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## **A Needle in the Artificial Intelligence Technology Stack? A Strategic Approach to Emerging Technologies Export Controls Could Target Semiconductor Hardware**

By Hdeel Abdelhady\*

In 2017, Russian President Vladimir Putin said that “artificial intelligence is the future . . . for all humankind. Whoever becomes the leader in this sphere will become the ruler of the world.”<sup>1</sup> On this, the Russian President, China, and U.S. political and technology leaders agree.

China has long taken a strategic approach to AI, making substantial technological strides and implementing successive national strategic plans with the objective of becoming the world’s AI leader by 2030. The Made in China 2025 plan of 2015 and the New Generation of Artificial Intelligence Development Plan of 2017 are two examples.

Recognizing the national and economic security significance of emerging technologies, and perceiving China’s technological ascendance as a threat, the United States has in the past few years as constructed a coordinated approach to preserving and bolstering the United States’ technological edge, in significant part through defensive legal measures to curb foreign access to U.S. technology by illicit means, such as intellectual property theft and “academic espionage,”<sup>2</sup> as well as by lawful means. Unusually, by Washington standards, the approach has bipartisan backing across the U.S. government.<sup>3</sup>

In 2018, the United States adopted two key pieces of legislation to protect the United States’ technological position: (1) subjecting foreign investment in technology to greater national security scrutiny by the Committee on Foreign Investment in the United States through the Foreign Investment Risk Review Modernization Act (**FIRREA**) and, relatedly, (2) laying the groundwork through the Export Control Reform Act of 2018 (**ECRA**) for greater control of exports of emerging and foundational technologies subject to U.S. jurisdiction.<sup>4</sup>

Lacking anything resembling an affirmative national AI plan, in 2018 the United States took the modest step of creating the National Security Commission on Artificial Intelligence (**NSCAI** or **Commission**) to conduct a review of the “methods and means necessary to advance the development of artificial intelligence, machine learning, and associated technologies by the United States to comprehensively address the national security and defense needs of the United States.”<sup>5</sup> The NSCAI, an “independent establishment of the Federal Government,” reports to both Congress and the President.<sup>6</sup>

### **Export Controls of Emerging Technologies: Artificial Intelligence**

Three months after ECRA’s enactment, the Department of Commerce’s Bureau of Industry and Security (**BIS**) provided a preview of what the U.S. government might define as “emerging technologies” and what the process for regulating their exports might look like. In November 2018, BIS issued an Advanced Notice of Proposed Rulemaking (**ANPRM**) on the “Review of Controls for Certain Emerging Technologies.”<sup>7</sup> The ANPRM identified 14 categories of emerging technologies for potential export control—including Artificial Intelligence as a category with 12 subcategories.<sup>8</sup>

Through the ANPRM, BIS sought public comment on, among other matters: how to define emerging technologies, the criteria by which to determine an emerging technology's national security significance, and the impact of emerging technologies export controls on U.S. technological leadership.<sup>9</sup> In response, many commentators pointed out that BIS' categories of emerging technologies in the ANPRM were too broad and, in some cases, insufficiently developed and understood to be controlled. In contrast to its swift issuance of the ANPRM after ECRA's passage—and perhaps reflecting the difficulty of defining emerging technologies and controlling their exports and/or the fluctuating character of Trump Administration policy relative to China—the BIS did not follow-up with export control measures mirroring the ANPRM.<sup>10</sup>

Whether and how the Commerce Department will control exports of AI and other emerging technologies remains an open question. But a recent report of the NSCAI may yield insights into what might come with respect to Artificial Intelligence.

### **Targeting Semiconductor Hardware, a Choke Point in the AI Technology Stack, to Curb AI Advances by Foreign Parties (Particularly China)**

In a November 2019 report, the NSCAI put AI's importance in geostrategic terms, stating that: "The convergence of the artificial intelligence revolution and the reemergence of great power competition . . . threaten the United States' role as the world's engine of innovation and American military superiority."<sup>11</sup> Echoing Mr. Putin's 2017 comments, the Commission opined that the "development of AI will shape the future of power. The nation with the most resilient and productive economic base will be best positioned to seize the mantle of world leadership. That base increasingly depends on the strength of the innovation economy, which will in turn depend on AI. AI will drive waves of advancement in commerce, transportation, health, education, financial markets, government, and national defense."<sup>12</sup>

The NSCAI's report—which was transmitted to the President and Congress—may yield insight as to how exports of Artificial Intelligence might be controlled or considered for control, if the Commission's recommendations influence the Commerce Department's next steps. The NSCAI recommended that the U.S. government adopt unilateral and multilateral export controls to "protect specific U.S. and allied AI hardware advantages, in particular in semiconductor manufacturing equipment" (SME), such as equipment needed to produce semiconductor components like silicon and electrical circuits, and for assembly and testing.<sup>13</sup>

In other words, the NSCAI recommended an indirect approach to AI export controls—that of curbing foreign capacity to advance in AI by restricting exports of key hardware in the AI technology stack. As the Commission explained:

*AI applications rely on hardware, and currently that hardware is almost exclusively powered by semiconductors. Generally, countries with greater access to high-end computer chips will have an inherent advantage in their ability to deploy high-performing AI algorithms. The demand for semiconductors to enable AI applications is expected to grow dramatically in the coming years. U.S.-headquartered firms account for nearly half of all semiconductor production. As AI becomes more widespread and advanced, demand for more sophisticated and specialized chipsets to run algorithms will increase. This, in turn, will also*

*increase demand for . . . SME. Due to the high cost and deep expertise necessary to construct SME, especially the most complex SME, this technology is heavily concentrated. About 90 percent of the SME industry is located in the United States, Japan, and the Netherlands, giving that small group of allies a major advantage. Controls to preserve U.S. and allied advantages in SME could ensure that U.S. and allied country firms retain a dominant position in the global semiconductor market, including in advanced hardware capabilities. It would also ensure that the U.S. government maintains access to the most cutting-edge hardware for AI applications and can scale up production in the event of a crisis.<sup>14</sup>*

Recognizing that controls of SME could be harmful to U.S. semiconductor companies, the Commission recommended that the U.S. Government invest in the development in the United States of “next-generation hardware” by increasing R&D spending on “semiconductor design, manufacturing, packing, and testing.”<sup>15</sup> Implicit in the focus on “next-generation hardware” is the recognition that the development of SME capacity by China or other foreign parties is not impossible, and therefore the United States, to maintain dominance, must look forward and continually out-innovate its peers and rivals.

The NSCAI’s recognition of the potential harms to the semiconductor industry of export controls was to be expected, including because the industry was harmed by the United States’ imposition in May of 2019 of unilateral controls of exports to Huawei and 68 of its non-U.S. affiliates.<sup>16</sup> The Commission’s recommendation to ease potential harms through increased R&D investment may not, without more, be sufficient in the immediate and longer term. And, the NSCAI’s report does not address whether any increases in U.S. R&D investment should be allocated partly to U.S. allies that dominate SME and would be critical to the success of the multilateral export controls proposed by the Commission.

### **The NSCAI’s Recommendation to Restrict AI Exports Through Semiconductor Manufacturing Equipment Is Compatible with the Export Control Reform Act**

The NSCAI’s recommendation of export controls on SME aligns with the ECRA’s provisions and goal of building the United States’ technological capabilities and maintaining its existing technological superiority.<sup>17</sup> ECRA, as the ANPRM recognized, requires the Commerce Department to consider and balance three factors in promulgating export controls of emerging technologies. Specifically:

1. The state of development of emerging and foundational technologies in foreign countries. (If other countries are advanced or dominant—as China is in “AI” (as very broadly understood)—controls on U.S. exports of an emerging technology would be unnecessary, and potentially harmful to the United States);
2. The effect export controls may have on the development of technologies in the United States (self-explanatory); and,
3. The effectiveness of export controls on limiting the proliferation of emerging and foundational technologies in foreign countries (self-explanatory).

## Key Takeaways

The NSCAI's recommendations on the use of export controls to bolster the United States' AI position—for dual commercial and military uses—illustrates what the ANPRM and public comments in response made clear: blunt controls on Artificial Intelligence as a category of emerging technologies, or on broad sub-categories of AI, are not practical and seem unlikely to advance the strategic objectives of ECRA and other U.S. laws, as well as the national and economic security objectives they purport to advance.

AI and semiconductor industry stakeholders should take note of the NSCAI's recommendations and reasoning, engage in the conversation, and watch for indications from the Commerce Department or other U.S. government entities as to what approaches, if any, might be taken to control exports of AI and AI hardware, particularly AI hardware presently dominated by the United States and its allies.

Beyond AI and semiconductors, participants in the technology industry, STEM research and academia, and policy spheres, among others, should watch developments to determine whether the NSCAI's strategy of targeting choke points in the technology stack—for the purpose of depriving foreign parties of capacity and/or to preserve the dominance of the United States and its allies—will manifest in future export or other controls on the transfer of technology to non-U.S. parties, whether within the United States or across U.S. borders.

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## NOTES

<sup>1</sup> RT, [Whoever leads in AI will rule the world': Putin to Russian children on Knowledge Day](#), Sept. 1, 2017.

<sup>2</sup> For background, see Hdeel Abdelhady, [Trade Wars: Restricting Foreign Access To US Technology](#), Law360, Oct. 2018 and Hdeel Abdelhady, [What Academia Must Know About DOJ's China Initiative](#), Law360 Jan. 2019.

<sup>3</sup> See, e.g., Hdeel Abdelhady, [Tech War: The United States' Whole-of-Government Approach to China is a Force Multiplier](#), MassPoint PLLC, May 2019.

<sup>4</sup> FIRRMA and the Export Controls Act of 2018, Part 1 of the Export Control Reform Act of 2018 were part of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (Aug. 13, 2018) (“**NDAA 2019**”). Congress declared in ECRA that the “national security of the United States requires that the United States maintain its leadership in the science, technology, engineering, and manufacturing sectors, including in foundational technology that is essential to innovation.”

<sup>5</sup> NDAA 2019 § 1051. Initially set to terminate in October 2020, the NSCAI's term was extended to October 2021 by § 1735 of the National Defense Authorization Act for Fiscal Year 2020, enacted on December 20, 2019.

<sup>6</sup> NDAA 2019 at § 1051.

<sup>7</sup> For an extended discussion of the ANPRM, see Hdeel Abdelhady, [Commerce Department Opens Process to Identify “Emerging Technologies” for Export Control, Public Comments Due by December 19](#), MassPoint PLLC, Nov. 25, 2018 (“**ANPRM Article**”).

<sup>8</sup> The ANPRM [identified](#) Artificial Intelligence (AI) and Machine Learning Technology, such as

- (i) Neural networks and deep learning (e.g., brain modelling, time series prediction, classification);
- (ii) Evolution and genetic
- (iii) computation (e.g., genetic algorithms, genetic programming);
- (iv) Reinforcement learning;
- (v) Computer vision (e.g., object recognition, image understanding);

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- (vi) Expert systems (*e.g.*, decision support systems, teaching systems);
  - (vii) Speech and audio processing (*e.g.*, speech recognition and production);
  - (viii) Natural language processing (*e.g.*, machine translation);
  - (ix) Planning (*e.g.*, scheduling, game playing);
  - (x) Audio and video manipulation technologies (*e.g.*, voice cloning, deepfakes);
  - (xi) AI cloud technologies; or
  - (xii) AI chipsets.

<sup>9</sup> See [ANPRM Article](#).

<sup>10</sup> In October 2019, Congressman McCaul (R-TX) urged the Commerce Secretary to act more swiftly to regulate exports of emerging technologies. “While our regulatory process moves slowly, China is sprinting ahead to acquire critical technology by any means necessary,” said in a letter to Secretary Ross. *E.g.*, Alexandra Alper, [Rules to stop China buying sophisticated U.S. tech should move faster: lawmaker](#), Reuters, Oct. 30, 2019. On January 6, 2020, BIS issued an Interim Final Rule, effectively immediately, placing unilateral export restrictions on AI software for geospatial imagery analysis: [Addition of Software Specially Designed To Automate the Analysis of Geospatial Imagery to the Export Control Classification Number 0Y521 Series](#).

<sup>11</sup> NSCAI Report, Nov. 2019, pg. 6. This language mirrors that of the U.S. National Security Strategy issued by the Trump Administration in December 2017.

<sup>12</sup> *Id.* at pg. 9.

<sup>13</sup> *Id.* at 41.

<sup>14</sup> *Id.*

<sup>15</sup> *Id.*

<sup>16</sup> The May 2019 export restrictions applied to manufactured and installable components, and not directly to SME. The semiconductor industry reportedly lobbied the Trump Administration to ease restrictions on semiconductor exports to the targeted Huawei entities, and pursued other avenues to conduct business. *See, e.g.*, Jenny Leonard and Ian King, [How U.S. Chipmakers Pressed Trump to Ease China's Huawei Ban](#), Bloomberg, July 1, 2019. China, whose vulnerability to U.S. and international semiconductor supply chains was underscored by U.S. export restrictions on Huawei and other Chinese firms, has redoubled its efforts to build its semiconductor industry. *See, e.g.*, Yoko Kubota, [China Sets Up New \\$29 Billion Semiconductor Fund](#), Wall St. Journal, Oct. 25, 2019.

<sup>17</sup> The ANPRM separately listed semiconductor equipment, such as Systems-on-Chip and Stacked Memory on Chip. *See, e.g.*, [ANPRM Article](#).