policy. The authorities strive to strengthen social control over the residents while implementing an open-door policy, in order to achieve regime stability and maximize economic benefits. Hence, the regime seeks to escape from continued economic crisis and to revive the economy from chronic depression.

The IT industry is a high value-added and value-adding industry. Therefore, there is a high probability that North Korea may seek to pursue a new economic strategy based on the IT industry, which does not require large-scale facilities investment. Only time will tell if North Korea is able or not to emerge as one of the winners of the global IT revolution. However, considering the current predicament of the North Korean economy and available material resources, the most efficient means for future economic development would most likely be found in the IT industry.

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