

Technological Origins of Korean Semiconductor Industry*

Sangwoon YOO[†]

Introduction

In early December 1983, South Korean newspapers celebrated a monumental achievement: the successful development of the 64-kilobit Dynamic Random-access Memory (64kb DRAM) chip. Articles lauded South Korea as the third country in the world to develop this technology, following the United States and Japan. The press emphasized the astonishing speed of this accomplishment, highlighting that while the United States and Japan had taken six years to develop the 64kb DRAM, Korean engineers succeeded in “just six months” after launching the project earlier in the same year. This feat was framed as a dramatic leap forward, with one report proclaiming that “the gap in semiconductor technology with the United States and Japan has been shortened from more than 10 years to just two or three years.”¹ This narrative of a “six-month” miracle quickly became the foundational story of the South Korean semiconductor industry.

The 1983 event, widely hailed as a miracle, came to be regarded as a pivotal milestone in South Korea’s semiconductor growth story. This achievement initiated

Received June 28, 2025; Reviewed August 6, 2025; Accepted August 7, 2025.

DOI: <http://dx.doi.org/10.36092/KJHS.2025.47.2.201>

[†] Hanbat National University, s.yoo@hanbat.ac.kr

* I thank Penny Ahlstrand, Ross K. Bassett, David C. Brock, Hyungsub Choi, Michelle Drobik, Sheldon Hochheiser, Melissa Knoll, Cyrus C. M. Mody, Seunghyun Oh, Yoehan Oh, Doogab Yi, and members of the Semiconductor History Research Group, all of whom provided generous support in accessing various archives and invaluable guidance throughout this research. I am grateful to Archives of Korean History, AT&T Archives, Computer History Museum’s Shustek Research Archives, Ohio State University Archives, and Stanford University Special Collections for providing access to essential materials. I am also grateful to the nineteen interviewees who participated in fifty-four interviews, sharing their experiences and insights that made this study possible. While not all interviewees appear directly in this paper, their contributions were essential to this work. I also thank the anonymous reviewers for their valuable comments that helped improve this article, and the editorial team at *The Korean Journal for the History of Science* for their support throughout the publication process. This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2024S1A5A80211801231482092260102).

¹ “‘64K DRAM’ Enters Mass Production System 「64KD램」 양산 체제로” *Kyunghyang Shinmun*, 1983. 12. 2.

a larger trend of closing the technological gap with the United States, so that today, the production capabilities for the world's most advanced semiconductors are predominantly concentrated in East Asia, led by South Korea and Taiwan. The history of semiconductors officially began in 1947 when three physicists—John Bardeen, Walter Brattain, and William Shockley—developed the point-contact transistor. Yet, as of 2024, approximately 80% of global wafer fabrication capacity is located in East Asia. The concentration becomes even more pronounced for cutting-edge technologies: in 2022, South Korea and Taiwan almost exclusively produced semiconductors with nodes of 10 nanometers or below.² These advanced chips serve not only civilian commercial applications but also function as essential components in military systems. Consequently, semiconductor competition transcends economic considerations, becoming directly linked to national security concerns. This dual-use nature has escalated the technology's geopolitical importance, leading to what Chris Miller describes as a “Chip War.”³

The rapid growth of the South Korean semiconductor industry since the 1980s has produced competing narratives surrounding its success. Samsung Group, in its official corporate histories, has emphasized the pioneering decisions of its founder, Lee Byung-chul, and his successor, Lee Kun-hee, in entering the semiconductor business.⁴ The South Korean government, on the other hand, has highlighted its own role, promoting the state-led research and development projects that supported conglomerates like Samsung as a major policy achievement. The narratives advanced by government and corporations, often paralleled and reinforced by social science research, together established the “from imitation to innovation” framework that has since defined the conventional view of the 1980s and 1990s.⁵ Much of the social science research, often grounded in the National Innovation System framework, has explored the governmental, managerial, and broader cultural factors behind the industry's development.⁶ While these macro-level analyses highlighted

² Scott Foster, “Balance of Chip Power still Tilts toward Asia,” *Asia Times*, 2024. 1. 5. <https://asiatimes.com/2024/01/balance-of-chip-power-still-tilts-toward-asia/#> (accessed on June 25, 2025).

³ Chris Miller, *Chip War: The Fight for the World's Most Critical Technology*. (London: Simon and Schuster, 2022).

⁴ Except in the bibliography, all Korean names in this paper are presented in the Korean order: family name followed by the given name.

⁵ Sangwoon Yoo, “Innovation in Practice: The ‘Technology Drive Policy’ and the 4Mb DRAM R&D Consortium in South Korea in the 1980s and 1990s,” *Technology and Culture* 61:2 (2020), 385–415.

⁶ Linsu Kim, *Imitation to Innovation: The Dynamics of Korea's Technological Learning* (Boston, MA: Harvard Business Review Press, 1997); John A. Mathews and Dong-Sung Cho, *Tiger Technology: The Creation of a Semiconductor Industry in East Asia* (Cambridge: Cambridge University Press, 2000); Keun Lee, *Economic Catch-up and Technological Leapfrogging: The Path to Development and Macroeconomic Stability in Korea* (Cheltenham, UK; Northampton, MA: Edward Elgar, 2016).

policy and strategy, more recent historical scholarship has begun to illuminate the crucial role of engineers. Challenging the state-centric narrative, Sungsoo Song has analyzed the specific technological choices and strategies made from a corporate perspective during the development of memory semiconductor technology.⁷ In addition, Dong-Won Kim has focused on the history of human resource development, highlighting the pivotal role of figures like Kim Choong-Ki and institutions such as the Korea Advanced Institute of Science and Technology (KAIST) in cultivating the expert workforce that drove Samsung's success.⁸

This scholarly focus on the Korean context mirrors the broader scholarly trend of explaining industrial development through the unique characteristics of different locales. In the case of Japan, for instance, the industrial policy of the Ministry of International Trade and Industry (MITI) has been a central object of analysis.⁹ Scholars in the field of East Asian studies have frequently examined the region's R&D and industrial policies to understand how these nations transitioned from technological followers to leaders.¹⁰ This tendency to explore regional specificities is also prominent among scholars in the United States, where the semiconductor was first developed. Differences between the East and West Coasts—in corporate structures, inter-firm networks, and culture—have been treated as crucial variables explaining the industry's trajectory.¹¹ While such scholarship has provided invaluable insights into the unique developmental paths of each region, its strong

⁷ Sungsoo Song, "The Growth of Samsung's Semiconductor Sector and the Development of Technological Capabilities 삼성 반도체 부문의 성장과 기술능력의 발전," *The Korean Journal for the History of Science 한국과학사학회지* 20:2 (1998), 151–88; Sungsoo Song, "From Follower to Leader: The Process of Technological Development in Samsung Semiconductor 추격에서 선도로: 삼성 반도체의 기술발전 과정," *The Korean Journal for the History of Science 한국과학사학회지* 30:2 (2008), 517–44; Sungsoo Song, *Industrialization and Technological Development in South Korea 한국의 산업화와 기술발전* (Paju: Dulnyuk, 2021), 299–321. For a study on the history of Korea's electronics industry policy, see Hisuk Kim, "Co-evolution of Export Industry and Skills Acquisition: The Case of the Korean Electronics Industry in the 1960s and 1970s 수출산업과 기술습득의 공진화: 1960-70년대 한국 전자산업의 사례" (Ph.D. dissertation, Jeonbuk National University, 2025).

⁸ Dong-Won Kim, "Transfer of 'Engineer's Mind': Kim Choong-Ki and the Semiconductor Industry in South Korea," *Engineering Studies* 11:2 (2019), 83–108; Dong-Won Kim, *Making a Semiconductor Superpower: The Seven Engineers from KAIST Who Shaped the Chip Industry* (Boca Raton, FL: CRC Press, 2023).

⁹ Chalmers Johnson, *MITI and the Japanese Miracle: The Growth of Industrial Policy, 1925–1975* (Stanford: Stanford University Press, 1982); Daniel I. Okimoto, *Between MITI and the Market: Japanese Industrial Policy for High Technology* (Stanford: Stanford University Press, 1989); Scott Callon, *Divided Sun: MITI and the Breakdown of Japanese High-Tech Industrial Policy, 1975–1993* (Stanford: Stanford University Press, 1995).

¹⁰ Robert Wade, *Governing the Market: Economic Theory and the Role of Government in East Asian Industrialization* (Princeton: Princeton University Press, 1990); Mathews and Cho, *Tiger Technology* (note 6).

¹¹ AnnaLee Saxenian, *Regional Advantage: Culture and Competition in Silicon Valley and Route 128* (Cambridge, MA: Harvard University Press, 1994).

focus on local factors has often left the transnational connections between them underexplored.

This study adopts a different approach: a technology-centered methodology that traces technological lineage across corporate and national borders. Rather than focusing primarily on institutions or policies, this narrative follows technology as it is embodied and carried by its key actors—the engineers and scientists moving between the United States, South Korea, and occasionally, Taiwan and Japan. This method shares similarities with Bruno Latour’s well-known injunction to “follow scientists and engineers.” However, an actor-focused methodology risks creating a fragmented narrative when an actor becomes invisible in the historical record. Latour himself exemplified this by using the case of Joao Dellacruz’s attempt to develop semiconductors in Brazil. Dellacruz’s ambitious project for self-sufficiency ultimately faded into obscurity, ending as a case of failure.¹² This illustrates Latour’s advice that “if your actors don’t act [...] just shut up.”¹³ This paper, however, does not stop at such moments. By faithfully following a specific technology rather than an individual or a group, this study constructs a technology-centered, rather than an actor-centered, narrative. While this technology-centric perspective may at first seem to run counter to the broader trends in Science and Technology Studies (STS), I argue that, on the contrary, it can make previously obscured actors more visible. By weaving together their fragmented and partially invisible stories through the common thread of technological development and migration, this approach can uncover a history that has not yet been fully told.¹⁴ This technology-centered approach will demonstrate that South Korean semiconductor technology history is deeply intertwined with—and extends back to—the very emergence of foundational semiconductor technologies in the United States.

¹² Bruno Latour, *Science in Action: How to Follow Scientists and Engineers through Society* (Cambridge, MA: Harvard University Press, 1987), 150–53. Latour notes that his account of the Dellacruz case is a “collage,” indicating that it is an illustrative example constructed from various existing sources rather than his own primary research; for his specific use of the term, see 262. For a recent study of the Argentine case, see Fernanda A. Soca and Mariana E. Di Bello, “Fragile Foundations: Tracing Argentina’s Semiconductor Saga amid Institutional Turmoil,” *Technology and Culture* 65:2 (2024), 555–70. For a case study on computer development in Bulgaria, see Victor Petrov, *Balkan Cyberia: Cold War Computing, Bulgarian Modernization, and the Information Age behind the Iron Curtain* (Cambridge, MA: MIT Press, 2023). For a study analyzing the formation of the U.S. military’s global market with a focus on the career of Ki Dong Kang, see Patrick Chung, “Militarized Circuits: Kang Ki Dong, the US Military, and the Rise of Global High Tech,” in Jennifer Mittelstadt and Mark R. Wilson eds. *The Military and the Market* (Philadelphia: University of Pennsylvania Press, 2022).

¹³ Bruno Latour, *Reassembling the Social: An Introduction to Actor-Network-Theory* (Oxford: Oxford University Press, 2005), 150.

¹⁴ Similarly, the essays in Gabrielle Hecht’s edited volume traces the global mobility of technologies to reveal how the previously fragmented histories of the metropole and the periphery were, in fact, deeply “entangled.” Gabrielle Hecht eds. *Entangled Geographies: Empire and Technopolitics in the Global Cold War* (Cambridge, MA: MIT Press, 2011).

The focal point of this study is the metal-oxide-semiconductor (MOS) technology, chosen for two critical reasons. First, MOS represents the most fundamental technology in modern semiconductors, enabling device integration that made integrated circuits possible. According to the assessment of historian Ross Bassett, MOS technology facilitated humanity's transition into the digital age.¹⁵ Second, MOS technology played a pivotal role in the growth of the East Asian semiconductor industry. Leading manufacturers today—TSMC, Samsung Electronics, SK Hynix, and Intel—all possess complementary MOS (CMOS) manufacturing capabilities and share the historical characteristic of adopting (C)MOS relatively early. Significantly, the 1970s witnessed two parallel developments: just as Silicon Valley was emerging as a technology hub and MOS was becoming mainstream in the United States, East Asian countries were simultaneously acquiring mass production capabilities for (C)MOS, along with skilled technical personnel. This chronology challenges conventional narratives of East Asian technological development. Rather than beginning with government policies and corporate strategies in the 1980s, the technological foundations were established much earlier through direct engagement with emerging semiconductor technologies in the United States.

By centering the narrative on a specific technology rather than institutions or policies, this paper seeks a broader perspective on the historical development of the semiconductor industry. Sungook Hong has argued that microhistorical approaches alone cannot comprehensively explain the relationship between science and technology, advocating for macrohistorical perspectives that reveal the gradual blurring of boundaries between them.¹⁶ Similarly, Frans van Lunteren proposed a machine-based “big picture” for understanding the history of modern science through the lens of specific artifacts.¹⁷ The interdisciplinary nature of semiconductor technology—seamlessly blending physics, chemistry, materials science, and electrical engineering—offers an opportunity for transcending disciplinary, geographical, and temporal boundaries. Existing scholarship has already demonstrated some aspects of this interconnectedness. Hyungsub Choi's work illuminates the active transfer of early transistor manufacturing technology from the

¹⁵ Ross Knox Bassett, *To the Digital Age: Research Labs, Start-up Companies, and the Rise of MOS Technology* (Baltimore: Johns Hopkins University Press, 2003). For representative studies on the history of semiconductor technology in the United States, including MOS, see Cyrus C.M. Mody, *The Long Arm of Moore's Law: Microelectronics and American Science* (Cambridge, MA: MIT Press, 2017); Christophe Lécuyer, *Making Silicon Valley: Innovation and the Growth of High Tech, 1930–1970* (Cambridge, MA: MIT Press, 2005); Arnold Thackray, David C. Brock, and Rachel Jones, *Moore's Law: The Life of Gordon Moore, Silicon Valley's Quiet Revolutionary* (New York: Basic Books, 2015).

¹⁶ Sungook Hong, “Historiographical Layers in the Relationship between Science and Technology,” *History and Technology* 15:4 (1999), 289–311.

¹⁷ Frans van Lunteren, “Clocks to Computers: A Machine-based ‘Big Picture’ of the History of Modern Science,” *Isis* 107:4 (2016), 762–76.

United States to Japan, highlighting the Japanese firms' agency beyond passive reception.¹⁸ Honghong Tinn's research on Taiwan reveals the dynamic "tinkering" activities of engineers and operators, demonstrating their active rather than merely imitative roles when facing technological challenges.¹⁹

This paper utilizes the global trajectory of MOS technology as a lens to write a more integrated history of the semiconductor industry. By following MOS from its "American origins" to the manufacturing centers of East Asia—and critically, by examining how engineers from East Asia were deeply intertwined in its initial development—this study challenges the simple narrative of diffusion from a technological center to a passive periphery. This approach prompts a re-examination of the very concept of a singular "American origin," revealing it as a globally entangled story from its inception. This entanglement becomes visible by tracing the subterranean connections the technology forged between otherwise disparate historical frameworks: the American military-industrial-academic complex, the vertical integration of East Coast firms, the horizontal networks of Silicon Valley, and the state-led industrial policies of East Asia.

A Dead End in the Microelectronics Revolution: Kahng Dawon's Invention of MOS

During the Cold War, American science developed in close conjunction with the military-industrial-academic complex, particularly in physics, materials science, electrical engineering, and aeronautical engineering.²⁰ Military patronage drove research with explicit defense objectives, with the military serving as both primary consumer and "institutional entrepreneur," leading technological development through sponsored research and industry dissemination.²¹ Semiconductor technology emerged at AT&T's Bell Telephone Laboratories within this environment. When the transistor was invented at Bell Labs in 1949, AT&T initially intended it as a replacement for vacuum tubes in mechanical telephone relays. However, the U.S. Army Signal Corps immediately recognized its potential for miniaturizing military

¹⁸ Hyungsub Choi, "Technology Importation, Corporate Strategies, and the Rise of the Japanese Semiconductor Industry in the 1950s." *Comparative Technology Transfer and Society* 6:2 (2008), 103–26.

¹⁹ Honghong Tinn, *Island Tinkerers: Innovation and Transformation in the Making of Taiwan's Computing Industry* (Cambridge, MA: MIT Press, 2025).

²⁰ Stuart W. Leslie, *The Cold War and American Science: The Military-Industrial-Academic Complex at MIT and Stanford* (New York: Columbia University Press, 1993).

²¹ Thomas J. Misa, "Military Needs, Commercial realities, and the Development of the Transistor, 1948-1958," in Merritt Roe Smith eds. *Military Enterprise and Technological Change* (Cambridge, MA: MIT Press, 1985), 253–87, 268.

communications equipment and began funding transistor R&D. The Korean War (1950–1953) significantly accelerated this trend, serving as a pivotal moment when military R&D spending more than doubled, with increased funds channeled directly into transistor manufacturing technology development.²²

The Korean War also served as an informal conduit for introducing advanced electronic technologies to Korea. North Korea's sudden invasion rapidly pushed front lines southward, making Busan the provisional capital. There, a unique confluence of war materiel accumulated: broken military radios from front lines and supplies unofficially diverted from U.S. military bases. These items, along with electronic components smuggled from Japan, circulated in local markets and reached radio repair shops. These markets became learning grounds for teenagers interested in technology, who repurposed vacuum tubes from broken radios into new devices and formed amateur radio leagues. This hobbyist culture, extending back to the colonial period and familiar with Japanese products, gained new exposure to American electronic technology during the Korean War, highlighting the technological gap between Japan and the United States in electronics. Many bright teenage radio enthusiasts subsequently left war-devastated Korea to pursue advanced studies in the United States.²³

After the Korean War's height, the U.S. military showed significant interest in a particular method of semiconductor manufacturing, namely the diffusion process. The Army Signal Corps heavily supported diffusion research at Bell Labs, viewing it as breakthrough technology for high-frequency device development.²⁴ This research occurred within the military-industrial-academic complex framework, exemplified by the collaboration between Bell Labs and Ohio State University's (OSU) Electrical Engineering Department. Marlin O. Thurston, a new OSU professor, led the diffusion process project beginning in the late-1950s, supported by the Air Force Office of Scientific Research and Army Signal Corps in conjunction with Bell Labs. Among the researchers participating in this project were South Korean graduate students Kahng Dawon (at OSU, 1954–1959) and Kang Ki Dong (at OSU, 1958–1962). Both of them came to the United States after graduating from Seoul National University with physics and electrical engineering degrees respectively. Subsequently, Joseph Cho Chuan Tsai, a Taiwanese graduate student, also joined the laboratory.²⁵ Thus, since the inception of the diffusion process in the

²² Ibid., 266–67.

²³ Sangwoon Yoo and Dongwon Jo, “From Walkie-talkie to Radio Receiver: An Entangled History of Electronic Technological Culture and the Beginning of Semiconductor Industry 무전기에서 라디오로 – 전자 기술 문화와 반도체 산업 발달의 착종사,” *The Korean Journal for the History of Science 한국과학사학회지* 43:3 (2021), 557–600.

²⁴ Misa, op.cit. (note 21), 270–72.

²⁵ Dawon Kahng, “Phosphorus Diffusion into Silicon through an Oxide Layer” (Ph.D. dissertation, Ohio State University, 1959); Ki Dong Kang, “Diffusion of Impurities into Silicon through an Oxide Layer” (Ph.D. dissertation, Ohio State University, 1962); Joseph Tsai, “The Simultaneous

United States, Korean and Taiwanese graduate students have contributed to its development within an OSU laboratory collaborating with Bell Labs.

Kahng and Kang meticulously replicated Bell Labs' experimental equipment at OSU laboratory, photographing setups to ensure precise installation for collaborative research. Both Thurston's OSU lab and Bell Laboratories were deeply engaged in problem-solving related to semiconductor surface issues. In 1955–56, Carl Frosch and Lincoln Derick at Bell Labs discovered that thermal oxidation could form an insulating silicon dioxide (SiO_2) layer on silicon. Building on this, in 1958, Martin (John) M. Atalla, an Egyptian-born mechanical engineer who had transferred from Bell Labs' New York branch to Murray Hill, demonstrated that silicon surfaces could be electrically stabilized using this oxide layer. This was a revolutionary breakthrough because it transformed the oxide layer, previously considered "dirty" as a source of transistor defects, into a "clean" and stabilizing component.²⁶ Concurrently, OSU's Thurston, in collaboration with L.A. D'Asaro of Bell Labs, developed the "closed box system" diffusion technique.²⁷ Based on this system, Thurston's team worked to expand and quantify Atalla's findings, undertaking a project to elucidate the diffusion mechanism of impurities into Si-SiO₂ that determines the electrical properties of semiconductors.²⁸

Upon completing his Ph.D. under Thurston in 1959, Kahng immediately joined Bell Labs as a research scientist, becoming part of Atalla's new team. His extensive research experience at OSU on silicon oxide film diffusion and interface behavior provided crucial theoretical and experimental expertise. In December 1959, Kahng sketched a structure in his laboratory notebook involving SiO₂ formation on silicon substrate with a metal electrode placed on top to induce field effect—marking the genesis of the metal-oxide-semiconductor (MOS) structure, although he did not use the term "MOS" at that time.²⁹ His accumulated expertise in interface physics and diffusion dynamics, coupled with Atalla's surface passivation technique, provided

Diffusion of Donor and Acceptor Impurities into Silicon" (Ph.D. dissertation, Ohio State University, 1962).

²⁶ Christophe Lécuyer and David C. Brock. *Makers of the Microchip: A Documentary History of Fairchild Semiconductor* (Cambridge, MA: MIT Press, 2010), 30, 111–13.

²⁷ Kahng, op. cit. (note 25), 4; L. A. D'Asaro, "Diffusion and Oxide Masking in Silicon by the Box Method," *Solid-State Electronics* 1 (1960), 3–12.

²⁸ Dawon Kahng and M. O. Thurston, "Research on Diffusion of Impurities into Silicon Through an Oxide Layer," Quarterly Technical Report No. 2, Contract No. DA-36-039-SC-83874, submitted to the U.S. Army Signal Supply Agency (Columbus, OH: The Ohio State University Research Foundation, July, 1959), Ohio State University Research Foundation (OSURF) Research Project Files, RG 38.O, Ohio State University Archives, Ohio State University.

²⁹ Dawon Kahng, Laboratory Notebook no. 32560 (1959), 3, location U52 SH 7B, AT&T Archives, Murray Hill, NJ. In his notebook, Kahng credited his team colleagues, Atalla and Richard Lindner. Meanwhile, Ernest Labate, a technician in the same group, had drawn a structure similar to MOS in his notes before Atalla, although he did not use silicon dioxide. Bassett, *To the Digital Age* (note 15), 325.

the theoretical coherence for a completely new device structure operating by field effect, later known as MOSFET (MOS Field Effect Transistor). Bell Labs and Thurston's OSU lab operated in synchronization under Signal Corps support. Meanwhile, Kang Ki Dong, completing his doctoral studies at OSU, worked on refining the closed box system for precise diffusion process control.³⁰ Kahng successfully fabricated this device and officially reported his findings in a 1961 Bell Labs internal technical memorandum titled "Silicon-Silicon Dioxide Surface Device."³¹

The period from 1958 to 1961, during which Kahng and Kang conducted diffusion experiments, was revolutionary for semiconductor technology. This era saw the integration of various components—transistors, resistors, and capacitors—onto single semiconductors, technology now known as integrated circuits (IC), being invented independently and simultaneously in multiple locations.³² In Japan, Tarui Yasuo of the MITI Electrotechnical Laboratory filed a patent in 1957 for a device combining various transistor types within a single semiconductor crystal, though he did not use the term "integrated circuit."³³ In the United States, Jack Kilby of Texas Instruments successfully tested the world's first integrated circuit in 1958 and filed a patent in 1959.

Bell Labs' discoveries significantly contributed to IC development by a West Coast company that gave rise to what would become known as Silicon Valley. In 1957, the Fairchild Semiconductor Company was founded in Palo Alto, California, by the eight scientists and engineers who had departed from William Shockley's tyrannical Shockley Semiconductor. Known as the "traitorous eight," these men came up with the concept of manufacturing integrated circuits through the planar process, rather than Kilby's proposed wiring method. Bell Labs' 1958 research demonstrating electrical stabilization of silicon surfaces by silicon oxide layers was adopted by Jean Hoerni of Fairchild, leading to his development of the planar process.³⁴ By 1961, both Texas Instruments and Fairchild Semiconductor had successfully developed the first commercial ICs.

³⁰ M. O. Thurston, "Monthly Status Report No. 10: Research on Diffusion of Impurities into Silicon through an Oxide Layer," submitted to the U.S. Army Signal Supply Agency, Contract DA-36-039-SC-83874 (Columbus, OH: The Ohio State University Research Foundation, March 8, 1960), Ohio State University Research Foundation (OSURF) Research Project Files, RG 38.O, Ohio State University Archives, Ohio State University.

³¹ Dawon Kahng, "Silicon-Silicon Dioxide Surface Device," Technical Memorandum MM-61-2821-1, (Murray Hill, NJ: Bell Telephone Laboratories, January 16, 1961), 1–22, Filecase 38589-35, AT&T Archives.

³² Hyungsub Choi and Cyrus C. M. Mody, "The Long History of Molecular Electronics: Microelectronics Origins of Nanotechnology," *Social Studies of Science* 39:1 (2009), 11–50.

³³ Hyungsub Choi, "Failure to Launch: Tarui Yasuo, the Quadrupole Transistor, and the Meaning of the IC in Postwar Japan," *IEEE Annals of the History of Computing* 34:1 (2010), 48–59.

³⁴ Bassett, *To the Digital Age* (note 15), 45–53.

Despite silicon oxide passivation technology's significant contribution to planar process and IC development, the MOS technology that Kahng further developed using this same technique was initially perceived as a "dead end" with limited commercial potential.³⁵ Bell Laboratories considered this work neither particularly novel nor commercially viable, viewing it as "pathological technology" due to the accompanying technical problems.³⁶ The core issue lay in the fundamental difference between MOS technology and bipolar junction transistors (BJT), which dominated semiconductor manufacturing at the time. BJTs controlled electrical current flow deep within the bulk silicon material, allowing them to largely circumvent the persistent challenge of electrical instability at the semiconductor surface. MOS technology, by contrast, was designed to exploit this very surface effect. It employed an electric field from a gate electrode to create or eliminate a conductive channel directly on the semiconductor's surface, making its performance critically dependent on precise control of surface properties. This surface dependency caused MOS devices to suffer from significant impurity and defect issues that severely compromised their reliability, rendering the technology commercially challenging and reinforcing its perception as a technological dead end.

Beyond these technical challenges, the advantages and disadvantages of MOS technology held little appeal for the U.S. military, which served as the primary consumer of semiconductor technology at the time. Although MOS offered the potential for significantly higher integration density compared to existing BJTs, its relatively slower operating speed represented a critical drawback. This performance characteristic made MOS technology particularly unattractive to military applications, where high-speed computing capabilities took precedence over integration density. Consequently, following the invention of MOS, Bell Laboratories discontinued the project entirely. This decision prompted Atalla to resign and move to Hewlett Packard, while Kahng shifted his research focus to other topics. The "possibility of application in integrated circuits" that Kahng had modestly suggested in his 1961 internal memorandum now appeared to be a distant and unlikely prospect.³⁷

From Dead End to Niche: The Formation of the MOS Civilian Market

The emergence of the planar process as a manufacturing standard unveiled a positive, clear vision for the future of ICs. Moore's Law, first articulated in the 1965 article

³⁵ Ibid., 33.

³⁶ Ibid., 11.

³⁷ Dawon Kahng, "Silicon-Silicon Dioxide Surface Device" (note 31), 22.

published in the *Electronics* magazine, exemplified this vision. In his initial draft, Gordon Moore, a Fairchild physical chemist and director of R&D, presented an outline of the short history of ICs: “The first point on this plot corresponds to the manufacturing of the first planar silicon transistor, which can be considered a starting point for the present semiconductor integrated technology.” Then, he went on to predict that component density would double every year. Moore made a radical prediction for his time, envisioning that all electronic devices would eventually incorporate ICs—a forecast largely materialized today, despite ICs primarily serving military applications at the time. Increased integration density and mass production capability were made possible by planar process standardization, facilitating “a readily available supply of low-cost functional packages.”³⁸

The “readily available supply of low-cost functional packages” enabling Moore’s envisioned future was expected to come from East Asia. Manufacturing process standardization based on the planar process facilitated the formation of a global supply chain business model, where chip fabrication occurred in the United States while back-end processes like assembly and packaging utilized inexpensive East Asian labor. Turning their attention to East Asia in the mid-1960s, American semiconductor manufacturers such as Fairchild established factories first in Hong Kong and then in South Korea.³⁹ The South Korean government provided exceptional tax incentives for foreign investment, making South Korea the preferred location among East Asian countries.⁴⁰ Following this, Motorola and Signetics also constructed assembly plants in South Korea.⁴¹ Signetics celebrated in its internal publications that they had “discovered” diligent and skilled South Korean female workers (see Figure 1).⁴²

³⁸ Gordon Moore, “The Future of Integrated Electronics,” Fairchild Semiconductor internal publication (1964) in David Brock eds. *Understanding Moore’s Law: Four Decades of Innovation* (Philadelphia: Chemical Heritage Foundation, 2006).

³⁹ Christophe Lécuyer, “Silicon for Industry: Component Design, Mass Production, and the Move to Commercial Markets at Fairchild Semiconductor, 1960–1967,” *History and Technology* 16:2 (1999), 179–216; Christophe Lécuyer, *Making Silicon Valley: Innovation and the Growth of High Tech, 1930–1970* (Cambridge, MA: MIT Press, 2005), 201–2; Cyrus C. M. Mody, *The Squares: US Physical and Engineering Scientists in the Long 1970s* (Cambridge, MA: MIT Press, 2022), 237.

⁴⁰ Jeong-Ro Yoon, “The State and Private Capital in Korea: The Political Economy of the Semiconductor Industry, 1965–1987” (Ph.D. dissertation, Harvard University, 1989).

⁴¹ For a recent and insightful study on the operation of Signetics’ overseas factories, see Cyrus C. M. Mody, *The Squares: US Physical and Engineering Scientists in the Long 1970s* (Cambridge, MA: MIT Press, 2022), 219–58; Kyle Stine, “The Logistics of Labor and Life at Signetics,” *IEEE Annals of the History of Computing* 46:2 (2024), 52–64.

⁴² “Meanwhile, Across the Sea of Japan,” in Sig-Kor Corporate Scrapbook, 1966–1991, Box 33, Folder 102700719, Computer History Museum Shustek Research Archives.



Figure 1 (Top) Signetics Korea assembly plant in Yeomchang-dong, Seoul, photographed in 1976. (Bottom) The founding members of Signetics Korea. Sources: (Top) Computer History Museum Archives, Box 27, Folder 102700656; (Bottom) Computer History Museum Archives, Box 33, Folder 102700719.

As late as the mid-1960s, most commercially-manufactured transistors were BJTs, and MOS technology was not yet fully embraced by industry. Amid the industry's general reluctance to pursue commercialization of MOS, RCA stood out as a notable exception, showing keen interest in MOS technology. RCA had separated research

and production facilities during the 1950s,⁴³ allowing the MOS technology laboratory to continue its research without facing intense competition from mature, high-performing BJTs. In spring 1960, William Webster, RCA's Director of Research, visited Bell Labs and expressed significant interest in Kahng and Atalla's work, conveying this to his research team. Subsequently, RCA researchers including Charles Mueller and Karl Zaininger successfully manufactured MOS devices internally.⁴⁴ On the West Coast, interest in MOS also began to emerge, though initially somewhat lukewarm compared to RCA's enthusiasm. Gordon Moore initially showed little MOS interest, but in Fairchild's relatively free research environment, Frank Wanlass, a young physicist who had received his Ph.D. from the University of Utah, and Sah Chih-Tang, a Chinese immigrant electrical engineer with a Ph.D. from Stanford University, developed a low-power complementary MOS (CMOS) device as an improved MOS version.⁴⁵

During this period, most semiconductor manufacturers handled MOS technology only at the laboratory level without moving into mass production. A contributing factor was the reluctance of the engineers experienced in BJTs to accept MOS. MOS processes often appeared incomprehensible from the perspective of BJT engineers. This challenge was common among companies like RCA and Fairchild with insulated research and manufacturing divisions.⁴⁶ Even after developing CMOS at Fairchild, Moore became interested in MOS but found it difficult to persuade others of its importance. Moore articulated this difficulty:

My laboratory developed the science of how to make MOS microchips stable and the technology of how to make the devices, yet we were unable to transfer that to manufacturing. It was very difficult to get people experienced with the earlier bipolar technology to believe everything that had to be done. They were unwilling to accept that it required special incantations to make it work.⁴⁷

Indifference toward MOS technology was equally pronounced at Texas Instruments (TI), another birthplace of ICs. They underestimated the potential of MOS technology, leading TI to allocate only a small eight-engineer team to MOS research. This team ultimately resigned as a group in 1968 to found Mostek, a company specifically focused on advancing MOS technology.⁴⁸

⁴³ Hyungsub Choi, "The Boundaries of Industrial Research: Making Transistors at RCA, 1948–1960," *Technology and Culture* 48:4 (2007), 758–82.

⁴⁴ Bassett, *To the Digital Age* (note 15), 41–45.

⁴⁵ *Ibid.*, 50–53.

⁴⁶ Choi, "The Boundaries of Industrial Research" (note 43).

⁴⁷ Thackray, Brock, and Jones, *Moore's Law* (note 15), 265.

⁴⁸ Morris Chang 張忠謀, chap. 6, "Undertaking MOS 承接MOS," *The Autobiography of Morris Chang, Part 2* 張忠謀自傳 下冊 (台北: 天下文化, 2024).

Among companies stepping forward to address the persistent surface issues that plagued conventional semiconductor manufacturing was Motorola. The company's commitment to solving these fundamental problems became evident when C. Lester Hogan, General Manager of Motorola's Semiconductor Products Division, presented at the June 1964 *IEEE Spectrum* industry forum. Speaking as the opening presenter among semiconductor industry leaders, Hogan discussed how surface material selection directly impacted IC performance and manufacturing costs.⁴⁹ Hogan's presentation reflected Motorola's substantial investment in surface research. Two years earlier, in 1962, he had established a dedicated "surface studies" laboratory within his division and recruited Kang Ki Dong, a recent Ohio State University graduate and former colleague of Dawon Kahng, to manage this critical facility. When Kang issued a nationwide call for Ph.D.-level researchers, the response proved insufficient to meet their ambitious goals. This recruitment challenge was compounded by Motorola's Semiconductor Products Division's unique circumstances: located in Phoenix, Arizona, it operated more like a production facility than a conventional research laboratory and remained geographically removed from other major semiconductor manufacturers. Consequently, Kang ended up filling approximately half the open positions with Korean Ph.D.s who had completed their studies in the United States, such as Woo Dae-sik, Kwon Young-deok, and Kim Jeong-kyu.⁵⁰

Interest in MOS technology grew as new commercial markets, distinct from the existing military sector, gradually opened up during the mid-1960s. The civilian applications included pocket calculators and electronic wristwatches, consumer products that required fundamentally different semiconductor characteristics than military equipment. The automotive industry presented another significant opportunity. As automobile safety regulations strengthened in the United States, car manufacturers sought to develop systems that would prevent ignition if seatbelts remained unfastened. Such systems required ICs capable of detecting seatbelt engagement even when engines were turned off and main power was disconnected, demanding exceptional power efficiency for continuous monitoring. These emerging applications—calculators, watches, and automotive safety systems—shared a common requirement that distinguished them from conventional military technology. Rather than prioritizing high processing speed, these civilian markets demanded lower-power consumption and higher integration density to enable compact, battery-operated devices. MOS technology, and particularly its improved

⁴⁹ C. Lester Hogan, "Types of Integrated Circuits," *IEEE Spectrum* 1:6 (June, 1964), 63–71; David Brock eds. *Understanding Moore's Law* (note 38), 30.

⁵⁰ Ki Dong Kang, *Ki Dong Kang and Hanguk Semiconductor: An Autobiography of Ki Dong Kang* (강기동과 한국반도체: 강기동 자서전 (Seoul: Amormundi, 2018), 140–54.

version CMOS, offered precisely these characteristics, providing distinct advantages over the existing BJTs that dominated military applications.

The Rise of Silicon Valley and the East Asian Engineers Behind the Scenes

In the dynamic environment created by emerging MOS niche markets during the mid-to-late 1960s, East Asian engineers actively sought various channels to acquire MOS technology. Japanese semiconductor engineers diligently attended and photographed American conference presentations. This behavior caused U.S. engineers to sarcastically nickname Japan the “click, click” country, though most American companies initially dismissed these activities as harmless.⁵¹ Such aggressive technology acquisition was hardly unique to Japanese engineers. The American semiconductor industry itself operated within a culture of intense information exchange and employee mobility that frequently crossed legal boundaries. Reciprocal lawsuits over employee poaching and intellectual property transfer had become commonplace among U.S. companies. Legal battles surrounding the fundamental patents for integrated circuits continued unresolved between Texas Instruments and Fairchild throughout the late 1960s. The industry’s fluid employment practices were exemplified when Kang Ki Dong’s supervisor, C. Lester Hogan, moved from Motorola to Fairchild with a substantial team of engineers, prompting Motorola to file suit for technology leakage.⁵²

For Japanese engineers seeking MOS technology, Korean engineers served as crucial intermediaries. Both Kang Ki Dong and Kahng Dawon, born during the Japanese colonial period (1910-1945), possessed fluent Japanese language skills that proved invaluable for technology transfer. At Motorola, whenever Japanese corporate officials visited the facility, Kang’s supervisors routinely asked him to serve as their host. Under his guidance, these delegations received comprehensive tours of Motorola’s surface research laboratory and pilot line, with full access for photography and technical discussions. These personal connections extended far beyond formal corporate visits. Michiyuki Uenohara exemplified the deep professional networks that facilitated technology transfer. Having earned his Ph.D. from Ohio State University’s Electrical Engineering Department at the same time as Kahng, Uenohara built his early career alongside Kahng at Bell Laboratories. When he moved to the Japanese semiconductor manufacturer Nippon Electric Company (NEC) in the early 1970s as vice president, he continued to engage in technical exchanges with his former colleague. Similarly, Jun-ichi Nishizawa—who would

⁵¹ Miller, *Chip War* (note 3), 82.

⁵² Lécuyer, *Making Silicon Valley* (note 15), 361.

later earn recognition as the “Godfather of Japan’s semiconductor industry”—cultivated ongoing relationships with Kang at Motorola.⁵³ As MOS technology evolved from laboratory curiosity to commercial reality, its migration from the United States to East Asia occurred not through formal agreements alone, but through the accumulated personal connections of Korean engineers who served as bridges between American military-industrial complex and Japanese electronics industry.

Following Hogan’s departure to Fairchild, Kang began developing plans for a CMOS manufacturing business in Korea. Recognizing the need for practical experience in establishing production facilities, he left Motorola in 1970 and joined Stewart Warner, a small company in Sunnyvale. Stewart Warner entrusted Kang with a project perfectly suited to his long-term goals: establishing a CMOS manufacturing line for automotive seatbelt systems. Kang approached this assignment strategically, viewing the manufacturing line as a pilot project that would provide essential experience for the facility he intended to establish in Korea.⁵⁴ During this same period, other Taiwanese and Korean engineers were positioning themselves within the American semiconductor industry. At Texas Instruments—one of the birthplaces of the integrated circuit—renewed interest in MOS technology led to the formation of a new research and development team focused on calculator ICs. In 1971, TI appointed Morris Chang to manage this MOS R&D team. Chang, a Taiwanese engineer who had joined TI in 1958 and contributed significantly to improving integrated circuit yields, would later apply his accumulated experience to establish TSMC in Taiwan.⁵⁵

Disappointed by Fairchild management’s indifference to MOS, Gordon Moore and Robert Noyce founded Intel in 1968. Ironically, their departure prompted Fairchild to reconsider MOS technology’s potential, particularly focusing on an emerging application: Charge-Coupled Device (CCD) technology. The CCD concept had emerged from Bell Labs in 1969, when Willard S. Boyle and George E. Smith devised a method for storing and transferring electrical charges using arrays of MOS capacitors—work that would eventually earn them the 2009 Nobel Prize in Physics. Fairchild’s Device Physics and Development Department recognized the commercial potential and launched efforts to transform the theoretical concept into practical devices. Kim Choong Ki, who had earned his electrical engineering degree from Columbia University in 1970, joined Fairchild’s CCD development team at this critical juncture.⁵⁶ Kim and his colleagues confronted the fundamental technical challenges that stood between laboratory concept and commercial reality. They methodically addressed the problems such as gate-to-substrate leakage, gate-to-gate

⁵³ Interview with Ki Dong Kang, 2021. 2. 22.

⁵⁴ Ki Dong Kang, *Ki Dong Kang and Hanguk Semiconductor* (note 50), 203–04.

⁵⁵ 張忠謀 (Morris Chang), “承接MOS Undertaking MOS” (note 48).

⁵⁶ Dong-Won Kim, *Making a Semiconductor Superpower* (note 8), 33–36.

shorts, and high-field breakdown—issues that had to be resolved to enable reliable charge storage and transfer in silicon devices. The team's progress proved substantial enough that Fairchild reorganized its development structure. In 1972, the company elevated the CCD project from a sub-unit within the Device Physics and Development Department to an independent CCD Department, with Kim assuming a leadership role. Under his guidance, the team achieved a significant breakthrough by developing buried-channel charge-coupled devices, representing a major advancement in CCD technology.⁵⁷

In 1971, American technology journalist Don Hoefler coined the term “Silicon Valley USA” to describe the rapidly growing semiconductor industry cluster in Santa Clara Valley, south of San Francisco.⁵⁸ This naming marked the moment when the region gained widespread recognition as the global center of semiconductor innovation. The emergence of Silicon Valley as a distinct industrial region coincided with a fundamental technological transition in semiconductor manufacturing—the shift from traditional BJT to MOS technology.⁵⁹ This period also witnessed the formation of a new industrial ecosystem that would define Silicon Valley's distinctive character. Beginning in the late 1960s, specialized equipment suppliers emerged as independent companies, developing sophisticated knowledge of semiconductor fabrication processes. These third-party vendors represented a departure from the previous model where semiconductor manufacturers had developed their own equipment internally.⁶⁰ Within this dynamic environment, East Asian engineers played crucial but often less visible roles in solving the technical challenges that made Silicon Valley's success possible. Working within American companies, these engineers accumulated substantial knowledge and experience in MOS manufacturing technology while contributing to the fundamental technical breakthroughs that established the region's technological leadership.

⁵⁷ Fairchild Semiconductor Research and Development Laboratory, Monthly Technical Summary, August–December, 1970; February, March, May, July, and December, 1971; January and April, 1972. Reports include: “Device Physics and Development Department (32-60): Charge Coupled Devices (C. Kim)” (1970–1971); “Charge-Coupled Device Department (G. Amelio): CCLID-500/60 Linear Photoarray Development (C.-K. Kim, B. Person, et al.)” (1971–1972). Fairchild Camera and Instrument Corporation, Research and Development Division, Technical Reports and Progress Reports, 1965–1987, Call Number M1055, Boxes 17–19, Fairchild Collection, Stanford University Special Collections.

⁵⁸ Don Hoefler, “Silicon Valley U.S.A.,” *Electronic News*, January 11, 1971.

⁵⁹ Arnold Thackray, David C. Brock, and Rachel Jones, *Moore's Law* (note 15), 319–22.

⁶⁰ Hyungsub Choi, “A Secret Force in the Silicon Revolution,” *Chemical Heritage* (Spring 2008): 36–7.

Bottom-up Technology Transfer and Top-down Policy Formation

Upon completing the CMOS fabrication line at Stewart Warner, Kang Ki Dong founded Hanguk Semiconductor in 1974, bringing together the technical team he had carefully assembled. The company established a manufacturing facility, or fab, in Bucheon, near Seoul, that represented a revolutionary advancement in Korean semiconductor capabilities. Unlike the existing assembly plants that packaged chips designed and fabricated in the United States, this facility focused on front-end CMOS chip fabrication—the actual creation of semiconductor devices from silicon wafers. Kang’s business model ingeniously mirrored the emerging Silicon Valley approach to global manufacturing. He established Integrated Circuit International, Inc. (ICII), an American company based in Sunnyvale, California, to serve as the crucial link between American equipment suppliers and his Korean facility. Through ICII, Kang ordered cutting-edge equipment from newly established local equipment companies, warehoused them at ICII’s facility, and then shipped the complete systems across the Pacific in containers to the Bucheon fab. From the Korean perspective, Hanguk Semiconductor appeared as a Korean-American joint venture, with capital jointly provided by the Korean company Kemco, a communications equipment importer that had accumulated capital as the Korean agent for Collins radio transceivers, and the American firm ICII. This structure enabled Kang to access both Silicon Valley’s technological resources and Korea’s manufacturing advantages while navigating the complex regulatory environments of both countries.⁶¹

Hanguk Semiconductor’s initial engineering team drew from Korea’s existing semiconductor workforce. Park Deung-yoon, who had worked at Motorola’s Korean assembly plant from its inception until 1974, became the company’s first engineer. The second and third engineering positions went to Song Dae-ho and Lee Ki-yoon, both of whom had gained experience at Signetics Korea.⁶² Although none of them possessed direct experience in chip fabrication processes, their backgrounds working at assembly plants for major U.S. semiconductor manufacturers had equipped them with knowledge of semiconductor production and, crucially, strong English proficiency that would prove essential for technology transfer. Kang sent these engineers to American equipment and facility companies for training to learn the

⁶¹ Department of Home Affairs 내무부, “Documents related to notification of land acquisition permit for foreigners and foreign corporations – Hanguk Semiconductor Corporation 외국인 및 외국법인의 토지에 관한 권리 취득 허가신고 서류철 – 한국반도체 주식회사,” LC DMI014_01 v.89 and v.129, 1974–1975, Archives of Korean History.

⁶² Interview with Deung-yoon Park, 2025. 6. 19; Interview with Ki-yoon Lee, 2025. 7. 17.

manufacturing processes and compile equipment procurement lists. The company simultaneously recruited a substantial workforce of skilled technicians and operators. Many came from prestigious technical high schools, including Seoul Technical High School's electrical department, while others were graduates of academic girls' high schools. These individuals possessed excellent academic credentials and had demonstrated strong technical aptitude, though most had forgone university enrollment primarily due to economic constraints (see Figure 2).⁶³

⁶³ Interview with Deung-yoon Park, 2025. 6. 19; Interview with Yeon-Jin Lee, 2023. 2. 15.



Figure 2 The founding members of Hanguk Semiconductor—including the CEO, engineers, technicians, operators, and administrative staff—in front of the Bucheon fab in 1974. Seated in the front row are engineer Park Deung-yoon (far left), CEO Kang Ki Dong (third from left), and ICII investor Joe Sudduth (fourth from left). Also pictured are engineers Song Dae-ho (middle row, third from right) and Lee Ki-yoon (top row, fifth from right). Source: Courtesy of Kang Ki Dong.

In the early to mid-1970s, growing interest in MOS and CMOS chips created significant market opportunities, yet the transition from laboratory-level development to reliable mass production remained a formidable challenge. Many American semiconductor companies struggled with internal organizational dysfunction that hindered technology commercialization. The separation between research and manufacturing departments frequently led to mutual blame when technical problems arose, with each division attributing failures to the other's incompetence. RCA exemplified this dysfunction when conflict erupted between its research and manufacturing divisions over the performance of newly introduced ion implanters for CMOS production.⁶⁴ Intel's founders, having witnessed similar organizational problems at Fairchild, took a radical approach to avoid these pitfalls. When Gordon Moore and Robert Noyce established Intel in 1968, they deliberately chose not to create a separate research department—a decision sometimes characterized as the “end of research.”⁶⁵ The burgeoning relationship between numerous equipment companies and semiconductor manufacturers also posed challenges, with frequent friction alongside close collaboration. When technical problems arose, semiconductor manufacturers often blamed equipment malfunctions, while equipment suppliers countered that the issues stemmed from defective semiconductor components supplied within their machines.

In contrast, the atmosphere at Hanguk Semiconductor's Bucheon facility differed markedly from the organizational dysfunction plaguing many American companies. Unlike their American counterparts, the Bucheon fab had no independent research department separate from manufacturing operations. Additionally, they had no established channels for lodging complaints with American equipment manufacturers. The American-made equipment installed in the facility represented what the Korean engineers called “luxurious equipment”—sophisticated machinery that seemed incapable of malfunction. However, contrary to their expectations, these machines frequently broke down, creating unexpected challenges for the Korean team. Rather than attributing failures to inherent equipment defects—the typical response in American facilities—the Bucheon engineers examined external factors. They considered exposure to rain during transpacific shipping, Korea's humid climate and frequent thunderstorms that differed dramatically from Silicon Valley's conditions, inadequate lightning protection in their building, water supply irregularities, and potential operator errors. Each malfunction prompted comprehensive environmental improvements, reinforced preventive maintenance protocols, and meticulous updates to operator procedures. When the equipment broke down, they sought alternative repair parts in the markets near U.S. military bases around Seoul—places they had frequented during their youth as radio

⁶⁴ C. W. Mueller, “Ion Implantation-Physics Laboratory to Factory Floor,” *RCA Engineer* 24 (1978-79), 4-9, from Choi, “The Boundaries of Industrial Research” (note 43), 780-81.

⁶⁵ Bassett, *To the Digital Age* (note 15), 285.

hobbyists.⁶⁶ This combination of technical expertise and resourceful improvisation gradually stabilized Hanguk Semiconductor's CMOS manufacturing processes. In 1975, Hanguk Semiconductor achieved successful mass production of watch chips for export to Hong Kong, positioning the company among the world's earliest CMOS watch chip manufacturers alongside Intel, which had begun production in 1974, and Fairchild, which started the following year.⁶⁷

As the mid-1970s progressed, East Asian governments began recognizing the semiconductor industry's strategic importance and launched ambitious technology development initiatives. Japan took the lead in 1976 when the Ministry of International Trade and Industry (MITI) established the Very Large Scale Integration (VLSI) Consortium. This project represented a model of government-coordinated industrial policy, bringing together major Japanese companies to develop next-generation memory semiconductor technology through systematic inter-company cooperation.⁶⁸ Taiwan pursued a different but equally strategic approach during the same period. In 1976, the Taiwanese government initiated direct technology transfer from the United States, targeting RCA's 7 μ m metal-gate CMOS process. The Electronics Research & Service Organization (ERSO) of the Industrial Technology Research Institute (ITRI) spearheaded this effort, securing the technology through a multimillion-dollar agreement with RCA. The American company provided comprehensive support, transferring not only technical knowledge but also dispatching engineers to Taiwan and helping construct a 3-inch wafer demonstration facility in 1977.⁶⁹

The Korean government also began to shift focus from the existing electronics (appliances) industry to semiconductor manufacturing. This policy reorientation led to the establishment of the Korea Institute of Electronics Technology (KIET) as a government-funded research institute in Gumi, Gyeongsangbuk-do, in 1977. Prior to this, the Korea Institute of Science and Technology (KIST) had maintained a semiconductor research laboratory since the early 1970s, initially led by Jung Man-young, who focused on bipolar junction transistor (BJT) development. Kim Man-jin succeeded Jung and redirected the laboratory toward emerging semiconductor applications. Kim brought industry experience from his previous work at General Electric's semiconductor division, and when GE decided to withdraw from the semiconductor business, he secured their equipment and transferred it to KIST, enabling the institute to launch a project developing integrated circuits for television applications. The establishment of KIET represented a significant expansion of

⁶⁶ Interview with Ki-Yoon Lee, 2022. 8. 27; Interview with Joo-Chun Park, 2024. 4. 15.

⁶⁷ Thackray, Brock, and Jones, *Moore's Law* (note 15), 332–33.

⁶⁸ Callon, *Divided Sun* (note 8).

⁶⁹ Ling-Ming Huang, "A Short History of Semiconductor Technology in Taiwan during the 1970s and the 1980s," *Taiwan Insight: The Online Magazine of the Taiwan Research Hub* (2024) <https://taiwaninsight.org/2024/05/10/a-short-history-of-semiconductor-technology-in-taiwan-during-the-1970s-and-the-1980s/> (accessed on August 29, 2025).

Korea's semiconductor research capabilities. With funding from the International Bank for Reconstruction and Development (IBRD), the new institute constructed state-of-the-art research facilities and launched an ambitious recruitment campaign targeting Korean engineers working in the international semiconductor industry.⁷⁰ Among the key recruits was Woo Dae-sik, who had gained extensive experience working alongside Kang Ki Dong in Motorola's surface studies laboratory. Woo was brought in as the manager of KIET's semiconductor department.⁷¹

KIET's initial technology acquisition strategy focused on direct learning from leading American companies through personnel exchanges. The institute dispatched Lee Jong Duk, a young physicist who had recently joined KIET, to Hewlett Packard's Integrated Circuit Laboratory (ICL) in 1978. The technology targeted for transfer was silicon gate MOS technology, which offered significantly higher integration capabilities than the existing metal gate MOS processes. This advancement proved crucial for developing Very Large Scale Integration (VLSI) devices such as advanced memory chips and central processing units. Hewlett Packard represented an ideal partner for this technology transfer initiative. The company had entered the semiconductor business in the mid-1960s to meet the growing demand for electronic calculators and established ICL in 1968 by recruiting experienced engineers from Fairchild Semiconductor. By the 1970s, ICL researchers had recognized the transformative potential of MOS technology and constructed large-scale fabrication facilities dedicated to silicon gate MOS-based VLSI production.

HP's approach to Lee's visit was exceptionally conducive to technology transfer. Although Lee did not receive a salary during his stay, HP treated him as a valuable collaborator rather than a potential competitor, integrating him fully into their operations and allowing him to attend internal training sessions and technical meetings as a regular staff member. John Moll, ICL's laboratory director and Lee's supervisor, played a particularly crucial role in ensuring the success of this technology transfer. Having previously worked at Bell Laboratories, Moll understood the importance of comprehensive knowledge transfer. While HP's own engineers typically specialized in specific processes, Moll ensured that Lee gained broad exposure to all aspects of semiconductor manufacturing. When Lee returned to Korea, he carried with him detailed knowledge of 4kb DRAM manufacturing processes, semiconductor factory layouts, equipment placement strategies, and

⁷⁰ International Bank for Reconstruction and Development and Korea Institute of Electronics Technology, "Project Agreement (Electronics Technology Project)," Loan Number 1676 KO, March 29, 1979, collection of the author, courtesy of Jong Duk Lee.

⁷¹ Unknown compiler, KIET's "organizational chart," collection of the author, courtesy of Jong Duk Lee. For an examination of South Korea's electronics industry policies, see Hisuk Kim, "Co-evolution of Export Industry and Skills Acquisition" (note 7).

comprehensive training programs—a complete blueprint for establishing advanced semiconductor manufacturing capabilities.⁷²

KIET's second major technology acquisition channel emerged through a production contract with VLSI Technology Inc. (VTI) for game ROM chip manufacturing.⁷³ This collaboration occurred during the gaming industry's nascent stage, when ROM chips represented one of the most promising applications of VLSI technology for the rapidly expanding consumer electronics market. VTI was an ideal partner for this venture, having been founded in 1979 by experienced engineers who had participated in MOS chip design at leading companies including Fairchild Semiconductor, its spin-off Synertek, and Intel. A crucial facilitating factor was the presence of Kim Sung-yong, a Korean electrical engineer working at VTI. Kim had immigrated to the United States in the 1960s, earned his master's degree from Oregon State University, and subsequently accumulated substantial experience at National Semiconductor beginning in 1972 before joining VTI. Working together, Kim Sung-yong and Lee Jong Duk established silicon gate technology at KIET's fabrication facility and systematically optimized the manufacturing processes to improve yield rates. Their efforts exceeded all expectations—the Korean facility achieved yields higher than VTI's own projections, demonstrating the effectiveness of the technology transfer. This partnership culminated in a historic achievement when the successful development of ROM chips in 1982 marked Korea's first successful VLSI development.⁷⁴

Lee's experience at HP extended beyond KIET's internal development. He adapted the employee training programs he had attended at HP to create comprehensive training courses for engineers from Korea's emerging semiconductor companies. Engineers from Samsung, Goldstar, and other domestic firms gathered at KIET to learn about the institute's state-of-the-art MOS fabrication facilities and manufacturing processes, creating a crucial knowledge transfer mechanism from government research to private industry. The timing of this training program addressed critical technological needs within Korea's semiconductor sector. At Hanguk Semiconductor's Bucheon facility, engineers faced a pressing challenge: advancing beyond their existing metal gate CMOS technology to silicon gate processes. While the facility had successfully implemented CMOS manufacturing since 1974, the metal gate approach limited integration density. Silicon gate technology represented the essential next step for achieving higher integration levels required for VLSI devices.

⁷² Interview with Jong Duk Lee, 2024. 10. 16.

⁷³ "Technology Transfer, Manufacturing License and Technical Assistance Agreement," by and between VLSI Technology, Inc., Korea Institute of Electronics Technology, and Anam Industrial Company Ltd., May 15, 1982, collection of the author, courtesy of Jong Duk Lee.

⁷⁴ Interview with Sung-yong Kim, 2025. 4. 30.

Ryu Byung-il, a physics graduate who had recently joined the Bucheon facility as a newly hired engineer, participated in KIET's training program at this moment. During his 1982 training, he mastered the silicon gate technology that KIET had developed through its ROM chip project with VTI.⁷⁵ Upon returning to Bucheon in December 1982, Ryu successfully implemented the silicon gate CMOS technology and was promoted to team leader of the semiconductor process development division.⁷⁶ This achievement represented a crucial step for Korea's semiconductor capabilities. With silicon gate CMOS technology in place at Bucheon, all the core manufacturing technologies necessary for VLSI mass production had been assembled.

The Beginning of the Semiconductor Myth in South Korea

In 1978, Samsung Group finalized its acquisition of Hanguk Semiconductor's Bucheon fab, leading to the company's rebranding as Samsung Semiconductor and marking Samsung's entry into the semiconductor business entry. Samsung began developing its own integrated circuits by reverse-engineering television audio ICs from RCA and Sanyo, subsequently supplying these to its Samsung Electronics television division.⁷⁷ Following Samsung's acquisition, Kang Ki Dong and several of the original Hanguk Semiconductor engineers, finding themselves at odds with Samsung's new management approach, departed to establish semiconductor equipment businesses in Korea. However, Samsung successfully recruited a new generation of engineers. These new hires came primarily from KAIST, where they had been trained by Kim Choong Ki, who had returned to Korea in 1975 after developing charge-coupled device (CCD) technology at Fairchild Semiconductor. Kim's laboratory at KAIST represented the only institution in Korea where comprehensive semiconductor manufacturing could be learned.⁷⁸ The facility's continuity during this transition period relied heavily on its experienced workforce. In contrast to the departure of many original engineers, the operators and technicians who actually ran the manufacturing equipment remained with the company. These skilled workers had accumulated years of hands-on experience with their respective machines and processes, enabling them to play crucial mentoring roles for the newly hired engineers and ensuring that Samsung retained the practical knowledge

⁷⁵ KIET's fab facility was acquired by Goldstar, a conglomerate distinct from Samsung, in 1986, and through several mergers and acquisitions, it eventually became part of what is now SK-Hynix.

⁷⁶ Interview with Byung-il Ryu, 2023. 1. 16.

⁷⁷ Sangwoon Yoo, "A History of Semiconductor Reverse Engineering: Development of TV Sound Integrated Circuits, 1977–1978 반도체 역공학의 기술사: TV 음향 집적회로의 개발, 1977–1978," *Journal of Science & Technology Studies* 22:3 (2022), 107–33.

⁷⁸ Dong-Won Kim, *Making a Semiconductor Superpower* (note 8), 36–44.

essential for continued production.⁷⁹

Shortly after establishing silicon gate CMOS technology at the Bucheon fab in 1982, Samsung Group founder Lee Byung-chul officially announced Samsung's entry into the semiconductor business in 1983. This period marked the escalation of the "semiconductor war" between the United States and Japan, as Japanese semiconductor manufacturers began dominating the DRAM market and American semiconductor companies faced mounting difficulties. Major American companies, including National Semiconductor and Intel, were either abandoning DRAM production—their flagship product—or seriously considering withdrawal from the memory chip market entirely. In this increasingly hostile atmosphere, semiconductor manufacturers became extremely reluctant to share their technologies through licensing agreements. After initial Japanese semiconductor manufacturers rejected all technology transfer proposals, Samsung's management contacted Lee Imsong, a Korean engineer serving as a technical advisor at Japan's Sharp Corporation.

Lee shared a similar background to Kahng Dawon—he had studied physics at Seoul National University when the Korean War broke out, emigrated to the United States after the war, earned his degree in electrical engineering at Stanford, built his career in American industry and universities, and eventually became a technical consultant for Sharp.⁸⁰ Lee leveraged his network to contact Korean engineers working throughout the American semiconductor industry. Among his key recruits were Lee Sang-jun, who had built his career at Control Data, Honeywell, and Zilog; Lee Il-bok, who had served as DRAM development manager at Intel and National Semiconductor; Lee Jong-gil, who had made significant contributions to CMOS manufacturing yield improvements at Intersil and Synertek; and Park Yong-eui, who had worked as a memory design engineer at Western Digital and Intel. Samsung aggressively recruited these experienced professionals and established Samsung Semiconductor's American subsidiary in Santa Clara as a technology acquisition channel, bringing these engineers together to operate a pilot production line.⁸¹

Samsung designated DRAM as its flagship product and identified Micron Technology as its technology transfer partner.⁸² As competition intensified between American and Japanese semiconductor manufacturers, each adopted distinctly different strategies. U.S. manufacturers, including Intel, had focused on cutting-edge product development but struggled against high-quality, low-cost Japanese products that achieved superior manufacturing yields. Micron Technology emerged from this

⁷⁹ Interview with Won-sik Lee, 2023. 1. 11.

⁸⁰ "Imsong Lee (1931-2024)," obituary, *Los Altos Online*, January 10, 2025, https://www.losaltosonline.com/people/obituaries/imsong-lee/article_5c9a9a56-e8ac-11ef-8feb-47421e38a924.html (accessed on August 23, 2025).

⁸¹ Sungsoo Song, "The Growth of Samsung's Semiconductor Sector and the Development of Technological Capabilities" (note 7), 166–67.

⁸² Samsung Semiconductor and Telecommunications, *Ten-Year History of Samsung Semiconductor and Telecommunications* 삼성반도체통신십년사 (Seoul: Samsung, 1987), 201–203.

crisis through an unconventional approach. Founded in 1978 by Jack Simplot—a potato chip processing magnate with limited semiconductor chip knowledge but sharp business instincts—the company established facilities in Idaho, far from Silicon Valley’s established networks. Rather than pursuing technological leadership or premium quality, Micron focused exclusively on manufacturing cost reduction, capitalizing on the widespread unemployment among American semiconductor engineers caused by the industry crisis. One notable recruit was Terry Martin, who had managed CMOS manufacturing processes at Hanguk Semiconductor’s Bucheon facility under Kang Ki Dong since the company’s founding in 1974, until disagreements with Samsung’s management approach led to his departure.⁸³ In its fabrication facility, completed in 1981, the company optimized production processes for 64kb DRAMs using the simpler NMOS structure instead of CMOS technology. Despite these cost-cutting measures, even Micron could not escape the U.S.-Japan semiconductor war entirely. The company adopted extreme cost-cutting measures, including dimming hallway lights and promoting what management called a “hardworking, blue collar work ethic” and “sweatshop mentality.” As one executive stated, “we either made DRAMs, or game over.”⁸⁴ Under these dire circumstances, Samsung’s technology transfer agreement provided Micron with essential cash flow during a critical period.

In summer 1983, the Samsung training team arrived at Micron’s Idaho facility after traversing endless expanses of potato fields, only to encounter an unexpectedly hostile reception. Friction emerged immediately due to inadequate coordination regarding technology transfer specifics, including visit duration, team size, and training protocols. Micron management treated the Samsung delegation “not as a training team but as spies.”⁸⁵ Access restrictions severely limited the program’s effectiveness. Only two team members could enter the fabrication facility, while note-taking and photography were strictly forbidden. The situation deteriorated further when, approximately two weeks into the training, Micron discovered a Samsung engineer operating equipment during the September Labor Day holiday shutdown when the facility was supposed to be quiet. This incident prompted the immediate expulsion of the entire delegation. The training program, originally structured for 60 person-months over six months, terminated after only one month. The Samsung team departed with minimal gains: basic chip blueprints and several physical samples.⁸⁶

⁸³ Dong-hee Oh, “The 30-Year Wheel of Samsung Semiconductor...A History of Korean, U.S., and Japanese Technology 삼성 반도체 30년의 수레바퀴... 한·미·일 기술사”, *Money Today*, 2013. 4. 13. <https://news.mt.co.kr/mtview.php?no=2013031315265347798> (accessed on August 29, 2025).

⁸⁴ Miller, *Chip War* (note 3), 122.

⁸⁵ Interview with Byung-il Ryu, 2023. 1. 16.

⁸⁶ *Ibid.*

An unplanned stop at Mostek yielded unexpected results. Unlike Micron's restrictive approach, Mostek engineers provided comprehensive technical information and welcomed extensive discussions. This cooperation proved bittersweet. Upon returning to Korea, the Samsung team learned through newspaper reports that Mostek had just declared bankruptcy.⁸⁷ The company, established in 1968 by former Texas Instruments engineers who had departed due to TI's failure to recognize MOS technology's potential, had finally succumbed to competitive pressures from Japanese manufacturers. The company most willing to share its expertise was also the one least able to survive the ongoing semiconductor war.

Upon the training team's return to the Bucheon facility, engineers, technicians, and operators committed themselves to achieving successful pilot production of the 64kb DRAM. The formal technology transfer agreement with Micron had yielded limited results: NMOS-based blueprints and several sample chips. However, the Bucheon fab was equipped with CMOS manufacturing machinery and cleanroom facilities that had been in place since 1974. Moreover, operators and technicians who had worked the manufacturing equipment since Hanguk Semiconductor's founding possessed detailed knowledge of process parameters accumulated over nearly a decade. Among the skilled workers available for this effort was operator Park Young-soon, who had developed understanding of detailed conditions across multiple processes. These workers methodically calibrated equipment settings to meet DRAM specifications.⁸⁸

Through intensive collaboration between operators, technicians, and engineers, the team achieved a breakthrough after several attempts. At dawn on November 10, 1983, they produced the first fully functional memory chip (see Figure 3). This success occurred approximately six months after Samsung's official announcement of its memory business entry. The achievement drew significant media attention both domestically and internationally. Industry observers noted that Samsung had accomplished in six months what typically required at least six years of development time. This breakthrough at the Bucheon facility established the foundation for what would become the official narrative of Korea's semiconductor industry emergence.

⁸⁷ Interview with Hyung-gyu Ihm, 2022. 12. 7.

⁸⁸ Interview with Byung-il Ryu, 2023. 1. 16; Interview with Soo-in Jo, 2023. 1. 6; Interview with Won-sik Lee, 2023. 1. 11.



Figure 3 64kb DRAM development team at Samsung's Bucheon fab, photographed in the early morning of November 10, 1983, moments after their breakthrough. Key figures include operator Park Young-soon (front row, center), engineer Lee Jong-gil (front row, second from left), and engineer Ryu Byung-il (back row, second from left). The background captures the historical context: blueprints from Micron are taped to the wall under a celebratory banner reading, "Congratulations on the Successful Test Production of the 64K DRAM Wafer." To the left, a portrait of Samsung founder Byung-chul Lee hangs askew next to the South Korean flag. (Source: Han Chuyöp, "[Korea Semiconductor 50 Years] <7> Lighting the Semiconductor Lamp... Samsung Develops 64K DRAM in 6 Months [한국 반도체 50 년] <7> 반도체 등불을 켜다... 삼성, 64K D 램 6 개월만에 개발," *The Electronic Times*, 2016. 8. 24, <https://www.etnews.com/20160824000230> (accessed on August 23, 2025).

Conclusion

Contrary to the widely reported six-month development of DRAM by Samsung, this paper has shown that there was a much longer and more poignant history of the accumulation of semiconductor manufacturing capabilities in South Korea. The success at dawn on November 10, 1983, represented the culmination of three decades marked by curiosity over emerging technologies and unwavering dedication: teenage radio enthusiasts during the Korean War, assembling functional devices from broken walkie-talkies amid the chaos of evacuation; young Korean students like Kahng Dawon and Kang Ki Dong, leaving their war-devastated homeland behind to pursue advanced studies in America, eventually sketching the first MOS structure in a Bell Labs notebook and solving surface problems with reassembled equipment at Motorola; Kim Choong-Ki, who contributed to Fairchild's CCD commercialization before returning to Korea to train a new generation of semiconductor engineers at KAIST; Kim Song-yong, who after years of building his career in the American semiconductor industry, finally connected with KIET to help establish Korea's first silicon gate technology; Lee Jong Duk, methodically learning every aspect of MOS processes during his training at Hewlett Packard and later transferring that knowledge to Korean industry engineers; the engineers and operators at Hanguk Semiconductor's Bucheon facility, who blamed themselves rather than their "luxurious equipment" each time it malfunctioned, patiently troubleshooting and calibrating processes through countless nights; the Samsung training team, unceremoniously expelled from Micron after being treated as spies; and finally, those same Bucheon fab operators and technicians, drawing upon nearly a decade of accumulated knowledge to achieve what the world deemed impossible in just six months. Each moment of struggle, each technical breakthrough, and each act of quiet dedication contributed to the invisible foundation that made November 10, 1983. The success of Samsung was not a sudden miracle, but the result of thirty years of Korean and American semiconductor history.

The prominent role of Korean and East Asian engineers in the development of MOS technology, as detailed in this paper, could be misinterpreted as an act of deliberate foresight—as if they recognized the intrinsic value of MOS while their American counterparts were focused on BJT. This impression, however, is an artifact of the paper's technology-centered methodology, which by its nature follows the trajectory of a technology that ultimately proved successful. As this study has shown, the reality was not a simple dichotomy. Key American figures like Intel's Gordon Moore were interested in MOS but struggled with the challenges of mass production. Likewise, not all East Asian practitioners were singularly focused on MOS; Kang Ki Dong, for example, dedicated significant time at Motorola's surface

laboratory to solving problems related to BJT. A more compelling explanation lies in the structural position of these East Asian engineers. As a growing wave of East Asian-born, American-trained specialists entered the U.S. industry, their access to the mainstream and high-stakes field of BJT was often limited. Consequently, MOS technology—with its uncertain applications and lower priority within established firms—may have represented a more accessible frontier for these newcomers to contribute and build their careers.

This broader historical analysis underscores the profound entanglement between East Asia and the United States in the development of semiconductor technology. This shared history began in the 1950s, with Korean engineers like Kahng Dawon and Kang Ki Dong deeply embedded in the foundational moments of American innovation. Yet they were not alone. This paper has offered glimpses of a much larger cohort of East Asian-born, American-trained specialists—figures like Morris Chang, who worked at Texas Instruments before founding TSMC; Chinese-American engineer Chih-Tang Sah, who co-invented CMOS technology at Fairchild; and Michiyuki Uenohara, who worked alongside Kahng at Bell Laboratories after earning his Ph.D. from Ohio State University before becoming a key figure at Japan's NEC.

Their story suggests a potential re-framing of the international circulation of scientific talent during the Cold War. While preliminary and requiring more systematic research, the trajectory of a crucial minority of specialists from South Korea and Taiwan—who returned home to transfer the latest technology—appears to transform the classic “brain drain” narrative into what AnnaLee Saxenian has termed “brain circulation.”⁸⁹ Future scholarship, by accumulating more case studies on the diverse paths taken by students from various nations, could move toward a more generalized perspective. A comparative analysis, for instance, between the return-oriented cohorts from East Asia and the larger cohorts from countries like India and China who often remained in the U.S., would illuminate the complex factors shaping these different patterns of scientific migration and industrial development. Such research would provide crucial insights not only into the history of semiconductor technology itself, but also into the broader historical transformation of science during the Cold War era. This perspective ultimately reveals the co-construction of technological and economic structures between the United States and its peripheral regions, a process in which both sides evolved through their mutual engagement and technological exchange.

The historical entanglement of science and technology between the United States and East Asia, however, now confronts a new regulatory approach that seeks to reconfigure this relationship, marking a significant departure from the previous era of allied globalization. Drawing upon John Krige's analysis, the findings of this

⁸⁹ AnnaLee Saxenian, *The New Argonauts: Regional Advantages in a Global Economy* (Cambridge, MA: Harvard University Press, 2007).

paper reveal the dual implications of this policy shift.⁹⁰ On one hand, the central role of transnational engineers documented in this study lends historical weight to the current U.S. regulatory strategy. Specifically, the American focus on controlling the activities of “U.S. persons” reflects a cogent understanding that human networks have long served as a primary conduit for technological migration and leadership. On the other hand, this paper demonstrates that the U.S.-East Asia semiconductor network is not a recent phenomenon but the product of a deep path dependency cultivated over more than half a century. Consequently, this analysis suggests that attempts to dismantle this deeply rooted legacy of cooperation and competition may entail unforeseen costs and consequences, challenging the assumptions that underpin current geopolitical strategies.

⁹⁰ John Krige, “Debate: Building a U.S. Regulatory Empire in the Chip War with China,” *Technology and Culture* 65:4 (2024), 1081–1108. For a discussion on the trade regulation cases between the South Korean and Japanese semiconductor industries, see Ji Young Kim, Hyungsub Choi and Sangwoon Yoo, “Is Techno-Nationalism in the Semiconductor Industry Viable?” *East Asian Science, Technology and Society: An International Journal* (published online, 2025), <https://doi.org/10.1080/18752160.2025.2472508>

Abstract

This study reconstructs the origins of South Korea's semiconductor industry through a technology-centered approach, challenging conventional narratives that emphasize government policies or corporate strategies in the 1980s. By tracing the development and transnational transfer of metal-oxide-semiconductor (MOS) technology, this research uncovers a deeply entangled history that extends the origins of the Korean industry back to the 1950s. The study reveals that Korean scientists and engineers were integral to the development of MOS technology in the United States, beginning with figures like Kahng Dawon and Kang Ki Dong who participated in crucial research at Bell Telephone Laboratories and the Ohio State University. Following the subsequent journey of this MOS technology from its American origins to Silicon Valley and eventually to East Asia, the research traces how these early contributions shaped the global semiconductor landscape. Through connecting previously disparate historiographical frameworks—the American military-industrial-academic complex, Silicon Valley's ecosystem, and East Asian industrial policy—this study reframes the rise of the semiconductor industry in South Korea not as rapid imitation but as the outcome of sustained technological participation in invention and problem-solving, followed by transnational knowledge transfer spanning the mid-20th century. This approach demonstrates how semiconductor technology can serve as a lens for understanding global technological development, offering a pathway toward a more integrated history of science and technology that transcends national and regional boundaries.

Keywords: metal-oxide-semiconductor (MOS), Korean semiconductor industry, technology-centered history, Kahng Dawon, Kang Ki Dong