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"Carving Nature Like a Piece of Artwork": *Hydrological Engineers' Identity-building in Modern South Korea*

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Abstract

During the late 1960s, South Korean state engineers from construction agencies promoted large dam-building projects with the notion that their expertise would allow them to carve nature for the benefit of the nation. Hidden under this audacious declaration to manipulate nature was the precarious identity-making of hydrological engineers from academia who contributed to rationalizing dam construction. This paper shows that the uncertain identity of hydrological engineers resonated with their position in a developing South Korea between the colonial legacy and the Cold War influx of Western knowledge. While working closely with state engineers, academic engineers had the distinct goal of establishing a unique Korean research program, overcoming both colonial river management and the Western methods on which it stood. This paper argues that carving nature *ultimately concealed the haphazardness of the national water resources development plan as manifested in the tensions between state and academic engineers.*

Keywords: development, nature, environment, engineering, hydrology, dams

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Introduction

In my long pursuit of nature, I have undertaken and enjoyed much work of carving mountains, filling the sea, impounding water, and constructing dams. […] My work becomes physical and tangible property that can be observed by the eyes of all. It is like a piece of art. - Ahn Kyung-mo (K. Ahn 1991).[1]

Ahn Kyung-mo (1917–2010) was an elite technocrat who led South Korea's water resources development as the CEO of the state-owned Korea Water Resources Development Corporation (Hanguk sujawon gaebal gongsa; KWRDC) from 1967 to 1983.[2] Every person entering his office would have first seen the framed calligraphy "鑿山導水" (*chaksan dosu*, or digging mountains and guiding water) that hung on the wall behind his desk. Ahn proudly proclaimed that the phrase was his motto in his efforts to block rivers, build dams, and reimagine the homeland (*Maeil Business Newspaper* 1968). Under his leadership, the KWRDC committed itself to building large multi-purpose dams and ushered in the golden age of dam construction in South Korea.

Ahn promoted the idea in cooperation with an emerging group of water experts affiliated with the Korean Association of Scientific Hydrology (Hanguk sumun hyeophoe; KASH) established in 1967 (Korea Water Resources Association 1997, 38–39).[3] Leading academic engineers of this professional organization had their roots in civil engineering, but redefined their expertise as hydrology, translating it as *sumunhak* 水文學 (studies on water). I call these experts "hydrological engineers," although they hardly

1. All Korean names are listed by their surname first, then their given name. The spelling of each name has been transliterated according to each individual's preference, as found in their English-language publications.
2. The present name of the corporation is Korea Water Resources Corporation, or K-Water. Technocrats of the Ministry of Construction led the establishment of the KWRDC and had the corporation lead multi-purpose dam construction projects (Korea Water Resources Development Corporation 1977).
3. The present name of the association is the Korea Water Resources Association (Hanguk sujawon hakhoe).

Figure 1. Ahn Kyung-mo (left) and Gilbert G. Stamm from the US Bureau of Reclamation (right). The framed "鑿山導水" hangs on the wall behind them.

Source: Korea Water Resources Development Corporation (1968).

used this term themselves, because these engineers proclaimed that they were trailblazing a new field of hydrology while maintaining their identity as civil engineers. Hydrological engineers did not completely shift their identity from civil engineers to hydrologists; but brought hydrology into their research agenda. With this new identity, hydrological engineers helped rationalize large multi-purpose dam construction projects by emphasizing the importance of water resources to national industrialization. Collaboration between these two institutions strengthened as Ahn Kyung-mo also began to serve as president of KASH in 1969.

Examining the idea of "鑿山導水" provides an interesting entry point for investigating the emergence of new engineering expertise and its conceptualization of nature in the pursuit of postcolonial and postwar development. Mainstream scholarly work has neglected this topic as historians have overwhelmingly focused on the political economy of development (Ko 2016). Due to this partial historiography, scholarship has

not fully provided alternative understandings other than the naïve declensionist narrative that South Korea during the 1960s and 1970s was a period of destruction of nature owing to an authoritarian regime obsessed with economic growth.[4] Some exceptional work has been achieved by political geographers, who have provided useful frameworks for examining a range of strategies conducted by the state to render nature into a national resource (Hwang 2015; Hwang and Park 2013). However, their methodological interest in exploring nature in relation to state power has led them to describe the state as the sole and singular subject that could discursively and materially produce nature in its favor. Another strain of scholars has emphasized the agency of non-human actors, but these scholars still describe the state as an homogenized entity and equate the state with "modern science," describing it only as a source of state power (J. Kim 2019).

This paper illuminates academic hydrological engineers' precarious identity-making in between colonial legacy and the Cold War influx of Western knowledge, which was hidden under the ambitious idea of manipulating nature. Following hydrological engineers' identity-building, I argue that the phrase "鑿山導水" ultimately concealed the uncertainty of hydrological engineering in modern South Korea, which stood between its colonial legacy and Western influence. Aspiring to build their own research program, South Korean engineers from academia emphasized careful studies on subtle and local interaction between humans, technology, and nature. Their aim was to overcome the limitations of both river management that originated from the colonial period and hydrological methods that were developed from the West. However, when formulating the comprehensive water resources development plan for the nation, hydrological engineers drew on colonial data and Western development models as these were the available sources. The propagation of the idea of *carving nature* did not just

4. Recently, some scholars have provided the counter-narrative that President Park Chung-hee was a pioneer in nature conservation, as evidenced by anti-pollution legislation and the Green Belt policy during his time in office (Jun 2019). This perspective is also problematic as it decontextualizes the understanding of the natural environment in the course of national development while giving the credit for legislation solely to Park Chung-hee.

manifest itself in modern state authority or the human hubris of disciplining nature; it also resided within the precarious field of hydrological engineering and the haphazard nature of the national water resources development plan.

The tensions between academic and state engineers were indicative of the precarious identity-building of professional hydrological engineering. While academic hydrological engineers worked closely with state engineers, they also made significant efforts to construct their own research program. Leaders of KASH called for detailed hydrological studies, arguing that colonial river management was outdated, and Western hydrological methods were not directly applicable to the nation's distinctive environmental conditions. KASH's close relationship with the KWRDC and the Ministry of Construction did not mean that KASH members merely served state authority. Engineers from academia sometimes criticized the government's hasty development policy, claiming that the national land-building project should be based on detailed domestic hydrological research. KASH and the KWRDC needed each other as KASH provided rationalization of large dam construction, and in return, members of KASH secured government support. Yet, there also existed tensions between the two institutions that had different goals.

By positioning the professionalization of South Korea's hydrology in postcolonial and Cold War contexts, I also examine how technical elites constructed and utilized (dis)continuity of colonialism in seeking a better position in the developing nation. Historians have long disputed whether colonial experience or Cold War US aid decisively influenced rapid economic growth in South Korea from the 1960s (B. Lee 2006; Lim 1994; T. Park 2007). The "hybrid" perspective discussed by historians of science has contributed to this debate by illuminating that postwar scientific and technological activities were founded on both a colonial legacy and a new global order led by Western scientists (DiMoia 2013; Moon 2018; T. Kim 2017). Building upon these achievements, I further claim that we need to examine the boundary between the colonial and the de-colonial as something constructed by historical actors rather than as *a priori* category. The issue of continuity and discontinuity is not just a matter for historical scholarship; it was also a matter for historical actors in the context that the

end of colonial rule led to "the beginning of competing narratives of the colonial past" (Hughes 2012, 9). In the case of identity-making by hydrological engineers, they drew on data collected by prior Japanese colonizers to represent the local environment, but at other times, they distinguished their activities from colonial science and technology. Similarly, they selectively embraced hydrology developed from the United States towards their own ends. This contradictory situation—standing on a colonial legacy and Western hydrology but arguing for the distinctiveness of Korean hydrology—indicated hydrological engineers' position in modern South Korea. This paper claims that, going beyond empirically determining whether colonial legacies impacted postwar development, we need to elucidate how historical actors appropriated (dis)continuity of the colonial period as a resource and how postwar intellectuals and practitioners became the "hybrids" (T. Kim 2001, 113).

This paper starts by examining the Bureau of Water Resources' vision of comprehensive water resources development and the Bureau's appropriation of global initiatives toward hydrology. Civil engineers who studied hydraulics participated in promoting this development plan while rebuilding their expertise as hydrological engineers. Next, by analyzing articles published in the early issues of the KASH journal, I demonstrate how hydrological engineers differentiated their research from both colonial river management and hydrological methods transferred from the West, the two essential sources for their hydrology program. This positioning was to build their identity as hydrological engineers for the long term in developing South Korea. Lastly, I show that hydrological engineers' desire did not always accord with that of technocrats.

Comprehensive Water Resources Development for *Gukto geonseol* (國土建設)

In 1961, the year Park Chung-hee came into power through the May 16 coup d'ětat, Ahn Kyung-mo led the establishment of the Bureau of Water Resources (Sujawonguk; BOWR) under the National Construction Agency

(Geonseolcheong).[5] The Agency, controlled by the Economic Planning Board (Gyeongje gihoegwon), had a mission to implement the "national land-building" (*gukto geonseol* 國土建設) project pushed forward by Park to eliminate poverty and achieve economic growth (*Kyunghyang Shinmun* 1961). By launching the project, Park demonstrated the construction of roads, manufactories, powerplants, levees, and other types of infrastructure to be the primary items on the national agenda for economic development. The newly established BOWR aspired to expand its influence by taking part in this national infrastructure construction initiative.

In order to contribute to Park's vision of national land-building, the BOWR projected a large dam construction plan. Since its establishment, the BOWR had conflicted with the Bureau of Electricity (Jeongiguk; BOE) under the Ministry of Commerce and Industry (Sanggongbu; MCI) and the Korea Electric Power Company (Hanguk jeollyeok; KEPCO) over the authority to plan and manage national large dam construction. As the newcomer in dam-building, the BOWR attempted to frame large dam construction as a matter of water resources development, rather than power development, to become the main agent of national dam construction that had heretofore been controlled by the BOE and KEPCO. The BOWR technocrats argued that national dam construction had to be planned not only for power generation, but also from the perspectives of water supply, flood prevention, and river basin development (Economic Planning Board 1962). The BOWR claimed that they should lead the national dam-building plan rather than electrical technocrats in the BOE or KEPCO, who approached dam construction only for power development.

In this vein, the director of the BOWR, Lee Mun-hyeok, proposed a "comprehensive water resources development plan" that highlighted large

5. Ahn Kyung-mo's career will be discussed later, but here I briefly mention his career path in construction bureaucracy. In 1961, he led the establishment of the BOWR as vice commissioner of the National Construction Agency, which was rebranded the Ministry of Construction in June 1962. Ahn had also served as the vice minister of the Ministry of Construction (1963–1964) and the minister of the Ministry of Transportation (1964–1967) until he became CEO of the Korea Water Resources Development Corporation in 1967 (Y. Kim 1995, 83–84).

multi-purpose dam construction for water utilization (M. Lee 1964). Lee was inspired by the Tennessee Valley Authority (TVA) and postwar Japan's comprehensive land development that was modeled after the TVA. Lee asserted that South Korea had to invest as much effort in *isu* 利水 (water use) as *chisu* 治水 (water control) to attain the goal of industrialization. Lee pointed out that, considering the country's limited land and expanding population, the nation could not overcome poverty with a policy centered on agricultural development. In order to build an industrial, independent, and self-sufficient nation, Lee asserted that the nation should secure water by constructing reservoirs and utilizing water resources properly.

According to Lee, South Korea specifically needed large dams due to the nation's distinctive environmental conditions. Based on colonial precipitation data gathered and organized by the BOWR, Lee elucidated that South Korea had a relatively large amount of annual average precipitation, approximately 1,100 mm, higher than the world average of 750 mm. However, two-thirds of the nation's precipitation fell during only three months, between mid-June and mid-September. Lee stressed that this uneven distribution of precipitation throughout the year had troubled the nation. During summer, torrential rains flooded the nation, while the nation suffered a lack of water during the rest of the year. As a solution to this problem, Lee suggested the building of large reservoirs to store the excessive flow of water during summer and use stored water during the dry season. Adding that hydroelectric power had a better cost-benefit than its rival, thermal power, Lee projected multi-purpose dam construction as key toward an epoch-making stage in terms of water utilization. The BOWR later specified this idea through the Ten-year Comprehensive Water Resources Development Plan (1966–1975) and Specific Multi-purpose Dams Act (1966) (Ministry of Construction 1966).

Taking account of Lee's experience studying civil engineering at Nihon University, and his reference to Japanese postwar comprehensive development, it is apparent that Lee drew on an idea from large dam construction in Japan. In the early post-World War II period, Japanese intellectuals and policymakers reconceptualized Japan's domestic landscape as a resource to deal with the anticipated economic crisis resulting from

decolonization and unstable overseas market in the Cold War (Dinmore 2013). Borrowing the TVA as a postwar development model, Japanese elites envisioned a situation where dams would convert Japan's hydrosphere into a manageable source available for the rebuilding of the economy. This TVA-type comprehensive development and postwar economic boom in Japan would have inspired Lee and the BOWR technocrats to frame water as a resource for industrializing the nation.

However, the BOWR had difficulty scaling up the large multi-purpose dam construction plan due to conflicts between government branches. Unlike Japan, which had had experiences in establishing cooperation between the ministries for imperial land planning during the era of wartime mobilization, South Korean ministries were competing to take the leadership of postwar nation-building. (Moore 2013, 79–80). The MCI and KEPCO suppressed the BOWR's water resources development plan in order not to lose control of the nation's dam business (Ministry of Commerce and Industry 1963). The Economic Planning Board and the Ministry of Finance also opposed the BOWR's multi-purpose dam construction plan to keep it in check from overspending (National Institute of Korean History 2009).

International Initiative towards "Scientific Hydrology"

At the time the BOWR was struggling to prove its value to the developing nation, world-leading hydrologists proposed a plan to promote "scientific hydrology" (Kohler 1963). Hydrologists under the leadership of the International Association of Scientific Hydrology demonstrated the necessity for an international hydrology program to solve global water problems and elevate the status of hydrology, which lagged compared to other scientific disciplines (Nace 1964, 413–414). The hydrologists argued that the program should embrace as many participants as possible from policymakers to scientists across the world. To this end, they chose to initiate the program in consultation with international non-governmental organizations (Kohler 1963, 194).

After a series of preparatory meetings, in January 1965, hydrologists led

UNESCO's declaration of the International Hydrological Decade (IHD) (Bock 1965). This worldwide program aimed to expand teaching, training, and research of hydrology with the notion that water circulates all around the globe; therefore, water could be effectively studied only with international cooperation. The activities of this program included installing water measurement stations and gathering and interpreting hydrologic data to better understand water circulation (Nace 1964, 415). In order to achieve this goal, the program made it mandatory for each participating country to organize its own committee, while encouraging collaboration between countries coordinated by international agencies and scientific associations.

This IHD program entailed the universalization of the notion of the hydrologic cycle and large-scale technical solutions. Water circulation on Earth was not a totally new idea, but a simplified hydrologic cycle diagram was the modern invention that made water visible to state planning agencies. Specifically, in the era of New Deal programs, American government officials employed the visual representation of the hydrologic cycle to normalize massive engineering intervention and national-scale water control (Linton 2008, 636–637). In the same manner, the IHD emphasized that humans had to manage water, "a gift from God," which had been wasted (*Time* 1965). Articulating water problems across the world, from water pollution to human conflicts over water resources, the IHD argued that we first needed to deepen our scientific understanding of water circulation before considering how to construct infrastructure for securing enough water resources.

The IHD also naturalized modern industrial development stemming from Western society. The cover story of *Time* for October 1, 1965 introduced hydrology and the IHD, saying, "[T]he world's demand for water will double" as a "result of modern industrial society's increasing and unquenchable thirst" (*Time* 1965). The article stated that the increasing water demand would come from the use of modern technologies at home, including "bathtubs, dishwashers, washing machines, and lawn sprinklers." The article also stated that the production of petroleum, steel, and synthetic rubber would require a huge amount of water. Framing industrial society as the standard for the entire global population, the article presented scientific

hydrology as a way of preparing for skyrocketing water demand.

This international initiative for scientific hydrology provided the BOWR with an opportunity to promote its comprehensive water resources development plans. Drawing on UNESCO's IHD program, the BOWR raised the importance of multi-purpose dam construction for the nation's economic development scheme. Yet, the BOWR had difficulty recruiting hydrologists who would take charge of hydrological research, surveys, and education as members of the national IHD committee. Even leading technocrats in the BOWR largely had civil engineering backgrounds but lacked training as hydrologists. They only learned about hydrology from periodicals and reports gained from US foreign aid agencies and the United Nations Economic Commission for Asia and the Far East (K. Kim 1998). Most of the personnel in the bureau were hydroelectric plant technicians transferred from other government agencies rather than hydrologists (Y. Kim 1995, 84).

Because having a national committee was mandatory for participation in the IHD, the BOWR still established the Water Resources Development and Hydrological Survey Committee by executive order in April 1965. With administrative support from the BOWR, the Committee was supposed to consist of thirty-one members with academic training or experience in hydrological studies (Ministry of Government Administration 1965).

However, as expected, the Committee was merely a nominal representative organization that took charge of the IHD program in South Korea. During the first year, the Committee had only one inaugural meeting, and no government budget was allotted for any domestic IHD program (*Kyunghyang Shinmun* 1966). The bigger problem was the limited number of researchers and technicians who could take over hydrological research and surveys. Moreover, no universities in South Korea had the curriculum to train experts in the field of hydrology (*Kyunghyang Shinmun* 1965). South Korea registered its name on the list of IHD participating countries, but in practice, the committee had meager capabilities to initiate hydrological studies in South Korea.

From Hydraulic Engineering towards Scientific Hydrology

While the IHD program lost its momentum in South Korea, several civil engineering professors were pioneering the field of *surihak* 水理學 (meaning studies on the principles of water). The equivalent word in English is hydraulics, which studies the mechanical behavior of water in the physical system based on fluid mechanics and hydraulic experiments. One of the leading researchers in hydraulic engineering was Ahn Soo-hahn (1925–2008), a professor in the Department of Civil Engineering at Seoul National University (SNU). Ahn had received all of his education since middle school in Japan and graduated from the Department of Civil Engineering at Kyushu University in 1951. While studying at the Graduate School of the University of Tokyo, Ahn returned to Korea to take up a lecturer position at SNU in 1954 (Pyun 2015).

During his early career, Ahn was interested in flood prevention. The year he was appointed to SNU, Ahn published an article in the College of Engineering Bulletin, *Buramsan*. The article interpreted the importance of national afforestation from the perspective of hydraulic engineering, arguing that afforestation could help stabilize stream runoff (S. Ahn 1954, 16–19). Ahn published more technical articles in the *Journal of the Korean Society of Civil Engineers*, discussing formula calculations and experiments to examine river flow (S. Ahn 1956; 1957; 1959; 1960). He also designed the first hydraulic laboratory in South Korea at SNU with assistance from an American civil engineering professor, Harold Babbitt, who visited South Korea to advise the College of Engineering (Babbitt 1961; S. Ahn 1962, 119–122). Ahn's overall research agenda focused on interpreting river flow for the purpose of flood prevention.

Ahn's focus on flood prevention led him to depict nature as an evil to humankind and something that had to be dominated. In an editorial he wrote in one of the nation's leading newspapers, Ahn cited a novel, *The Good Earth* by Pearl S. Buck, articulating that floods and droughts were a "merciless punishment" to Chinese peasants who "only loved and complied with nature" (*Dong-A Ilbo* 1963). Ahn also brought up the TVA and mentioned how a river in Tennessee had been an "intractable tyrant," but

came under complete human control after a decade of battles against nature (*Dong-A Ilbo* 1963). Ahn concluded that nature punishes neglectful people in the form of floods and droughts, as in South Korea, where rivers were completely out of control.

Ahn attributed this failure to take control of nature to the outdated river levees constructed during the Japanese colonial period. Ahn claimed that the colonial river management system was built without considering future riverbed changes. According to Ahn, sediment deposition had been accumulating on the bottom of rivers for more than 30 years, turning even a small amount of precipitation into flooding. Saying that "rivers are alive," Ahn emphasized studies on fluctuating river flow and the rebuilding of the flood prevention system ill-designed by Japanese colonizers (*Dong-A Ilbo* 1963).

Ahn connected this anti-colonial sentiment to his call for national support in hydraulic engineering. He asserted that river management inevitably requires national support because research for improving the flood prevention system necessitates a huge amount of resources that are not affordable to an individual or an organization. In this vein, Ahn called for the establishment of a national hydraulic laboratory in which researchers could model national rivers. At the end of his editorial, Ahn asks, "there was a political revolution [the May 16 coup d'état led by Park Chung-hee], so why haven't we had a scientific and technological revolution despite it being more important?" (*Dong-A Ilbo* 1963). Ahn concluded that scientists and engineers should play a key role in building the nation.

As a way of expanding hydraulic engineering in South Korea, Ahn formed a research group by gathering professors from different universities. Ahn worked closely with two early-career scholars, Lee Won-hwan and Choi Young-bak, who both graduated from SNU. They had studied under Professor Won Tae-sang (1903–1976), who had studied civil engineering at Keijō Higher Technical School and worked at the Bureau of Home Affairs under the Government-General of Korea before teaching at SNU.[6] After

6. Keijo Higher Technical School was later incorporated into the College of Engineering at SNU (W. Lee 1993, 27–36; Choi 1997, 11–26).

studying river engineering and hydraulics at SNU, Lee Won-hwan took up a professor position at Pusan National University, while Choi Young-bak was hired by Chunggu University, both located in the southern part of the Korean Peninsula. Ahn asked Lee and Choi to come to Seoul in order to have closer interactions and to construct a hydraulic engineering research collective.

Fortunately, both Lee and Choi were able to find new positions in Seoul without difficulty thanks to the expansion of civil engineering along with the increasing demand for civil engineers for postwar national infrastructure-building (Kang and Choi 2018, 52). Lee joined the Civil Engineering Department at Yonsei University, and Choi took a position at Hanyang University (W. Lee 2008, 61–66). Gathering in Seoul, Ahn, Lee, and Choi organized the Hydraulic Engineering Research Group, inviting six more professors to join. The group held its first research meeting at SNU on January 21, 1964, with Ahn presenting his paper, "Experiment of the Muju Dam Spillway Hydraulic Model" (Korea Water Resources Association 1997, 48). The research group decided to meet twice a year to share their research outcomes with the members.

This group of hydraulic engineers took an opportunity to participate in the IHD, advertising their expertise and obtaining support from the government. According to a request from the BOWR, members of the hydraulic engineering research group joined the national committee for the IHD program (Korea Water Resources Association 1997, 17). The first task for initiating the IHD in South Korea was to arrange a glossary as well as translations of English terms in hydrology. In the summer of 1967, the BOWR requested Choi Young-bak and Lee Won-hwan to join the committee reviewing hydrology terminology (Korea Water Resources Association 1997, 8–10). The glossary committee also included one professor from SNU's College of Agriculture, and three technocrats from the Ministry of Agriculture and Forestry, the Agricultural Development Corporation, and the Central Meteorological Service.

In the process of selecting and defining terminology, Choi and Lee had to deal with the interdisciplinarity of hydrology. The committee translated the term hydrology as *sumunhak* 水文學 (studies about water), and decided

the production of a glossary to be the first step toward facilitating communication between scholars from different disciplines. Choi and Lee had expertise in the mechanical study of water based on hydraulics, but studying water circulation—the core theme of hydrology—needed diverse perspectives from meteorology, geology, silviculture, soil science, and agriculture. Committee members with different backgrounds conflicted in identifying some of the terms and articulated different opinions, forcing them to occasionally stop their meetings. The Committee noted how such difficulties stemmed from the nature of hydrology itself. In the introduction to the glossary they ultimately produced, the Committee stated,

> Academic terms in *sumunhak* have not been determined and entirely standardized even in advanced countries, save for a few exceptions. This is because, first, hydrology is a recently developed field with relations to many other disciplines, and its boundary is changing and expanding. Further, technicians and scholars responsible for academic terminology have different perspectives and interests though they share common concepts. (Ministry of Construction 1967, 4)

As the glossary committee noted, hydraulic engineering alone could not cover all the dimensions of "scientific hydrology" coined by the IHD, which called for a comprehensive understanding of water circulation in the environment. Scientific hydrology required other types of expertise besides the mechanical study of water movement in order to investigate water circulation in the ecological system. To that end, the BOWR requested the glossary committee team to organize an interdisciplinary association for hydrological surveys and research to assist the government and the initiation of the IHD in South Korea. In accordance with this request, the hydraulic research group had a meeting to prepare the establishment of an association. Hydraulic engineering research group members, including Ahn Soo-hahn, Choi Young-bak, and Lee Won-hwan, took part in the preparatory committee, which also included scholars from other relevant fields (Korea Water Resources Association 1997, 29–30).

Governmental attention to hydrology, triggered by international

initiatives, provided the hydraulic engineers with both opportunities and challenges. The hydraulic engineering research group had a chance to expand its community. The government needed the group's expertise to initiate the IHD program and promulgate a comprehensive water resources development plan, and the hydraulic engineers aspired to demonstrate their important role in the developing nation. However, members of the research group had to redefine their expertise and engage with those from other disciplines to fill the gap between hydraulic engineering and scientific hydrology.

Identifying Hydrology for the Industrial Nation

The preparatory committee internally had difficulty defining hydrology, though it was eager to publicly promote it. As one way to publicize hydrology, the team issued an IHD commemorative postcard that depicted society centered on an engineered river (Ministry of Communications 1967). The postcard image pictured rain falling to a reservoir and water contained and released from a dam. Leaving the reservoir, water continues running through a linearized stream and is joined by other straight streams. As water flows downstream, it passes through farmland, under a bridge, through irrigation facilities, and to a factory. This simplified image of a river delivered a message that a well-regulated river harmonized with society facilitates human economic activities. The postcard was an imaginary river engineered by hydrological experts. The description of the stamp issued with this postcard stated, "[T]he purpose of initiating hydrology as an international project is…to gain the full benefits of water. […] As we suffer from no little damage from flood and drought, the development of hydrology is absolutely necessary" (Korea Stamp Portal Service 1968).

Around the end of 1967, the preparatory committee established the association and named it Sumun hyeophoe 水文協會, with the English name, Korean Association of Scientific Hydrology (KASH). The Association stated its mission as follows:

> [The initiative by the IHD] clearly proves how the development of scientific hydrology has a great influence on the national building of industry and its development. … Following the international and domestic trends, we are establishing KASH to make a groundbreaking leap for the nation's development of hydrological technology, which had lagged behind, by advancing the scientific process of hydrology and actively participating in making water policy. (Korean Association of Scientific Hydrology 1967)

The Association justified the value of its expertise by emphasizing hydrology as a means of expanding industry. This identity-building echoed President Park's emphasis on industrialization in the first year of the Second Five-Year Economic Development Plan (1967–1971). In his 1967 New Year's address, Park framed Asia as a "hardship area" where the Free World was facing challenges arising from Communist China and the Vietnam War (C. Park 1967). Park argued that, over the past several years, South Korea had grown into a leader in building an Asia-Pacific community within these global circumstances. As the nation moved into the second phase of its economic development plan, Park declared 1967 to be a "year of progress." Park highlighted building South Korea as the "shining industrial nation" of Asia, declaring, "Let's unite the government and the people as one and launch a full-scale operation to build the nation based on industry!" (C. Park 1967). KASH's mission argued that hydrological experts could be legitimate contributors to this elite vision of national industrializing.

The Association framed water issues on a national scale. Notably, the Association projected a lack of water in the near future, asserting that the water supply was not keeping up with an increasing water demand caused by the rapid expansion of industrial facilities (*Chosun Ilbo* 1968). The Association argued that this water shortage might be attributable to the country's obsolete water supply and storage system, but the fundamental problem was the insufficient amount of freshwater rather than unsatisfactory water supply facilities. In this respect, the association argued for a comprehensive plan for the efficient use of the nation's entire riverine system.

The installation of Ahn Kyung-mo in 1969 as the second president of KASH furthered the Association's close relationship with the state. Ahn had led water resources development in South Korea since the creation of the BOWR in 1961, but he was an elite construction technocrat rather than a hydrologist. He began his career at the Railway Bureau of the Government-General of Korea in 1939 after studying civil engineering at Tokushima Higher Technical School (K water 2017, 16). Following national liberation, he continued to work in the Ministry of Construction and the Ministry of Transportation and participated in the nation's *modernization* projects, including the First Five-Year Economic Development Plan, Ulsan industrial city planning, and the Gyeongbu Highway construction (K water 2017, 137–138). Later, in December 1967, he began to serve as CEO of the newly established state-owned enterprise, the Korea Water Resources Development Corporation (KWRDC). Ahn reminisced about his time in the KWRDC as an extension of his career as a construction technocrat, proudly saying he dedicated himself to "changing the map" of the nation with large dams (K. Ahn 2002).

The cooperation between the BOWR and KASH was mutually beneficial. The BOWR expected KASH to promote the Bureau's idea of comprehensive water development by conceptualizing the natural environment as a national resource to be used for industrializing the nation. In return, the BOWR helped KASH by offering financial and administrative support (Korea Water Resources Association 1997, 10–11, 23). With bureaucratic support, members of KASH rebuilt their expertise in hydrology and took the mission of expanding hydrology to rationalize comprehensive water development.

Overcoming Both Colonial River Management and Western Hydrology

Leaders of KASH utilized their rebranded expertise to secure government support, but at the same time, they struggled to build their identity. To this point, the Association's journal, *Mul-ui gwahak* (Water Science), provides a window into how members of KASH attempted to frame water issues and

build their professional identities.[7] One of the journal's most enthusiastic contributors was Choi Young-bak, a founding member of KASH's hydraulic engineering research group.[8] He was the only researcher to author an article in every issue for the journal's first five years. His early publications in the journal focused on analyzing the current status of water-resources development in South Korea and suggesting future development directions, rather than on narrow technical solutions to specific problems. The broader framework of his writings shows how KASH engineers redefined the natural environment and the nation's economy through the lens of water development as they rebranded themselves as hydrological engineers.

Responding to President Park's vision and the mission of KASH, Choi Young-bak presented TVA as a model for industrializing the nation. In projecting South Korea in the 2000s, Choi anticipated the rapid increase of country's urban population, the expansion of heavy and chemical industry, and the improvement of living standards (Choi 1970, 20–21). Choi argued that this change would increase the total amount of annual water use in the nation from 9.2 billion tons in 1968 to 26.8 billion tons in 2001. Mentioning how the TVA had transformed the Tennessee Valley, once notorious for its heavy rains and flooding into one of the most industrial districts in the US, Choi suggested large dams as a key to industrializing society (Choi 1968, 12). Choi added, however, that South Korea lacked the hydrological research that had led to the success of the TVA in the United States.

Choi's engagement in hydrology led him to present a domestic water problem from the perspective of water circulation subject to the local environment. When representing South Korea's environmental conditions, Choi drew on colonial data. Choi calculated that the South Korea had access to 114 billion tons of water annually by simply multiplying annual average precipitation (1,159 mm) and the national land area (98,477 km^2) (Choi 1971, 37). Then he subtracted 51 billion tons of water loss resulting from evaporation and other causes, concluding that the country had 63 billion

7. The original name of the journal was *Water*, but it changed its name to *Water Science* after its first issue. The present name of the journal is *Mul-gwa mirae* (Water for Future).
8. Choi Young-bak moved from Hanyang University to Korea University in 1967.

tons of "permanently recyclable water resources" (Choi 1971, 37). According to Choi, such an amount of water resources would be sufficient for the nation considering the expected national water demand of 26.8 billion tons in 2001, but South Korea annually was thus far using only about 9.2 billion out of 63 billion tons of available national water resources (Choi 1968, 21). This calculation was based on hydrological data produced by colonial technical officials for the purpose of colonial river management.

Choi pointed out that the country possessed hostile natural conditions for utilizing river water. First, Choi noted that the country had uneven precipitation distribution throughout the seasons. As he explained, South Korea has a hot and humid summer due to high pressure formed as the maritime tropical air mass from the North Pacific meets the maritime polar air mass from the Sea of Okhotsk (Choi 1971, 36–37). This meteorological phenomenon as well as typhoons, which largely occur between July and September, entail heavy rain. Choi claimed that even though the peninsula had sufficient precipitation, a huge seasonal difference made steady river water usage difficult. Choi also indicated that 68 percent of the country's land area was mountainous with steep slopes, so that water flowed rapidly downstream, resulting in unstable water flow (Choi 1968, 38). Due to these conditions, Korean rivers had much higher river regime coefficients—the ratio of maximum discharge to minimum discharge throughout the course of a year—compared to other rivers in the world. For example, the coefficients of the two longest rivers in South Korea, the Han River and the Nakdong River, are 393:1 and 372:1 respectively, while those of the well-known Rhine, Yangtze, Nile, and Mekong Rivers are 14:1, 22:1, 30:1, and 35:1 (Choi 1968, 12).

The study of these challenging river conditions was barely a new idea, but Choi employed it to legitimize localized hydrological research for water resources development. During the colonial period, Japanese officials studied monthly precipitation and streamflow for the purpose of flood prevention (Government-General of Korea 1929). Drawing on the same data, Choi articulated how Korean rivers possessed distinctive characteristics, thus national water resource development required a new research program specific to the local environment, rather than just the

application of hydrological techniques from foreign countries. For instance, Choi asserted that many hydrological methods developed in the US during the 1930s were designed based on rivers with "continental" characteristics that were relatively stable and linear waterways (Choi 1968, 13). Choi doubted if those methods would be appropriate for interpreting non-linear rivers in the mountainous areas of South Korea.

Choi's claim echoes his and his fellow hydrological engineers' identity-making and positioning in postcolonial/postwar South Korea. In order to define the nation's riverine environment, their scholarship largely drew on survey outcomes produced by Japanese colonizers, such as hydrological data on rivers. On the other side of the coin, Choi and his fellow engineers made no mention of the colonial origins of the references in order to repel the Japanese legacy and claim their own role in studying Korean rivers.[9] At the same time, they modeled their approaches after the TVA, but had to prove their research was more than simply borrowing Western methods.

To this end, Choi highlighted "locality" and "historicity" in investigating the relationships between water and human activities (Choi 1969). By locality, he meant that each nation should employ a different approach in utilizing water in its natural environment. Choi argued that there was no universal way of developing water resources; but, every river engineering practice should be based on a specific survey and a construction method corresponding to local conditions. He also added the factor of temporality to river engineering, saying that the purpose of river engineering changes depending on the needs of the times. His conclusion was that "If [we] do not understand that a direct purpose of river management varies from country to country as well as according to the times, […] river improvement will fail" (Choi 1971, 49). By defining the temporal and spatial specificity of river engineering, Choi aspired to establish South Korea's own hydrology program, keeping a distance from colonial river management (historicity) and hydrological methods developed in the US (locality), concealing that both were essential sources upon which to draw.

9. Colonial data became available as the BOWR gathered and organized it (Ministry of Construction 1962; 1963).

Choi went further to conceptualize the relationship between nature, society, and technology in river engineering. With a diagram (Fig. 2), Choi explained that water, humans, and technology each give an action and receive a reaction with the others. In an advanced society, the reaction of natural forces to human action becomes greater and stronger as people utilize more water from the natural environment, which can bring about unexpected outcomes (Choi 1969, 39). Choi gave the example of how a layer of sediment accumulated on a riverbed over time could cause a malfunction in an artificial waterway (Choi 1969, 41). Dam-building also divides rivers, resulting in the accumulation of sediment upstream and riverbed scour downstream. Articulating that these phenomena could have negative effects on society, Choi called for paying close attention to the balance of dynamic interaction between nature, society, and technology.

In this vein, Choi did not present multi-purpose dam construction as a magic bullet. Instead, he argued that a multi-purpose dam should be carefully designed and operated from a hydrological point of view. Choi advocated a multi-purpose dam as the primary solution to future water problems, but cautioned that "it is excessive to say that multi-purpose dam construction alone can solve all water problems" (Choi 1970, 22). He

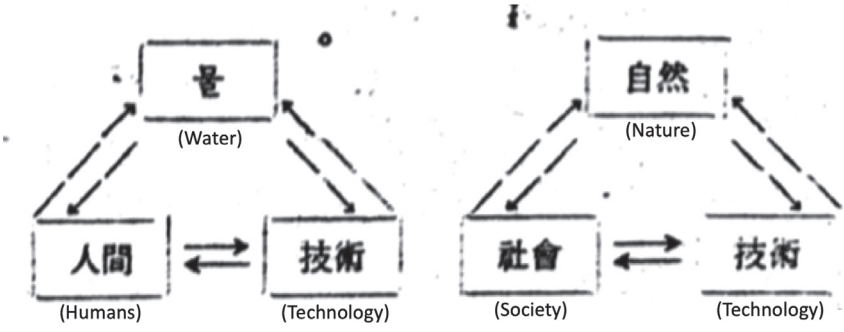

Figure 2. Diagram describing the interaction between nature (water), humans (society), and technology, drawn by Choi Young-bak (translation by author).

Source: Choi (1969, 39).

pointed out a contradiction between water use and flood prevention inherent in a multi-purpose dam. In order to generate electricity and deal with increasing water demand, a dam should contain enough water all the time in its reservoir. However, for the purpose of flood prevention, a reservoir needs to remain empty to detain heavy rains from flowing downstream. In conclusion, Choi solicited "surveys, planning, and measures for new problems, such as sluice gate operations, upstream and downstream riverbed changes, and sediment problems in a reservoir" (Choi 1970, 22).

In the early years, civil engineers associated with KASH incorporated hydrology in their research agenda and rationalized national water resources development. For Choi Young-bak and other civil engineers who studied hydraulics, participating in KASH was a good opportunity to receive government support and better position themselves in the developing nation. KASH collaborated with the Ministry of Construction, conducting river basin surveys as well as providing studies on the national "four major river basin development project" in a special issue of the association's journal (Korea Water Resources Association 1997, 112, 128).

However, frictions existed between the identity-making by those engineers and technocrats' aspirations to lead national development. The academic engineers of KASH advocated a national comprehensive water resources development plan. Yet, as a newly emerged group of researchers, they also aspired to establish their own professional identity between colonial legacy and the global influx of hydrological knowledge. Choi conceptualized "locality" and "historicity" of hydrology for this purpose, but bureaucrats were only interested in accelerating water resources development to meet Park Chung-hee's vision.

Two Different Dreams

Hydrological engineering during the early period could not be separated from colonial river management and Western hydrology. On the one hand, academic engineers utilized those as useful resources for the sake of contributing to the national development plan and proving themselves to

the developing nation. On the other hand, however, they identified the outdatedness of colonial river management and the inapplicability of Western hydrological methods in order to articulate the value of their own research program specific to the environmental conditions found in South Korea. The latter was more important for academic engineers as they aspired to construct their singular professional identity beyond mere collectors of colonial data or translators of Western hydrological methods.

Unlike academic engineers, technocrats prioritized contributing to Park Chung-hee's land-building program. The first project implemented by the Korea Water Resources Development Corporation, since its establishment in 1967 in cooperation with the BOWR, was to reclaim 100,000 *pyeong* (1 *pyeong* = approximately 3.3 m^2) of the Han riverside in Seoul (*Maeil Business Newspaper* 1969). This project, called the "Seobinggo Reclamation," was made feasible by a comprehensive water development plan. The KWRDC anticipated that large dam construction in the upstream Han River would lower the river's water level. In this way, the abandoned Han riverside would be freed from recurring floods (K. Ahn 2002, 48). This reclamation business was successful from both financial and political perspectives. The KWRDC earned a profit of 1.7 billion KRW by selling the reclaimed Seobinggo area. The corporation also proved their contribution to the national land-building program as they named the reclaimed land "the symbol of modernization, the Han riverside water resources village" (*Dong-A Ilbo* 1970; KTV 1969). This profitable business model proved that investment in dam-building would not be a losing game (National Institute of Korean History 2009, 36).

However, academic engineers had concerns over the nation's riverside development projects. In his comment on the deadly flood that occurred on August 19, 1972, which killed two hundred people, Choi Young-bak and Lee Won-hwan mentioned that the disaster resulted from the haphazard city planning of Seoul and an inherent lack of hydrological research. Articulating that cities in advanced nations prohibited the urbanization of lowlands, Choi argued that the government should not overissue construction permits in areas prone to flooding (*Dong-A Ilbo* 1972). His suggestion of turning those areas into parks or flood reservoirs rather than residential or commercial zones opposed the KWRDC's reclamation business (*Kyunghyang Shinmun*

1972). Hydrological engineers further criticized the government's naïve attitude towards a large multi-purpose dam. They pointed out that large multi-purpose dam-building alone could not solve all the issues pertaining to water control and water use. They claimed that a new structure on a river could change flooding areas, water flow, and patterns of sediment deposits, resulting in unanticipated damage to society.

Hydrological engineers also pointed out the unreliability of colonial hydrological data and a need for more hydrological surveys and research. They questioned the quality of hydrological data on which river management was based because they had been collected by untrained personnel (*Kyunghyang Shinmun* 1972). According to their claim, the failure of water management would be an obvious result considering the lack of reliable data. Here, academic engineers labeled colonial data—the data once used for numerically representing the water resources of the nation—as unreliable and called for rigorous hydrological studies on rivers.

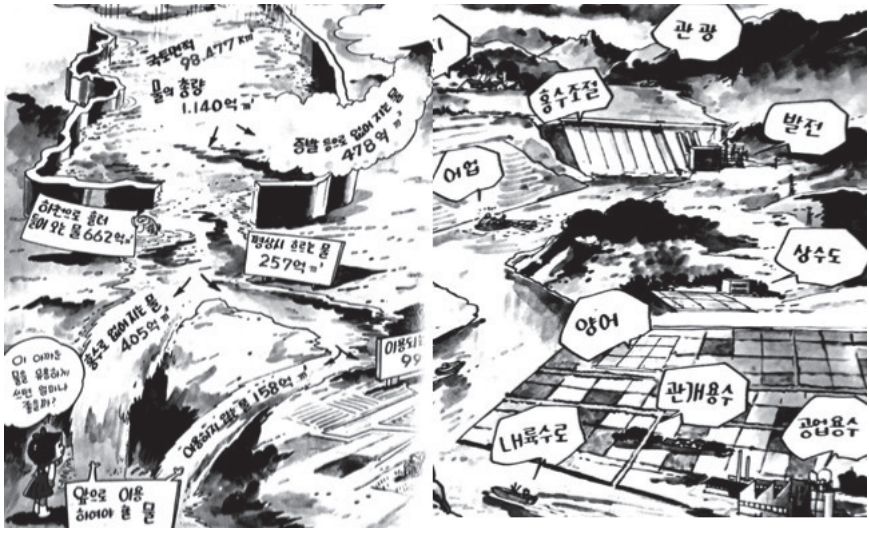

Figure 3. Current status of water use (left) and blueprint of a multi-purpose dam in the government's promotional material.

Source: Ministry of Construction (1976).

Taking into account the different motivations of research and state engineers, it is not surprising that technocrats appropriated knowledge produced by academic engineers in a different way than the former had expected. A promotional pamphlet published by the BOWR used the calculation of water resources in order to rationalize large dam construction in South Korea (Ministry of Construction 1976). The promotion says that we need to utilize the 56.3 billion tons of "unused water" that flows out of the country. The right illustration in Figure 3, which appeared in this promotional pamphlet, depicts the dammed world, focusing on the well-managed river that provides water to economic activities in society. While academic engineers requested further research, technocrats utilized a hydrological understanding of rivers to envision a utopian society enriched by engineered rivers. Under this blueprint, the late 1960s and the 1970s were the heyday of "Public Waters Reclamation," a project aimed at reclaiming riversides while protecting reclaimed land from floods by river control.

Conclusion

Despite the concerns of academic engineers, state engineers expedited the implementation of water resource development. Construction technocrats showed confidence in initiating large dam construction with a blueprint that drew upon engineered rivers. State engineers rationalized their costly construction projects with a hydrological representation that human intervention in water circulation would provide affluent water resources, leading South Korea to becoming an industrialized nation. In that sense, the government promotional materials projected a utopian society centered on well-controlled water circulation (Ministry of Construction 1976).

Behind this blueprint lay the cautions of academic engineers, who argued for *Korean hydrology* in the planning and operating of water resource development. Although the academic engineers cooperated with construction bureaucrats, their former's priority was to build their own research program that consisted of measuring hydrologic characteristics, conducting and modeling experiments, and developing empirical methods

pertaining to the local environment. They argued that the nation should sponsor hydrological research for more accurate and effective development of the riverine environment, rather than merely bringing in colonial data or applying Western methods. From these hydrological engineers' perspectives, the government's rapid initiative on massive dam-building needed to be slowed down until they had enough of a hydrological understanding of rivers.

The propaganda of elite government officials about "carving nature" only hid the unstable partnership between government agencies and professional associations. With the chant of manipulating nature for national interests, elite construction bureaucrats downplayed the hydrological engineers' call for long-term studies and pushed forward with large multi-purpose dam construction. Within this representation of nature, technocrats erased the uncertain position of Korean hydrological engineering, which relied heavily upon colonial data and Western models, while simultaneously aspiring to overcome them. Publicizing the idiom of "鑿山導水" by elite technocrats consequently obscured the uncertainty of localized scientific and engineering practices standing between the colonial legacy and the global expansion of Western knowledge.

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