Asymmetric Competition:
A Strategy for China & Technology

Actionable Insights for American Leadership

China Strategy Group

Fall 2020

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About this Project

The China Strategy Group was formed in July 2020 with the purpose of tackling the most difficult questions regarding the United States's competitiveness with China on technology. This effort was undertaken in the service of providing actionable insights to underpin a new U.S. strategy.

The group, conceived and founded by Eric Schmidt and Jared Cohen, brings together an eclectic group of individuals, with the belief that fresh perspectives must be brought to bear on the key issues in order to generate deeper understanding. To that end, the fifteen-person group includes China scholars, start-up founders, cryptography techies, venture capital investors, academics, a leading quantum computing engineer, technology executives, and former policymakers. We are Democrats, Republicans, and Independents. Some of us are old China hands, while others are established technology hands who are new to policy conversations.

Over the course of three months, the group conducted research, generated hypotheses, and met regularly to debate a range of thorny topics. The unorthodox approach and methodology of the group has generated novel thinking, demonstrating that in order to devise truly creative and unconventional solutions, new voices must be brought into the conversation. We believe this generative model—of a pop-up think tank or ad hoc brain trust of diverse experts—breaks new ground in this regard, and can be replicated to contribute meaningfully to future sense-making in a interdisciplinary, complex world.

We have been both humbled and inspired by the enormity of the challenge facing American leadership. As citizens, we hope that the insights of the group will be illuminating for those charged with the weighty and difficult task of positioning the United States for enduring success in our competition with China.

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All members participated in their personal capacity. This report was prepared independently from any political or governmental entity. While the report generally reflects the observations, insights and recommendations of the group, it is not the case that every member will agree with everything expressed herein. Debate inside the group was vigorous, and this document is intended to stimulate further discussion rather than represent the final word.

Executive Summary

America's technological leadership is fundamental to its security, prosperity, and democratic way of life. But this vital advantage is now at risk, with China surging to overtake the United States in critical areas. Urgent policy solutions are needed to renew American competitiveness and sustain critical U.S. technological advantages.

In this report, the China Strategy Group, formed in July 2020 by Eric Schmidt and Jared Cohen, advances policies that position the United States to out-compete China without inviting escalatory cycles of confrontation, retaliation, or unintended conflict. While competition is the dominant frame, also essential is considering where cooperation, collaboration, and exchange with China is in our interest, as severing ties and closing off the United States to the ideas, people, technologies, and supply chains necessary to compete effectively will undermine U.S. innovation.

The report makes key judgements about the status and stakes of U.S.-China technology competition and then advances specific policy frameworks and recommendations in three broad areas: 1) Technological Battlegrounds, 2) Functional Capabilities for the Competition, and 3) Structures for the Future.

Critical Technologies & Platform Competition

In order to lead, the United States will need to maximize its competitive advantage in key strategic technologies in ways that overcome China's advantages, which include greater scale, hyper-integrated platforms, and faster product integration loop.

- We developed criteria for assessing the criticality of technologies including their relation to choke points, competitive moats, security risks, and ability to accelerate other technologies. Key diagnostic questions include: Is this a single point of failure for a broader economic field? Does a lead in this domain provide a highly defensible competitive advantage? Does this technology pose a straightforward risk to U.S. national security interests under specific circumstances? Does this technology increase the overall rate of invention?

Platform dominance is a crucial aspect of competition with China.

- We developed criteria for assessing the strategic, political, and human rights importance of different kinds of platform competition as well as a taxonomy of potential remedies to mitigating our dependence on platform technologies owned by foreign firms. These remedies range from acceptance of the dependency, to specific negotiated concessions and technical requirements, to technological ways to mitigate future risks, and, as a last resort, bans of the platform technology.

Functional Capabilities

Intelligence. We need to upgrade our intelligence capabilities to dominate the forecasting space. If we cannot forecast where technology is going, we cannot stay competitive.

- We argue for the creation of a new, open-source National S&T Analysis Center (NSTAC); mechanisms that allow the public and private sectors to share insights about S&T intelligence efficiently, legally, and fairly; bringing private sector forecasting capabilities to bear on security issues; broader sharing of intelligence and analysis on technology with a new alliance of democratic nations

with technology concerns, called the T-12; new intelligence capabilities to detect and compete with Chinese disinformation; improved technological fluency within the IC; and the creation of an Intelligence Reserve Corps of external experts.

Brain Drain. The United States will need to develop, attract, and retain human capital and foster environments for inquiry and experimentation.

- We urge addressing current bottlenecks in immigration policy; building educational systems that prepare researchers for industry roles; creating risk-tolerant research environments that encourage innovation; and cultivating a broad base of skilled labor that drives much of our economy.

Supply Chains. Building more resilient supply chains is critical to diminishing our vulnerability to Chinese control, but will require significant investment in domestic infrastructure, ally-centric production, and advances in automation.

- We recommend a framework for evaluating critical supply chains as well as specific policies on how to protect the U.S. through export controls, niche market R&D, and reshoring.

Structures for the Future

Multilateralism. We must work with allies to strengthen cooperation among like-minded countries; promote collective norms and values around the use of emerging technologies; and protect and preserve key areas of competitive technological advantage.

- We urge a new multilateral forum called the T-12 to bring together key countries to coordinate responses to technological competition with members as the United States, Japan, Germany, France, Britain and Canada, the Netherlands, South Korea, Finland, Sweden, India, Israel, and Australia. We also argue for a new International Technology Finance Corporation, strategy of microlateralism that gives smaller countries the opportunity to lead on select issues, a global body for standard-setting, and the creation of multilateral trust zones to achieve global integration that promotes American values.

Government Redesign. Our internal government structures are not optimized to address the new challenges posed by emerging technologies.

- We propose a menu of potential executive branch reforms at the White House and across departments & agencies to: 1) upgrade how strategy assessments are made; 2) bolster tech expertise in policymaking; 3) position the White House to lead across the interagencies & with industry; and 4) architect a new era of technological statecraft. Specifically, we propose the creation of a new Deputy National Security Advisor for Technology and NSC Directorate on Emerging Technology.

II. Introduction: Winning the Technology Competition with China

America's technological leadership is fundamental to its security, prosperity, and democratic way of life. But this vital advantage is now at risk, with China surging to overtake the United States in a number of critical areas. Left unattended, the U.S. position will further erode as Beijing garners power and influence over the rights and well-being of people around the world, including in the United States. This challenge calls for urgent policy solutions to renew American competitiveness, arrest these trends, and sustain critical U.S. technological advantages.

Technology competition between the United States and China is emerging at a time of substantially greater tension in the bilateral relationship. Although the Trump administration has accelerated the deterioration of ties and approached China in a chaotic and often self-defeating manner, the two countries were already on divergent trajectories prior to Trump's presidency, particularly after Xi Jinping's ascension to party leader.

A new administration should recognize and embrace this competition, developing policies that position the United States to out-compete China. While there are some aspects of this competition that are fair, there are a number of asymmetries that favor China (for example, its lack of separation between public and private sectors, large population, abundant state capital, and data-generating surveillance apparatus). In competing where we are strong and navigating the asymmetries where we are disadvantaged, the U.S. should lean into democratic values as an asset and grow its competitive capacity by coordinating more closely with democratic partners and technology companies. In areas where we have fallen too far behind to catch-up, we should focus on mitigating risks and closing the gap.

Getting there will require a more sophisticated approach that bolsters U.S. competitiveness without inviting escalatory cycles of confrontation, retaliation, or unintended conflict with China. Even as competition is the dominant frame, we should consider where cooperation, collaboration, and exchange with China is in our interest. The United States will also have to take care to avoid actions that, on balance, are counterproductive and undermine U.S. innovation by severing ties and closing off the United States to the ideas, people, technologies, and supply chains necessary to compete effectively.

Guided by these principles, we sought to probe foundational assumptions, assess the stakes of the U.S.-China technology competition, and gain a clearer understanding of what objectives and possible policy solutions are acceptable, preferable, and realistic for the United States. The subsequent pages reflect the results of these efforts.

Several framing points guide these results:

The Competition is Asymmetric—China plays by a different set of rules that allow it to benefit from corporate espionage, illiberal surveillance, and a blurry line between its public and private sector. Beijing views these asymmetries as our problem, not theirs. It will be America's burden to navigate these.

The Window for Competing on Technology Remains Open—But Not Indefinitely: Too often in Washington, concerns about China are vague and ill defined. Our memos focus specifically on the implications of losing America's dominant position in foundational and emerging technologies, which would seriously harm U.S. prosperity and security, as well as dependencies on China in critical sectors that could be weaponized against us. We also

assessed witting or unwitting complicity in China's human rights violations and techno-authoritarianism, and the dwindling opportunity to intervene.

The Current Trajectory Is Not Favorable to U.S. Interests: The Trump administration's policies have done little to arrest America's eroding technological advantage, which has resulted from China's industrial policy (including its illegal and unfair trade and investment practices), as well as our own long-term neglect of our R&D base, atrophy of federal funding, and insufficient response to the China challenge. At this point in time, China is in a highly competitive position in several critical technologies, with massive investments driving its efforts to indigenize production and eventually supplant U.S. technological dominance, though it currently remains dependent on the United States and allies in key areas.

We Have Agency—Not to Change China, but to Shape Favorable Outcomes for U.S. Interests: We should assume that we will continue dealing with China as we see it today and not expect to change China's trajectory or overall approach to technology and economics, even if we can do more to pressure their choices and blunt their power. We can make key policy choices that give us greater agency to shape outcomes: restructuring the executive branch (*Government Redesign*), new talent and immigration policies (*Brain Drain*), dominating the forecasting space (*Intelligence*), and forging new multilateral partnerships (*Multilateralism*). These choices will allow us to bolster the distinctive strengths and advantages that the United States has, even as we are also clear-eyed about our vulnerabilities.

There Is No Returning to the Pre-Trump "Status Quo," and Some Degree of Technological Bifurcation is in U.S. Interests : Political and economic forces have, for the foreseeable future, eliminated the possibility of reverting to the previous path of near-unbounded integration. As we seek to avoid unnecessary and counterproductive levels of separation, we should also recognize that some degree of disentangling is both inevitable and preferable. In fact, trends in both countries—and many of the tools at our disposal—inherently and necessarily push toward some degree of bifurcation. Notably, even as the process of disentangling is tense and occasionally chaotic, some end states will in the long term be more stable, more predictable, and more favorable to U.S. interests. In any case, the pre-Trump "status quo" has been radically disrupted; returning to it cannot, and should not, be a goal of our policy.

We Should Be Explicit about Tradeoffs We Face: Responding effectively to the China challenge is largely about getting the balance right between competing objectives. Our group's discussions focused, for example, on the tradeoff between creating risk-tolerant research environments that encourage innovation versus security/espionage risks (*Brain Drain*). There are also important tradeoffs around export controls, where we limit profits in sensitive technologies for national security or human rights reasons. Of course, there are many other tradeoffs—and it's worth being explicit about where the hard choices are and how they ought to be managed and adjudicated.

The task at hand is to develop an approach for the coming period of intensified competition and friction, as well as rapid technological change, that allows the United States to most effectively advance its interests and values. These papers analyze aspects of this challenge with the aim of informing key decision-makers. This strategy document does not focus on everything, choosing instead to anchor our analysis and recommendations around seven objectives and key results that could be considered by the new administration on day one.

IV. Technological Battlegrounds

A. Critical Technologies

In order to lead, the United States will need to maximize its competitive advantage in key strategic technologies, rather than trying to outcompete in every area. To do so, we must first identify the most critical technologies, developing a rigorous set of criteria for determining inclusion in such a list. The framework for evaluation, below, provides a means to effectively differentiate between headline-grabbing apps and truly critical technological developments.

It is important to note that the United States leads in a number of novel technologies that have hinged on achieving a cutting-edge technical breakthrough, for example, artificial intelligence (AI) research, fusion, quantum computing, and autonomous vehicles. But in many other regards, China has a number of competitive advantages that positions it for technological leadership. First, it has the advantage of **greater scale**, which is a key fact in the progress of many industrial technologies, as well as data-driven innovations such as facial recognition or autonomous vehicles. Second, China benefits from **hyper-integrated platforms**, or technology products that are built on other platforms, yielding performance advantages as a result of the tight integration. Third, the Chinese consumer market has a much greater appetite for new innovations, a demand to which companies are able to respond rapidly, resulting in a **faster product integration loop**. Fourth, a more **flexible regulatory environment**, access to vast sums of **state and quasi-state capital**, and **different rules** that govern how they stifle non-Chinese competition and steal intellectual property (IP), create a faster path to scale.

Framework for Evaluation
The following set of questions help to determine if a given area of technology development is strategic, divided into four categories. A given technology does not need to meet all of these criteria to be considered critical. Additionally there are varying degrees to which any individual point can be true.

1. ***Choke point technologies: Is this a single point of failure for a broader economic field?***
   If a technology represents a choke point technology, a possible disruption may leave the United States particularly vulnerable. Whether a technology qualifies as choke point can be determined based on the answers to the following questions:
   a. Is this component on the critical path for an important sector? Would significant damage be caused if a single supplier was cut off? For example, China's national champions—ZTE, Huawei—are dependent on Qualcomm for core operations.
   b. Does a single country control disproportionate supply? For example, the world is dependent on rare earth metals from China.
   c. Is this dependency difficult to move elsewhere? For example, highly-managed infrastructure (e.g., enterprise software, avionics, telecom) does not cross borders easily.

2. ***Significant competitive moats: Does a lead in this domain provide a highly defensible competitive advantage?***
   A technology that confers a significant advantage by producing high barriers to competitors will prove critical to U.S. positioning by resulting in an enduring economic or technological leadership. The nature of that advantage can be assessed by determining:

   a. How deep is the moat? How significant of an advantage does this provide? Can the technology be deployed globally?
   b. How long will the moat last? There's an advantage in being "novel," but if the technology is valuable, it will soon become commoditized. How long the "moat" lasts depends on sheer magnitude of resources (talent, money, infrastructure) and information asymmetry.

3. ***Combating security risk: Does this technology pose a straightforward risk to U.S. national security interests under specific circumstances?***
   Some technologies pose inherent risks to national security, either due to integration with and access to critical information, or its ability to intercept crucial systems or infrastructure:
   a. Can an adversary intercept sensitive information flows, for instance by controlling a layer of the tech stack?
   b. Could they shut off some critical system? Could an adversary turn off critical information systems in a wartime situation?

4. ***Tech that accelerates other technology: Does this technology increase the overall rate of invention?***
   Some innovations have a multiplier effect, serving as an accelerant or building block for the development of other derivative technologies. The following questions measure the likelihood that a technology qualifies as a multiplier:
   a. Is the impact multiplicative across multiple domains? (e.g., semiconductors directly impact progress in 5G, quantum computing, AI)
   b. Can we maintain information asymmetry for the base technology?

This framework helps to elucidate subtle differences between fields competing for American resources in the form of investment, talent, and security. If a technology satisfies any of the above criteria, it should register as strategic and therefore critical to U.S. competitiveness. A technology that satisfies multiple criteria may be more valuable and therefore ought to be prioritized in terms of attention and resources. The framework also serves as a useful tool for elimination, distinguishing those inputs that are important but not-quite-critical, those apps that are popular but not truly threatening, and those areas of research where collaboration may be preferable to zero-sum competition.

Application of the Framework: Representative Case Studies

The framework's application to diverse technologies can help in determining those critical technologies meriting special attention, investment, and safeguarding. The following case studies represent under-discussed yet important technology areas, demonstrating how the framework can be used to assess complex and rapidly evolving areas of emerging technology.

1. **Gene Editing:** Gene-editing describes technologies that enable scientists to edit an organism's DNA sequence by adding, removing, or altering genetic material. Currently, CRISPR/Cas9 is the leading technique in the field. There are several strategic applications for this technology, for example:
   a. **Improved CRISPR precision**: Better CRISPR could eliminate many side effects of current gene editing, unlocking the enhancement of humans and other organisms.
   b. **Gene therapies and viral vector production**: Viral vectors are a way to transfer new genetic material to target cells, a technique that can be applied to immunotherapy and personalized medicine.

c. **Better multiplexing**: The ability to edit multiple genes at a time would accelerate development of T-cell immunotherapy and "stacks" of linked genes for disease-resistant crops.
d. **Protein characterization and editing**: Proteins form much of the structural elements for cells, serving as the key to future gene-editing and therapies.

These applications touch on the following parts of our framework:

- **Tech that accelerates other tech**: Better gene editing would advance cell and gene therapies and accelerate research in agriculture, cancer, and inherited diseases.
- **Competitive moat:** If the U.S. leads in gene editing, it can set precedents and create global coalitions around the regulation of these technologies.

2. **Next Generation Chips:** Chips are key components in electronics and computing. Innovation hinges on the development of better, more powerful semiconductors. Potential breakthrough technologies that could lead to step-change improvements include high-temperature superconductors that conduct electricity with zero resistance and faster speed. Similarly, biochips, which are still in an early research phase, have the potential to leapfrog silicon-based hardware.

   These applications touch on the following parts of our framework:

   - **Choke point:** High-power chips are crucial to strategic industries such as military technology and consumer ICT infrastructure.
   - **Security risk:** Chips could enable compute tracking or remote disabling.
   - **Tech that accelerates other tech**: Chips accelerate emerging technologies such as brain-computer interfaces, ubiquitous computing, wearables, and AR/VR.

B. Platform Dominance

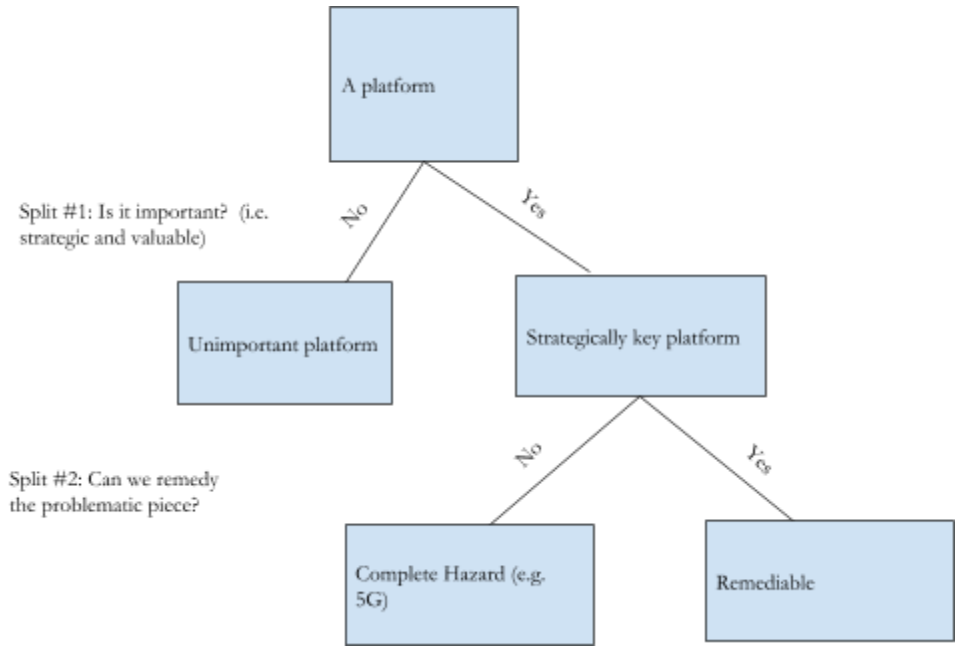
The U.S. government can and should work to shape the digital platform ecosystem in the United States and overseas, and aim to collaborate with other countries to do so.

Digital platforms are systems that facilitate interactions and transactions between multiple different groups using software. In these systems (e.g. Windows operating system) a considerable amount of the economic value and activity is driven by the parties using the platform (e.g. app developers), rather than just the company that builds and mediates the platform (e.g. Microsoft). Platforms rely on network effects to gain momentum and scale, giving Chinese companies a natural advantage as its robust domestic base that provides a runway for global digital proliferation. Thus, our outreach should go beyond advanced democracies. Carving the digital world into regulatory islands or focusing entirely on the U.S. markets at the expense of global coalitions is a losing battle, as China's domestic markets are larger than the U.S. market.

We must also recognize that any actions taken by the U.S. government against Chinese companies will be used to justify similar actions against U.S. companies abroad. The United States must avoid precipitating second order effects that may be more damaging to U.S. interests than the original threat.

Framework for Evaluation
We propose the policy tree below to guide policymakers on when to consider intervention in the market for a Chinese tech platform gaining adoption, based upon two questions:

1. **Is it important?** Is the given platform both strategic and valuable, thereby meriting substantial attention in the first place?
2. **What are the potential remedies?** Can the potential threats from Chinese platforms be mitigated through technical solutions and/or negotiation with the Chinese government/company? Or are they fundamentally hazardous, presenting problems that cannot be tolerated or successfully managed?



Question 1: Is it important?

What is Strategic? Democractic platforms that are strategic are those that may fundamentally enable or impair a well-functioning democracy. Examples of specific forms of risks that strategic platforms may expose:

1. **Threats to free and fair elections**
    a. **Misinformation Campaigns**: Social and news platforms can be used to manipulate information prior to an election. Disinformation campaigns became common during Taiwan's elections and contributed to the victory of pro-Beijing candidates. These may be conducted via bots using modern AI techniques or well-coordinated groups of humans.
    b. **Propaganda:** Platforms with algorithmic filters for content may be unintentionally biased in the information they present. For example, a Chinese social media network can make a particular candidate's posts more or less viral to promote or suppress particular view points.
    c. **Voter Suppression:** Incorrect information about when to vote, how to vote, polling data, or other such information could be used to influence voter turnout.
    d. **Societal discord**: Campaigns can cultivate distrust and conflict in and across racial, ethnic, religious, or employment boundaries in other countries.

2. **Threats to civil and human rights**
    a. **Privacy violations**: Chinese platforms are unlikely to adhere to U.S. privacy standards or norms around data use. For example, Chinese platforms may gather sensitive location data about its users which may include journalists, politicians, and their families.
    b. **Censorship**: Distribution algorithms may censor or demote content deemed antithetical to Chinese interests, restricting users' freedom of speech.
    c. **Surveillance:** Data collected may support discriminatory and authoritarian surveillance models, such as facial recognition and targeting of Uighur minorities.

3. **Threats to national security and sovereignty**
    a. **Sensitive data theft**: Commercially valuable data, consumers' and businesses' economic activity, and politically strategic data/communications traveling through Chinese-owned platforms can be intercepted.
    b. **Circumventing sanctions, money laundering, and criminal/terrorist financing:** Chinese digital payments systems such as DCEP can enable Chinese entities or other countries to transact internationally without the USD, circumventing and weakening U.S. financial sanctions. 55% of trade between Russia and China is no longer denominated in USD, indicating both countries' desire to circumvent USD settlement and the U.S. banking system.

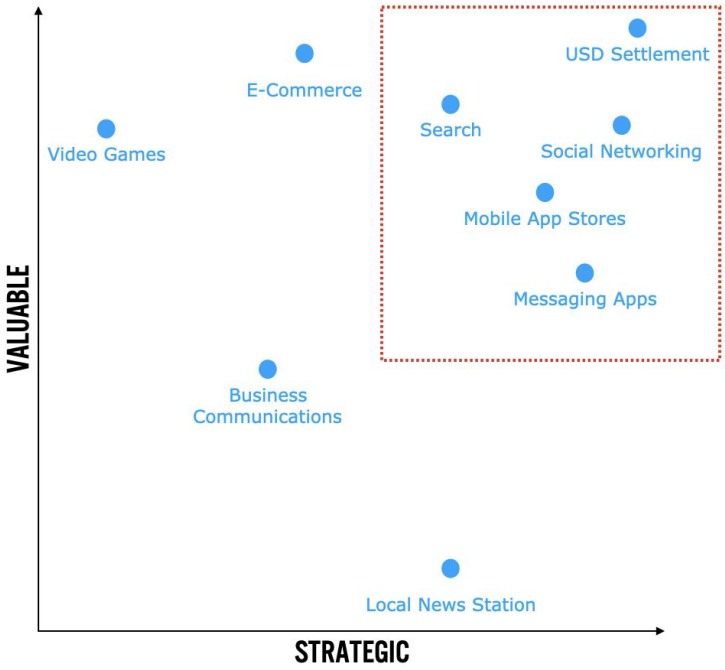
What is Valuable? A valuable platform must have sufficient impact to merit attention and possible action. An example of a platform that is not valuable may be a single local news station, which although influential to a local geography, does not have influence at scale. A social network with 100 million users across diverse geographies is valuable due to its reach and potential for impact on strategic impact.

Standard technology measures of value can determine if something is large enough to prioritize.

1. **Number of people** using the platform.

2. **Total time spent** on the platform.
3. **How much money** (payment volume, gross merchandise volume) is driven by the platform.

Example Assessments



Question 2: What are the potential remedies?
Whether strategically important and valuable platforms *may or may not* be remedied leads to substantially different policy choices for the United States. In practice, there is a spectrum of mitigations of increasing intensity that we may consider:

1. **Acceptance of the dependency** on an important platform owned by a Chinese company
2. **Specific concessions negotiated** with the Chinese government
3. **Specific technical requirements** that we require Chinese companies to adhere to (in areas such as data storage, data privacy, end-to-end encryption, code audits, open standards, etc.)
4. **Proactively enable technology** to mitigate future risks
5. **Ban** as a last resort.

Crucially, 1-4 minimize second order impact on U.S. companies and interests. If the E.U. were to make similar asks of the U.S. or U.S. companies, we would not impair U.S. interests.

1. **Acceptance of the dependency on an important platform owned by a Chinese company**
   It may be the case that a strategically important platform is owned by a Chinese company, but for any number of reasons the U.S. Government is comfortable with this. For example, if the Chinese company's offering to U.S. customers is in a wholly owned subsidiary, headquartered in the U.S., and with a U.S. Board of Directors.

2. **Negotiate with the Chinese Government**
    - We may want to negotiate directly with the Chinese government for specific concessions around data storage, encryption, access to markets, intellectual property rights, etc. In practice, these will be a broad set of asks that impact all platforms rather than solutions for specific platforms. Specific tactics to enlist may include:
    - **Import Restrictions:** Tariffs and other restrictions on Chinese imports. Targeted sanctions.
    - **Export Restrictions:** Restrictions on U.S. high tech exports, broadly, or targeting individual Chinese companies.
    - **Transaction Scrutiny:** Heightened U.S. investment scrutiny. International Emergency Economic Powers Act (IEEPA) to block transactions and freeze assets in response to extraordinary threat. Divestment requirements.
    - **Disclosure and transparency requirements:** through FARA reform (Foreign Agents Registration Act)

3. **Require Chinese companies to adhere to specific technical requirements**
    a. Specific requirements can be tailored to the particular threats from a specific platform:
    b. ***Technical Restrictions***
        - **End-to-end encryption**: Mandating the use of open source encryption protocols that limits the service provider's access to user data. This eliminates the ability for the Chinese government to access the encrypted data.
        - **API access to social graph:** Unlock access to the underlying social graph for a social network so that competitors can bootstrap easily and flourish. This prevents monopolistic behaviors and allows domestic competition to international companies.
        - **Operating System Controls:** Push mobile operating systems to allow granular controls of data that applications may access, more ways to remind people of data they are sharing with applications, easier access to turning off specific types of data/applications, and to reject applications from app stores that are overly aggressive in the permissions they request.

    c. ***Technical Transparency***
        - **Open Sourcing:** It may be required that key components of a technology be made open source to allow for public scrutiny and verification of security.
        - **Code Audits:** Having a company provide sample code to a trusted intermediary (e.g. Academia, legally liable U.S. company) to perform an audit. Limitation: certain code cannot be open-sourced because of risks of trade secrets or risks of breaking the ecosystem (e.g. Google will not open source the search algorithm because 3rd parties will game the system)
        - **Transparency Reports:** Firms may be required to publicly disclose aggregate data about numbers of bots, what percentage of their content has been censored, the types of URLs they may be banning, and other aggregated data.
        - **Black Box Tests**: Similar to stress tests on banks or security audits done by third parties, audit firms attempt to exploit platforms' weaknesses and determine how

many of the actions are caught by the platform as a measure of how resilient platforms are to exploitation.

d. ***Data Localization***

- **Geographically Isolated Data Silos:** Data obtained in the U.S. must stay on servers in the U.S. and cannot be transmitted offshore, even for analysis or processing
- **Domestic Payments:** Payments must be processed by domestic banks so that transaction and purchase data does not leave the U.S..
- **Transmission Constraints:** Data of U.S. citizens may not be analyzed inside of the country and any metadata must remain inside the U.S..

4. **Proactively enable and support technologies to mitigate future risks**
   - **Open Standards:** Force platforms to abide by open standards set by the industry for data sharing, encryption, and interoperability to enable participants to audit each other.
   - **Homomorphic encryption:** Homomorphic encryption would allow platforms to operate on data encrypted using a mobile phone without being able to access the unencrypted data itself. This would prevent U.S. citizens' data from being abused by any corporation and protect against data breaches.
   - **Open source trusted execution environments:** Trusted execution environments allow for secure computation on data without data ownership being granted to a third party or being exposed to a third party.
   - **Novel network packet routing technology:** Protocols to route data on networks while obfuscating the data from the network provider grant extra security from Chinese networking providers, messaging clients, and search engines and may be useful for journalists, dissidents, and citizens in oppressive regimes.
   - **Central bank digital currency and settlement layer:** Proactive investment in payment technologies and central bank digital currencies (CBDC) to counteract the investments being made by the Chinese government in their CBDC and digital settlement layer are necessary to avoid a 5G situation in 5 years.

5. **Ban (Last Resort)**

   Banning would represent a failure to have acted swiftly in years prior with options B, C, or D at an earlier stage. While it may be necessary in some cases, this should be seen as a last resort and with a clear articulation of why the risks inherent in the platform are not remediable through negotiation, legislation, or technology.

V. Functional Capabilities

A. Intelligence

It is critical that we upgrade our intelligence capabilities to dominate the forecasting space to remain competitive. Compared to China, the United States suffers from two science and technology (S&T) intelligence disadvantages: the U.S. government doesn't benefit from intelligence collected by the U.S. private sector; and the U.S. private sector doesn't benefit from intelligence collected by the U.S. government. While our system will never adopt the model of the Chinese Communist Party with its use of state intelligence capabilities to advance Chinese companies, the U.S. nevertheless needs a robust S&T intelligence capability to assess and forecast foreign S&T capabilities and investments. Such intelligence can inform technology policies, including R&D investments, technology procurement, technology diplomacy, trade negotiations, research security, export controls, investment screening, and patent enforcement.

To date, there is no process that consistently gathers, evaluates, and distributes critical technology intelligence to the necessary policy organizations. The intelligence community has not prioritized identifying risks and opportunities regarding U.S. technology leadership. There is not a comprehensive view of how to create and sustain intelligence across critical technology sectors. There are also inherent limitations in how the U.S. government engages private companies and institutions in gathering and evaluating intelligence. New structures and arrangements are needed, including better ways to appropriately and legally pool insights and information from the public and private sector, expanded information sharing on technology with key allies beyond Five Eyes, and, most importantly, the creation of an open-source National S&T Analysis Center (NSTAC).

The New Landscape

The United States is no longer the global science and technology (S&T) hegemon. Whereas U.S. R&D in 1960 was more than two-thirds of global R&D, today it is less than one-third. Worldwide S&T literature has grown 10 times from 1980 to present, augmented by exponential growth in geospatial, news, social media, and contextual data. Given the globalization of S&T innovation and the central role of technology in U.S. national security and prosperity, effective strategy and policy require timely open-source collection and analysis of worldwide S&T developments. Open-source collection and analysis is widely misunderstood in the United States as a mere "enabler" of classified intelligence, not as a source of intelligence itself, and is deprioritized for funding.

Our rivals have already moved to monitor this new information space. China's rapid rise in S&T has been facilitated by a staff of more than 60,000 open-source collectors and analysts monitoring and exploiting foreign S&T, which has enjoyed massive, multi-layered state support for some 65 years. Other countries have similar, if smaller, enterprises under the umbrella of a ministry of science and technology. The United States has no equivalent enterprise. Its S&T collection and analysis has prioritized military affairs and technical collection rather than global developments in emerging technologies or their implications for economic competitiveness. As a result, the Intelligence Community (IC) has not emphasized open-source intelligence (OSINT), and other potential institutions with insights on technology (e.g., DoD, DoE) have failed to develop robust open-source capabilities.

The strength of innovation in the commercial sector also means that many technologists and technological expertise exists outside the government. As a result, in many cases, the U.S. private sector has substantially better insights about S&T intelligence than the intelligence community, but the U.S. government has limited means for receiving these insights or sharing its own observations about critical trends and strategic developments. Presently, "National Asset" programs for some IC agencies are severely constrained, and reporting information is inconvenient. Additionally, with so little reciprocity, there are few incentives for private sector professionals to share their knowledge and insights, even as the government and private sector share many of the same information and forecasting needs. A new approach to private sector cooperation is needed.

Similarly, there is a wealth of technology data within different U.S government organizations. However, this data is not aggregated on a broadly useful basis. Sources of useful data can be found in the National Labs, NIH, NSF, NASA, DARPA, among others. New ways of marshalling it are needed.

Policy Options

- **Establish a new, open-source National S&T Analysis Center (NSTAC).** Such a center would be an independent entity like the National Science Foundation, not housed within the intelligence community or limited by Title 50 authorities, and primarily or exclusively dedicated to S&T collection, analysis, and decision support, and funded for that priority. The center would carry out open-source analysis and decision support for functions including allocating R&D investment and/or divestment, promoting international collaboration and partnerships, detecting unwanted tech transfer, channeling hiring, supporting S&T forecasting, refining assessments of foreign S&T collection and intent, and supporting long-term S&T strategic planning for federal, and, as appropriate, sub-federal authorities, as well.

- **Develop mechanisms that allow the public and private sectors to share insights about S&T intelligence efficiently, legally, and fairly.** These could include: 1) amend existing policies that already allow USG to share "threat intelligence," to also allow sharing of general S&T intelligence; 2) provide a larger number of private sector experts with security clearances, or alternative vetting (e.g., anyone with a Global Entry, or anyone with FFRDC or UARC employment is automatically qualified); 3) create mechanisms that allow efficient collection and vetting of insights and information from the private sector (e.g., secure surveys, prediction markets); 4) provide incentives for accurate information (e.g., leaderboards for accuracy scores can be turned into monetary prizes, bragging rights, resumes, or rare experiences such as visiting NORAD.

- **Identify how private sector forecasting capabilities can be brought to bear on security issues.** When it comes to technology, much of the intelligence gathering and analysis can take place in unclassified domains. In most cases, the U.S. government has no particular advantage in collecting & analyzing OSINT S&T intelligence compared to the private sector. We should prioritize government billets and activities for unique classified intelligence work and create trusted mechanisms outside of government to analyze the vast amount of raw data that exists in the public domain. Another option is to create forecasting boards with both public and private sector members. These could exist at multiple levels and proliferate as necessary to cover specific regions, countries, and/or functional challenges.

- **Multilateral sharing beyond the Five Eyes is essential to pool intelligence and information about technology, which is itself inherently multi-sector and multi-national.** One possible model to embrace for broader sharing of intelligence and analysis on technology is to build on the emerging alliance of democratic nations with technology concerns, such as the T-12 (see *Multilateralism* for a detailed description of the T-12). There already exists a series of bilateral arrangements among many of these countries (in various combinations), so there is an existing, compartmentalized information-sharing foundation that could be expanded or restricted as necessary. Significant private sector sharing also takes place within these countries, so it would be natural to have a corresponding multilateral mechanism to ensure governments derive a benefit from those exchanges. There may be some instances in which more expansive sharing is useful, in which case a T-12 + N model could create an opportunity to bring in countries with whom we wish to share, or who have unique expertise relevant to the specific context. These multilateral approaches offer an opportunity to extend a hand to countries otherwise excluded from Five Eyes.

- **China's growing AI capabilities and evolving tactics in the disinformation space represent a growing threat that will require new intelligence capabilities to detect and combat Chinese information operations.** While some organizations such as DARPA through its SMISC & MediFor & SemiFor programs have made progress in our ability to detect and counter disinformation, much more progress is needed to mainstream these capabilities and modernize the IC to be able to protect and defend American citizens from attempts by rivals to manipulate the information space for political, social, or economic benefit.

- **Elevate the technological fluency of the IC.** Create fluency training in critical technologies and offer the opportunity to test into different levels of proficiency and be rewarded with extra compensation and recognition. The goal is not to turn everyone in the IC into coders or engineers, but rather incentivize the work force to become conversant in how critical technologies work.

- **Establish an Intelligence Reserve Corps of outside experts, pre-cleared, who on any given notice can be called upon to lend their expertise to a specific problem.** These would be individuals drawn from the private sector, academia or civil society. Differently from an advisory board where they are regularly meeting and involved on an ongoing basis, this would be a much larger group (could be thousands of people), organized and categorized by expertise and capability. They would be dormant unless called upon for short-term projects with clear goals.

B. Brain Drain Wars

To continue to lead in a broad range of technologies, the United States will need to develop, attract, and retain human capital and foster environments for inquiry and experimentation. This will require: 1) addressing current bottlenecks in **immigration policy**; 2) building **educational systems** that prepare researchers for industry roles; 3) creating risk-tolerant **research environments** that encourage innovation; 4) and cultivating a broad base of **skilled labor** that drives much of our economy.

Immigration

High-skilled immigration represents a key asymmetric advantage for the United States, as most scientists & engineers strongly prefer to live here over China.[1] Our universities, cosmopolitan culture, meritocracy, and the prospect for raising a family here all make the U.S. an attractive destination. But there have been signs of declining stay-rates, and the current administration's stance has made the U.S. less hospitable to foreign-born talent.[2] Immigration obstacles (e.g., quotas, waiting time, uncertainty), inability to bring or secure employment for family members, racism, and the unaffordability of tech hubs all serve as deterrents.

Fortunately, the politics of high-skilled immigration policy are favorable. There is zero fiscal burden, and research indicates strongly positive economic effects associated with increased high-skilled immigration. There has historically been bipartisan support for high-skilled immigration (though recently it has been used as a bargaining chip in comprehensive immigration reform debates). In addition, high-skilled immigration does not displace homegrown talent, as demand often exceeds supply.[3]

Policy Options:

- **A steady & more predictable approach**: Undo the recent visa suspensions and make modest fixes, expand O-1s, national security visas, National Interest Waivers.[4]
- **A more conservative stance**: Develop more opportunities to "work in place" abroad, including U.S. labs overseas. Fund R&D collaborations with allies and developing economies.[5]
- **The Canadian strategy**: Increase visa numbers, reduce green card backlogs,[6] shorten timelines, lift quotas (see, e.g., India, where there is a 7% cap on employment-based green cards for a country representing 75% of applications), and create accelerated pathways to permanent residency.[7]
- **The more ambitious strategy:** Revamp tech immigration policy, focusing on restoration of optional practical training (OPT) and raising the number of "Special Immigrant Status" awards to 10,000 scientists and engineers per year; reduce standard green card backlogs, and lift country quotas; provide a green card with every qualifying U.S. STEM graduate degree; place a $40,000 tax on every H-1B to be used toward domestic training (Dep't of Homeland Security, EOP)
- **Separate IP concerns from immigration:** Double the billets provided for investigation and prosecution of illegal tech transfer and IP theft. Create a "proportional response" doctrine for illegal tech transfer directed by foreign governments.

Education

Our current educational system is not geared toward supplying industry with required skills & talent. Academic research is often far-removed from industry or commercial needs. While some top performers in technology come from established academic pedigrees, many others have unorthodox educational paths (e.g., early entrances, dropping out, accelerated programs). The U.S. education system should increase opportunities for cross-pollination with industry.

Policy Options:

- Require that 10% of all federal STEM grants be used for teaching, ensuring investment in future talent (National Science Foundation)
- Encourage industry-academia exchanges, with incentives for universities to place professors and graduate students in industry, and to allow practitioners to hold teaching or lecturer positions. Industry funding for PhD students should be accompanied by opportunities for internships / physical exchanges.
- Survey high-performers to identify non-traditional patterns that have led to previous success, and ensure those paths remain available to high-potential students.
- Facilitate international sabbaticals and exchanges, including for researchers outside academia (e.g., "Fulbright for research/tech professionals") to lower barriers to experiences in other democratic countries and increase connective tissue between the research communities of our allies (Dep't of State)

Research Environments

Physical co-location remains important for an innovation ecosystem to thrive, providing a reliable workforce for start-ups, efficient access to shared infrastructure (physical prototyping, office amenities, etc.), and an intellectual hub for interdisciplinary exchange. But the rising cost of living in current tech hubs may ultimately detract from their ongoing ability to support bootstrapped innovation, calling for more micro-innovation hubs.

In addition, there may be a misallocation of highly-skilled talent between academia, government (national labs, contractors), and the private sector (big tech, as well as start-ups). Academics argue that their best students are lured away by lucrative industry jobs; yet, academia fails to produce enough PhDs in computer science due to a shortage of faculty, and punishes 10-year postdocs through limited appointments.

Finally, innovation can be deliberately cultivated through tailored management of large research projects. The "powerful visionary" approach (e.g., Steve Jobs, Elon Musk) may be more effective where the goal is clear and there are no fundamental questions about feasibility. For less-defined research projects, more flexible research environments (e.g., Bell Labs) are optimal.

Policy Options:

- Invest in more affordable R&D hubs in urban centers outside of the Bay Area & Boston.
- Expand accessible S&T infrastructure including compute and prototyping (e.g., Manufacturing Institutes).

Broad-Based Skilled Labor

Competing with China will require creating a U.S. economy that is more automated. Building automated production capacity generates dual advantages: less dependence on China and a more robust base of middle-class jobs. Repatriating $600 billion in manufacturing would require an additional 3-4 million U.S. workers[8]—currently an impossibility due to the relative scarcity of workers in the U.S. and the higher wages required to attract them.

Advances in automation could solve both these problems. Devices like cobots, and hand-like robotic arms can now work side-by-side with humans. 3D printing can also be used to augment traditional manufacturing. In some sectors, like apparel manufacturing, it may not be possible to increase productivity enough to achieve the wage levels U.S. workers demand. But in key industries like machinery and electronics manufacturing, automation could raise productivity enough to create jobs paying $20-30 per hour, consistent with current manufacturing rates.

Policy Options:

- **Invest in automation:** Create incentives to increase large-scale capital investment in automation and physical plant capacity.
- **Use slack in the workforce:** Divert unemployed construction labor from commercial retail sectors to manufacturing.
- **Encourage vocational training & skills-based hiring:** Increase support for vocational school at the secondary level (allowing for high school graduates to have a certified trade), vocational school grants at the tertiary level, and subsidies/tax incentives for on-the-job training or apprenticeship programs.
- Award grants and loans for skilled-labor training (Dep't of Education).
- Standardize certifications for skilled labor to improve transferability (Dep't of Labor)
- Identify opportunities to replace degree-based job qualifications with skill-based credentials/exams, increasing flexibility and reducing barriers to entry.

C. Supply Chains

Building more resilient supply chains is critical to diminishing our vulnerability to Chinese control, but will require significant investment in domestic infrastructure, ally-centric production, and advances in automation. Bolstering those supply chains ultimately serves to advance a wide range of U.S. interests and values, in order to maintain national security; preserve health security; impose costs for violations of human rights in China; keep U.S. firms from participating in business with known human rights-violating entities in China[9]; and improve and broaden the base of economic prosperity in the United States.

Framework for evaluating critical supply chains

The danger of any repatriation effort is its capacity for overreach; any product or service could be termed essential to national security in an extreme hypothetical ("the economy would collapse if 100% of screw imports were cut off"). Therefore we recommend that any such efforts be limited in scope. We need to thoughtfully designate for protection areas that are vulnerable to a real security risk.

To determine what is protected, we recommend the following filters:

1. Is the product vulnerable to politically-motivated supply restrictions?
2. Is the source of the product an entity linked to known human rights violations?
3. If either of the first two criteria are true, do reasonable, obtainable substitutes exist or could they be quickly developed if needed?
4. Are we willing to bear the costs of protecting the product or supply chain, and has the cost-bearing entity been identified?

For those products that fulfill this criteria—examples include cutting-edge semiconductors and the tools to manufacture them, DNA sequencers and synthesizers, and genomics data—a strategy to protect both the technologies and talent should be proactively developed now, before the United States loses its control over the core assets it needs to lead in science and technology.

The current focus on personal protective equipment (PPE) and 5G is important but primarily *reactive*: driven by events (COVID-19), high-profile PRC firms (Huawei), or high-profile PRC initiatives (indigenization). Policymakers must harness the momentum in current focus areas to implement a supply chain strategy that increases resilience and anticipates *future* events, high-profile competitor firms, and noteworthy initiatives (both high-profile and under-the-radar efforts). This strategy must also take advantage of automation (both industrial and service sector), as automation technologies are critical technologies in their own right as well as crucial enablers of reshoring.

Ecosystem support for secure critical supply chains

The process for disentangling key supply chains from China involves more than a focus on the end products.[10] Safeguarding key technologies requires the United States to define and secure the entire ecosystem of production, from fabrication to supply to talent to cutting-edge innovation. Recognizing the critical components and pinch points will help focus early efforts.

The elements of creating a robust, secure supply chain include:

1. **Physical infrastructure including transportation, energy, and fabrication capacity**:
    - The U.S. transportation system is optimized around importing and distributing containers. Domestic production will require investments in rail, truck, and ports to move goods in different patterns, between the Mexico/TX corridor, for example, or to eastern ports.
    - Fabrication capacity (with a high degree of automation) is clearly required for companies to reshore.[11] These investments require long-term planning and long lead times.[12]

2. **A robust set of allies and partners**

    The United States must work with allies and partners to secure supply chains. From basic inputs like rare earths from Australia to economically sustainable labor-intensive manufacturing in Mexico, U.S. allies will be a necessary part of many production processes. While the countries represented in the United States-Mexico-Canada Agreement (USMCA) and Five Eyes are secure locations, we might also need Quad countries (India for pharma APIs, for example). An updated policy towards Taiwan defense may be necessary given Taiwan's role as the largest and most cutting-edge chip manufacturer.[13] Despite the EU's ambivalent policy towards China, Ericsson and Nokia are necessary substitutes for Huawei equipment, requiring cooperation with Europe if realistic alternatives are to be developed in the telco space.

3. **Network of supporting capabilities, particularly in identified pinch points**:
    - The United States and allied countries need to have the right ecosystem of suppliers, vendors, and other providers to support highly evolved production processes. Intel's consideration of outsourcing all manufacturing to Taiwan and/or South Korea is a testament to the strength of those ecosystems and an example of the fragility of the United States' edge.[14]
    - Many suppliers are highly specialized, and they in turn require their own supporting suppliers which may not be easily transportable. Subsidies or tax incentives may be required, particularly in high fixed-cost industries where suppliers cannot otherwise justify investment in additional fabrication capacity. If pursued, such policies should be transparent and accountable (unlike China's subsidies), justified on the basis of job creation as well as faster time to market for U.S. players. In some cases, these key supplier systems may need to remain in secure allied nations.

4. **Tracking/tracing systems for verification of origin, authenticity**.

    Complex supply chains with international (a selected set of countries, vs. global) sourcing necessitate a means of ensuring traceability and enforcing regulations around sourcing. Blockchain technology may offer a solution.

5. **Scaling capability**:

    R&D prowess alone is not enough: to maintain an edge, a country must also excel in commercializing the research at scale.[15] In the past few decades, the go-to-market strategy (to create, scale, and sell a product) for many U.S. companies has increasingly relied on engaging overseas contractors. Because of this pattern, many companies have lost manufacturing skills including sourcing raw materials, assembly design, testing and quality control, and others.

The lack of scaling skill may necessitate greater reliance on sub-component suppliers and time to redevelop those lost skills.

6. **Talent**:

   The United States and allies must have the right talent at the right price to support reshored industries. As discussed in *Brain Drain*, the lack of skilled labor is a critical bottleneck. The United States also will need to enhance the appeal of trade schools, and in the coming years update their offerings to match the skills needed for highly automated re-shored industries. These skills are as important as physical capital to supporting domestic production.

7. **Automation**:

   A reshored production capability is necessarily one that is more automated. Access to robotics from secure suppliers (particularly in an IoT world where data and data security are fundamental elements of functionality) needs to be part of any secure supply chain strategy.

Executed too quickly or broadly, legislation to require reshoring is likely to be highly inflationary as well as infeasible given the lack of engineering skills, labor, and critical networks. However over time, the reshoring of manufacturing will produce multiple positive impacts on the broader economy, from job creation to investment in R&D to the creation of related and supporting industries.

Potential Chinese responses

China's leaders understand U.S. dependency as an important source of leverage.[16] At one time, it might have been possible to imagine an uneasy truce between the two countries, when various dependencies would lead to a kind of equilibrium. But the possibility of an equilibrium is now quixotic. Policymakers on both sides of the Pacific are working hard to gain the upper hand in setting the terms of the next phase of interdependence.

In the near term, the United States should prepare for China to go on the offensive more aggressively, deploying coercive economic measures and lawfare, such as threats around the export of rare earths, the new Unreliable Entities List, the beefed-up anti-monopoly law, and even arrests of executives or other American citizens living in China. Crucially, a U.S. supply chain strategy will play out alongside an ambitious and cross-cutting Chinese supply chain strategy (e.g., Made in China 2025), designed to minimize China's vulnerabilities to the United States.[17] Yet China is not only focused on indigenizing its production of foundational technologies it needs. Amid the pandemic and the trade war, China's government is making a significant play to bring more global supply chains to China, where manufacturing has already rebounded, as part of its "dual-circulation strategy."

Avoiding unintended consequences

We must be careful to avoid unintended consequences. Regulatory, export, and other limitations may hinder U.S. capacity in critical advanced manufacturing and R&D, erecting barriers to innovation in the very technologies we need to stay competitive. Policies to cut off exports may hurt China, but need to be carefully crafted not to equally hurt the United States. It may be necessary to sacrifice some short-term profits to achieve U.S. policy goals, as discussed above, but these should be in clearly-defined priority areas, with careful examination of the costs and benefits.

- **U.S. export controls on emerging tech**. Tracking evolving export control regulations is expensive. In a field of active research (e.g., superconductive materials), the restrictions are inevitably unclear and constantly changing, costing each research organization time trying to monitor what aspects of its work is controlled. This burden is particularly heavy for start-ups.

- **U.S. export control + high-end talent hiring.** Export controls often significantly limit an organization's ability to benefit from foreign talent. For example, an organization that would like to offer a lab tour to potential hires must screen for export clearance, but are not able to do so because "country of origin" is a protected status in employment law. In some instances, at the end of a (long, expensive) hiring process, a new employee is not able to do the work for which they were hired, because export controls have since evolved to encompass new areas of research.

- **R&D and reshoring**: As production has been offshored, some existing domestic factories and production lines have been repurposed for specialized prototyping (e.g. for niche markets) or complex development work requiring extra care. Researchers and developers rely on these "development-friendly" manufacturers for prototyping and the scaling process.
    1. Reshoring policies that motivate these facilities to pivot back to commercial production (e.g. through subsidies or tax breaks) could leave a critical hole in the prototype-stage of the manufacturing process. Reshoring also demands facilities with the ability to scale less-mature technology (as discussed in "scaling capability," above).
    2. Fluctuation in availability of materials also hits these small manufacturers first (and hardest) as suppliers have more to gain by satisfying higher-volume production customers.

Policy Options

This analysis points toward a range of next steps for government, business, and the two in partnership:

- Define secure locations for supply chains beyond U.S. borders. This includes USMCA, key European and Asian allies,[18] Five Eyes, possibly Quad, and other partners. The United States also needs to state a clear affirmative policy towards protecting Taiwan's semiconductor industry. This process also provides us an opportunity to engage countries outside of our traditional security allies, particularly in Africa and Latin America.
- Consider direct investments in infrastructure including transportation, energy, and other supportive sectors, along with potential tax incentives to encourage private sector partnerships.
- Make favorable-term loans and scholarships available for trade schools.
- Develop a U.S. government office that can audit supply chains and create industry reporting requirements to identify potential pinch points, ensure compliance with security requirements, and support key allies.
- Develop a recycling program for rare earths.
- Consider tax breaks on inventory to encourage more stock in supply chains.

Of course, these make only a partial list. But as the United States considers its economic recovery—and its economic future amid intensified U.S.-China competition—ambitious thinking about U.S. supply chains and national resilience is more necessary than ever.

VII. Structures for the Future

A. Multilateralism

There currently exists no mechanism at the global level where technologically-advanced democracies can coordinate geopolitical strategy with one another and their private-sector counterparts. The establishment of new multilateral mechanisms for state parties and key technology infrastructure companies would create the conditions for a coherent strategy and renewed American leadership on the global stage.

Our analysis is based on a set of assumptions about the nature of U.S. competition with China:

- First, U.S. tech competition with China plays out globally along numerous fault lines, including China's Digital Silk Road, and in norm-setting institutions such as the United Nations.
- Chinese dominance in tech infrastructure in particular has become a divisive issue that could lead to the creation of two distinct technological and normative digital worlds.
- The creation of two distinct digital worlds is suboptimal for global productivity and growth, and the United States should continue to try to find areas of common ground, where possible, with China.
- At the same time, Washington should assume that for the foreseeable future, China will pursue a vision of the world's technology landscape that is at odds with its own and will rapidly ramp up a coherent and coordinated strategy in partnership with like-minded nations to achieve its policy preferences.
- In addition to the scenario of two distinct digital worlds is that of a single digital world in which the governing standards and norms do not reflect democratic values (i.e., a world in which China has "won" the internet). Indeed the gradual chipping away at the existing edifice may prove a more reliable glidepath toward control than bifurcation for China and other autocrats, and must be guarded against.

The United States seeks global deployment of: 1) U.S. values and norms around transparency, freedom of information flow, data privacy, and ethics; 2) U.S. technologies (or those of other allies and democracies) as the backbone of countries' digital infrastructure: telecommunications networks, satellite systems, fiber optic cables; 3) U.S. products in information & media, healthcare, commerce, finance, hardware, and culture.

The United States cannot advance this agenda alone—in part because it lacks the resources or technology and in part because a unilateral approach alienates as much as attracts other countries. Progress needs to play out within a multilateral framework, not in an attempt to change China's behavior, but to build critical mass to counter it.

A Multilateral Framework

Our existing multilateral structures have become increasingly anachronistic and deficient over time. Any new multilateral structure must be built to withstand new crosscurrents and trends in foreign policy, including: the gradual degradation of international law and disenchantment with international bodies; the rise of multinational corporations as potent actors in the international system; increasing skepticism of U.S. exceptionalism; the shrinking shelf-life of foreign policy strategy; the asymmetric power dynamics of our current world order; and a global distribution of power among states that is far different from that which existed during the founding of key institutions. Our future global structures should be built to take advantage

of (or at the very least, accommodate) these trends. In order to address the key dynamics of the U.S.-China rivalry, we believe that a new multilateral framework must do the following:

1) Enable collective action among global technological leaders
2) Prioritize economic competitiveness (as opposed to political or military dominance)
3) Build allegiances, particularly with the Global South
4) Facilitate norm-setting and values-based consensus among like-minded countries, particularly in the absence of binding legal regimes

Policy Options

We recommend a new multilateral framework that consists of the following components. This architecture is intended to build on—rather than supplant—existing multilateral structures.

1. **T12: a new plurilateral coalition of "techno-democracies"** to strengthen cooperation among like-minded countries; promote collective norms and values around the use of emerging technologies; and protect and preserve key areas of competitive technological advantage. To be most effective the T12 would be an international grouping, not a new, secretariat-laden international organization or an alliance with a mutual defense agreement. Rather, it would bring together key countries to coordinate responses to the types of technological questions that threaten the existing world order. A shortlist of countries that meet these criteria would include such members as the United States, Japan, Germany, France, Britain and Canada, the Netherlands, South Korea, Finland, and Sweden. India, Israel, and Australia are also logical candidates.

2. **International Technology Finance Corporation:** a jointly-funded development finance institution, modeled on the International Finance Corporation, to extend loans and loan guarantees to developing nations for tech infrastructure buildout consistent with liberal values, to counter the Digital Silk Road. The fund would subsidize technological infrastructure, provide opportunities for low- and middle-income countries to participate in trusted supply chains; establish innovation hubs with multinationals to cultivate local talent, partner with local universities; seed entrepreneurs and invest in domestic businesses to build goodwill.

3. **Strategy of Microlateralism:** Microlateralism refers to any ad hoc, multilateral effort that includes at least one G20 country and is led by a smaller country. The smaller country elects to become a testbed for experiments and pilot projects related to technology development or roll-out. Smaller countries are well-positioned to do this as they tend to be more agile, they may have unique expertise or capabilities to distinguish them as a credible leader, or there may be a pressing global issue where great power rivalry comes with too much baggage and a non-threatening honest broker is required to bring the capacities of larger countries together. Such a strategy would decentralize and proliferate technological progress among smaller allies, enlisting them as partners.

4. **A Global Body for Standard-Setting:** international agency (akin to OECD or WIPO) with broadly inclusive membership responsible for developing a common values platform on technology. The organization—which could be an outgrowth or initiative of the T-12—would identify important new standards and support capacity-building around laws, regulations, and bureaucratic infrastructure.

5. **Trust Zones:** Create multilateral trust zones to achieve global integration that promotes American values. These trust zones would include a set of like-minded countries that agree to open up together at the same time, with a set of agreements that are expansive. In the COVID context, for example, this would include alignment on testing and tracing with meaningful enforcement. This trust zone would prioritize joint R&D and remove significant regulatory barriers to create the flexibility needed to incentivize collective innovation against China in AI, quantum computing, 5G, etc. For example, the zone could facilitate free exchange of IP and coordinate R&D investment against a set of priorities. To gain access to the benefits of the Trust Zone, countries would have to commit to a Huawei-free zone, for example.

	Techno-Democracies (T-12)	**Int't Technology Finance Corp.**	**Strategy of Microlateralism**	**Global Body for Standard-Setting**	**Trust Zones**
Enables collective action among global tech leaders	✓	✓			✓
Prioritizes economic competitiveness		✓	✓		✓
Builds allegiances, particularly with the Global South		✓	✓	✓	✓
Facilitates norm-setting	✓	✓		✓	✓

	Techno-Democracies (T-12)	**Int't Technology Finance Corp.**	**Strategy of Microlateralism**	**Global Body for Standard-Setting**	**Trust Zones**
Durability	Permanent (but informal)	Permanent	Ad Hoc	Permanent	Permanent or ad hoc
Enforceability	Non-Binding	N/A	N/A	Binding	Non-Binding
Exclusivity	Exclusive by default	Inclusive by default	Inclusive by default	Inclusive by default	Inclusive by default
Centralization	Decentralized	Centralized	Decentralized	Centralized	Decentralized

B. Government Redesign

Technology is increasingly shaping the national security landscape. But our internal government structures are not optimized to address the new challenges posed by emerging technologies. We propose a menu of potential executive branch reforms at the White House and across departments & agencies to: 1) upgrade how strategy assessments are made; 2) bolster tech expertise in policymaking; 3) position the White House to lead across the interagencies & with industry; and 4) architect a new era of technological statecraft. A combination of the below can be used to place technology more at the center of policymaking.

White House

New Deputy National Security Advisor for Technology

A new position of Assistant to the President (or Deputy Assistant to the President) and Deputy National Security Advisor for Technology would oversee: 1) the existing Cyber Directorate; 2) the new Emerging Technology Directorate; 3) the Space Directorate; 4) telecom and supply chain policy, which could constitute a separate NSC directorate; 5) strategic forecasting on technology; and 6) the promotion of cleantech as a tool of diplomacy and development. Grouping these functions under a Deputy dedicated to technology would give them more muscle and influence in the White House and greater convening power across the interagency. Consider dual hatting this person as a second deputy secretary of state to lead the multilateral effort.

NSC Directorate on Emerging Technology

A new Directorate of Emerging Technology would solidify the brief but failed experiment of the NSC "Office of Emerging Technology" from 2018-19. Creating a directorate devoted to emerging technology will focus high-level policy analysis and coordination on tech-related threats and economic strategy. Because of the linkages between the economics and security of emerging technology, many of its directors should be dual-hatted with OSTP and NEC and cooperate closely with the NSC Directorate for Strategic Planning.

NSC Directorate for Strategic Planning

#Stratplan should consider dedicating two directors or even adding a second Senior Director to focus exclusively on technology strategy and lead a policy planning group, similar to the Obama NSC's Strategic Planning Small Group, that brings together long-term planning cells across the government (DoD-ONA, NIC, CIA Red Cell, State Policy Planning reps from Commerce, Treasury, etc.) to bring to bear their insights on the formulation of U.S. policy and strategy.

National Technology Council

One optional additional structure—not without its complications—to better elevate the issue of technology within the White House beyond the reforms identified above could be the creation of a National Technology Council similar in structure to the recently-resurrected National Space Council. The Council would serve as the convening ground for representatives from the NSC and NEC and would manage a portfolio of civil, commercial, national security, and international economic and geopolitical policy matters with Cabinet level attendance. Chaired by the Vice President, the Council would be better-positioned to secure high-level attention and commitment across departments and agencies.

OSTP-NSC Integration

Strengthening NSC connectivity with all parts of OSTP is a priority, with the Chief Technology Office (CTO) in particular joining OSTP/NSIA as a driver of analysis and policy integration on issues with broader security and economic dimensions.

Economic Forecasting

Far greater capability is needed to understand the interplay between markets, U.S. policy, and corporate strategy. Such a group should have within it a competitive scanning function, using constantly-evolving market intelligence to drive projections and surface strategy considerations, as well as red vs blue analysis of asymmetric tech strengths and weaknesses. The office could also identify supply chain choke-points and wargame policy moves and countermoves.[19]

NSC-Industry Consultation

The next Administration should explore how to establish a viable framework for more direct, occasional consultation between NSC staff and the private sector at acceptable levels of legal risk and issue guidelines to this effect. One additional solution would be expanding PCAST's role to supporting NSC in addition to OSTP, bringing the expertise of leading industry and technical advisors to bear on policy questions before the NSC.

Departments and Agencies

Intelligence Community. To continue to strengthen its capacity, the IC should 1) increase the number of analysts & intelligence collectors who track civilian technology developments; and 2) link its analysts closer together with other parts of the government with similar interests. In addition, intel-gathering resources need to be directed toward commercial intelligence priorities, with tightly prescribed earmarks to prevent default allocations to weapons intelligence and increased connectivity to private sector perspectives and information.

Commerce. The Department of Commerce has not yet adjusted its internal capacity to a U.S. economy in which 40% of the S&P 500 are technology companies. A strengthened Commerce staff can identify ongoing policy processes in which market or trade expertise is needed and inject relevant expertise as needed. The kind of enhanced market forecasting capability called for above could sit in part within Commerce, perhaps in an office modeled on DoD's Office of Net Assessment, but with a personnel structure more akin to DARPA, which facilitates the rotation of top private sector talent for 2-3 year tours.

Treasury. With technology becoming increasingly a part of the financial system as well as with more technology firms implicated in U.S. sanctions and CFIUS, the Treasury Department stands to significantly strengthen its organic expertise on technology. Just over four years ago, Treasury created a new position of Chief Risk Officer focused part-time on emerging technology. This is a start, but there is a great opportunity for Treasury to make deeper investments.

State. Over the past ten years, technology coordination officers, liaisons to Silicon Valley, and innovation offices have come and gone, with little resolution about what permanent structures within State ought help advance a new era of technological statecraft. State's capacity to understand and act on technology issues cannot be significantly strengthened without substantially restructuring how S&T operates in the Department. A proposed Cyberspace and Emerging Technology bureau (akin to what is outlined in Cyber Diplomacy Act)

could help to address this issue. State should also consider the creation of a technology track for foreign service officers as well as a dedicated second Deputy Secretary of State.

USAID. The advent of the USAID Global Development Lab has increased the agency's ability to grapple with emerging technology. However, USAID must still do more to examine how the proliferation of emerging technology may alter the transitional macroeconomic path to development for many countries and, if so, how development assistance should change in response.

DOE. While containing an impressive capacity for advanced science and technology, DOE does not have a similarly-developed strategic planning function to forecast how technology trends will impact its mission space. If ARPA-E is reconstituted, such a function could be housed there.

Defense. With its focus on using commercial technology in its third offset strategy, the opening Defense Innovation Unit (DIU) in Silicon Valley, the creation of the Defense Digital Service and Defense Innovation Board, and the Joint AI Center (JIAC), DoD has made important strides. Further integrating the department's perspectives on the risks and threats of commercial technology with economic agencies is also a priority. Offices within OSD-P, AT&L R&E, Net Assessment, and DIA, as well as the DIB, DIU, DDS, and JIAC, will all have important contributions to interagency policy making, but more thought is needed for how to lift up and integrate them further.

DHS. DHS has some of the most interesting S&T authorities, including the loaned executive program and 1101 authority for term hiring. However, in practice it uses very few of them. Much like the State Department, a deeper look at possible reorganization and new capabilities is merited.

DOJ/FBI. FBI is strongly positioned to track and monitor developments in emerging technology through its technology assessment groups. The central question for DOJ and FBI is whether they have the right methods at the needed scale and across the widening technology domains that are now relevant to law enforcement and international security.

VIII. Conclusion: Tools for Navigating the Asymmetric Competition

The U.S. security dialogue surrounding China and technology has begun to revolve around a small set of headline-generating topics: the threat of a particular Chinese-owned video app, the battle over 5G, or whether the potential risks of high-skilled immigration outweighs the benefit. But many of the most important questions about U.S. strategy towards China on technology have continued to go unanswered: How do we know if a digital platform is worth our attention and focus? What would it take to build a more resilient supply chain? How do we actually win the brain drain wars?

In this project, we have attempted to bring discipline and structure to a dialogue that has become disordered, panicked, and reactionary. Rather than relying on broad strokes assessments about the wisdom of "decoupling" (an often-imprecise term that does not appear in this paper), we have undertaken the more focused task of building—from the ground up—processes, frameworks, and criteria for zeroing in on the technologies that matter and designing a strategy to navigate the risks they pose. Rather than focus on retrospective diagnosis or vague prescriptions, we have attempted to provide a clear, actionable blueprint for sound policy and strategy-formulation. Instead of reassuring ourselves of U.S. technological primacy, our assessments are made with a clear-eyed recognition of the asymmetries that complicate our relationship and weaken the U.S. position.

In undertaking this effort, we took as a given that this strategy would need to be informed by those who are on the frontlines of technological research and innovation—those who understand firsthand the nuances of how technology is built, as well as the set of research and commercial ties that connect, and at times limit, technological interchange between the United States and China. We hope that the resulting work makes clear the value of formulating strategy with that expertise, reinforcing the importance of building connective tissue between policy leadership and day-to-day practitioners in the regular course of business.

Many important questions about our technological competition with China remain unanswered. We encourage decision-makers to leverage external experts and advisors as they plan policies and programs. We undertook the present task motivated by curiosity, a sense of service, and a desire to strengthen free and open societies. There are no doubt many more who are similarly poised to contribute.

Endnotes

1. Most of our >$1B tech startups have foreign-born cofounders; 55% of U.S. STEM PhDs (~17k/yr) are awarded to intl students; greater than 70% of those (greater than 80% for AI) want to stay in the United States after their degree, and most do. The National Science Foundation doesn't collect data on other degrees, but China's Ministry of Education data suggest that stay rates for CN undergrads are much lower, under 50%. See Stuart Anderson, *Immigrations and Billion Dollar Startups*, National Foundation for American Policy (March 2016), https://nfap.com/wp-content/uploads/2016/03/Immigrants-and-Billion-Dollar-Startups.NFAP-Policy-Brief.March-2016.pdf; Remco Zwetsloot et al., *Trends in U.S. Intention-to-Stay Rates of International Ph.D. Graduates Across Nationality and STEM Fields*, Center for Security and Emerging Technology (Apr. 2020), https://cset.georgetown.edu/wp-content/uploads/CSET-Trends-in-U.S.-Intention-to-Stay-Rates.pdf; Remco Zwetsloot, *Keeping Top AI Talent in the United States*, Center for Security and Emerging Technology (Dec. 2019), https://cset.georgetown.edu/research/keeping-top-ai-talent-in-the-united-states/.

2. Everytime we train a foreign-born scientist or engineer and then compel them to leave the country, it is a double loss: we lose a brain and a competitor gains one. The impact is greater when one considers multi-generational effects: we lose a brain and all of its descendents.

3. In strategic fields like AI and semiconductors, U.S. employers need many more skilled workers than the native-born population can supply. Studies show that high-skilled immigrants increase native-born workers' wages, create jobs, and boost innovation and productivity. See Remco Zwetsloot, *Strengthening the U.S. AI Workforce*, Center for Security and Emerging Technology (Sept. 2019), https://cset.georgetown.edu/wp-content/uploads/CSET_U.S._AI_Workforce.pdf; Giovanni Peri et al., *STEM Workers, H-1B Visas, and Productivity in US Cities*, Journal of Labor Economics (July 2015), http://giovanniperi.ucdavis.edu/uploads/5/6/8/2/56826033/stem-workers.pdf; Alex Nowrasteh, *Don't Ban H-1B Workers: They are Worth Their Weight in Innovation*, CATO Institute (May 2020), https://www.cato.org/blog/dont-ban-h-1b-workers-they-are-worth-their-weight-patents.

4. Zachary Arnold, *Immigration Policy and the U.S. AI Sector*, Center for Security and Emerging Technology (Sept. 2019), https://cset.georgetown.edu/research/immigration-policy-and-the-u-s-ai-sector/.

5. Together with democratic allies, we fund ~60% of global R&D. Melissa Flagg, *Global R&D and a New Era of Alliances*, Center for Security and Emerging Technology (June 2020), https://cset.georgetown.edu/research/global-rd-and-a-new-era-of-alliances/.

6. David Bier, *Backlog for Skilled Immigrants Tops 1 Million*, CATO Institute (Mar. 30, 2020), https://www.cato.org/publications/immigration-research-policy-brief/backlog-skilled-immigrants-tops-1-million-over#employment-based-green-card-backlog.

7. Tina Huang & Zachary Arnold, *Immigration Policy and the Global Competition for AI Talent*, Center for Security and Emerging Technology (June 2020), https://cset.georgetown.edu/research/immigration-policy-and-the-global-competition-for-ai-talent/.

8. Currently, China enjoys a manufacturing advantage in the form of its vast workforce, which is about 11 times the size of the American manufacturing workforce. Nevertheless, the Chinese manufacturing sector only produces 1.8x in terms of GDP value, implying the average U.S. worker is 6 times as "productive" as an average Chinese worker. Repatriating $600 billion of manufacturing would therefore require an additional 3 to 4 million U.S. manufacturing employees.

9. Note, we focus on China here, but the United States may have related concerns—from U.S. national security dependencies to human rights and labor rights violations in supply chains—with other countries.

10. For end products, we can define "nationality" through two dimensions: the location of manufacture and the headquarters or ownership of the parent company.

11. Note that commentary often conflates manufacturing for export and manufacturing for the Chinese market, which will likely remain localized in China.

12. It should come as no surprise that we have seen little market movement to date given the necessary lead time. Notably, TMSC announced that it could open a semiconductor factory in AZ by 2024 focused on 5nm chips (which will no longer be cutting edge by the time the plant opens). Tom Mitchell, *US Companies Defy Trump's Threat About 'Decoupling' from China*, Financial Times (Sept. 9, 2020), https://www.ft.com/content/8d23d65b-ee20-4449-a615-e3d2a9b672f8; Ben Lovejoy, *TSMC Arizona Plant: Company Seeking Huge Subsidies from US Government*, 9To5Mac (June 9, 2020), https://9to5mac.com/2020/06/09/tsmc-arizona-plant/.

13. Taiwan's "non-red" production policy might be instructive for U.S. reshoring policies. Matthew Fulco, *Is Taiwan Winning the U.S.-China Trade War?*, Taiwan Business Topics (Aug. 16, 2019), https://topics.amcham.com.tw/2019/08/taiwan-winning-trade-war/.

14. Ian King, *Intel Plunges as It Weighs Exit From Manufacturing Chips*, Bloomberg (July 23, 2020), https://www.bloomberg.com/news/articles/2020-07-24/intel-considers-what-was-once-heresy-not-manufacturing-chips.

15. Japan has been a leader in innovation and lags at scale commercialization, for example, and recently the United States has suffered from a similar challenge. Willy C. Shih, *Bringing Manufacturing Back to the U.S. Is Easier Said Than Done*, Harvard Business Review (Apr. 15, 2020, https://hbr.org/2020/04/bringing-manufacturing-back-to-the-u-s-is-easier-said-than-done.

16. This should come as no surprise, because they see so many other areas of China's dependence on the United States—whether advanced semiconductors or the dollar-dominated international financial system—as American leverage over China. For more on Chinese views of this topic, see Julian Gewirtz, *The Chinese Reassessment of Interdependence*, China Leadership Monitor (June 1, 2020), https://www.prcleader.org/gewirtz.

17. For the latest statement by China's government on its "strategic emerging industries," see PRC National Development and Reform Commission et al., *New Chinese Ambitions for 'Strategic Emerging Industries*, translated by the Center for Security and Emerging Technology and DigiChina Project (Sept. 29, 2020), https://cset.georgetown.edu/research/new-chinese-ambitions-for-strategic-emerging-industries-translated/. Bai Chunli, president of the Chinese Academy of Sciences, declared in September 2020, "The United States' technological containment list will be our mission for scientific and technological development."

18. These partners may include all of the EU, though in some cases EU position/member states' positions are too ambiguous today with respect to China for inclusion in all instances, and members may need to be considered on an individual basis.

19. Many different organizational permutations could bring this function into being. As a start, CEA should recruit at least one senior economist and two staff economists to lead a new government-wide focus on tech issues. OSTP should also name and appoint a Senior Economist with a small staff. The Office of Economic Policy at Treasury, NTIA, and the Chief Economist's Office at Commerce and the Department of Labor's as well as the Department of State should follow suit and create within them small expert staffs.