

December 13, 2018

Matthew S. Borman
Deputy Assistant Secretary for Export Administration
Bureau of Industry and Security
U.S. Department of Commerce
14th Street and Pennsylvania Avenue NW
Washington, DC 20230

Re: Agency/Docket No. 180712626-8840-01

Dear Mr. Borman,

On behalf of the Information Technology and Innovation Foundation, we are pleased to submit comments in response to the advanced notice of proposed rulemaking (ANPRM) on the review of controls for certain emerging technologies (Agency/Docket No. 180712626-8840-01).¹

The Bureau of Industry and Security (BIS) issued an advance notice of proposed rulemaking regarding extending export controls to what are termed “emerging and foundational technologies” (EFTs): new or foundational technologies that in some cases are essential to national security and are not currently covered by existing export control rules. It seeks to establish appropriate controls, including interim controls, on the export, reexport, or transfer (in country) of emerging and foundational technologies.²

In considering BIS’s role regarding EFTs there are several issues that are important to recognize and distinguish between. One clearly is the nature of the technology and the potential importance of it for giving our adversaries technological advantages that could be used for military or intelligence purposes. The second is the nature of the technology being transferred: is it a final product, an intermediate product, a process, or intellectual property. The third is the extent to which foreign countries subject to controls can obtain the controlled technology either domestically or from other nations.

¹ The Information Technology and Innovation Foundation (ITIF) is an independent, nonpartisan research and educational institute focusing on the intersection of technological innovation and public policy. Recognized as the world’s leading science and technology think tank, ITIF’s mission is to formulate and promote policy solutions that accelerate innovation and boost productivity to spur growth, opportunity, and progress.

² “Review of Controls for Certain Emerging Technologies,” *Federal Register*, vol. 83, no. 223, November 19, 2018, <https://www.gpo.gov/fdsys/pkg/FR-2018-11-19/pdf/2018-25221.pdf>.

To frame this issue, it's important to recognize that for the first time since WWII, the United States is facing potentially peer technology competitors, and in the case of China, one that is also an adversary. For much of the post-war period the United States could afford to restrict the exports of some of its technologies. Not only were fewer other nations able to sell to the targeted nations, but the U.S. lead was sufficient that the loss of sales generally had limited effects on U.S. company technological leadership. Those days are rapidly ending, if not already gone. In an array of advanced industries, including biotechnology,³ advanced manufacturing,⁴ solar panels, telecommunications equipment, displays, and others, U.S. firms face an array of robust challengers. And in some emerging industries, like artificial intelligence (AI), not only are many nations putting in place robust national AI strategies, but China in particular is poised to catch up and perhaps surpass U.S. firms in AI.⁵ Couple this with the relatively anemic and unfocused U.S. national innovation policy for supporting advanced technology leadership and it's a recipe for continued loss of global market share in advanced industries.

Export Controls

These trends suggest that BIS should be cautious in extending export controls to EFTs. These technologies will increasingly shape competitive advantage for nations around the globe and limiting U.S. exports will make it more difficult for U.S. firms in the race for global innovation advantage. In particular, stronger advanced technology exports help U.S. companies and the U.S. economy maintain its competitive position in two ways. First, it enables greater sales and by extension greater reinvestment into R&D and next-generation technologies by U.S. companies. Second, it reduces the sales of foreign competitors, including in adversary countries, making it harder for them to progress and innovate.

In addition, most of these technologies are dual use, and many are still in relatively early phases of development (e.g., artificial intelligence (AI), blockchain, virtual reality, etc.). These factors pose challenges for identifying technologies without compromising the development of these technologies domestically, some of which may have limited military use. AI is a case in point. As an emerging “general purpose technology,” AI is a technology that will be used broadly in many sectors and

³ Robert D. Atkinson, et al., “Leadership in Decline: Assessing U.S. International Competitiveness in Biomedical Research” (Information Technology and Innovation Foundation, May 2012), <https://itif.org/publications/2012/05/17/leadership-decline-assessing-us-international-competitiveness-biomedical>.

⁴ Stephen Ezell, et al., “Manufacturing Digitalization: Extent of Adoption and Recommendations for Increasing Penetration in Korea and the U.S.” (Information Technology and Innovation Foundation, August 2018), <https://itif.org/publications/2018/08/13/manufacturing-digitalization-extent-adoption-and-recommendations-increasing>.

⁵ Robert Atkinson, review of *AI Super-Powers: China, Silicon Valley, and the New World Order*, by Kai-Fu Lee, (Boston: Houghton Mifflin Harcourt, 2018), <https://www.nyjournalofbooks.com/book-review/ai-superpowers>.

applications to cut costs and drive innovation. As such, AI will be used in a massive number of applications, most of which will be commercial. It's difficult to imagine how an export control regime would limit AI exports without significantly reducing U.S. exports, competitive advantage, and innovation.

But that is not to say that BIS should do nothing. In some cases, BIS should focus on ensuring that existing bans for certain sensitive applications continue to cover new sensitive applications that make use of EFTs. For example, a ban on certain advanced weapons systems should also extend to AI-enabled advanced weapons systems. However, what it generally should not do is limit or ban the sale of EFTs to other nations. In particular, it should not extend export controls to AI or related technologies. As noted, China is working on developing these technologies already, and for many of them, there are alternative sellers in other nations. In most cases, simply possessing the technology does not significantly advance our adversaries' technical capabilities.

BIS should also focus on particular "chokepoint technologies." These are technologies that are generally only sold by U.S. companies and that if obtained by China will undermine U.S. competitiveness and advance Chinese military capabilities. As it stands, it does not appear that the U.S. government possesses adequate institutional knowledge to understand and identify these particular technologies.

Another consideration when extending export controls to "emerging and foundational technologies" is to have as complete and full a possible understanding of the current global state of play with the development and commercialization of advanced technologies. For instance, when it comes to high-performance computing (e.g., supercomputers), systems that were global state-of-the-art a mere five-years ago are often run-of-the-mill today, given the dramatic pace of innovation in the field.⁶ High-performance computing (HPC) has been an area where the U.S. export control regime has not kept up-to-date with the pace of technological change.

Going forward, the U.S. export control system should be updated so that only the newest and most-sensitive HPC systems and technologies are subject to export control rules. HPCs have historically fallen under export rules for "digital computer systems," meaning that when U.S. vendors wish to export an HPC system or component, they must undertake an exhaustive analysis of what they are shipping, who the system is going to, what the device is going to be used for, and determine if an export license will be required or not. Such determinations entail an arduous, time-consuming process that on some occasions has cost U.S. vendors sales.

⁶ Stephen Ezell and Robert D. Atkinson, "The Vital Importance of High-Performance Computing to U.S. Competitiveness" (Information Technology and Innovation Foundation, April 2016), <https://itif.org/publications/2016/04/28/vital-importance-high-performance-computing-us-competitiveness>.

Further, the United States should advocate that requirements under the International Traffic in Arms Regulations (ITAR) regime be amended so they don't inadvertently control commercial components and technology that may be used by government and commercial customers. Current ITAR controls often trigger an automatic review for any device (and device is a broad term here, meaning hardware, software, services, etc.) that is being used for a defense application (and that's also a very broad term, because it can apply to any HPC system or component being used by a national laboratory). Accordingly, these controls snare HPC systems and components that are also being sold in other contexts for government, academic, or commercial purposes, meaning that often these machines cannot be sold overseas (or only sold after triggering an extensive and often times costly ITAR compliance review). Put simply, current ITAR controls are at odds with the increasing trend toward the democratization of HPC, and again should be updated to narrowly apply only to the most sophisticated and sensitive cutting-edge HPC systems. These regulations hinder the ability of commercial companies that export products and technology worldwide to collaborate effectively with government agency customers for fear their technology will be inadvertently captured under the ITAR. Going forward, applying export controls to exascale systems may be sensible, but not to petascale or lesser systems.

In some cases, overly stringent export control regulations have prevented the sale of noncritical HPC systems to customers in some nations, a policy decision that (as with China) has had the unintended consequence of further spurring these nations to pursue their own HPC development programs. HPC vendors from a number of countries, from China and Japan to Korea and Taiwan, have benefitted by being able to step in and make sales in situations where potential sales of U.S.-made HPC systems have been impeded by export control regulations. When Chinese makers of HPC interconnects and high-speed network interface chips are able to support development of HPC systems nearing speeds of 100 petaflops, as *Scientific Computing World* reports, U.S. export controls preventing exports of similar, U.S.-produced components are unlikely to achieve their intended purpose.⁷ That's why a thorough understanding of the global state of play with regard to commercially available advanced-technology systems will be vital to developing a U.S. regime of export controls for "emerging and foundational" technologies.

Technology Transfer

While BIS should generally not restrict most exports of EFTs, it should focus on the transfer of EFT-based technical know-how to adversaries, particularly to China. This is a particular challenge

⁷ "China: Two 100 Petaflop Machines," *Scientific Computing World*, August 25, 2015, <https://www.scientific-computing.com/news/china-two-100-petaflop-machines-within-year>.

vis-à-vis China because the country has made forced technology transfer from foreign technology companies a centerpiece of its strategy to gain global technology leadership.

Chinese forced technology transfer is not new. A 1987 Congressional Office of Technology Assessment report states, “Although most U.S. firms approach the China market with the intent to sell products, many find they must include technology transfer if they wish to gain access to the China market.”⁸ But what is new are two things. First, there are more foreign companies seeking to get in the Chinese market, such that the scale of forced technology transfer is much larger than it was two decades ago. In 2015 for example, 6,000 new international joint ventures, amounting to \$27.8 billion of FDI inflows, were established in China.⁹

Second, the sophistication and value of the technology the Chinese government is now demanding is significantly higher than in decades past when U.S. companies could afford to give their Chinese “partners” older generations of technology, confident that the U.S. firms could innovate faster. Now for many foreign advanced industry companies, doing business in China requires transferring ever-more valuable technology to Chinese joint venture partners. As the United States Trade Representative’s Office (USTR) points out in its 301 report on China, pressures on U.S. companies to form joint ventures and transfer technology “is particularly intense.”¹⁰

The Chinese government has employed the weapon of forced technology transfer to gain technological know-how in a variety of industries. A well-known case in point concerns high-speed rail. Over the past 15 years China built the largest high-speed rail network in the world. China’s massive purchase of rolling stock, signal systems, and related equipment was something no foreign rail producer could afford to ignore. As such, the Chinese government had enormous leverage to pressure foreign producers to give Chinese state-owned enterprise competitors key technology and intellectual property (IP). The Chinese term for this is “exchanging market for technology.”¹¹ As Chen and Haynes document, in 2004 the State Council of China adopted a new railway development strategy that shifted from just subsidizing domestic producers in order to help them

⁸ U.S. Congress, Office of Technology Assessment, “Technology Transfer to China,” (Washington, DC: U.S. Government Printing Office, July 1987), 6, <https://www.princeton.edu/~ota/disk2/1987/8729/872901.PDF>.

⁹ Kun Jiang, Wolfgang Keller, Larry Qiu, and William Ridley, “International Joint Ventures and Internal vs External Technology Transfer Evidence from China” (working paper, National Bureau of Economic Research, Inc., 2018), <https://ideas.repec.org/p/nbr/nberwo/24455.html>.

¹⁰ Office of the U.S. Trade Representative Executive Office of the President, *Findings of the Investigation into China’s Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation Under Section 301 of the Trade Act of 1974*, (Washington DC: March 2018), 22, <https://ustr.gov/sites/default/files/Section%20301%20FINAL.PDF>.

¹¹ Zhenhua Chen, Kingsley Haynes, “A Short History of Technology Transfer and Capture: High Speed Rail in China,” (November 2016), 4, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2872527.

improve their technology to one where they “introduce advanced technology through joint design and manufacturing, [with an ultimate objective to] to build a Chinese brand.”¹² After that the state Ministry of Railways (MOR) launched three tenders for foreign high-speed electric trains and in each one MOR stipulated that foreign companies had to collaborate with domestic partners in the competition and had to transfer key technologies to achieve localization.¹⁶ The tender included two key conditions: to win, the bidder had to transfer technology to China and the final products had to be marketed under the Chinese state-owned enterprise rail car brand. This was all in support of the government’s “Action Plan for the Independent Innovation of Chinese High-Speed Trains.” As a result, multiple foreign train companies were pressured to transfer valuable technology to the Chinese companies (now principally one company due to the central government forcing the two main companies to merge into a powerful national champion, the Chinese Railway Construction Corporation (CRCC), now the largest rail producer in the world.) As Chen and Haynes write, “The result is a new HSR [high speed rail] industry in China has emerged which now serves the new vast HSR network and looks externally to export its new skill in HSR production and its new cutting-edge activity in HSR innovations.” Not only are CRCC and related Chinese companies virtually guaranteed all Chinese rail projects, but CRCC is now aggressively exporting trains and train systems containing advanced foreign technology to other nations, backed with generous export subsidies from the central government. For example, the China Export-Import Bank (a state agency) announced in 2017 the equivalent of \$30 billion in financing assistance for CRCC exports.¹³ (Surprisingly, the U.S. Department of Commerce International Trade Administration, in its document promoting U.S. rail export opportunities to China, makes no mention of the fact that the lion’s share of these opportunities come with forced technology transfer requirements.)¹⁴

The Chinese have employed different tactics to the same end in the biopharmaceutical industry, where various policies enable Chinese firms to get access to U.S. technology. For example, the relatively short six-year term for data exclusivity, coupled with the lack of a formal definition of a “new chemical entity,” means the Chinese government can pressure U.S. firms to turn over important data to Chinese generic drug firms. Similarly, the Chinese government requires that any drugs sold in China must go through Chinese clinical trials, even if they are approved in the United States. This extends the time for sales before a company can sell a drug by as much as eight years, meaning that the company has only 12 years left of patent-protected sales in China before a Chinese generic company can copy the drug. Moreover, in China, unlike the United States and Europe, there is no extension of marketing exclusivity at the back end to take into account long clinical trial delays.

¹² Ibid, 8.

¹³ “China’s High-Speed Train Maker to Get \$30 Billion for Export Push,” *The Economic Times*, October 3, 2017, <https://economictimes.indiatimes.com/news/international/business/chinas-high-speed-train-maker-to-get-30-billion-for-export-push/articleshow/60924380.cms>.

¹⁴ “China- Rail and Urban Rail,” Export.gov, 2017, <https://www.export.gov/article?id=China-Rail-and-Urban-Rail>.

Moreover, China also issues compulsory licenses for the intellectual property for particular drugs.¹⁵ Finally, it presses foreign biopharmaceutical companies to form joint ventures if they want their drugs more easily put on the government list of drugs to qualify for reimbursement.¹⁶

We also see this in cloud computing. China requires companies running cloud-computing operations to be locally controlled. This means that if a company like Amazon Web Services or Microsoft wants to serve the rapidly growing Chinese market it must partner with a Chinese company and sell its services under the Chinese company brand. And as part of this partnership the expectation is that the foreign cloud provider will provide the Chinese firm with technology and know-how.¹⁷ Yet Chinese cloud providers, like Aliyun, the cloud services unit of Alibaba, are able to establish their own data centers in the United States without any similar requirements.

China is able to do this because its domestic market is so large and growing so rapidly that as a “monopsonist” foreign firms are willing to enter into commercial arrangements that they would reject in much smaller nations, knowing that if they do not accede to Chinese government demands that their share of the market will be zero.

China does this because its enterprises, including state-owned enterprises, generally lag Western technology leaders in technological capabilities, and coercing foreign firms to transfer technology is a relatively straightforward way for China to catch up.

As a result, often U.S. firms feel they have no choice but to transfer technological know-how to China. This suggests that BIS should focus much less on product exports and more on transfers of actual technology know how (e.g., joint ventures, technology licensing, etc.) to Chinese organizations (private companies, state-owned enterprises, and government organizations).

However, absent our allies also taking steps to enact a similar regime the risk is that the Chinese government will turn to non-U.S. firms where they can, shutting out U.S. firms from the Chinese market. In other words, the Chinese government will make it clear to the non-U.S. firm that if they

¹⁵ Daniel C.K. Chow, “Three Major Problems Threatening Multi-National Pharmaceutical Companies Doing Business in China,” (working paper, Ohio State Public Law and Legal Theory, 2017), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3029347.

¹⁶ Angus Liu, “Riding on Booming Drug Sales, AstraZeneca Forms \$133M China Joint Venture,” *FierceBiotech*, November 27, 2017, <https://www.fiercebiotech.com/biotech/riding-booming-drug-sales-astrazeneca-forms-133m-china-joint-venture>.

¹⁷ Cate Cadell, “Amazon Sells Off China Cloud Assets as Tough New Rules Bite,” *Reuters*, November 13, 2017, <https://www.reuters.com/article/us-china-amazon-cloud/amazon-sells-off-china-cloud-assets-as-tough-new-rules-bite-idUSKBN1DE0CL>.

accede to Chinese demands that they can have market access and a relatively “smooth road” (e.g., no government investigations, permits that are approved, etc.).

In this case, China will have gotten the technology it wants, U.S. firms will have lost sales and earnings they could have reinvested back into R&D, and U.S. competitors will have gained market share. This suggests that just as some covered products on multilateral export control regimes are part of a multilateral export control regime, that any restrictions on technology transfer also be part of a similar multilateral regime. Of course, this solution will be much easier if the global community successfully presses China to abandon its forced tech transfer regime.

It will also be important for BIS to do a better job of understanding the nature of the Chinese organization the technology is being transferred to. The Chinese government has pursued an aggressive civilian-military technology fusion program focused on forced tech transfer and intellectual property theft. And it is not always clear the nature of the Chinese companies and organizations and the extent of their ties to the Chinese military. As a result, what may look like, and what may be, a normal transaction is not, particularly if it is a state-owned enterprise. To prevent this, BIS should focus on joint venture and technology transactions with Chinese state-owned enterprises with a link to the military.

Sincerely,

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