

## Directions and Implications of the United States Artificial Intelligence Strategy

### | Summary |

- On March 2, the National Security Commission on Artificial Intelligence (NSCAI) released its final report: a glimpse of the U.S. view of advanced industries such as artificial intelligence (AI) and semiconductors, as well as the direction of its related strategies.
- The commission urged a full-scale mobilization of government capacity to beat China for global supremacy in AI and other related advanced industries.
  - Recommendations included the creation of a Technology Competitiveness Council under the Executive Office of the President to implement effective governance and a National Technology Foundation to promote cutting-edge technological development.
  - Also proposed were: the National Defense Education Act II, a National Security Immigration Act and a Digital Service Academy to foster a core workforce. The report also urged the monitoring of investment in sensitive technology and corporate espionage by China and other “countries of special concern” through amendments to legislation by the Committee on Foreign Investment in the United States (CFIUS).
  - To maintain a technological lead of two or more generations over China in semiconductors, the commission recommended supervising exports of advanced semiconductor manufacturing equipment to China and making large federal investments in production facilities and R&D to boost U.S.-based manufacturing capacity.
  - The report also recommended checking China’s rise in advanced industries by establishing global institutions with democratic allies, including an “emerging technology” coalition and a global initiative for digital democracy.
- American strategies for AI and other advanced industries are key constants to be considered in devising Korea’s industrial policy, and a national blueprint is needed to respond to such strategies.
  - Since the U.S. considers its rivalry with China over technological supremacy as similar to the Cold War of the 1970s and 80s, Korea also needs a mid-to-long-term response system from a strategic perspective and its own strategies for AI and industrial technologies that fully utilize national capabilities.
  - With changes expected in the global supply chains of advanced sectors based on an ally system, Korea needs a strategy for preemptively obtaining positions in those chains to promote its national interests and boost competitiveness that exploits the country’s advanced workforce and semiconductor manufacturing know-how.

■ **Recent report shows U.S. perceptions of and strategies for advanced sectors such as AI, semiconductors, and next-generation communications**

- On March 2, the NSCAI presented its final report to the President and Congress: a general assessment and policy suggestions for advanced industries in the U.S.
  - As a pan-government task force for strategic planning established under the National Defense Authorization Act of 2019, the commission has 15 members who are considered preeminent leaders in their respective fields in the U.S.
  - The final report reflected two years of activity and presented a detailed assessment and analysis of AI and related technologies from a national security perspective. Also included were strategies for boosting overall know-how and pursuing national interests and policy measures for implementing such strategies.

Table 1. Overview of National Security Commission on Artificial Intelligence

Basis	<ul style="list-style-type: none"> <li>• Section 1051 of John S. McCain National Defense Authorization Act for fiscal year 2019</li> </ul>
Objectives	<ul style="list-style-type: none"> <li>• Comprehensively assess U.S. capacity in AI, machine learning, and related advanced technologies</li> <li>• Research policy approaches and methods to comprehensively boost national security and defense capabilities</li> </ul>
Members	<ul style="list-style-type: none"> <li>• 15 commissioners including chair and vice chair                             <ul style="list-style-type: none"> <li>- Chair: Google cofounder Eric Schmidt. Vice chair: former Deputy Defense Secretary Robert Work</li> </ul> </li> <li>• Members recommended by secretaries of defense and commerce and chairs and members of major Senate and House committees, including those related to commerce, science, transportation, armed services, intelligence, and energy</li> </ul>

Source: [www.nsc.gov](http://www.nsc.gov)

- Given the policies of the Biden administration and their progress, the influential report offers insightful predictions of American activity in advanced industries.
  - Many policy recommendations in the report are becoming a reality, including the containment of China’s rise in semiconductors, the formation of exclusive ally-centered supply chains, and the expansion of infrastructure for emergency technology.
  - China’s Five-Year Plan emphasizes many of the same technologies highlighted in the NSCAI report. Korea has also made investments in these sectors and should monitor additional steps taken by the U.S.

- \* The eight technologies are (1) AI, (2) autonomy and robotics, (3) advanced manufacturing, (4) biotechnology, (5) quantum computing, (6) 5G and advanced networking, (7) semiconductors and advanced hardware, and (8) energy systems

Table 2. NSCAI's Final Report: Major Policy Suggestions and Progress

Major policy suggestions	Results
<ul style="list-style-type: none"> <li>• Set up Nat'l Technology Foundation               <ul style="list-style-type: none"> <li>- Raise non-defense R&amp;D budget to USD 32 bln</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Pursuit of Endless Frontier Act<sup>1)</sup> <ul style="list-style-type: none"> <li>- National Technology Foundation established through creation of new directorate of technology at National Science Foundation (NSF)</li> <li>- Additional USD 100 bln earmarked for R&amp;D to boost AI and advanced industries</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>• Assume leadership in semiconductors               <ul style="list-style-type: none"> <li>- Contain China's rise in semiconductors (control exports of advanced manufacturing equipment)</li> <li>- Build new advanced production facilities to secure manufacturing competitiveness in nano-scale processing at a three-nanometer (3nm) level and below</li> <li>- Provide USD 35 bln for R&amp;D</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Restrictions raised on exports of advanced semiconductors and manufacturing equipment to China</li> <li>• Improvements made in U.S. semiconductor capacity               <ul style="list-style-type: none"> <li>- American Foundries Act</li> <li>- CHIPS for America Act</li> <li>- Biden's New Infrastructure Plan</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>• Form exclusive supply chain for advanced sectors               <ul style="list-style-type: none"> <li>- Set up emerging technology coalition and global initiative on digital democracy with democratic allies</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Pursuit of Strategic Competition Act<sup>2)</sup> <ul style="list-style-type: none"> <li>- Budget for "China decoupling" allocated; attempts to work with major allies to claim advantage in advanced industrial standards (including 5G, semiconductors, and biotech) and form exclusive supply chains that circumvent China</li> </ul> </li> </ul>

Source: Compiled from NSCAI (2021), U.S. Senate Foreign Relations Committee, and related news articles.

### ■ Report concludes that China seriously threatens U.S. technological advantage in AI, which will determine global supremacy in economy and national security

- Describing AI as key a technology as electricity was in driving the Second Industrial Revolution,<sup>3)</sup> the report stressed the need to gain an overwhelming technological advantage.
  - AI was deemed a key "general purpose" technology that drives developments in other advanced industries such as semiconductors, biotech, advanced networking,

1) While this legislation was voted down when presented on March 21, 2020, under the leadership of Senate Majority Leader Chuck Schumer, efforts for a new vote were made after it was presented again on April 21 under the leadership of 12 Democratic and Republican senators and five House members.

2) A bipartisan bill on global efforts to contain China, the Strategic Competition Act of 2021, was approved by the Senate Foreign Relations Committee on April 21 by an overwhelming 21-1 margin and sent to the Senate floor.

3) Stressing the potential and future ripple effects of AI, the NSCAI quoted Thomas Edison's description of electricity as something that "holds the secrets which will reorganize the life of the world."

and quantum computing.<sup>4)</sup>

- The report defined leadership in all eight of the advanced industry areas (including AI) as comprising the technological dominance the U.S. should be seeking. Key strategic targets included efforts to slow China's development in those areas and contain the spread of Chinese influence on the global market.
- The commission warned that if trends continue, China will have the ability to overtake the U.S. in AI within the next 10 years.
  - Characterizing the battle with China for AI dominance as a “values competition” transcending the realms of economy and industry, the report warned of unavoidable confrontation.<sup>5)</sup>
  - It also warned of the threat of China's highly coordinated decision-making system, saying enormous subsidies were going to Chinese businesses and universities that develop advanced AI and related technologies.<sup>6)</sup>

■ **China's strategy for national AI development targeting “global leadership by 2030” has produced tangible results in sectors such as intellectual property.**

- China has consistently pursued the development, application, and proliferation of AI technology and expansion of markets, combined with effective implementation capacity under the central government's leadership.
  - In 2017, China announced its Next-generation Artificial Intelligence Development Plan, pushing for China becoming the world's AI leader by 2030.<sup>7)</sup>
  - China's 14th five-year plan (2021–25) named seven advanced sectors (AI, quantum computing, biotech, and semiconductors) and predicted annual seven-percent hikes in the R&D budget to raise technological capabilities in all seven fields.
  - The “Two New, One Major” plan,<sup>8)</sup> China's version of the New Deal, includes a

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4) The NSCAI described AI as “the field of fields,” like electricity.

In the report's introduction, NSCAI chair Eric Schmidt and vice chair Robert Work quoted remarks made by British Prime Minister Winston Churchill in 1942 during World War II, underscoring the momentous importance of national security in competition with China in advanced technology as exemplified by AI.

Schmidt and Work noted Chinese efforts to integrate AI-related technological achievements by private businesses and universities with the defense sector.

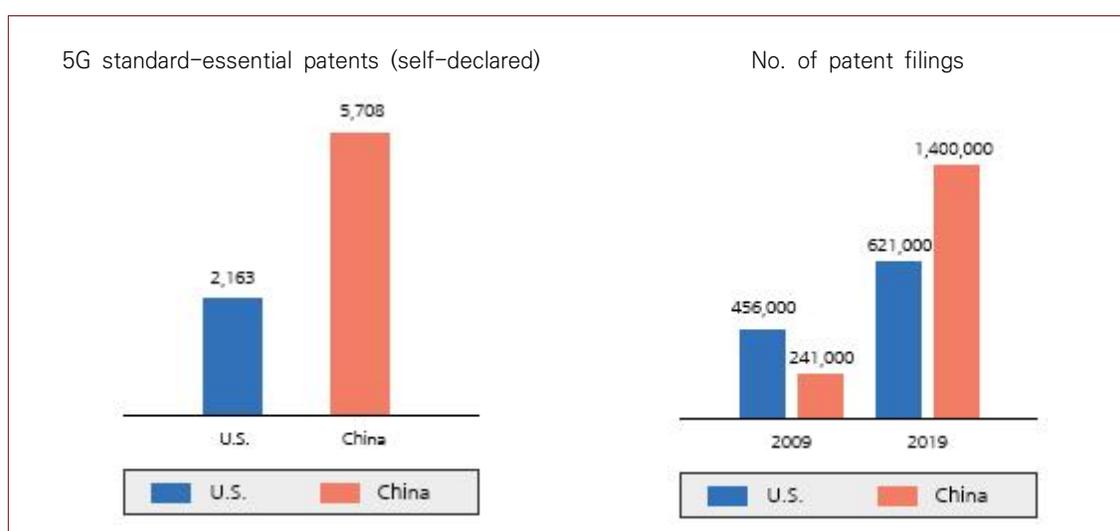
Specifically, the Next Generation Artificial Intelligence Development Plan seeks to foster AI as an economic growth driver through 2020, expanding it across society to sectors such as manufacturing, agriculture, distribution, and finance by 2025 and making China the global hub of AI innovation by 2030.

First used during the Two Sessions (NPC & CPPCC National Committee) in May 2020, the term “Two New, One Major” refers to “new infrastructure and a new urbanization model,” together with civil engineering and construction efforts involving transportation, repairs, and other areas.

planned investment of CNY 10 trillion (approximately USD 1.714 trillion) through 2025 for infrastructure in seven new sectors including AI, 5G, and the industrial internet of things.

- Thanks to this massive investment, China is considered a threat to the U.S. with competitiveness in intellectual property related to advanced technology areas such as AI and advanced communications.
  - In 2009, the U.S. had 456,000 patent applications and China 241,000; by 2019, China had overtaken the U.S. by a whopping margin of 1.4 million to 621,000,<sup>9)</sup><sup>10)</sup> with more than twice as many applications than the U.S. for 5G patents.
  - China has used the quantity of its patent applications to tell the world that it is “defeating” the U.S. in technology and encourage its neighbors to adopt Chinese-made communications equipment and infrastructure.<sup>11)</sup>

Figure 1. Applications for domestic and 5G patents in U.S. and China



Source: NSCAI (2021), Final Report, 203.

Note: Standard-essential patents are key patents for items deemed difficult to produce or sell without patent infringement. Qualcomm (1,293) and Intel (870) are the leaders in the U.S. for self-declared standard-essential patents and Huawei (3,147) and ZTE (2,561) are tops in China.

9) U.S. businesses have been found to incur considerable costs in performing prior art searches due to the large number of Chinese patent applications.

With Chinese government support mobilized to achieve policy aims, a substantial number of China's patent applications are filed by universities and government institutions (Hudson Institute, 2020).

11) Through its “Digital Silk Road” initiative, China has provided digital infrastructure to ASEAN member countries and more than 13 major African countries including Zimbabwe, Botswana, and Ghana through loans and low-cost orders. Sixteen Chinese companies including Huawei, ZTE, Alibaba, and WeChat Pay sell software and communications equipment through the project (Steven Feldstein, 2020).

■ **NSCAI proposes full-scale mobilization of national efforts toward governance, human resources, intellectual property, semiconductors, and technological allies to win the AI battle with China**

① **A powerful governance system centered on the Executive Office of the President**

- The NSCAI proposes establishing a Technology Competitiveness Council<sup>12)</sup> under the White House.<sup>13)</sup>
- The council's roles include setting priorities related to national security, the economy, and science for technology policy and formulating and monitoring the implementation of the National Technology Strategy.
- Another proposal is for a National Technology Foundation (NTF) separate from the National Science Foundation (NSF) and a large-scale hike in its R&D budget.
- The scope of NTF activities would revolve around more established technologies—rather than the basic science at the core of NSF's mission—focusing on promoting commercialization and industrialization.
- The NSCAI proposes doubling the annual budget for non-defense AI R&D to USD 32 billion by 2026, of which 20 billion would go to the NTF.
- The commission also advocates more than tripling the number of national AI research institutions receiving federal financial support (i.e., by creating 30 new ones) to expand education and research opportunities including those for industry and academia.

② **Full-scale response to foster a skilled workforce**

- The report proposes a National Defense Education Act II benchmarking the existing National Defense Education Act<sup>14)</sup> to cultivate human resources in AI and STEM fields.

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Chaired by the U.S. vice president, the proposed NTC would consist of the highest-ranking figures in the U.S. Cabinet, including the secretaries of eight departments, the U.S. Trade Representative, the director of the Office of Management and Budget, and assistants to the president for economic policy, national security, science and technology, and domestic policy.

13) The NSCAI is considered to lack the capacity to coordinate and integrate the national agenda because its roles are spread across the presidential office on a case-by-case basis, including to the National Security Council, National Economic Council, and National Science and Technology Council.

14) Both the National Defense Education Act and the National Science Foundation emerged out of the shockwaves of the Soviet Union's launch of the Sputnik satellite in 1957. After the law's passage, the number of undergraduate degree holders in the U.S. more than doubled from 3.6 million in the 1960s to 7.5 million in the 1970s. The NSCAI considers the act a key factor in the American victory over the Soviet Union in the Cold War and one of the most successful education laws in U.S. history.

- This legislation would establish an annual budget of USD 7.2 billion and create 30,500 scholarships for undergraduate and doctoral programs in STEM fields.<sup>15)</sup>
- Statistics would be made a required subject in middle and high schools as the academic foundation of AI, while STEM-related education would be increased in the K-12 system, afterschool programs, and summer school.
- Another proposal is a U.S. Digital Service Academy as the sixth American military academy, to ensure a core workforce in AI and software.
- The academy would be a four-year institution of higher education with 500 students selected<sup>16)</sup> in its first semester, all of them on full scholarship.
- After graduation, students would be required to perform five years of civil service at a public institution or intelligence agency rather than being appointed a commissioned officer.
- The commission proposed a National Security Immigration Act<sup>17)</sup> to attract outstanding talent from overseas in AI and STEM fields and encourage a Chinese “brain drain.”
- Permanent residency would go to everyone with doctorates in a STEM subject earned at an accredited U.S. university,<sup>18)</sup> and the immigration quota of the H-1B visa program would be doubled, from 140,000 to 280,000.
- The report also recommended the adoption of two new visas — an entrepreneur visa<sup>19)</sup> and a visa for emerging and disruptive technology — and the relaxation of visa restrictions for those with specific or high-level qualifications to ensure the recruitment of world-class talent.

### ③ Strengthening intellectual property protection

- The report recommended devising a national intellectual property strategy as a key national security concern to promote the development and protection of AI and advanced technologies.

15) Scholarships would go to 25,000 undergraduate, 5,000 doctoral, and 500 post-doctoral positions.

The NSCAI said the board of regents of the proposed U.S. Digital Service Academy should consist of 17 members, including nine civilian experts appointed by the White House and eight *ex officio* members representing the heads of major ministries and agencies.

See Appendix D in NSCAI (2021), “Final Report.”

To receive permanent residency in the U.S., applicants must meet three criteria: they must hold a doctorate degree, have an open job offer in the U.S., and not be deemed a threat to U.S. national security. PhD-holding immigrants under the National Security Immigration Act would not face restrictions on annual immigration and country-based quotas.

19) These proposals seek to create a favorable environment for small-scale startups by circumventing large capital restrictions associated with the EB-5 visa or the constraints of the H-1B visa, which in practice can only be provided by mid-market or large companies.

- Another proposal urged the adoption of an intellectual property strategy to create a new order for AI-related advanced technologies through an executive order directed at the Commerce Department, the U.S. Patent and Trademark Office (USPTO), and the Office of the Vice President.
- The Commerce Department was advised to set eligibility standards and review intellectual property safeguards, cooperation in international patent standards, and the process for granting standard-essential patents.
- More advanced export restrictions and an investment monitoring system, the report said, could respond to issues facing major dual-use technologies such as AI.
- Regulations are needed to protect key dual-use technologies such as AI and an executive order should direct an overhaul of systems at intellectual property-related institutions.
- Amendments to legislation by the Committee on Foreign Investment in the United States should mandate prior monitoring and reports on investment related to sensitive technologies from “countries of special concern” such as China.
- Other proposals include thwarting programs aimed at acquiring intellectual property such as China’s “Thousand Talents” plan<sup>20)</sup> and prohibiting cooperation with figures and institutions with ties to the Chinese military.

#### ④ Better protection of semiconductor competitiveness and technology

- The committee recommended controls on the export of advanced manufacturing equipment to ensure at least a two-generation lead over China in semiconductor technology, especially in manufacturing equipment needed for 16nm and smaller-scale processing.<sup>21)22)</sup>
- The commerce and state departments should conduct a study on the efficacy of export controls and then identify additional strategic areas for such controls (such as layer etching tools).
- A national support system to boost the competitiveness of U.S. semiconductor technology and industry is needed to ensure domestic manufacturing capacity.

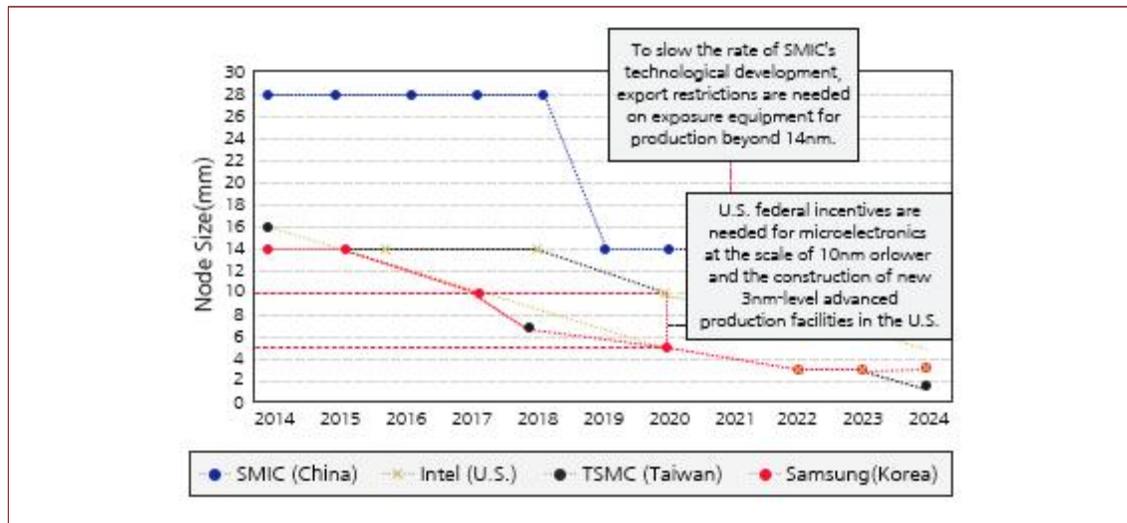
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CSET (2019), *China's Access to Foreign AI Technology*, September 2019.

The report named exposure equipment for argon fluoride (ArF) and extreme ultraviolet (EUV), light sources, mirrors, and laser amplifiers as examples of advanced manufacturing equipment requiring export controls.

22) The report specifically indicated the need to form links and cooperation with countries that make advanced semiconductor equipment, such as Japan and the Netherlands, for the purpose of export controls on such equipment.

Figure 2. Recent Acquisitions of Semiconductor Manufacturing Tech by Company



Source: NSCAI (2021), Final Report, 215.

Note: As of 2020, TSMC and Samsung were the world's only companies to possess manufacturing technology at the 5nm level. Intel is seen as having technology at the lower level of 10nm, and China's SMIC with that of 14nm. The NSCAI concluded that export controls for technology of 14nm and lower were needed to stop SMIC from acquiring technology.

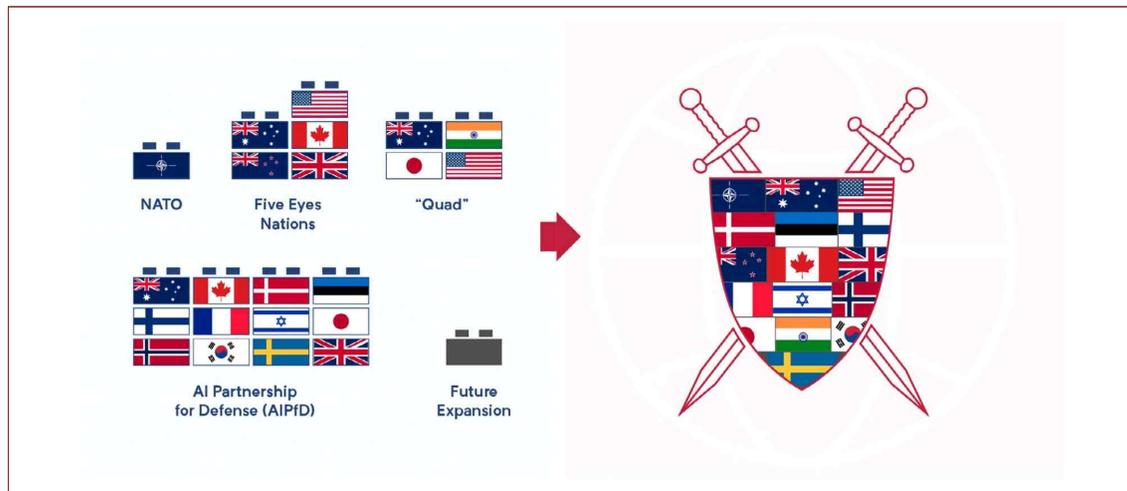
- The report urged the formulation of a national microelectronics strategy under a pan-government effort to systemically foster the semiconductor sector at the national level.
- It proposed the creation of a National Semiconductor Technology Center and advanced packaging production program and the addition of USD 12 billion over the next five years to the semiconductor R&D budget under the supervision of the NSF, the Defense Advanced Research Project Agency, and the commerce and energy departments.
- To support domestic production at the 3nm level and strengthen the industrial ecosystem, the report proposed USD 35 billion in federal financial support, a 40-percent tax credit for investment, and a higher R&D budget to acquire semiconductor technology.<sup>23)</sup>

##### ⑤ Technological alliance to stop China's rise in advanced tech

- The report recommended devising an international science and technology strategy (ISTS) under the supervision of the State Department. The gist of the report's proposals are below.

23) The CHIPS for America Act seeks USD 15 billion to build semiconductor production facilities and USD 20 billion in federal R&D funding over the next five years.

Figure 3. Proposed Alliances and Partnerships for Joint AI Response



Source: NSCAI (2021), Final Report, 83.

- An “emerging technology” coalition and global initiative for digital democracy through ISTS should serve as global consultative bodies centered on democratic allies.<sup>24)</sup>
- Global standards and norms for AI and related advanced industries should be set based on the Technology Coalition system.
- The global proliferation of Chinese-made digital infrastructure should be contained and exclusive supply chains that circumvent China are needed.
- Through the Technology Coalition system, democratic values such as human rights and the rule of law should be upheld in responding to abuses of AI technology by authoritarian states.
- Exclusive supply chains that circumvent China should be formed in key future sectors such as semiconductors, batteries, advanced networking, and biotech.

■ **U.S. strategies for AI and advanced industries are a key consideration for Korea when devising industrial and technological policy; a national response strategy is also needed**

① **With the U.S. approaching the fight for technology supremacy with China as akin to the Cold War of the 1970s and 80s, Korea must muster its national capabilities to**

The NSCAI seeks to have the Emerging Technology Coalition and International Digital Democracy Initiative serve as international consultative bodies for forming a joint response to the expansion of digital infrastructure and influence in authoritarian states in AI and related advanced technologies.

**create a response system and AI strategy.**

- The NSCAI called the battle for leadership in AI and advanced industries a “values competition” between democracy and authoritarianism. It recommended a full-scale national response on par with that used in the Cold War against the Soviet Union.
  - The report’s proposals for a National Defense Education Act II, National Technology Foundation, and U.S. Digital Service Academy are rooted in the American experience of winning the Cold War through a superior workforce and technological competitiveness.
  - Korea’s industrial structure is closely connected to both the U.S. and China,<sup>25)</sup> so Seoul must closely observe developments in the Sino-U.S. conflict and fully reexamine its strategies for AI and industrial technologies through comparison with those of advanced economies.
  - Korea needs to constantly monitor developments in the U.S.-China race over the mid-to-long term, while developing systems for quickly responding to issues that could arise.
  - The major tasks and progress of the AI National Strategy (December 2019) and industrial technology policy need assessment and comparison with those of major powers. Major upgrades are also needed in financial outlays, human resource development, legal and institutional infrastructure, and governance.
- ② **With global supply chains for advanced industries expected to undergo reorganization based on an alliance-based system, Korea must gain an early advantage in new chains through an effective strategy.**
- In light of U.S. efforts to form ally-based technology supply chains that circumvent China, major shifts are foreseen in global supply chains in advanced manufacturing sectors such as semiconductors, batteries, and biotech.
  - Under an executive order from President Biden, the U.S. is closely assessing supply chains for semiconductors, batteries, pharmaceuticals, and rare earth elements.
  - If the study discovers supply chain risks, the U.S. is expected to conduct an overhaul to reduce the risks, in which case it is expected to request cooperation and participation from its tech allies.<sup>26)27)</sup>

25) As of 2020, China was Korea’s largest trading partner; the U.S. was second. (KITA trade statistics)

On April 6, President Biden and Japanese Prime Minister Yoshihide Suga concluded the U.S.-Japan

- Having established global supply chains with close links to China, Korea is expected to feel the impact of the expansion of exclusionary supply chains.<sup>28)</sup> This trend will necessitate strategies aimed at securing an early position within those chains to protect national interest.
  - Korea must objectively recognize the practical impossibility of immediately restructuring its supply chains and devise a mid-to-long-term strategy to ensure a soft landing. It must also open a permanent strategic channel between the government and major companies in relevant sectors to make timely responses to global issues.
  - Korea should also form its own version of the U.S. Technology Competitiveness Council, creating a top-level public-private decision-making body (organization or committee) to respond at the national level to changes in global supply chains for advanced industries.
- ③ **Korea needs a strategy for improving competitiveness focusing on areas that leverage its strengths, those being an advanced workforce and semiconductor manufacturing know-how.**
- The NSCAI stressed having an advanced workforce and cutting-edge know-how in semiconductor manufacturing as crucial for maintaining American technological dominance and containing China's digital rise.
  - Specifically, the commission said manufacturing success will hinge on a high-quality workforce, urging not only direct efforts to foster workers through a National Defense Education Act II but also a full-scale campaign including use of the National Security Immigrant Act to attract outstanding overseas talent and streamlining the education system to boost basic AI skills.
  - Additionally, the commission recognized the enormous importance of supply chain stability and acquiring independent know-how in advanced semiconductor

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Competitiveness and Resilience Partnership that included the following: USD 4.5 billion in combined investment in joint R&D for 5G and 6G communications networks (USD 2.5 billion from the U.S., USD 2 billion from Japan), commitments to pursuing a Global Digital Connectivity Partnership with other countries, proposals for protecting and developing semiconductors and other core technologies and joint biotech research on genetic base sequencing.

An exclusive supply chain for advanced semiconductors is taking shape linking the U.S., Japan, Taiwan, the Netherlands, and Korea based on intellectual property and advanced semiconductor manufacturing equipment. Semiconductors are providing a link to the reorganization of other exclusive supply chains expected in core areas such as AI, big data, next-generation communications, and biotech.

China is the main hub of Korea's global supply chain for manufacturing, with 30.5 percent of materials, components, and equipment exports and 28.6 percent of related imports as of 2019.

- manufacturing through expansion of the U.S. production base for semiconductors.
- Korea has the national capacity to play and demand meaningful roles in the exclusive ally-centered supply chains for technologies envisioned by the U.S.
  - Korea is leveraging its world-leading manufacturing capacity and advanced engineering workforce to gain a secure position in the global supply chains of future core industries like semiconductors and batteries.
  - Maintaining and strengthening Korea's advanced workforce and cutting-edge manufacturing technology urgently requires strategies for improving human resources and technological capacity to the levels of the U.S. and China, two countries that seek to maximize their know-how to advance technologically at the national level.<sup>29)</sup>

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<sup>29)</sup> Among the 500 key global figures in AI, the U.S. has 14.6 percent of them and China 13 percent, whereas Korea's rate is a mere 1.4 percent. (National Assembly Research Service, 2021)



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EDITOR-IN-CHIEF **Kim, Youngsoo**

ASSISTANT EDITORS | **Jeong, Gyeonghee & Jo, Gyehwan**

COPY EDITOR **Aaron Crossen**

370 Sicheong-daero, Sejong City, 30147, Republic of Korea

Tel. 044-287-3114 Fax. 044-287-3333 [www.kiet.re.kr](http://www.kiet.re.kr)

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