Mr. John Donovan
NSTAC Chair
6306 Norway Road
Dallas, TX 75230

May 24, 2022

The Honorable Joseph R. Biden
The White House
1600 Pennsylvania Avenue, N.W.
Washington, D.C. 20500
Dear Mr. President:

In your tasking dated January 4, 2022, you requested the National Security Telecommunications Advisory Committee (NSTAC) share insights to enhance U.S. competitiveness in international communications technology standards. As noted, technology standards provide the foundation for transforming innovation into interoperable and secure products and services through industry-driven, transparent, and voluntary consensus-building processes. As a result, standards enable the development of technology that supports interoperability and unlocks greater functionality–value that is greatly beyond the sum of the individual parts. To date, the industry-led standards model has been a crucial component to innovation in and the development of the global digital economy, which has made enormous contributions in improving quality of life around the world.

As cyberattacks have grown more frequent and serious–and as geopolitical and economic competition has increased–concerns with security, resiliency, interoperability, and other critical information and communications technology (ICT) issues have caused governments, industry, and users to focus more intently on how those standards are developed and whether products and services are compliant with robust standards. In addition, there is concern that one actor (nation or company) may unduly influence the standardization system, which would represent a threat to national security. Against this backdrop, some governments are asserting new standards strategies to promote their domestic agendas within the global standardization system. Therefore, the Administration requested that the NSTAC take a holistic look at the current state of standards and make recommendations to ensure that U.S. interests are protected, and that the widely accepted principles for the development of international standards (e.g., transparency, openness, impartiality, consensus, etc.) are followed.

The remainder of this letter outlines the NSTAC's key observations regarding the current state-of-play of ICT standards development. These observations were derived from a series of briefings provided to the NSTAC from experts across industry, government, and academia. Additionally, the letter includes the NSTAC's key takeaways and recommendations on how to preserve and enhance U.S. competitiveness through participation in standards bodies and the appropriate role for government. The following is a short summary of the NSTAC's key findings and recommendations, which are discussed in more detail in the remainder of this letter:

Key Findings:

- Industry-led standards play a vital role in ensuring U.S. technology leadership.
- Technology shapes international standards.
- There is no evidence of security vulnerabilities being placed in standards. Standards by their nature are open and transparent, which inherently minimizes this risk. The greater risk is in the implementation of products that may include functionality above and beyond standards.
- Standards are constantly evolving to address security concerns. Many standards bodies, such as the Third Generation Partnership Project (3GPP), include processes within their security working groups to address ongoing security concerns.
- There are no one-sized fits all approach to standards. There are thousands of standards development organizations. We cannot assume that experience in one entity is indicative of all.
- Standards development bodies include rules promoting balance.
- Internationally recognized standards drive a more vibrant ICT supply chain.
- There remains a need to make strategic investments to bolster participation in standards.

Recommendations:

- Revise export control rules to encourage standards participation.
- Make structural changes in areas such as visas to establish the United States as a venue of choice for hosting standards meeting.
- Make investments in emerging and developing technologies, which serve as the underlying foundation for U.S. leadership in standards development.
- Ensure the continued independence of industry-led standards development.
- Maintain U.S. leadership in the International Telecommunication Union (ITU) Radiocommunication Sector (ITU-R) and reform the ITU Telecommunication Standardization Sector (ITU-T) through the continued support of U.S. leadership at the ITU.
- Invest in developing a more standards savvy U.S. workforce to ensure a robust bench of standards subject matter experts.
- Collaborate with industry to ensure robust U.S. standards participation by leveraging the U.S. Government's convening capabilities and through incentives bolster participation in standards development processes.

Discussion of Key Findings

Industry-Led Standards Play a Vital Role in Ensuring U.S. Technology Leadership

Internationally recognized standards establish harmonized foundational concepts, reduce fragmentation, facilitate technical interoperability between diverse systems, and promote responsible operational and management practices. Instead of closed systems wherein only certain equipment works in a particular geography (i.e., U.S. and European systems being functionally different), or where devices can only interact and communicate with components and software from the same manufacturer, standards enable equipment and services from multiple manufacturers/producers to operate across an integrated global system. Further, global interoperability allows companies to market their products worldwide, which in turn means larger economies of scale, lower technology development and production costs, reduced pricing

for consumers, and increased innovation. These developments have greatly benefitted the United States, as we have seen U.S. technology promulgate around the world. [1]

Technology Shapes International Standards

One of the major themes reiterated by several expert briefers to the NSTAC is that the best technological contributions shape standards, not the total number of participants or contributions to a given standards body. This means that investments in foundational and emerging technology are vital to ensuring U.S. leadership in standards. Investment in emerging technology has been a consistent theme in previous NSTAC reports. In the 2019 *NSTAC Report to the President on Advancing Resiliency and Fostering Innovation in the Information and Communications Technology Ecosystem* (2019 NSTAC ICT Report), the NSTAC noted that the United States has a natural strategic advantage due to its market-driven economy; strong, clear, and enforceable legal system (most notably to protect intellectual property [IP]); relatively limited degree of Government intrusion and regulation; unparalleled financial and higher education systems; and culture that encourages and manages risk-taking.[2] However, the NSTAC also concluded that the United States does not invest enough in research and development (R&D) in basic science and in providing well-defined paths to market for new and emerging technologies.[3] The NSTAC has encouraged the U.S. Government to increase financial support for R&D. Simply put, more R&D equals more innovations that can then be introduced to drive standards. This is a critical issue for long-term U.S. competitiveness, as the Nation has seen significant strategic investments by strategic competitor nations in critical and emerging technologies, such as quantum computing, artificial intelligence (AI), and fifth generation (5G)/sixth generation networks.

Standards are Transparent and Adapt to Security Concerns

Standards developed through an industry-led standards development model are available for all participants and market implementers to see. Standards participants make contributions that are designed to be subject to broad scrutiny, including the result of a published standard being made public. This means that it is unlikely that any potential security vulnerability would be intentionally introduced by one participant without it being observed by another. Furthermore, there is an essential difference between what is written in a public specification and what is added to a product that reaches beyond the standard and is unique to that implementation. Therefore, there is a need to invest in the international standardization process to subject specifications to as broad a review as possible and, more importantly, to increase the rigor of testing for individual products and services before they are put into production use. Given the evolving concerns over security vulnerabilities, which could include government-ordered surveillance backdoors, intentionally weak encryption, or mandated use of government-controlled encryption keys, there has been a growing industry-led effort to incorporate "security by design" concepts into technology and standards development to address this important issue.

This evolution in security practices and the inherent transparency of the standards-setting process have further diminished the possibility of security vulnerabilities being introduced through the

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[1] Alexandra Bruer and Doug Brake, *Mapping the International Fifth Generation (5G) Standards Landscape and How It Impacts U.S. Strategy and Policy*, November 8, 2021, https://itif.org/publications/2021/11/08/mapping-international-5g-standards-landscape-and-how-it-impacts-us-strategy.

[2] President's National Security Telecommunications Advisory Committee (NSTAC), *NSTAC Report to the President on Advancing Resiliency and Fostering Innovation in the Information and Communications Technology Ecosystem*, September 2019, https://www.cisa.gov/publication/2019-nstac-publications.

[3] Ibid

development of the underlying standards. To ensure security vulnerabilities are not intentionally introduced through the standards-setting process, it is essential that standards and specifications continue to be developed globally through industry-led bodies with relevant technical expertise. Historically, it has been the case that wider participation leads to greater scrutiny and technical engagement, which leads to better and more resilient security, whereas "security through obscurity" or "country-unique" standards may lack sufficient input from the global community of experts and could pose security problems if required by law or regulation.

There is No One-Sized-Fits-All Approach to Standards Bodies

There are thousands of standards-setting organizations worldwide developing standards with the involvement of tens of thousands of engineers, architects, researchers, and other experts from the private and public sectors. Standards-setting organizations vary in terms of their governance, participation, outputs, and decision-making procedures. Some standards-setting organizations are more formal, rely on one-nation-one-vote rules, or are government-driven—all of which can create challenges for the industry to contribute and influence outcomes. Others are industry-led, support open membership, and make decisions by consensus.

While the "big three" formal standards development organizations—the International Electrotechnical Commission (IEC), the International Organization for Standardization (ISO), and the ITU—often garner attention in standards policy discussions, the vast global ecosystem of private sector-led standards-setting organizations and consortia fuel the bulk of the standards development work happening at the cutting edge of technological innovation today, driving products in the marketplace. This ecosystem supports not just the writing of technical specifications, but the interoperability testing, hardware and software development, and certification schemes needed to ensure that standards are successfully adopted in the marketplace.

We should not assume that challenges present in one standards body are the same in other bodies or can be addressed in the same way. The experts who appeared before the NSTAC offered no empirical evidence that China or other governments have comprehensively co-opted the standards process to their own advantage. As such, it is important that concerned parties identify where they have specific concerns related to standards development so that it can be determined if the issue is unique to an individual standards organization or systemic, allowing industry and government to work together to address such concerns.

Standards Setting Organizations Include Rules Promoting Balance

One of the principal concerns identified is that Chinese entities are making a concerted effort to dominate the standards process through a substantial infusion of representatives and contributions at meetings of standards bodies. However, global standards bodies have rules to prevent the dominance of any given interest or actor. Most importantly, technical work is based upon written proposals by individual members, and technical decision making is by consensus and based upon the evaluation of technical merit. The reality is that the U.S. industry generally holds a strong position in global standards development and the U.S. tech sector continues to maintain an innovation leadership posture. Simple statistics about the number of standards participants, contributions, or leadership positions per country do not paint a complete picture of the technology outcomes resulting from standards development. Attachment A*, Putting Standards Metrics in Context*, provides more detail about participation in selected standards bodies.

Open Standards Drive a More Vibrant ICT Supply Chain
Open standards also play a key role in expanding the ICT supply chain and ensuring vendor diversity. Standards create a pro-competitive environment where markets are characterized by vendors whose products can interoperate with one another while also demonstrating value-added differentiation. The radio access network market provides an illustrative example. As discussed in the 2019 NSTAC ICT Report, there have been concerns about the growing presence of Chinese telecommunications equipment manufacturers, particularly in networks outside of the United States, and the long-term implications for the ICT supply chain.[4] However, as networks have evolved toward software and virtualization, open standards are playing a key role in driving the industry toward a more interoperable, modular network design that will foster competition between suppliers and lower barriers to entry for new entrants in the marketplace.

There is a Need to Make Strategic Investments to Bolster Standards Participation
Finally, there remain some challenges in standards development that require further attention from government. There are barriers to U.S. industry engagement in standards development that need to be addressed in the near term. For example, the Department of Commerce's (DOC) Bureau of Industry and Security (BIS) Entities List rules have created uncertainty around the ability for U.S. participants to engage in standards bodies and participate in standards-related discussions that also include listed entities. Another near-term barrier that remains are current U.S. policies around short-term visas working against U.S.-hosted standards meetings, which are critical to driving positive outcomes.

Moreover, the pandemic has created its own set of near-term challenges as meetings have turned virtual, resulting in increased number of superfluous participants while simultaneously reducing the ability for standards participants to work together to resolve issues in a timely fashion. Looking long-term, and as noted above, R&D in next generation technologies and the development of a skilled science, technology, engineering, and math (STEM) workforce to drive continued leadership in innovation and ultimately standards are vital to our future success. Finally, several Government briefers raised concerns about U.S. Government agencies' ability to participate in certain standards development alliances that may be vital to the development of emerging technologies solutions such as open radio access networks.

Recommendations

The following recommendations are organized in order of priority based on ability to be implemented immediately versus those that are ongoing and longer term.

Immediate Action

1. Revise Export Control Rules to Encourage Standards Participation

The DOC's BIS posted a "General Advisory Opinion Concerning Prohibited Activities in the Standards Setting or Development Context When a Listed Entity Is Involved"[5] in May 2019 that

[4] NSTAC, *NSTAC Report to the President on Advancing Resiliency and Fostering Innovation in the Information and Communications Technology Ecosystem*, September 2019, https://www.cisa.gov/publication/2019-nstac-publications.
[5] *Additions to the Entity List*, 84 Fed. Reg. 22961 (May 21, 2019); *Temporary General License*, 84 Fed. Reg. 23468 (May 22, 2019) (effective May 20, 2019 through August 19, 2019).

many interpreted to limit industry participation in standard-setting efforts. This rule was included in the Export Administration Regulations (EAR) (15 CFR 734.7). In June 2020, BIS published a new rule, replacing the May 2019 guidance, clarifying the EAR in response to industry concerns about participation in standards activity. Despite this clarification, several NSTAC briefers expressed ongoing concerns regarding a lack of clarity about the applicability of the EAR to standards development activities posing significant problems for U.S. standards competitiveness and creating new economic risks for the United States. These restrictions imposed by BIS have hindered U.S. companies' participation in standards-setting bodies, and they have negatively impacted the success of many bodies based in the United States. These restrictions make the standards bodies less effective and harm U.S. standards leadership, the consequences of which are likely to be long lasting. These restrictions are also not expected to achieve significant security advantages that would justify the economic risk.

Moreover, for decades U.S. policy has encouraged nations, such as China, to adopt international standards to enable open markets. Further, the National Security Agency endorses inclusive standards processes with all participants. The ICT industry, particularly telecommunications, revolves around scale. International markets are vital to creating scale effects versus a balkanization between regions or countries. The most urgent and important action that the U.S. Government should take to improve U.S. leadership in standards and specification development is to amend the current BIS rule to exempt standards development activities that do not involve national security-controlled technology from the Export Administration Regulations. This should include activities related to the development and promulgation of standards, including conducting conformity assessment, testing, certification, or market promotion based on a standard.

Recommended Action: Instruct the DOC to clarify that industry participation in standards development activities is permitted under U.S. export controls even when participants include companies named on DOC Entity Lists.

2. Establish the United States as a Venue of Choice for Standards Bodies

Facilitating the hosting of global standards bodies meetings in the United States would encourage greater industry and U.S. Government participation in standards development. Global standards bodies typically avoid holding their meetings in the United States because visa processes or overt visa restrictions often make it very difficult for foreign participants to attend in a timely manner or at all. Implementing a streamlined short-term visa process for participants in standards and specification-setting meetings to enable travel to the United States would be beneficial in making the United States a desirable host for these important meetings.

The U.S. can also lead by example by demonstrating our adherence to the principles underlying standards bodies. This can be done by advancing widely accepted principles for market-driven (industry-led) standards development. It is in the United States' interest to maintain an inclusive posture for all participants, including all nationalities, and for governments to avoid top-down technology mandates, remain neutral on which standards development organizations are addressing individual technologies, and actively promote and defend strong governance models for all standards organizations. In addition, the U.S. Government should engage in productive government-to-government dialogues that support public-private coordination and adoption of the principles outlined in the Office of Management and Budget Circular A-119, *Federal*

Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities.[6]

Recommended Action: Reform visa processes or restrictions to enable and encourage the United States to host standards development meetings.

3. Ensure the Continued Independence of Industry-Led Standards Development

Today, ICT standards are largely developed through industry-driven, voluntary, consensus-based standards bodies with the primary exception of the ITU, a treaty-based organization. The U.S. Government can and should take steps to help ensure the continued independence and success of the industry-driven voluntary standards and specification development model. This includes encouraging all interested stakeholders and countries to participate in international standards development and to adopt international standards rather than setting their own country or region-specific standards, which risks a balkanization between the U.S. and allied countries and other nations, particularly China and India. Through the industry-driven development model, U.S. participation in ICT standards and specification development has been successful over many decades.

This approach has generally proven more successful than government-driven efforts. In bodies such as the ITU, where governments decide and formally vote on standards, geopolitics play the main role in decisions about technology and policy, and there is significantly less emphasis on relevant technical expertise. In addition, such government-driven bodies do not include meaningful industry engagement and have not typically been enablers of innovation. While there are some challenges with respect to the industry-driven bodies, these bodies maintain and utilize governance mechanisms to ensure a level playing field. Even in the ITU-T, where membership is open to industry, there are repeated observations of the specter of government-driven positions, rather than market consensus or technical expertise, forming the basis of policy proposals. This speaks to the need for the U.S. Government to pursue reform of ITU-T governance, together with like-minded government partners, and advocate for focusing on technology within the scope of the organization as well as encourage the use of industry-driven standards.

Recommended Action: Lead by example by promoting market driven standards development, including openness to participation, transparency, and representation by all stakeholders.

4. Increase Investments in R&D to Bolster Foundational Technology

As discussed above in our key findings, a vital issue to driving favorable outcomes in standards development is investment in underlying foundational and emerging technology (and associated IP) that can be introduced in standards. In October 2020, the United States released the *National Strategy for Critical and Emerging Technologies* to secure the national security innovation base and promote a U.S. technology advantage.[7] This report identified 20 strategic technology areas, including communications and networking technology. This list was subsequently updated in February of 2022[8] It is critical that the United States makes investments in strategic and

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[6] Office of Management and Budget, Circular A-119: *Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities*, The White House, Revised January 2016, https://www.federalregister.gov/documents/2016/01/27/2016-01606/revision-of-omb-circular-no-a-119-federal-participation-in-the-development-and-use-of-voluntary.

[7] *National Strategy for Critical and Emerging Technologies*, The White House, October 2020, https://trumpwhitehouse.archives.gov/wp-content/uploads/2020/10/National-Strategy-for-CET.pdf.

[8] *Critical and Emerging Technologies List Update*, February 2022, https://www.whitehouse.gov/wp-content/uploads/2022/02/02-2022-Critical-and-Emerging-Technologies-List-Update.pdf.

emerging technology R&D in key strategic areas that are most compatible with the U.S. technology strategy to drive standards outcomes. Other countries, such as China, are making similar investments in strategic technologies such as AI/machine learning, wireless communications, data analytics, quantum computing, and other areas. The NSTAC wrote extensively about these issues in the 2017 NSTAC Report to the President on Emerging Technologies Strategic Vision.[9] The United States should ensure the U.S. tax code provides incentives for businesses to invest in the R&D of new products and ideas through a robust R&D tax credit and a means for companies to efficiently expense such investments.

Recommended Action(s): Direct the Office of Science and Technology Policy to review and update as necessary the U.S. *National Strategy for Critical and Emerging Technologies*.[10] Continue to work with Congress on legislation to increase Government support and beneficial tax treatment for R&D, including a robust R&D tax credit and a means for companies to efficiently expense such investments for R&D in strategic technology areas such as the U.S. Innovation and Competition Act of 2021,[11] the America Competes Act of 2022[12], and other legislation that promotes R&D investments.

Ongoing and Longer-Term

5. Collaborate with Industry to Ensure Robust U.S. Standards Participation

To better understand the landscape and activity in international ICT standards and specification bodies that are relevant to the national economy or security, the U.S. Government should regularly interact with U.S.-based standards leaders and stakeholders and together help identify and increase knowledge of standards setting bodies, organizations, initiatives, and activities that are critical to U.S. leadership in emerging technologies. The National Institute for Standards and Technology is ideally suited to this role as the federal agency Congressionally authorized to perform it. Through this exchange, the U.S. Government could support the efforts of industry-led standards development organizations to effectively promote awareness of and participation in standards activities. While the U.S. Government should not coordinate industry positions on any given project, a forum to share information can ensure that all stakeholders, including small and medium-sized enterprises and Government representatives, have access to information and can make informed decisions about where to best allocate their time and resources. This information exchange can also help address specific concerns related to the U.S. Government's agency visibility and participation in standards organizations.

The U.S. Government can also consider targeted financial incentives to support and increase participation in industry-led global standards and specification development bodies. This was previously proposed by National Telecommunication and Information Administration in the congressionally mandated 2021 *National Strategy to Secure 5G Implementation Plan*[13] and

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[9] NSTAC, *NSTAC Report to the President on Emerging Technologies Strategic Vision*, July 2017, https://www.cisa.gov/publication/2017-nstac-publications.

[10] *National Strategy for Critical and Emerging Technologies*, The White House, October 2020, https://trumpwhitehouse.archives.gov/wp-content/uploads/2020/10/National-Strategy-for-CET.pdf.

[11] U.S. Congress, United States Innovation and Competition Act of 2021, June 2021, https://www.congress.gov/bill/117th-congress/senate-bill/1260.

[12] U.S. Congress, America Competes Act of 2022, March 2022, https://www.congress.gov/bill/117th-congress/house-bill/4521. (Note: the America Competes Act is being conferenced with the Senate U.S. Innovation and Competition Act of 2021 and has adopted the same naming convention).

[13] National Telecommunication and Information Administration, *National Strategy to Secure 5G Implementation Plan,* January 2021, https://www.ntia.gov/5g-implementation-plan.

could include tax incentives or targeted grant programs. The U.S. Government can also participate in regularized public-private sector stakeholder engagement to exchange information around standards threats, take defensive actions to protect consensus-driven standards processes, identify leadership roles in standards, and expand public-private partnerships on capacity building for effective participation. Finally, the U.S. Government can support consistent U.S. Government staff participation in relevant standards work, including long-term engagements for staff to develop expertise, reputation, and leadership capacity.

6. Collaborate with Allies on ITU Reform and Beyond

In international bodies such as ITU-T, which are treaty-based, the U.S. should seek like-minded Government partners to reform such bodies' governance and working methods and to focus on the appropriate technologies within the scope of those bodies. Reform could include enabling cooperative relationships with other expert industry-led bodies (e.g., liaison relationship between 3GPP and ITU-R Working Party 5D). The State Department should also be actively collecting positions from industry-led bodies to either be promoted within the ITU or to limit or reduce the scope of ITU activities in regard to other, industry-led standards development organizations where ITU involvement is unnecessary. It should also collaborate with allies on existing standardization initiatives (e.g., at the U.S.-European Transatlantic Technology Council and the Quadrilateral Security Dialog). Positions on standards should also be included in the Office of the United States Trade Representative bilateral agreements where relevant to insure greater reciprocity in industry participation in standards development.

7. Increase Standards Investments in the U.S. Workforce

Another area where government can help is by increasing investment in people who perform standards work on behalf of U.S. industry. Today standards are largely the realm of experts who invest years engaging in and building their credibility in standards bodies. If the longer-term desire is greater U.S. and allied participation in standards bodies, there is a need to increase our pool of standards experts through policies to attract more expertise to standards development. There are a variety of policies that the U.S. Government could enact to achieve this objective. The U.S. Government could make available targeted financial incentives to support participation in industry-driven global standards and specification development bodies. This may be important in telecommunications as the industry shifts more towards software and smaller companies become increasingly part of the value chain. Further, given the long-term, multi-million-dollar nature of most standards investments, properly structured tax credits or incentives may allow private sector entities to increase their standards footprints. Making such provisions standards-specific would avoid duplication with the existing R&D tax credits.

The U.S. Government can also take actions to celebrate U.S. standards leadership in a more visible way to fuel continued industry investment in leadership roles. Industry and Government can also work to celebrate "national heroes," the technical experts who dedicate significant effort in promoting innovation and R&D in ICT or STEM. Finally, U.S. multinational companies also need great technologists outside of the United States. The U.S. Government can support these efforts by re-invigorating the admission process for top foreign students to do graduate studies in the U.S and simplifying the process for graduates to stay in the U.S. and work for U.S. companies. Companies and university programs can also train emerging and promising R&D leaders in the kinds of skills necessary to succeed in standards and should promote the development of a skilled STEM workforce to drive continued leadership in innovation and, ultimately, standards.

On behalf of the NSTAC, I thank you for the opportunity to provide our industry insights and recommendations relating to standards. This is an area that is vital to our continued leadership in strategic and emerging technologies. We appreciate your Administration's consideration of our recommendations.

Sincerely,

John Donovan
NSTAC Chair

Attachments:
A−*Putting Standards Metrics in Context*
B−*Subcommittee Members and Briefers*

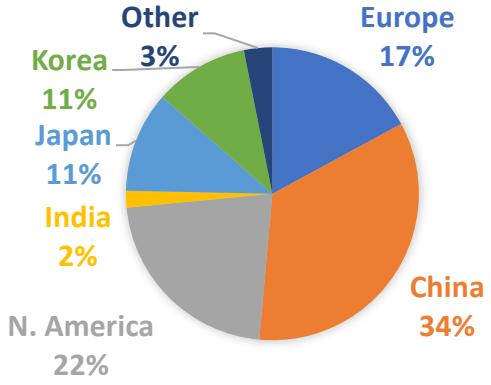
Attachment A: Putting Standards Metrics in Context

For the last decade, three major entities have been vying as dominant sources of leadership and influence in international standards: the United States, the European Union, and China. Each entity's influence is characterized in part by a unique relationship between government and industry that impacts how they approach standards development. Standards organizations exist with the common assumption that industry-led standards will result in a better outcome than will a government-directed process. In sum, while it is important to understand any representation about standards participation, leadership, or contributions in context, no single data point can accurately portray the tremendous variety that exists in these metrics across the standards ecosystem.

Understanding actual leadership and influence over standards requires looking beyond the variety of metrics and focusing on standards outcomes. To assess the value of participation in a standards body, one must evaluate if the final specification, as adopted by the expert community or the market, represents the consensus of the contributions to develop that specification. Many contributions are left on the cutting room floor during the process of standardization. If a published standard is neither market relevant nor broadly adopted, this indicates that its contributors are limited in their ability to influence market dynamics or national interests. Therefore, the adoption and market relevance of standards is perhaps the most important metric. Unfortunately, adoption data is far more difficult to gather than data about participation, leadership, or contributions. When assessing the latter, it is critical to remember that they paint a limited picture of the impact of specific entities or countries on standards outcomes.

Nevertheless, some published reports have focused on standards participation as indicative of leadership and influence, which fuels the concern that China is co-opting or dominating the standards development process. The truth is that the number and proportion of participants and entities from China vary significantly from one standards body to another, and the impact or influence of that number varies. To illustrate this, Charts 1 and 2 below show recent statistics about the participants in the Third Generation Partnership Project (3GPP) and the Broadband Forum, respectively.

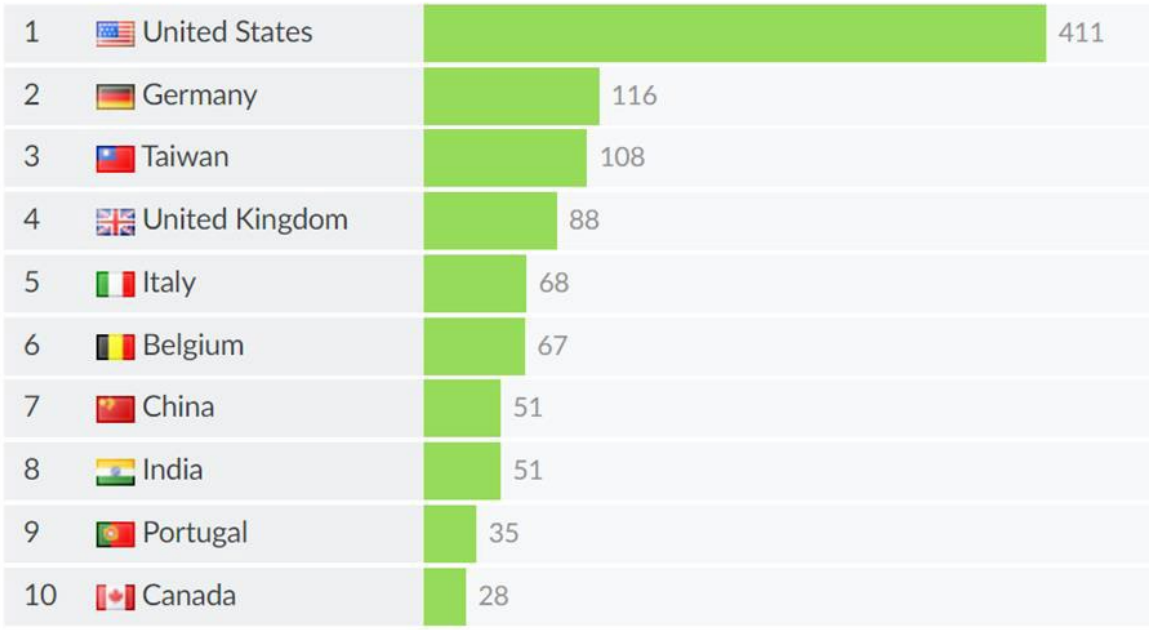
Chart 1: Home Region of Meeting Participants' Company in 3GPP's Key Technical Specification Groups (TSGs) and Working Groups (WGs) [2021][14]



[14] Iain Sharp, ATIS, "ATIS Presentation to NSTAC Standards Subcommittee," Briefing to the NSTAC Enhancing U.S. Leadership in International Communications Technology Standards Subcommittee. Arlington, VA, March 17, 2022.

As the chart illustrates, China sends the most people to the key 3GPP technical specification groups (TSG) and working groups (WG). China's share of meeting participants (34%) outpaces China's share of 3GPP individual members, which is 21%. By contrast, the share of meeting participants from North America (22%) is slightly less than the share of North American individual members (24%). However, if one considers the totality of the U.S. and allied participation (North America, Europe, Korea, and Japan), those countries still equate to greater than 60% of all 3GPP TSG and WG participants. One must also keep in mind that global companies may participate through and hold leadership positions from several regions. For example, a Huawei delegate to 3GPP currently holds a 3GPP leadership role through Huawei's European Telecommunications Standard Institute European membership.[15] Compare this to the Broadband Forum:

Chart 2 Broadband Forum Meeting Participants by Country, 2017-202116

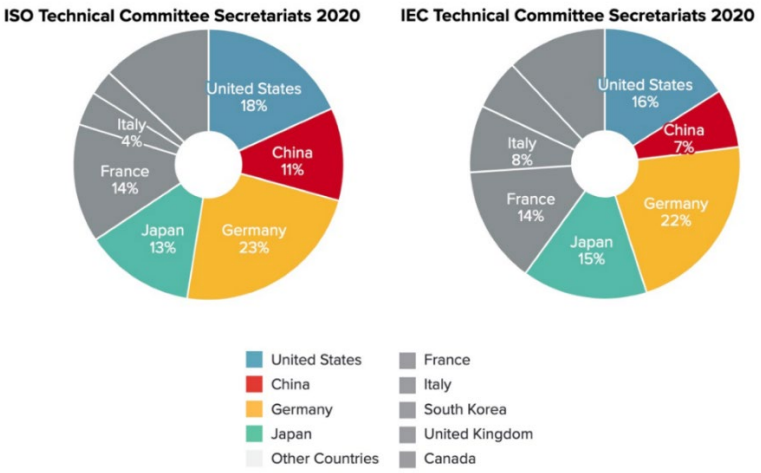


The pattern here differs significantly from that of 3GPP. U.S. participants are overwhelmingly the largest participation segment, with Chinese entities sending 12% as many participants as U.S. entities.

Leadership statistics can also vary significantly across standards bodies. It has been observed by many and confirmed by briefers to the NSTAC that Chinese entities have taken on an increasing number of leadership roles in key 3GPP WGs over time. However, U.S. and allied nations still hold most leadership positions at 3GPP. In contrast, as illustrated by the chart below, Germany has the leading share of technical committee secretariats, with Europe as a region occupying a majority share, and the U.S. outpacing China in International Organization for Standardization/International Electrotechnical Commission leadership roles.

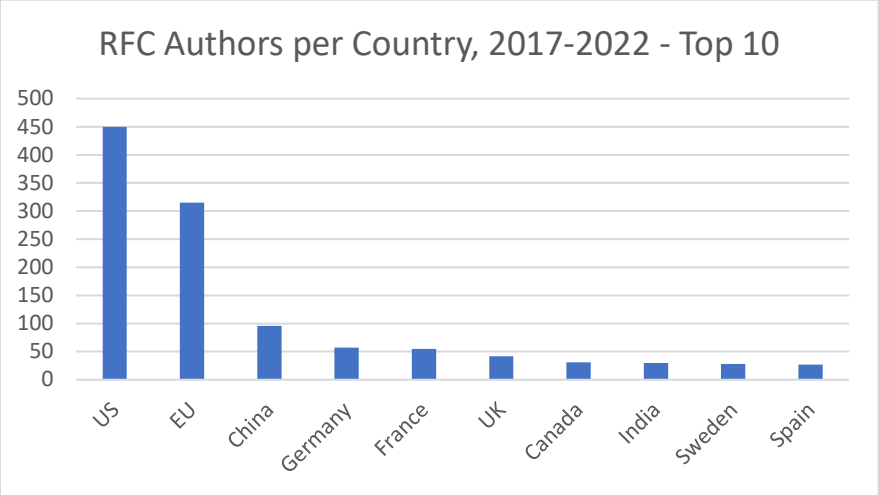
[15] Third Generation Partnership Project (3GPP), *3GPP Elects Plenary Leadership for the Next 2 Years*, March 21, 2019, https://www.3gpp.org/news-events/2023-2019_elections.
[16] Brian Daly, AT&T, "A North American Operator View of Global Standards," Briefing to the NSTAC Enhancing U.S. Leadership in International Communications Technology Standards Subcommittee. Arlington, VA, March 17, 2022

Chart 3: ISO and IEC Technical Committee Secretariats by Country, 2020[17]



Finally, there is variation among standards bodies in terms of how easy it is to trace which contributions to the final standards were made by which participants. In 3GPP, it is a difficult exercise to trace which contributions are adopted into the final specifications; in addition, the source of the contribution development may not be clear as contributions are typically co-sourced with several companies "signing on" in support of the contribution. In the Internet Engineering Task Force (IETF), standards (known as Requests for Comments [RFC]) include their individual authors. This allows for the collection of aggregate statistics about RFC authors per country.

Chart 4: IETF RFC Authors per Country, Top 10 Countries, 2017-2022[18]



[17] Giulia Neaher, David A. Bray, Julian Mueller-Kaler, and Benjamin Schatz, *Standardizing the Future: How Can the United States Navigate the Geopolitics of International Technology Standards?,* The Atlantic Council GeoTech Center, October 2021, https://www.atlanticcouncil.org/wp-content/uploads/2021/10/Standardizing-the-future-How-can-the-United-States-navigate-the-geopolitics-of-international-technology-standards.pdf.

[18] *Draft/RFC Statistics*, Internet Engineering Task Force Datatracker, https://datatracker.ietf.org/stats/document/author/country/?type=rfc&time=5y.

The chart shows that in the last five years, U.S. participants have authored more than four times as many RFCs as participants based in China, and European participants have authored more than three times as many RFCs as participants based in China. Note that this data is based on authors' addresses, not the domicile of authors' employers.

ATTACHMENT B – Subcommittee Members and Briefers

Table 1: Subcommittee Leadership

Name	Organization	Role
Mr. Ray Dolan	Cohere Technologies, Inc.	Subcommittee Chair
Mr. Christopher Boyer	AT&T, Inc.	Working Group Co-Lead
Mr. Yoav Hebron	Cohere Technologies, Inc.	Working Group Co-Lead
Mr. Kevin Riley	AVID Technology, Inc.	Working Group Co-Lead

Table 2: Subcommittee Membership

Name	Organization
Mr. Jason Boswell	Ericsson, Inc.
Ms. Kathryn Condello	Lumen Technologies, Inc.
Dr. Alissa Cooper	Cisco Systems
Mr. Brian Daly	AT&T, Inc.
Ms. Cheryl Davis	Oracle Corp.
Mr. Robert Hoffman	Broadcom, Inc.
Mr. Kent Landfield	Trellix
Mr. Jason Matusow	Microsoft Corp.
Ms. Susan Mohr	Lumen Technologies, Inc.
Mr. Richard Mosley	AT&T, Inc.
Dr. Stephen Palm	Broadcom, Inc.
Mr. Thomas Patterson	Unisys Corp.
Mr. Thomas Quillin	Intel Corp.
Mr. Glenn Reynolds	ATIS
Ms. Diane Rinaldo	Open RAN Policy Coalition
Mr. Travis Russell	Oracle Corp.
Ms. Jordana Siegel	Amazon Web Services, Inc.
Ms. Stephanie Travers	Lumen Technologies, Inc.
Dr. Claire Vishik	Intel Corp.

Table 3: Briefers, Subject-Matter Experts

Name	Organization
Mr. Donald Abelson	Sudbury International, LLC
Mr. Muhammad Ali	Hewlett-Packard, Inc.
Dr. Justus Baron	Northwestern University Pritzker School of Law
Ms. Monica Barone	Qualcomm Technologies, Inc.
Mr. Mike Boyle	National Security Agency
Ms. Lisa J. Carnahan	National Institute of Standards and Technology
Dr. Alissa Cooper	Cisco Systems
Mr. Brian Daly	AT&T, Inc.
Ms. Jessica Fitzgerald-McKay	National Security Agency
Dr. Ajit Jillavenkatesa	Apple Inc.
Mr. John Linford	The Open Group
Ms. Amy Marasco	Microsoft
Ms. Elaine Newton	Oracle Corp.
Ms. Bridget Petruczok	Ericsson, Inc.
Ms. Mary Saunders	American National Standards Institute
Mr. Iain Sharp	ATIS Technology, Inc.
Mr. Andras Szakal	The Open Group
Mr. Ed Tiedemann	Qualcomm Technologies, Inc.
Mr. Mark Walker	CableLabs, Inc.
Mr. Philip Wennblom	Intel Corp.
Ms. Michaela Wong	Information Technology Industry Council
Ms. Jaisha Wray	National Telecommunications and Information Administration

Table 4: Subcommittee Management

Name	Organization
Ms. DeShelle Cleghorn	President's National Security Telecommunications Advisory Committee (NSTAC) Alternate Designated Federal Officer (ADFO)
Ms. Rachel Liang	NSTAC ADFO
Ms. Megan Keeling	Booz Allen Hamilton, Inc.
Mr. Kole Kurti	TekSynap Corp.
Ms. Laura Penn	Edgesource Corp.