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Science, Technology, and the Imaginaries of Development in South Korea*

Sang-Hyun Kim | Hanyang University

The Korean studies literature consistently points out that science and technology have played an important role in the rapid socio-economic transformation of South Korea. But the emphasis in this literature is placed predominantly on their contributions to the nation's industrial performance. Questions such as what type of policies and institutional reforms have been introduced to facilitate these contributions and how successful they have been are frequently asked. Science, technology, and development per se are, nevertheless, generally conceived as politically neutral and seldom interrogated. However, Korea has a long cultural tradition that envisions science and technology as tools for national empowerment. This instrumental view of science and technology has served as a crucial constitutive element of nationalist developmentalism that defines 'advanced/developed' and 'backward/underdeveloped' primarily in terms of industrialization and economic growth. In the South, it was under the Park Chung Hee regime that a more concrete form of nationalist developmentalism emerged and became firmly entrenched across the country. By reviewing the historical genealogy of the official and popular discourses of science, technology, and development in South Korea, the present paper traces how the nation's prevailing conceptions of the meanings, purposes, and roles of science and technology have embedded and been embedded in distinctive ideas of nationhood and development.

Keywords: *science and technology, sociotechnical imaginary, development, developmentalism, nationalism, South Korea*

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Introduction

Perhaps one of the most frequently recurring keywords in the literature on modern Korea is 'development.' Several strands of this literature—as illustrated in the debate on the 'developmental state'—have effectively contested the conventional wisdom of neoclassical political economy, paving the way for rethinking the multi-faceted and layered relationships between state, market, and society in South Korea (Woo-Cumings 1999). Likewise, studies using the concept of 'colonial modernity' have challenged modernization theory's assumption that modernization entails a universal, unidirectional path to development (Shin and Robinson 1999). However, even these studies have tended to approach development in a traditional way. Attention has been given to the specific historical, social, and political contexts in which development is facilitated, hindered or distorted, and also to the complex and varied impacts of development projects. As yet, development itself has been defined narrowly in technical terms. The idea, logic, forms and contents of development have rarely been problematized as historically and socially constructed assemblages of discourse, knowledge, and practices.[1]

This tendency is all the more pronounced regarding the relationship between science, technology, and development. The Korean studies literature consistently points out that science and technology have played an important role in the rapid socio-economic transformation of postcolonial South Korea (see, e.g., Branscomb and Choi 1996). The emphasis, on the other hand, is placed predominantly on the contributions of science and technology to the nation's economic and industrial performance. Questions are typically asked as to what type of policies and institutional reforms have been introduced to organize and promote the industrial application of science and technology and how successful they have been. The issues of who have actually benefited or lost out due to those initiatives, and of their broader social and political implications, are much less analyzed. More fundamentally, just as the notion of development is presupposed rather than interrogated, science and technology are generally conceived as value free and politically neutral and exempted from serious historical, social, and political analysis.

This is not to say that the political aspects of science and technology are

[1] For a growing field of critical development studies that approaches development as a discursive formation, a regime of knowledge/power, or a form of governmentality, see (Escobar 1994; Crush 1995; Li 2007).

simply ignored in the existing literature. Like in other parts of the world, science and technology have been regarded as one of the most potent symbols of national pride and prosperity in South Korea. It is thus well understood by many scholars that the South Korean state's persistent mobilization of science and technology for industrialization has been partly a political response to the popular yearning for an advanced industrial nation.

However, acknowledging the prestige and material benefits that accrue to the nation from its scientific and technological achievements alone cannot properly shed light on the complex interplay between science, technology, the nation, and development. Recent works in the history, sociology, and anthropology of science and technology have convincingly shown that supposedly universal and neutral science and technology are always interwoven with the construction of national self-understandings and purposes. Despite the transnational movements of people, ideas, and practices in science and technology across the globe, the framing and bounding of related issues and policies both embed and are embedded within projects of nation-building that reaffirm what the nation stands for (Jasanoff 2005; Harrison and Johnson 2009). National imaginations can also shape the very production of scientific knowledge—as well as of technological artifacts and systems—which in turn form integral parts of the technologies of power that produce and sustain particular political understandings of the nation's past, present, and future (Hecht 1998; Hogle 1999; El-Haj 2001).

Drawing on insights from these studies, this paper examines the ways in which South Korea's prevailing vision of science and technology has been co-produced with distinctive, collectively shared ideas of nationhood and development. Such processes of co-production are explored through the concept of 'sociotechnical imaginaries,' which has been defined elsewhere as "collectively held, institutionally stabilized, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology" (Jasanoff and Kim 2015, p. 4). By reviewing some of the key moments in the historical genealogy of South Korea's sociotechnical imaginaries, the paper argues that the dominant form of these imaginaries stems from a unique amalgamation of nationalist developmentalism (or developmental nationalism) and a strong instrumental view of science and technology. The historical roots of this assemblage can be traced back to the colonial period under Japan (1910–1945), or even back to the late 19th and early 20th century when Korea made the first serious attempt to modernize. Yet, its more enduring pattern developed as science and technology were

systematically incorporated into the projects of modern state- and nation-building under the Park Chung Hee regime (1961–1979).

Beginning of Korea's Sociotechnical Imaginaries

Although the introduction of Western science and technology to Korea had a long history (S-R. Park 1978), it was in the mid-to-late 19th century that they emerged as a subject of serious concern for the Korean polity. At the time, through humiliating and often violent encounters with Western powers, the viability of the Sino-centric Confucian world order was increasingly called into question. Initially, the ruling elites of the Chosŏn Dynasty responded to the crisis with the slogan, *wijŏngchŏksa* (衛正斥邪: the defense of orthodoxy and the rejection of heterodoxy). The West's science and technology were conceived as the embodiment of its barbaric values, not as the key to advanced civilization (Lim 1999, pp. 74-6). In this intellectual atmosphere, the Chosŏn government, under the regency of Hŭngsŏn Taewŏn'gun (1863–73), maintained an isolationist policy, allowing only the limited and selective importation of Western military technologies (S-R. Park 1980). As Korea was forced to open its doors from 1876 onward, however, a significant number of intellectuals and bureaucrats began to realize that the adoption of 'things Western' was unavoidable. Moderate reformists embraced what historians now term the ideology of *tongdosŏgi* (東道西器: Eastern ways, Western technology)—i.e., mastering Western technology while retaining the Confucian social and moral order (Y-H. Kim 1983, p. 477). A group of more radical reformists went further, urging the wholesale introduction of Western political ideas, institutions, and technologies.

The intellectuals of the *wijŏngchŏksa* school, and later *Tonghak* (東學: Eastern Learning) peasant rebellions, continued to resist Western influence, though without much success (Y-H. Kim 1968, pp. 326-27). By the time the Chosŏn Dynasty became the Korean Empire in 1897, the need to accommodate Western science and technology per se was no longer seriously disputed. Western political ideas such as popular sovereignty and constitutionalism, introduced through China and Japan as well as through American missionaries, were also gaining ground. But Korean reformist elites' attitude to change was equally prompted by the sense of urgency to protect the country from external threats. Impressed by Japan's successful transformation into a world power since the Meiji Restoration, many of these elites came to believe that Korea, too, should pursue a 'rich nation and strong

army (富國强兵)' through Westernized modernization and with the state as a principal agent.[2] Democratic political reforms were advocated, but tended to be justified on the grounds that they were necessary for mobilizing the masses to participate in the project of building a wealthy and powerful nation-state (see, e.g., Y.H. Chung 2004). This instrumental framing of modernization was buttressed both by the Confucian tradition of centralized statecraft and by the statist interpretation of Social Darwinism.[3] And within that framing, science and technology were seen primarily as tools to support the state's economy and military and, at a more symbolic level, as expressions of national will and strength.

Ezrahi (1990, pp. 87-96) suggested that, in some of the Western countries, modern science and technology served as cultural and ideological resources for liberal democratic politics—not just by providing a secular worldview and undermining the authority of traditional social hierarchies but by designating a critical role to ordinary citizens as 'attestive' publics, thereby depersonalizing and legitimizing the exercise of political power. In late 19th and early 20th century Korea, the introduction of modern science and technology and new sociopolitical changes were also linked culturally and ideologically, but in a quite different way. As already noted, Korean reformist elites' understanding and pursuit of science and technology were largely shaped by the felt imperative to secure the nation's survival against powerful Others (the West, and later on, Japan as well). This led to a form of sociotechnical imaginaries that combined a strong instrumental view of science and technology with a nationalist vision of development. For example, a scholar-politician Yu Kil-Chun, who went beyond the ideology of *tongdosŏgi* and wanted to incorporate Western political ideas and a scientific way of thinking into Korean society, emphasized the importance of science and technology but mainly for their utility in acquiring national wealth and power. In his influential monograph *Sŏyugyŏnmun* (西遊見聞: Observations during a Journey to the West), he wrote that, to attain 'real' Enlightenment:

> … rather than purchasing machines from foreign countries or employing foreign specialists, one should first let his own country's national subjects

[2] 'Rich nation and strong army (富國强兵)'—*pugukkangbyŏng* in Korean and *fukoku kyōhei* in Japanese—was one of the three formative slogans of the Meiji Restoration. The other two were 'civilization and enlightenment (文明開化)' and 'increasing production and promoting industry (殖産興業).' For Korean reformists' view of Japan, see, e.g., (Huh 2006).

[3] On the reception of Social Darwinism in Korea during the late 19th and early 20th century, see, e.g., (S-J. Park 2003).

(國民) learn and implement those technologies themselves (Yu 2004, p. 398).[4]

Koreans, as dutiful national subjects, should be educated and mobilized to enrich and strengthen the nation-state, and science and technology were an indispensable part of that process.

The Korean Empire's attempts to materialize this vision, through a policy of 'increasing production and promoting industry (殖産興業)' and the institutionalization of modern technical education (G.B. Kim 2005; Y. Kim 2016), did not bear much fruit as Korea became a protectorate of Japan in 1905 and was annexed as a formal colony in 1910. However, the association of an instrumental view of science and technology with a nationalist vision of development was reinforced, not weakened, under Japanese rule.

Science, Technology, and Colonial Industrialization

While 36 years of Japanese colonialism (1910–45) were harsh and repressive, the period witnessed a considerable degree of industrialization. Especially since the 1930s, Korea was de facto transformed into a military-industrial supply base—at first for Japanese expansion in Manchuria and China and for the Pacific War in the early 1940s. Administered by a highly centralized colonial state, extensive networks of railways and telecommunications were created, along with light and heavy industries, including textiles, steel, chemicals, and hydroelectric power (Cumings 1984; Eckert 1996). Though limited in scope, the Government-General of Korea expanded modern technical education and training, and testing facilities.[5] Techno-economic developments in colonial Korea were obviously driven by the needs of Japanese empire-building, entailing discrimination and often brutal coercion against colonial subjects. Korean participation in industrial or scientific and technological activities was also severely restricted, and even when permitted, was usually confined to learning and practicing relatively rudimentary technical skills (G.B. Kim 2005, pp. 239-332). But it was through these processes that Koreans for the first time experienced state-directed

[4] Yu was one of the first Koreans to study abroad. *Sŏyugyŏnmun* was published in 1895 although its manuscript was completed in 1889.

[5] Some of the examples were: Central Testing Laboratory (1912), Kyŏngsŏng Higher Technical School (1916), Geological Survey (1918), Fuel and Ore Research Institute (1922), Taedong Higher Technical School (1938), and Kyŏngsŏng Higher Mining School (1939). See (G.B. Kim 2005).

industrialization on a large scale and the systematic use of modern science and technology for that purpose. This left an indelible imprint on Korean society, consolidating a cultural understanding of development primarily in terms of national industrial strength and of science and technology as a means to achieve state-led development goals.

The sociotechnical imaginary engendered by colonial industrialization did not fundamentally differ from the one espoused by Korean elites of the late 19th and early 20th century. Nor was it in conflict with the view of Korean elites during the colonial period. In the absence of an independent state, Korean intellectuals turned to nationalism as an organizing principle of their thought and action. And they believed that, in order for the Korean nation to survive, it should develop its indigenous scientific-technological capability for industrialization. In 1921, the daily *Tongailbo* published a series of editorials titled "On nation-building through industrialization (工業立國)." In calling for efforts to build an 'industrial Korea (工業的 朝鮮),' one of the editorials asserted:

> ... [under] the iron law of competition that enslaves the weak and exploits the poor ... whether to guarantee the survival of the Self, or to resist plundering by the Other, the application and use of scientific amenities cannot be avoided (*Tongailbo* May 16, 1921).

This thinking, couched in the language of Social Darwinism, was shared not only by technically-trained intellectuals such as Kim Yong-Gwan, who soon established the Society of Invention (發明學會), but also by cultural nationalists such as Yi Kwang-Su. Yi, an editor of *Tongailbo* and prominent writer in the moderate nationalist circle, wrote in 1924:

> The reason European advanced nations are superior to us lies in the spread of scientific knowledge. We are inferior to them because our scientific knowledge is not comparable to theirs. ... We should launch a massive campaign to diffuse scientific knowledge to the entire population (*Tongailbo* January 5, 1924).[6]

Nationalists' interest in science and technology reached a peak in 1934

[6] This was part of his controversial editorial, "National Administration (民族的 經綸)." Yi eventually resigned from *Tongailbo* due to the controversy over its rather compromising attitude toward Japan.

when a 'Science Day' event was organized by the Society of Invention, and as a follow-up, the Society for the Diffusion of Scientific Knowledge (科學知識補給會, hereinafter SDSK) was founded (Hyun 1977). Supported by such well-known figures as Yun Chi-Ho, Cho Man-Sik, Kim Sŏng-Su, and Yŏ Un-Hyŏng, the SDSK initiated the movement for building a 'scientific Korea (科學朝鮮),' with the catchphrases, 'making everyday life scientific (生活의 科學化)' and 'making science a part of everyday life (科學의 生活化).' What they really meant, and how they could be accomplished, was understood rather differently by different groups within the movement (Lim 1995). Some bourgeois nationalists wanted to encourage inventions that could help Korea's self-sufficient small-scale production. Others contended that Koreans should develop their capacity for self-reliance through engaging with colonial modernization—economically, educationally, and scientifically. Still others laid more emphasis on the general importance of scientific ways of thinking in everyday life. Marxist nationalists thought that science and technology represented historical progress, but were not actively involved in the SDSK, focusing on class struggle.[7] Yet, notwithstanding these differences, all the groups shared the vision that science and technology should serve, first and foremost, the development goals of the Korean nation.

After the outbreak of the Sino-Japanese War in 1937, it became extremely difficult for Korean nationalists to deliver their messages. The SDSK's activities rapidly declined, and eventually ceased to exist. On the other hand, Japan's total mobilization of science and technology for war disseminated the imaginary of science and technology for national development—or of what Mizuno (2009) has described as 'scientific nationalism'—although the nation in question was not a future independent Korea but the Greater East Asia Co-Prosperity Sphere. Slogans like 'serving the nation through science (科學報国)' and 'nation-building through technology (技術立国)' were frequently chanted (Pauer 1998, p. 43; Mizuno 2009, p. 161). In 1941, just before the Pacific War, the Konoe Cabinet in Japan approved the basic plan for 'New Order for Science-Technology (科學技術新體制),' which sought to link science and technology to the requirements of an 'advanced national defense state' (Mimura 1998, pp. 148-61). It was in this context that the Faculty of Science and Engineering (1941) was created at Kyŏngsŏng Imperial University. It was also probably around this time that the compound term 'science-technology (科學技術: *kwahakkisul* in Korean and

[7] For a study of some of the debates between Marxist and bourgeois nationalists at the time, see, e.g. (Yoon 1992).

kagaku gijutsu in Japanese)' carrying the connotation of the practical utility of science and technology, began to be used more widely in Korea.[8] Few Koreans considered the Japanese wars as their own, and even less of them were allowed to take part in the wartime science and technology effort. Nevertheless, the imaginary of science and technology for national development resonated well with Koreans' yearning for a strong nation, regardless of anti- or pro-Japanese sentiment.

Cold War, Modernization Theory, and Developmentalism

In August 1945, Korea was finally liberated from Japan. Within a few months, a range of new political and professional organizations were formed, including those involving scientists and engineers such as the Korean National Academy (朝鮮學術院) and the Korean Industrial Technicians Alliance (朝鮮工業技術聯盟). While Koreans were deeply troubled by the provisional division of the country into North and South, under the tutelage of the Soviet Union and the United States respectively, there were high hopes and expectations for building a new, independent nation with a viable economy. Influenced in one way or another by the Confucian statecraft tradition, the experiences of colonial development, and socialist planning ideas, most political elites and intellectuals across the ideological spectrum then believed that Korea should adopt a state-planned mixed economy (Bae 2000; T-G. Park 2004). There was also a broad consensus that science and technology should play a leading role in the reconstruction of Korea, though not so much as a bearer of liberal values but as a guarantor of national wealth and strength.[9] An introductory remark to a column series published in *Tongailbo* in 1947, "Scientific Design for Reconstructing the Fatherland (祖國再建의 科學設計)," neatly illustrated the durability of the sociotechnical imaginary that had developed since the late 19th century and during the colonial period. The author suggested:

> … the only thing that would make our fatherland wealthy and strong is the power of science. … The total mobilization of science-technology,

[8] As Mizuno (2009, pp. 60-68) has pointed out, the term *kagaku gijutsu* was first coined by Japanese nationalist technocrats, not as a convenient shortening of the two words, but as an expression of their ideology that science and technology should be directed toward the nation's economic and military goals.

[9] This can be contrasted to the situation in postwar Western Europe. See, e.g. (Krige 2006).

> scientification of production, scientific planning and establishment in all areas ... are the only ways to place our beloved nation on a stable foundation. … (*Tongailbo* January 1, 1947)

The task proved difficult. Before any serious attempts were made, the 'scientific' reconstruction of Korea was thwarted by increasing ideological polarization. There were intense clashes between the left and right—for instance, over the Moscow agreement for a four-power trusteeship of Korea and over the establishment of Seoul National University (SNU). Scientists and engineers were not exempt from this turmoil, and in the midst of it, some of those on the political left moved to the North (G.B. Kim 1997). In 1948, with mounting Cold War tensions, separate governments were established in the North and South. Two years later, civil war broke out in full scale, which lasted until 1953. Korea's already weak capability in science and technology suffered greatly from the conflicts. Most of the industrial facilities in both parts of Korea were damaged or destroyed during the war. Scientific and technical education and training were hampered by a shortage of qualified teaching staff and a lack of resources. In the South, the conservative Rhee Syngman government was predominantly concerned with the political and ideological battle over which part of Korea had the legitimacy to represent the nation, giving only secondary attention to techno-economic development.

In spite of these problems, many South Korean intellectuals continually advocated that the state-led initiatives were urgently needed to industrialize and expand the national economy. By the late 1950s, the Rhee government had established the Economic Development Council to formulate national economic development plans (J-A. Chung 2009).[10] Crucial in this unfolding was the introduction of American-led discourses of 'modernization theory' and 'development economics' to South Korea (T-G. Park 2004, pp. 121-27; Brazinsky 2009, pp. 163-68). They were more than academic, and reflected the U.S. strategic interest to maintain political and economic stability in the Third World and to contain the expansion of communism. It was no coincidence that, along with the growing influence of these discourses, U.S. policy toward South Korea also shifted from prioritizing military security to simultaneously supporting economic development (T-G. Park 1997). Equally

[10] The Economic Development Council was established under the Ministry of Reconstruction in 1958. The Council was given responsibility for formulating a long-term economic development plan.

significantly, the discourses of modernization theory and development economics conveyed the conception of development that viewed technological progress, industrialization, and economic growth as prime measures of 'advanced/developed' versus 'backward/underdeveloped' (Adas 2003). The spread of such conception tended to further strengthen the emerging nationalist form of developmentalism, in which economic development and independence figured as the main goal and obligation of the Korean nation.

The slow but steady institutionalization of science and technology during the mid- to late 1950s—again aided by the Cold War context—also provided the symbolic and material basis for nationalist developmentalism. Technical aid to several industries, offered by the U.S. State Department's International Cooperation Administration (ICA), helped South Korea to extend its technological infrastructure and skills, albeit in a piecemeal fashion (S. Hong 2012, pp. 151-54). Moreover, the ICA organized the Minnesota Project (1954–1962), through which over two hundred faculty members at SNU—majoring in engineering, medicine, agriculture, and public administration—were sent to the University of Minnesota for training and research (SNU 2006, pp. 68-70, 581-83). In 1959, facilitated by the 1956 Korea-U.S cooperative agreement on the 'civil uses of atomic energy,' the government established the Atomic Energy Research Institute (AERI) (Koh 1992). President Rhee's keen support for the AERI seemed to originate from his interest in the potential development of nuclear weapons. The more substantial implication of AERI, though, was that it served as a site for rebuilding the South Korean scientific and engineering communities, around the idea of science and technology for national development (I. Park 1999, pp. 111-14; S-J. Kim 2009).

However, South Korea's transition from a security state to a developmental state was not a smooth one. The Rhee government's corruption and despotic rule provoked massive opposition and, in the end, brought about the demise of the regime in 1960. The successive Chang Myŏn government was more sensitive to popular aspirations for development, and its pledge of 'economics first-ism (經濟第一主義)' had wide appeal. It also prepared a 'Five-Year Economic Development Plan,' which was more elaborate than the Rhee government's three-year plan (G.S. Kim 2002). But the Chang government was politically weak—beset by internal party struggles and the upsurge of progressive social movements—and was overthrown by a military coup only in nine months after taking office.

'Nation-Building through Science' and 'Technological Self-Reliance'

It was under the new military regime led by coup leader Park Chung Hee that a state-directed strategy of nationalist developmentalism became more clearly manifested. Park had served as an officer in the Japanese Kwantung Army during the Pacific War. He admired the Meiji Restoration—and even more so, the failed Shōwa Restoration—and had witnessed firsthand Japan's large-scale techno-economic experimentation in Manchuria.[11] When he seized power, as the Meiji reformers had done a century ago in Japan, he advocated 'national restoration (民族中興)' through 'modernization of the fatherland (祖國近代化)' and establishment of a 'self-reliant economy (自立經濟)' (H-A. Kim 2004). Only a decade after the Korean War, and in order to win U.S. support, the Park regime proclaimed its commitment to defending the 'free world' against communism. But his capitalist economic program was a nationalist development project with strong state direction and centralized control, resembling that of Manchukuo or wartime Japan. Also, like the New Order technocrats in wartime Japan, Park did not want to embrace liberal democratic values and institutions. Instead, he argued for 'nationalistic (民族的)' or 'Korean-style (韓國的)' democracy, which stressed the unity of the nation and Confucian values such as loyalty and filial piety (忠孝) (Jeon 2000). This statist, authoritarian form of developmental nationalism was often justified as an effective means to compete with communist North Korea.

The Park regime's disapproval of Western liberal democratic ideas did not prevent it from taking up modern science and technology. On the contrary, from the very beginning, science and technology were essential constitutive elements of its developmental nationalism. This was succinctly summarized in Park's address to scientists and engineers in 1966:

> … I affirm that the most direct route to economic self-reliance lies in the promotion of science-technology. Science-technology is the foundation for increasing productive forces and the source of power for accelerating economic development. It is, in short, a prerequisite and necessary condition for the 'modernization of the fatherland' project. … (C.H. Park 1966)

[11] For the influences of Shōwa Restoration and Manchurian experience on Park Chung Hee, see (Eckert 2016).

For Park, at stake was the survival of the Korean nation. Because of Korea's lack of scientific-technological capability:

> … we are now suffering from poverty and underdevelopment. The fundamental reason we are backward in scientific civilization is that our ancestors fifty, even twenty years ago, being overawed by advanced scientific civilizations at the time, gave up and wasted their time without making any effort to improve and develop. If our generation today makes the same mistake, our descendants ten or twenty years from now will suffer far worse poverty and underdevelopment, literally in a scientific savage land. … (C.H. Park 1966)

Yet, he maintained, the future of the Korean nation should not necessarily be so.

> … It was our nation that invented the first metal movable type in the world. It was our nation that developed and used the most advanced rain gauges in the world. It is not that we were incapable or untalented. We just did not have the desire and courage to prove our ability. … (C.H. Park 1966)

The solution to these problems was his state-led developmentalist project, which, by promoting science and technology, would bolster 'modernization of the fatherland' and 'economic self-reliance' and ultimately lead to the building of 'scientific Korea (科學韓國)' or 'technological Korea (技術韓國).' Park thus framed his regime's state-led developmentalist appropriation of science and technology as an inevitable fulfillment of the destiny of the Korean nation.[12]

Park Chung Hee later condensed this sociotechnical imaginary into the slogans 'nation-building through science (科學立國)' and 'technological self-reliance (技術自立)' (MOST 1976). These slogans were not merely rhetorical, but had material consequences. Park had what earlier proponents of similar visions lacked—political power and state machinery. Immediately after the coup in 1961, the Supreme Council for National Reconstruction proposed the creation of a centralized science and technology institute that would coordinate R&D activities across different sectors and state agencies (C. Hong

[12] In so doing, Park went even further than many of his predecessor nationalists and came close to the position of what Jeffrey Herf has called "reactionary modernism." See (Herf 1984). Jeon (2000) has also made a similar argument, though without paying much attention to Park's vision of science and technology.

1961). Although the idea was abandoned for various reasons, it showed Park and his associates' early interest in science and technology. In one of the Council's briefing meetings, Park also personally directed the attention of the newly established Economic Planning Board (EPB) to the importance of science and technology in economic development (Chŏn 1982, pp. 8-22). As a result, starting in 1962, Five-Year Technology (from 1966, Science and Technology[13]) Promotion Plans began to be formulated along with EPB's Five-Year Economic Development Plans. Throughout his presidential tenure, a succession of policies and institutional changes were introduced to promote science and technology: for example, the setting up of the Ministry of Science and Technology (1967); Science and Technology Promotion Act (1967); Technology Development Promotion Act (1972); the establishment of the Korea Institute of Science and Technology (KIST) (1966) devoted to industrial applications; and the founding of a graduate research university, the Korea Advanced Institute of Science (KAIS) (1971) (Kim and Leslie 1998; MOST 2008; M. Moon 2010).

These initiatives, in fact, had to rely heavily on foreign technology, expertise, and financial resources, especially from the United States and Japan. In 1965, against considerable domestic opposition, Park signed the Normalization Treaty with Japan—largely to gain access to Japanese capital and technology that he saw as necessary for the success of South Korea's export-led industrialization. While exports indeed grew substantially throughout the 1960s and the early 1970s, concerns were soon raised about South Korean firms' technological dependence on Japan (Sŏ 1971). Even in South Korea's more explicit attempts to enhance its indigenous scientific-technological capability, the role of the United States was evident. KIST was not only assisted by the Battelle Memorial Institute in organizing its research programs and recruiting and training its staff; it was also funded by Lyndon Johnson's development loans, which were a reward for South Korea's military commitment to the Vietnam War (M. Moon 2004). Likewise, KAIS was established with financial and technical support from the U.S. Agency for International Development. Frederick Terman, former dean of Stanford's

[13] *kwahakkisul* (科學技術) has usually been translated into English as 'science and technology,' especially in official documents. Thus, the use of 'science and technology' in the names of government plans, institutions, organizations, or laws in the paper actually refers to *kwahakkisul*. Otherwise I have used the expression 'science-technology' as an English translation of the term. As has been noted above, this compound term was introduced to Korea during Japanese colonial rule, and carried with it a particular political connotation. See note 8. Geun Bae Kim (2016, pp. 45-50) has proposed the notion of 'scientech' to capture a technology-oriented meaning of *kwahakkisul*.

school of engineering and known as the 'father of Silicon Valley,' was instrumental in the planning and implementation of this venture (Leslie and Kargon 1996). But U.S. involvement did not seem to have carried forward the imaginary of 'social contract for science,' which was influential in postwar America and highlighted the autonomy of science and technology from the state (Guston 1999, pp. 37-63). Instead, the South Korean state framed foreign assistance as part of its deliberate strategy to foster technological self-reliance.

The Park government's techno-economic restructuring of South Korea proceeded in tandem with the consolidation of scientists' and engineers' cultural identities that had been formed since the colonial period and the immediate post-independence years—that is, expert professionals serving the nation through their scientific and technical knowledge and skills. Scientists and engineers, Park Chung Hee argued, were the "motive power for national development" and the "pride of the nation," and it was vital to create a social climate that would appreciate and support their role in serving the nation (C.H. Park 1967b). In return, scientists and engineers were expected to dedicate themselves to the state's efforts to build a strong country and to "willingly accept today's sacrifices for tomorrow's scientific Korea" (C.H. Park 1966). In 1966, with the government's backing, the Korean Federation of Science and Technology Societies (KOFST) was founded, consisting of 71 academic societies and professional organizations (KOFST 1986). In the next year, Park helped launch the Korea Science and Technology Supporters' Association (renamed to the Korea Science and Technology Promotion Foundation in 1972) as its official founder. Apparently, not all scientists and engineers approved of Park's authoritarian politics or 'growth first' developmentalism, but many of them—the KOFST elite group in particular—responded enthusiastically to the Park government's support for science and technology. The resolution of the KOFST Annual Meeting in 1969 stated:

> 1. We, scientists and engineers, pledge to recognize our duty and the importance of science-technology for 'modernization of the fatherland' and to devote all our energies to the cultivation of science-technology.
> 2. We, scientists and engineers, pledge to contribute to national economic development by making all our efforts to advance Korean science-technology … (KOFST 1986, p. 250)

As the roles and duties of scientists and engineers were reaffirmed and expanded, ordinary South Koreans were also asked to transform themselves

into national subjects of a new type, "national subjects practicing science (科學하는 國民)"—one that had the qualities of mind and character needed to build a "scientific Korea" (C.H. Park 1967a, 1967b), This did not mean that South Koreans were envisaged as public citizens with critical minds. Rather, they were imagined as national subjects with a duty and obligation to support and participate in the state-led techno-economic development. The Park regime's attempts to construct new developmentalist subjectivities intensified as the focus of its economic strategy shifted from labor-intensive, light industries to capital-intensive, heavy and chemical industries. The 'scientification of the all-nation (全國民의 科學化)' movement was a case in point, which was announced on the same day in 1973 as the launching of the ambitious heavy and chemical industrialization program (Song 2008; D.K. Kim 2010). Park declared in his address on the movement:

> All of us should learn, acquaint with, and develop 'science-technology.' Only then, our national power can be enhanced rapidly. Without the advancement of science-technology, we will never be able to become an advanced nation. … (C.H. Park 1973)

Although the need for a scientific way of thinking in everyday life was stressed, it was secondary to the other goals of the campaign. As the Ministry of Culture and Public Information explained, the scientification of the all-nation movement is:

> … a national movement that aims to promote the development of science-technology, which would build the basis for modernization of the fatherland and lead to an advanced industrial structure … (MCPI 1973, p. 16)

The five main goals of the movement, delineated by the Ministry, showed more clearly what this meant: (1) turning all South Koreans into 'industrial warriors'; (2) developing skilled manpower for heavy and chemical industrialization; (3) increasing exportation with new products; (4) innovative development of farming and fishing communities; and (5) rationalization of everyday life and social reforms. The Ministry suggested that even the fifth one aimed at raising 'efficiency' and 'productivity.'

By the mid-1970s, the mobilization of science and technology for heavy and chemical industrialization was well under way. Modeled after KIST, numerous government-supported research institutes (GRIs) were created to target specific industrial sectors, including chemicals, machinery and metals,

ship-building, and electronics (Lee, Bae, and Lee 1991). The government worked hard to recruit South Korean scientists and engineers working abroad, some of whom would later play a central role in the take-off of these GRIs. In 1977, to tackle the shortage of high-level scientific-technological manpower, the Korean Science and Engineering Foundation was established to support research and training in universities (KOSEF 2007, pp. 87-97). In the meantime, Park's autocracy came under increasing criticism from opposition politicians and social movements. His relationship with the United States also began to deteriorate over human rights issues and the policy of 'self-reliant national defense.'[14] In addition, the situation was aggravated by economic grievances. South Korea's economic growth was still impressive; the average annual GNP growth rate between 1972 and 1979 was almost 10%. Even so, excessive and duplicate investment in heavy and chemical industries resulted in high inflation, increased external debt, and a balance-of-payments deficit, which were exacerbated by the two oil shocks. Faced with these problems, the working- and middle-classes, who had grown steadily through the Park regime's techno-economic developments, now increasingly became sympathetic to the democratic struggle against him.

However, growing dissatisfaction with Park's leadership did not inevitably lead to the questioning of the dominant national sociotechnical imaginary. As recent historical studies have pointed out, the Park regime was often successful in eliciting mass consent—if not support—for its authoritarian programs, even without coercion and without deluding the masses by false consciousness or ignorance (see, e.g., Kim and Lim 2005; Jang and Lee 2006). On more than a few occasions, South Korean workers, farmers, and intellectuals voluntarily collaborated with the 'modernization of the fatherland' project, seeking to re-imagine themselves as members of an advanced industrial nation. Even those dissident groups who had vigorously opposed Park's authoritarian rule shared some of the key goals and assumptions that constituted his developmental nationalism. For instance, *Sasanggye* (思想界: World of Thought), South Korea's leading liberal magazine in the 1960s and a staunch critic of the Park regime, firmly adhered to the project of state-led nationalist development (B-H. Kim 2003; M. Kim 2007). The *minjung* (民衆) movements that had emerged since the mid-1970s was more openly critical of the 'grow-first' policies of Park's 'developmental dictatorship' for

[14] Shortly after North Korea's nearly successful attempt to attack on the presidential palace in 1968, Park announced the policy of 'self-reliant national defense.' In the early 1970s, when he found out that the U.S. was planning to withdraw its troops from South Korea, he started a secret nuclear weapons program. See O (1994).

prioritizing economic growth at the expense of civil liberties, workers' rights, and social justice (B-C. Lee 2005; N. Lee 2007). They cast serious doubt on the state's advocacy of 'national' development, arguing that it would only serve the interests of the ruling establishment, *chaebŏls* (big business conglomerates), and multinational corporations. And yet, the nationalist imaginary of development could not be effectively challenged (B-H. Kim 2005). Nor did the developmental nationalist appropriation of science and technology come under political scrutiny. By the late 1970s, a particular form of national sociotechnical imaginaries—embodied by the slogans 'nation-building through science' and 'technological self-reliance'—was deeply entrenched in South Korean society.

Post-Park Chung Hee Era

The Park Chung Hee regime ended in October 1979 when he was assassinated by his own intelligence chief. South Korea enjoyed a brief moment of democracy, but only to find itself confronted with another coup led by Chun Doo Hwan. The new military junta was a product of Park's 19-year rule, and readily pursued the path of developmental dictatorship, placing economic growth at the forefront of the national agenda to offset the lack of political legitimacy. The mounting economic crisis compelled the Chun regime to adjust the previous regime's highly expansionary and interventionist approach to national development. For example, a series of economic stabilization and liberalization measures were introduced. The style of industrial policy also began to shift away from discretionary, sector-specific interventions (C-I. Moon 1995). These changes had a non-trivial impact on the power relations between the state and big business. However, the nationalist imaginary of development, with a strong emphasis on South Korea's indigenous technological capability, remained intact. To remedy the problems of surplus capacity and business concentration in heavy and chemical industries, the Chun regime launched 'technology-drive' policy and actively promoted new strategic high-technology industries such as semiconductors, telecommunications, and biotechnology (MOST 2008; H.-S. Shin 2015). The private sector—especially *chaebŏls*—was now given a more prominent role in national R&D. But the slogans 'nation-building through science (or science-technology)' and 'technological self-reliance' continued to be popular, and were recurrently employed not only by government bureaucrats and the scientific and engineering elite but also by industry and the media (see, e.g.,

Chosŏnilbo April 17, 1985).

The Chun Doo Hwan regime was even more oppressive than its predecessor regime, but by the mid-1980s, encountered stiff resistance from a coalition of students, intellectuals, trade unionists, and opposition politicians. In June 1987, nationwide mass demonstrations forced the Chun regime to concede demands for a constitutional amendment to allow direct presidential elections that had been halted since 1971. Even though Roh Tae-Woo, an ex-general and friend of Chun, managed to win the election, the tide had turned in favor of democratization. South Korea's transition from military to civilian rule finally commenced. In 1992, Kim Young Sam, one of the opposition leaders under the Park and Chun regimes, was elected as the first civilian president since 1960. Five years later, he was succeeded by another former opposition leader, Kim Dae Jung. In 2002, Roh Moo Hyun, a human rights lawyer who had been involved in the anti-military dictatorship movement, came into office. As the democratic transition progressed with the introduction and implementation of a range of new political reforms, civil society flourished (K-Y. Shin 2006). Yet, advances in political liberalization did not bring about any significant changes to South Korea's official vision of science, technology, and development. While the three consecutive civilian governments condemned the vices of the Park and Chun military regimes, they all praised the vision of catching up with advanced industrial nations through the projects of 'nation-building through science' and 'technological self-reliance' and declared their firm commitments to realize that vision.[15]

In fact, many of the core members and supporters of those civilian governments were former dissidents during the 1970s and 1980s. As has already been implied, they largely adopted the conventional view of science, technology, and development: science and technology were politically neutral, and yet were essential tools for South Korea's road to an advanced industrial nation.[16] Similarly for *Sasanggye* intellectuals, the problem for them was not the logic of science and technology for national development, but South Korea's scientific and technological dependence on the United States, Japan, or other foreign nations. One of the few early exceptions was the critiques of science and technology by progressive Church groups in the late

[15] See, e.g. (Y.S. Kim 1993), (D.J. Kim 1998), and (Roh 2002).

[16] South Korean student activists and progressive intellectuals had been influenced by various traditions of radicalism, but during the 1980s, many of them turned to orthodox Marxism as the ideological basis for their activism. But their dogmatic interpretation of Marxism was based on strong scientism and technological determinism and precluded them from critically reflecting upon the dominant view of science and technology.

1960s and 1970s. Though not always explicitly, these groups questioned the hegemonic imaginary of modernization and development, and in so doing, addressed the destructive and dehumanizing aspects of science and technology—for instance, alienation, ecological devastation, and the centralization of power (S.R. Lee 2007; S-H. Kim 2017). Their critiques prompted critical reflection on the nature, function, and consequences of science and technology—as well as on the alternative path of development—among a small group of student activists and intellectuals, who later played an important role in the emergence of the South Korean environmental movement.[17] They nevertheless had little influence on the thoughts and actions of most contemporary social movement activists. With the consolidation of *minjung*-centered perspectives since the mid-1980s, both within and outside the Church, such discussions were quickly subordinated to more immediate political and economic concerns.

As South Korea entered the 1990s, signs of change did begin to loom on the horizon. The rise of neoliberalism, the ever-growing power of *chaebŏls*, and the advent of globalization all combined to constrain the capacity of South Korea's developmental state (Y.T. Kim 1999). New social movements—environmentalist and women's health activist groups among others—increasingly came to challenge the official vision of science, technology, and development through the controversies over such issues as nuclear power and biotechnology (see, e.g., Jasanoff and Kim 2009; Bak 2014; S-H. Kim 2014, 2015). Neither of these trends, however, successfully disrupted South Korea's dominant sociotechnical imaginary. The imperative of securing the nation's techno-economic development persisted as a key element of South Korea's national identity. This situation was reinforced by the public's experience of the material changes brought about by the state-led initiatives for techno-economic development throughout the 1960s to 1980s, which in turn led to a widely shared sense of positive national accomplishments. New social movement activists were as yet unable to provide a clearly articulated alternative vision of science, technology, and development to counter the public memory of South Korea's 'developmental success.' Despite notable progress in democratization, policies related to science and technology were invariably driven by a pro-development coalition of the state bureaucracy, big business, and the political establishment with advice from elite scientists and engineers. For the most part, the public was excluded from decision-making

[17] For a review of the South Korean environmental movement of the late 1980s and 1990s, see, e.g. (Ku 1996).

since their perceived role was to accept and support, as dutiful members of the nation, the policies formulated by the state, without problematizing the state's prerogative to define legitimate development goals for the nation. The social, health, and environmental risks of science and technology were interrogated more than before, but they were constantly weighed against what many South Koreans saw as the bigger risk—falling behind leading nations and being chased by other developing nations in a rapidly changing and highly competitive global economy.

Concluding Reflections

Too often, the discussion on South Korea's development has been drowned into the examination of the changing relationships between the state, market, and society, however important this may be in itself. The idea, logic, forms, and contents of development are largely taken for granted as technical matters of organizing industrialization and capital accumulation by increasing productivity, savings, and investment, and of facilitating overall economic growth. Similarly, when the issues of science and technology are raised, the focus is placed mainly on the role of the state and other institutions in promoting R&D and innovation, the patterns of technological learning and innovation at the levels of firms, the ingenious efforts of scientists and engineers, and how each of them contributes to the nation's economic and industrial performance. The meanings, values, and goals of science and technology—and also the criteria for assessing their achievements and impacts—are taken as given, rather than as products of particular historical and social contexts. Such biases not only underscore the lack of contextual understanding of science, technology, and development, but at the same time reflect South Korea's dominant national sociotechnical imaginary. In this paper, I have attempted to fill the gap left by these shortcomings by tracing how South Korea's deep-seated vision of science, technology, and development has historically evolved and become entrenched.

South Korea's engagement with science and technology has not merely been fostered, inhibited, or distorted by a wave of ardent nationalism. Nor have science and technology been one-sidedly mobilized for the state's political and economic purposes. The ways in science, technology, the nation, and development have been intertwined are more intricate and dynamic. The meanings, values, and goals of science and technology, the public good they should deliver, and the roles and identities of the state, scientists and

engineers, industry, and publics have been simultaneously (re)imagined—or co-produced—along with understandings of nationhood and development, over a considerable period of time. As described in the paper, South Korea has conceived science and technology, first and foremost, as a form of power and as instruments to serve national development, which is defined primarily in terms of autonomous and self-reliant industrialization and economic growth and is presumed as the main goal and obligation of the nation. This entanglement of developmental nationalism and an instrumental view of science and technology has been experienced and enacted through the material advances achieved by science and technology. Any effort to confront the official vision of science, technology, and development—and the underlying sociotechnical imaginary—would thus require a daunting task of deconstructing and reconstructing the very discursive and material foundations of South Korea's national identity.

The recent controversies over Hwang Woo-Suk's human embryonic stem cell (hESC) research forcefully illustrate this point (S-H. Kim 2014, 2015). Unlike in other countries, the most vocal critique of South Korea's support for hESC research came not from religious conservatives but from a progressive coalition of new social movement activists. For these activists, both Hwang and hESC research symbolized an instrumental, developmentalist appropriation of science and technology by the state and corporate interests, which they feared would subjugate the public interest and democracy in the name of dubious 'national interest.' The issues of the moral status of human embryos or research ethics were then the sites of their struggle for a more just and democratic South Korea. Contrary to the conventional narrative, Hwang's credibility and the ethical implications of his hESC research were also not simply misperceived or ignored by his supporters. They were interpreted through the prism of a national aspiration, one that accorded with South Korea's prevailing sociotechnical imaginary—i.e., the protection of 'indigenous technology' against foreign competitors to secure the techno-economic future and survival of the Korean nation. The activists' call for public debate on the social, ethical, and environmental consequences of hESC research was sidelined, if not dismissed entirely, by the government and its followers because it was seen as an undesirable hindrance to South Korea becoming a technologically advanced nation.

To put it another way, the disputes over Hwang and his hESC research were, even if it was not recognized as such, essentially a contest over the public imagination of what South Korea's national goals should be, what type of developmental path is required to achieve these goals, and what roles

science and technology should play in that process. Having been unable to forge a coherent, compelling alternative vision to South Korea's deeply ingrained imaginary of science and technology for national development, activist critics of hESC research were bound to face enormous difficulties in advancing their agenda. Even after the revelation of Hwang's fraud and his subsequent downfall, South Korea's approach to science, technology, and development continues to revolve around enhancing the nation's indigenous technological capability for industrial competitiveness, attesting the power of the dominant national sociotechnical imaginary. For example, the framing of the relationship between science, technology, and development in the current South Korean discourse of the so-called 'Fourth Industrial Revolution'—which constantly invokes the urgent need to catch up with advanced nations in technological innovations—surprisingly resembles that put forward by the proponents of hESC research. It is also noteworthy that, while, as this paper has sought to highlight, the logic of science and technology for national development embedded in such discourse is inherently political, all major political groups (except for social movement activists and perhaps the small, progressive Justice Party) do not show any meaningful difference in their response to it.

Clearly, more research is needed. There is no doubt that the dominant form of South Korea's sociotechnical imaginary had solidified during the Park Chung Hee era. But the discourses, knowledges, and practices of science, technology, and development that traveled to (South) Korea are far more diverse—in their origins, nature, and content—than presented in this paper. It is yet to be understood how these discourses, knowledges, and practices have been appropriated, redefined, and reassembled, producing a collectively shared sociotechnical imaginary. In-depth studies are also required to examine how the resulting imaginary has been sustained, challenged, or modified over the long course of Korea's modern transformation. Adequate attention should be paid to the institutions, practices, and discourses of the media, industry, and civil society, in addition to those of the state. Furthermore, it has to be taken into account that the incorporation of science and technology into the project of nationalist development is not unique to Korea. Comparable findings have been observed in other nations (see, e.g., Hecht 1998; Greene 2008; Amir 2012; S-H. Kim 2016). The comparative analysis of the association of science and technology with nationalism and developmentalism across different national or cultural contexts would therefore be invaluable in illuminating the distinctive features of South Korea's sociotechnical imaginary. Only when we comprehend the

complex nexus between science, technology, the nation, and development by exploring such detailed aspects of sociotechnical imaginary, can a more nuanced and contextual understanding of the politics of development in South Korea be obtained.

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Chosŏnilbo

SANG-HYUN KIM is associate professor at the Research Institute of Comparative History and Culture, Hanyang University, Korea. He holds a D.Phil. in chemistry from the University of Oxford and a Ph.D. in the history and sociology of science from the University of Edinburgh and is currently involved in the HK Transnational Humanities Project funded by the National Research Foundation of Korea. His recent publications include: "The Politics of Human Embryonic Stem Cell Research in South Korea: Contesting National Sociotechnical Imaginaries" (*Science as Culture*, 2014); *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power* (co-edited with Sheila Jasanoff, University of Chicago Press, 2015); and "Science and Technology: National Identity, Self-reliance, Technocracy and Biopolitics" (in *The Palgrave Handbook of Mass Dictatorship*, 2016). *Address*: Research

Institute of Comparative History and Culture, College of Humanities 113, Hanyang University, Seoul 14763, Korea [*E-mail*: shkim67@hanyang.ac.kr]