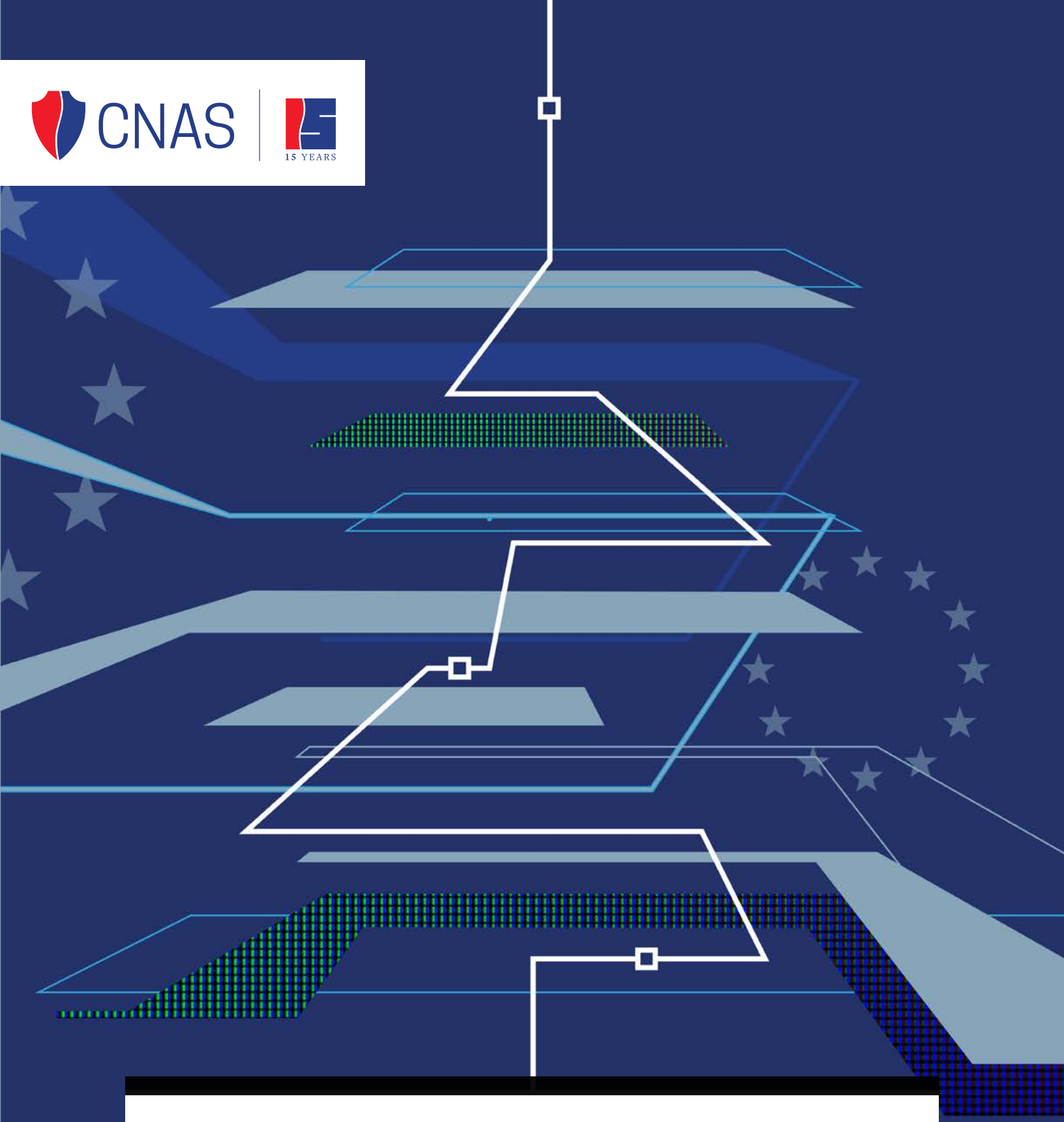

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Lighting the Path

Framing a Transatlantic Technology Strategy

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Executive Summary

The world's leading powers are engaged in an unprecedented technology competition. Autocratic regimes are advancing a vision for technology use—a techno-totalitarianism that entrenches authoritarian rule—that directly opposes the interests of democratic states. This vision, which includes control over key economic inputs, the domination of supply chains, breakthrough capabilities in emerging technologies, and unfettered surveillance, threatens to upend a decades-old rules-based system that promotes economic competitiveness and freedoms, supports democratic values, and protects fundamental rights.

How this technology competition unfolds will shape the global economic, political, and military balance for decades. Collaboration among the world's tech-leading democracies will be essential to maximize the odds of a favorable outcome. Perhaps the most important factor in this dynamic is reimagining the long-standing transatlantic partnership to meet this challenge.

To succeed, the United States and Europe must compete or risk ceding the competition to autocracies. They must be guided by a strategy that matches the moment. Yet no such strategy currently exists. This report aims to light that path by developing the contours of a transatlantic technology strategy.

This framework has a two-part approach. First, it identifies persistent friction in technology policy between the United States and Europe. The transatlantic partners must align approaches, when possible, and manage disagreement in the relationship to pave the way for a cooperative agenda. Second, this report advances a promote and protect agenda to ensure U.S. and EU economic security and long-term technological competitiveness. The report covers seven areas in which transatlantic cooperation will be key: artificial intelligence (AI), biotechnology, clean energy technology, information and communications technology and services (ICTS), quantum information science and technology (QIST), semiconductors, and standard-setting.

This report offers concrete, actionable recommendations to maintain the transatlantic partners' technological edge, ensure economic competitiveness, and protect democratic values. Ultimately, the report charts a blueprint for transatlantic success in a wide-ranging and consequential technology competition.

Summary of Recommendations

Lighting the Path lays out recommendations to secure the United States' and Europe's technological leadership and economic competitiveness and promote technology use in line with the interests and values of democratic countries. The study offers U.S. and European policymakers recommendations to deal with rifts in the transatlantic technology relationship, build the foundation for cooperation, and advance a protect and promote agenda across seven critical technology areas.

MANAGE RIFTS IN THE TRANSATLANTIC RELATIONSHIP

To better collaborate on technology policy, the United States and Europe must work to manage rifts in the relationship. A profound disagreement centers on data governance and privacy, where Europe is well ahead of the United States in codifying its views into law and policy. The United States lacks global influence on data protection and privacy issues and may struggle to mitigate associated national security risks because of its patchwork of laws.

To prepare the United States for data-driven economic growth and technology competition, Congress should:

- Enact a national data protection and privacy law.

To pave the way for enhanced cooperation in data governance and in competition and antitrust policy, the United States and Europe should:

- Focus on privacy-enhancing technologies.
- Adopt Organisation for Economic Co-operation and Development (OECD) common principles on government access to data to harmonize transatlantic policies.
- Stand up a transatlantic competition policy group.
- Include start-up investors in competition dialogues.

CRAFT AN AFFIRMATIVE AGENDA

Talent, research and development (R&D), and shared goals should underpin a transatlantic technology strategy. To foster a collaborative innovation base, the United States and Europe should:

- Prioritize talent.
- Invest in joint R&D.
- Identify technologies of shared strategic interest to guide cooperation.

CRAFT A PROTECT AGENDA

Alongside advancing an affirmative agenda, the United States and Europe must strengthen their protect tools. To enhance transatlantic coordination, the United States and Europe should:

- Align export control and investment screening processes.
- Collaborate on monitoring and enforcement.
- Pursue ad hoc coalitions of countries that impose export controls on chokepoint technologies judiciously.
- Start a transatlantic dialogue on outbound investment controls.
- Advance a new multilateral export control regime.

ADVANCE SECTOR-SPECIFIC RECOMMENDATIONS

The transatlantic partners must lead in critical technologies, including in AI, biotechnology, clean energy technology, ICTS, QIST, semiconductors, and standard-setting. To enhance their advantages in these fields, the United States and Europe should carry out the following steps in the following areas:

Artificial Intelligence

- Develop joint regulatory sandboxes.
- Ensure the compatibility of underlying standards that guide the EU's Artificial Intelligence Act and the National Institute of Standards and Technology's AI Risk Management Framework.
- Develop a joint AI research initiative to inform standard-setting activities.
- Pair the technical standards and innovation agendas.

Biotechnology

- Invest in systems and processes for predicting and mitigating risks.
- Collaborate on reforming the regulatory regimes that govern the biotechnology field.
- Establish ongoing U.S.-EU dialogue on ways to manage biosecurity risks.
- Partner on developing norms and standards across the biotechnology field, particularly in areas with sensitive data concerns.

Clean Energy Technology

- Map shared risks stemming from dependence on raw materials.
- Develop shared approaches to counter distortive industrial subsidies from competitor nations.
- Collaborate on strategies to mitigate reliance on foreign clean energy technology suppliers.
- Share best practices on innovating financing for clean energy.

Information and Communications Technology and Services

- Incentivize open radio access network (RAN) development and deployment.
- Coordinate open RAN risk assessments.
- Craft a transatlantic 6G strategy.
- Conduct research on improving the energy efficiency of data centers.

Quantum Information Science and Technology

- Collaborate on research security best practices in the QIST field.
- Bolster transatlantic capabilities and collaboration for assessing QIST developments and trends.
- Identify potential bottlenecks and vulnerabilities in the QIST supply chain.
- Build new and ongoing bilateral and multilateral partnerships to boost QIST collaboration.

Semiconductors

- Coordinate economic security policies.
- Counter distortive industrial semiconductor subsidies from competitor nations.
- Maintain close coordination and information exchanges on their own semiconductor development and strategies.
- Avoid a subsidies arms race to reduce risk of World Trade Organization (WTO) litigation.
- Establish subsidies guardrails, such as placing restrictions on investments in China.

Standard-Setting

- Leverage the Trade and Technology Council (TTC) to coordinate the promotion of certain standards.
- Reform standard-setting organizations to bolster their integrity.
- Provide incentives for companies to participate in standard-setting activities.
- Take leadership contests seriously.
- Bolster standards expertise by expanding and training a workforce engaged in standard-setting activities.
- Appoint standards coordinators to centralize issues that pertain to standard-setting and to streamline transatlantic cooperation.

Section I: Managing Rifts in the Transatlantic Tech Relationship

The United States and Europe are at risk of embarking on divergent paths on important technology issues that could harm the transatlantic alliance and impair their respective economic competitiveness and security. Newer areas of disagreement have emerged in the transatlantic relationship: matters of digital sovereignty, clashes on antitrust and competition policy, and differing policies regarding China. Other rifts have plagued the relationship for decades, such as privacy policy. Left unaddressed, continued splintering could have harmful consequences by thwarting coordinated responses to authoritarian actors seeking to advance their own visions for the digital era. Encouragingly, there are signs that both sides are moving closer together on some of these issues. This section outlines how to further mitigate the divergences to enable transatlantic cooperation.

Digital Sovereignty

A looming divergence between the European Union and the United States is the pursuit of digital sovereignty for Europe. While lacking a succinct definition, "digital sovereignty" is in essence an EU vision for greater autonomy on digital and technology policy. A few factors drive Europe's aim for digital sovereignty, including the strong market position of U.S. technology companies in Europe, rocky U.S.-European relations during the Trump administration, and a European attempt to chart a third way in a U.S.-China technology competition.

Europe's vision includes championing its technology companies through industrial policies, prioritizing purchases of European-origin hardware and software, localizing data, and onshoring high-tech manufacturing.[1] Conceptually, European digital sovereignty efforts are similar to policies pursued by the U.S. government, such as bills to subsidize semiconductor fabrication and diversify supply chains. The friction with digital sovereignty, however, results from how European leaders are executing their vision, which generally disadvantages U.S. firms. As an example, the National Cybersecurity Agency of France's recent revisions to its cybersecurity certification and labeling program—SecNumCloud—would prevent foreign cloud firms from being considered trusted providers. In effect, this would prevent U.S firms from operating in parts of the French market, unless they set up a local joint venture. In other cases—matters of antitrust and competition policy—U.S. firms are directly in the crosshairs.

Competition Policy and Digital Regulation

Competition policy and digital regulation are arguably the most contentious issues in transatlantic technology policy. At the core of the problem is that the United States and Europe differ on the appropriate balance to strike between regulation and innovation. Some analysts argue that Europe links its competition and industrial policies, and that Europe seeks to strengthen European firms by hobbling U.S. technology firms.[2] The United States' approach to fostering competition, however, is to remove barriers to innovation.[3] The centerpiece of the EU strategy is two legislative packages—the Digital Services Act (DSA) and the Digital Markets Act (DMA).

The DSA aims to create a safer space online, and it holds online platforms accountable for illegal and harmful content.[4] It specifically targets online platforms (mainly Facebook, Instagram, Google, Twitter, YouTube, and Amazon) that provide intermediary services, including network infrastructure, cloud computing and webhosting services, large search engines, online marketplaces, and large online platforms.[5] The DSA includes measures to counter illegal goods, services, and content online; to empower users and civil society; and to assess and mitigate risks.[6]

The DMA bans certain practices by large technology companies designated as "gatekeepers." Gatekeepers are defined as companies with a strong and durable economic position in multiple EU countries, and that provide "core platform services," such as search engines and social networks.[7] While the European Commission has not yet designated companies as gatekeepers, the list will likely consist of several U.S. companies as well as China's Alibaba.

> **At the core of the problem is that the United States and Europe differ on the appropriate balance to strike between regulation and innovation.**

The DMA aims to ban self-preferencing or unfair ranking of gatekeepers' own services and products, to give businesses access to certain data held by gatekeepers, to improve interoperability for the customer, and to increase choices of where other companies can offer services or products. A failure to comply with these rules would result in fines levied by the European Commission.[8] The final text of the DMA awaits publication in the EU official journal.[9]

China

While U.S. policy prioritizes China as the most critical challenge to U.S. national security, European policy identifies China as a "partner for cooperation and negotiation, an economic competitor and a systemic rival."[10] For the past few years, Europe has attempted to chart a third way in the technology competition between the United States and China.

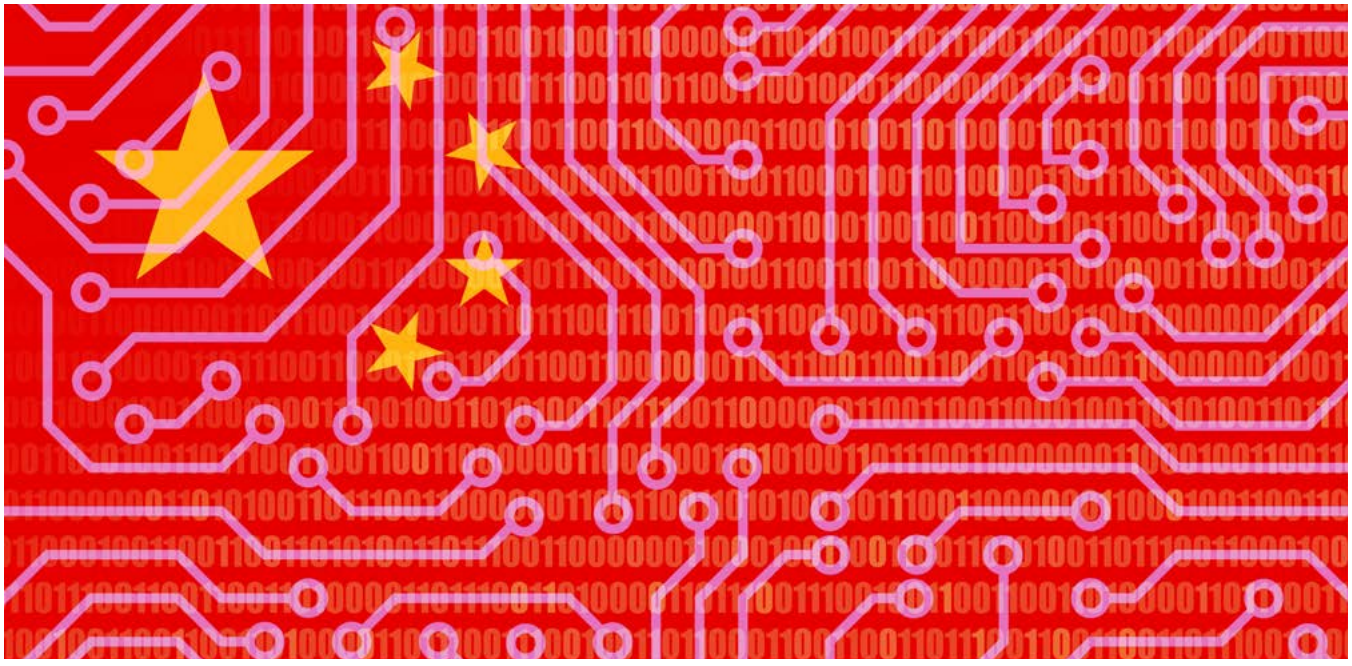
Two key EU-initiated technology policy efforts underscore how European leaders seek to thread the needle between addressing security and trade concerns over China while at the same time maintaining the potential for an enhanced trade relationship by not singling out Beijing. When the United States and the European Union stood up the Trade and Technology Council (TTC), European Commission officials explicitly stated: "The TTC is not a dialogue on China."[11] Furthermore, the EU favors actor-agnostic approaches in its risk assessments and strategies. For example, the EU "Cybersecurity of 5G Networks: EU Toolbox of Risk Mitigating Measures" assesses risks in 5G networks, without recommending an approach that would ban 5G kit originating from Chinese companies.[12] Different outlooks on digital sovereignty, antitrust and competition, and how to deal with a rising China pose hurdles to fostering greater alignment between the transatlantic partners. But while each poses distinct challenges, there is a common thread: data. Understanding and tackling the issue of data governance and privacy is at the core of the misgivings between Europe and the United States.

Privacy

Data governance and privacy are persistent divergences between the transatlantic partners. Dating back to the 1950 European Convention on Human Rights, the European Union and precursor groupings have held that privacy is a human right.[13] In contrast, the United States primarily views data privacy through the lens of consumer protection and rights, excluding a few U.S. states with comprehensive privacy laws.[14] As a result, the United States' privacy regime is far less sweeping than the EU's, with a patchwork of state, federal, and sectoral privacy laws.

The European Union first legislated on privacy in its 1995 European Data Protection Directive.[15] The 2013 Snowden leaks, which exposed U.S. surveillance activities worldwide, prompted new action by EU leaders.[16] The resulting General Data Protection Regulation (GDPR) went into effect in May 2018. The self-proclaimed "toughest privacy and security law in the world," the GDPR has a broad scope that imposes requirements on organizations in any jurisdiction if they collect data on people in the EU.[17]

A 2020 EU data strategy aims to create a single market for data within the EU (Data Act) and an accompanying data governance strategy that will facilitate the flow of data (Data Governance Act [DGA]). As they wind their way through the European Union's legislative process, these proposals risk further impeding data flows between the transatlantic partners due to the extraterritorial approach of both measures.[18]



While the United States and Europe share many of the same goals in technology, they sometimes differ on their strategy or approach, for example with regard to China and microchips. (Yaorusheng/Getty)

It is critical that the transatlantic partners get data governance right. There are more data flows between the United States and Europe than anywhere else in the world. Not only does data underpin the digital economy, but it also underpins the $7.1 trillion U.S.-EU economic relationship.[19] These data flows and digital trade risk being disrupted if the transatlantic partners do not find a solution. Furthermore, data localization could splinter the data ecosystem and hinder the transatlantic partners' abilities to jointly develop critical technologies, such as artificial intelligence (AI), cybersecurity, and cloud computing.

Signs of Convergence

There are signs that these issues are not as intractable as they appear. Although U.S. government officials initially balked at the DMA and DSA, several policymakers have since proposed stronger antitrust measures. In July 2021, U.S. President Joe Biden issued an executive order on promoting competition in the American economy, noting the downsides of market concentration.[20] In the same vein, U.S. lawmakers have announced new legislative initiatives aimed at reining in big tech. Most notable is the American Choice and Innovation Online Act (S.2992), which was introduced in October 2021 by Senators Amy Klobuchar and Chuck Grassley.[21] This bill largely mirrors the goals of the DMA and prevents big technology companies from self-preferencing their own products, limiting competing products from another business on their platform, and discriminating among similarly situated users in the application of terms of service.[22] The bill will next go to a full vote in the Senate.[23] Potentially sensing the shift in the U.S. policy on these issues, Commerce Secretary Gina Raimondo expressed support for the American Choice and Innovation Online Act.[24]

It is critical that the transatlantic partners get data governance right. There are more data flows between the United States and Europe than anywhere else in the world.

Whereas U.S. officials have moved closer to the European position on antitrust, EU leaders have adopted a stance toward Beijing that is more aligned with the U.S. perspective. In March 2021, in response to Beijing's human rights abuses and the detention of Uyghurs in Xinjiang, EU leaders imposed an asset freeze, a travel ban to the EU, and a ban on four Chinese party and regional representatives from receiving EU funds. In retaliation, China imposed its own measures on various EU officials and members of the European Parliament.[25] This tit-for-tat effectively killed the EU-China Comprehensive Agreement on Investment, which members of the European Parliament voted to freeze until China lifts sanctions against the EU lawmakers.[26] Beijing's economic coercion of Lithuania over its relations with Taiwan further soured relations such that the EU-China summit in April 2022 was a non-event.[27] Josep Borrell, the EU's foreign policy chief, described the summit as "a dialogue of the deaf."[28] These developments suggest that a rapprochement on long-standing divisions between the United States and Europe is feasible.

On data privacy, there have been several mechanisms to govern transatlantic data flows, including the Safe Harbour Agreement and EU-U.S. Privacy Shield Framework.[29] However, these attempts to govern transatlantic data flows were challenged in court by European privacy advocates and nullified.[30] On March 25, 2022, the United States and European Commission announced a new structure to govern transatlantic data flows, the Trans-Atlantic Data Privacy Framework.[31] While this still must be codified into U.S. code and approved by the European Union, it signals progress in a policy area previously frozen due to disagreements between transatlantic partners.

Recommendations

U.S. and EU leaders have expressed a desire to increase collaboration on myriad technology policy matters. There is considerable opportunity to do so, given the extensive shared interests and concerns. Full alignment on all these issues is not realistic. It is also not necessary. While differing opinions on core issues will persist, they need not derail an overall agenda for cooperation. The following recommendations offer pragmatic approaches to manage current rifts.

Enact a national data protection and privacy law. The United States Congress should pass national data privacy legislation. While this would not be a silver bullet to repair the rift with Europe, it would chart a comprehensive U.S. position on data privacy and make it easier for the United States to cooperate with partners in Europe and beyond.[32]

Focus on privacy-enhancing technologies. Even though a solution to transatlantic divergences on privacy policy remains unlikely, the United States and Europe should still work around the rift on data privacy. The TTC should form a consortium of research

institutions and companies focused on the development of privacy-enhancing technologies—such as federated learning, homomorphic encryption, and secure multi-party computation—on both sides of the Atlantic. This consortium could share best practices on the development of the technologies. In tandem, the U.S. National Science Foundation (NSF) and the European Commission should set up a fund to invest in companies developing privacy-enhancing machine learning technologies.[33]

Adopt Organisation for Economic Co-operation and Development (OECD) common principles on government access to data to harmonize transatlantic policies. Progress on the Trans-Atlantic Data Privacy Framework should pave the way for agreement on principles for government access to personal data for national security purposes. Agreement on government access could unlock broader progress on cross-border data flows with other countries in the OECD.[34]

Stand up a transatlantic competition policy group. As part of the EU-U.S. Joint Technology Competition Policy Dialogue, the United States and Europe should stand up an expert group charged with "systematically reviewing antitrust investigations and decisions on the objective grounds of consumer welfare, innovation, and competition in the marketplace."[35] This would enable the United States and Europe to examine the impact on market structures of competition policy enforcement.[36]

Include start-up investors in competition dialogues. Preventing big tech firms from acquiring start-ups would be deleterious to the start-up environment and to start-up investors. The European Commission should bring start-up investors into competition dialogues by surveying investors on antitrust policy proposals and creating an event series that gauges their opinion on policy proposals.[37]

Section II: Charting a Transatlantic Protect & Promote Agenda

A core tenet of a transatlantic technology strategy is that transatlantic partners must pair affirmative and defensive agendas to be effective in technology competition. This report identifies seven priority technology areas for transatlantic cooperation: artificial intelligence, biotechnology, clean energy technology, information and communications technology and services (ICTS), quantum information and science technology (QIST), semiconductors, and standard-setting. These technology areas are priorities because they underpin critical infrastructure, enable other technologies, and/or have the potential to transform society. This section of the report analyzes the strategic approaches for the United States and Europe in each of these technologies. It also outlines areas where approaches align or diverge. It concludes with concrete recommendations for a shared promote and protect agenda, and a range of sector-specific suggestions to enhance capabilities and bolster resilience in the United States and Europe.

Artificial Intelligence

AI is poised to reshape societies, economies, and ways of life. From climate change to food security, artificial intelligence has the potential to unlock solutions to some of the world's most pressing challenges.

Authoritarian regimes such as China and Russia are exploiting AI technologies to tighten their grip on power, and are exporting their model of digital authoritarianism around the world. China supplies AI surveillance technology to dozens of countries, and Russia is advancing a model of digital authoritarianism that is even more adaptable and cost effective to implement than China's model.[38]

The United States and Europe must not allow authoritarians to set the rules of the road for AI. To avoid ceding AI leadership to autocracies, the United States and Europe must cooperate to advance AI that reflects shared democratic values; harnesses its benefits, such as increased efficiency and accuracy; and ensures it is used as a force for global good.

U.S. STATE OF PLAY

The U.S. government has made incremental progress on measures to safeguard U.S. leadership in AI. The Obama, Trump, and Biden administrations each initiated strategic plans focused on issues such as research and development (R&D) funding, workforce, and commercial interests. Federal spending on AI R&D has also grown, increasing from an estimated $10 billion in fiscal year 2020 to an estimated $11 billion in FY 2021.[39]

In 2018, Congress authorized the creation of the National Security Commission on Artificial Intelligence (NSCAI), an independent commission charged with crafting a national approach to AI and monitoring advances in AI to address U.S. national security needs. The NSCAI released its final report in March 2021, outlining several priority areas, including leadership, talent, hardware, innovation investment, and engagement with like-minded countries.[40] Numerous NSCAI recommendations have become law.[41]

Federal agencies have implemented their own AI strategies. Since August 2017, the Departments of Transportation, Defense, Justice, Homeland Security, State, Health and Human Services, and Veterans Affairs have published 21 AI strategies.[42] The Department of Defense has about 685 programs focused on AI, and the Pentagon recently established the Chief Digital and Artificial Intelligence Office, in part to coordinate these efforts.[43]

EUROPEAN STATE OF PLAY

Europe has two aims in AI development: protecting European values and fostering competitiveness.[44] Europe's approach to AI centers on tackling global challenges, such as climate change, digital democracy, transportation, and healthcare.[45] Since 2018, the EU has published several AI strategies and has taken a leading role in promoting ethical and trustworthy AI.[46]

From 2018 to 2020, the EU's Horizon 2020 program dedicated €1.5 billion to AI funding, and this investment is poised to increase.[47] The European Commission plans to invest €1 billion per year in AI through the Digital Europe and Horizon Europe programs.[48] The commission also plans to secure member state and private sector investments to reach an annual investment of €20 billion.[49] Horizon 2020 also provides funding for Digital Innovation Hubs, which provide companies with technical expertise and the ability to "test before invest"; as well as a European Network of AI Excellence Centers, which "develop synergies, provid[e] networking opportunities, and devis[e] common AI research."[50]

On the regulatory front, the EU AI Act proposed in 2021 would categorize end uses as "unacceptable risk, high risk, limited risk, and minimal risk."[51] The proposal has extraterritorial effect, meaning that U.S. companies would need to conform with EU standards to provide AI products and services on the European market. The act also contains stringent requirements for AI transparency.[52] Prominent figures in the U.S. tech sector have pushed back against these stipulations, arguing they are unrealistic and would hinder transatlantic collaboration.[53]

TRANSATLANTIC CONVERGENCES

Despite distinctions in their regulatory approaches, the United States and Europe share an overall common approach to AI. The United States and Europe share:

A values-based approach to AI. The United States and Europe prioritize AI that protects fundamental rights and democratic values. The United States and EU are members of the Global Partnership on Artificial Intelligence—a coalition of like-minded partners that aims to "support and guide the responsible development of AI that is grounded in human rights, inclusion, diversity, innovation, economic growth, and societal benefit."[54]

A commitment to trustworthy AI. A necessary extension of a values-based approach to AI is the development of trustworthy AI.[55] Although no agreed-upon definition exists, the transatlantic partners prioritize the development of trustworthy AI in their national strategies and in the TTC's joint statement.[56] The transatlantic partners also adhere to the OECD Principles on Artificial Intelligence, which provide guidelines for stewardship of trustworthy AI and are complemented by the OECD AI Policy Observatory, which aims to operationalize the principles and shape public policies for trustworthy AI.[57]

TRANSATLANTIC DIVERGENCES

Despite the shared U.S.-EU approach to AI, several issues could hinder transatlantic cooperation:

Divisions on data privacy and governance. Divergent views of data privacy and governance have threatened to hinder cooperation on technology development between the transatlantic partners. Today the stakes are high. AI and machine learning depend on data, making shared datasets a necessity for cooperation in this domain. The Trans-Atlantic Data Privacy Framework, announced in March 2022, has the potential to repair this rift across the Atlantic for now. The past few years have shown, however, that progress on such cooperation can be ephemeral. To prevent disruption in the long term, the United States and Europe should work to circumvent the rift by advancing privacy-preserving technologies.

Conflicting priorities for AI. While the United States views AI leadership as a key battleground in its competition with China, Europe does not focus its AI development solely through a geopolitical lens. Instead, Europe prioritizes economic competitiveness and securing fundamental European rights as its motivation to secure AI leadership. Conversely, the United States views AI development through a predominately national security lens, which explains the U.S. Defense Department's focus on AI innovation and R&D strategies and the emphasis on defense applications of AI.[58]

Differing approaches to regulation. While Europe is putting forward a comprehensive EU-level regulation on AI, the United States approaches regulation from the sectoral and state levels, rather than federal. The transatlantic partners have also diverged on the timing of regulation, with the United States waiting for technology to reach more mature stages of development before imposing regulation, while Europe regulates earlier in the technology's lifecycle. Despite these differences, the United States' approach is shifting. The National Institute of Standards and Technology (NIST) and the White House are working on an Artificial Intelligence Risk Management Framework and AI Bill of Rights. The shifting U.S. approach might open a window for greater transatlantic cooperation if the United States and Europe can align their comprehensive regulations.

Biotechnology

Advancements in biotechnology are creating remarkable opportunities for economic growth and more societal resilience across a range of sectors, such as medicine, agriculture, manufacturing, and energy. Biotechnology—using living organisms or their components to create a new product or process—underpins two critical aspects of a country's economy and defense: the bioeconomy and biosecurity.

Interest in the bioeconomy has surged in nations around the world in recent years.[59] While no consensus definition of "bioeconomy" exists, a 2012 report from the Obama administration describes it as "based on the use of research and innovation in the biological sciences to create economic activity and public benefit."[60] No shared definition of "biosecurity" exists either, but in a 2019 Defense Department Directive, it is "the discipline addressing the security of microbiological agents and toxins and the threats posed to humans and animal health, the environment, and the economy by deliberate misuse or release."[61] Biosecurity risks from conventional bioweapons have long existed, but advancements in biotechnology are shifting and complicating the threat landscape.

The United States and Europe have their own priorities and approaches to the bioeconomy and biosecurity, some of which overlap. As developments in biotechnology continue to shape countries' economies and security, the transatlantic partners should work together to shape this future, particularly in the areas of risk mitigation and standard-setting.

Advancements in biotechnology will have major impacts on economic growth and cross-sector resilience. While the United States and its transatlantic partners may have differing approaches to biosecurity and the bioeconomy, they must work together to preemptively addresses risk mitigation and standard-setting. (Longhua Liao/Getty)

U.S. STATE OF PLAY

The Obama administration actively pursued strategies targeting biotechnology and the bioeconomy. It released its *National Bioeconomy Blueprint* in April 2012, focusing on five strategic objectives for harnessing the full potential of America's bioeconomy, including supporting R&D investments, facilitating the transition of biotech innovations from research lab to market, developing and reforming regulations to reduce barriers, strengthening a national workforce, and supporting public-private partnerships.[62]

In 2016, the White House Office of Science and Technology Policy released the *National Strategy for Modernizing the Regulatory System for Biotechnology Products*, which aimed to ensure the federal regulatory system was prepared to assess the potential risks of future biotech products.[63] The strategy built upon a long-standing policy—the 1986 *Coordinated Framework for Regulation of Biotechnology*—which outlines the federal government's regulatory policies for ensuring the safety of biotechnology products.[64]

Congressional interest in biotechnology has grown over the years, partly because the field has emerged as a potential battleground in America's technology and economic competition with China. The National Security Commission on Emerging Biotechnology was established in March 2022 as part of the FY 2022 National Defense Authorization Act (NDAA).[65] The commission will review how emerging biotechnology capabilities will shape the actions of the Defense Department and will offer recommendations to policymakers on how to leverage these technologies for U.S. economic and national security.[66]

Ongoing investments and projects in the biotech space exist across the federal government. The Defense Department initiated the Bioindustrial Manufacturing and Design Ecosystem (BioMADE) in 2020, with the aim of connecting public and private entities on projects related to bioindustrial manufacturing technology.[67] The National Institute for Innovation in Manufacturing Biopharmaceuticals—stood up through an agreement with NIST in 2016—is a public-private partnership aimed at leveraging non-federal investments to jumpstart biopharmaceutical innovation.[68] The National Institutes of Health (NIH) is also heavily involved in the biotechnology field, acting as a significant investor of R&D in the bioeconomy.[69]

EUROPEAN STATE OF PLAY

Biotechnology is an ongoing priority for the European Union, as well as individual countries across Europe. A 2021 McKinsey report named the United Kingdom, France, and Germany as biotech leaders in Europe, as they account for half of Europe's biotech companies.[70]

The European Union has long recognized the role of biotechnology in the development and growth of its economy. The European Commission identifies three broad groups that rely on biotech applications: healthcare and pharmaceutical applications, agriculture, and industrial processes and manufacturing.[71] Several different strategies and programs have guided the EU's biotech and bioeconomy priorities, including *Life Sciences and Biotechnology: A Strategy for Europe*, *Horizon 2020*, and *A Sustainable Bioeconomy for Europe: Strengthening the Connection between Economy, Society and the Environment*[72].

Horizon 2020 named biotechnology as a key enabling technology for Europe's industrial leadership.[73] The EU's primary objective for biotech research and innovation was to "develop competitive, sustainable, safe and innovative industrial products and processes and to contribute as an innovation driver in a number of European sectors, like agriculture, forestry, food, energy, chemical and health as well as the bioeconomy."[74]

The EU's 2018 report on a sustainable bioeconomy identifies five primary objectives: ensuring food and nutrition security; managing natural resources sustainably; reducing dependence on non-renewable, unsustainable resources; mitigating climate change; and bolstering European competitiveness.[75]

The United States has historically been the leading global investor in clean energy research and development but lacks the funding and institutional structures to shepherd promising technologies through to commercialization.

While the European Union recognizes the importance of the biotechnology field, it needs to take additional action, particularly on R&D resources and regulatory reform. According to the 2021 EU Industrial R&D Investment Scoreboard, U.S. biotech companies "outperformed their EU counterparts in terms of R&D investment (11 times larger) and number of companies (166 vs 20)" in 2020.[76] Joint R&D represents a prime area of potential transatlantic cooperation.

TRANSATLANTIC CONVERGENCES

Despite distinctions in their approaches to biotechnology, the United States and Europe also share commonalities. The United States and Europe share:

A commitment to mitigating biosecurity risk. The United States and Europe both prioritize the need to mitigate biosecurity risk, particularly as emerging technologies, such as AI, influence and ramp up the speed of technological change. The United States and Europe have long wrestled with how to reduce the risk from conventional bioweapons, and this challenge will only grow in complexity as time goes on.

The view that biotech is a critical technology area. Both the United States and Europe view biotechnology as a critical technology area with remarkable potential for a country's economy and national security. However, the United States and Europe also have both struggled to identify the best approach to balancing the risks and rewards posed by the biotech field. Too much regulation, for instance, may stifle growth and innovation, while too little oversight may leave countries vulnerable to accidents or misuse.

TRANSATLANTIC DIVERGENCES

Despite the shared U.S.-EU approach to biotechnology, two key issues threaten to hinder transatlantic cooperation:

Differing regulatory structures. The United States operates out of a more lenient regulatory regime, while the European Union has more stringent policies in place, particularly surrounding genetically modified organisms (GMOs).[77] According to many analysts, these strict policies have hindered ongoing research and innovation, especially in the agricultural biotechnology field.

Differences in data privacy and regulation. Advancements in the biotechnology field, especially healthcare, rely on robust amounts of data. Differences in U.S. and EU data protection and privacy have impacts across the biotechnology field. Limitations on the transfer of international data may undercut the efforts of biotech researchers across the Atlantic.[78]

Clean Energy Technology

Clean energy technologies—needed to achieve net zero carbon emissions—include both energy production technologies, such as wind and solar power generation, and technologies that use non-carbon-based energy sources, such as electric vehicles.[79] Because clean technology has implications for a country's energy security and climate change, it is a highly political sector and vulnerable to geopolitical disruptions.

China is the world leader in clean energy technology. A key producer of finished materials, it makes three-quarters of the world's solar panels, more than half of global wind turbines, and three-quarters of the lithium ion batteries needed for electric vehicles and energy storage.[80] China also dominates global processing of critical minerals for clean energy products.[81] China's emergence as a clean energy leader has been powered by state subsidies, lax environmental and labor standards, and a large domestic market for clean energy, as well as inconsistent policy from the United States to develop a more robust clean energy sector.[82]

U.S. STATE OF PLAY

The United States has historically been the leading global investor in clean energy research and development but lacks the funding and institutional structures to shepherd promising technologies through to commercialization.[83] While the United States has had some success in creating consumer markets for clean energy technologies, through tools such as tax credits for the purchase of electric vehicles, its support for building clean energy industrial capacity has been underdeveloped. This has allowed

imports, primarily from Asia, to surge to fill unmet demand in the U.S. market. U.S. clean energy policy has also been marked by high levels of trade restrictions and trade remedy actions, including in response to China's success in exporting products such as wind turbine towers and solar panels.[84]

The Biden administration has demonstrated a strong commitment to clean energy technology development. The president signed the Bipartisan Infrastructure Law, which mandates a suite of clean energy initiatives, such as geological mapping of minerals critical for clean energy technology and investments in clean energy sources and electric vehicle infrastructure. The administration also prioritized clean energy supply chains in its 100-day supply chain review efforts, which were intensive all-of-government efforts to map supply chains in critical sectors and recommend concrete steps to address vulnerabilities.[85] Most recently, the United States Congress enacted the Inflation Reduction Act, which aims to bolster U.S. efforts in clean energy technology development with provisions such as clean energy tax incentives and investment in the clean energy work force and innovation ecosystem.[86]

EUROPEAN STATE OF PLAY

The European Green Deal, launched in December 2019, provides an overarching strategy for competition and growth in the clean energy technology sector, with the goal of reducing greenhouse gas emissions by 55 percent by 2030, compared with 1990 emissions levels. The twin goals of a "digital and green transformation" describe a European community geared toward becoming the first climate-neutral continent by 2050.[87] The European Green Deal seeks to mobilize more than €1 trillion in investments during the next decade, including through the EU budgetary process, and will catalyze complementary private sector investments.[88] Clean energy initiatives may also be supported by the EU's Horizon 2020 program, which supports European industrial competitiveness in climate, energy, and mobility.[89] European restrictions on state aid (e.g., subsidies) may be relaxed for clean energy investments.

The European Green Deal is supported by a suite of regulatory efforts under the "Fit for 55" package geared toward restructuring the economy to enable the 55 percent emissions-reduction goal.[90] "Fit for 55" includes regulations for the EU's carbon emission–trading program, the carbon-border adjustment mechanism that imposes tariffs on the import of carbon-intensive goods, and a range of energy use targets and efficiency standards.

European green energy goals have taken on new urgency with Russia's invasion of Ukraine and the resulting turmoil in global energy markets.[91] Europe is heavily dependent on Russian energy sources, with nearly half of its natural gas and a quarter of its oil coming from Russia in aggregate, though certain member states have near total reliance on Russian energy. As part of its goal to reduce its reliance on Russian energy, which continues to provide Russia with significant import revenue, Europe has announced ambitious plans to sharply advance its pivot to clean energy sources, though the feasibility of these plans is uncertain.[92]

TRANSATLANTIC CONVERGENCES

Despite distinctions in their clean energy sectors, the United States and Europe share similar vulnerabilities. The United States and Europe share:

The need to secure access to raw materials. The United States and Europe recognize the strategic need to reduce their reliance on adversarial nations for key energy inputs, but doing so will be highly challenging. China's advantages have been solidified by structural advantages, including its lax environmental policies that enable dirtier processing techniques.[93]

A reliance on foreign technology. Firms in China, South Korea, and Japan dominate global electric vehicle battery manufacturing.[94] For solar energy technology, Asian producers account for 95 percent of global manufacturing in 2020, with China taking up two-thirds of that capacity.[95] In offshore wind installations, European countries are more competitive than their American counterparts in the global marketplace, though China still has a strong global presence.[96]

The struggle with China's strong advantage. China's advantage in clean energy sectors is driven in part by structural factors that the United States and Europe cannot or should not mimic, including the use of forced labor in clean energy supply chains, pollution-enabling regulations, and massive subsidization of its industries.

A strategic interest in clean energy transition. The clean energy transition can enable the transatlantic partners to reduce strategically problematic reliance on difficult countries, such as Russia and the Gulf states. However, moving sharply to clean energy sources without bolstering domestic production capacity risks trading one vulnerable supply chain for another, given China's strong role in clean energy production.

Telecommunications is an important area for transatlantic alignment, as success in this domain is key to advancing myriad key technologies and securing critical infrastructure. (Anton Petrus/Getty)

TRANSATLANTIC DIVERGENCES

The domestic and international politics of clean energy may complicate transatlantic cooperation, including:

Differing political commitments on climate policies. U.S. policy on clean energy policy is subject to change with transitions in political administrations, creating challenges for durable cooperation with Europe on long-term initiatives.

Possibility of trade irritants. The U.S. Congress has passed legislation that provides tax credits to consumers purchasing electric vehicles produced in the United States, which could draw the ire of European countries.[97]

Information and Communications Technology and Services

ICTS have transformed societies by underpinning critical technologies and infrastructure and serving as the backbone of the transatlantic economy, which accounts for one-third of global gross domestic product (in terms of purchasing power).[98] This section focuses on two areas of ICTS that transatlantic partners must lead: telecommunications—specifically 5G, open radio access network (RAN), and 6G—and cloud computing.

While European companies lead in 5G development and U.S. companies in cloud computing, sustained leadership is not a foregone conclusion. Beijing is attempting to upend transatlantic leadership in these areas by creating Chinese national champions, blocking market access for transatlantic companies, and preferencing Chinese companies in public procurement. While Huawei's attempt at dominating the 5G market is well documented, Beijing is attempting to also lead in cloud computing.[99] To ensure transatlantic leadership, the partners must work together in these domains, despite divergences that threaten to fray the relationship.

U.S. STATE OF PLAY

The United States has taken a more defensive approach to 5G by focusing on securing networks and responding to the threat that China poses. In May 2019, Huawei was added to the Commerce Department's Entity List,[100] and then, in August 2020, the U.S. Commerce Department strengthened the export controls on Huawei, blocking all globally produced chips from being sold to Huawei.[101] As a complement to the defensive agenda, the United States advanced an affirmative agenda to spur 5G innovation, primarily through investments. In its FY 2022 funding request, the Department of Defense requested about $600 million for 5G experimentation and testing.[102]

As the U.S. government focused on stopping the proliferation of Huawei's 5G infrastructure, the need was clear to also advance an alternative to Huawei. As a result, the U.S. government expressed support for open RAN—network architecture that consists of interoperable software run on vendor-neutral hardware. Open RAN enables greater vendor diversity, interoperability,

and enhanced security at a lower cost.[103] The United States has invested in the development of open RAN, for example, by dedicating $1.5 billion in the CHIPS and Science Act, $750 million in the Utilizing Strategic Allied (USA) Telecommunications Act, $50 million for research in the 2021 NDAA, $25 million from the Open Technology Fund for standards development, and another $2.5 billion to a joint initiative with Japan.[104]

To avoid repeating its mistakes with 5G, the United States is progressing quickly in 6G research and is investing now to lead in 6G in the future. The U.S. government, private sector, and academia have launched several research initiatives, including the Center for Converged TeraHertz Communications and Sensing (ComSenTer), the NextG alliance, and the National Science Foundation's Resilient & Intelligent NextG Systems (RINGS) program.[105] The Federal Communications Commission has also opened frequency bands for 6G research and testing experiments.[106]

To avoid repeating its mistakes with 5G, the United States is progressing quickly in 6G research and is investing now to lead in 6G in the future.

The United States is a global leader in the cloud infrastructure service market. Four U.S. companies—Amazon Web Services, Google, IBM, and Microsoft—control more than half of the worldwide cloud infrastructure service market.[107] While U.S. policymakers have acknowledged how to leverage cloud computing resources to lead on other technologies, such as AI, there is a dearth of U.S. strategies on how to advance U.S. leadership in cloud computing. The U.S. government has no comprehensive strategy for maintaining leadership in cloud computing. U.S. companies' current market position has largely been driven by the private sector.

During the Trump administration, the U.S. cloud strategy primarily comprised defensive actions. In May 2019, President Donald Trump issued Executive Order 13873 on "Securing the Information and Communications Technology and Services Supply Chain" (ICTS EO). The ICTS EO was the culmination of a multi-administration effort to craft a process whereby the government could restrict, for national security reasons, the activities of Chinese technology companies within the United States. For example, this rule could be used to restrict the ability of U.S. citizens to utilize Chinese companies for cloud services, as was done when the Biden administration initiated a review of Alibaba Cloud in 2022.[108]

EUROPEAN STATE OF PLAY

In 2021, European companies Ericsson and Nokia led the RAN market, displacing Huawei as leader.[109] Their market position is bolstered by an EU strategy for 5G development and innovation and investments, including more than €700 million through Horizon 2020 and €70 million for pilot projects.[110] On the defensive agenda, Europe faced pressure from the United States to act against Huawei. In response, the European Union released the *EU Coordinated Risk Assessment of the Cybersecurity of 5G Networks*, which takes an actor-agnostic approach to assessing risk in 5G networks.[111]

European telecommunication firms have expressed support for open RAN and are running open RAN trials, and the EU has invested €2 billion in its development.[112] Despite this, some analysts are pushing back on open RAN due to security concerns, including the presence of Chinese companies in the O-RAN alliance, an industry grouping that sets open RAN specifications.[113] As a result, Germany's Federal Office for Information Security and the EU's Network and Information Systems Cooperation Group have released security assessments, which estimate medium to high security risks and urge a cautious approach to moving toward open architecture.[114]

Europe aims to maintain its leadership in the telecommunications market through 6G development. In January 2021, the EU launched HEXA-X, a consortium of key players in industry and academia that aims to chart the 6G research agenda.[115] A month later, the European Commission dedicated €900 million from 2021 to 2027 to coordinate on 5G deployment and on 6G research under Horizon Europe.[116] In addition to EU initiatives, Finland and Sweden are leaders in 6G research and development and have established research programs and projects to advance new wireless access infrastructure.[117]

In Europe, the cloud computing market was worth €63 billion in 2021 and is forecasted to reach €560 billion by 2023.[118] However, 69 percent of cloud services in Europe is provided by large U.S. firms.[119] Due to the dominance of U.S. firms, Europe has pushed forward a cloud services strategy that aims to challenge U.S. companies and advance a European cloud alternative distinct from that of the United States or China.[120] Specifically, Europe aims to develop a cloud with strong commitments to data protection and as a means to advance European technological sovereignty. To this end, Europe has built several strategies and projects, including Gaia-X in June 2020. Gaia-X strives

to develop a trusted European cloud market and reduce dependency on the United States, but has struggled to find its footing in recent years due to disagreements among members and significant delays in meeting its objectives.[121] Additionally, the EU announced the European Alliance on Industrial Data, Edge and Cloud, which will produce a European cloud security certification scheme, an EU Cloud Rulebook, and a European marketplace for cloud services.[122] Complementing these strategies, the EU has allocated €10 billion for data center modernization from 2021 to 2027.[123]

TRANSATLANTIC CONVERGENCES

Despite the transatlantic divergences in approaches, the United States and Europe share:

A commitment to minimize risky vendors. The United States and Europe have converged on their core aim to minimize risky vendors in telecommunications networks, even though they advance different approaches to doing so.

The desire for energy efficiency. The United States and Europe aim to improve energy efficiency in data centers, which account for an estimated 1 percent of electricity demand worldwide.[124] The U.S. Environmental Protection Agency announced initiatives to improve energy efficiency in U.S. data centers, including an updated Energy Star certification of data storage products.[125] Similarly, the European Digital Strategy highlights the goal of reaching climate-neutral data centers by 2030.[126]

TRANSATLANTIC DIVERGENCES

While the United States and Europe are converging on some aspects of ICTS, there remain a few divergences between the two:

Differing levels of enthusiasm for open RAN. While the United States has signaled interest in open RAN as a 5G alternative, Europe is divided. As mentioned previously, Europe takes a risk-averse position on open RAN.[127] The United States prefers to advance open RAN as a way of restructuring the radio access network to reduce reliance on any one company.

Divisions on actor-agnostic vs. actor-specific policies. The most toxic issue in the transatlantic relationship on 5G technology was a difference between the United States' and Europe's approaches to securing 5G networks. In 2019, the United States created a framework aimed at banning Huawei 5G equipment in U.S. networks through executive order and advanced a policy of targeting one of Beijing's national champions.[128] By contrast, Europe favors an actor-agnostic approach and developed a risk assessment for 5G networks, rather than targeting Huawei.[129] Ultimately, the United States and Europe ended up with similar policies, as only a handful of EU member states are implementing Huawei in their networks.[130]

Varied views of a "trusted cloud." Even though the United States and Europe share cloud security as a top priority, Europe remains concerned about the potentially unlawful U.S. use of European citizens' data. This is particularly salient because 69 percent of European data is hosted by U.S. companies.[131]

Promotion of technological sovereignty. A closely related challenge to the "trusted cloud" is Europe's desire for technological sovereignty in this area. Due to concerns over the potential misuse of European citizens' data and the dominance of U.S. companies, Europe strives to assert technological sovereignty in cloud computing through European projects such as Gaia-X and regulations aimed at chipping away at U.S. dominance.

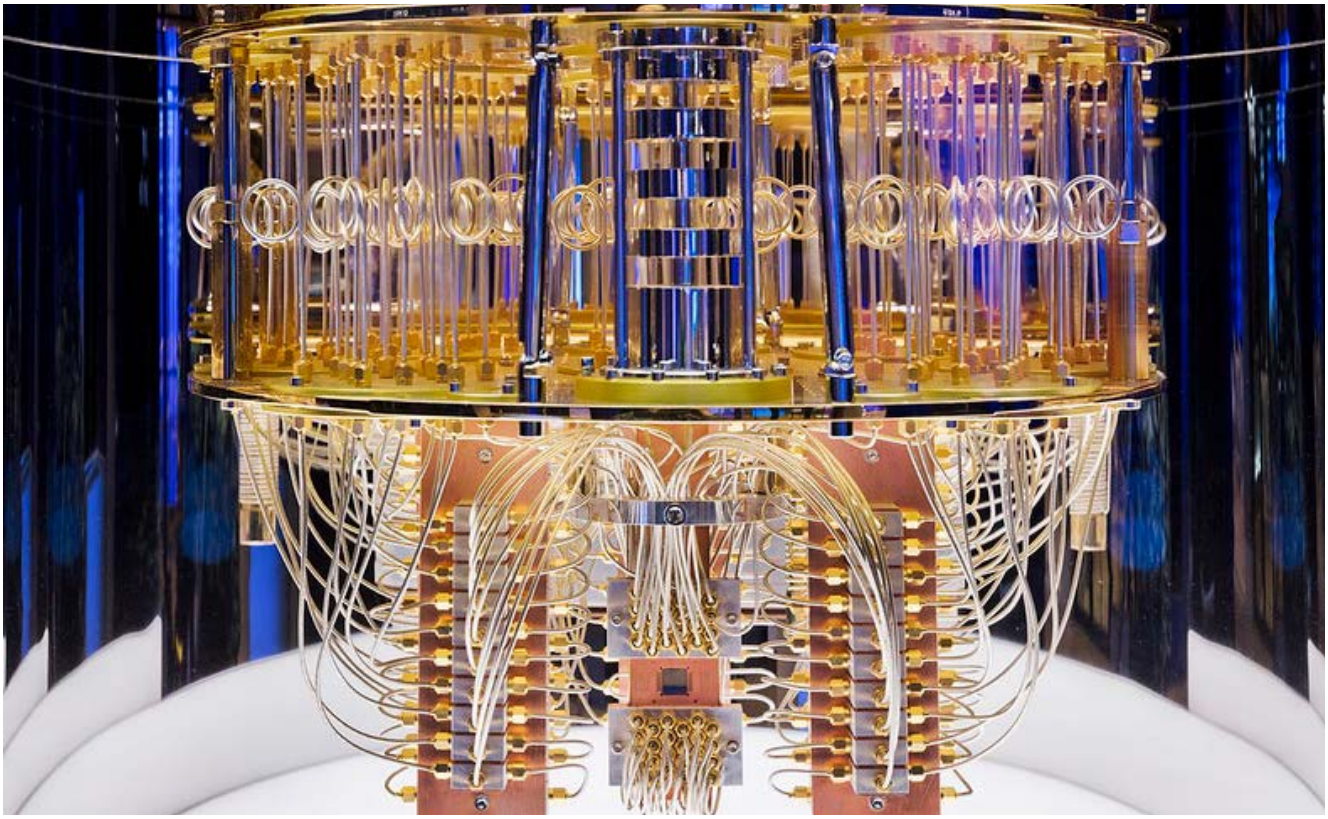
Quantum Information and Science Technology

QIST is a burgeoning field that encompasses myriad disciplines.[132] While many advancements remain at an experimental level, the U.S. government and governments across Europe are attempting to chart a path forward to harness the technological power that quantum capabilities hold. Today, the United States and China are the world leaders in these capabilities.[133] Although Europe is further behind, several countries have boosted investments and resources into the field.

As QIST develops from research labs into actual use cases—such as enhanced AI, new cryptographic methods, and drug development—the United States should identify new avenues of collaboration with its transatlantic partners, particularly on investments, talent, and standards, to shape the technology and its use in years to come.

U.S. STATE OF PLAY

The U.S. government released its *National Strategic Overview for Quantum Information Science* in September 2018, calling for a "visible, systematic, national approach to quantum information research and development" and identifying six key policy areas to focus the country's efforts: science, workforce, industry, infrastructure, economic and national security, and international cooperation.[134] Months later, in December 2018, Congress passed the National Quantum Initiative Act, which provided $1.2 billion in funding "to accelerate quantum research and development for the economic and national security of



QIST technologies offer myriad possibilities for future innovation. The United States must maintain its leadership in this critical field, and identify new ways to collaborate with its transatlantic partners to shape the future of the quantum technology domain. Pictured is the interior of a quantum computing system. (IBM)

the United States" over an initial five-year period and established a National Quantum Coordination Office to serve as the synchronizing body for quantum activities across the federal government.[135]

Since the 2018 legislation, the federal government has increased funding in QIST, explored ways to bolster a QIST workforce, and established research centers across the country. Federal government funding for QIST has steadily risen since 2019, increasing from $449 million in FY 2019 to $793 million in FY 2021. The requested total budget for FY 2022 is $877 million, an increase from 2021 of about 10.6 percent.[136] This funding goes toward a range of activities across government in agencies such as NIST, the NSF, the Department of Energy, and the Defense Department.[137]

NIST, for example, initiated the formation, and is supporting the Quantum Economic Development Consortium, an industry-led group that seeks to identify and address gaps across QIST technology, workforce, and standards.[138] The NSF launched a series of Quantum Leap Challenge Institutes, which aim to "advance quantum biological sensing and quantum simulation."[139] The Department of Energy stood up five QIST research centers in 2020—leveraging existing facilities across the national labs ecosystem—to "foster and facilitate" the development of QIST.[140]

The annual NDAA has largely driven QIST efforts within the Pentagon. Among other objectives, the Department of Defense has been directed to coordinate with private industry on a quantum technology R&D program, develop ethical guidelines for the use of quantum capabilities, establish quantum research centers within each military service, and find ways to "accelerate the development and deployment of dual-use quantum capabilities."[141]

EUROPEAN STATE OF PLAY

Countries across Europe are developing strategies and bolstering investments in their respective QIST sectors. The European Union has launched new avenues for international collaboration on quantum technologies, both within and outside of the EU. France, the United Kingdom, and Germany have the most robust QIST start-up ecosystems and research capacities in Europe.[142]

The European Union launched its Quantum Technologies Flagship in 2018, which aims to bring together research institutions, policymakers, and

industry to expand Europe's leadership and competitiveness in quantum technologies and capabilities.[143] The European Commission promised €1 billion in funding over a 10-year period to fund the flagship. The flagship's ramp-up phase, which ran from October 2018 to September 2021, included 24 projects and had a total budget of €152 million. The long-term vision of the flagship is the creation of a "quantum web": "quantum computers, simulators and sensors interconnected via quantum networks distributing information and quantum resources such as coherence and entanglement."[144]

France is a leader in the European Union in quantum capabilities and investment. It announced its Quantum Plan in February 2021, allocating €1.8 billion in public-private investment over the next five years toward quantum computing, communications, and sensing.[145] France's major investment placed it close behind the United States and China in terms of public investment in quantum research and development.[146] The Quantum Plan aims to boost R&D investments, bolster the private sector, and build a pipeline of talent in France, including 16,000 new jobs within the sector by 2030.[147]

France, the United Kingdom, and Germany have the most robust QIST start-up ecosystems and research capacities in Europe.

The German government announced a plan in May 2021 to invest €2 billion in quantum computing and quantum technologies over five years.[148] The aim of Germany's quantum plan is to "build a competitive quantum computer in five years, while growing a network of companies to develop applications."[149] One month later, in June 2021, Germany announced it was developing a quantum computer in partnership with IBM—the first European country to do so.[150]

The UK first announced its National Quantum Technologies Program in 2013.[151] The initial program called for £270 million in investment to establish a "UK National Quantum Technologies Programme."[152] The second phase of the UK's program launched in 2019, and is set to run until 2025.[153] In a 2021 strategy document, the UK laid out several recommendations for the country's QIST efforts, including sustained investment in research infrastructure; leadership in regulation, standards, and responsible innovation; and the preservation of the UK's competitive edge as a supplier of quantum devices.[154]

TRANSATLANTIC CONVERGENCES

Despite some distinctions in their approaches to QIST, the United States and Europe share commonalities, including:

The view that QIST is a priority technology area. Even though capabilities within the QIST field remain at a nascent stage, both the United States and Europe understand that the technology holds much promise across a range of fields. As the technology develops, the United States and Europe will have to continue prioritizing investment in the field to maximize its impact on countries' economies and security.

An understanding that breakthroughs happen in the private sector. The United States and Europe both have an understanding that major technological breakthroughs in the QIST field are occurring predominantly in the private sector. While it is important for governments to invest in basic research and guide development in the QIST field through national strategies, governments will need to continue prioritizing relationships with private sector leaders.

TRANSATLANTIC DIVERGENCES

Despite the shared EU-U.S. approach to QIST, there are also several issues that threaten to hinder transatlantic cooperation:

Divergent approaches to China competition. Europe does not want to get caught in the middle of the U.S.-China tech competition.[155] As researcher Alice Pannier explains, "European governments fear the consequences of becoming caught between American and Chinese quantum competition. Chief among those is quantum tech becoming subject to export restrictions."[156]

Differing strategies for research security. A second rift may manifest from countries' differing approaches to balancing research security with collaboration and openness. Much of the research in the QIST field is sensitive, and countries have an obvious desire to protect this research. International cooperation in the QIST field, however, can allow for a shared talent base and knowledge.[157] The United States and European countries will have to determine how to strike this balance—reaping the benefits of collaboration while limiting the potential harm.

Semiconductors

Semiconductors underpin the functioning of modern economies. Demand for chips continues to grow rapidly as more products are digitized and functions of daily life are

increasingly moved online. Despite the importance of the sector to national economies, no country in the world can be entirely self-reliant in its production of semiconductors. Globalization and the intense competitive pressures of the industry led to the development of highly complex, multinational supply chains for every kind of semiconductor. This business model came with unanticipated risks, as globalized supply chains must rely on stable geopolitical conditions, dependable global transportation, and steady production across the various nodes of the value chain. And while supply chains are globalized, nodes within them—such as the production of cutting-edge chips in East Asia—are highly concentrated, raising a new set of geopolitical risks. The challenge for transatlantic partners is to maintain the efficiency and innovation derived from the current market structure, while simultaneously building resiliency in supply chains and mitigating the risks of an extreme dependency on East Asia.

U.S. STATE OF PLAY

The United States plays an outsize role in the global semiconductor industry, accounting for 47 percent of that market in 2020.[158] On the production side, the U.S. semiconductor industry has strengths across the value chain, notably in both fabless design (which means the manufacturing of the semiconductor is outsourced to a contracted fabrication facility) and integrated design (meaning the designer of the semiconductor also manufactures it), as well as in design software and semiconductor manufacturing equipment tools. The United States also has an important, albeit declining, domestic manufacturing capacity for non–cutting edge chips.[159] The U.S. primacy in chip design software and its leading role in manufacturing equipment provide significant geopolitical leverage, as has amply been demonstrated with recent export controls that leveraged these technology chokepoints to cut off Russia's supply of semiconductors.[160]

As well, the United States also has significant vulnerabilities in cutting-edge manufacturing. No U.S. firms can produce at the 5-nanometer level, which currently represents the cutting-edge capability available at TSMC of Taiwan and Samsung of South Korea.[161] The United States has virtually no capacity in advanced lithography tools.[162] On the back end of the production process, the U.S. share of the packaging, assembly, and testing segment is a mere 2 percent, in part reflecting the labor-intensive nature of these processes.[163]

U.S. semiconductor policy has largely focused on imposing new controls on the export of this technology to adversary countries, as well as shoring up vulnerabilities in domestic production. The CHIPS Act, arguably the highest profile U.S. effort, was enacted into law and provides $52.7 billion in funding and a 25% tax credit to bolster domestic manufacturing of semiconductors. The bill also establishes guardrails on companies' abilities to grow non-trailing edge investments in adversary countries while taking U.S. taxpayer money.[164]

EUROPEAN STATE OF PLAY

Europe has a smaller footprint than the United States in semiconductors, with only 10 percent of global market share in 2020.[165] European strengths in production tend to be concentrated in niches of the market, rather than widely distributed across the production value chain. Europe is relatively strong in mobile device chip design and chips for automotive and industrial applications. ASML of the Netherlands is world-leading in equipment necessary to produce cutting-edge chips. Comparatively speaking, firms in Europe have fallen behind other countries in fabrication. No European firms can produce at nodes below 10 nanometers, which puts them behind U.S., South Korean, and Taiwanese producers.[166]

President Joe Biden met with state governors and business leaders in March 2022 to discuss legislation on semiconductor technology and manufacturing. Investing in the domestic semiconductor industry while boosting fab capacity can benefit the U.S. economy and strengthen partnerships with allies and partners. (Doug Mills/Pool/Getty)

As in the United States, European policymakers have centered their semiconductors strategy on increasing domestic production, including of the most advanced chips. Europe has set a goal to double its domestic manufacturing to 20 percent of the global market by 2030, and to establish cutting-edge capacity at nodes lower than the current world-leading five nanometers.[167] The EU Chips Act, proposed in February 2022, aims to promote diversification with like-minded nations, while correcting imbalances in supply chain interdependencies by avoiding "single points of failure."[168] It anticipates €43 billion in public and private investments.[169]

TRANSATLANTIC CONVERGENCES

Across the semiconductor production value chain, the United States and Europe share:

The desire to boost domestic production. U.S. and European policymakers frame the need to boost capacity as a necessary response to current supply chain shocks.[170] Despite this common policy perspective, chips incentives on both sides of the Atlantic are unlikely to create capacity quickly enough to alleviate current shortages, given the length of time required to do so. The incentives may be more impactful as part of broader efforts to boost long-term resiliency. Both U.S. and European policymakers are prioritizing cutting-edge production capacity, in part to mitigate the extreme reliance on Taiwan—and to a lesser extent South Korea—for the most advanced chips. This drive for "technological sovereignty" may undercut the common interest that both sides have in increasing capacity relative to Asian producers.

Commitment to addressing distortive impacts of non-market economies. The TTC has provided a forum for discussing the distortive effects of non-market economies. While China is not named, its chips subsidies are a long-standing concern.[171] The United States and the EU are coordinating with Japan on similar topics, though new approaches to dealing with this persistent issue have yet to be identified.[172]

TRANSATLANTIC DIVERGENCES

Despite large areas of common interest, the United States and Europe have policy friction related to:

Varying degrees of willingness to restrict activities with China. U.S. policymakers have been quicker to deploy export controls and investment screening on commercial transactions involving chips and China, a trend consistent across presidential administrations. The U.S. foreign policy community has a greater degree of consensus around the severity of the strategic threat presented by China, while Europe considers China to be at once a partner, strategic competitor, and systemic rival. China's geopolitical support for Russia during the invasion of Ukraine may harden European views toward China, though it remains too early to tell if that will translate into more aggressive policy actions on chips specifically.[173]

Risk of a subsidies race. The United States and the EU plan to subsidize increased fab capacity within their borders. This may lead to a subsidies competition, as firms decide between U.S. or European locations for establishing new plants. At the May 2022 TTC meeting, leaders announced a joint mechanism to avert a subsidy race by coordinating a "transatlantic approach to investments aimed at ensuring security of [chip] supply."[174]

Standard-Setting

Standard-setting activities are a key arena in the global technology competition. The countries and companies that set the rules shape the use of technology and promote their economic competitiveness. Standards underpin the advancement of other critical transatlantic objectives, including fair labor practices, sustainable and green technology, and liberal democratic norms.

Standards are technical specifications that "provide industries and innovators with a common language that facilitates trade [and] simplifies transactions."[175] Standard-setting activities occur at several different levels, including in domestic markets, international organizations such as the International Telecommunication Union (ITU), standards development organizations (SDOs), and the Group of Seven (G7). Countries that first develop a technology often enjoy a first mover advantage in standard-setting, as they are better positioned to draft the technical standards. Given the shared interest in open and competitive technology sectors and common challenges to technological leadership posed by a rising China, the transatlantic partners should link their standards and innovation agendas for critical technologies.

Despite the United States' and Europe's historical advantage in standard-setting activities, China is challenging their leadership. Beijing has prioritized standard-setting as a key pillar of its industrial policy and drive for global competitiveness. In 2021, China released a strategy that focused on standard-setting for critical and emerging technologies.[176] Beijing is also dedicating increasing resources to standard-setting activities, including bolstering technical expertise, drafting government-led strategies, and ensuring active participation of Chinese companies in standard-setting activities.[177]

Continued transatlantic leadership in standard-setting is not assured. While the United States and European countries hold most leadership roles in most international SDOs, China seeks more clout in standard-setting activities for critical technologies.[178] A comparison of 4G with 5G standard-setting illustrates that China is increasingly dedicating resources to these activities. China provided 22.4 percent of standards contributions for 4G, but 31.5 percent for 5G.[179]

As a result, the transatlantic partners must galvanize a joint approach and devote more resources to standard-setting activities to remain competitive. If the United States and Europe can align on standards, they have a key advantage. The core of the European Union's approach to standardization originates from its need to harmonize across 27 member states.[180] The European Union has its own architecture for developing European standards: the European standardization organizations (ESOs).[181] This process of harmonizing standards among member states paves the way for Europe's rise as the world's regulator and has the potential to multiply its power in standards organizations.[182] An aligned transatlantic approach could benefit from this process and enable the partners to more easily globalize standards due to the size of their markets.

TRANSATLANTIC CONVERGENCES

The United States and Europe both want to advance strong standards based on technological merit and in line with common core values. Because of this, the transatlantic partners also share:

The view that standards should be consistent with the World Trade Organization (WTO). The United States and European Union agree on the critical role of standards in promoting the rules-based international order, specifically by advancing standards underscored by core WTO principles, including non-discrimination. The importance of standards consistent with WTO principles is central to the United States' and Europe's strategies.[183]

A commitment to promoting private-public partnerships for standards development. Both the United States and European Union have outlined the importance of public-private partnerships in standards development. In various strategies, the transatlantic partners have highlighted the need to expand the actors at the table in SDOs to include civil society organizations, small- and medium-size enterprises (SMEs), and start-ups.[184]

TRANSATLANTIC DIVERGENCES

Despite shared overarching goals, there are looming divergences between the transatlantic partners:

Differing perceptions of China. One potential roadblock in advancing transatlantic standards is differing perceptions of the China challenge. While there is a growing concern in Europe regarding China's politicization of technology standards, Europe prefers to refract these issues through the lens of a competition between democracies and autocracies, rather than applying a counter-China framing. The United States should link Beijing's domestic standard-setting as an industrial policy with Europe's concern over market reciprocity to ease tensions over the issue and prompt a convergence of framing across the Atlantic.

Divergent approaches on linking standards and fundamental rights. The EU prioritizes advancing fundamental rights in its standards development strategy more than does the United States. Specifically, Europe views standards development as an opportunity to protect EU values, advance social and environmental strategies, and complement data privacy regulations.[185] The EU's recently released information and communications technology (ICT) standardization strategy highlights the importance of aligning European standardization efforts with the region's green transition and specifically the European Green Deal.[186]

Recommendations

To form the basis of a transatlantic technology strategy, the United States and Europe should first establish the building blocks of cooperation, including by crafting an affirmative agenda and a protect agenda. To build on that foundation, the United States and Europe must take actions in key sectors: AI, biotechnology, clean energy technology, ICTS, QIST, semiconductors, and standard-setting.

CRAFT AN AFFIRMATIVE AGENDA

Building and maintaining a collaborative innovation ecosystem across the Atlantic will require a sustained effort across three key areas. The United States and its transatlantic partners must coordinate to nurture and retain skilled talent, remove barriers that hinder joint R&D, and foster alignment on technology areas where the allies can focus. The United States and Europe should:

- **Prioritize talent.** The United States and its European partners are gifted with a remarkable human capital base. This base, which represents a key

pillar of technology competitiveness, is oftentimes underutilized—or, worse, stifled by restrictive and short-sighted immigration policies. Talent is a limited resource, and the United States and its transatlantic partners should identify new ways to promote talent exchanges while also reducing bureaucratic hurdles, such as limited student or work visas. A formalized human capital network that allows high-skilled talent (e.g., scientists, technologists, and engineers) to move between countries would allow for deeper research collaboration in both the public and private sectors.

- **Invest in joint R&D.** Sustained R&D investment is an integral component of long-term technological competitiveness. It can be challenging, however, for countries to determine *which* technology to invest in and *how much* investment is needed. Joint R&D efforts can allow for cost sharing, alignment of know-how and expertise, and increased interoperability across participating countries.[187] Cooperation on R&D investments could also help avoid duplication across critical technology areas such as AI, biotechnology, and next-generation telecommunications.
- **Identify technologies of shared strategic interest.** The partners should focus on technologies that are important for the current and future functioning of the economy, integrated into physical or digital critical infrastructure, relevant for national security objectives, or important for the functioning of democratic institutions and protection of human rights. They should assess the relative U.S. and EU strengths across the full value chains of strategic technologies and develop a shared understanding of opportunities for and threats to transatlantic leadership in these technology areas. This must include work to create common views on risks presented by China's growing role in strategic technology areas and agreement on steps to take under each side's respective authorities to manage these risks.

CRAFT A PROTECT AGENDA

As both the United States and Europe strengthen their range of protect tools, they must equally increase their cooperation to ensure that the use of these tools supports rather than undermines a level playing field for U.S. and European firms and workers. Unilateral action by either side is less effective than joint action taken in tandem to protect technologies of shared strategic interest. To achieve higher levels of coordination, the United States and Europe should take the following actions:

- **Align export control and investment screening processes.** The transatlantic partners should align processes so that commercial transactions involving similar threats and technologies result in similar outcomes on both sides of the Atlantic. Today, a firm in Europe may be able to export technology that a U.S. exporter cannot or vice versa, which creates unnecessary imbalance in the competitive conditions for U.S. and European firms. Similarly, outcomes of the U.S. and member state investment screening review processes can vary, even if both sides are reviewing the same cross-border transaction. The new export controls targeting Russia are a notable exception, as both sides adopted an unprecedented policy of denial for controlled items. Work in the TTC has been instrumental to laying the foundations for a shared Russia policy, and the TTC working group should continue to press for closer alignment on China-related policies.[188]
- **Collaborate on monitoring and enforcement.** To reinforce the effectiveness of the new Russia export controls, the United States and Europe must coordinate closely on monitoring and enforcement.[189] In particular, intelligence sharing related to the potential backfilling of technology to Russia from China will be necessary to ensure that the export controls have their intended effect of degrading Russia's military capabilities.
- **Pursue ad hoc coalitions of countries that impose export controls on chokepoint technologies judiciously.** The United States and Europe enjoy global dominance in certain technologies, allowing them to impose targeted controls that have significant impact in certain sectors. Imposing controls on these chokepoint technologies may help manage the strategic competition with China, but this action should be weighed against countervailing risks such as incentivizing firms to offshore key capabilities and undercutting the strategic advantage that the United States and Europe may maintain by preserving global dependency on these technologies.[190]
- **Start a transatlantic dialogue on outbound investment controls.** The United States should pursue a dialogue with Europe on establishing a tailored set of outbound investment controls, designed to ensure that U.S. and EU investments do not support the *development* of technology in China if the *transfer* of such technology would be subject to export controls due to U.S. or European origin. Such a system of outbound investment controls should specifically address concerns related to China's indigenous technology development in strategic sectors. Linking outbound investment controls with existing export control classifications provides

clarity and predictability to the private sector and leverages existing processes for identifying sensitive technologies. Such a tailored approach is more likely to gain European support than a broad-based, generally applicable screening mechanism. Because any U.S. outbound investment controls will be highly ineffective if pursued on a unilateral basis, a tailored approach will be of critical importance.

- **Advance a new multilateral export control regime.** The transatlantic partners must work toward a new multilateral export control regime to facilitate stronger cooperation on strategic technology controls.[191] The Wassenaar Arrangement, which addresses dual-use technology, sets controls on a country-agnostic basis, and is constrained by its mandate to limit destabilizing accumulations of conventional weapons. It is not designed to allow the allies to effectively manage the strategic competition with China, nor to set appropriate controls on emerging technologies, the full applications of which may not yet be known. Additionally, Russia remains a member of Wassenaar, allowing it to have a say in setting new controls. With no mechanism to expel Russia, its continued participation makes the process unworkable. A new regime with countries that have globally significant production capabilities and are willing to set ambitious controls is needed to reflect the reality of Russia and a rising China.

ADVANCE SECTOR-SPECIFIC RECOMMENDATIONS

To build on the foundation of transatlantic cooperation, the United States and Europe should develop strategies for technologies of critical importance to transatlantic leadership. The allies must lead in foundational technologies and related policies, including for AI, biotechnology, clean energy technology, ICTS, QIST, semiconductors, and standard-setting. To maintain the transatlantic partners' technological edge, the United States and Europe should carry out the following steps in the following areas:

Artificial Intelligence

- **Develop joint regulatory sandboxes.** The transatlantic partners should develop joint regulatory sandboxes—closed testing environments—to test products, technologies, and business models.[192] Such sandboxes would help the United States and Europe better align their respective approaches to AI regulation and help to mitigate regulatory differences from hindering transatlantic cooperation in this area.
- **Ensure the compatibility of underlying standards guiding the EU's Artificial Intelligence Act and NIST's AI Risk Management Framework.** NIST and the European Commission should align the standards that underpin their approaches to AI risk management to facilitate better transatlantic cooperation. The incentive to align approaches is high because, given the size of the U.S. and European markets, a unified approach could underscore a global approach to AI standards.[193]
- **Develop a joint AI research initiative to inform standard-setting activities.** The TTC's inaugural joint statement highlights the importance of the transatlantic partners developing a shared conception of trustworthy AI.[194] NIST and the European Commission should stand up a joint research initiative to tackle several foundational elements that ensure trustworthy AI, including the standardization of risk management strategies; testing, validation, verification, and evaluation of AI; and technical requirements and approaches.[195] This would complement the TTC's proposed development of a hub of metrics and methodologies to measure AI trustworthiness.[196]
- **Pair the technical standards and innovation agendas.** The United States and Europe should ensure that the technical standards underpinning trustworthy AI are considered in the design and development of AI, especially in high-risk applications such as critical infrastructure and military uses.[197] The transatlantic partners should also create a project through the TTC that explores and promotes the development of AI techniques fostering trustworthy AI.[198]

Biotechnology

- **Invest in systems and processes for predicting and mitigating risks.** The speed of advancement in biotechnology creates new and evolving risks for potential weaponization or misuse. The United States and EU have a shared interest in ensuring this risk is minimized as much as possible. Relevant U.S. agencies, such as NIST, NIH, and NSF, should partner with their EU counterparts to develop tools and horizon scanning methods to predict future biotechnology risk. Private industry has little incentive for developing and maintaining these tools, which are complicated and expensive to produce. However, such tools are essential to minimize the risk of misuse, particularly as biotech capabilities advance more rapidly.[199]

- **Collaborate on reforming the regulatory regimes that govern the biotechnology field.**[200] The United States and EU operate from very different regulatory regimes that govern the biotechnology field. In existing forums, such as the TTC, the United States and its European partners should discuss regulatory reform, focusing on how to develop regulation that appropriately oversees and mitigates risk, while also ensuring that innovation is not stifled. Advancements in the biotechnology field may be hindered without effective regulatory regimes in place.
- **Establish ongoing U.S.-EU dialogue on ways to manage biosecurity risks.** The United States and European countries have long had to strategize on how to protect against conventional bioweapons and biosecurity threats. This challenge is exacerbated by developments in the biotechnology space, as well as advancements in other technology areas such as AI. The United States and its European partners should establish an ongoing dialogue, through the TTC, OECD, or NATO, to assess ongoing biosecurity risks. This dialogue could also feature capabilities that might be beneficial to a country's economy or security, such as developments in vaccine technology.
- **Partner on developing norms and standards across the biotechnology field, particularly in areas with sensitive data concerns.** Biotechnology touches on sensitive issue areas, from security concerns about dual-use biotech products to questions on how to secure the privacy of genomic data. The United States and European countries should take the lead within international standard-setting organizations to shape global norms in the biotechnology space, focusing on both technical capabilities and the potential application and impact of certain biotech products.[201]

Clean Energy Technology

- **Map shared risks stemming from dependence on raw materials.**[202] The United States and Europe have growing demand for raw materials. Joint mapping can facilitate a cooperative rather than competitive approach to securing essential resources.
- **Develop shared approaches to counter distortive industrial subsidies from competitor nations.** The United States and the EU should both commit to maintaining a global innovation ecosystem that fosters maximal innovation while mitigating harm from distortive trade practices. They should develop approaches that avoid both subsidies races with each other and litigation against each other in the WTO.
- **Collaborate on strategies to mitigate reliance on foreign clean energy technology suppliers.** The United States and the EU should upgrade their domestic capacity for processing rare earth minerals and collaborate on research of energy storage technologies to change current technology paradigms and weaken China's dominance over critical inputs.[203]
- **Share best practices on innovating financing for clean energy.** In addition to continued funding for early stage research efforts, the United States and Europe should share best practices for innovative financing mechanisms to support bringing to market new clean energy technologies.

Information and Communications Technology and Services

- **Incentivize open RAN development and deployment.** The U.S. Congress should provide tax incentives to encourage open RAN innovation and deployment in the United States. The European Union should encourage member state parliaments to provide similar tax incentives.[204] Simultaneously, the EU should devise a strategy to promote earlier adoption of virtualized networks to boost vendor diversity and promote the ability of European firms to adapt to a telecommunications sector shift toward virtualized networks. In addition, the United States and Europe should work with other countries, such as Japan, South Korea, and India, to transition to open network architecture.[205]
- **Coordinate open RAN risk assessments.** As a necessary complement to incentivizing open RAN deployment, the United States should develop an open RAN risk assessment. Further, the United States and European Union should coordinate risk assessments in the TTC's ICTS competitiveness and security working group and jointly develop recommendations to mitigate risks.
- **Craft a transatlantic 6G strategy.** The United States and European Union should collaborate on R&D of 6G technologies and coordinate on issues such as spectrum management, security, and standard-setting.[206] The transatlantic partners should include in these efforts other key countries such as Australia, Canada, India, Japan, South Korea, and the United Kingdom.[207]
- **Conduct research on improving the energy efficiency of data centers.** The TTC's climate and clean tech working group should commission a joint study assessing the carbon footprint of data centers and recommending measures to improve energy efficiency.

Quantum Information Science and Technology

- **Collaborate on research security best practices in the QIST field.** Much of the ongoing research in the QIST field is highly sensitive. The United States and European countries are navigating how to balance collaboration and openness with a desire to protect sensitive research and technology. The United States and its transatlantic partners should establish channels for coordinating and sharing research security best practices. These communication channels could be useful in reducing or preventing cases of potential academic or industrial espionage in the QIST field.
- **Bolster transatlantic capabilities and collaboration for assessing QIST developments and trends.** Much of the QIST field is still in the experimental phase, making it difficult to predict where the field might be headed in the near and long term. Horizon scanning efforts will be crucial to try to stay ahead of transformative advancements in the field and major developments in an allied or non-allied country's industrial base.[208] The United States and its European partners could look for ways to collaborate on these horizon scanning efforts, particularly in areas that might involve a military application of quantum technology.
- **Identify potential bottlenecks and vulnerabilities in the QIST supply chain.** The United States and its European partners should work together to ensure that their QIST companies and research labs have access to the hardware and software they need for continued advancement. The United States and the European Union should establish a recurring dialogue to continually identify and mitigate supply chain dependencies and supplier risk, paying particular attention to overreliance on peer competitors, such as China.
- **Build new and ongoing bilateral and multilateral partnerships to boost QIST collaboration.** The United States already has several bilateral agreements with international partners in the QIST field, including the United Kingdom. The United States and UK issued a joint statement in November 2021, calling for a "shared vision to promote collaborative research efforts, enhance training opportunities for scientists and engineers, and grow the market for quantum technologies."[209] Additional partnerships with transatlantic allies could be modeled on this arrangement. Such partnerships would allow for increased collaboration on basic scientific research, joint R&D, and ongoing dialogue on interoperability challenges. The United States and its transatlantic partners should also explore ways to expand partnerships to include other important actors, such as Australia and Japan, which have advanced capabilities in the QIST field.

Semiconductors

- **Coordinate economic security policies.** Further restrictions on exports of enabling technology, such as advanced manufacturing equipment, should continually be assessed.
- **Counter distortive industrial semiconductor subsidies from competitor nations.** Joint litigation could be pursued at the WTO, as the primary forum in which China has made commitments that can be subjected to dispute settlement proceedings. Given the difficulty in achieving durable change in China's industrial policies through WTO litigation, however, the United States and the EU must consider using available remedies under their own domestic authorities.
- **Maintain close coordination and information exchanges on their own semiconductor development and strategies.** The United States and the EU should host transatlantic exchanges to share information on market trends that may be relevant to transatlantic chips supply. For example, the May 2022 TTC meeting resulted in a commitment to develop a joint "early warning system" for future supply chain disruption.[210]
- **Avoid a subsidies arms race.** Subsidies strategies should be coordinated to ensure that companies are not able to play governments off against one another. The United States and the EU must also agree on subsidies best practices, to reduce the risk that either side ends up litigating against the other under the WTO.
- **Establish subsidies guardrails.** The United States and Europe should establish complementary policies for imposing obligations on companies that receive subsidies, to ensure that the recipients are not taking U.S. or EU money on the one hand and increasing their capacity in China on the other.

Standard-Setting

- **Leverage the Trade and Technology Council.** The United States and Europe should use the TTC to coordinate which standards each will advance in SDOs. The TTC's working group on technology standards cooperation provides a venue for the United States and European Union to identify and jointly advance standards. The TTC should continue to bolster its engagement with the private sector to communicate key standards in advance. The TTC joint statement in May 2022 contains promising language on this front.[211]

- **Reform standard-setting organizations.** The United States and European Union should coordinate in the TTC's working group on technology standards to chart a course for reform of standard-setting organizations. The group should identify measures to prevent bloc voting, including by reforming voting rules and disallowing proxy voting. Additionally, they should develop criteria for how and when a technical document can be put forward in SDOs, to prevent companies from gumming up the standard-setting process.
- **Provide incentives.** The U.S. Congress should incentivize companies to attend SDO meetings, including by allowing them to use R&D tax credits to send representatives. From 2015 to 2019, the European Union provided about €85 million to the European Standardization Organizations and €20 million to organizations participating in the European standardization process. The European Commission should bolster the current financial incentives it offers to companies to participate in the European standardization process, and it should also dedicate grants for organizations participating in SDOs. Incentives will be especially helpful for small- and medium-size enterprises that often have limited resources and staff to send representatives to SDO meetings.
- **Take leadership contests seriously.** The transatlantic partners should focus energy on leadership contests in standard-setting organizations, especially in the United Nations. The World Intellectual Property Organization (WIPO) leadership contest in 2020 is an illustrative case study. In this contest, the United States built a coalition of partners to support the Singaporean candidate over the Chinese candidate for director general. The United States and Europe should replicate this process in future leadership contests.[212] Furthermore, the United States and European companies should be encouraged to attend SDOs at early stages of standards development, when organizations often make leadership decisions.[213] In SDOs, U.S. and European companies should convene or administer consensus groups; volunteer for technical leadership roles, such as standards project editors; and serve in executive positions.[214]
- **Bolster standards expertise.** The United States and European Union should stand up a joint center of excellence for standard-setting with the goal of expanding and training a workforce that will participate in standard-setting, promote and protect the integrity of global standard-setting, and share best practices on the politics and mechanics of standards development. Furthermore, the European Commission and U.S. Department of State, Department of Commerce, and Office of the U.S. Trade Representative should offer education and training to bolster relevant skill sets and create a promotion path that encourages participation in standards development in relevant roles.[215]
- **Appoint standards coordinators.** The European Commission should create and empower a standards director position in the Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs.[216] This role could coordinate standard-setting activities across the European Commission, which could also prevent unnecessary delays in the European standardization process.[217] Likewise, the U.S. government should create standards coordinators in the National Science and Technology Council's subcommittees.[218] These coordinators would serve as a hub for standards needs, strategies, and best practices.[219] Further, this would enable horizontal coordination of standards to complement the United States' vertical (or sectoral) approach to standards.

Conclusion

Technology competition will define geopolitics for decades. At stake is economic competitiveness, societal resilience, and the vitality of democratic values. The transatlantic partners bring to bear many advantages in this competition. Better collaboration between the United States and Europe on matters of technology policy will strengthen both.

Increased alignment will allow the United States and Europe to better promote and protect each country's respective technological advantages. Coordination on supply chain resilience, R&D investments, talent development, and standard-setting will bolster the economic and national security of all allies.[220] The United States and its transatlantic partners should also identify ways to align their respective industrial policy strategies. The goal should not be to mirror each other's industrial policies; it is sensible that each country should seek to promote and protect its own interests. However, Europe and the United States should also work to ensure that their uniquely crafted industrial policy strategies avoid protectionist measures that may inadvertently stifle innovation.

As of yet, a strategic framework to guide U.S. and European leaders is missing. The United States and Europe must craft a transatlantic technology strategy that maximizes their potential for strategic competition, with technology at its core. Currently, rifts between the transatlantic partners—from debates over data privacy to divergent approaches to regulation—threaten to drive a wedge between them and hinder cooperation. To succeed in this competition, the United States and Europe must manage their divergences and prevent spillover to the affirmative agenda. This will not be easy, but the stakes are high. A failure to act risks ceding leadership to authoritarian actors such as China and Russia, which have their own visions of the future.

While the divergences are abundant, so too are the opportunities. The transatlantic partners must advance an affirmative agenda in seven key areas where it is vital to ensure continued leadership: artificial intelligence, biotechnology, clean energy technology, ICTS, QIST, semiconductors, and standard-setting. But an affirmative agenda is not enough. The transatlantic partners must also leverage defensive policy actions, focusing on investment screening and export controls, that can protect identified technologies of core economic and national security importance to both.

To remain competitive, the United States and Europe must harness the strengths of their alliance—one of their greatest competitive advantages—to foster technological innovation, spur inclusive growth, and build resilience in the relationship. Doing so will require doubling down on issues where goals and interests are aligned, mitigating the fallout in areas where they diverge, and advancing a democratic vision for technology. The United States and Europe need a strategic framework to light the path to sustained security, resilience, and well-being.

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