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STATE OVER SOCIETY: SCIENCE AND TECHNOLOGY POLICY IN NORTH KOREA

Speaking at North Korea's General Satellite Control and Command Center in April 2009, Kim Jong Il called the launch of the *kangmyongsong-2* (Lodestar-2) rocket a “striking demonstration of the might of our *Juche*-oriented science and technology.”¹ To be sure, the rocket launch derived from various political and strategic reasons both international and domestic. Yet Kim's phrasing is indicative and hints at another underlying theme, one that persists despite the technical failure of the launch. In praising “the patriotic devotion of the scientists and technicians who are playing a vanguard role in the drive to open the gate to a great prosperous and powerful nation,”² Kim laid an explicit emphasis on the role of science and technology (S&T) as an instrument of national power.

Indeed, scientific and technological development has emerged as a distinct national strategy for North Korea over the last decade. Facing external security challenges, domestic economic stagnation, and rising political uncertainty stemming from the succession issue, North Korea seems to have singled out science and technology as an instrument for national revival. It is celebrated in official publications as a means to achieve core national goals. In 2000, the joint New Year's editorial of North Korea's major government newspapers established science and technology, along with ideology and arms, as the “three pillars for the building of a powerful nation.”³ S&T became an important focus of the 2002 reforms and North Korea has more recently articulated a seemingly more ambitious desire to become a “strong science and technology nation” by 2022.⁴

Yet S&T policy strikes at the heart of manifold dilemmas facing the North Korean leadership. Considered a means of modernization, technology also poses formidable challenges to the maintenance of political control, introducing new pressures on the balance of power between state and society. Moreover, decades of economic decline have degraded North Korea's infrastructural backbone, constraining the country's capacity to effectively absorb and leverage technology for social and economic development. Navigating these often countervailing imperatives places significant demands on the ruling elite. Nevertheless, the North Korean leadership seems to have embarked on a policy of active promotion of S&T, but one that seeks to maintain, if not enhance the power of the state over society. North Korea's S&T policy is essentially a gambit to maximize the strategic benefits of science and technology while minimizing its political costs.

The next section traces out the historical antecedents of North Korea's science and technology policy. Section II uncovers the policy goals of S&T policy as articulated through official discourse, while Section III attempts to identify three modalities of policy implementation. Given the usual caveats about the lack and unreliability of information about North Korea, Section IV is a first-cut assessment about how science and technology is recalibrating North Korean state-society relations. The final two sections discuss policy implications and conclusions.

I. HISTORY OF S&T POLICY IN NORTH KOREA

The emergence of a serious North Korean S&T policy in the early 2000s builds on a two-decade legacy of scientific and technological development. The first attempt to enhance the country's scientific and technological base was undertaken by Kim Il

Sung in the early 1980s.⁵ He initiated an exploratory policy foray into then-emerging computer technologies and later in the decade developed a broader policy strategy for the information technology (IT) sector.⁶ North Korea first asked the UNDP, based on a similar project undertaken by the international body in Romania, to build a pilot plant for the production of integrated-circuits (precursor to modern computers) for the Electronics Institute of North Korea's Academy of Sciences.⁷ An IT training program was established for institute personnel in 1983 and in 1986, an Indian firm under contract to the UNDP finished construction of the plant.⁸ Kim's more developed S&T policy strategy emerged after his trip to Europe in 1984, during which he negotiated technology cooperation agreements that, *inter alia*, allowed for privileged North Koreans to undertake advanced S&T study in various European countries.⁹ Part of this effort focused on building a domestic research base and the North Korean government established numerous indigenous research institutes to stimulate the S&T industry, including the Pyongyang Information Center (PIC). Established in 1986, PIC focused on the development of "computer-based modern management techniques" to help technologize the state's administrative apparatus.¹⁰ In 1988, North Korea announced a formal three-year strategy to guide North Korean investment in science and technology.¹¹

Analysts have identified a more concentrated "second phase" of science and technology policy beginning in the mid- to late-1990s. Consolidating political control after the challenges posed by the fall of communism, the death of Kim Il Sung, and the famine of the mid-1990s, Kim Jong Il in 1998 began to focus more prominently on S&T policy, in part stimulated by worldwide attention to the IT revolution.¹² He recognized the possibilities of leveraging S&T as a means of industrial economic revival and issued a policy directive mandating increased attention and resources to the development of science and technology.¹³ Computer science colleges were established at the elite Kim Il Sung and Kim Chaek Universities in 1999, and in the same year, the Ministry of Electronic Industry was formed to help coordinate and oversee government sponsorship of S&T research.¹⁴ In 2001 the North Korean government allowed for the establishment of the English-language Pyongyang University of Science and Technology, a \$150 million venture to train the next generation of scientists and technicians.¹⁵ Completed in 2007, its opening has been delayed for unknown reasons.¹⁶

II. THE DISCOURSE OF SCIENCE AND TECHNOLOGY

Policy pronouncements by Kim Jong Il and official discourse in newspapers and journals characterize science and technology policy as a matter of high politics and as an instrument to achieve various national goals. Foremost are the classical objectives of socialist revolution and "self-reliance" (*juche*). In 2008, Kim Jong Il declared: "At the present period, rapid science and technology development is the most pressing and most indispensable demand of our revolution and construction."¹⁷ Without science and technology, according to *Rodong Sinmun* in 2007, North Koreans would not be able to enjoy "political independence, self-defensive military capabilities, or self-supporting industry."¹⁸

This discursive linkage of science and technology to classical objectives is complemented by a parallel strategy of elevating scientists and technicians to more prominent levels within the national hagiography. Official publications have begun to extol their virtues with effusive descriptions such as "the vanguard flagmen in the construction of a socialist powerful state."¹⁹ An

economics journal article in 2006 discussed their historical rise to prominence:

The scientists and technicians in our county have always contributed greatly to the party, the revolution, the fatherland, and the people, but never before in our revolution and construction had science and technology been emphasized as such an important state affair or had scientists and technicians been faced with such a heavy yet honorable task as today.²⁰

Other official sources have developed a more ambitious discourse, emphasizing the importance of S&T development in not only the current period but as a paramount feature throughout modern North Korean history. In what appears to be a post-hoc justification for the currently enhanced S&T focus, some publications have argued that S&T has *always* been a leading force in the drive toward socialism and self-reliance. A 2008 article in *Rodong Sinmun*, for example, centralizes the role of S&T over the last 60 years by detailing various technological achievements integral to the socialist revolution, and then builds continuity with this legacy by declaring the 21st century as “an era of science and technology.”

Importantly, recent S&T discourse has revealed an evolution in the conceptualization of *juche*. In 2005, while conducting a sight inspection of a machinery enterprise in Sinuiju, Kim Jong Il noted that “there is a critical difference, in terms of content, between the self-reliance policy pursued in the past and the one that is being pursued and promoted now.”²¹ Characterizing past policy as one of non-reliance on foreign assistance, Kim regards the new S&T-based *juche* as more willing to openly acknowledge the contribution of foreign technological innovation to the development of North Korean S&T.²² This view is exemplified in a 2006 article in the journal *Kyo’ngje Yo’ngu*, which notes that “the content of self-reliance is never set the same in different periods” and that the “thinking [of] accepting other countries’ advanced technology was against the principles of self-reliance...revealed deficienc[ies] of slowing down the country's economic development in some part.”²³

Today’s reality is different from the time when everything had to be carried out from scratch atop the rubble, and arising before us is the task to establish an economically powerful state based on the solid foundation of the self-dependent economy. If each person uses the method of following the things of the past in the name of self-reliance, it is impossible to guarantee actual profits and vitalize the economy. If (people) think that bringing in other countries’ modern plants is inconsistent with the principle of self-reliance, it is impossible to further enhance self-dependence of the national economy by making the world-class advanced technology as our own as soon as possible.²⁴

Carrying out a policy of “self-reliance based on S&T” thus means a more “pragmatic” and profit-oriented approach, which while never explicitly linked to an open endorsement of foreign investment at least hints at the benefits of leveraging foreign technologies.

This important reformulation of “self-reliance” reflects in part a trend of linking S&T discourse with newer political concepts of “military-first politics” (*songun chongchi*) and a “strong and prosperous country” (*kangsong taeguk*). These terms emerged in national discourse in 1998 and 1999 respectively, just as the policy emphasis on science and technology was assuming strate-

gic form under Kim Jong Il. The highest-priority S&T policy area is the military, the effective development of which is regarded as imperative for national survival and political control. S&T is described as “an important element that enables our country to build its military strength in all aspects,”²⁵ and core capabilities upon which North Korea addresses the threat from “US imperialists [who] are frantically trying to suffocate our republic by means of ‘high-tech’ weapons.”²⁶

The concept of *kangsong taeguk*—the strategic objective of the North Korean leadership to be realized in 2012—embodies not only military but also economic pre-eminence, and science and technology are often regarded as critical instruments toward economic development as well. Military strength will be “solidified even more firmly when great innovations are made in the economic field by combining the revolutionary soldier spirit with the *Ch'o'llima* spirit of the period of the great *Ch'o'llima* upswing in the 1950s.” Harnessing the *Ch'o'llima* spirit, the article argues, requires “developing the economy on the basis of science and technology.”²⁷

While maintaining continuity with the past, much of the discourse linking S&T to economic development is premised on the new “single leap theory”²⁸ in which North Korea achieves socialist economic growth by “leapfrogging to the information era.”²⁹ *Rodong Sinmun* described S&T as “the most straight[forward] shortcut to elevate the country’s economy to the status of that of a powerful state in accordance with the demands of a new era in a short period of time.”³⁰ Science and technology, for the North Korean government, will help stimulate rational production techniques, improve production quality, and lay the groundwork for revitalized economic activity in advanced industrial and information sectors. S&T is thus an instrument of national development. As part of this process, S&T is also seen as a mechanism to overcome the debilitating constraints on North Korean economic growth. *Rodong Sinmun*, in a rather frank admission of the economic reality of the country, wrote that “reliance on science and technology” will help surpass the “numerous difficulties and obstacles, which include the lack of raw materials, fuel, resources, currently laid before us.”³¹ Science and technology, another paper noted, “should be developed quickly to resolve issues related to people’s standard of living improvement at a high level consistent with the demands of the construction of a powerful socialist state, including the food problem, the eating problem, and the clothing problem.”³²

III. “PATRIOTISM IN PRACTICE:”³³ S&T POLICY IMPLEMENTATION

The scientific community in North Korea is estimated to number 1.9 million people,³⁴ with about 100,000 IT-specific experts.³⁵ Most of this workforce is presumably concentrated in high-level strategic parts of the military and party bureaucracies. Yet a number of research institutes and implementing partners of the government are responsible for S&T research and development, including the Academy of Sciences, Pyongyang Informatics Center, the Korea Computer Center, and Kim Il Sung and Kim Chaek Universities.³⁶ Little is publicly known about the manner and processes in which science and technology are integrated into the economy and less so for the defense industries, although some specific S&T development strategies can be identified.³⁷

Prioritized Implementation

State investment in science and technology, which the government claims increased 8 percent in 2009,³⁸ is prioritized by the type of technology and by potential sectoral application. Official documents often cite the precedence of three “core technologies:” information technology, nanotechnology, and bio-engineering.³⁹ IT is the most widely mentioned in the press, and fairly extensive technical discussions of North Korean advances in nanotechnology and bio-engineering can be found in state newspapers and trade journals, although it is difficult to identify implementing strategies for them.⁴⁰ Generally North Korea’s emphasis on these three reflects a belief in their potential for positive economic spillovers and a desire to maintain parity with global research trends.

In order to rapidly develop state-of-the-art science and technology, it is necessary to put priority efforts into the development of basic core technologies. Today, the rapid development of up-to-date science and technology and the scientific and technological changes in the socio-economic life are all taking place on the basis of the development of information technology, nanotechnology, and bioengineering, which serve as the basic core technologies in the scientific and technological development of the present age.⁴¹

These three technologies are then ranked across various economic sectors according to the prerogatives of “military-first politics.” The defense industry thus receives the lion’s share of technological resources and products, with special emphasis on the strategy bureaus of the Korean Worker’s Party and the Ministry of National Defense, particularly the WMD programs.⁴²

The direction of S&T resources to the military reflects in part the KPA’s concern about deterring the advanced US military, whose technology-intensive campaigns in the Persian Gulf and Kosovo were the subjects of careful KPA study.⁴³ One lesson reportedly learned by Kim Jong Il is that “[t]he basic key to victory in modern warfare is to do well in electronic warfare.”⁴⁴ Accordingly, the KPA has administered special programs for computer hackers and developed core competencies in electronic warfare and electronic intelligence capabilities.⁴⁵ South Korea’s intelligence agency reported in May 2009 that the KPA operates a 100-person team dedicated to the monitoring and disruption of US and ROK computer networks,⁴⁶ and experts have cast suspicions on North Korea’s role in hacker attacks against US and South Korean national security computer grids in July 2009.

The second priority areas after the military are the energy, agriculture, and metal industries.⁴⁷ Some reports also add the transportation and construction sectors to this category. For agriculture in particular, bio-engineering is attempting to generate more hearty and productive food stocks to mitigate food supply concerns. For IT, a recently released North Korean Cabinet paper helps provide clues to technology application strategies in this second tier. Building on Kim Jong Il’s injunction to “informatize all sectors of the people’s economy,” the paper first urges technology adoption in existing factories and enterprises:

By adopting facilities for information technology like computers in the social production sectors such as agri-

culture, construction, transportation, and communications, among others, we should undertake social production on the basis of information science and technology, (rather than) from the basis of machine technology. All sectors and units should deeply study and analyze the current technical level of their own units and the worldwide trend of development, the level reached by the pertinent technical and economic indexes, and the scientific and technological successes accomplished in various sectors of the people's economy, so that they will boldly adopt information facilities and latest information technology in our style.⁴⁸

After leveraging technology for production, new applications should lead to the “informatization of business activities and economic management” in these sectors.⁴⁹ Such a process should aim specifically at:

...collecting, processing, and treating all management information, including all sequential links in business activities, from the preparation of plans to production preparation and organization, and the sales of products; all per-object links from the management of labor to the management of facilities, resources, and funds; and (everything else) from the links of reproduction to the phases of expanded reproduction and the activities in regions and units and their connection.⁵⁰

Toward that end, in what appears as a concerted government effort, North Korea particularly sponsors and promotes IT software development. Applications are geared toward improving management and administrative process of firms in specific second-tier industries. This includes planning systems for light industrial firms, management and operational control programs for SMEs (particularly in the water-powered electricity industry), design programs for apparel-makers, and various administrative programs to improve capacity in government ministries (Education, Light Industry, and Agriculture, Forestry, and Fisheries).⁵¹

The focus on the software sector is for two reasons. Lacking investment capital, the government finds it cheaper to promote labor-intensive software rather than relatively more capital-intensive hardware production.⁵² Moreover, North Korea is unable to import the necessary inputs to develop a hardware sector because of existing sanctions regimes banning the purchase of items with potential military application (dual-use).

Patterns of Domestic and Foreign Investment

Although the government prefers to undertake indigenous S&T research and development, the lack of domestic investment capital and the country's low technological base necessitate openness to foreign investment. While the ideological scaffolding of “self-reliance” seems to have been modified to accommodate foreign outreach, the government—and foreign investors for that matter—have demonstrated only a limited tolerance for engagement. This reflects the central dilemma facing North Korea's leadership today: balancing the need for S&T and economic development on the one hand, and the imperatives of maintaining political and economic control on the other. This dilemma is doubly important in the context of science and technology, particularly IT, as it challenges the regime's monopoly on information and serves as a facilitator of economic modernization that may also undermine political control.

Domestic investments have focused on establishing a rudimentary IT infrastructure. A nationwide intranet was established in 2002 offering most amenities of the internet—email, access to digitized documents, electronic commerce—save for an actual outside connection.⁵³ Electronic libraries have been established throughout the country and have recently been connected to the holdings at the main electronic library at Kim Chaek University in Pyongyang.⁵⁴ North Korea in 2007 became the last country in the world to register its national domain name on the internet (.kp), to which only two addresses are permitted use.⁵⁵

Hardware investments have been relatively modest, however, compared to an emphasis on software. Most software applications, as discussed in the previous section, focus on management process improvement for selected enterprises. Mainly administered through the Korea Computer Center, the government sponsors research, development and production of software for domestic consumption and export, the most well-known of which includes the award-winning computer version of the popular Asian chess game, *baduk*.⁵⁶ North Korean programmers routinely compete—and win—in international competitions in computer animation and the design of open-source computer operating systems.⁵⁷

Given limitations on domestic investment—lack of capital, factor endowment impediments, and sanctions—North Korea has turned tentatively to outside assistance. In June, at the most recent yearly gathering of North Korean and Chinese S&T officials, the two countries pledged closer scientific and technological cooperation and China donated computers and printers to the DPRK's National Academy of Sciences.⁵⁸ The most well-known foreign investment was the announcement in early 2008 by the Egyptian telecommunications firm, Orascom, of its willingness to invest up to \$400 million in North Korea to develop and operate a nationwide mobile phone network.⁵⁹ By March 2009, Orascom had reportedly sold 6,500 3G mobile phones despite the high cost and operating fees for users relative to average monthly wages.⁶⁰

Orascom's operations in North Korea are through its 75 percent ownership in a joint venture with the North Korean government, the main investment structure through which North Korea allows foreign operations. A series of small joint ventures with limited foreign stakes have been established in recent years, primarily between the North Korean government, private Chinese or South Korean firms, and Japanese business interests via the North Korea-linked Chosen Soren. In 2002, Pyongyang teamed up with a Chinese firm to create the Morning Panda Joint Venture Company to produce personal computers for domestic consumption and export.⁶¹ In 2004 South Korean investors and the North Korean government established Hana 21, a PDA production company in Dandong, China.⁶² Another inter-Korean joint venture was established to research virtual reality technologies between the Pyongyang Information Center and South Korea's Pohang University of Science and Technology.⁶³

As evidence of North Korea's interests in foreign investment and IT-focused development, the government has undertaken modest efforts in establishing a legal framework to regulate investment and activity in IT. The government established a Computer Software Protection Law in 2003 as well as the Software Industry Law in 2004, a law guiding IT sector development.

State Direction and Government Centralization

Science and technology policy in North Korea is subject to high degrees of central government direction and control. This accords with existing North Korean practices of continuing heavy state involvement in the realization of a socialist economy and a proto-industrial policy of helping direct technology investment to priority sectors.⁶⁴ It also reflects the regime's concerns about information control and political stability.

Tracing out the relationship between the government, research institutes, and state-owned firms is difficult. The Ministry of Electronic Industry seems the central player in helping set the research agenda and policies for S&T and particularly the IT sector, but other agencies undoubtedly play a role, both according to the nature of the technological development and the prerogatives of state security and control⁶⁵ The strategic bureaus in the KWP and the intelligence agencies in the defense apparatus, specifically the Department of National Security and the Ministry of People's Security, assume important roles in formulating and implementing S&T policy.⁶⁶ Research centers, largely directed by the state, are reportedly now allowed greater independence from the government to identify new areas of potentially economically productive research, although their applications remain under tight government scrutiny.⁶⁷

Despite the overwhelming policy rhetoric about the need to adopt science and technology in pursuit of a socialist economy, it is likely that a certain degree of malleability or uncertainty surrounds the government's S&T policy. One possible indication is the publication of a number of long articles in North Korean reference journals putting forth various policy recommendations in this area. Notwithstanding the obvious questions about the role of outside actors in policy formulation in North Korea, the articles outline in broad form how S&T policy should be formulated. A December 2006 article states:

An orderly system of overseeing and managing science and technology and production on a systematic basis should be established at all levels from the Cabinet, ministries, and central organs to factories, enterprises, and crop and cattle farms to organize and mobilize science and technology capabilities in areas of national interests and resolve science and technology issues arising from modernizing the people's economy and expediently and smoothly improving socialist economic management methods.⁶⁸

Another article makes a similar recommendation about integrated state direction down to the firm level. "The Cabinet and provincial economic guidance organizations and committees should place the top priority on scientific and technological development over all other economic development projects and thoroughly establish a work system and order of planning, operating, organizing, and carrying out all economic work on the basis of meticulous scientific and technological calculations and firm scientific and technological guarantees."⁶⁹

One way to achieve this, the article continues, is to foster closer geographic and structural proximity between research institutes and economic firms. Productive enterprises should be established in science districts and at scientific research organizations where science and technology capabilities are concentrated for the strengthening of direct tie-ups between science and technology and production.⁷⁰ The potential benefits include information-sharing among economic and research units and,

more importantly, the foundation for a more sustainable mode of scientific-economic production akin to a proto-scientific-industrial complex.⁷¹

Moving down from the policy level, the main concern is the establishment of mechanisms that integrate technology into the production process. The North Korean government exhorts firm managers to realize Kim Jong Il's observation—"we live in an age in which S&T and production, one may say, form the two sides of the same coin"⁷²—by striving to integrate new technological practices to meet socialist production targets. This technological adoption "generates substantial amounts of savings in labor, raw materials, and supplies during production processes and makes decisive improvements in product quality."⁷³

Yet the primary means of achieving this integration is not left to managers themselves—indeed, the most common policy of technology implementation seems a government-based supply-side promotion effort. Specialized government units called "science and technician shock brigades" do what official documents define as "mass-oriented activities that allow scientists and technicians to go out into the field of production, sort out pending science and technology issues in collective discussions with the masses of producers, and forge more active tie-ups between science and technology and production."⁷⁴ Shock brigades were reportedly established by Kim Il Sung in 1975 as an "organized mass technical innovation movement" of scientist and technician teams to help upgrade the technology level of various firms and agencies throughout North Korea.⁷⁵ Key sites often visited by shock brigades include "party organizations at all levels, economic agencies of the state, public organizations, and scientific research units."⁷⁶ Two shock brigades receive explicit mention in official news reports: the 17 February Shock Brigade and the 15 April Technology Renovation Shock Brigade (the dates represent the respective birth dates of Kim Jong Il and Kim Il Sung).

A January 2009 media report provides insight into how shock brigades promote technological adoption. The 17 February brigade, according to North Korean radio, introduced 15 technology-improvement programs in the K'aech'o'n Railway Bureau related to the computerization of business management activities.⁷⁷ The shock brigade in this case consisted of a cross-cutting membership of researchers and experts from the State Academy of Sciences' railway science sector, Ministry of Railways Computer Center, and the Pyongyang University of Railways.⁷⁸

The same radio report described a similar effort by the 17 February brigade in the agricultural sector. This activity, to develop "soil-less sod," involved a multi-functional team across various levels of government and ostensibly non-governmental research sectors: the Ministry of City Management, Ministry of Light Industry, and the State Academy of Sciences' light industrial science department alongside researchers from the Textile Research Center (the Ministry of City Management's City Management Science Institute) and the Central Tree Nursery.⁷⁹

IV. TECHNO-STATE OVER SOCIETY?

North Korea's science and technology policy strikes at the heart of the national development dilemmas confronting the re-

gime. S&T itself poses unique challenges to the government—both in terms of realizing stated objectives of a strong and prosperous socialist state as well as in maintaining the state’s dominance over society. Balancing between conflicting imperatives of political control and economic development is key. While a genuine albeit cautious openness to S&T development cannot be ruled out, the balance of discreet and fragmentary evidence suggests that the North Korean leadership seems to have embarked on a gambit to maximize the strategic and economic benefits of S&T while minimizing political costs.

Toward that end, North Korean S&T policies appear to strengthen the capacity of the state apparatus while limiting societal mobilization. In short, S&T reinforces vertical control mechanisms while restricting the emergence of horizontal linkages. This implies, but by no means confirms that a strong state dominates a weak society, for other outside factors may be increasing societal capabilities that challenge state control. Indeed, the *net effect* on the general balance of power between state and society is difficult to ascertain and beyond the scope of this paper. In the narrower focus on S&T policy, however, a common pattern of ‘vertical consolidation and horizontal restriction’ seems apparent across the military, information and economic domains.

Figure 1: Posited Effects of S&T

	<i>Vertical Consolidation</i>	<i>Horizontal Restriction</i>
S&T and Military	<ul style="list-style-type: none"> • Consolidating top-down command-and-control mechanisms 	<ul style="list-style-type: none"> • No “integrated battlespace” across units
S&T and Information	<ul style="list-style-type: none"> • Strengthening state propaganda Apparatus 	<ul style="list-style-type: none"> • “Correct use” monitoring
S&T and Economy	<ul style="list-style-type: none"> • Rent extraction • State-firm links as pillar of control 	<ul style="list-style-type: none"> • “Disabling” environment

S&T and the Military

The imperative of “military-first politics” ensures that the military receives the predominant share of state investment for S&T research and development—which the military uses to deter external aggression, maintain its political position domestically, and suppress internal threats. Thus the *distribution* of S&T resources *per se* can be regarded as a means of strengthening the repressive apparatus of the state. Moreover, the pattern of technology *adoption* in the military suggests that within the KPA the focus on integrating new technologies is to reinforce top-down command-and-control hierarchies rather than to facilitate horizontal information-centered networks.⁸⁰ Mansourov notes that instead of fostering “common battlespace awareness among various KPA services and military units at the operational and tactical levels, IT is likely to be used to advance one-man real-time battlespace knowledge and assessment resulting in single-handed action.”⁸¹ Such a process, while perhaps detrimental to warfighting capabilities, strengthens state authority over the military while minimizing the lateral linkages that could potentially facilitate organized action independent from (or even against) interests of the top leadership.

S&T and Information

Technology also facilitates greater state capacity to control information by consolidating vertical mechanisms of information dissemination while limiting horizontal distribution. Indeed, the US intelligence community assesses that Pyongyang is “channeling information to regime goals” and “harnessing IT for domestic indoctrination and foreign propaganda.”⁸² Owing to the development of the national intranet and electronic libraries, technology is enabling the dissemination of propaganda by making a wider range of materials available to the populace through more accessible mediums.

At the same time, the government is monitoring potential spillovers by limiting horizontal information flow that could potentially undermine state control. This security concern was first realized in 2004 after the Ranchyon railway train explosion. Allegedly an assassination attempt on Kim Jong Il triggered remotely by a mobile phone, the government banned and confiscated mobile phones to prevent follow-on attacks and limit the spread of information that could galvanize wider social unrest.⁸³ More common are concerted government attempts, in recognition of the potentially deleterious effects of widespread IT dissemination on political control, to make technology itself an object of propaganda. The government routinely stresses the need for “correct” use of technology. Official newspapers remind people of the importance of integrating S&T in a way that ensures “accurate viewpoints and attitudes.”⁸⁴ This task is carried out by the KWP and various party organs, which “vigorously conduct the ideological indoctrination work and political work to firmly arm functionaries and workers with the party’s line of attaching importance to science and technology and to instill in them a solid viewpoint on science and technology.”⁸⁵ By not only leveraging technology for greater control of information but also exerting control over technological use, the government is keen to strengthen its role over society to prevent the erosion of political control.

S&T and Economics

The introduction of technology into the economic domain poses the most complex challenge for the government. The government is committed to leveraging technology to stimulate economic modernization but also eager to limit any anti-government pressures that might emerge as a side effect of economic reforms. The government seems unsure of how best to integrate technology into the economic process in a manner that is least disruptive to political priorities. Shock brigades are the most widely publicized government mechanism of technology adoption in state firms, but new policy strategies are likely to be developed as the government comes to better understand the inter-relationship between technology, economic growth, and political control. At this point, however, some discreet evidence suggests that technological investment is focused on strengthening the state’s vertical power while limiting horizontal spillovers to society. Through technology, North Korea seems to be building an economic foundation of state power while controlling for the potentially negative side-effects of economic growth.

First, North Korea attempts to capture disproportionate benefits of S&T while bearing little cost. This is most evident in the state’s behavior in the IT sector. In assessing Orascom’s investment activity in North Korea, Noland concludes that the introduction of new technologies has been less a means to “boost productivity, efficiency and competitiveness than an easy

way to extract hard currency rents for the central government, without significantly altering existing practices.”⁸⁶ This may indicate a broader, more systemic tendency to treat technology as an instrument for elite revenue-generation rather than an engine of broad-based economic growth.

Second, the tight links between the state, S&T research and development activities, and economic firms suggests that technology is being leveraged to build an economic base of state power. North Korean leaders realize that technological improvements are necessary for economic revitalization that, in turn, is crucial for maintaining political legitimacy and stability. Moreover, the *process* through which the state administers technological research and its integration in the economy helps to strengthen state power. Maintaining firm control over the entire “life cycle” of technology, the government effectively establishes a state-scientific-industrial complex that ensures the alignment of the twin goals of economic growth and political stability.

Yet the process of integrating technology into the economy is hampered by two deficiencies in North Korea’s S&T policy, which reveal the government’s unwillingness to allow technology to strengthen horizontal linkages in the economy. First, technology is seen as a substitute for markets in generating economic growth. North Korea seems to regard technology as a *deus ex machina* that can stimulate economic improvement without the corresponding reliance on free markets that could generate wealth—and political stability. Technology appears as a means to provide the state with modest economic support—through rent extraction and low-level productivity gains—while insulating it from the political pressures of genuine market-based economic reform. This accounts for North Korea’s active promotion of technology and simultaneous delegitimization of market activities.

Second, North Korea is seemingly unwilling to establish the secondary conditions necessary to fully unlock the benefits of S&T, curtailing the “multiplier effect” of relying on S&T as a catalyst for economic growth. The lack of attention to establishing an effective “enabling environment” suggests that the government wants to capture partial economic gains while controlling for political side effects. The government achieves this result by frustrating the development of horizontal linkages through society and the economy. The country’s IT infrastructure is woefully inadequate to serve as the base of a technologically-intensive society and economy, despite improvements in recent years.⁸⁷ Mobile phone access is difficult outside Pyongyang and land-lines in use number just over 1 million out of a total population of 23 million.⁸⁸ Private internet access is restricted. The state retains the sole proprietorship over the research, development, and implementation of new technologies. Various internal and external constraints on foreign investment remain and, when foreign joint ventures are permitted, most are domiciled in China to avoid direct socio-economic impact in North Korea. This “disabling environment” is reinforced by the continued primacy of international politics, in which North Korea’s calculated external belligerency distorts and disrupts the S&T policy environment by giving cover for foreign countries to maintain sanctions on dual-use technology items. In short, the government is attempting to control the effects and spillovers of technology.

V. POLICY IMPLICATIONS

Policy trends for North Korean S&T have important implications for the US government. Despite Pyongyang's best efforts, technology effects are difficult to control, as displayed by the recent experience of the Chinese government in censoring internet use. There are already numerous anecdotes about North Koreans working around government controls and it is reasonable to expect that such trends will continue despite the government's declared intention to mandate "accurate and proper" application of new innovations.⁸⁹ Moreover, as technology is increasingly developed and integrated into economic practices, spillovers—many of which are often unpredictable—will help set off second order effects that will recalibrate the relationship between state and society.

Hence greater engagement by external actors in the scientific and technical fields seems like an important long-term policy measure to help lay the crucial foundations for the resuscitation of political and economic life in North Korea—under Kim Jong Il or otherwise under his successor. Engagement should proceed despite the possible—indeed likely—prospect that such assistance may benefit the elite in the short-term; the long-term benefits are greater.⁹⁰

Yet the current political environment complicates engagement strategies. To be sure, North Korea's missile launch and subsequent reconstitution of its nuclear reactor have badly damaged the environment in which to recommend greater engagement between the US and North Korea. Political difficulties on long-standing security issues, however, paradoxically raise the importance of engagement on unconventional issues, such as science and technology. After a reasonable "cooling off" period, the new Obama Administration should indicate a willingness to encourage various measures to engage North Korea in issue-areas outside the dominant domain of geopolitics, such as science and technology. Such "science diplomacy" should be undertaken with a view toward enhancing scientific understanding and establishing working bilateral relationships in the epistemic communities that can help undergird more durable bilateral state relations.

Academic Exchanges

At the "track two" level, US scientific institutions can help facilitate US-DPRK scientific and technical cooperation. This effort builds on near decade-long cooperation between Syracuse University and Kim Chaek University in Pyongyang,⁹¹ and even more broadly on US academic engagement with the Soviet Union during the Cold War. The program administered by Syracuse University has helped to establish digital libraries in North Korea and provide various forms of technical assistance in computer software development.⁹² The program has enabled nine exchanges of US and North Korean scientists between countries or to third-countries, many of which have occurred at sensitive times in the overall bilateral relationship and may reflect a North Korean desire to maintain some albeit unofficial contact with the US.⁹³

Engaging with North Korea in S&T during times of political difficulty is not without precedent, and thus important S&T linkages should be strengthened. The Obama Administration should provide the necessary support to help enable greater cooperation among US and North Korean scientific communities. The State Department should remain willing to issue visas to North Korean scientists for study visits to the US and export licenses should be granted for the transfer of genuine scientific equipment to North Korea in support of such programs. Moreover, relevant enabling administrative actions should be

taken to ensure the US-DPRK Scientific Engagement Consortium, led by the US Civilian Research and Development Foundation (CRDF) is allowed to visit North Korea in 2009 as planned.⁹⁴

Wassenaar Arrangement

At the official level, the US can explore the possibility of ceasing or revising application to North Korea of the Wassenaar Arrangement (WA), the international regime of export controls for dual-use goods. Established in 1996, the arrangement is a voluntary system for coordinating national export controls on sensitive civilian technologies that could be diverted to potential military use. The WA has been applied to North Korea in excessively narrow terms. Modern computers, routers, and servers, for example, are unable to be exported to North Korea.⁹⁵

The alleged benefits of narrowly applying the WA have been marginal for military advantage: not only does North Korea smuggle in this IT equipment from China, but easing restrictions on common electronic equipment may have important spillovers for unthawing official relations. Balancing engagement with security is undoubtedly a tenuous balance, but the broader effects of integrating technology more widely in the North Korean economy override narrow military concerns. The US should work with the private organizations involved in S&T collaboration with North Korea, especially Syracuse University, CRDF, and AAAS, to draw up a new list of allowable technologies for export to North Korea. Revising WA provisions should not, however, impact the potential to prohibit export of genuine sensitive technologies to North Korea, which are already covered under controls of the Nuclear Suppliers Group.

DPRK-ROK Scientific Exchanges

S&T cooperation between the two Koreas leverages natural complementarities—North Korean software proficiency with South Korean manufacturing and hardware expertise. Yet owing to the North-South rivalry and dueling claims for legitimacy, North Korea is reluctant to participate in inter-Korean technology cooperation projects. A 2008 ROK government audit showed that of the 18 IT exchange project proposed by the government, North Korea participated in only 4.⁹⁶ The deterioration in inter-Korean relations under the Lee Myung-bak Administration has complicated, if not rendered infeasible, greater S&T cooperation.

The US has limited space to encourage greater inter-Korean cooperation in this matter. Nevertheless, the US should work quietly with its South Korean ally to maintain the possibility for good-faith technical S&T cooperation between the two Koreas, despite prevailing political tension. Toward North Korea, the US should encourage where possible greater engagement with South Korea, but should avoid calls to explicitly link greater inter-Korean cooperation to other improvements on the broader policy menu. The utility of scientific and technical engagement is its ostensible autonomy from the arena of high politics, and thus any linkage unhelpfully insinuates S&T into much larger aspects of the bilateral relationship.

VI. CONCLUSION

Science and technology has emerged as a new and important aspect of national strategy in North Korea. Garnering legitimacy through linkage to classical national objectives of socialist revolution and self reliance, S&T is now also regarded as a key instrument of national development, enabling military and economic modernization in line with the immediate imperatives of realizing a “strong and prosperous country.” Yet without more detailed understanding of the process through which North Korea administers S&T policy, it is difficult to assess the government’s efforts relative to stated objectives. This paper has attempted to address that gap, preliminarily identifying three themes that govern North Korean S&T policymaking: the prioritization of technology and sectoral application, cautious domestic and foreign investment, and state-directed supply-driven adoption practices.

This paper has then ventured a tentative analysis of the effects of S&T policymaking, particularly relating to the balance of power between state and society. Within the core national domains of military, information, and economy, the administration of North Korean S&T policy seems to be strengthening the vertical apparatus of the state while weakening horizontal spillovers in society. The overall effect is to strengthen state over society, although the overall net effect is difficult to ascertain without a more comprehensive investigation outside the realm of S&T policymaking.

Given the trajectory of North Korean S&T policymaking as well as the broader context of technology and national development, three policy recommendations can be identified. Owing to positive externalities and knowledge spillovers, external actors should encourage greater technological adoption in North Korea, even if the short-term benefits accrue disproportionately to the elite. The long-run implications are more valuable. Notwithstanding current political tensions, greater S&T engagement should be promoted at the track two level and the US should ease restrictions on the export of common technological equipment for ostensible, if not genuine, scientific use. Greater inter-Korean cooperation should also be strengthened. The benefits accrue in the long-run, as North Koreans develop the technological facility and common base of ideas on which to interact with the wider world. Perhaps, too, they will be empowered to foster the changes necessary for durable political and economic modernization.

¹ “Kim Jong Il Observes Launch of Kwangmyo’ngso’ng-2 Satellite,” KCNA, April 5, 2009, OSC translated text via World News Connection.

² *Ibid.*

³ “Joint New Year Editorial Published,” Korea Central News Agency, January 1, 2000, <http://www.kcna.co.jp/item/2000/200001/news01/01.htm#1>.

⁴ Byun, Sang Jung, “DPRK’s 2022 Strong Science and Technology State Construction and Inter-Korean Scientific and Technological Exchange and Cooperation,” NK Technology Column, Kyungnam University, 2008, <http://ifes.kyungnam.ac.kr/eng/m05/s40/content.asp?spcReportNO=2&GoP=%201>.

⁵ This timeline ignores the early attempts at securing nuclear and other military-relevant technologies beginning in the late 1950s.

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⁷ *Ibid.*

⁸ *Ibid.*

⁹ Bae, Seong In, “North Korea’s Policy Shift Toward the IT Industry and Inter-Korean Cooperation,” *East Asian Review* (13.4), 2001. See also Hwee Moon Sung, “The Origins of Science Education and First Senior Middle Schools,” *DailyNK*, July 15, 2009, <http://www.dailynk.com/english/read.php?catald=nk00400&num=5173>.

¹⁰ Hayes.

- ¹¹ Bae.
- ¹² *Ibid.*
- ¹³ *Ibid.*
- ¹⁴ *Ibid.*
- ¹⁵ McNeill, David, "International University Will Open in North Korea," *Chronicle of Higher Education*, September 7, 2007.
- ¹⁶ Some outside experts speculate that the government has had no real intention to open it and has used it as a political tool. Personal Interview, Mark Suh, April 8, 2009.
- ¹⁷ "Science and Technology Development Is an Indispensable Demand of the Construction of a Powerful State," *Minju Choson* (via KPM Internet), October 15, 2008, OSC translated text via World News Connection.
- ¹⁸ "Chuch'e Science and Technology That Has Solidly Consolidated the Country's National Power Under the Republic's Banner," *Rodong Sinmun*, August 28, 2008, OSC translated text via World News Connection.
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- ²⁰ "Developing the Economy on the Basis of Science and Technology Is an Important Task for Bringing About a Great Upswing in the Military-First Revolution," *Kyo'ngje Yo'ngju*, January 6, 2006, OSC translated text via World News Connection.
- ²¹ Quoted in "Kim Jong Il Stresses a New Self-Reliance Policy Based on Advanced Science and Technology," NK Brief No. 05-5-24-1, Kyungnam University, 2005, http://ifes.kyungnam.ac.kr/admin/upload_file/nk_brief/NK_Brief_050524.pdf.
- ²² *Ibid.*
- ²³ "The Immortal Feat the Respected and Beloved Comrade Kim Jong Il [Kim Cho'ng-il] Performed by Illuminating the Path to Building an Economically Powerful State Based on Advanced Science and Technology," *Kyo'ngje Yo'ngju*, October 14, 2006, OSC translated text via World News Connection.
- ²⁴ *Ibid.*
- ²⁵ "Science and Technology is Synonymous with National Strength," *Rodong Sinmun*, November 9, 2008, OSC translated text via World News Connection.
- ²⁶ "Science and Technology Development Is an Indispensable Demand of the Construction of a Powerful State," *Minju Choson*, October 15, 2008, OSC translated text via World News Connection.
- ²⁷ "Developing the Economy on the Basis of Science and Technology Is an Important Task for Bringing About a Great Upswing in the Military-First Revolution," *Kyo'ngje Yo'ngju*, January 6, 2006, OCS translated text via World News Connection.
- ²⁸ Bae.
- ²⁹ Ko, Kyungmin, Seungkwon Jang, and Heejin Lee, "kp North Korea," in *Digital Review of Asia Pacific 2007-08*, International Development and Research Center (Canada), http://www.idrc.ca/fr/ev-127149-201-1-DO_TOPIC.html.
- ³⁰ "Let Us Thoroughly Embody the Line of Attaching Importance to Science and Technology in the Party's Economic Building," *Rodong Sinmun*, November 22, 2008, OSC translated via World News Connection.
- ³¹ *Ibid.*
- ³² "Science and Technology Development Is an Indispensable Demand of the Construction of a Powerful State."
- ³³ *Rodong Sinmun*, September 19, 2004.
- ³⁴ Neureiter, Norman, "Talking with North Korea," *Science*, September 17, 2004.
- ³⁵ Lee, Hyung Seog, "Information Technology Progress in North Korea and its Prospects," in Mansourov, Alexander, ed., *Bytes and Bullets: Information Technology Revolution and National Security on the Korean Peninsula*, (Honolulu, HI): Asia-Pacific Center for Security Studies, 2005.
- ³⁶ Bae; Ko, *et al.*
- ³⁷ A report released on March 6, 2009 summarizing a meeting between KWP and Chinese officials identifies "three major ideas" and "five major tasks" that guide North Korea's science and technology policy, but the specific terms are left undefined. "Roundup on WPK Delegation's Visit to Ministry of Science, Technology, Suzhou City," China-OSC roundup, OSC translated text via World News Connection.
- ³⁸ "Report on Implementation of State Budget for 2008 and State Budget for 2009," KCNA, April 9, 2009, OSC translated text via World News Connection.
- ³⁹ "Chuch'e Science and Technology That Has Solidly Consolidated the Country's National Power under the Republic's Banner;" "Basic Demand of the Party's Line of Attaching Importance to Science and Technology," *Rodong Sinmun*, September 21, 2007, OCS translated text via World News Connection; "Encouraging and Promoting the Building of a Powerful Economic State Through Scientific and Technical Results; At the Kim Ch'aek University of Technology," *Rodong Sinmun*, February 6, 2009, OCS translated text via World News Connection; "Let Us Thoroughly Embody the Line of Attaching Importance to Science and Technology in the Party's Economic Building," *Rodong Sinmun*, November 22, 2008, OCS translated text via World News Connection.

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⁴⁸ “Informatization of People’s Economy,” *Minju Choson*, April 8, 2009, OSC translated text via World News Connection.

⁴⁹ *Ibid.*

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